

## 2011 Coordinating Committee Meeting

12 October 2011

### SUMMARY OF ACTIVITIES (2010 AND 2011 CALENDAR YEARS)

#### PUBLICATIONS

##### *Peer reviewed*

- Andersen, D. E.**, M. E. Reiter, K. E. Doherty, and D. C. Fulton. 2010 (Released in 2011). Magnitude and spatial distribution of American woodcock hunting pressure in a central Minnesota Wildlife Management Area. Pages 203-212 in C.A. Stewart and V.R. Frawley (eds.) and D.E. Andersen, J.G. Bruggink, T.R. Cooper, D.R. Dessecker, D.G. Krementz, S.L. Mayhew, M.W. Olinde, and G.J. Roloff (assoc. eds.). *Proceedings of the 10<sup>th</sup> American Woodcock Symposium*, Michigan Department of Natural Resources and Environment, Lansing, Michigan, U.S.A.
- Beck, M. W., L. K. Hatch, **B. Vondracek**, and R. D. Valley. 2010. Development of a macrophyte-based index of biotic integrity for Minnesota lakes. *Ecological Indicators* 10:968–979.
- Chizinski, C. J., **B. Vondracek**, C. Blinn, D. Atuke, E. Merten, N. Hemstad, R. M. Newman, N. Schlessor and K. Fredricks. 2010. The influence of partial timber harvesting in riparian buffers on macroinvertebrate and fish communities in small streams in Minnesota, USA. *Forest Ecology and Management* 259:1946-1958.
- Chizinski, C.J., A. Peterson, J. Hanowski, C. Blinn, **B. Vondracek**, and G. Niemi. 2011. Breeding bird response to partially harvested riparian management zones in northern Minnesota. *Forest Ecology and Management* 261:1892-1900.
- Dolph C.L., A. Sheshukov, C.J. Chizinski, **B. Vondracek**, and B. Wilson. 2010. The Index of Biological Integrity and the bootstrap revisited: an example from Minnesota streams. *Ecological Indicators* 10:527–537.
- Dolph, C.L., D.D. Huff, C.J. Chizinski, and **B. Vondracek**. 2011. Implications of community concordance for assessing stream health at three nested spatial scales in Minnesota, USA. *Freshwater Biology* 56:1652–1669.
- Doherty, K.E., **D.E. Andersen**, J. Meunier, E. Oppelt, R.S. Lutz, and J.G. Bruggink. 2010. Past patch quality as a predictor of future habitat selection: relating movement behavior of American woodcock to environmental factors. *Wildlife Biology* 16:379-388.
- Fieberg, J., L. Cornicelli, **D.C. Fulton**, and M.D. Grund. 2010. Design and analysis of simple choice surveys for natural resource management. *Journal of Wildlife Management* 74:871-879.

- Huff, D.D., L.M. Miller, and **B. Vondracek**. 2011. Patterns of ancestry and genetic diversity in reintroduced populations of the slimy sculpin: implications for conservation. *Conservation Genetics* 11: 2379–2391.
- Merten, E.C., N.A. Hemstad, S.L. Eggert, L.B. Johnson, R.K. Kolka, R.M. Newman, and **B. Vondracek**. 2010. Relationship of sediment dynamics in moraine, headwater streams in northern Minnesota to forest harvest. *Ecology of Freshwater Fish* 19:63–73.
- Merten, E.C., N.A. Hemstad, R.K. Kolka, R.M. Newman, E.S. Verry, and **B. Vondracek**. 2010. Relationship of sediment dynamics in moraine, headwater streams in northern Minnesota to forest harvest. *Journal of the American Water Resources Association* 46:733–743.
- Merten, E., J. Finlay, L. Johnson, R. Newman, H. Stefan, and **B. Vondracek**. 2011. Entrapment of wood in Minnesota streams determined by a length ratio and weight. *Journal of Hydrological Processes* 25: 593–602.
- Merten, E., J. Finlay, L. Johnson, R. Newman, H. Stefan, and **B. Vondracek**. 2011. Factors influencing wood mobilization in Minnesota streams. *Water Resources Research* 46: W10514.
- Meunier, J., R. S. Lutz, K. E. Doherty, **D. E. Andersen**, E. Oppelt, and J. G. Bruggink. 2010 (Released in 2011). Fall diurnal habitat use by adult female American woodcock in the western Great Lakes region. Pages 83–94 in C.A. Stewart and V.R. Frawley (eds.) and D.E. Andersen, J.G. Bruggink, T.R. Cooper, D.R. Dessecker, D.G. Krementz, S.L. Mayhew, M.W. Olinde, and G.J. Roloff (assoc. eds.). *Proceedings of the 10<sup>th</sup> American Woodcock Symposium*, Michigan Department of Natural Resources and Environment, Lansing, Michigan, U.S.A.
- Oppelt, E., J. G. Bruggink, K. E. Doherty, **D. E. Andersen**, J. Meunier, and R. S. Lutz. 2010 (Released in 2011). Fall survival of American Woodcock in western Great Lakes region. Pages 107–108 in C.A. Stewart and V.R. Frawley (eds.) and D.E. Andersen, J.G. Bruggink, T.R. Cooper, D.R. Dessecker, D.G. Krementz, S.L. Mayhew, M.W. Olinde, and G.J. Roloff (assoc. eds.). *Proceedings of the 10<sup>th</sup> American Woodcock Symposium*, Michigan Department of Natural Resources and Environment, Lansing, Michigan, U.S.A.
- Raymond, K. L. and **B. Vondracek**. *In Review*. Relationships among rotational and conventional grazing systems, stream channels and macroinvertebrates. *Hydrobiologia* 669:105–117.
- Reiter, M.E. and **D.E. Andersen**. 2011. Arctic foxes, lemmings, and Canada goose nest survival at Cape Churchill, Manitoba. *Wilson Journal of Ornithology* 123:266–276.
- Schramm, H.L., Jr., **B. Vondracek**, W.E. French, and P.D. Gerard. 2010. Factors associated with mortality of walleye and sauger caught in live-release tournaments. *North American Journal of Fisheries Management* 30:238–253.
- Schroeder, S.A. and **D.C. Fulton**. 2010. Land of 10,000 lakes and 2.3 million anglers: conflict, crowding, and coping among Minnesota anglers. *Journal of Leisure Research* 42:291–316.

- Streby, H.M. and **D.E. Andersen**. 2011. Seasonal productivity in a population of migratory songbirds: why nest data are not enough. *Ecosphere* 2:Article 78.
- Streby, H.M., S.M. Peterson, and D.E. Andersen. 2011. Invertebrate availability and vegetation characteristics explain use of non-nesting cover types by mature-forest songbirds during the post-fledging period. *Journal of Field Ornithology* 82:405-413
- Wan, H., C.J. Chizinski, C.L. Dolph, **B. Vondracek** and B. Wilson. 2010. The impact of rare taxa on measures of fish index of biotic integrity. *Ecological Indicators* 10:781-788.
- Williams. M. A. and **B. Vondracek**. 2010. Spring distributions in Winona County, Minnesota, USA. *Carbonates and Evaporites* 25:333-347.

*Book chapter and symposium proceedings*

- Gresswell, R. and **B. Vondracek**. 2010. Coldwater streams. *In* Inland fisheries management in North America (3<sup>rd</sup> edition). W. A. Hubert and M. C. Quist (editors). American Fisheries Society, Bethesda, Maryland.

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

- Atuke, D.M., R.M. Newman, and **B. Vondracek**. *In Review*. 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 Revision*. Effects of riparian forest harvest on instream habitat and fish assemblages in eight northern Minnesota streams. *Canadian Journal of Fisheries and Aquatic Sciences*.
- Bruggeman, J.E., **D.E. Andersen**, and J.E. Woodford. *In Press*. Bioregional monitoring for northern goshawks in the western Great Lakes region. *Journal of Raptor Research*.
- 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*.
- Carlin, C., S.A., Schroeder and **D.C. Fulton**. *In Revision*. Using choice models to understand walleye angler preferences in Minnesota. *North American Journal of Fisheries Management*.
- Cornicelli, L., **D.C. Fulton**, M. Grund, and J. Fieberg. *In Press*. Hunter perceptions and acceptance of alternative deer management regulations. *Wildlife Society Bulletin*.
- Eells, L., R. Vondracek, and **B. Vondracek**. *In Press*. Hunting or fishing for information. *In* Scientific communication for natural resource professionals. C. Jennings, T. E. Lauer, and B. Vondracek (editors). American Fisheries Society, Bethesda, Maryland.
- Loomis, J.H, **B. Vondracek**, and H.L. Schramm, Jr. *In Review*. The survival and blood chemistry response of walleye to a simulated live-release fishing tournament. *Transactions of the American Fisheries Society*.

