

Minnesota Cooperative Fish and Wildlife Research Unit

Biennial Report

January 2001 - December 2002

UNIT COOPERATORS:

University of Minnesota

U.S. Geological Survey

Minnesota Department of
Natural Resources

The Wildlife Management
Institute

U.S. Fish and Wildlife Service



U.S. Geological Survey

Minnesota Cooperative Fish and Wildlife Research Unit

University of Minnesota

Department of Fisheries, Wildlife, and Conservation Biology

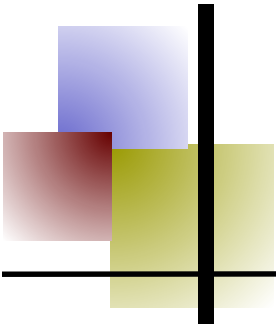
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Introduction

The Cooperative Fish and Wildlife Research Units Program was established to facilitate cooperation among the U.S. Department of the Interior (currently through the U.S. Geological Survey), universities, state fish and wildlife agencies, and private organizations, by developing and conducting programs of research and education related to fish and wildlife resource conservation. The Minnesota Cooperative Fish and Wildlife Research Unit emphasizes research on impacts of human activities on aquatic and terrestrial ecosystems that are of state, regional, and national significance. Our research program addresses not only the biological, but also social and economic aspects of both game and nongame fisheries and wildlife management in the context of maintenance of biological diversity, and integrity and sustainability of ecosystems.

The Minnesota Cooperative Fish and Wildlife Research Unit was established in 1987, and staffed beginning in 1988. This is the seventh biennial report produced by the Minnesota Coop Unit and summarizes Unit activities during 2001 and 2002. This period has been one of relative stability for our Coop Unit, in that there have been no major structural reorganizations within the federal system that directly affected the Unit Program. However, in 2001, Teri Kanikula left her position as Unit secretary/office manager. In September of 2001, Hattie Curtner took over as Unit secretary/office manager.

Over the past two years, support for the Unit program in general, and for our Unit in particular, has been as strong as it has ever been. We have worked with a wide range of cooperators, outstanding graduate students, and many university and federal scientists and resource managers to further our research, teaching, and technical assistance mission. We invite you to review the summary of our Unit's accomplishments and to contact us with comments or to request additional information. Thanks to our many partners!

Sincerely,

Dr. David E. Andersen, Leader
Minnesota Cooperative Fish and Wildlife Research Unit

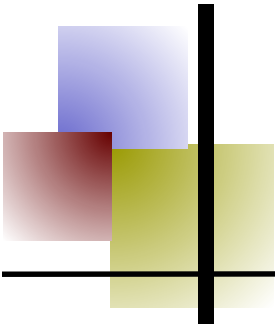
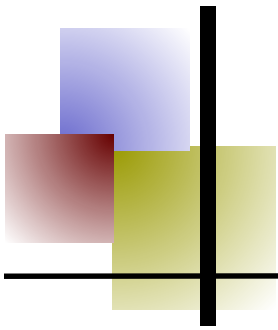


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Personnel and Cooperators

UNIT PERSONNEL

UNIT STAFF – U. S. GEOLOGICAL SURVEY – COOPERATIVE RESEARCH UNITS

- Dr. David E. Andersen, Unit Leader
- Dr. Bruce Vondracek, Assistant Leader – Fisheries
- Dr. David C. Fulton, Assistant Leader – Wildlife

UNIT STAFF – UNIVERSITY OF MINNESOTA

- Dr. Clint W. Boal, Postdoctoral Research Fellow
(January 2001 through August 2001)
- Teri Kanikula, Principal Secretary
(January 2001 through October 2001)
- Hattie Curtner, Principal Secretary
(September 2001 through December 2002)
- Sue Schroeder, Research Fellow
(October 2002 through December 2002)



UNIT STUDENTS

Leakhena Au, M.S. (Andersen)
Kristen L. Blann, Ph.D. (Vondracek)
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Linda R. Wires (Cuthbert)

UROP RECIPIENTS AND FACULTY SPONSORS

The Undergraduate Research Opportunity Program (UROP) is a University-wide competitive program that supports undergraduate research projects. Twice a year, students may apply by writing a proposal with the assistance of a faculty advisor.

Name	Year	Title of Project	Faculty Sponsor
Nicholas Altringer	2002	Species interactions and sediment effects on two trout species in Valley Creek	B. Vondracek
Ann Ollila	2002	Multi-habitat versus multi-plate assessments of muddy bottom streams	B. Vondracek

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James A. Cooper (emeritus)	Andrew M. Simons
Francesca J. Cuthbert	J. L. David Smith
Peter A. Jordan	Peter W. Sorensen
Anne R. Kapuscinski	George R. Spangler
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John Loegering	Robert Blair

ADJUNCT FACULTY IN THE DEPARTMENT OF FISHERIES, WILDLIFE, AND CONSERVATION BIOLOGY

Charles Anderson	Richard Kimmel
Glenn DelGiudice	L. David Mech
Alan Franklin	Donald L. Pereira
David Garshelis	Carl Richards
Frederick J. Jannett	Edward Swain

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Jay Hatch
Donald Siniff
Anthony Starfield

FACULTY AS PRINCIPAL INVESTIGATOR IN UNIT RESEARCH

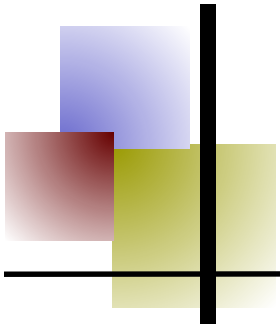
Dorothy Anderson	Frederick Jannett
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Thomas E. Burk	David Lime
Francesca J. Cuthbert	Raymond M. Newman
Susan M. Galatowitsch	Peter Sorensen
William Gartner	

COOPERATING UNIVERSITY OF MINNESOTA ACADEMIC UNITS

College of Natural Resources
Conservation Biology Graduate Program
Department of Ecology, Evolution, and Behavior
Department of Fisheries, Wildlife, and Conservation Biology
Department of Forest Resources
Fisheries Graduate Program
Minnesota Institute for Sustainable Agriculture
College of Agricultural, Food, and Environmental Sciences
Wildlife Conservation Graduate Program
Water Resources Science Graduate Program

COOPERATING STATE AND FEDERAL AGENCIES

Michigan Department of Natural Resources
Minnesota Department of Natural Resources
National Park Service
 Voyageurs National Park
 Cuyahoga Valley National Recreation Area
National Fish and Wildlife Foundation
National Science Foundation
University of Minnesota
University of Wisconsin-Madison
U.S. Geological Survey-Biological Resources Division
 Upper Mississippi Science Center
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
 Division of Migratory Birds
 Sherburne National Wildlife Refuge
 Upper Mississippi River National Wildlife and Fish Refuge
U.S. Forest Service
 Chippewa National Forest
 Superior National Forest
 North Central Forest Experiment Station
Voyageurs National Park
Wisconsin Department of Natural Resources



Completed Research



Applied Ecology



A Model for Prioritizing Wetland Habitat Restoration in the St. Louis River Watershed

Investigator: Susan Galatowitsch (Cooperating Faculty)

Students: Barbara Peichel, M.S. (Water Resources Science)

Duration: August 2001 to October 2002

Funding Source: U.S. Fish and Wildlife Service

Project Location: St. Louis River Watershed, Minnesota

Numerous wetland evaluation tools have been developed and used in the past 30 years for decision-making between protection and development of existing wetlands, but a comprehensive protocol for setting wetland restoration goals does not exist. All of the current restoration procedures lack a comprehensive consideration of the numerous wetland attributes that could be restored at each site. Therefore, an objective protocol was developed to drive restoration planning, design, and prioritization in the St. Louis River Watershed, Minnesota. The protocol was based on evaluations of hydrology, vegetative integrity, habitat suitability, and watershed characteristics using a combination of wetland evaluation tools. The project also provided the U.S. Fish and Wildlife Service with a scientific



basis for designing and implementing restoration at the Arrowhead Wetland in Hermantown, Minnesota or a comparable site.

Great Lakes Colonial Waterbird Survey

Investigator: Francesca Cuthbert (Cooperating Faculty)

Students: Dale R. Trexel, M.S. (Conservation Biology)

Duration: May 1997 to March 2002

Funding Source: U.S. Fish and Wildlife Service

Project Location: All five Great Lakes, connecting waters and Lake Winnebago (WI), Lake Champlain (NY, VT), and Oneida Lake (NY)
University of Minnesota, St. Paul

Information on the distribution and abundance of colonial waterbirds is essential for implementing effective conservation and management strategies and for studying ecosystem change. During the 1997-1999 breeding seasons, we surveyed shoreline and islands in the U.S. Great Lakes, their connecting waters and in lakes Winnebago (WI), Champlain (NY, VT) and Oneida (NY) to obtain estimates of breeding pairs of colonial waterbirds. Additionally, we obtained information on threats and habitat use and compared population estimates to those obtained during previous census efforts in the 1970s and 1980s. Approximately 400,000 pairs of 15 species nested at 446 sites in the U.S. Great Lakes between 1997-1999; this estimate is approximately 100 fewer colony sites than recorded in 1989-1991. Two new species (American white pelican and glossy ibis) were found nesting in small numbers, two species documented in previous surveys (little gull, little blue heron) were not found, and three species (great black-backed gull, cattle egret, snowy egret) were very uncommon (< 50 breeding pairs). Seven species were present during all three census periods and occurred in numbers < 5,000 pairs. These include: great blue heron, great egret, black-crowned night-heron, Caspian tern, common tern, Forster's tern and black tern. Of these seven, breeding pair estimates increased for two (Caspian tern, great egret), decreased for three (black-crowned night-heron, Forster's tern, black tern) and two species

estimates (great blue heron, common tern) fluctuated but remained essentially stable since 1977. The Great Lakes colonial waterbird community is dominated by three species: ring-billed gull, herring gull and double-crested cormorant. Population estimates (breeding pairs) for these species in the Great Lakes are approximately 275,000, 36,000 and 50,000, respectively. Ring-billed gull pairs more than doubled between the first two census periods and then remained close to the 1989-1991 estimate in our census. Although herring gull pairs increased from approximately 30,000 to 45,000 pairs between the first two census periods, the estimate for 1997-99 declined to about 35,000 pairs. Cormorant numbers in the U.S. Great Lakes proper quadrupled in size since 1989-1990. Several important current and impending issues may affect future population estimates. These include the effect of extreme low water levels on all species, particularly the marsh-nesting terns, and the impact of potentially large-scale cormorant population reduction efforts on other co-occurring species.



Inventory of Heather Vole and the Northern Bog Lemming on the Superior National Forest

Investigator: Frederick Jannett (Cooperating Faculty)

Duration: August 2000 to December 2001

Funding Sources: U.S. Forest Service

Project Location: Superior National Forest

An inventory for the northern bog lemming (*Synaptomys borealis*) and the heather vole (*Phenacomys intermedius*) was undertaken on Superior National Forest (SNF) where the first species is undocumented and the latter is a designated Sensitive Species. The objectives of the study were to ascertain the geographic distributions, habitat affinities, and relative abundances of these species on SNF. U.S. Forest Service Wildlife Biologists and other staff on all five forest districts were queried regarding habitat types that could support these species, and inventory efforts were concentrated in these habitats. Field work was undertaken 4 June – 16 July, 2001. Fifty sampling transects were established. Each transect consisted of one to three types of traps: pit traps, unbaited Museum Special traps, and Museum Special traps baited with peanut butter, apple, and oats. Most traps were set in dyads to ascertain the relative

efficacy of trap type, e.g., baited versus unbaited Museum Special traps. Traps at most transects were left out for six days. The minimum number of nights for which traps were deployed at transects was four, the maximum 12. There was a total of 15,735 trap-nights set.

