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Feasibility of Developing a Fish and Wildlife Research Facility in Minnesota

Prepared for the
Minnesota Division of Fish and Wildlife

by the

Wildlife Management Institute

Study Team Members:

Laurence R. Jahn, Vice-President, Wildlife Management Institute, Washington, D.C. -- Chairman
Keith W. Harmon, Western Field Representative, Wildlife Management Institute, Firth, Nebraska
Cyril Kabat, Director of Research (Retired), Wisconsin Department of Natural Resources, Madison, Wisconsin
Robert C. Summerfelt, Professor and Former Head, Department of Animal Ecology, Iowa State University, Ames, Iowa

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EXECUTIVE SUMMARY

The 1986 Minnesota Legislature, as a part of the Reinvest in Minnesota (RIM) Act, authorized funds for developing a new fish and wildlife research facility. The Minnesota Department of Natural Resources (DNR) through its Division of Fish and Wildlife (DF&W) contracted with the Wildlife Management Institute (WMI) to conduct a feasibility study to identify need for the proposed facility, especially in the northeastern area of the state. In addition, WMI was asked to examine non-DNR fish and wildlife research being conducted in the state, as well as the nature and extent of efforts to coordinate research within and among agencies and institutions.

Current investments for fish and wildlife research in Minnesota total about $6.7 million: $3.5 million through the University of Minnesota (UM) offices at Duluth and St. Paul; $2.5 million by the DNR/DF&W; and possibly another $700,000 or so by the USDA Forest Service's North Central Forest Experiment Station and the National Park Service. A large percentage of funds for research conducted through the University is from non-State of Minnesota sources, such as the U.S. Environmental Protection Agency and the National Science Foundation.

DNR/DF&W research is administered through two sections headquartered in St. Paul. Wildlife research is organized on a regional basis, with three groups of biologists and support staff (about 40 total) stationed in Bemidji, Grand Rapids and Madelia. About 50-60 percent of their time is devoted to wildlife population inventory and assessments, and the balance to research. Fisheries biologists and support personnel (about 35 total) are located mainly in DNR Area Offices throughout the state. They provide only cooperative support (about 20 percent of their time) for fish population inventories and assessments

completed primarily by management personnel, and devote about 80 percent of their time to research.

Overall, this total investment of dollars and time in research is below the level required to meet present and future needs to perpetuate and expand the multimillions of dollars in recreation/tourism benefits that accrue to Minnesota. Additional investments are needed in several areas to strengthen research and management efforts.

Facilities to accommodate research personnel are inadequate, with the exception of those at Grand Rapids. Most of the DNR buildings are old, in poor condition, and inadequate in terms of office and laboratory space and equipment. Some space does not meet state safety standards. Field research equipment is lacking, scarce or not suited to work being done and needing doing.

Some relief is in the offing for office space and laboratory facilities under construction at Brainerd and planned for Bemidji. A few additional fisheries research personnel were hired in mid-1986 with expanded Dingell-Johnson funds. In view of anticipated budget shortfalls in wildlife research, there is little promise for badly needed new technical support staff for project leaders.

Most, but not all, DNR/DF&W fish and wildlife research facilities are in reasonable locations to generate pertinent information required to carry out present and future resource management. Consideration is being given to relocating the Farmland Wildlife Group from its present site at Madelia to a better location in the Willmar area. A few additional locational adjustments of certain stations may be appropriate in the future as research missions are redefined and new research projects are initiated.

Although the Study Team found gross inadequacies in facilities, budgets, staffing and equipment in Minnesota's DNR/DF&W research program, most improvements can be accomplished by increasing operating funds, upgrading existing

facilities or moving to new facilities being planned, and adding some personnel. No evidence was identified to justify a new, large, separate fish and wildlife research center in northeastern Minnesota or any other region of the state. Such a center would not correct the broad array of present deficiencies in the statewide fish and wildlife program. However, there is strong suggestion that a new, large, separate research center may further dilute the already tightly constrained fish and wildlife research program.

The RIM legislation provides for capital improvements only. No funds are designated for operation or maintenance. In light of pending severe budget limitations, there is no surplus in the Game and Fish Fund for operating and maintaining a new, large, separate research center. If constructed, such a center would have to be staffed, equipped and funded at the expense of existing research capabilities, already operating at substandard levels.

There are unmet fish and wildlife research/management needs in the northeastern area, as well as other parts of Minnesota. If a new facility is to be constructed in the northeastern area using RIM funds (not Game and Fish Fund money), the logical alternative is a much-needed, well-justified new management/research Area Office in the Ely area. The existing facility is inadequate for addressing present and future management and research needs of the area and accommodating public service requirements. With proper office and laboratory space, the building would meet management, research and public service needs. The Area Office alternative would satisfy pressing facility needs and be more cost-effective. Funds now being used for operating and maintaining the existing antiquated building could be transferred to the new building.

Additional complementary space in which to station researchers in northeastern Minnesota could be obtained in Duluth via a cooperative agreement with the UM-Duluth and near Ely, through an agreement with the USDA Forest Service's North Central Experiment Station. Existing buildings at those two locations

potentially could accommodate up to 50 or more individuals. With the use of house trailers, as mobile temporary stations, and additional rented facilities, even more scientists could be accommodated and located where priority research projects need to be completed.

Investments given above show that a considerable amount of fish and wildlife research is being conducted by non-DNR agencies and institutions. While all fish and wildlife research yields information that may prove useful at some time, the Study Team found little evidence that steps were being taken to ensure that non-DNR research addresses specific management problems important to Minnesota's DNR. Although some sporadic individual initiatives have been used to exchange information on research within and among DNR/DF&W and non-DNR researchers, no organized or formal mechanism is in place to coordinate all fish and wildlife research in Minnesota.

Research coordination could be improved substantially through two approaches:

1. Provide a block of new dollars through DNR and use them to make grants to scientists in various institutions that have special expertise in fish and wildlife and related research. This would permit DNR to help focus efforts on priority research projects identified in strategic plans anticipated to be completed in 1987 for managing fish, wildlife, other natural resources and public uses on a sustained basis.
2. Develop a formal mechanism to coordinate all research effort--DNR/DF&W and non-DNR--to ensure relevance to management objectives set forth in DNR's strategic fish and wildlife management plans. This need is being recognized and responded to by several states, including Missouri and Wisconsin. It is recommended that either an executive directive by the Governor or a mandate from the Legislature be issued to stimulate initial, positive actions. The statement should direct the DNR/DF&W to take the lead and work with the UM system and agencies and groups to develop policy

and procedures that establish and guide coordination of research programs and projects. It also should require establishment of a Research Review Committee for evaluating and advising on all fish and wildlife research conducted in Minnesota. This committee should review all proposed and continuing research projects to identify their relevance to DNR/DF&W objectives spelled out in the comprehensive strategic fish and wildlife management plan pending completion. A report of findings and recommendations on the research coordination mechanism and Research Review Committee should be provided to the Governor, Legislature or both, by early 1988. This report should provide the basis for aligning research to yield information required to improve uses and management of Minnesota's natural resources.

The Study Team believes firmly that implementation of the recommendations provided here would help ensure substantial dividends from the $39 million 10-year investment called for in 1984 by the Governor's Citizen Commission to Promote Hunting and Fishing in Minnesota. Strengthening research will help provide the base of information required to carry out the more-intensive management programs needed to perpetuate fish, wildlife, other natural resources and associated public uses.