- Nagle, F., T. Fuitak, K. C. Nelson, and **B. Vondracek**. *In Review*. Empowering conservation decisions: establishing authenticity in arenas for environmental conflict management. *Negotiation and Conflict Management Research Journal*.
- Peterson S.M., H.M. Streby, and **D.E. Andersen**. *Accepted*. Effects of brood parasitism of ovenbirds by brown-headed cowbirds may persist into post-fledging. *Journal of Field Ornithology*.
- Reiter, M. E. and **D.E. Andersen**. *In Review*. Impacts of lesser snow goose-mediated habitat alteration on Canada goose nest density. *Avian Conservation and Ecology*.
- Reiter, M.E., **D.E. Andersen**, A.H. Raedeke, and D.R. Humburg. *In Revision*. Species interactions and habitat influence the range-wide distribution of breeding Canada geese in northern Manitoba. *Journal of Wildlife Management*.
- Schroeder, S. A. and **D.C. Fulton**. *In Revision*. Political action and philanthropy for lake protection: Do outdoor recreation participation and place attachment predict intention to conserve Minnesota lakes? *Society & Natural Resources*.
- Schroeder, S. A. and **D.C. Fulton**. *In Revision*. Do outdoor recreation participation and place attachment relate to Minnesota lake home owners' attitudes about protecting their lake? *Environment & Behavior*.
- Schroeder, S. A. and **D.C. Fulton**. *In Revision*. 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. *Journal of Environmental Psychology*.
- Schroeder, S. A., **D.C. Fulton**, W. Penning, and K. DonCarlos. *In Revision*. Using persuasive messages to encourage hunters to support a ban on lead shot. *Journal of Wildlife Management*.
- Streby, H.M. and **D.E. Andersen**. *In Review*. Don't count your chicks unless you know where they hatched: testing common assumptions in studies of songbird reproductive success. *Auk*.
- Streby, H.M. and **D.E. Andersen**. *In Review*. Movements, cover-type selection, and survival of fledgling ovenbirds in managed deciduous and mixed-coniferous forests. *Journal of Wildlife Management*.
- Streby, H.M. and **D.E. Andersen**. *In Review*. Survival of fledgling ovenbirds: influences of habitat characteristics at multiple spatial scales. *Auk*.
- Streby, H.M., J.P. Loegering, and **D.E. Andersen**. *In Review*. Spot mapping does not accurately estimate size or cover-type composition of golden-winged warbler territories. *Wildlife Society Bulletin*.
- Streby, H.M., S.M. Peterson, T. L. McAllister, and **D.E. Andersen**. *In Review*. Early successional forest use by post-fledging mature-forest birds in managed mixed northern hardwood-conifer forests. *Condor*.

**Vondracek, B.**, H. L. Schramm, Jr., W E. French, and C. J. Chizinski. *In Revision*. Factors associated with initial mortality of walleye and sauger caught in live-release tournaments. *North American Journal of Fisheries Management*.

MANUSCRIPTS IN PREPARATION

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*. 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*.

Bruggeman, J.E., **D.E. Andersen**, and J.E. Woodford. *In Preparation*. Landscape-level models of goshawk breeding area attributes in the western Great Lakes region. *Journal of Raptor Research*.

Bruggeman, J.E., **D.E. Andersen**, and J.E. Woodford. *In Preparation*. Population estimates of breeding goshawks in the western Great Lakes region based on occupancy surveys and home range size. *Journal of Wildlife Management*.

Cornicelli, L.J. Fieberg, and **D.C. Fulton**. *In Preparation*. Applying 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.**, J. Bruskotter, H. Schramm, and B. Vondracek. *In Preparation*. Social acceptability of walleye mortality in live release tournaments in 5 Midwestern states. *North American Journal of Fisheries Management*.

**Fulton, D.C.**, S. Schroeder, and J. Lawrence. *In Preparation*. A study of motivational and preferences changes in a panel of Minnesota waterfowl hunters 2000-2005. *Human Dimensions of Wildlife*.

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*.

- Reiter, M.E. and **D.E. Andersen**. *In Preparation*. Evidence of territoriality and inter-specific interactions from point-pattern analysis of subarctic-nesting geese. *Auk*.
- Rudberg, E., **D.C. Fulton**, and S.A. Schroeder. *In Preparation*. Understanding attitudes and beliefs concerning support for banning toxic shot. *Journal of Wildlife Management*.
- Fulton, D.C.** and J. Vlaming. *In Preparation*. Developing a fishing opportunity spectrum: an example of Minnesota trout anglers. *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*.

## TECHNICAL PUBLICATIONS

- Andersen, D.E.** 2010. Production of EPP Canada geese near Cape Churchill, Manitoba. Pages 63-65 *In* L. Chow and K. McKay, eds. *Hudson Bay regional research*. Aboriginal Issues Press, University of Manitoba, Winnipeg, Manitoba, Canada.
- Andersen, D.E.**, and R.R. Nack. 2010. Brood movements and distribution of EPP Canada geese in northern Manitoba. Pages 66-68 *In* L. Chow and K. McKay, eds. *Hudson Bay regional research*. Aboriginal Issues Press, University of Manitoba, Winnipeg, Manitoba, Canada.
- Andersen, D.E.**, and M.E. Reiter. 2010. Sympatric nesting EPP Canada geese and lesser snow geese on the Hudson Bay Lowlands: nest predation and spatial distribution. Pages 69-70 *In* L. Chow and K. McKay, eds. *Hudson Bay regional research*. Aboriginal Issues Press, University of Manitoba, Winnipeg, Manitoba, Canada.
- Andersen, D.E.**, and J.E. Sammler. 2010. Population trends of tundra-nesting birds in Churchill, Manitoba. Pages 71-72 *In* L. Chow and K. McKay, eds. *Hudson Bay regional research*. Aboriginal Issues Press, University of Manitoba, Winnipeg, Manitoba, Canada.
- Andersen, D.E.**, C.W. Boal, G. Perry, R.N. Mannan, and M.E. Reiter. 2010. Factors affecting distribution and detection of boreal chorus frogs and wood frogs at Cape Churchill, Manitoba. Pages 309-311 *In* L. Chow and K. McKay, eds. *Hudson Bay regional research*. Aboriginal Issues Press, University of Manitoba, Winnipeg, Manitoba, Canada.

## TECHNICAL REPORTS

### *Final reports*

- Streby, H.M. and **D.E. Andersen**. 2010. Habitat use of post-fledging forest-nesting songbirds in northern hardwood-coniferous forests in northern Minnesota: final report. Final 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.

## *Annual Reports*

- Andersen, D.E.**, et al. 2010. Production of EPP Canada geese near Cape Churchill in 2010. Annual Report to the Mississippi Flyway Council. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, Minnesota.
- Bruggeman, J.E. and **D.E. Andersen**. 2011. Summarizing data and developing conservation practices for eagle nesting and concentration areas in the Midwest Region. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, Minnesota.
- Fronczak, D. and **D.E. Andersen**. 2011. The use of satellite telemetry to evaluate migration chronology and breeding, migratory, and wintering distribution of Eastern Population of sandhill cranes. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, Minnesota.
- Nelson, M.R., **D.E. Andersen**, and J.R. Kelly. 2010. 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: 2009 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.
- Streby, H.M. and **D.E. Andersen**. 2011. Demographic response of golden-winged warbler to habitat and management across a climate change gradient in the cores of the species range: 2010 summary report. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, Minnesota.

## **GRANT PROPOSALS**

### *Funded*

#### David E. Andersen

*The use of satellite telemetry to evaluate migration chronology and breeding, migratory, and wintering distribution of Eastern Population sandhill cranes.*

Funding: U.S. Fish and Wildlife Service - \$324,316

*Demographic response of golden-winged warbler to habitat and management across a climate change gradient in the core of the species range.*

Funding: U.S. Fish and Wildlife Service - \$638,202

*Summarizing data and developing conservation practices for eagle nesting and concentration areas in the Midwest Region*

Funding: U.S. Fish and Wildlife Service - \$53,257

*Assessment of techniques for evaluating woodcock population response to best management practices applied at the demonstration area scale*

Funding: U.S. Fish and Wildlife Service - \$106,419

#### David C. Fulton

*Understanding general public beliefs, attitudes, and perceptions regarding climate change impacts and adaptation in northeast Minnesota*

Funding: Minnesota Department of Natural Resources - \$35,000

Bruce Vondracek

*Scaleable indices of watershed health.*

Funding: Minnesota Department of Natural Resources - \$110,000

*Quality assessments and restoration potential of groundwater fed streams within the watersheds of Minnesota.*

Funding: U.S. Fish and Wildlife Service (Quick Response Program) - \$10,000

*Assessing the cumulative impacts to near-shore, in-water habitat.*

Funding: Minnesota Environmental Trust Fund as recommended by the Legislative Citizens Committee on Minnesota's Resources. \$300,000

*Predicting and mitigating vulnerability of trout streams in Minnesota to global warming.*

Funding: Minnesota Environmental Trust Fund as recommended by the Legislative Citizens Committee on Minnesota's Resources. \$299,999

**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.

Technical advisor for Woodcock Minnesota.

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

American Woodcock Information Needs Assessment Workshop. U.S. Fish and Wildlife Service. Bloomington, Minnesota.

David C. Fulton

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.

Invited member to the Dialogue on Consilience in the Cognitive, Behavioral and Social Sciences of Climate Change hosted at Ft. Collins, Colorado in April 2010



Invited instructor for human dimensions short-course in applied social science methods. Midwest Fish & Wildlife Conference. December 2010. Minneapolis, MN.

Invited instructor for human dimensions short-course in applied social science methods. Society for Conservation Biology. Sponsored by the Social Science Working Group of the SCB at the international meeting. July 2010. Edmonton, Alberta.

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 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.

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.

**PRESENTATIONS**

Beck, M. W., **B. Vondracek**, and L. K. Hatch. 2010. Assessing the health of Minnesota's lakes using indices of biotic integrity. Joint Meeting of the Minnesota Chapters of the American Fisheries Society, Society for Conservation Biology, Society of American Foresters and The Wildlife Society, Nisswa, Minnesota.