No northern bog lemmings were secured, and SNF remains east of the known geographic range of the species in Minnesota. Three heather voles were obtained, one in each of three transects. Two transects were in close proximity, one on a boulder field, the other on a clearcut with about 50% canopy closure. The third site was a dry granitic outcrop, a habitat type not previously known to support this species in Minnesota. The third site is the most southwesterly known locality for the heather vole in eastern North America.

Inventory of Northern Goshawks on the Superior National Forest

Investigators: David E. Andersen and Clint Boal

Student: Aimee Roberson, M.S. (Conservation Biology)

Duration: August 2000 to September 2001

Funding Sources: U.S. Forest Service
Superior National Forest

Project Location: Superior National Forest (Northeast Minnesota)
Minnesota Cooperative Fish and Wildlife Research Unit

The Superior National Forest encompasses over 12,000 km² and is one of the largest areas of forested public land in the western Great Lakes region. Considerable concern exists regarding northern goshawk populations in this region, yet few efforts to systematically survey potential breeding habitat for goshawks have been completed. Recent research on goshawk survey techniques in Minnesota suggests that conducting broadcast surveys during the courtship period increases the probability of a response by breeding goshawks, and also facilitates location of nesting attempts prior to potential nest failure. From March through mid-April 2001, we conducted call broadcast surveys in accessible older (> 50 years old) forested habitats on the Superior National Forest. Goshawk alarm calls were broadcast at 1,764

locations on 106 survey routes of varying length. Goshawks were detected at 4 locations in the effective area surveyed (683 km²), or 1 detection per 170 km². Our results suggest that call broadcast surveys during the courtship period could be used to assess goshawk breeding populations in the western Great Lakes region.



Piping Plover Habitat Recovery Assessment for St. Louis River Estuary, Minnesota and Wisconsin

Investigator: Francesca Cuthbert (Cooperating Faculty)

Student: Elizabeth Price, M.S. (Conservation Biology)

Duration: August 2001 to June 2002

Funding Source: U.S. Fish and Wildlife Service

Project Location: St. Louis River Estuary (Duluth, MN; Superior, WI)

Historically, piping plovers nested in the St. Louis River Estuary on lakeside habitat, harbor islands formed from dredge material, and industrial piers. Human activity and encroachment of vegetation are thought to have caused the extirpation of piping plovers from the estuary by 1985. Since that time, plovers have been seen in the estuary only as occasional spring migrants. Assessment of historic nesting sites revealed that suitable habitat remains at Minnesota Point, although potential for disturbance from human activity exists. Additionally, habitat modification and restoration potential exists at Wisconsin Point. Harding Island is currently wooded and habitat restoration there is not feasible. Barker's Island has undergone large-scale residential development, and no plover habitat remains. The Port Terminal and Erie Pier areas have documented plover use in the past, but due to potential for disturbance from human activity these sites are not currently suitable. Interstate Island was listed as Critical Habitat for piping plovers under the Endangered Species Act, but it is not known to be an historic nest site. Additionally, this site contains a ring-billed gull



colony of ~13,000 individuals and removal of the colony is not practical. Creation of a new dredge material island in the harbor may attract plovers to the estuary, although long-term gull and vegetation management would be necessary. Successful recolonization of the estuary by piping plovers will require readiness by local managers to provide rapid nest protection, develop a careful public relations campaign to control human recreational activity, and consider other issues that may arise such as water level impacts on habitat and problems with predation.

Testing Pheromones as an Approach for Controlling the Common Carp

Investigators: Peter Sorensen (Cooperating Faculty)

Post Doc: Marilyn Sherman, Ph.D. (Fisheries)

Duration: August 2001 to August 2002

Funding Source: USGS Biological Resources Division

Project Location: University of Minnesota, St. Paul, MN

This project investigated the possibility that sex pheromones and food odor cues might be used to control the common carp (*Cyprinus carpio*), one of the most damaging nonindigenous species to be introduced into Midwestern lakes, and one for which few control measures exist. Because common carp are difficult to raise to maturity and hold in the laboratory, their close relative, the goldfish (*Carassius auratus*) was used in these initial studies to determine if attraction was possible. Responses of small groups of goldfish or carp were assessed in a large 3.6 x 1.1 m tank with laminar flow into which test odors were introduced. Responses were then recorded using an overhead camera for 25 min. Three test stimuli were employed: well water control, a solution made from fish food, and the odor of females releasing the prostaglandin sex

pheromone. No flow and 2 flows of increasing speed were also tested. Both goldfish and carp were strongly attracted to food odor at all 3 flow conditions indicating that odor could be used as baits. The prostaglandin sex pheromone was also attractive to goldfish but this response was not persistent and was accompanied by high levels of activity as they apparently searched for females. Carp were not tested because we were unable to get them to mature completely in the laboratory at a small size. However, we expect they would show the same behavior as goldfish. In conclusion, non-specific feeding odor clearly can be used as bait for carp removal and while prostaglandin sex pheromone also has potential it would require either a very efficient trap or the use of other stimuli to keep attracted fish in the area.

Trophic Cascade Interactions in a Coldwater Stream

Investigators: Bruce Vondracek and Raymond Newman

Student: Carl Ruetz, Ph.D. (Fisheries)

Duration: September 1997 to November 2001

Funding Source: Cargill Fellowship

Project Location: Valley Creek, Washington County, Minnesota
Minnesota Cooperative Fish and Wildlife Research Unit

This project was a four-year study to examine the effects of fish on benthic macroinvertebrates, benthic algae, and leaf litter processing. Enclosure/exclosure experiments during summer 1998 and 1999 assessed top-down effects of slimy sculpin (*Cottus cognatus*) on grazing invertebrates and periphyton in six riffles. Each riffle contained an enclosure (three sculpin), an exclosure (fishless), and control (downstream sides open). In 1998, total invertebrate and grazer densities on clay tiles were significantly higher in exclosures than enclosures and control cages; however, densities of individual grazer taxa (*Glossosoma* and *Baetis*) on tiles did not differ significantly among treatments. Fish had no significant effect on benthic invertebrates, suggesting that invertebrates inhabiting gravel substrate may have been less vulnerable to fish predation than those associated with tiles. In 1999, densities of total invertebrates and grazers on tiles and inhabiting the stream bottom did not differ significantly among treatments. Slimy sculpin did not have a detectable effect on the drift propensity of invertebrates during either year. Regardless of the effect of fish on grazers in either year, periphyton biomass did not differ significantly among fish treatments even though there was a strong, negative correlation between *Glossosoma* density and periphyton biomass. Periphyton biomass was significantly higher on tiles with a petroleum barrier that excluded *Glossosoma* larvae from the surface, indicating that *Glossosoma* limited periphyton biomass. In a separate experiment, indirect effects of fish (slimy sculpin, and rainbow *Oncorhynchus*



mykiss, brown *Salmo trutta*, and brook trout *Salvelinus fontinalis*) on leaf litter decay were investigated during winter 1998-99 in three riffles. Our hypothesis was that fish would decrease shredders associated with leaf packs and thus reduce leaf litter processing rates. Willow leaves (*Salix* spp.) were fastened into leaf packs (~3 g dry mass) and placed in 10 cm² cages that either excluded fish or were accessible to fish. Two replicates of each treatment were collected after 0, 14, 31, 55, and 112 days. Linear regression of the proportion of leaf mass (log 10) remaining in relation to time was used to calculate leaf decay rates. Decay rates were significantly different among treatments and riffles, suggesting that fish exclusion had an effect on decay rates that varied among riffles. Thus, fish may affect benthic macroinvertebrates associated with leaf packs and affect leaf litter decay rates.

Viability of Captive Rearing Techniques for the Great Lakes Piping Plover

Investigator: Francesca Cuthbert (Cooperating Faculty)

Student: Elizabeth Price, M.S. (Conservation Biology)

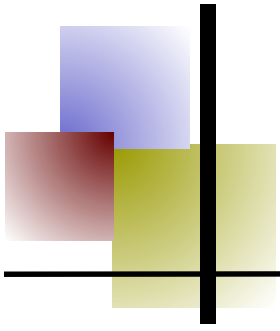
Duration: April 2001 to June 2002

Funding Source: U.S. Fish and Wildlife Service

Project Location: University of Michigan Biological Station, Pellston, MI

The Great Lakes population of piping plovers is federally endangered with a breeding population of 32 pairs. A Great Lakes-specific stochastic model, employing a range of survival estimates derived from the current population, was used to test the viability of egg removal strategies as a first step in developing a proactive captive rearing effort to enhance the Great Lakes population. We identified several strategies that

appear to have the potential to significantly augment the population. These are: four 4-egg (full clutch) removals from 25% or 37.5% of pairs over two and four years. These strategies also appear scientifically, logistically, and politically acceptable to stakeholders involved in recovery.



Completed Research



Human Activities,
Management, and
Conservation



Assessing Social-psychological Aspects of Deer Management in Cuyahoga Valley National Recreation Area

Investigators: David C. Fulton, David Lime, Dorothy Anderson

Student: Erin M. Dougherty, M.S. (Conservation Biology)

Duration: May 1999 to June 2001

Funding Source: National Park Service, Cuyahoga Valley National Recreation Area

Project Location: Minnesota Cooperative Fish and Wildlife Research Unit

This study was conducted to assess the positive and negative social consequences of various potential deer management alternatives in Cuyahoga Valley National Recreation Area (CVNRA). Information was used to help the staff at CVNRA develop a deer management strategy that considered public desires and concerns relating to management of the CVNRA. The following specific study objectives were identified: 1) determine the acceptability and preferences among the local public for deer management activities, the perceived positive and negative consequences of deer management activities, and deer population levels; 2) identify and determine the intensity of the psychological and emotional impacts among the local public served by CVNRA due to

various deer management actions; 3) determine the effect of deer management activities on local public attitudes toward the park, its services, and park staff; 4) determine the degree to which deer management activities may affect park visitation patterns among the local public.

Study results indicated that a majority of residents in the CVNRA service area support lethal control of deer at CVNRA. Residents support lethal control for both social and ecological reasons. Conversely, most residents are opposed to the NPS taking no action to address deer overabundance. A report summarizing study results is available from the Minnesota Cooperative Fish and Wildlife Research Unit.

Economic Impact and Social Benefits Study of Coldwater Angling

Investigators: David C. Fulton and William Gartner

Postdoc: Lisa Love, Ph.D. (Tourism Center)

Duration: January 2001 to January 2003

Funding Sources: Minnesota DNR Fisheries and Wildlife

Project Location: Minnesota Cooperative Fish and Wildlife Research Unit

The Minnesota DNR has a need for statewide information concerning the economic impact (amount of money anglers spend pursuing recreational fishing) and social benefits that fisheries provide and information concerning the preferences that different types of anglers have for recreation experiences and management actions. The purpose of this research was to: 1) investigate coldwater anglers' expenditure patterns statewide; 2) identify anglers' satisfaction with coldwater fishing experiences and factors affecting level of satisfaction; 3) identify anglers' recreation experience preferences related to coldwater angling and the social benefits they derive from coldwater angling; 4) describe experience-use histories and socio-demographic characteristics of coldwater anglers; 5) identify coldwater anglers' preferences for various management actions related to coldwater fisheries management; 6) segment coldwater anglers based on recreation experience preferences and experience use history information.

The coldwater fishing resources examined in this study were: streams year round; Lake Superior by boat; Lake Superior shores and streams (up to the first boundary); inland lakes in winter; and inland lakes in spring, summer and fall. A staggered mail back design was used to collect detailed data, based on the recipients most recent coldwater angling trip, on expenditures and benefits received for anglers fishing in each of five different resources.