BACKGROUND

The Reinvest in Minnesota (RIM) program enacted by the 1986 State Legislature provided an initial $100,000 to the Commissioner of the Department of Natural Resources (DNR) to develop a "fish and wildlife research center." Consideration for locating such a facility was to be given to northeastern Minnesota. The legislative intent was interpreted to require a feasibility study before additional funds would be provided.

In addressing the RIM provision, Minnesota DNR, through the Division of Fish and Wildlife (DF&W), contracted with the Wildlife Management Institute (WMI) to conduct the feasibility study. The contract calls for identifying the needs for a proposed fish and wildlife research center and determining the feasibility of establishing it.

The feasibility of such a center cannot be examined in isolation since it is not clear whether the center is intended to operate as the nucleus for all DF&W research, an additional fish and wildlife research station, or an addition to existing stations now in place at various locations. Therefore, the Study Team explored it from all three aspects. In so doing, it examined: (1) existing research administration, facilities and staffing; (2) present levels of research funding; (3) current research projects; (4) capabilities of meeting current and future research needs; and (5) fish and wildlife research conducted by five organizations other than the DF&W.

During the study, the Study Team contacted DF&W St. Paul staff, biologists at wildlife research facilities in Grand Rapids, Bemidji and Madelia, and biologists at fisheries research facilities in Grand Rapids, Bemidji, Hutchinson, Brainerd and Waterville. Interviews also were held with DF&W management personnel at Regional headquarters in Grand Rapids, Bemidji, Brainerd and New Ulm.

Contacts were made with personnel from the University of Minnesota (UM)-St. Paul, UM-Duluth, U.S. Fish and Wildlife Service, Iron Range Rehabilitation Research Board, U.S. Environmental Protection Agency (EPA), USDA Forest Service, National Park Service, and DNR's Division of Waters and Bureau of Tourism. In addition, the Study Team reviewed more than 30 documents applying to past, current and future research on Minnesota's fish and wildlife resources.

All persons contacted and interviewed during the course of this study were most cooperative in providing information, opinions and documents. Without their assistance, the evaluation would have been impossible given the short time frame.

WILDLIFE RESEARCH: DIVISION OF FISH AND WILDLIFE

Responsibilities for wildlife research rest with DNR's Section of Wildlife under direct supervision of the Inventory and Research Supervisor at St. Paul. The Supervisor's staff includes an Assistant Research Supervisor in St. Paul and the Group Leaders for Farmland Wildlife, Wetland Wildlife and Forest Wildlife headquartered at Madelia, Bemidji and Grand Rapids, respectively.

Other activities of the Inventory and Research Supervisor are Natural Heritage and part (inventory and research) of the Nongame Wildlife programs. Most nongame research is conducted on a contract basis.

Field Research Facilities

Grand Rapids. Physical facilities for the Forest Wildlife Populations and Research Group are in DNR's Regional Headquarters at Grand Rapids. This relatively new building provides adequate laboratory, library and office space for forest wildlife research.

Approximately one-half of the staff's time is devoted to wildlife population inventories, surveys and evaluations. This consists of compiling, analyzing and interpreting population data collected by area wildlife personnel stationed in different geographical locations. From this standpoint, research personnel appear to be meeting management's major inventory and assessment needs at this time. However, additional efforts are required for other wildlife populations and to intensify management as needed. Relative to inventory needs, the facilities at Grand Rapids are appropriately located to work cooperatively with the managers responsible for collecting field data.

Forest wildlife research efforts at Grand Rapids currently are at a low level. Only two projects are operational--black bears and wolf/deer relationships. The latter is supported by Section 6 Endangered Species funds, which became unavailable after July 1986, leaving the Forest Wildlife Group with one research project of consequence. With this constrained research level, forest wildlife species are not receiving the attention required for more-intensive management. The station would not be capable, however, of meeting those needs with existing staff and funding.

Forest wildlife research needs are many and varied. As a result of the Endangered Species Act and an international convention, which applies in part, to exporting fisher, lynx and bobcat pelts, for example, Minnesota has received guidelines from the federal government to manage forest wildlife more intensively. These guidelines require detailed information on certain species' life history, population level, distribution and exploitation. Also, as land-use conflicts and recreational demands continue to increase in Minnesota, the DF&W will need additional research findings to more intensively and cost effectively manage such traditional species as deer and grouse.

The white-tailed deer situation in Minnesota is one example illustrating the need for aggressive management based on sound research. Direct annual

expenditures for whitetail-related recreation are estimated at $104 million ($63.5 million and $40.8 million for consumptive and nonconsumptive, respectively). Using other economic indicators, such as "multiplier effect" and "willingness to pay," suggests that deer-generated economic activity could approach $600 million annually.

Although white-tailed deer are distributed throughout the state, densities are 10-20 per square mile in the Rainy River, Itasca and Mille Lacs Deer Management Units (DMU)(Figure 1). Similarly, high densities are found in the West and Central Subunits of the Superior DMU, but decrease rapidly to the east where habitat favors moose.

Opportunities to increase deer herd size are greatest in the Itasca DMU, as the draft long-range deer plan proposes. About 50 percent of the land is publicly owned, contains dominant forest stands of aspen/birch, has reasonably good access, and has good accessibility to timber markets that would help maintain young stages of forest growth to support deer. In the Superior DMU, access is relatively limited and timber markets have been scarce. Also, the Superior DMU is primary moose range, and efforts to increase deer numbers would adversely impact moose populations. Considering these opportunities, the Grand Rapids station is strategically located to conduct needed deer research, inventory and assessments to ensure more effective management, as called for in the draft deer management plan.

Bemidji. The DF&W's Wetland Populations and Research Group is located in Bemidji. Unlike its counterparts--Forest Wildlife and Farmland Wildlife--waterfowl inventory and assessment work, being more-specialized efforts, are handled entirely by the Wetland Group and the Staff Waterfowl Specialist. The Waterfowl Staff is stationed with the Wetland Group in Bemidji. About 50 percent of the Group's discretionary budget is expended for inventory and assessment, which includes aerial surveys of spring breeding waterfowl populations, aerial surveys of