Beck, M. W., L. K. Hatch, **B. Vondracek**, and R. D. Valley. 2010. Development of a macrophyte-based index of biotic integrity for Minnesota lakes. 2010 International Congress for Conservation Biology, Edmonton, Alberta, Canada.

Beck, M., **B. Vondracek**, and L. Hatch. 2011. Image analysis techniques to evaluate effects of nearshore lake development on aquatic macrophytes. 141<sup>st</sup> Annual Meeting of the American Fisheries Society, 4-8 September 2011, Seattle, Washington.

Beck, M., **B. Vondracek**, and L. Hatch. 2011. Image analysis techniques to evaluate effects of nearshore lake development on aquatic macrophytes. 44<sup>th</sup> Annual meeting of the Minnesota Chapter of the American Fisheries Society, 8-9 February, Sandstone, Minnesota.

Bergh, S.M. and **D.E. Andersen**. 2010. Factors affecting detection of American woodcock on Singing-ground Surveys. 2010 Joint Meeting of the Minnesota Chapters of The Wildlife Society, American Fisheries Society, Society of American Foresters, and the Society for Conservation Biology, Nisswa, Minnesota.

Bergh, S.M. and **D.E. Andersen**. 2010. Estimation of the effective area surveyed for American woodcock on Singing-ground Surveys. 71<sup>st</sup> Midwest Fish and Wildlife Conference. Minneapolis, Minnesota.

Bergh, S.M. and **D.E. Andersen**. 2010. Factors affecting detection of American woodcock on Singing-ground Surveys. 17<sup>th</sup> Annual Conference of The Wildlife Society, Snowbird, Utah.

- Biedermann, J., L. C. Ferrington, Jr., **B. Vondracek**, Jim Perry, J. Magner, W. French, J. Louwsma, L. Krider, P. Sherman, and P. Kranzfelde. 2011. Predicting and mitigating vulnerability of trout streams to climate change. 4<sup>th</sup> Annual Driftless Stream Restoration Symposium, 15-16 March, La Crosse, Wisconsin. (Invited)
- Bruggeman, J.E., **D.E. Andersen**, and J.E. Woodford. 2010. Northern goshawk monitoring in the western Great Lakes bioregion. 71<sup>st</sup> Midwest Fish and Wildlife Conference. Minneapolis, Minnesota.
- Dolph, C. L., D. D. Huff, C. J. Chizinski, and **B. Vondracek**. 2010. Implications of concordance for assessing aquatic communities at three nested spatial scales in Minnesota, USA. Joint Meeting of the American Society of Limnology and Oceanography and the North American Benthological Society. Santa Fe, New Mexico.
- Dolph, C., **B. Vondracek**, and J. Magner. 2011. Linking ecosystem processes to macroinvertebrate community structure in a restored stream in the Minnesota River Basin. 44<sup>th</sup> Annual meeting of the Minnesota Chapter of the American Fisheries Society, 8-9 February, Sandstone, Minnesota. (Poster)
- French, W., J. Biederman, J. Louwsma, P. Sherman, L. Krider, L. C. Ferrington, Jr., **B. Vondracek**, and J. Perry. 2011. Winter diets and dynamics of brown trout in groundwater dominated streams. 141<sup>st</sup> Annual Meeting of the American Fisheries Society, 4-8 September 2011, Seattle, Washington. (Poster)
- French, W., L. Ferrington, **B. Vondracek**, J. Perry, J. Magner, J. Biederman, J. Louwsma, L. Krider, and P. Kranzfelder. 2011. Mitigating the effects of climate change on cold water streams in southeastern Minnesota. 44<sup>th</sup> Annual meeting of the Minnesota Chapter of the American Fisheries Society, 8-9 February, Sandstone, Minnesota.
- Huff, D. D., L. M. Miller, C. J. Chizinski, and **B. Vondracek**. 2010. Outbreeding depression and genetic diversity in reintroduced populations of the slimy sculpin. Joint Meeting of the Minnesota Chapters of the American Fisheries Society, Society for Conservation Biology, Society of American Foresters and The Wildlife Society, Nisswa, Minnesota.
- Huff, D. D., L. M. Miller, and **B. Vondracek**. 2011. A simulated reciprocal transplant experiment: local adaptation in reintroduced populations of a native North American fish. 141<sup>st</sup> Annual Meeting of the American Fisheries Society, 4-8 September 2011, Seattle, Washington. (Invited)
- Lepore, J., J. Keville, D. Dustin, C. Tomckko, and **B. Vondracek**. 2011. Cumulative impacts of residential lakeshore development on littoral habitat. 44<sup>th</sup> Annual meeting of the Minnesota Chapter of the American Fisheries Society, 8-9 February, Sandstone, Minnesota. (Poster)
- Louwsma, J., **B. Vondracek**, J. Perry, J. Biederman, W. French, L. Krider, and L. C. Ferrington, Jr. 2011. 2011 Upper Midwest Stream Restoration Symposium, 1-3 March, Oconomowoc, Wisconsin. (Poster)
- Nelson, M.R. and **D.E. Andersen**. 2010. American Woodcock Singing-ground Surveys in the western Great Lakes region: assessment of woodcock counts, forest cover types along

- survey routes, and landscape cover type composition. 2010 Joint Meeting of the Minnesota Chapters of The Wildlife Society, American Fisheries Society, Society of American Foresters, and the Society for Conservation Biology, Nisswa, Minnesota.
- Nelson, M.R. and **D.E. Andersen**. 2010. American Woodcock Singing-ground Surveys in the western Great Lakes region: assessment of woodcock counts, forest cover types along survey routes, and landscape cover type composition. 71<sup>st</sup> Midwest Fish and Wildlife Conference. Minneapolis, Minnesota.
- Raymond, K. L. and **B. Vondracek\***. 2011. Grazing systems, stream channels, and macroinvertebrates. 4<sup>th</sup> Annual Driftless Stream Restoration Symposium, 15-16 March, La Crosse, Wisconsin. (Invited)
- Reiter, M.E., **D.E. Andersen**, A.H. Raedeke, and D.D. Humburg. 2011. (*Presenter*). Species interactions and habitat influence the range-wide distribution of breeding Canada geese in northern Manitoba. Churchill Northern Studies Centre and Parks Canada Science Symposium, Winnipeg, Manitoba, Canada.
- Streby, H.M. and **D.E. Andersen**. 2010. When is success not success? When it's songbird nesting success. Society for Integrative and Comparative Biology Annual Meeting. Seattle, Washington.
- Streby, H.M., J.P. Loegering, and **D.E. Andersen**. 2010. Golden-winged warbler demography: productivity and survival in northwest Minnesota in 2010. 71<sup>st</sup> Midwest Fish and Wildlife Conference. Minneapolis, Minnesota.
- Streby, H.M., S.M. Peterson, and **D.E. Andersen**. 2011. Golden-winged warbler demography: productivity and survival in Minnesota and Manitoba. 2011 The Wildlife Society Annual Conference. Waikoloa, Hawaii.
- Streby, H.M., S.M. Peterson, and **D.E. Andersen**. 2011. Golden-winged warbler demography: nest productivity and adult and fledgling survival. Northwest Golden-winged Warbler Working Group Meeting, Winnipeg, Manitoba, Canada.
- Streby, H.M. and **D.E. Andersen**. 2011. Demographic response of golden-winged warbler to habitat and management across a climate-change gradient at the core of the species' range. Conserving the Future: Wildlife Refuges and the Next Generation. Madison, Wisconsin.
- Streby, H.M. and **D.E. Andersen**. 2011. (*Invited*). What the post-fledging period tells us that the nesting season does not. 129<sup>th</sup> Stated Meeting of the American Ornithologists' Union. Jacksonville, Florida.
- Vondracek, B.**, B. Blick, P. Bolstad, I. Chisholm, B. Knudson, P. Nacionales, D. O'Shea, and H. Wan. 2011. The current state of the Watershed Assessment Tool. 44<sup>th</sup> Annual meeting of the Minnesota Chapter of the American Fisheries Society, 8-9 February, Sandstone, Minnesota. (Invited)

## TEACHING

David C. Fulton

*Invited lecture*

Fall 2010 **CB 8004: Economic and Social Aspects of Conservation Biology**  
Conservation Biology Program, University of Minnesota (1 lecture)

Fall 2011 **CB 8004: Economic and Social Aspects of Conservation Biology**  
Conservation Biology Program, University of Minnesota (1 lecture)

Bruce Vondracek

*Instructor*

Fall 2010 **CBIO8201: Seminar- How to Excel in Graduate School**  
Conservation Biology Program, University of Minnesota

*Invited lecture*

Fall 2010 **GEO 8601: Introduction to Stream Restoration**  
Department of Geology (2 lectures)

Fall 2011 **FW5401: Fish Physiology and Behavior**

**STUDENT THESES AND AWARDS (2010/2011)**

- Bergh, S.M. 2011. Factors influencing detection of American woodcock during Singing-ground Surveys. M.S. Thesis, University of Minnesota. 64pp. (D.E. Andersen)
- Huff, D. D. 2010. Examining genetic diversity, outbreeding depression, and local adaptation in a native fish reintroduction program. Ph.D. Dissertation, University of Minnesota. 116pp. (B. Vondracek)
- Nelson, M.R. 2011. American woodcock Singing-ground Surveys in the western Great Lakes region: assessment of woodcock counts, forest cover types along survey routes, and landscape cover type composition. M.S. Thesis, University of Minnesota. 105pp. (D.E. Andersen)
- Streby, H. M. 2010. Survival and habitat use by post-fledging forest-nesting songbirds in managed mixed northern hardwood-coniferous forests.. Ph.D. Dissertation, University of Minnesota. 148pp. (D.E. Andersen)

*Student Awards*

- Marcus Beck. 2011. Best Student Presentation, 44<sup>th</sup> Annual meeting of the Minnesota Chapter of the American Fisheries Society, 8-9 February, Sandstone, Minnesota.
- Stephanie Bergh. 2010. Best Student Presentation, 2010 Joint Meeting of the Minnesota Chapters of The Wildlife Society, American Fisheries Society, Society of American Foresters, and the Society for Conservation Biology, Nisswa, Minnesota.