On average anglers spent over 6 days per year fishing in streams year round followed by over 4 days fishing in lakes in spring, summer and fall. Inland lakes in winter recorded an average of 2 trips per angler per year, followed by Lake Superior shores and streams (less than 2 days annually) and Lake Superior by Boat (slightly over 1 day per year). Anglers rated the overall fishing experience quite high in terms of satisfaction. In general, the experiences that anglers rated as most important to fishing satisfaction included relaxation, nature appreciation, personal achievement and social affiliation. Attributes such as catching fish to eat, catching a trophy fish, and simply catching a fish all recorded lower mean scores and were not considered as important as some of the more intangible benefits.

Average per day angler expenditures for all types of coldwater angling was \$33.90 for home purchases and \$71.31 away from home. On average coldwater anglers spent approximately \$105 per person per day in pursuit of trout and salmon. Total Economic impact across all categories of cold water angling account for between \$140.7 to \$156.7 million in direct sales, \$85.5 to \$95.2 million in income, and together all expenses support between 3,128 and 3,482 full and part time jobs.

Evaluating Decision-processes: Case Studies of Fisheries Issues in Minnesota

Investigator: David C. Fulton

Student: John Epton, M.S. (Conservation Biology)

Duration: August 1999 to June 2002

Funding Source: Minnesota Department of Natural Resources

Project Location: Minnesota Cooperative Fish and Wildlife Research Unit

This study was conducted to improve understanding of decision-processes for addressing contentious fisheries-related issues and to develop practical, theory-based guidelines for designing and participating in decision-processes. Although numerous studies identify general factors associated with successful collaborative decision-making, few studies systematically examine the role that these factors play in affecting the relative success or failure of collaborative decision-processes. There is also a need to develop a theory of decision-process success that integrates the literature in alternative dispute resolution with the theoretical and experimental literature concerned with factors affecting perceptions of justice and fairness in decision-making

and factors affecting the quality and technical competency of decisions made within a group context.

This study assessed the Group-Value Model of procedural justice as a tool for understanding multi-stakeholder decision processes led by an agency authority (Minnesota Department of Natural Resources). Results of three case studies provided mixed support for the Group-Value Model. A summary of study results is available from the Minnesota Cooperative Fish and Wildlife Research Unit. Study results were used to develop a training seminar for the Minnesota Department of Natural Resources Fisheries personnel and will be used for future collaborative decision-making training efforts in the agency.

Minnesota Waterfowl Hunter Survey

Investigator: David C. Fulton

Student: Elizabeth Price, M.S. (Conservation Biology)

Duration: December 2000 to December 2001

Funding Source: Minnesota Department of Natural Resources

Project Location: Minnesota Cooperative Fish and Wildlife Research Unit

Minnesota has the largest number of waterfowl hunters of any state in the United States, yet quantitative information about this important clientele is limited. Hunter numbers and harvest are estimated annually by the U.S. Fish and Wildlife Service (Federal Harvest Estimates) and the Minnesota Department of Natural Resources (MNDNR) Small Game Hunter Survey. Minnesota participated in the North American Duck Hunter Survey, and Minnesota hunter responses have been compared to those the in rest of the United States. Hunter satisfaction is important, and while the MNDNR is primarily a regulatory agency, maintaining waterfowl hunter numbers over the long term will depend upon a satisfied clientele.

The objectives of this study were: 1) to provide baseline information on waterfowl hunter demographics in Minnesota; 2) identify hunter preferences/opinion on various waterfowl

hunting, management, and regulations issues; and 3) measure hunter satisfaction.

Development of annual waterfowl hunting regulations must be within the frameworks established by the U.S. Fish and Wildlife Service, yet there is some latitude within those frameworks to adjust season structure based upon unique state characteristics and hunter preference. A Saturday opening day, youth waterfowl hunt, or customized regulations are examples of regulations that could be modified by hunter preference. Also, hunter responses will provide a better understanding of where the MNDNR Division of Wildlife needs to focus information and education efforts.

A report summarizing results from this study is available from the Minnesota Cooperative Fish and Wildlife Research Unit.

Modeling the Environmental Impacts of Farming Systems in Two Watersheds in Minnesota

Investigator: Bruce Vondracek

Student: Julie Zimmerman, Ph.D. (Fisheries)

Duration: September 2000 to June 2001

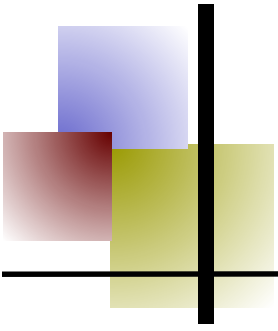
Funding Source: Land Stewardship Project

Project Location: Minnesota Cooperative Fish and Wildlife Research Unit

A multi-disciplinary team was established to investigate the multiple benefits that farming provides to citizens in Minnesota. The team was interested in developing policy that rewards farmers for producing multiple benefits, especially in the transition to integrated, sustainable farming systems. Most analyses have focused on farm profitability, but have included cost-benefit analyses of trade-offs between water quality improvements or other environmental gains on on-farm profitability. However, economic values for other ecosystem impacts, such as flood control or production of wild plants and animals in the landscape, are not often reported.

We developed detailed computer simulation models to calculate in-stream suspended sediment concentrations using estimates of sediment delivery, runoff, baseflow and stream bank erosion, and quantified the effects of suspended sediment exposure on fish

communities in two streams. We predicted the effects of agricultural practices on stream fish communities under several possible land use scenarios, with reference to current conditions. Land-use changes lead to reductions in sediment loading of up to 84% in Wells Creek and 49% in the Chippewa River. The reduction in sediment loading across scenarios may be directly related to a reduction in runoff by about 35% in both study areas. We found a 98% decrease in “lethal” concentrations of suspended sediment on fish in Wells Creek with an increase in conservation tillage, riparian buffers, and permanent vegetative cover. However, the effects of suspended sediment on fish did not significantly decrease in the Chippewa River. The difference between study areas was likely due to differential tolerance to suspended sediment between coolwater and warmwater fish communities and differences in topography, runoff and bank erosion between the two streams.



Ongoing Research



Applied Ecology



Double-crested Cormorant Status Assessment and Biodiversity Impact Study

Investigator: Francesca Cuthbert (Cooperating Faculty)

Students: Dale R. Trexel, M.S. (Conservation Biology)

Duration: August 2000 to March 2003

Funding Source: U.S. Fish and Wildlife Service, Region 3

Project Location: University of Minnesota, St. Paul

Increases in population sizes of double-crested cormorants have resulted in concern about their impacts on prey populations and breeding habitat. This project will assess impacts of cormorants on breeding habitat and other colonial-nesting waterbirds on selected islands in the U.S. Great Lakes, and summarize existing information on cormorant population status in North America. Results of this project will provide information regarding impacts of cormorants on prey populations, breeding habitat, and other colonial-nesting waterbirds. This information will be used by management agencies to develop management strategies for cormorants.

In 2001, a status assessment was completed that considered the North American range of the double-crested cormorant. The report detailed population trends, factors contributing to the rapid population growth witnessed over the last twenty years, diet and interactions with commercial fisheries, impacts on other bird



species, and vegetation near colony sites. Also included within the report, management agencies from across the cormorant's range identified basic research and monitoring needs to more effectively manage this highly visible species. Further analyses of impacts to local native flora and fauna surrounding high cormorant density areas are currently underway.

Conservation of Great Lakes Colonial Waterbirds

Investigator: Francesca Cuthbert (Cooperating Faculty)

Staff: Linda R. Wires

Student: Dale R. Trexel, M.S. (Conservation Biology)

Duration: July 2002 to June 2003

Funding Source: U.S. Fish and Wildlife Service, Division of Migratory Birds

Project Location: Lakes Michigan, Huron and Superior in State of Michigan waters
LaCrosse, Wisconsin
University of Minnesota, St. Paul

The double-crested cormorant (*Phalacrocorax auritus*) is listed as a U. S. Fish and Wildlife Service (USFWS) Region 3 Resource Conservation Priority Species, and is of special concern to the USFWS because of problems associated with recent increases in the Region. Because the USFWS is interested in potentially managing this species, demographic data are necessary to develop biologically sound management plans. Data on important life history parameters (e.g., survival, age of first reproduction) are limited, and research in this area has been identified as a top research priority (Research Needs for North American Cormorant Management: An Interagency Panel Discussion, held in Sandusky, OH, 2000). Long-term studies of marked individuals are needed to acquire these types of data.

Project objectives include obtaining the following information from marked birds: fidelity to natal colony; survival estimates for adults and juveniles; age of first reproduction;



movement among colonies and to wintering grounds; assess the impact of night-time banding of double-crested cormorant nestlings; and coordinate these studies with the efforts of other investigators in the region. This proposed work is especially relevant for any modeling efforts that may be incorporated in the development of management plans for the Great Lakes double-crested cormorant population.

Characterization of Existing Critical Habitat for the Great Lakes Piping Plover

Investigator: Francesca Cuthbert (Cooperating Faculty)

Student: Adam Barlow, M.S. (Conservation Biology)

Duration: July 2002 to June 2003

Funding Source: U.S. Fish and Wildlife Service, Region 3

Project Location: University of Minnesota, St. Paul

The piping plover (*Charadrius melodus*) is a shorebird endemic to North America. Three breeding populations are recognized; Atlantic Coast, Great Lakes, and Northern Great Plains. The smallest of these, Great Lakes, was listed as endangered in the mid-1980s. As part of the recovery process, critical habitat was recently designated under the Endangered Species Act. Selection of this habitat was done based on records of current and historic use by plovers; some habitat was included because it appears to have potential for use by piping plovers. Because this habitat is needed by the population to achieve recovery, it is imperative that the habitat is characterized and evaluated close to the time designation was completed. The characterization we propose to do will be part of a larger study, conducted by a graduate student at the University of Minnesota, that examines habitat characteristics at currently used, historical, and potential plover nesting habitat in the Great Lakes.

Specific Objectives:

1. Use aerial photos to delineate boundaries, measure Primary Constituent Elements, and identify



major landmarks (e.g. piers, marinas, significant buildings, public beaches) of the 35 Critical Habitat Units in the U.S. Great Lakes.

2. Organize this information in a spatial database (ArcView).
3. Develop database structure and begin entering data on nest location, breeding pair natural history, and historical plover use of critical habitat to demonstrate database structure and utility.

Eastern Prairie Population Canada Goose Breeding Ecology

Investigator: David E. Andersen

Students: John E. Sammler, M.S. (Wildlife Conservation)
Robert R. Nack, M.S. (Wildlife Conservation)

Duration: August 1999 to December 2003

Funding Sources: U.S. Geological Survey – Biological Resources Division,
Cooperative Research Units
Mississippi Flyway Council, EPP Canada Goose Technical
Committee (through the Wildlife Management Institute)
Manitoba Department of Natural Resources
Minnesota Department of Natural Resources
U.S. Fish and Wildlife Service
Iowa Department of Natural Resources
Missouri Department of Conservation
Arkansas Game and Fish Commission
Canadian Wildlife Service

Project Location: Cape Churchill, Manitoba
Minnesota Cooperative Fish and Wildlife Research Unit

Eastern Prairie Population (EPP) Canada geese (*Branta canadensis*) breed in the Hudson Bay Lowlands in northeastern Manitoba. This population of Canada Geese migrates through southern Manitoba and western Minnesota, and historically wintered in Missouri and Arkansas. Because they nest in the sub-Arctic, EPP geese exhibit wide variation in productivity and recruitment, and annual information regarding breeding ecology and population status is required to effectively manage harvest.