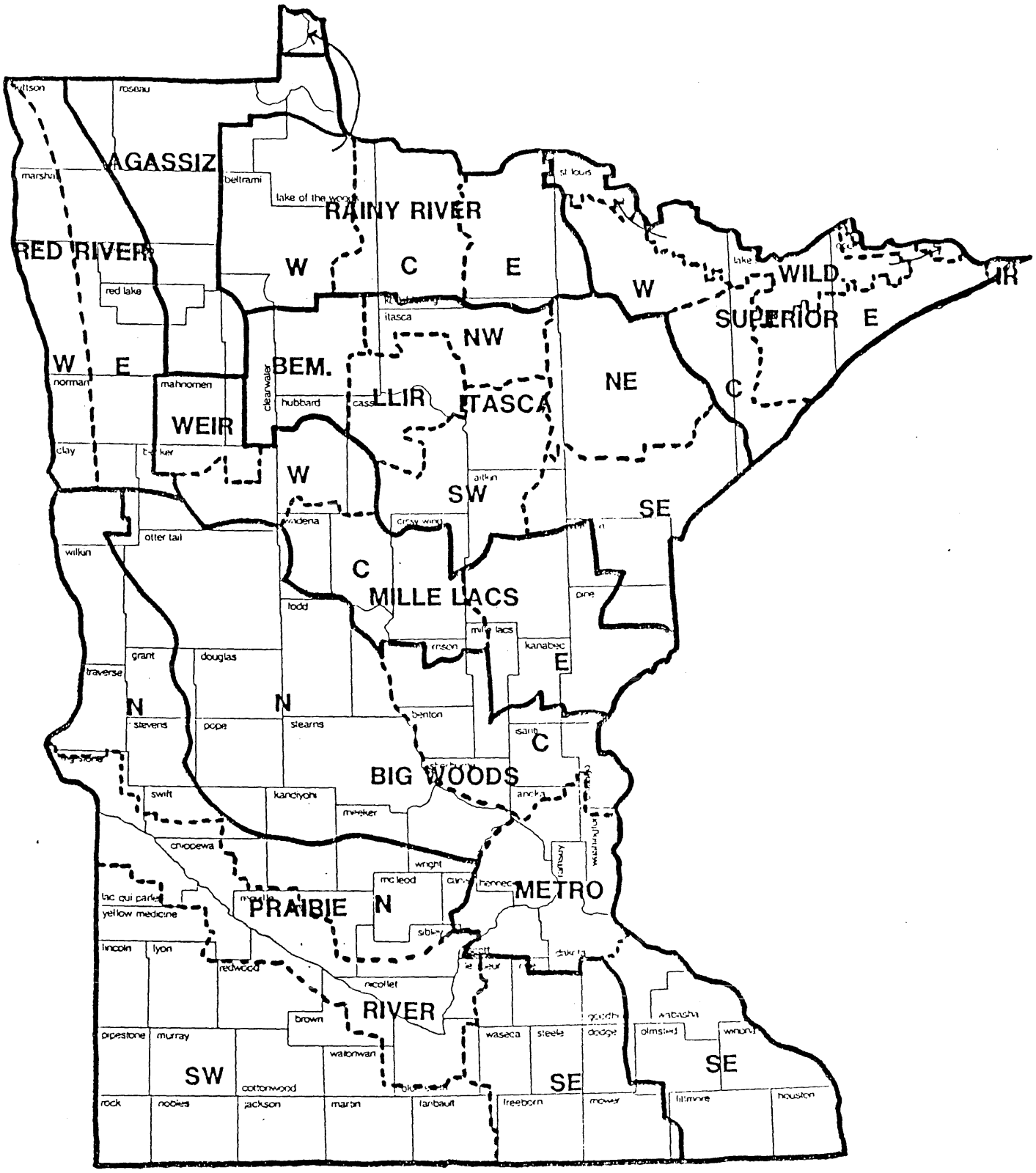

Figure 1. Deer Management Units (DMUs) and Subunits.

autumn waterfowl populations and substantial summer/autumn waterfowl banding efforts.

On-going research is directed toward cavity-nesting waterfowl, diving ducks and over-water nesting of mallards. Limited "outside" funding has been available for other research. A loon project is funded from nongame check-off monies. And financial support has been provided by the U.S. Fish and Wildlife Service for analysis of stabilized duck hunting regulations.

Waterfowl figure prominently in Minnesota's past and present. On a national scale, Minnesota ranks first in the number of waterfowl hunters and fourth in harvest. Waterfowling in the state accounts for approximately 1 million hunter-recreation days, providing an economic stimulus to local economies.

As in other waterfowl breeding states, Minnesota's wetland base has been reduced significantly. Of its 18.4 million acres of wetlands historically, approximately 8.7 million acres remain. The greatest loss has occurred in the prairie-region--the area most attractive to breeding waterfowl. Despite this loss, Minnesota has had a well-based, continuing wetland protection effort for the past 30+ years. Nearly 530,000 acres of waterfowl and other wildlife habitat have been acquired in 1,000 Wildlife Management Areas. In addition, 42,353 acres of lakes have been designated for wildlife. Further protection is provided through Minnesota's protected waters and wetland tax credit and tax-exemption programs.

Considering the importance of waterfowl to Minnesota's quality of life and economy, waterfowl research is at a minimal level. Present projects concentrate on transition-zone and forest-wetland habitats. While that focus is important, especially as forests mature, limited research currently is being conducted on prairie wetlands, where the highest densities of breeding waterfowl occur. Draft plans call for evaluating measures to increase waterfowl production on state-managed lands and wetlands. Given present staffing and funding levels,

this Group's capabilities for additional research are limited. Without support technicians, project leaders are forced to do routine field tasks at the expense of other important work.

Physical facilities for the Wetland Group are inadequate, to say the least. They consist of an old residence acquired from the Division of Forestry, which provides only marginal office space and does not satisfy state safety standards. Use of all available space for offices precludes a library or laboratory.

Full implementation of plans for housing the Wetland Group in new facilities to be constructed on the Bemidji Regional Office grounds should alleviate the substandard space problem. Office space would be provided for the Group Leader, Project Leaders and entry-position biologists. Also to be included are a library, wet lab, necropsy room, walk-in freezer and storage space. This facility is reportedly scheduled for construction after the Brainard Regional Office, now being built.

Madelia. The Farm Wildlife Populations and Research Group is headquartered in what formerly functioned as a pheasant game farm. Office space in the main building is adequate. Structurally, however, the building needs major renovation and remodeling. It is not energy efficient, lacks adequate laboratory facilities and is in need of a new heating plant.

Estimates in 1980 placed needed renovations at about $150,000. These renovations would be cost effective if the Farm Wildlife Group's research program had not been expanded to meet increasing demands for information to improve management. Duties of the Farmland Group have expanded beyond traditional pheasant research to include deer population and assessment work in the agricultural and transition zones of Minnesota. Deer research at Madelia has included effects of bovine virus diarrhea, deer/vehicle collisions, mortality and home range of fawns, and population modeling. Research is done on other species, including wild turkey, gray partridge and muskrat.

Because the total research effort covers large geographical areas, consideration has been given to moving the Farmland Group to the Willmar area. The DNR presently operates a facility at Spicer, which houses an Area and Assistant Area Fisheries Supervisor, six fisheries technicians and one Division of Waters person. Such a move, in lieu of renovating the Madelia station, would involve a new structure on the Spicer Fisheries property to accommodate the Farmland Group, plus provide space for the Area and Assistant Area Wildlife Supervisor and Area Forester now occupying rented office space in Willmar. Estimated 1980 costs for such a facility were about $300,000. We found no evidence of any firm decision regarding this proposed move.

The responsibilities added to the Farmland Wildlife Group and loss of a Natural Resource Specialist (NRS) 3 position have reduced its ability to conduct research. One result is that data from worthwhile projects, such as Operation Pheasant and roadside management, remain only partially analyzed, although field-work was completed some time ago.

Wildlife Research Status--Statewide

Wildlife research in Minnesota is conducted, directly or indirectly, by a staff of 20 full-time employees, 21 less-than-full-time employees and about 45 seasonal workers. Many of these same employees are responsible for wildlife population inventory and assessment work that accounts for 50-60 percent of the Research Units' workload. To fund this effort, the Section of Wildlife expends approximately $1.5 million annually, or about 11 percent of its budget.

Without additional income in the near future, it is unlikely that wildlife research needs will be met, particularly efforts required to manage wildlife populations on a sustained-yield, multiple-benefit basis. Anticipated budget deficits after June 1986 indicate that there is little chance of adding new research positions or even filling several vacancies. In fact, discussions have been held on further reductions. Relative to income, there has been a

leveling off of hunting and fishing license sales. There has been no increase in fees during the past four years, except for nonresident licenses and a $2.50 fishing license surcharge fee. Even at recent, lower inflation rates, there has been a decline in real purchasing power of the DF&W for all activities, including research.