Christine Dolph. 2010. EPA STAR Graduate Fellowship

Alexander Heeren. 2010-2011. Graduate School Fellowship, University of Minnesota.

Henry Streby. 2009-2010. Graduate School Dissertation Fellowship, University of Minnesota.

Henry Streby. 2011. U.S. Fish and Wildlife Service Region 3 Award for Strategic Conservation (Notable Projects/Team Achievement category – 2011)

*Coop Unit Scientist Awards*

David E. Andersen. 2011. U.S. Fish and Wildlife Service Region 3 Award for Strategic Conservation (Notable Projects/Team Achievement category – 2011)

**GRADUATE STUDENTS ADVISED**

David E. Andersen

**Matthew Nelson** – M.S., Natural Resources Science and Management (Wildlife Ecology and Management track – completed degree in 2011)

**Matthew Reiter** – Ph.D., Wildlife Conservation

**Henry Streby** – Ph.D., Natural Resources Science and Management (Wildlife Ecology and Management track – completed degree in 2010)

**Stefanie Bergh** – M.S., Natural Resources Science and Management (Wildlife Ecology and Management track – completed degree in 2011)

**Dave Fronczak** – M.S., Natural Resources Science and Management (Wildlife Ecology and Management track)

**Stephanie Jenkins** – Ph.D., Natural Resources Science and Management (Wildlife Ecology and Management track)

**Kyle Daly** – M.S., Natural Resources Science and Management (Wildlife Ecology and Management track)

**Sean Peterson** – M.S., Natural Resources Science and Management (Wildlife Ecology and Management track)

David C. Fulton

**Alexander Heeren** – M.S., Natural Resources Science and Management

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

Bruce Vondracek

**Marcus Beck** – Ph.D., Conservation Biology (Fisheries and Aquatic Biology track)

**Jennifer Biederman** – Ph.D. Conservation Biology (Fisheries and Aquatic Biology track)

**Bethany Blick** – M.S., Water Resources Science

**Veronica Bullock** – M.S., Conservation Biology (Fisheries and Aquatic Biology track)

**Joel Chirhart** – M.S., Water Resources Science

**Christine Dolph** – Ph.D., Water Resources Science

**William French** – Ph.D., Conservation Biology (Fisheries and Aquatic Biology track)

**David Huff** – Ph.D., Conservation Biology (Fisheries and Aquatic Biology track)  
**Matt Kocian** – M.S., Conservation Biology (Fisheries and Aquatic Biology track)  
**Jennifer Keville** – M.S., Water Resources Science  
**Jessie Lepore** – M.S., Conservation Biology (Fisheries and Aquatic Biology track)  
**Kara Raymond** – M.S., Water Resources Science  
**Kathrine Ruddick** – M.S., Conservation Biology (Fisheries and Aquatic Biology track)

## RESEARCH SUPERVISION

### David E. Andersen

**Jason E. Bruggeman**, Research Fellow, Department of Fisheries, Wildlife, and Conservation Biology, June 2007-August 2009; September 2010 - present.

### David C. Fulton

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

**Narayan Dhakal**, Research Fellow, Department of Fisheries, Wildlife and Conservation Biology, October 2010-present.

### Bruce Vondracek

**Haibo Wan**, Research Fellow, Department of Forest Resources, July 2010-present

## UNDERGRADUATE MENTORING

No undergraduate research projects supported in 2010-2011

## 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 10<sup>th</sup> American Woodcock Symposium*
- Chair, *Awards Nomination Committee*, The Raptor Research Foundation, Inc.
- Steering Committee Member, 2010 Midwest Fish and Wildlife Conference
- American Woodcock Information Needs Assessment Workshop participant, U.S. Fish and Wildlife Service
- Associate Editor, *Journal of Raptor Research*

### Manuscript Reviews (2010/2011)

*Journal of Raptor Research* (1 as reviewer and 7 as Associate Editor)  
*Journal of Wildlife Management* (2)  
*Oecologia* (1)  
*Waterbirds* (1)  
*Wilson Journal of Ornithology* (1)  
*Wildlife Society Bulletin* (1)

#### Proposal Reviews

*Natural Sciences and Engineering Research Council of Canada (1)*  
*Great Lakes Fish and Wildlife Restoration Act (1)*

#### David C. Fulton

- Organized symposium Trout and the Trout Angler for the Midwest Fish and Wildlife Conference, Minneapolis, MN December 2010.
- Member, Planning Committee, *Pathways to Success: Integrating Human Dimensions into Fisheries and Wildlife Management*, Conference October 2010.
- Associate Editor, *Journal of Wildlife Management* July 2009-Present

#### Manuscript Reviews (2010/2011)

*Human Dimensions of Wildlife (1)*  
*Journal of Wildlife Management (6)*  
*Society and Natural Resources (1)*

#### Bruce Vondracek

- 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
- North American Benthological Society, member, Environmental Stewardship Award Committee

#### Manuscript Reviews (2010/2011)

*Ecological Indicators (1)*  
*Environmental Management (1)*  
*Fisheries Management and Ecology (1)*  
*Forest Ecology and Management (1)*  
*Hydrobiologia (1)*  
*Journal of the North American Benthological Society (1)*  
*Oecologia (1)*  
*North American Journal of Fisheries Management (1)*  
*Transactions of the American Fisheries Society (1)*

#### Book Review

*The Ecology and Historical Management of the Northern Pike in Minnesota*, University of Minnesota Press.

### RESEARCH PROJECTS

#### *Ongoing projects*

#### **The 2010 waterfowl hunting season in Minnesota: a study of hunters' opinions and activities**

Funding: Minnesota Department of Natural Resources. Research Fellow: Susan Schroeder.

*Status:* Data have been collected and a draft report is being edited.

Minnesota has generally had the largest number of waterfowl hunters in the United States. In recent years we have expanded efforts to obtain quantitative information about opinions and motivations for this important clientele. Minnesota participated in the North American Duck Hunter Survey, and Minnesota hunter responses have been compared to those in other states. More recently, we have prepared reports documenting hunter activity and opinions following the 2000, 2002, 2005, and 2007 waterfowl hunting seasons. In addition, we completed a series of surveys looking at hunter recruitment and retention were completed following the 2005 waterfowl hunting season. Information from these reports has been used to inform management decisions.

The objective of the current study is to identify hunter preferences/opinion on daily bag limits relative to their satisfaction, success, and opinions/preferences on other waterfowl hunting and management issues. These results will be compared to results from previous Minnesota surveys and other hunter surveys. The questionnaire will be similar to the 2000, 2002, 2005, and 2007 questionnaires and many questions will be the same so we can compare hunter responses following different waterfowl seasons. In addition, questions on duck zones and splits, Canada goose management, waterfowl hunting framework dates, and other current issues may be addressed. We will review questionnaires and results from other state waterfowl hunter surveys and coordinate with biologists in other states to assist in designing the Minnesota survey. In 2011, states can select a zone/split combination for the 2011-2015 period. This survey will also provide essential information for selecting the best option for Minnesota.

**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. Student: Matt Nelson (M.S., Natural Resources Science and Management – Wildlife Ecology and Management).

*Status:* Graduate student started data collection and degree program in summer 2007, completed vegetation classification and delineation along survey routes in Wisconsin and Minnesota in 2009, completed his M.S. thesis in 2011a, and is preparing a manuscript for publication.

Our overall objective was to better understand the relationship(s) between changes in counts of woodcock (*Scolopax minor*) 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. Specific project objectives were 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.

See M.S. thesis abstract for further project details.

**Assessing the cumulative impacts to near-shore, in-water habitat**

\$300,000. Funding: Environment and Natural Resources Trust Fund as recommended by the Legislative Citizens Committee on Minnesota's Resources. Principal Investigator: Bruce Vondracek. Students: Jennifer Keville and Jessie Lepore.

*Status:* Graduate students selected and initial field season (2011) completed.

Human structures related to shoreline development, such as docks, boatlifts, and other structures, and disturbance from recreational activity may have a cumulative impact on aquatic ecosystems. Near-shore areas (< 4.5 m deep) often contain most of the vegetation and are generally the spawning area for fish. Several studies have addressed the effects of incremental changes on lake ecosystems despite ongoing concerns about the rate and extent of near-shore, in-water habitat alterations, and expansion of in-lake structures. However, there is limited knowledge about the cumulative effects of human activities on aquatic habitat, water quality, and fish populations, which has hindered regulatory authorities and lake managers to guide landowners toward lower impact practices. We will assess the extent of near-shore vegetation, fish, and macroinvertebrates along a gradient of shoreline development and develop a framework to assess cumulative impacts on whole lake systems. We will use aerial photos and existing DNR data to estimate whole lake disturbances of ~100 lakes in the Northern Lakes and Forests Ecoregion. We will also conduct assessments of a subset of lakes (~30) at the individual lot scale, to quantify impacts to vegetation and fish along a gradient of shoreline development and shoreline types. Finally, we will assess the biovolume, species, and areal coverage of aquatic macrophytes in 12 lakes (included in the 30 lake subset). We will use our research to develop a model to predict the cumulative impact of development on aquatic ecosystems, providing a tool to guide lake managers toward sustainable near-shore, in-water development.