Research on breeding ecology of this population of sub-Arctic-nesting geese has continued since the 1960s, and information from these studies has been used to develop management and harvest strategies. Long-term monitoring of breeding density, nesting success, gosling production, and other breeding population parameters has resulted in information useful in modeling this population. These monitoring efforts occur in close proximity to the La Perouse Bay snow goose (*Anser caerulescens caerulescens*) colony, and over the past 20 years, snow goose use of the study area has increased



dramatically. During the same period, breeding densities of Canada geese have dropped dramatically, and snow geese now dominate numerically in historic Canada goose brood-rearing areas. Beginning in 1999, we initiated field work on a project designed to investigate the relationship between Canada and snow geese on the breeding grounds. Adult female geese were radio-marked prior to hatch, and subsequently monitored from the ground and air to document habitat use and interactions with

snow geese during the brood-rearing period. In 2001 and 2002, we also repeated extensive aerial brood surveys and compared our results to those from surveys conducted in the late 1970s, prior to use of this area by snow goose broods. In addition, surveys for nesting songbirds and shorebirds were conducted in 1998, 1999, and 2000, and these data were compared to survey

data collected in 1984, prior to significant use of the study area by snow geese. Field activities in 2001 and 2002 also included monitoring Canada goose breeding density, nesting success, and other breeding population parameters at the Cape Churchill study area.



Ecology of Oak Savanna Birds at Sherburne National Wildlife Refuge

Investigator: David E. Andersen

Student: Leakhena Au, M.S. (Wildlife Conservation)

Duration: September 2000 to September 2003

Funding Sources: U.S. Fish and Wildlife Service
Sherburne National Wildlife Refuge
National Science Foundation

Project Location: Sherburne National Wildlife Refuge
Minnesota Cooperative Fish and Wildlife Research Unit

Oak savanna habitats are one of the most endangered habitats in the Upper Midwest and relatively little is known regarding the ecology of birds that occupy these habitats. Habitat management activities at the Sherburne National Wildlife Refuge in east-central Minnesota emphasize maintaining, restoring, and enhancing oak savanna, yet few data exist regarding occurrence of breeding birds at this site and their response to management activities. Effects of habitat changes on breeding birds in landscapes dominated by oak savanna are likely to be different than in landscapes dominated by forest or grassland habitats, where fragmentation is generally thought to have negative consequences. In contrast, oak savanna habitats are naturally heterogeneous, and birds that breed and persist in these habitats may not be affected in the same manner by habitat fragmentation as birds in other landscapes. Aspects of this project



include summarizing and reviewing existing data on oak savanna birds, conducting surveys for these birds at Sherburne National Wildlife Refuge, and evaluating habitat relations and effects of habitat management. Breeding bird surveys were conducted in 2001 and 2002 and data are currently being analyzed for publication.

Fall Movements, Habitat Use, and Survival of the American Woodcock in the Western Great Lakes Region

Investigator: David E. Andersen

Student: Kevin Doherty, M.S. (Wildlife Conservation)

Duration: September 2000 to December 2003

Funding Sources: U.S. Fish and Wildlife Service
Minnesota Department of Natural Resources
U.S. Geological Survey – Biological Resources Division

Project Location: Mille Lacs and Four Brooks Wildlife Management Areas
Minnesota Cooperative Fish and Wildlife Research Unit

Little is known regarding fall movements, habitat use, and survival of American woodcock (*Scolopax minor*), particularly in the Central Management Unit. As part of a regional study to investigate these aspects of woodcock ecology, and to understand the impact of harvest on fall woodcock survival, we initiated a 3-year study of fall woodcock ecology in Minnesota. This study is being conducted in parallel with studies in Wisconsin and Michigan. Specific project objectives include: (1) Identify a pair of study sites in close geographic proximity in Minnesota, where woodcock habitat and population sizes are expected to be similar. One of these areas would be open to woodcock hunting, and the other would be closed to woodcock hunting; (2) Capture and equip woodcock with radio transmitters on both study sites (n = 30 - 60 per site per year) in late summer and early fall, prior to the initiation of the woodcock hunting season; (3) Monitor survival and habitat use of radio-marked woodcock on both study sites through the hunting season or until surviving woodcock migrate from the study sites; (4) As much as possible, make the study protocol compatible with data collection in the Eastern Management Unit, and any concurrent studies of woodcock



survival and fall movement in the Central Management Unit. Field work in Minnesota began in 2001 and continued in 2002. Seventy-five woodcock were radio-marked in 2001 and 138 woodcock were radio-marked in 2002. In general, survival during the hunting season was higher in 2001 than in 2002, with only 1 radio-marked bird in 2001 compared with 8 birds shot in 2002. In both years, radio-marked woodcock remained on the study area into late October and early November, but many birds made significant local movements prior to migration. Field work will continue through at least the 2003 field season.

Home Range and Habitat Use of Breeding Northern Goshawks in North-central Minnesota

Investigators: David E. Andersen, Clint Boal, and Patricia L. Kennedy (Colorado State University)

Student: Aimee Roberson, M.S. (Conservation Biology)
Brett Smithers, M.S. (Wildlife – Texas Tech University)

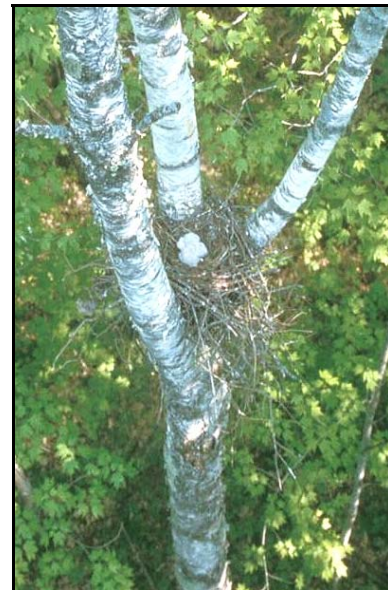
Duration: January 1998 to December 2003

Funding Sources: U.S. Forest Service
Chippewa National Forest
Superior National Forest
Voyageurs National Forest
National Council of the Paper Industry for Air and Stream Improvements
Potlatch Corporation
Leech Lake Band of Chippewa
Minnesota Department of Natural Resources
Minnesota Falconer's Association
U.S. Fish and Wildlife Service

Project Location: Chippewa and Superior National Forests and surrounding northcentral and northeastern Minnesota

In the western Great Lakes Region, the population status of goshawks is largely unknown. Existing information on goshawk population ecology in this portion of their range is limited to long-term monitoring of nest sites and scattered information on food habits and movements from studies of individual nests or birds. Only recently have efforts been undertaken to quantitatively describe nest sites and assess breeding population status beyond single study sites. The objective of this cooperative study is to begin to address this information gap by collecting data on habitat use, home range, and habitat requirements for goshawks in Minnesota, with potential for direct application toward conservation and management of goshawks throughout the Laurentian Mixed Forest Province. From 1998 through 2000, we captured and radio-equipped 33 breeding northern goshawks in northern Minnesota, and monitored their movements from the ground and air (1998) or exclusively from the air (1999 and 2000) through the fledgling-dependency period (mid-August). In addition, we measured structural habitat characteristics at

a subset of locations for each male goshawk, and in 2000, 2001, and 2002 placed video cameras and recording equipment at nests to document food habits. In 1999 and 2000, we also established fixed stations at active nest sites, and evaluated call broadcasts for potential use as a survey technique in the western Great Lakes region. Mean home range size for male goshawks during the breeding season averaged 2,676 ha (Minimum Convex Polygon) and male goshawks exhibited a strong preference for old



early successional upland hardwood, mature late successional upland conifer, and mature upland early successional conifer habitats. Stands used for foraging had high stem densities of large canopy trees, with distinct subcanopy and shrub

layers. Call broadcast surveys were most effective during the courtship and nestling breeding phases, and we developed an approach to use these surveys to estimate breeding density.



Recovery Information Needed to Prevent Extinction of the Federally Endangered Winged Mapleleaf Mussel

Investigators: Mark C. Hove and Anne R. Kapuscinski (Cooperating Faculty)

Duration: June 2001 to August 2004

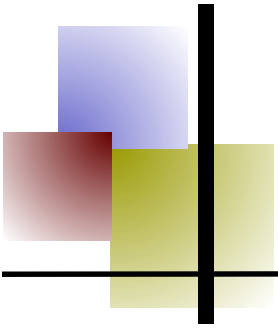
Funding Sources: U.S. Fish and Wildlife Service
Undergraduate Research Opportunities Program, University of Minnesota

Project Locations: St. Croix River, Minnesota and Wisconsin
Wet Laboratory, University of Minnesota

Freshwater mussels are among the most threatened groups of organisms in the United States and resource managers need ecological information to improve conservation efforts. Biologists concerned about rare freshwater mussels have identified the need to increase fundamental knowledge of basic mussel biology as a top priority in the national strategy for freshwater mussel conservation. As part of the freshwater mussel's life cycle, a larval mussel must briefly attach to a particular host fish species in order to metamorphose into a juvenile. Identification of fish hosts is the highest priority item listed under the basic biology research goal. Host requirements of the federally endangered winged mapleleaf and Higgins eye need further analysis. Lack of information makes it nearly impossible to determine the viability of imperiled mussel populations either in degraded habitats, where they now occur, or in habitats being considered for translocation of mussels to rescue them from spread of zebra mussels or from other threats. This project includes:



verifying known suitable host species, identifying new host species, and improving methods to propagate juvenile mussels. Host suitability trials and propagation studies were conducted during 2001 and 2002. Some data have been published, and remaining data are being analyzed for presentations and publications.



Ongoing Research



Human Activities,
Management, and
Conservation



Assessment of Use and Benefits of Waterfowl Production Areas in Minnesota

Investigators: David C. Fulton and Dorothy Anderson

Student: Jonathan Vlaming, M.S. (Forest Resources)

Duration: September 1999 to June 2003

Funding Source: U.S. Fish and Wildlife Service, Region 3

Project Location: Wetland Management Districts, Minnesota
U.S. Fish and Wildlife Service
University of Minnesota

Although information concerning public visitation and the factors affecting public support of Waterfowl Production Area (WPA) management are essential to effective WPA management strategies, at the present time little is known about the level of public use on WPAs or the value and benefits of the WPAs to users. The purpose of this study is to develop a sampling methodology for accurately estimating the level of public use on small, dispersed recreation areas such as WPAs and to identify the types of benefits provided by WPAs and the non-economic value and importance of those benefits to the public. Specific study objectives are to: 1) develop a valid and reliable methodology for estimating visitation rates at WPAs within each of the 5 Wetland Management Districts

(WMDs) within Minnesota (estimates at the WMD level); 2) identify the level of use for different activities at WPAs; 3) develop and assess a social psychological framework for identifying and measuring the non-economic benefits that WPA users receive from WPAs; and 4) determine the influence of non-economic benefits on user support for federal ownership and management of WPAs.

A report summarizing visitor activities and benefits associated with WPAs has been completed and is available from the Minnesota Cooperative Fish and Wildlife Research Unit. Protocols for estimating visitation were developed and data used to estimate visitation levels have been collected and are being analyzed.

Biodiversity Conflict Management: Land-use Policies in Island Landscapes, a State-level Comparison

Investigators: Bruce Vondracek and Kristen Nelson

Student: Fiona Nagle, M.S. (Conservation Biology)

Duration: December 2001 to June 2004

Funding Sources: Consortium on Law and Values in Health, Environment
MacArthur Fellowship

Project Location: Hawaii, Southern California, Tasmania

State and regional policies that designate land for biodiversity reserves are found worldwide. However, with escalating globalization, development, and biodiversity crises, policy goals have faced increasingly intense competition from human-oriented land uses. Island landscapes, both oceanic and terrestrial (i.e., geographically isolated areas), foster particularly contentious disputes between government officials and land users due to the

juxtaposition of local species crises and the finiteness of land and economic alternatives. Using policy case studies, disputes, which disrupt policy implementation will be explored to determine whether conflict management effectively promotes biodiversity and human welfare. Recommendations will address improved future conservation land-use policies. One case study, Hawaii, is complete.