The need for better inventory and assessment data on hunted wildlife populations has increasingly consumed greater amounts of the Research Group's time. This responsibility, assumed in 1973, formerly was delegated to various individuals and units within the Section of Wildlife. As a result, data collection was not always standardized, and data were not comparable among geographic regions. Placing this assignment in the research unit has improved the foundation of basic information for managing Minnesota's wildlife populations and habitats. As a consequence, however, research has been curtailed. Without improved funds and staff, this problem will be compounded in the future, as land-use conflicts and population pressures require more-imaginative management strategies.

FISHERIES RESEARCH: DIVISION OF FISH AND WILDLIFE

Fisheries Research--Statewide

In concept, the structure of the Fisheries Research Unit is centralized. Administrative authority is delegated by the Chief of the Section of Fisheries to the Research Manager. Reporting to the Research Manager are two Research Scientists--Coldwater and Warmwater. Occupants of these two positions, in turn, supervise 10 research biologists stationed throughout the state, mainly located in DF&W Area Offices.

The Study Team examined fisheries research field facilities in Grand Rapids, Bemidji, Brainerd and Hutchinson. In addition, discussions were held with fisheries staff from St. Paul and Waterville, as well as management personnel in Grand Rapids, Brainerd, New Ulm and Ely.

The Grand Rapids facility was rated good, Hutchinson adequate, and Brainerd and Bemidji antiquated and lacking laboratory space and equipment (hood, chemical sink and storage, gas, air and vacuum jets) required to comply with Occupational Safety and Health Administration regulations. Although field research can benefit from fish-holding tanks to determine mortality of marked fish, retention of tags, etc., none of the sites visited had aquarium rooms. The team found little evidence of compound and dissecting microscopies, spectrophotometers, dissolved oxygen meters, pH meters, etc.

From what was observed, fieldwork equipment, such as vehicles, boats, motors and electrofishing apparatus, is minimal. From a comparative national perspective, it would be regarded as inadequate. For example, Region III (Brainerd) has one boat equipped for electrofishing ("boom shocking") for both management and research. As a consequence, Minnesota fisheries biologists have limited their lake sampling procedures to gill and trap nets. Although netting may be suitable for population assessments of walleyes during certain seasons, these sampling methods are not suitable for assessments of largemouth bass or many other species not easily caught in nets. Equipment shortages reduce capabilities of research and management personnel to do needed fish population assessments and research.

Unlike in wildlife research, fisheries research personnel have no primary responsibilities for fish population assessment work. This is a management function. Cooperation of research personnel in fish assessment work comprises about 20 percent of their efforts, compared to 80 percent on research projects. Although fisheries research also is constrained by budget and support staff

limitations, the impact has not been as drastic as for wildlife research, where wildlife population assessment responsibilities have increased substantially.

Fisheries research projects largely are of the applied type and directed at on-going management problems (e.g., evaluation of walleye stocking, use of catfish and bullheads to create urban fisheries, marking techniques, analysis of under-ice distribution of fish toxicant with lake aeration equipment, etc.). These studies are designed to provide a scientific basis for management by evaluating current management efforts and providing an understanding of new sampling or stocking techniques.

Fisheries research personnel consist of: (1) full-time employees--one research manager, two research scientists, one biometrician and 10 field research biologists; and (2) less-than-full-time employees--four NRS 1s (90 percent of full time), data-input clerk (work-as-needed basis) and one to six creel-census clerks during the open-water season. In mid-1986 six additional NRS 1s at 90 percent of full time were hired with increased Dingell-Johnson (Wallop-Breaux) funds and along with one electronic data-processing programmer.

The Section of Fisheries' budget for FY 1986 is about $11 million, up from $8.1 million for FY 1985. The present research budget of $700,000 is projected to be about $1 million after July 1986, when additional D-J funds become available. This level of research is below that required to protect and manage a fishery resource that currently generates more than $515 million annually. In addition, just to maintain this benefit, let alone to increase it, further research needs have been identified with more than 50 projects.

In freshwater fishing, Minnesota's 19.5 million fishing days (by persons 16 years old or older), ranked 12th in the United States. Averaged over the entire state, given the abundance of water, fishing pressure (days of fishing/acre) is not as high as in many states. Areas such as northeastern Minnesota are perceived generally to be remote and lightly fished. However, fishing

pressure is sufficiently heavy at some times and sites in the Northeast (e.g., winter ice-fishing for lake trout) and in more accessible areas nearer metropolitan areas to require restrictive harvest regulations to protect fish populations from depletion and attain optimum fish size and age classes (e.g., creel limits of not more than one walleye over 20 inches in Mille Lacs Lake).

In addition to regulating certain aspects of fish harvest, stocking is a major component of Minnesota's fish management. Most fisheries personnel recognize that the effects of stocking on fish communities are not readily considered or understood. There is need for research on stocking/fish community relationships, since the effects of releasing individual species can be long-term in northern latitudes where growth rates and population turnover occur at comparatively slow rates. For example, stocking northern pike in Horseshoe Lake reduced the abundance of yellow perch. Growth rates of walleye and largemouth bass subsequently declined--a response evident 10 years after stocking. Needs for additional research on assessing and improving the fish-stocking program were identified in a February 1986 report provided by the Office of the Legislative Auditor.

For certain species in specific lakes, especially those located within easy commuting distances for people from large population centers, fishing pressures dictate the intensity of management required based on sound research findings. This is particularly true for the walleye. For this and other species, draft comprehensive plans have identified research projects that would yield practical results having statewide application.

Fish genetics is only recently receiving attention in Minnesota. Such findings can be useful in improving fish strains for faster growth, better survival and disease resistance. As a result of frequent inputs of stocked fish, genetic resources are less unique and more homogeneous. In addition to genetic research to improve stocking, research is needed on fish husbandry practices

to reduce costs and provide a hatchery product that best serves its intended purpose.

Minnesota's fisheries program is critically deficient in measuring fishing pressures and harvest. There are insufficient creel data for many waters to identify management needs, such as regulations for fish species and populations, and to support management decisions regarding levels of exploitation to ensure sustained fish populations and fishing opportunities. While management personnel collect such data on a limited basis, those efforts should be expanded. Resulting data should be handled with automated data processing equipment to facilitate analyses by researchers and to expedite establishing baseline data on fish harvests, trends and geographical distribution of fishing effort.

Other fish research needs are many and varied. Additional data are needed on: (1) management strategies for fish populations under heavy exploitation; (2) use of underutilized species--sunfish, crappies, etc.; (3) evaluation of on-going and new management practices; (4) factors influencing survival of stocked fry and fingerling walleye; and (5) species listed as endangered, threatened or of special interest.

Northeastern Minnesota. Certain research needs are more restricted to this region because of its uniqueness. Within the seven "Arrowhead" counties, there is a sizeable area of public lands, ranging from 92 percent in Cook County to 28 percent in Carlton County. For the seven counties, public land ownership consists of 1.9 million acres of tax-forfeited county land, 2.7 million acres administered by DNR, 128,000 acres in the Voyageurs National Park, and 2.6 million acres of national forests. Within the Superior National Forest lies the Boundary Waters Canoe Area (BWCA), the only large federal wilderness area east of the Mississippi River and the sole canoe wilderness area in the United States.

The seven county northeastern area also is rich in water resources--lakes, wetlands, rivers and streams. Of Minnesota's protected waters (lakes), 47.8 percent (2.25 million acres) is located in the area. There are 13,708 acres of inventoried wetlands (5.2 percent of state total), and 15,416 miles of river shoreline (21.4 percent of state total).