**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. dissertation completed in 2009. Operational data collection in 2010.

For over thirty years, the breeding grounds of Eastern Prairie Population (EPP) Canada geese (*Branta canadensis*) 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 (*Chen caerulescens*) 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 his Ph.D. dissertation in 2009.

**Demographic response of golden-winged warbler to habitat and management across a climate change gradient in the core of the species range**

\$638,202. Funding: U.S. Fish and Wildlife Service (Region 3 Migratory Birds), U.S. Geological Survey (Science Support Program), Minnesota Department of Natural Resources, Minnesota Cooperative Fish and Wildlife Research Unit. Principal Investigator: David E. Andersen. Post-doctoral Research Associate: Henry Streby. Student: Sean Peterson (M.S., Natural Resources Science and Management – Wildlife Ecology and Management).

*Status:* Pilot study conducted at Tamarac National Wildlife Refuge in 2010. Project expanded to Rice Lake National Wildlife Refuge and southeast Manitoba in 2011. M.S. student accepted for 2012 (formerly worked on the project as a technician and site leader).

Golden-winged warbler (*Vermivora chrysoptera*) populations have been declining across their distribution for at least 40 years. This Nearctic-Neotropical migratory species is listed as “threatened,” “endangered,” or “of management concern” in 10 states, and is described by the U.S. Fish and Wildlife Service as a “species of management concern.” The cause of range-wide declines, and some local extinctions, is a complex combination of habitat loss, blue-winged warbler (*V. pinus*) hybridization and competition, brood-parasitism by brown-headed cowbirds (*Moluthrus ater*), and likely global climate change. Although golden-winged warbler range is contracting from the south, it is expanding to a lesser degree to the west and north. However, in areas of recent range expansion, populations have been declining over the past 15 years, and range expansion will soon be limited by lack of suitable habitat to the north and west.

Golden-winged warblers depend on early successional forest stands and open forested wetlands for nesting. The northern hardwood-coniferous forests of northern Minnesota, Wisconsin, Michigan, and south-central Canada host the highest densities of breeding golden-winged warblers. Predicted to be a bioregion among the earliest and most dramatically affected by global climate change, there is currently considerable debate about the desired future composition and juxtaposition of habitats within these forests. Considerations for wildlife, including species associated with early successional forests, are an important part of this conversation. Golden-winged warbler nesting habitat is in decline as abandoned farmlands regenerate to mature forest, timber harvest declines, and wetlands are drained for development. Assessing the demographic response of golden-winged warbler populations to forest management and other habitat alterations is critical for this species to be included in future management planning. Detailed knowledge of habitat-specific demographic parameters is necessary to predict golden-winged warbler population responses to climate change.

Little is known about golden-winged warbler survival and habitat use throughout the nesting period in this region, and less is known about these parameters during the post-fledging period anywhere in the species’ range. To our knowledge, survival and reproductive success

have not been compared among breeding habitat types for this species. The objective of this study is to investigate golden-winged warbler adult survival and reproductive success, including nest productivity and juvenile survival between the species' main breeding habitat types; early successional forests and forested wetlands. We will use resulting demographic data to model golden-winged warbler reproductive success, and better understand factors influencing golden-winged warbler habitat quality. We will conduct this research in the core of golden-winged warbler range, at 3 sites that span a global climate change gradient, and a gradient of blue-winged warbler genetic introgression.

#### **Effects of imperfect detectability on inferences from monitoring**

\$212,688. Funding: U.S Geological Survey, Northern Prairie Wildlife Research Center. Principal Investigator: David E. Andersen. Co-Principal Investigator: Doug Johnson. Student: Beth Rigby (Ph.D., Natural Resources Science and Management – Wildlife Ecology and Management).

*Status:* Research Work Order established and Ph.D. graduate student selected.

The value of bird monitoring has come under increasing scrutiny recently due to concerns about imperfect detectability. In particular, because the probability of detecting a bird in the area surveyed often is less than one, counts are indices of abundance, rather than actual estimates of abundance. Often the issue is cast in the equation,

$$E(C) = pN,$$

where  $E(C)$  is the expected count of some species made during a survey,  $N$  is the true number of that species in the surveyed area at the time of the survey, and  $p$ —detectability—is the proportion of the true number that is recorded. In recent years many authors have emphasized that variation in  $C$  reflects not only variation in  $N$  but also variation in  $p$ . From that fact, they caution against drawing inferences about population changes from indices.

A variety of methods that attempt to adjust counts for imperfect detectability have been advanced, including distance sampling, multiple-observer sampling, and time-to-detection sampling. Surveys, especially of breeding birds, are constrained by limited time—both during the season and within a day, suitable weather conditions, the number and skills of observers, access to sites, and other factors. Gathering the information necessary to employ these techniques can take additional effort and thereby reduce the number of sites that can be surveyed. Furthermore, the suitability of available adjustment methods in multispecies surveys has been questioned.

A critical question is the extent to which additional effort to employ these techniques is rewarded by improved results. Clearly, estimates of abundance will be affected by adjustments for detectability; what is not known are the consequences on estimates of population trajectories. The objective of the proposed study is to evaluate the influence of imperfect detectability on inferences about population changes. Results from this study could suggest that certain situations involving detectability seriously compromise conclusions drawn from a survey; in that case, appropriate adjustments may be strongly commended. Conversely, other types of variation in detectability might induce only inconsequential errors in survey results; then the detectability adjustments may not be warranted.

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

*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, and field seasons (2009 and 2010) completed. M.S. thesis completed in 2011.

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

- (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.

See M.S. thesis abstract for further project details.

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

\$225,000. Funding: 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 (Ph.D., Natural Resources Science and Management - Wildlife Ecology and Conservation).

*Status:* Pilot season (2005), 3 field seasons (2006, 2007, and 2008), and 1 post-study field season (2009) completed. Ph.D. dissertation defended in 2010. Manuscripts submitted for publication in the peer-reviewed literature.

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 included;

- (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. See Ph.D. dissertation abstract for further project details.

#### **Human Dimensions Research Fellow**

\$215,000. Funding: Minnesota Department of Natural Resources. Principal Investigator: David C. Fulton. Postdoctoral Research Associate: Susan Schroeder (Ph.D., Natural Resource Science and Management - Environmental Science Policy and Management).

*Status:* The first year of projects are being completed.

There is continued 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.

#### **Predicting and mitigating vulnerability of trout streams**

\$299,000. Funding: Environment and Natural Resources Trust Fund as recommended by the Legislative Citizens Committee on Minnesota's Resources. Co-Principal Investigator: Bruce Vondracek. Students: Jennifer Biederman, William French, and Jane Louwsma.

*Status:* Graduate students selected and initial field season (2011) completed.

Trout require streams with excellent water quality that are fed by groundwaters, which keep streams cold in summer but ice-free in winter. The trout sport-fishing industry is vulnerable to global climate changes that can increase stream temperatures, alter the cold-adapted aquatic insects that form trout diets, and affect trout reproduction. Increasing air temperatures are predicted to increase the maximum water temperatures during summer, but also are very likely to dramatically change winter thermal conditions in trout streams. Our objectives are to: (1) investigate the role of stream bank vegetation and adjacent land use to minimize changes in stream temperatures in relation to climate change during summer; (2) determine winter diets and growth of trout populations; and (3) determine kinds, abundances, and timing of growth patterns of cold-adapted insects that are essential in winter diets of trout. We will work on 36 trout streams in the Driftless Area, using GIS coupled with habitat surveys for objective (1); seining and standard diet analysis techniques for objective (2); and rapid bioassessment protocols for objective (3). The project will identify and rank the streams most vulnerable to increases in summer high temperatures, and will identify cold-adapted insects that are most critical to trout diets and growth during winter. Trout fishing annually provides more than \$150 million dollars in direct expenditures to local economies in Minnesota and \$654 million through the Driftless Region (Trout Unlimited, 2008). With re-circulating dollars this represents more than one-billion dollars of economic stimulus to local economies. Our research will enable us to identify streams and food species that are most vulnerable to increasing temperatures, and translate scientific results into management strategies to protect and conserve this valuable industry.

**Resource use of arctic peregrine falcons along the Colville River, Alaska**

\$205,000. Funding: U.S. Bureau of Land Management. Principal Investigators: David E. Andersen and Patricia L. Kennedy (Oregon State University). Student: Stephanie Jenkins (Ph.D. – Natural Resources Science and Management, Wildlife Ecology and Management track).

*Status:* Intra-agency agreement to support this project in place and Research Work Order established. Ph.D. student and PI participated in peregrine productivity surveys and met with project collaborators to identify specific project objectives and protocols.

The Colville River Special Area (CRSA) was designated in 1977 to protect nesting and foraging habitat of the then-endangered arctic peregrine falcon (*Falco peregrinus tundrius*). The CRSA is approximately 2.44 million acres, and provides nesting habitat for approximately one-fourth of Alaska's arctic peregrine falcon population. To afford additional protections to the arctic peregrine falcon, the Record of Decision (ROD) from the 2004 Integrated Activity Plan/Environmental Impact Statement (IAP/EIS) for the Northwest planning unit of the NPR-A and the final ROD for the Northeast planning unit required a management plan for the arctic peregrine falcon in the CRSA to be developed and put into effect prior to any lease sales. The Colville River Special Area Management Plan (CRSAMP) was completed in July 2008 (Bureau of Land Management 2008 Colville River Special Area Management Plan) and specifically addresses the need for additional measures to protect arctic peregrine falcon nesting habitat and the need for research to determine the characteristics of peregrine falcon nesting habitat in the CRSA.