Breeding Biology and Management of the Great Lakes Piping Plover Population: Shoreline Habitat and Species Protection Program

Investigator: Francesca Cuthbert (Cooperating Faculty)

Staff: Jennifer Hathaway-Stucker

Students: Vanessa Pompeii, M.S. (Conservation Biology)
Elizabeth Weaver, M.S. (Conservation Biology)
Olivia LeDee, Ph.D. (Conservation Biology)

Duration: April 2000 to February 2003

Funding Source: U.S. Fish and Wildlife Service, Region 3

Project Location: Upper Peninsula Michigan
University of Minnesota, St. Paul

The Great Lakes population of the piping plover was given federal endangered status in 1986. At that time, the only remaining breeding areas in the Great Lakes region were located within the state of Michigan. The islands of northern Lake Michigan (Charlevoix County) and shoreline of Emmet, Leelanau, and Cheboygan counties are historically important breeding sites for piping plovers in Michigan's Lower Peninsula. Since the mid-1980s, nesting sites have been located and monitored in the Lower Peninsula of Michigan in Benzie, Charlevoix, Emmet, Leelanau, and Cheboygan counties. In the Upper Peninsula, nests have been located in Mackinac, Chippewa, Luce and Alger counties. During 1998, a pair of plovers hatched at different Michigan sites dispersed to Long Island (Ashland County, Wisconsin), successfully fledged young, and expanded the recent breeding range of the Great Lakes population. Objectives of this study are to continue to locate and monitor breeding plovers in the Great Lakes population, coordinate nest protection efforts, and estimate population parameters important for conservation.

In 2002, the research group surveyed the Michigan shoreline, targeting areas where recent



or historical breeding and nesting attempts are known to have occurred. The U.S. Fish and Wildlife Service and the Wisconsin Department of Natural Resources surveyed portions of the Wisconsin shoreline. Existing nests were protected with predator enclosures monitored throughout the season. As much as possible, both adults and chicks were banded for future identification, and locations recorded for each capture or nesting site. In total, 51 pairs of plovers were confirmed to have nested in the Great Lakes region; 79.4% and 19.6% of these nested on public and private land, respectively. The 2002 breeding season resulted in 61 chicks successfully fledged, based on nests monitored, and 19 captive reared birds released.

Constraints and Opportunities for Quality Trout Angling Experiences in Southeastern Minnesota

Investigators: David C. Fulton and Bruce Vondracek

Students: Kristen Blann, Ph.D. (Conservation Biology)
Jonathan Vlaming, Ph.D. (Conservation Biology)

Duration: August 2000 to December 2003

Funding Source: Minnesota Department of Natural Resources

Project Location: Southeast Minnesota
Minnesota Cooperative Fish and Wildlife Research Unit

Management of quality trout fishing opportunities in the state of Minnesota has been a contentious issue for several years. Much of the conflict focuses on the competing demands of anglers who have different beliefs about the size and quantity of fish that can be produced by various streams in the region. Managers are challenged with identifying the demands of the trout angling public as well as developing regulations that attend to these various demands while adhering to the available scientific knowledge of resource conditions and capabilities. This project will develop an outcomes-based management system designed to improve the quality of the trout fishing experience in southeastern Minnesota. We will accomplish this goal through seven objectives: 1) identify differences in the biological productivity (e.g., species and size class abundance, growth rates, and growth potentials) of diverse trout streams in southeast Minnesota; 2) determine the factors affecting stream productivity such as physical habitat measures and habitat suitability, habitat improvement activities, land use practices, food availability, fishing pressure, and supplemental fish stocking (brown and indigenous brook trout), 3) assess trout angler knowledge of factors affecting trout

populations and stream quality, and 4) define public preferences for angling experiences, activities, settings and benefits associated with these trout waters. To integrate the biophysical and social information we will 5) use general linear, structural equations, and multinomial logit modeling to define the social and biophysical variables that most influence production of desired stream and fisheries benefits (e.g., angler satisfaction levels) at the individual, community, and environmental levels. Based upon variables identified through modeling the fishery's benefit production, we will then develop 6) commensurate angler classification and stream classification systems using cluster and principal components analyses that will form the basis for a "Trout Angling Opportunity Spectrum," and 7) angler demand and participation models incorporating biological, social, and economic (e.g., travel cost and willingness-to-pay) variables to estimate the demand for various trout angling opportunities identified by the "Trout Angling Opportunity Spectrum." The demand and participation models will allow managers to determine the most appropriate mix of trout angling opportunities.

Geospatial Techniques for National Wildlife Refuge Planning and Management

Investigator: Thomas E. Burk (Cooperating Faculty)

Students: Jennifer Sieracki Karen Walker
Nicole Brown Kari Geurts
Brian Mueller Perry Nacionales
Marcelle Caturia

Duration: August 2000 to September 2003

Funding Source: U.S. Fish and Wildlife Service, Region 3

Project Location: University of Minnesota, St. Paul

Geographic Information Systems (GIS), with an accompanying relational database management system, for managing, manipulating, and analyzing spatial data have been derived and illustrated for use in Comprehensive Conservation Planning. The GIS are built on the basic framework begun in previous cooperative work related to data acquisition, analysis, and presentation. A new hierarchical system for standardizing the collation of important data themes was derived and implemented on refuges. The use of remote sensing technology for acquiring habitat data has been examined. Approaches utilizing color infrared aerial photography collected in the fall proved to provide the level of detail refuge managers require in a cost effective manner. Approaches for constructing matrices relating critical species needs to habitat were used to augment the derived habitat maps for use in futures planning. A standard operating procedure for producing refuge boundary maps was derived and the resulting data will be the basis for an Internet-WWW system that allows easy access to USFWS holdings information by the public and other organizations. Techniques for improving



the presentation of resulting image mosaics, for example as background in public meetings, are being compared. Gaps where a significant field data collection component is required for adequate characterization of features of interest in conservation planning are being studied.

Groundwater Modelling in Southeast Minnesota

Investigator: Bruce Vondracek

Students: Mary Williams, Ph.D. (Conservation Biology)

Duration: July 2002 to June 2005

Funding Source: Minnesota Department of Natural Resources

Project Location: University of Minnesota, St. Paul

The goal of this project is to develop a better understanding of groundwater input to southeast Minnesota streams. Often stream habitat management treats the symptom (building instream habitat or stocking trout) rather than the problem (modifying terrestrial vegetation and soil that affect hydrology). To appropriately manage southeast Minnesota streams, it is important to understand the mechanisms that may contribute to changes in the quality of streams, principally coldwater input, and the effect on fish communities. Some streams appear to have potential for supporting trout, but do not support healthy trout populations at this time, likely due to insufficient groundwater input. Brook trout have been associated with colder upstream reaches in southeast Minnesota where groundwater inputs are likely. This study will offer insight into the effects of conventional agricultural impacts on water quantity and trout populations of southeastern Minnesota streams. There are four objectives: 1) predict locations of groundwater input to streams in southeast Minnesota based on bedrock type, slope, and stream gradient using GIS data layer from Fillmore County as a template, 2) predict

groundwater delivery (volume) to streams in southeast Minnesota based on modelling with the Soil and Water Assessment Tool (SWAT), 3) relate groundwater delivery to trout abundance/size structure, and 4) model change in groundwater delivery based on potential landuse changes, especially forestry practices and agricultural land use. To achieve these objectives the SWAT model will be linked with a Geographic Information System (GIS) to predict locations of groundwater input, simulate groundwater delivery, and assess how changes in land use could affect volume of groundwater input. Land use will be examined under two types of simulation: a baseline condition representative of current conventional agriculture and forestry practices and a second condition representative of BMP practices and other landuse changes that increase perennial vegetation. Trout population abundance and size structure will be assessed in relation to current and potential groundwater delivery using available DNR stream survey data. Stream survey and groundwater inflow information will be linked to the streams coverage in GIS.

Trends on Fisheries Issues in Minnesota

Investigator: David C. Fulton

Students: John Epton, M.S. (Conservation Biology)
Joanna Rosendahl, M.S. (Forest Resources)

Duration: January 2000 to June 2003

Funding Source: Minnesota Department of Natural Resources

Project Location: Minnesota Cooperative Fish and Wildlife Research Unit

The purpose of this study is to develop a better understanding of anglers' perceptions of fisheries management issues and to initiate a long-term research program that will assist the Minnesota Department of Natural Resources with tracking trends in public perception of fisheries management issues. The objectives of this study are to 1) determine anglers' attitudes toward and support for various fishing regulations in the state including regulations pertaining to the size and number of fish that can be retained; 2) assess anglers' perception of the effect of fishing regulations on the fishing experience; 3) develop a battery of items based on research studies in Minnesota and

other states that will be used to track trends in anglers' 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.

Data are being collected to provide baseline information concerning Minnesota angler's perceptions of crowding, angling ethics, and conflicts among users in the state. Data collection will be complete by 1 June 2003, and a study report available 1 July 2003.

Understanding Visitor Uses, Motives, and Benefits at Sherburne National Wildlife Refuge

Investigators: David C. Fulton and Dorothy Anderson

Student: Michelle Payton, M.S. (Forest Resources)

Duration: September 2000 to December 2003

Funding Sources: U.S. Fish and Wildlife Service
U.S. Geological Survey

Project Location: Sherburne National Wildlife Refuge
Minnesota Cooperative Fish and Wildlife Research Unit

This project focuses on developing information concerning refuge visitors' motivations for visiting Sherburne National Wildlife Refuge (NWR) and their perceptions of management issues at the refuge including issues involving visitor-visitor interactions, visitor-resource interactions and impacts, and visitor-management structure interactions. The research will be directed primarily by current ideas and theory concerning outcomes-based management (experience and benefits-based) of natural resource use. This approach to managing recreational use of natural resources is a relatively new area of research focus. One key aspect of this approach will be the development of a system of indicators and standards for specifying management objectives that will facilitate the integration of biophysical and social information in the Comprehensive Conservation Planning (CCP) process, as well as serve as a basis for quantitative evaluation of planning decisions and actions. This research will improve the scientific understanding of the relationship between recreational experiences and long-term social and psychological benefits associated with recreation participation as well as providing guidance in development of a CCP for the Sherburne NWR. The proposed



study will be coordinated with a larger effort to develop a foundation for accomplishing CCP in the refuge system. A series of studies with a focus of integrating biophysical and social information for refuge planning are being developed in Region 3 and Region 6 of the U.S. Fish and Wildlife Service. This study will be fully integrated with those research efforts and substantial funding for this effort will be contributed by U.S. Geological Survey. Specific study objectives are to:

1. Identify visitor motivations for visiting Sherburne NWR,
2. Identify the desired experiences and benefits that visitors receive from Sherburne NWR,

3. Identify objectives preferred by various visitor segments interested in the management of Sherburne NWR,
4. Develop a system of biophysical and social indicators to facilitate long-term monitoring of whether or not desired management objectives are being achieved for Sherburne NWR.

A visitor study report has been completed and is available from the Minnesota Cooperative Fish and Wildlife Research Unit. This information was used in developing the Sherburne CCP. Additional information from the communities surrounding Sherburne will be gathered during summer 2003.



Trends in Human Use and Conservation of Fisheries and Wildlife Resources in Minnesota

Investigators: David C. Fulton

Student: Susan Schroeder, Ph.D. (Natural Resources)

Duration: September 2002 to December 2005

Funding Sources: Minnesota Department of Natural Resources
Division of Fisheries
Division of Wildlife

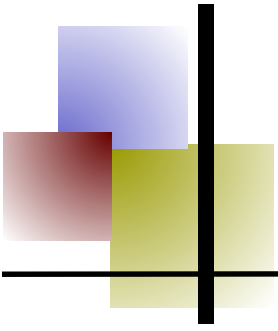
Project Location: Minnesota Cooperative Fish and Wildlife Research Unit

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



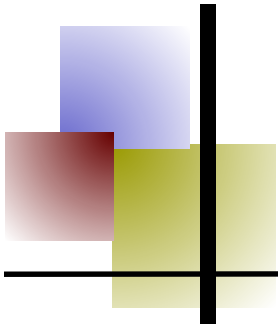
Fish and Wildlife Research Unit.