Fisheries management in northeastern Minnesota (Region II) is under the direct supervision of the Regional Fisheries Supervisor stationed at Grand Rapids. Within the Region, fieldwork is carried out by management personnel in Ely (staff of six), French River (staff of 10), Finland (staff of four), International Falls (staff of three) and Grand Rapids (staff of six), plus seasonal assistants. Also located at Grand Rapids, French River and Ely are battery-type seasonal fish hatcheries which are closed after completion of operations each year.

Fisheries research in the northeastern area is conducted by biologists stationed at Grand Marais (lake trout), French River (anadromous fish) and Grand Rapids (especially fish in Lake of the Woods). In all, seven research projects are in progress through Region II (Grand Rapids). They include: (1) response of bluegill and associated fish to yellow perch and walleye abundance; (2) walleye population dynamics in the Kawishiwi River system; (3) fish community response to removal of northern pike less than 24 inches; (4) evaluation of lake trout strains in inland lakes; (5) identifying densities of juvenile salmonids and habitat utilization; (6) developing a simulation model for inland lake management of rainbow trout; and (7) measuring long-term retention of fluorescent pigment marking of chinook salmon. A number of other active research projects throughout the state also has implications for managing fish populations in the Northeast.

As is the case for the entire state, many research needs in the northeastern area are not being met by current levels of funding and staffing. In

particular, some unique opportunities exist in the BWCA. Native strains of lake trout are found in the BWCA that may be better adapted for stocking Minnesota's inland lakes. Controlled access and isolation of waters in the BWCA, as well as inaccessibility to some other lakes in northeastern Minnesota, make assessments and stocking of walleyes and northern pike difficult. But it also protects these populations from genetic swamping from commonly stocked strains. The "silver pike" in the BWCA is an example of a population with unique characteristics. Channel catfish in the St. Louis River on the Minnesota/Wisconsin border are at their northern limit in Minnesota. Fish culturists may find this species has useful genetic potential for raising catfish for commercial and sportfish purposes, possibly attaining optimum growth rates at cooler water temperatures than for southern strains.

Lakes and streams in the northeastern area are the least productive in the state. In particular, lakes of the BWCA often have total alkalinities of less than 10 mg/l, and rarely more than 20 mg/l. Thus, lakes in the BWCA have low productivity and a short growing season, leaving fish populations vulnerable to excessive exploitation. Waters with low productivity do not have the potential for sustaining intensive fishing pressure and, therefore, require careful, sensitive assessments and management to perpetuate fish populations.

Currently, there is a scarcity of data on both fishing pressure and fish harvests in northeastern Minnesota. Until about 1978, interior lakes of the BWCA received substantial fishing pressure. But subsequent changes in regulations now prohibit outboard motors and snowmobiles in the BWCA and are believed to have reduced fishing pressure somewhat, especially in winter. During the summer, however, many popular lakes within the BWCA still reach the limit of available camping permits. What this saturation of campers in given areas means in terms of fishing pressure and exploitation of fish populations is unknown at this time. Basic assessments and evaluations are needed to determine characteristics of the situation.

Some lakes in the BWCA have nothing but stunted perch or sucker populations. These lakes need renovation and new strategies for predator stocking. Stocking alternative species may be one way of improving fish population structure in these lakes, especially where natural reproduction does not occur.

Outside the BWCA, some lakes support adequate but underutilized populations of largemouth bass, panfish and intermediate-sized northern pike. Better use of these species could potentially help meet fishing demand and relieve some pressure on more heavily exploited species, such as the walleye. More access to little-fished lakes could distribute fishing pressure, thereby reducing pressure on more-sensitive lakes. Additional fisheries (lake, trout, landlocked Atlantic salmon and multiple species as multistoried populations) may be possible in mine-pit lakes. But research is needed on limnology, oxygen distribution, contaminants, etc., before large financial commitments are made for developing and managing these pit lakes.

A number of other areas requiring research are evident in northeastern Minnesota. Acidification of aquatic ecosystems occurs where sensitive soils receive acid deposition. Part of the northeastern area is the only part of Minnesota where base rock is Precambrian Shield--a bedrock formation of granite lacking in limestone. The absence of limestone makes the soils and lakes of northeastern Minnesota vulnerable. They lack the natural buffering needed to prevent acidification. No fish species are known to reproduce successfully in water with a pH below 5. Popular gamefish--smallmouth bass, brown trout, walleye and northern pike--are among the first affected. Some lake monitoring is underway, but many lakes in the region have never had their water quality or fish populations sampled. DNR should proceed to fill these informational voids and work cooperatively with other federal and state agencies (including the Iron Range Rehabilitation Research Board), as well as private organizations to document the importance of acid precipitation on northeastern area waters and identify measures to prevent degrading impacts.

Other contaminants--mercury, dioxin and PCBs--are or may be problems in parts of Region II. Mercury may be present naturally in some rock, and a few lakes in the Region have been posted with warning signs on consuming fish with certain levels of mercury. Mercury and other metal ions, such as aluminum, are brought into solution from soils and rocks by acid precipitation.

Waters in the Region also are being affected by local point source pollution. Dioxin has been found in high concentrations in the Rainy River downstream from an industrial source. Nickel may be a contaminant in parts of the iron range. Any research on mine-pit lakes as a potential fishery should look carefully at possible contaminant problems.

FISH AND WILDLIFE RESEARCH OF FIVE OTHER ORGANIZATIONS

The Study Team obtained information from five organizations, other than DNR, with responsibilities or involvements in Minnesota natural resources research, including fish and wildlife, particularly in northeastern Minnesota. They include the University of Minnesota-St. Paul, Department of Fisheries and Wildlife; University of Minnesota-Duluth, Department of Biology and Natural Resource Research Institute; USDA Forest Service, North Central Forest Experiment Station; National Park Service; and Iron Range Rehabilitation Research Board.

University of Minnesota-St. Paul

Department of Fisheries and Wildlife. The mission of the Department is to: (1) provide high quality programs at the undergraduate, M.S. and Ph.D. levels for students desiring to broaden their scientific knowledge or enter the fisheries or wildlife professions; (2) conduct basic and applied research to resolve long-term and short-term resource management problems; (3) provide extension educational programs to the public and service to appropriate agencies in natural resource

management where the unique expertise of the faculty, staff and facilities can serve the state; (4) work with regional, national and international organizations and agencies that share similar interests and goals for developing and applying research technology to significant problems and issues.

A staff of 11 full-time scientists in the Department concentrates on teaching basic and applied research. Fisheries has four staff members, one of which devotes some time to extension aquaculture. Of the seven staff members in wildlife, one provides full-time extension services. Eight other graduate faculty members cooperate with the Department of Fisheries and Wildlife, with two individuals, supported financially by organizations other than the University, having adjunct appointments to the Department. These appointments permit them to teach special courses and advise graduate students pursuing degrees. Three biologists of the Minnesota Department of Natural Resources serve on graduate student committees, though they cannot serve as primary counselors for the graduate students. These cooperative working relationships strengthen the degree-granting program and expose students to resource managers in agencies, such as the DF&W/DNR and the U.S. Fish and Wildlife Service.

The Department of Fisheries and Wildlife is housed in Hogdon Hall, built in the late 1960s, on the UM-St. Paul campus. Overall, the physical facilities are attractive and functional. Current needs are additional desk space for graduate students, office and laboratory rooms for a few faculty members, and a bit more storage area for field equipment. Faculty offices designed about two decades ago, in some cases, are smaller than required to accommodate computers and the usual materials needed to maintain a progressive graduate program. The wet laboratory on campus has adequate space, but is limited in design for large volumes of water to hold large fish required for pioneering genetics studies. Additional fish-holding facilities are being provided temporarily through cooperative arrangements with the DNR's metro hatchery, with a request in the

University's capital budget to overcome in 1989-1991 the wet laboratory limitations.