One objective of the CRSAMP was to: Improve knowledge about the ecology, life history, and behavior of arctic peregrine falcons to help decision makers and managers make informed decisions on proposals that could have an impact on falcons. To address that information need, we propose to (1) summarize and evaluate existing CRSA peregrine nesting data to assess nesting habitat use and related productivity, and (2) implement

additional data collection efforts focused on assessing nesting area occupancy related to habitat and other factors associated with productivity.

**Scaleable indices of watershed health**

\$188,000. Funding: Minnesota Department of Natural Resources. Co-Principal Investigator: Bruce Vondracek. Student: Bethany Blick (M.S.-Water Resources Science Program). Research Fellow: Haibo Wan.

*Status:* Funding began 15 June 2008; data collection and metric development is nearing completion.

A watershed-based approach is increasingly recognized as the most comprehensive framework for understanding and managing natural resource systems, including streams and lakes. However, for this approach to be successful, a large amount of information regarding the current state of watershed resources is necessary. Unfortunately, despite the large amount of existing geographic information system (GIS) information that could be utilized, this information is not readily available for managers in an easily accessible, broadly applicable, summarized form. The Watershed Assessment Tool (WAT) Project is designed to bridge this gap by acquiring background information on watershed concepts and developing a comprehensive series of GIS layers. This information will be organized in a 5-component framework of hydrology, geomorphology, biology, connectivity and water quality to facilitate quantification of healthy watershed function and interactions. We are developing a meta-analysis and syntheses to support the broad-scale, long-term quantification of watershed health in major Minnesota watersheds (8-digit HUC boundaries), the selection of a set of health indices, and the application of these health indices for all such watersheds in Minnesota. This work is specifically designed to support the development of the Minnesota Department of Natural Resources (MNDNR) watershed assessment tool.

**Summarizing data and developing conservation practices for eagle nesting and concentration areas in the Midwest Region**

\$21,710. Funding: U.S. Fish and Wildlife Service. Principal Investigator: David E. Andersen. Post-doctoral Researcher: Jason E. Bruggeman.

*Status:* Agreement supporting this project processed and in place, and initial data compilation and summary completed.

Although bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) were delisted pursuant to the Endangered Species Act in 2007, they remain protected from harassment and disturbance under the Bald and Golden Eagle Protection Act (Eagle Act). The Eagle Act defines Important Eagle Use Areas as, "an eagle nest, foraging area, or communal roost site that eagles rely on for breeding, sheltering, or feeding, and the landscape features surrounding such nest, foraging area, or roost site that are essential for the continued viability of the site for breeding, feeding, or sheltering eagles" (50 CFR §22.3).

Foraging, communal roosting, and wintering areas (here-after called "concentration areas") are often harder to locate and protect than nests, but may be equally important to the survival of the species. Consequently, a violation of the Eagle Act can occur if human activity at or near these concentration areas agitates eagles to the extent it causes a loss of productivity, injury, or death.

Adequate protection of eagle nesting and concentration areas is contingent upon accurate location data; however, there is currently no database of eagle concentration areas. Much information regarding eagle concentration areas is known but disparate in consistency and quality; locations may be known to one party but not shared with another. Additionally, the frequency of updating nest location and nest productivity data varies among parties. Databases of nest locations are frequently managed by state agencies and not readily shared between states. Significant amount of information on eagle concentration areas, nest disturbance, and disturbance minimization measures is in the form of “gray” literature including unpublished graduate theses, technical reports, annual monitoring reports, etc. These data need to be compiled and summarized so biologists may benefit from this information. For efficient and meaningful protection of eagles, gaps in information need to be filled and existing knowledge compiled, summarized and shared. With these improvements, the Fish and Wildlife Service can make conservation decisions grounded in scientific rationale. These conservation decisions need to be compiled into a set of Advanced Conservation Practices (ACPs), which will be tailored to various industries (wind, electric) to ensure eagle management and population growth. ACPs are scientifically-supportable measures approved by the Fish and Wildlife Service that represent the best-available techniques to reduce eagle disturbance and/or ongoing mortalities to a level where remaining take is unavoidable.

**A systems approach to develop improved bovine tuberculosis mitigation strategies**

\$150,000. Funding: U.S. Department of Agriculture, National Institute of Food & Agriculture. Principal Investigator: David C. Fulton. Co-investigators: Scott Wells & Srinand Sreevatsan, College of Veterinary Medicine, University of Minnesota. Research Fellow: Narayan Dhakal.

*Status:* A survey instrument has been drafted and data will be collected 2011-2012.

The specific objectives of this study include are to improve the effectiveness of bovine tuberculosis eradication programs developed and implemented by state agencies including the Minnesota DNR, by identifying the risk perceptions, beliefs, attitudes, social and personal norms, and behaviors among landowners/cattle producers and deer hunters relevant to BTB; understanding how risk perceptions, beliefs, attitudes, norms and behaviors affect willingness of cattle producers and deer hunters to support or implement BTB policy; and identifying the social networks existing among cattle producers and deer hunters that allow exchange of information about BTB. This objective will be achieved by increasing the knowledge and understanding of social and psychological factors influencing cattle producers’ and deer hunters’ support for BTB eradication programs.

**Understanding grouse hunter preferences and participation in Minnesota**

\$22,500. Funding: Minnesota Department of Natural Resources. Principal Investigator: David C. Fulton. Student: Alexander Heeren (M.S., Natural Resource Science and Management).

*Status:* Data were collected and a report is being finalized.

Ruffed grouse (*Bonasa umbellus*) populations in Minnesota cycle on an approximately a 10-year period in Minnesota. During the 20<sup>th</sup> century grouse hunter participation fluctuated with the population cycle. However, grouse hunter participation in the past couple of seasons (2008-2009) has been dramatically less (87,000) than peak hunter participation (142,000) during the same point in the grouse population cycle in the late 1990s. We conducted a statewide survey of small game hunters to understand motivations for grouse hunting;



preferences for regulations and hunting experiences; and potential reasons for not participating in grouse hunting.

**Understanding human behaviors concerning lake shoreline management**

\$230,000. Funding: Minnesota Department of Natural Resources. Principal Investigator: David C. Fulton. Student: Ed Rudberg (Ph.D., Natural Resource Science and Management – Environmental Science Policy and Management).

*Status:* Data for the first 2 phases have been collected and dissertation manuscripts are being prepared. Data for the final phase are being collected Fall 2011.

Rapid residential development around Minnesota's fisheries lakes during the past 3 decades has led to dramatic changes in lake shorelines. Sandy beaches, rip rap, and grassy lawns now cover significant proportions of shorelines that once held native vegetation important as wildlife habitat and as biological filters to maintain water quality. Although the cumulative impacts are difficult to quantify, there is general agreement that anthropogenic changes are leading to declines in water quality and fish habitat. 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

This study involves 3 distinct phases of research:

- (1) An elicitation study and preliminary research on important beliefs affecting attitudes and behavior toward maintaining and restoring native vegetation on private residential properties around lakes;
- (2) A statewide cross-sectional survey of residential property owners on Minnesota lakes to assess the relationships among pro-environmental values, attitudes, norms, beliefs and behaviors concerning managing for native shoreline vegetation.
- (3) A field experiment to assess the effectiveness of communication strategies to influence attitudes and behavior concerning shoreline restoration.

In phases 1 and 2, we used the Integrative Model to segment lakeshore landowners by their behavior and behavioral intention and to assess the ability of attitudes, norms and self-efficacy variables to predict behavioral intention. Findings demonstrate that five belief evaluations (decrease maintenance  $\beta = 0.09$ , increase water quality  $\beta = 0.13$ , be attractive  $\beta = 0.24$ , impede recreation  $\beta = 0.09$ , and create privacy  $\beta = -0.05$  one self-efficacy evaluation (ability to keep up with maintenance  $\beta = 0.21$ ), and three normative influences (family  $\beta = -0.18$ , friends  $\beta = 0.08$  and Minnesota DNR  $\beta = 0.13$ ) were significant predictors of intention ( $R = 0.60$ ). We also compared findings from the Integrative Model with the Theory of Normative Social Behavior. Our findings indicate that for shoreland restoration intention, the Integrative Model's ( $R^2 = 0.241$ ) prediction of behavioral intention can be improved by including descriptive norms, group ID and injunctive norms ( $R^2 = 0.323$ ). Findings from this study were also used to design a field experiment concerning the efficacy of communication in changing attitudes and behavior related to shoreland restoration.

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

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

*Status:* Kara Raymond successfully defended May 2009. Additional analysis underway.

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 addresses 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.

**The use of satellite telemetry to evaluate migration chronology and breeding, migratory, and wintering distribution of Eastern Population sandhill cranes**

\$324,316. Funding: U.S. Fish and Wildlife Service. Principal Investigator: David E. Andersen. Student: Dave Fronczak (M.S., Natural Resources Science and Management – Wildlife Ecology and Management).

*Status:* Research Work Order established and first sample of EP sandhill cranes captured in late 2009 and early 2010. Additional project objectives identified and expanded to include survey evaluation in 2010. Additional cranes captured and radio-marked in late 2010 and 2011.