A research fellow was hired in fall 2002, and she is currently conducting research related to the 2002 waterfowl hunting season and trends in hunter and angler recruitment and retention in Minnesota.



Activities





Publications

PEER-REVIEWED

2001

Fulton, D.C. 2001. Integrating social information into decision-making. Pp. 43-50 in R. DuBois, K. Kayle, M. Ebbers, and S. Turner, editors. *Trout and the Trout Angler: Workshop II*. American Fisheries Society, North Central Division, Salmonid Technical Committee, St. Paul, Minnesota.

Lane, W.H., **D.E. Andersen**, and T.H. Nicholls. 2001. Distribution, abundance, and habitat use of singing male boreal owls in northeast Minnesota. *Journal of Raptor Research* 35:130-140.

Nerbonne, B.A. and **B. Vondracek**. 2001. Effects of land use on benthic macroinvertebrates and fish in the Whitewater River, Minnesota. *Environmental Management* 28:87-99.

Runstrom, A.L., **B. Vondracek**, and C.A. Jennings. 2001. The population dynamics of paddlefish in the lower Wisconsin River. *Transactions of the American Fisheries Society* 130:546-556.

Vaske, J.J., **D.C. Fulton**, and M.J. Manfredo. 2001. Human dimensions considerations in wildlife management planning. Pp. 89-105. D. Decker and T. Brown, eds. *Human dimensions of wildlife management in North America*. The Wildlife Society. Bethesda, MD.

Vondracek, B., K.L. Blann and B. A. Nerbonne. 2001. Habitat-fish relationships across local to watershed scales. Pp. 7-22. in R. DuBois, K. Kayle, M. Ebbers, and S. Turner, eds. *Trout and the trout angler: Workshop II*. American Fisheries Society, North Central Division, Salmonid Technical Committee, St. Paul, Minnesota.

2002

Blann, K.L., J.F. Nerbonne and **B. Vondracek**. 2002. Relationship of riparian buffer type to physical habitat and stream temperature. *North American Journal of Fisheries Management* 22:441-451.

Fulton, D.C., D. Whittaker, and M.J. Manfredo. 2002. A planning framework for experience-based wildlife-viewing management. Pp. 93-122. In M. Manfredo, ed. *Wildlife Viewing in North America*. Oregon State University Press, Corvallis, OR.

Grant, G.C., **B. Vondracek**, and P.W. Sorensen. 2002. Spawning interactions between sympatric brown and brook trout may contribute to species replacement. *Transactions of the American Fisheries Society* 131:569-576.

Ruetz, C.R. III, R.M. Newman, and **B. Vondracek**. 2002. Top-down control in a detrital-based food web: fish, shredders, and leaf breakdown. *Oecologia* 132:307-315.

Warnke, D.K., **D.E. Andersen**, C.R. Dykstra, M.W. Meyer, and W.H. Karasov. 2002. Provisioning rates and time budgets of adult and nestling bald eagles at inland Wisconsin nests. *Journal of Raptor Research* 36:121-127.

In Press, Review or Revision

Andersen, D.E., T.B. FitzHenry, R.S. Sikes, D.K. Warnke, M.W. Meyer, C.J.R. Dykstra, and W.H. Karasov. *In Review*. Response of nesting bald eagles around western Lake Superior to human activity. *Journal of Raptor Research*.

Boal, C.W., **D.E. Andersen**, and P.L. Kennedy. *In Review*. Home range and residency status of northern goshawks breeding in Minnesota. *Condor*.

Cummings, D., E.F. Perry, J.E. Sammler, and **D.E. Andersen**. *In Revision*. Nest visitation rates near fledging of least flycatchers and red-eyed vireos in northcentral Minnesota: implications for nest monitoring. *Journal of Field Ornithology*.

Dougherty, E.M., **D.C. Fulton**, and D.H. Anderson. *In Press*. The influence of gender on the relationship between wildlife value orientations, beliefs, and the acceptability of lethal deer control in Cuyahoga Valley National Park. *Society and Natural Resources*.

Manolis, J.C., **D.E. Andersen**, and F.J. Cuthbert. *In Press*. Edge effect on nesting success of ground nesting birds near regenerating clearcuts in a forest-dominated landscape. *Auk*.

Meneks, M.L., **B. Vondracek**, and J. Hatch. *In Review*. Larval fish distribution in relation to physical and chemical factors in the Red River of the North. *Journal of Freshwater Ecology*.

Nack, R.R. and **D.E. Andersen**. *In Review*. Distribution of Eastern Prairie Population (EPP) Canada geese broods near Cape Churchill, Manitoba 1977-2002: potential influence of increased snow goose abundance. *Proceedings of the 2nd International Canada Goose Symposium*.

Nerbonne, J.A. and **B. Vondracek**. *In Press*. Volunteer macroinvertebrate monitoring: assessing training needs through examining error and bias in untrained volunteers. *Journal of the North American Benthological Society*.

Perry, E.F. and **D.E. Andersen**. *In Review*. Advantages of clustered nesting for least flycatchers in north-central Minnesota. *Wilson Bulletin*.

Ruetz, C.R., III, A.L. Hurford, and **B. Vondracek**. *In Revision*. Interspecific interaction between brown trout and slimy sculpin: competition and facilitation. *Transactions of the American Fisheries Society*.

TECHNICAL AND SEMI-TECHNICAL

2001

- Andersen, D. E.** and Clint W. Boal. 2001. Inventory of northern goshawks on Superior National Forest. U.S. Forest Service, Superior National Forest. Final Report. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, MN.
- Au, L. and **D.E. Andersen**. 2001. Avian indicators for dry oak savannas on the Anoka Sandplain, Minnesota. Annual Progress Report. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, MN.
- Boal, C.W., **D.E. Andersen**, and P.L. Kennedy. 2001. Home-range and habitat use of northern goshawks in Minnesota. Final Report. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, MN.
- Boody, G., M. Krinke, J.K. Henry, **B. Vondracek**, and 13 others. 2001. Economic analysis of agriculture for multiple benefits. Legislative Committee for Minnesota's Resources, St. Paul, MN.
- Currie, Leigh K. and **D.C. Fulton**. 2001. Managing Minnesota's fishing resource: a review of angler and resort owner attitudes toward bag limits. Final Report to Minnesota Department of Natural Resources.
- Doherty, K. and **D. E. Andersen**. 2001. American woodcock: fall survival, habitat use and movement patterns in central Minnesota. Annual Progress Report. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, MN.
- Dougherty, Erin M. and **D.C. Fulton**. 2001. Deer management in Cuyahoga Valley National Park: a study of local residents' attitudes. Cuyahoga Valley NP, Midwest Region, National Park Service. Final Report. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, MN.
- Nack, R. and **D.E. Andersen**. 2001. Canada geese brood movement and habitat use at Cape Churchill, Manitoba. Annual Progress Report. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, MN.
- Smithers, B., C. Boal and **D.E. Andersen**. 2001. An analysis of northern goshawk food habits using time lapse video recording systems and inventory of breeding sites in Minnesota. Annual Progress Report. Texas Cooperative Fish and Wildlife Research Unit, Lubbock, TX.

2002

- Epton, J.A. and **D.C. Fulton**. 2002. Evaluating decision-processes: summary of case studies of fisheries issues in Minnesota. Final Report. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, MN.
- Fulton, D.C.**, J.S. Lawrence, J. Vlaming, and E. Price. 2002. The 2000 waterfowl hunting season in Minnesota: a study of hunters' opinions and activities. Final Report. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, MN.

- Gartner, W.C., L.L. Love, D. Erkkila, and **D.C. Fulton**. 2002. Economic impact and social benefits study of coldwater angling in Minnesota. Final Report. Minnesota Tourism Center and Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, MN.
- Payton, M.A., D.H. Anderson, and **D.C. Fulton**. 2002. Sherburne National Wildlife Refuge visitor use 2000-2001. Final Report. Minnesota Cooperative Fish and Wildlife Research Unit and Cooperative Park Studies Program, University of Minnesota, St. Paul, MN.
- Vlaming, J., **D.C. Fulton**, D.H. Anderson, and J. Rosendahl. 2002. Minnesota Waterfowl Production Areas 2001 visitor use study. Final Report. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, MN.

Cooperating Faculty Publications

Note: This is an incomplete list as not all cooperating Principal Investigators provided publication information.

PEER-REVIEWED

2001

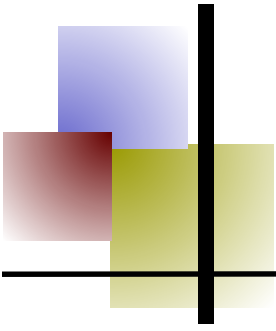
- Wemmer, L.C., U. Osmezi and F.J. Cuthbert. 2001. Habitat-based population model for the Great Lakes Piping Plover population. *Biological Conservation*. 99: 169-181.

2002

- Cuthbert, F.J., L.R. Wires and J.E. McKearnan. 2002. Potential impacts of double-crested cormorants on nesting great blue herons and black-crowned night-herons in the U.S. Great Lakes. *International Journal of Great Lakes Research*. 28:145-154.

In Press, Review, or Revision

- Wires, L.R., D.N. Carss, F.J. Cuthbert, and J.J. Hatch. Transcontinental connections in relation to cormorant-fisheries conflicts: perceptions and realities of a "bête noire" (black beast) on both sides of the Atlantic. *Vogelwelt*.



Completed Theses and Dissertations of Minnesota Coop Unit Students

2001

Currie, Leigh K. 2001. Managing Minnesota's fishing: a relationship between angler motivations and attitudes towards management practices and ethical angling behavior. M.S. Thesis, University of Minnesota, St. Paul. 107 pp.

Abstract: The overall objective of this study was to provide managers with more information regarding the users of Minnesota's fishing resources to allow for improved benefits-based management. This objective was accomplished by creating a typology of anglers to better understand targeted species, ethics, attitudes and preferences for management activities and the effect age may have on angling motivations. The results from this study can be applied to Minnesota fisheries management in both direct and indirect ways.

By grouping the angler respondents by age and by motivation typologies, we were able to provide a greater understanding of the users of Minnesota's fishing resources, which is the first step in benefits-based management. While the differences in angler clusters focused primarily on the domain of achievement/stimulation, the cluster centers of the motivational domains for all four clusters clearly showed that escaping pressure, self improvement and reflection, and enjoying nature and learning all rank higher in terms of importance than does the achievement/stimulation domain. This points to the importance of managing to reduce user conflicts, decrease crowding and promote scenic and natural beauty. These aspects of the angling experience may as important, if not more so, than the opportunity to catch large fish. However, understanding that the greatest differences in attitudes and ethics stemmed from differences within the achievement/stimulation domain can also help managers tailor their biological strategies for the greatest amount of user satisfaction. In addition, a greater percentage of respondents belonged to clusters 1 and 4 than to clusters 2 and 3. Clusters 1 and 4 were the clusters, which placed greater importance on achievement and stimulation as a motivating factor. So while escape, reflection and enjoying nature are deemed very important by a large majority of anglers, more than half of all anglers also include activity-based motivations in that 'very important' category.

Understanding differences between the various age groups of anglers shows that while there is perhaps a shifting social value regarding angling ethics and management practices, the shift is not necessarily a generational one. While education of future anglers is always important, education needs to be a part of management strategies for all age groups if the strategies are to be truly effective.

Simply providing managers with information regarding public opinion, however, does not insure the incorporation of social values and opinion into future management decisions. The gap between collecting the data and successfully implementing the results is one that is continuously closing, but that unfortunately still exists. In part this gap exists due to the difficulty in measuring values. As stated earlier, values are more deeply held than attitudes, beliefs or preferences. While the results of this

survey provide managers with sufficient information to better understand the publics' stated preferences towards various management actions, their underlying values towards nature may differ in such a way that these preferences are not manifested as expected. For example, while people may say they prefer lower limits for walleye, their value of personal freedom may override that sentiment and cause them to react negatively against any attempts at tightening regulations.