The Department claims to be understaffed. Two positions are believed needed to round out the fisheries team--a reproductive physiologist for the expanding fish-genetics project and an extension fisheries specialist to focus on aquaculture and other management topics. In wildlife, one technician is needed to assist staff scientists.

To facilitate and strengthen the Department's research program and improve ties to management agencies, an application has been filed with the U.S. Fish and Wildlife Service to establish a Cooperative Fishery and Wildlife Research Unit on campus. The Department believes this Unit would facilitate cooperation and coordination among the University of Minnesota, U.S. Fish and Wildlife Service, Minnesota DNR, and private organizations to conduct research, education and in-service training programs related to fish, wildlife, associated outdoor recreation and other resource management. Operation of the proposed Unit would be conducted through a formal cooperative agreement signed by the four principal cooperators (University, Minnesota Division of Fish and Wildlife, U.S. Fish and Wildlife Service, and Wildlife Management Institute). Space would be made available to house the Unit on campus in Green Hall. As proposed, the Unit would emphasize research on impacts of human activities on aquatic and terrestrial ecosystems, as well as social/economic and ecological/biological aspects of game/nongame fisheries/wildlife management. This integration and coordination of ecological, social and economic research are expected to provide information for the DF&W's strategic and operational plans, as well as the U.S. Fish and Wildlife Service, and USDA Forest Service.

Approximately $572,700 support about 37 research projects in 1985-86, with funds from the following sources:

- 38.4 percent from six federal agencies, including the Sea Grant, Agricultural Experiment Station, U.S. Fish and Wildlife Service, National Park Service, USDA Forest Service, and Great Lakes Fish Commission;
- 31.6 percent from the UM Graduate School;
- 13.4 percent from several local governments in the Twin Cities area;
- 7.9 percent from the DNR;
- 7.7 percent from private sources (e.g., Forest Wildlife Foundation and General Mills); and
- 1.0 percent from the Leech Lake Indian Reservation.

In the past five years, it has become increasingly difficult to obtain research funds. Existing staff believe they could expand research on fish and wildlife if more funds were made available. New research thrusts in fish genetics and wildlife policy and socio-economics await additional monies.

Although the Department staff has not yet prepared a specific list of fish and wildlife research needs, that topic will receive attention at the staff retreat in late September 1986. Department personnel are aware of the DF&W's strategic planning exercise, and are prepared to review and comment on draft materials as they are released. Likewise, staff would welcome funds to complete priority research identified in the planning process.

The St. Paul-based Department scientists and graduate students have done research on fish and wildlife throughout Minnesota, and would continue to respond to such needs. House trailers, rented quarters and contributed government facilities have not only been satisfactory, but have provided the flexibility to locate where studies are needed. Department staff report that temporary facilities have not been a limitation in the past and are not expected to become a problem in the future.

University of Minnesota-Duluth

Seventeen staff scientists with expertise on fish and wildlife and their habitats in northern Minnesota are located at the UM-Duluth. Nine (part-time research) ecologists are in the Department of Biology and eight (largely full-time research) ecologists are at the Natural Resources Research Institute (NRRI).

Department of Biology. In the past decade (1976-86), the 25-30 year old Department of Biology has shifted from strictly a teaching staff to a teaching/research staff. At least six members have been conducting ecological research for several years in northern Minnesota. Presently, all nine staff members carry out some ecological research on about $150,000-$160,000 per year, with at least 75 percent coming from outside sources, such as the EPA and National Science Foundation.

Physical facilities to house staff and carry on the biology teaching/ecological research program are filled to capacity. Administrators believe there is need for some support personnel and an oceanographer to address Lake Superior's management problems and place management on a sustained basis. With these added personnel, Department of Biology administrators believe the staff would be capable of undertaking additional cooperative studies needed in northern Minnesota. Some joint research projects already have been developed between the Department of Biology and the NRRI.

Natural Resources Research Institute. Of approximately 60 scientists and staff, eight NRRI scientists are conducting research on aquatic and terrestrial communities, with emphasis on fish and wildlife populations. These studies have been initiated since July 1983, when NRRI was established with the legislatively mandated mission "to create private sector employment in Minnesota through the development of the state's natural resources in an ecologically acceptable manner." Staff is to evaluate existing natural resources and their potentials for use in designing developments, particularly those involving minerals, water, energy, peat and forests. Special attention is being focused on Minnesota's abundant

freshwater lakes, including Lake Superior (the largest freshwater body in the world), to identify opportunities and management regimes for aquaculture and fisheries developments. The pressing need is for sound information, policies and procedures to encourage economic growth and design management on an ecologically acceptable, sustained basis.

The NRRI staff devotes almost full time to research, except for teaching an occasional ecological course. Currently 12 research projects (see attached List 1) are funded with $2.9 million of external (nonstate of Minnesota) funds, largely federal (84 percent), from such sources as the EPA, National Science Foundation, Department of Navy, Oak Ridge National Laboratory, National Oceanic and Atmospheric Administration and U.S. Fish and Wildlife Service. Less than $240,000 per year is provided by the Minnesota DNR (16 percent) for water ($225,000) and nongame wildlife/fish ($6,250) research. One project involves $5,472 from a private source (Robert Wallace and Associates).

The NRRI is housed in refurbished facilities at the former Duluth Air Force Base. Laboratory and library space/materials have been provided and could be planned for expansion as needed. About 115,000 square feet of space will be renovated in the first stage (1983-86). Additional space could be renovated to accommodate double or triple the present staff, if and when needed. With funds for renovation, operations and research projects, this expansion could be planned and completed. More applied research, as well as basic research, on fish and wildlife populations and habitats could be conducted to evaluate proposed land and/or water developments and provide information required to yield ecologically acceptable designs. Twenty-one potential research areas have been identified as important for perpetuating and managing fish and wildlife in northern Minnesota (see attached List 2).

Lack of State of Minnesota dollars is constraining the NRRI research program now, especially on fish and wildlife. However, with appropriate DNR or other

List 1. Some current research projects with implications for fish and wildlife habitats and populations, Natural Resources Research Institute, University of Minnesota-Duluth, 1985-89.

1. Multivariate model development for fiber carcinogenicity and the bioavailability of fine particles. Grant from U.S. Environmental Protection Agency, 1984-86.

2. Economic evaluation of Minnesota's Water Resources. Grant from State of Minnesota, 1985-87.

3. Hydrological control of nutrient cycling processes: animal influences on the drainage network. Grant from National Science Foundation, 1986-89.

4. Monitoring the effects of the ELF antenna system on bird species and communities. Grant from U.S. Department of Navy through the Illinois Institute of Technological Research, 1984-88.

5. Habitat requirements of wildlife species with special concern in Minnesota. Grant from Minnesota Department of Natural Resources, 1984-88.

6. Recovery of soil carbon after agricultural abandonment and intensive forest management. Grant from Oak Ridge National Laboratory, 1985-86.

7. Resource partitioning among Lake Superior forage fishes. Grant from National Oceanic and Atmospheric Administration, National Sea Grant College Program, 1985-86.

8. Cedar Creek long-term ecological research. National Science Foundation, 1985-86.

9. Monitoring bird populations at the Biwabik wetland treatment area. Grant from Robert Wallace and Associates, 1985-86.

10. Factors controlling the recovery of aquatic systems from disturbance. Grant from U.S. Environmental Protection Agency, 1986-88.