The Eastern Population (EP) of sandhill cranes (*Grus canadensis*) is rapidly expanding in size and geographic range. The core of their breeding range occurs in Wisconsin, Michigan, and southern Ontario; however, the EP range has expanded in all directions as the population has grown. Little is known about the geographic extent of breeding, migration, and wintering ranges of EP cranes. In addition, little is known about migration chronology including when fall/spring migration commences or how long birds remain at staging areas.

Recently, tracking of cranes via satellite telemetry has successfully been used to better understand the breeding, migration, and wintering distribution as well as migration chronology for the Mid-Continent Population of sandhill cranes. A similar study is necessary for EP cranes not only to improve our understanding of migration ecology, but such information will be critical for evaluating the timing and location of population surveys.

The Mississippi and Atlantic Flyway Councils are currently in the process of developing a management plan for EP sandhill cranes that includes provisions for establishing a hunting season for EP cranes in states within these flyways. It is anticipated that some states will

immediately request approval for hunting seasons once the plan is completed. Therefore, having an informed population monitoring survey is important for the future management of EP cranes. The results from this study will assist managers in making decisions about optimal survey timing and locations.

The objectives for this study are to employ satellite transmitters on a sample of EP sandhill cranes to:

- (1) delineate the breeding and wintering distribution of EP sandhill cranes;
- (2) delineate migratory corridors for EP sandhill cranes; and
- (3) determine migration chronology.

#### *New projects*

##### **Assessment of techniques for evaluating woodcock population response to Best Management Practices applied at the demonstration area a scale**

\$106,419. Funding: U.S. Fish and Wildlife Service (Division of Migratory Birds), Minnesota Cooperative Fish and Wildlife Research Unit. Principal Investigator: David E. Andersen. Student: Kyle Daly (M.S., Natural Resources Science and Management – Wildlife Ecology and Management).

*Status:* Pilot study conducted at Tamarac National Wildlife Refuge in 2009 and 2010. First project field season completed in 2011.

American woodcock populations have shown long-term population declines in both the Eastern and Central Management Regions. Many stakeholders believe that the long-term declines are primarily caused by habitat loss due to forest succession. In response, the Migratory Shore and Upland Game Bird Working Group of the Association of Fish and Wildlife Agencies formed the Woodcock Taskforce to develop a conservation plan with a goal to stabilize and ultimately reverse the declines. The taskforce completed the American Woodcock Conservation Plan in 2008, which contains both population and habitat goals. Under the leadership of the Wildlife Management Institute, partners have formed 3 regional woodcock initiatives to begin implementing the habitat goals of the conservation plan. After considering the alternatives, initiative cooperators believed that the best way to influence landscape change and ultimately increase woodcock populations was to develop a system of demonstration areas where specific best management practices (BMPs) are applied throughout the woodcock breeding range. They thought that if public land managers and/or private landowners could view the BMPs at demonstration areas, they would be more likely to apply the practices on the lands that they manage. Through time, if enough managers and landowners adopt the BMPs used on demonstration areas, initiative cooperators expect populations to increase because of improved habitat conditions.

The overall objectives of this project are to estimate baseline demographic parameters for woodcock at demonstration areas and to evaluate techniques for measuring woodcock response to habitat management. Specifically, we intend to:

- 1) Gather baseline data of displaying male woodcock use of three demonstration areas and compare demonstration area indices with indices from surrounding routes that are part of the American Woodcock Singing-ground Survey. Our hypothesis is that indices at demonstration areas that are actively being managed will be higher than indices from surrounding routes.

- 2) Estimate hen survival, nest success, and brood survival at three demonstration areas and relate these parameters to habitat variables at each demonstration site.
- 3) Evaluate the use of night lighting and mist nests capture techniques to estimate recruitment at summer roost fields.

**Minnesota general angler survey - 2011**

\$30,000. Funding: Minnesota Department of Natural Resources. Principal Investigators: David C. Fulton.

*Status:* A data collection instrument has been designed and data are being collected.

The purpose of this study is to provide a current update of angler attitudes and behaviors that can be compared with existing information over the past 13 years. The specific objectives of this study are to:

- 1) Determine anglers' values, attitudes, norms and behaviors concerning fishing experiences, issues, and management;
- 2) Develop and refine a battery of items based on research studies in Minnesota and other states that will be used to track trends in angler's preferences and attitudes on key issues and perceptions including satisfaction with the general fishing experience, satisfaction with the number and size of fish caught, perceptions of crowding, and other key indicators of the quality of fishing experiences;
- 3) Continue baseline data for tracking trends in angler perceptions and attitudes on various fisheries issues in Minnesota;
- 4) Determine differences between resident male and female anglers concerning values, attitudes, and behaviors.

**Understanding general public beliefs, attitudes, and perceptions regarding climate change impacts and adaptation in northeast Minnesota**

\$35,000. Funding: Minnesota Department of Natural Resources. Principal Investigator: David C. Fulton. Student: Alexander Heeren. M.S. (Natural Resources Science and Management).

*Status:* Focus groups have been completed and a survey questionnaire is being drafted for implementation Fall 2011.

As Minnesota develops strategies for adaptation to climate change, a human dimensions approach integrating both social and natural sciences is critical for understanding the values, basic beliefs and risk-perceptions of climate change, societal vulnerabilities and reactions to climate change, the societal consequences and acceptability of adaptation alternatives. Developing a thorough understanding of these topics is a complex task. As a starting point, we propose a pilot study that can provide important baseline understanding of the public concerning climate change and adaptation to climate change in northeast Minnesota.

Several Minnesota Department of Natural Resources units (i.e., Divisions of Fish and Wildlife, Ecological and Water Resources, Forestry, and Parks and Trails) recognize the urgent need and benefit to conduct such a study in northeastern Minnesota in order to develop natural resource policies, programs, and communication efforts for a part of the state that is projected to undergo significant ecological and biological change. This proposal will complement a statewide approach and will serve as a prototype that will inform future statewide efforts.

At a national level, several studies have documented beliefs about climate change, its causes and its potential consequences. While a few regional and local studies have been completed, there have been no studies focused on Minnesotans' beliefs about climate change. Just as understanding the regional and local biophysical impacts of climate change will require downscaled analysis, understanding what social policy options are available and will be viable will require downscaled human dimensions analysis. The purpose of this study is to provide a thorough understanding of the values, beliefs, risk perceptions and attitudes that influence people's preferences for adaptation alternatives as well as their behavioral adoption of alternatives in northeast Minnesota.

The outcome of this study will be information that can be used to guide development of policies, programs and communication efforts associated with Department of Natural Resources adaptation strategies in at least northeast Minnesota. The study will also help to develop a more thorough study protocol to building baseline data on the topic statewide, and perhaps regionally and nationally. The target populations for the study are northeast Minnesota Residents and landowners. Two phases of research will develop detailed information across northeast Minnesota. The first phase of research includes focus groups with area residents. The second phase of research is a general public survey of area residents.

*Ongoing projects – Cooperating Faculty*

**Determining the olfactory sensitivity of Asian carp (*Hypophthalmichthys* spp.) to putative hormonal sex pheromones**

\$94,604 Funding: U.S. Geological Survey (Ed Little, Columbia River Lab). Principal Investigator: Peter Sorensen. Post Doctoral Researcher: Hangkyo Lim.

*Status:* Project agreements established and initial experiments completed.

All species of carp that have been studied to date (common carp, crucian carp, goldfish) have been found to rely heavily upon species-specific hormonally-derived sex pheromones (chemical cues that pass between members of the same species) to mediate reproductive interactions. This study hypothesizes that Asian carps function in similar manners and use novel, limited sets of hormonal metabolites as sex pheromones as well. It examines this hypothesis by measuring electrophysiological responses from their olfactory systems (electro-olfactogram or EOG) to a range of over 100 hormonal products to determine if any are detected with extraordinary sensitivity (picomolar) and specificity. The project started in September 2010. We are now raising juvenile bighead carp to a size that they can be tested and have established the EOG technique using goldfish as a surrogate. Steroid mixtures will be tested on bighead carp by the end of November 2010.

**Identifying risks to migratory birds and bats from wind development**

\$367,192. Funding: U.S. Fish and Wildlife Service. Principal Investigator: Jim Perry. Co-Principal Investigator: Doug Johnson. Student: Kevin Heist.

*Status:* Research Work Order established and Ph.D. graduate student selected. The study was designed over the winter of 2009-2010, and the initial field season was completed in spring 2010.

Wind energy development is occurring at a rapid pace and is expected to increase dramatically under the U.S. objective of producing 20% of the Nation's energy from wind by 2030. Although wind provides a renewable source of energy, concerns exist about the effects

on wildlife, particularly migratory birds and bats. Migratory birds and any endangered bats are trust species of the federal government, and any "take" of such animals are of concern. The federal government has also made extensive investments in refuges, waterfowl production areas, and wetland and grassland easements, primarily for the protection and production of migratory birds. It is important to understand the extent to which wildlife values associated with these investments may be compromised by wind energy development.

The goal of this study is to explore methods to assess risks to migratory birds and bats posed by wind energy development at a local level. Specific project objectives include:

- (1) Determine the relative likelihood of wind energy development in relation to federal wildlife management areas,
- (2) Identify general migratory bird and bat resources in areas with both high likelihood of wind energy development and federal land management,
- (3) Explore methods for determining, at a local scale, risks to migratory birds and bats that would be posed by wind energy development at a site.