Dougherty, Erin M. 2001. Wildlife values, gender, and conflict over the acceptability of lethal deer control in Cuyahoga Valley National Park. M.S. Thesis, University of Minnesota, St. Paul. 37 pp.

Abstract: This study examined how wildlife value orientations, attitudes and gender influence acceptance of lethal actions to control deer in Cuyahoga Valley National Park in Ohio. Data were collected from female and male residents (n = 659) in a nine county area, the primary service area of the park. Females and males demonstrated significant differences in their wildlife value orientations, attitudes toward lethal deer control, beliefs about the outcome of lethal deer control, and perceived personal impacts of lethal deer control. Gender also acted as a moderator of the relationship between variables values, beliefs and attitudes. Results indicate that a focus on understanding differences between males and females is essential to public participation in decision-making concerning this and similar issues.

Roberson, Aimee M. 2001. Evaluating and developing survey techniques using broadcast conspecific calls for northern goshawks in Minnesota. M.S. Thesis, University of Minnesota, St. Paul. 41 pp.

Abstract: Broadcast surveys are effective at detecting northern goshawks (*Accipiter gentilis*) during their breeding season. Goshawk surveys are generally conducted using the alarm call during the nestling phase and the juvenile food-begging call during the fledgling-dependency phase (referred to as "standard calls"). However, goshawks are more vocal during their courtship phase than at any other time of the year. Because the probability of detecting goshawks declines after a nest has failed, a reliable means of surveying goshawks during the courtship phase would be more likely to detect nesting pairs than surveys conducted later in the breeding season. To evaluate the influence of breeding phase, distance, and call type on the probability of detecting goshawks, I estimated goshawk detection rates during the courtship, nestling, and fledgling-dependency stages of the breeding season, using three conspecific calls (adult alarm call, male contact call, and juvenile food-begging call) at distances of 100, 150, 225, and 325 m from active nests in northern Minnesota. Unlike previous studies, broadcasts were conducted at only one distance per trial to better describe the relationship between distance and probability of detection and to estimate effective area surveyed per broadcast station. In 1999, 85 broadcast trials were conducted in 9 active nest areas. Detections occurred during 18.9% of broadcast trials and during at least on broadcast trial at 9 of 11 nests. In 2000, 132 broadcast trials were conducted in 16 active nest areas. Detections occurred during 48.5% of broadcast trials and during at least on broadcast trial at all 16 nests. When using standard calls during broadcast trials and when pooled over all distances, detection rates were highest during the courtship (70.4%) and fledgling-dependence phases (67.6%). Detection rates were lowest during the nestling phase (28.1%), when there appeared to be higher variation in the likelihood of response among individuals, during the courtship and fledgling-dependency phases, detection rates decreased with distance from goshawk nests, whereas during the nestling phase, detection rates were highest at 225 m from nests. Differences in detection rates among breeding phases highlight the importance of incorporating knowledge about local breeding phenology into survey design. The male contact call did not improve detection rates over the alarm and juvenile food-begging calls. Results from this study will assist in designing systematic landscape-level surveys with a known probability of detection in the Western Great Lakes Region (WGLR) and in defining a distance-detection relationship for calibrating results of extensive surveys. I used probability of detection as a function of distance in the courtship and fledgling-dependency phases to calculate the effective area surveyed per broadcast station

using the survey techniques recommended in this paper. the effective area surveyed was 39.8 ha during the courtship phase and 34.4 ha during the fledgling-dependency phase. These results indicate that in Minnesota broadcast stations may be spaced 712 m and 662 m, respectively, when conducting systematic surveys during these two breeding phases. Calculation of the effective area surveyed could be applied to other regions where the probability of detection as a function of distance is known.

Ruetz, Carl Richard III. 2001. Effects of trout and sculpins on benthic macroinvertebrates, periphyton, and leaf litter decay in Valley Creek, Minnesota. Ph.D. Thesis, University of Minnesota, St. Paul. 166 pp.

Abstract: I used three approaches to investigate top-down control by fish in stream food webs. First I excluded fish from leaf packs in a stream to ascertain whether fish can cause a detritus-based trophic cascade. Fish reduced the densities of total invertebrates and shredders inhabiting leaf packs and that in turn affected leaf breakdown rates. However, fish effects on leaf breakdown were not always consistent with trophic cascade predictions due to differential responses of shredder taxa. I also manipulated the density of slimy sculpin (*Cottus cognatus*) to determine whether benthic fish can cause an algal-based trophic cascade. Slimy sculpin had inconsistent effects on invertebrates. I did not detect a trophic cascade because *Glossoma* larvae, which regulated periphyton biomass independently of other grazers, were not susceptible to predation and did not alter their behavior in response to fish. Therefore, top-down control by fish was stronger in detritus-based than algal-based food webs. Second, I developed a mathematical model to predict optimal drift strategies for prey faced with the conflicting demands of feeding efficiently and avoiding both benthic and drift predators. This model provided a framework to evaluate the effects of food availability and predation risks on the drift propensity of stream invertebrates. The model indicated that prey should drift from a site when food availability was low, benthic predation risk was high, and drift predation risk was low. Drifting should be affected by the likelihood of encountering an acceptable site and the rate of settling from the drift. Prey with high settling rates spent less time drifting and were less susceptible to drift predators. Finally I tested the strength of interspecific competition and predator facilitation between benthic-feeding slimy sculpin and drift-feeding brown trout (*Salmo trutta*) in stream enclosures. Brown trout growth was unaffected by slimy sculpin, whereas slimy sculpin growth was reduced when brown trout were present. *Gammarus pseudolimnaeus* densities were lowest when brown trout were present, indicating that exploitative competition may govern this interaction. In conclusion, top-down control by fish can be an important factor regulating stream food webs; however, the strength of top-down control appeared to be context dependent.

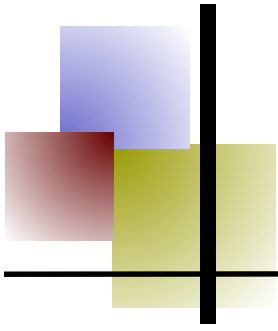
Sammler, John E. 2001. Population trends of tundra-nesting birds in Churchill, Manitoba: potential effects of increasing lesser snow goose (*Chen caerulescens caerulescens*) populations. M.S. Thesis, University of Minnesota, St. Paul. 60 pp.

Abstract: Recent increases in lesser snow goose (*Chen caerulescens caerulescens*) abundance have raised the question of how populations of other tundra-nesting birds are impacted by increased goose herbivory and habitat degradation. Line transect surveys were conducted on 30 transects at the Nestor 1 study site outside of Churchill, Manitoba in June 1984, 1999, and 2000 to obtain estimates of population densities of tundra-nesting birds and determine if density changes have occurred in relation to increased goose habitat damage. We also compared bird abundance at a smaller scale between degraded and non-degraded freshwater sedge meadows.

Herring gulls (*Larus argentatus*) and semipalmated sandpipers (*Calidris pusilla*) exhibited significant ($P < 0.05$) increases in population densities from 1984 to 1999 and 2000. Dunlins (*Calidris alpina*) had significantly lower densities from 1984 to 1999 ($P < 0.10$) and nonsignificant declines from 1984 to

2000. Horned larks (*Eremophila alpestris*), Lapland longspurs (*Calcarius lapponicus*), savannah sparrows (*Passerculus sandwichensis*), and the sedge meadow shorebird guild exhibited nonsignificant increases in density. The tundra-nesting passerine guild exhibited a significant ($P < 0.05$) increase in density from 1984 to 1999. Arctic terns (*Sterna paradiseaea*), pectoral sandpipers (*Calidris melanotos*), and willow ptarmigan (*Lagopus lagopus*) indicated significant ($P < 0.05$) declines in densities of birds seen on transects and in the numbers of transects birds were detected on. Significantly lower abundances of passerines and shorebird guild birds were detected in degraded freshwater sedge meadows versus non-degraded meadows.

Results indicate that most species did not exhibit population density declines over time on the study area, despite increased snow goose damage and density. However, at the scale of the habitat patch, the same groups of species had lower abundances in degraded habitats versus non-degraded habitats. Results suggest that habitat degradation led to lower bird abundance, however habitat damage may have to be widespread and severe to elicit population density declines over a large area, like Nestor 1. The species that exhibited density declines over the study area were larger, ground-nesting species.



Presentations

INVITED PRESENTATIONS

2001

Blann, K.L. and **B. Vondracek**. 2001. Linkages between instream habitat, riparian, and catchment characteristics: insights from GIS in southeastern Minnesota. 63rd Midwest Fish and Wildlife Conference, Des Moines, Iowa. December.

Vondracek, B., C.R. Ruetz, III, and A. L. Hurford. 2001. Interspecific interaction between brown trout and slimy sculpin: a test of competition and facilitation. Annual meeting of the North American Benthological Society, LaCrosse, Wisconsin. June.

Zimmerman, J.K., **B. Vondracek**, and J. Westra. 2001. Effects of agricultural practices on fish communities in two Minnesota watersheds. 63rd Midwest Fish and Wildlife Conference, Des Moines, Iowa. December.

2002

Boal, C.W., **D.E. Andersen**, and P.L. Kennedy. 2002. An ecological study of northern goshawks in Minnesota. Invited Seminar, Utah State University-Uintah Campus, Vernal, Utah. March.

Boal, C.W., **D.E. Andersen**, and P.L. Kennedy. 2002. Northern goshawk: status, conservation, and Minnesota overview. 2002 Minnesota SAF summer meeting. Cass Lake, Minnesota. September.

Fulton, D.C. 2002. Minnesota waterfowl hunters: A study of hunters' opinions and activities in 2000. Minnesota. Waterfowl Association Annual Meeting, Okoboji, Iowa. April.

CONTRIBUTED PRESENTATIONS

2001

Blann, K.L. and **B. Vondracek**. 2001. Hierarchical classification of southeastern Minnesota streams. Joint meeting of the Dakota, Minnesota, and Southeast Ontario chapters of the American Fisheries Society, Fargo, North Dakota. March.

- Currie, L.M. and **D.C. Fulton**. 2001. Using a normative approach to assessing fishing bag limits in Minnesota. 34th Minnesota Chapter of American Fisheries Society Meeting, Fargo, North Dakota. March.
- Currie, L.M. and **D.C. Fulton**. 2001. Using a normative approach to assessing fishing bag limits in Minnesota. 131st American Fisheries Society Meeting, Phoenix, Arizona. August.
- Henry, J.K., **B. Vondracek**, and J. Westra. 2001. Effects of agricultural practices on fish communities. Joint meeting of the Dakota, Minnesota, and Southeast Ontario chapters of the American Fisheries Society, Fargo, North Dakota. March.
- Roberson, A.M., **D.E. Andersen**, and P.L. Kennedy. 2001. Evaluating and developing survey techniques using broadcast conspecific calls for northern goshawks in Minnesota. 2001 Annual meeting of the Cooper Ornithological Society, Albuquerque, New Mexico. April.
- Ruetz, C.R., III, A.L. Hurford, and **B. Vondracek**. 2001. Interspecific interactions between brown trout and slimy sculpin: a test of competition and facilitation. 131th Annual meeting of the American Fisheries Society, Phoenix, Arizona. August. (Poster, awarded Honorable Mention)
- Ruetz, C.R., III, A.L. Hurford, and **B. Vondracek**. 2001. Interspecific interactions between brown trout and slimy sculpin. Joint meeting of the Dakota, Minnesota, and Southeast Ontario chapters of the American Fisheries Society, Fargo, North Dakota. March.
- Ruetz, C.R., III, R.M. Newman, and **B. Vondracek**. 2001. Complex trophic interactions in a coldwater stream: fish, benthic macroinvertebrates, and periphyton. Annual meeting of the Ecological Society of America, Madison, Wisconsin. August.
- Ruetz, C.R., III, R.M. Newman, and **B. Vondracek**. 2001. Top-down control in a detrital-based food web: fish, shredders, and leaf litter decay in a coldwater stream. Annual meeting of the North American Benthological Society, LaCrosse, Wisconsin. June.
- Schrader, D., C.R. Ruetz III, **B. Vondracek**, and R.M. Newman. 2001. Brown trout and slimy sculpin consumption on *Gammarus*. Joint meeting of the Dakota, Minnesota, and Southeast Ontario chapters of the American Fisheries Society, Fargo, North Dakota. March. (Poster)
- Vondracek, B.** and K.L. Blann. 2001. Hierarchical classification of southeastern Minnesota streams based on instream and landscape characteristics. 9th National Nonpoint Source Monitoring Workshop, Indianapolis, Indiana. April.