11. Acid precipitation mitigation project-National acid precipitation program. Grant from Minnesota Department of Natural Resources and U.S. Fish and Wildlife Service, 1986-88.

12. Bioavailability of chlorinated dioxins and related compounds associated with freshwater sediments and anthropogenic particulates. Grant from U.S. Environmental Protection Agency, 1986-89.

List 2. Some ideas on fish and wildlife research needs (not in priority order), University of Minnesota-Duluth, 1986.

1. Resource economics of fish and wildlife activities.
2. Ecosystem manipulation for sustainable fishery yields.
3. Viability of a trophy fishery in reclaimed or damaged lakes.
4. Sharp-tailed grouse management of sedge-shrub wetlands (population of this species has declined drastically in recent years because of fire suppression in wetlands).
5. Moose and beaver: their role in forest productivity and the cycling of nutrients.
6. Abiotic and biotic factors as determinants of survival of young walleye.
7. Habitat enhancement for increased fish production in large lakes.
8. "Community" and "ecoystem" perspective in holistic wildlife management.
9. Strategy of fish stocking programs based on bioenergetic models of predators and prey.
10. Potential uses of Landsat satellite images of natural landscapes in wildlife management.
11. Life history bottlenecks reducing the survival of stocked fishes and the cost effectiveness of stocking fish.
12. Ecology of fur-bearing mammals.
13. Transfer of knowledge on what fish and wildlife managers don't know about basic research and what academicians don't know about fish and wildlife management, including use of regulations.
14. Energetic requirements of young salmonids in Lake Superior.
15. Fishing pressure and the sustainability of lake trout populations in northern Minnesota.
16. Importance of beaver impoundments for fish and waterfowl production.
17. Landscape dynamics generated by beaver impoundments and foraging.
18. Interactions among predators with regard to their regulation of prey.
19. Wildlife ecology in winter.
20. Herbivore mineral nutrition and plant/herbivore interactions.
21. Forest management practices and relationships to wildlife communities and populations.

state funding, the research effort at NRRI could be enlarged, with field studies to be completed from Duluth and, when required, through use of complementary field stations provided by others or rented. Advantages favoring this approach include (1) close proximity to the EPA's Environmental Research Laboratory at Duluth, (2) libraries at EPA, the Department of Biology and NRRI, as well as interlibrary loan service from the UM-St. Paul to any of these three Duluth-based facilities, and (3) a team of scientists from a variety of disciplines to stimulate each other and help ensure accelerated generation of information important to developers, resource managers and the general public.

USDA Forest Service

North Central Forest Experiment Station. The broad, forest-oriented research program at this regional Station covering seven states (Minnesota, Wisconsin, Michigan, Iowa, Illinois, Indiana and Missouri) is in transition. A number of wildlife and related studies are drawing to a close; research working units within the seven states are being consolidated; and a new research mission statement is being developed. Major manuscripts providing pertinent findings for northern Minnesota have been or are being prepared on (1) black bear, (2) timber wolf and its prey, (3) beaver and managing impoundments for wildlife, and (4) impacts of natural ecological succession and silvicultural treatments on aspen/pine/spruce forest communities and associated birds and small mammals. A new manuscript for wildlife viewers emphasizes wildlife habitat relationships. It is designed to help recreationists/tourists enjoy wildlife and understand wildlife survival needs in 20 habitat types in northern Minnesota.

The Station's permanent staff includes five wildlife and fish professionals and two technicians, plus a cooperative education student, graduate students and temporary help. Some of this seven-state regional staff are located in Minnesota, as needed, to complete studies on or in the vicinity of the Chippewa and Superior National Forests.

The Station's budget for the seven-state area for each of two fiscal years (1985-86 and 1986-87) includes $465,000 for wildlife research and no funds for fisheries research. In addition, an unidentified (but probably small part) of the approximately $0.5 million annual budget for recreation research provides some information relative to wildlife and fish management. One fisheries research position is included in the proposed 1988 budget. Overall, Station research capabilities are limited by funds, which have been shrinking in recent years of tight federal dollars.

Following establishment of the North Central Forest Experiment Station on the UM-St. Paul campus in 1962, additional laboratories--such as the Forest Science Laboratory at Grand Rapids, Minnesota--and other existing and new physical facilities were obtained to provide permanent and seasonal field stations from which to conduct research. Among several facilities in the seven-state area, the Kawishiwi Field Laboratory near Ely, Minnesota, has served as an important station for USDA Forest Service and other wildlife researchers for decades. It consists of a ranger station built in the 1930s, a sizeable main lodge, log cabin, mess hall, garage and shop. Although the lodge is not fuel-efficient in winter, some individuals have lived there year round. With completion of USDA Forest Service wildlife studies in recent years, these facilities were leased to the U.S. Fish and Wildlife Service for a small number of researchers to complete wildlife studies underway in northeastern Minnesota, particularly those on wolf/prey relations. USDA Forest Service station administrators would entertain a similar lease from Minnesota's Department of Natural Resources, such as the Division of Fish and Wildlife. Up to 20 individuals could be housed there easily in the permanent facilities, especially during seasons other than winter. With the addition of house trailers, as were used in some past years, even more personnel could be based there, if needed.

The Station's research program continues to be designed to provide the scientific basis for the protection, use and management of renewable natural

resources, with special emphasis on integrating forest/wildlife management. Although new priorities for future fish and wildlife research have not been established as of September 1986, research needs most appropriate to problems and opportunities identified in the land management planning process for the Chippewa and Superior National Forests are included in the Land Resource Management Plan, released in mid-1986 for each forest. The USDA Forest Service, for example, identified 17 categories of research needs comprised of 85 specific concerns for managing the Superior National Forest. All of these concerns apply to fish and wildlife--17 directly and 68 indirectly. Sixteen wildlife research needs have been identified for national forests in the northcentral and northeastern U.S. (see attached List 3). While concerns, problems, needs and opportunities have been generated for doing wildlife and fish research on national forests in Minnesota through the North Central Forest Experiment Station, individual items on the recently developed lists await detailed evaluations, priority selection and coordination with others having responsibilities for conducting wildlife and fish research in Minnesota. These tasks must be completed promptly to permit cost estimates to be generated and proposals to be packaged for consideration by funding authorities.

National Park Service

The National Park Service manages the Grand Portage National Monument, Pipestone National Monument, St. Croix National Scenic Riverway and Voyageurs National Park in Minnesota. Fish and wildlife research at these locations is rather site-specific, although results may have broader geographical application. Projects are conducted either directly by National Park Service personnel or through grants (see list 4).

Grand Portage National Monument. Available Park Service records show one research project in the monument. Done under contract with personnel at the UM-Duluth (Department of Biology and Olga Lakela Herbarium), the project started in 1983,

List 3. Some wildlife research needs identified by USDA Forest Service biologists on national forests in northcentral and northeastern U.S.

1. Effects of road density on wildlife populations.
2. Life cycle of snags and number needed per acre.
3. Methods to monitor indicator wildlife species and determine key habitat parameters that affect them.
4. Wildlife habitat relationships.
5. Effects of even-aged versus uneven-aged hardwood management on wildlife.
6. Effects of regenerating white cedar, hemlock, red oak, white pine, white birch and yellow birch on wildlife.
7. Effects of forest fragmentation on wildlife populations (consider exploring theories of island biogeography and biotic diversity).
8. Importance of nonconsumptive use of wildlife for recreation (e.g., nature study, wildlife viewing and photography).
9. Models for predicting population responses of indicator wildlife species to habitat changes.
10. Determination of endangered, threatened, and sensitive species ecology, habitat relationships, and monitoring systems.
11. Construction and evaluation of habitat capability models for wildlife, using principles of vegetative pattern recognition models.
12. Fisheries habitat relationships.
13. Raptor ecology and habitat requirements.
14. Economic methods for putting dollar values on wildlife to justify wildlife management.
15. Effects of forest management practices on wildlife.
16. Increase availability of management information on nongame species.