Field sites were selected for the first field season (spring 2010) at (1) wind farms where fatality searches were being conducted (independently of this study), and (2) locations of varying distances from physiographic and landscape features that may influence bird and bat abundance during migration, including riparian corridors and grasslands under federal and state protection. The first season of data collection was completed, with nightly recordings from 19 sites in northern Iowa and southern Minnesota. Recording began again in August, 2010 at the 19 original sites and 12 additional sites in northern Texas and central and western Minnesota. Sites include private farmland, state parks and wildlife management areas, and federal waterfowl production areas and wildlife refuges.

Ultrasonic (bat) recordings from spring 2010 were processed and analyzed. Bat calls were recorded regularly at all 19 recorders, and a total of over 7,000 bat passes were recorded. Activity was clearly heightened near forest edges in wetter regions relative to other sites. Acoustic data from spring 2010 are currently being processed and analyzed.

**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: Lori Krider

*Status:* Project initiated in 2007. All field seasons completed. Final report due February 2011.

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 4<sup>th</sup> 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 cooperating faculty projects initiated in 2010-2011.

#### *Completed Research*

**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:* Rebecca Bronk successfully defended 9 July 2008; David Huff's dissertation defended 8 April 2010.

The Departments of Natural Resources in Iowa, Minnesota, and Wisconsin have implemented "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.

**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:* Completed June 2009. Two manuscript published and final report (Ph.D. dissertation) submitted.

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 conducted research to 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 had two objectives;

- 1) Quantify precision and sensitivity of index of biological integrity (IBI) scores and component metrics of the IBI. This objective included quantifying the response of IBI scores to random sampling error, developing confidence intervals for IBI and metric scores, and determining which metrics contribute most strongly to overall IBI variability and
- 2) Evaluate IBI variability at the stream reach, assessment unit, and major watershed scales.

A review of the scientific literature for indicators of stream health included:

- 1) understanding how structural indicators of stream health correspond to stream function;
- 2) developing better screening tools to identify reference condition;
- 3) evaluating how information from different types of stream health indicators can be used in complementary ways;
- 4) developing ways to link changes in biotic community composition to specific stressors; and
- 5) understanding seasonal variation in stream health indicators.

A bootstrap analysis indicated that fish IBIs may vary by as much as 40 points due to random sampling error alone. However, 90% of IBI scores calculated from bootstrap replicate samples for a given stream site yielded the same impairment status as the original IBI score, suggesting that random sampling variability is not sufficient to change the impairment status in the majority of replicate samples for stream sites in Minnesota. For sites with IBI scores near the impairment threshold, random sampling variability is more likely to affect status determination, and more than one field sample may be needed to verify impairment status.

We suggest that sampling variability in IBI scores is related in part to the number of fish in a collection. We found that field samples containing at least 160 fish could be interpreted with



a reasonable degree of confidence. Obtaining a sample this large for all sites would likely require increasing either the standard length over which a stream reach is sampled, or increasing the sampling intensity (i.e., conducting multiple sampling passes of the same stream reach). Sampling variability in IBI scores is related to stream drainage area

A comparison of the effects of different scoring methods on IBI variability indicates that a continuous scoring method may reduce the amount of bias in IBI scores.

Rare taxa contribute critical information to fish community metrics based on taxa richness. Failure to capture a single rare taxon will have slight effect on individual metrics or total IBI score. Failure to capture multiple rare taxa at a study site may have a substantial effect on individual metrics or total IBI score.

We used multivariate analysis to identify which environmental variables best discriminated assemblages found in reference streams across the state. The variables which best discriminated reference invertebrate assemblages included: calendar day, watershed area, stream gradient, latitude, ecoregion, and year in which streams were sampled. The variables that best discriminated fish assemblages across the state were: average annual precipitation, watershed area, latitude, longitude, mean thalweg depth, ecoregion. The variables that best discriminated a combined fish and macroinvertebrate assemblage were: average annual air temperature, watershed area, stream gradient, latitude, ecoregion, and year streams were sampled. Multivariate models developed at the statewide scale for macroinvertebrate, fish, and a combined assemblage (macroinvertebrates + fish) are able to accurately predict the number of taxa expected at reference sites.

When the ratio of observed to expected (O/E) taxa derived from multivariate models is used as an index to evaluate stream health, we found that O/E scores and IBI scores are in concordance for very high quality and very low quality sites, but may differ for intermediately disturbed sites. A combined assemblage model appears to integrate information from both fish and macroinvertebrate communities, and may be more sensitive to high levels of disturbance than models based on either macroinvertebrates or fish alone.

The metric contribution analysis indicates that the *Headwater-Tolerant* and *%Piscivore* are among the metrics that contribute most to the sensitivity of IBI total score, whereas the *Benthic insect*, *Sensitive taxa* and *Total Taxa* are among the metrics that contribute least to the sensitivity of IBI total score.

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.

**Quality assessments and restoration potential of groundwater fed streams within the watersheds of Minnesota Valley National Wildlife Refuge**

\$10,000 Funding: U.S. Fish and Wildlife Service Region 3 Quick Response Research. Principal Investigator: Bruce Vondracek. Student: Veronica Bullock (M.S. Conservation Biology, Fisheries and Aquatic Biology track).

*Status:* Project completed December 2010.

In 2005, the US Fish and Wildlife Service (USFWS) Minnesota Valley National Wildlife Refuge (Refuge) initiated a partnership with the Minnesota Department of Natural Resources (MNDNR), Trout Unlimited (TU) and several other organizations to evaluate the quality of a Refuge groundwater fed stream as suitable habitat for brook trout, a USFWS Region 3 Conservation Priority species. There are several groundwater fed streams within Refuge that are currently designated trout streams and several that may have the potential to support trout, due to their morphological condition and water quality parameters. Although many organizations have been interested in confirming the condition of these streams, there has not been a coordinated effort to determine whether these streams have suitable water quality and quantity to support trout and other aquatic organisms. The goal of this study is to collect information to determine the potential recovery of several streams located in the metro twin cities area. Specific objectives are to: (1) determine the stream health of seven urban streams located in lower Refuge, specifically in relation to water quality and habitat characteristics required by brook trout, (2) locate other groundwater streams in the watersheds of Refuge that may display suitable habitat to support a diverse and healthy assortment of biota including brook trout to compare with the seven study streams, and (3) work closely with concerned partners such as MNDNR, TU, Lower Minnesota River Watershed District, and the USFWS to conduct stream assessments and rank them in order of restoration potential. This project supports the MNDNR Stream Management Plans for streams entering the Refuge and the Lower Minnesota River Watershed Districts Management plan, which includes improving water quality in streams and wetlands throughout the District.

*Completed Research – Cooperating faculty*

**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.

Understanding the boundaries between populations of northern (*Strix occidentalis caurina*) and California spotted owls (*S. o. occidentalis*) is important for management and conservation of the species. Morphometric characteristics have proved unreliable in delineating subspecies, but the boundary between subspecies occurs somewhere in northern California. Currently, there are no relevant samples from north-central California that could be used to delineate this range boundary. The objective of this project is to use genetic analysis to evaluate whether this boundary exists in the vicinity of the Pit River in northeastern California.

We captured or sampled 23 owls between Mt. Shasta and Lassen Peak between 2007 and 2009 and obtained mtDNA sequences from 22 of them. One owl possessed the mtDNA haplotype of a Barred Owl (*S. varia*), 14 had northern spotted owl haplotypes and 8 had California spotted owl haplotypes. The proportion of NSO haplotypes to total haplotypes fell below 50% approximately 24 km south of the Pit River, however, the 95% confidence interval for this transition point included the entire geographical region between the Pit River and Lassen Peak. The standard width (20%-80%) of this hybrid zone was estimated to be 104 km. We cannot reject the hypothesis that the boundary between northern and California spotted owls was the Pit River, as had been previously hypothesized.

**Source population assignment of Isle Royale and Minnesota North Shore brook trout**  
\$7,264. Funding: U.S. Fish and Wildlife Service. Principal Investigator: Loren M. Miller.  
Student: Jacob Hennig (Undergraduate Research Assistant).

The U. S. Fish and Wildlife Service (U.S. FWS) Ashland, Wisconsin, office contributed to a research project on coaster brook trout (*Salvelinus fontinalis*) genetics. Rehabilitation efforts for coaster brook trout in Lake Superior have included stocking fish from various broodstocks, including two strains from Isle Royale derived from populations in Tobin Harbor and Siskiwiit Bay. In one part of our research, we genetically screened 45 wild adults captured at Tobin Harbor for gamete collection and determined they were not strays from other populations, which could alter the genetic diversity of the broodstock. In a second part of our study, we examined the impact of coaster brook trout stocking on natural populations along Minnesota's North Shore of Lake Superior. The Minnesota Department of Natural Resources (MN DNR) has documented a slight increase in larger brook trout in recent years at some North Shore streams. These large individuals may result from recent restrictive changes in regulations allowing fish to get older and grow larger, or from straying of potentially faster-growing hatchery fish from coaster brook trout strains. Using microsatellite DNA markers, we evaluated potential coaster hatchery strain ancestry in brook trout sampled in 20 Minnesota North Shore streams and Grand Portage streams. All 31 fish from Grand Portage streams assigned to hatchery strains. Of 302 fish from Minnesota North Shore streams, approximately 16% had hatchery strain ancestry but coaster hatchery fish did not account for most of the larger fish. These results will contribute to determining which management strategies are effective or necessary to increase the number of large brook trout in Lake Superior tributaries. The results were reported to the U.S. FWS and MN DNR and will be incorporated into a presentation at the 2010 Midwest Fish and Wildlife Conference and a subsequent peer-reviewed manuscript.