2002

- Blann, K.L. and **B. Vondracek**. 2002. Landowner perspectives on stream management and conservation programs in southeastern Minnesota. Annual meeting of the Minnesota Chapter of the American Fisheries Society, Duluth, Minnesota. January.
- Epton, J.A. and **D.C. Fulton**. 2002. Using participatory decision-making to build relationships in natural resource communities of interest. The 9th International Symposium on Society and Resource Management. Indiana University. Bloomington, Indiana. June.

- Fulton, D.C.** and D.H. Anderson. 2002. Assessing non-economic benefits of waterfowl production areas in Minnesota. The 9th International Symposium on Society and Resource Management. Indiana University. Bloomington, Indiana. June.
- Fulton, D.C.**, J.S. Lawrence, E. Price, and J. Vlaming. 2002. Comparison of Minnesota waterfowl hunters and wildlife professionals on beliefs about and support for waterfowl conservation and management strategies. 9th Annual The Wildlife Society Conference, Bismarck, North Dakota. September.
- Nack, R.R. and **D.E. Andersen**. 2002. Brood movements and distribution of Eastern Prairie Population (EPP) Canada geese in northern Manitoba. 9th Annual The Wildlife Society Conference. Bismarck, North Dakota. September.
- Payton, M.A., **D.C. Fulton** and D.H. Anderson. 2002. Place attachment and social capital at Sherburne National Wildlife Refuge. 9th Annual The Wildlife Society Conference, Bismarck, North Dakota. September.
- Payton, M.A., **D.C. Fulton** and D.H. Anderson. 2002. Understanding visitor uses, motives, and benefits at Sherburne National Wildlife Refuge. The 9th International Symposium on Society and Resource Management. Indiana University. Bloomington, Indiana. June.
- Rosendahl, J., **Fulton, D.C.**, and D.H. Anderson. 2002. Assessing non-economic benefits of waterfowl production areas in Minnesota. 9th Annual The Wildlife Society Conference, Bismarck, North Dakota. September.
- Smithers, B.L., C.W. Boal, and **D.E. Andersen**. 2002. Analysis of northern goshawk food habits using time-lapse video monitoring systems in Minnesota. Annual Meeting of the Minnesota Chapter of The Wildlife Society, St. Cloud, Minnesota. February.
- Vlaming, J. and **D.C. Fulton**. 2002. Social and environmental classification of trout streams in SE Minnesota. The 9th International Symposium on Society and Resource Management. Indiana University, Bloomington, Indiana. June.
- Westra, J., J.K. Zimmerman, and **B. Vondracek**. 2002. Encouraging farmers to produce environmental benefits from agriculture. 2002 Annual meeting of the American Agricultural Economics Association, Long Beach, California. 28-31 July.
- Zimmerman, J.K., **B. Vondracek**, and J. Westra. 2002. Effects of agricultural practices on fish communities in two Minnesota watersheds. Annual meeting of the Minnesota Chapter of the American Fisheries Society, Duluth, Minnesota. January. (Best Student Presentation).

Cooperating Faculty Publications

Note: This is an incomplete list as not all cooperating Principal Investigators provided publication information.

INVITED PRESENTATIONS

2001

Cuthbert, F.J., C. Pekarik, D.V. Chip Weseloh, J. McKearnan, L.R. Wires, and D.R. Trexel. 2001. Distribution and abundance of cormorants, gulls and terns in the Great Lakes. Waterbird Society Meeting. Niagara, Ontario. November.

Cuthbert, F.J., L.R. Wires, and J.E. McKearnan. 2001. Potential impacts of nesting double-crested cormorants on waterbird colonies in the Great Lakes region. International Association for Great Lakes Research Annual Meeting. Green Bay, Wisconsin. June.

Trexel, Dale R. and F.J. Cuthbert. 2001. Selection of colony sites by double-crested cormorants in the Upper U.S. Great Lakes: A landscape scale analysis using GIS. Waterbird Society Meeting. Niagara, Ontario. November.

Wires, L.R. and F.J. Cuthbert. 2001. Prioritizing nesting habitat for colonial waterbird conservation in the U.S. Great Lakes. Waterbird Society Meeting. Niagara, Ontario. November.

2002

Cuthbert, F.J. and L.R. Wires. 2002. Biology and politics of the double-crested cormorant in North America. American Bird Conservancy Meeting. Washington, D.C. March.

Cuthbert, F.J. and L.R. Wires. 2002. Conservation and management of abundant colonial waterbirds: a double-edged sword. North American Ornithological Conference. New Orleans, Louisiana. September.

Stucker, J.H., F.J. Cuthbert, A. Starfield. 2002. Viability of captive rearing piping plovers from the Great Lakes population. Lincoln Park Zoo. Chicago, Illinois. May.

Wires, L.R. and F.J. Cuthbert. 2002. Historic vs. current distribution of an abundant species: are there too many double-crested cormorants? Waterbird Society Meeting. LaCrosse, Wisconsin. November.

CONTRIBUTED PRESENTATIONS

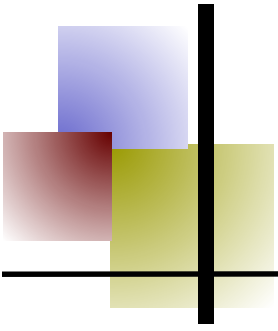
2001

Cuthbert, F.J., L.R. Wires, and J.E. McKearnan. 2001. Population trends and colony site use by co-occurring double-crested cormorants, black-crowned night-herons and great blue herons. Waterbird Society Meeting. Niagara, Ontario. November.

McKearnan, J. and F.J. Cuthbert. 2001. Colonial waterbird populations in the Great Lakes. Minnesota Ornithologists' Union. Minneapolis, Minnesota. December.

- Price, E., F.J. Cuthbert and J.H. Stucker. 2001. Status of Great Lakes piping plovers and planning for St. Louis Estuary recolonization. Minnesota Ornithologists' Union. Minneapolis, Minnesota. December.
- Stromborg, K.L., L.R. Wires and F.J. Cuthbert. 2001. Double-crested cormorant demographics on Lake Michigan. Waterbird Society Meeting. Niagara, Ontario. November.
- Trexel, D.R. and F.J. Cuthbert. 2001. Do landscape characteristics influence double-crested cormorant colony location and growth in the Great Lakes? International Association for Great Lakes Research Annual Meeting. Green Bay, Wisconsin. June.
- Trexel, D.R., F.J. Cuthbert, and L.R. Wires. 2001. Local population dynamics of double-crested cormorants in the upper Great Lakes: importance for education and management. International Symposium and Workshop on Interaction between fish and birds: implications for management. Hull, UK. April.
- Wires, L.R., D.N. Carss and F.J. Cuthbert. 2001. Transcontinental connections: cormorant-fisheries conflicts, perceptions and realities on both sides of the Atlantic. International Association for Great Lakes Research Annual Meeting. Green Bay, Wisconsin. June.
- Wires, L.R., D.N. Carss, and F.J. Cuthbert. 2001. Transcontinental connections: cormorant-fisheries conflicts, perceptions and realities on both sides of the Atlantic. Waterbird Society Meeting. Niagara, Ontario. November.
- Wires, L.R., F.J. Cuthbert, and D.R. Trexel. 2001. Assessing impact of double-crested cormorants on fish resources in North America: review of population trends and diet studies; implications for management. International Symposium and Workshop on Interaction between fish and birds: implications for management. Hull, UK. April.
- 2002**
- Pompei, V. and F.J. Cuthbert. 2002. Stopover migration sites used by Great Lakes piping plovers: early progress report. North American Plover Species at Risk Conference. Ann Arbor, Michigan. January.
- Pompei, V. and F.J. Cuthbert. 2002. Stopover migration sites used by Great Lakes piping plovers. North American Ornithological Conference. New Orleans, Louisiana. September.
- Pompei, V. and F.J. Cuthbert. 2002. Stopover migration sites used by Great Lakes piping plovers. Waterbird Society Meeting. LaCrosse, Wisconsin. November.
- Price, E. and F.J. Cuthbert. 2002. Assessment of historic piping plover habitat in the Great Lakes. North American Plover Species at Risk Conference. Ann Arbor, Michigan. January.
- Price, E. and F.J. Cuthbert. 2002. Piping plover recolonization potential in the Great Lakes: assessment of historic habitat. North American Ornithological Conference. New Orleans, Louisiana. September.
- Stucker, J.H., F.J. Cuthbert, E. Price, L. Wemmer, and A. Powell. 2002. Piping plover recovery in the Great Lakes (1985-2001). North American Plover Species at Risk Conference. Ann Arbor, Michigan. January.

- Stucker, J.H., F.J. Cuthbert, E. Price, L. Wemmer, and A. Powell. 2002. Piping plover recovery in the Great Lakes (1985-2001). Waterbird Society Meeting. LaCrosse, Wisconsin. November.
- Stucker, J.H., F.J. Cuthbert, L. Wemmer, and B. Winn. 2002. Winter observations of Great Lakes piping plovers 1995-2001: conservation and management implications. North American Ornithological Conference. New Orleans, Louisiana. September.
- Stucker, J.H., F.J. Cuthbert, L. Wemmer, and B. Winn. 2002. Winter observations of Great Lakes piping plovers 1995-2001: Conservation and management implications. North American Plover Species at Risk Conference. Ann Arbor, Michigan. January.
- Stucker, J.H., F.J. Cuthbert, L. Wemmer, and B. Winn. 2002. Winter observations of Great Lakes piping plovers 1995-2001: conservation and management implications. Waterbird Society Meeting. LaCrosse, Wisconsin. November.
- Wires, L.R. and F.J. Cuthbert. 2002. Historic vs. current populations of an abundant species: are there too many double-crested cormorants? North American Ornithological Conference. New Orleans, Louisiana. September.



Unit News



Teri Kanikula left her position as Unit secretary/office manager in the fall of 2001. We at the Coop Unit will miss her energy and all of the hard work and effort that Teri invested to make the Coop Unit function well, and to make this a good place to work. Those of you who had the pleasure of working with Teri know what a capable job she did here. As one of her last tasks for the Coop Unit, Teri helped find a great replacement. Hattie Curtner joined the Coop Unit as Unit secretary/office manager in 2001, and has done an admirable job following in Gerda Hagen and Teri's footsteps. We were sorry to see Teri leave, but are happy to have Hattie as part of the Coop Unit.

Other MN Coop Unit news includes adding Mike DonCarlos (MN DNR) and Rob Manes (WMI) to our Coordinating Committee meetings. Bruce Vondracek was promoted to Adjunct Professor in 2002, and Susan Schroeder joined our staff as a Human Dimensions specialist in 2002. Clint Boal accepted the position of Assistant Leader-Wildlife at the Texas Cooperative Fish and Wildlife Research Unit in Lubbock, TX in 2001. MN Coop Unit students continue to excel in their respective graduate programs, and those who have completed their programs here have continued to excel in professional positions or in continuing their education.