List 4. Some current research projects conducted by the National Park Service in Minnesota with implications for fish and wildlife habitats and populations.

Voyageurs National Park

1. Water level effects on beaver and muskrat.
2. Water level effects on benthic macroinvertebrates.
3. Water level effects on littoral biota of Namakan Reservoir and Rainy Lake.
4. Aquatic research--northern pike spawning, monitor young-of-the-year fish, creel censuses, water quality and plankton.
5. Distribution, abundance and habits of the otter.
6. Distribution, abundance and reproductive success of osprey.
7. Effects of water level fluctuation on marsh and shoreline nesting birds.

Pipestone National Monument

1. Habitat use by small mammals.
2. Prairie restoration.
3. Bird observations.

Grand Portage National Monument

1. Rare plant survey.

St. Croix National Scenic Riverway

1. Endangered and threatened species study.
2. Bald eagle habitat study.
3. Namekagon River fisheries study.
4. St. Croix River smallmouth bass study.
5. Migratory Birds.
6. Ecosystem analysis.
7. Prairie restoration.

consisted of developing a specimen checklist of the flora present on the monument and was completed in 1985.

Pipestone National Monument. Records currently show nine projects addressing small mammals, prairie restoration, soils, water quality and birds. Other related activities deal with herbarium collections, photo stations and weather station monitoring. Eight of the projects are conducted by Park Service personnel located at the monument. One project (small mammal habitat use) is being done under contract with Iowa State University.

St. Croix National Scenic Riverway. Since the St. Croix River serves as a part of the boundary between Minnesota and Wisconsin, the Wisconsin Department of Natural Resources (DNR) has been involved in some research efforts. These involve analysis of special fishing regulations and a smallmouth bass study. For these, the Wisconsin DNR contributed $100 for tags and 40 hours toward report preparation in the smallmouth bass work and $15,000 (two years) for the special regulation study.

Of the other 12 research projects, other agencies and institutions involved include U.S. Geological Survey (floodplain delineation and water quality), U.S. Fish and Wildlife Service (bald eagle habitat), University of Wyoming (endangered species) and James Ford Bell Natural History Museum at the University of Minnesota (migratory birds). Related studies by Park Service personnel consist of limnology, peatland inventory and impoundment study.

Voyageurs National Park. Discussions with staff at this park indicate that approximately 28 research projects are in progress. Fourteen are being conducted by Park Service employees. The other 14 are being handled under grants to other agencies and institutions--EPA, UM-St. Paul, University of Iowa, Michigan Technological University, New York Biological Gardens Institute, Minnesota Environmental Quality Control Board and Wisconsin DNR.

Park Service staff estimated that Voyageurs National Park's research budget ranged from $300,000 to $400,000 annually. Approximately one-fourth to one-third of that amount was used to conduct research through grants.

Iron Range Rehabilitation Research Board (IRRRB).

This Board, established in 1941, has broad authorities to carry out a wide variety of activities, including making grants to support research. Most grants made in the past four decades have been small for "pertinent" projects, with the largest being a $1.2 million grant for a minerals study conducted some years ago. Although the IRRRB has attempted to interest others in completing surveys for contaminants in lakes, mine-tailing ponds and mine pits, to assist in defining the potential of these water areas for fish and fishing, such surveys have not been done, except in a few isolated cases.

The IRRRB supports applied research, particularly on fish and wildlife indigenous to Minnesota, that is oriented to help understand and promote outdoor recreation in the northeastern part of the state. Even though no fish and wildlife research projects are sponsored by IRRRB now, the Board would consider making small grants for specific applied-type studies with potential implications for enhancing tourism and other types of economic development in northeastern Minnesota.

RESEARCH COORDINATION NEEDS

While there are a number of fish and wildlife research projects being carried out by six or more agencies and institutions in Minnesota, there is no formal or standard informal procedure in place (1986) to coordinate the research and help ensure that it is targeted on topics of paramount importance to management. A coordination mechanism is needed to align research with DNR/DF&W state and regional objectives to address the state's responsibilities for sound management of fish, wildlife and their associated public uses.

This need for a mechanism to coordinate research was identified by almost all researchers interviewed. Some researchers reported that they had participated in a few sporadic informal discussions, structured meetings and workshops to exchange information on research coordination. These initial coordinating efforts rest on individual initiative. The strongest interagency coordinating review process identified in Minnesota is that used by the USDA Forest Service's North Central Forest Experiment Station to develop new work units for its seven-state research program.

Collective experience demonstrates that despite the best of intentions, seminars, workshops, informal discussions, etc., usually fail to produce a well-coordinated research program. This is the case for a single agency (such as DNR/DF&W) or for a group of agencies and institutions (such as the six in Minnesota) operating statewide. The missing element is a set of common goals and objectives, with definition of responsibilities for designated individuals to achieve.

Such a set of goals and objectives for managing Minnesota's fish and wildlife resources, together with identified research needs and priorities, is being defined through the strategic planning exercise being carried out by the DNR/DF&W. This is timely and appropriate, as the DNR has the legal responsibilities for the protection, perpetuation and use of the state's fish and wildlife species, populations and habitats. Those responsibilities include providing leadership in coordinating research.

During the strategic planning exercise, there is an excellent opportunity to define and establish a mechanism to coordinate fish and wildlife research in Minnesota, within the DNR/DF&W and among all agencies and organizations with interests and/or responsibilities for research. Either an executive directive issued by the Governor or a mandate from the Legislature is recommended to stimulate initial, positive actions. The statement should direct the DNR/DF&W to take the lead and work with the University of Minnesota system and agencies and

groups to develop policy and procedures that establish and guide coordination of research programs and projects. It also should require establishment of a Research Review Committee for evaluating and advising on all fish and wildlife research conducted in Minnesota. With appropriate staff support, this proposed committee should review all proposed and continuing research projects to identify their relevance to DNR/DF&W objectives spelled out in the comprehensive strategic fish and wildlife management plan pending completion in 1987 (estimated date). A report of findings and recommendations on the research coordination mechanism and Research Review Committee should be provided to the Governor, Legislature or both by early 1988. This report should provide the basis for improving (1) the scope and nature of fish and wildlife research, (2) coordination of research within and among agencies, and (3) alignment of research to yield information required to enhance management of Minnesota's natural resources.

Some other states also are moving to identify ways to coordinate research and align it to yield information for management programs. This includes Wisconsin's DNR, which has used an internal departmental Research Steering or Review Committee for decades and a Research Advisory Council since 1954. Council members represent a variety of disciplines from public and private sectors with special backgrounds in research. They review all new and continuing research projects. Nevertheless, since the early 1980s, these research review groups have been undergoing evaluation and realignment to help the DNR better meet its research needs being spelled out in strategic plans for managing fish, wildlife and other natural resources.

More closely monitored coordination of research is essential, even at current constrained levels of fish and wildlife research in Minnesota. It will be even more important if the 10-year investment of $39 million ($29 million for fisheries and $10 million for wildlife) to strengthen research recommended in 1984 by the Governor's Commission to Promote Hunting and Fishing in Minnesota.

is implemented. In the absence of stronger research coordination, the return from that investment only can be speculative. However, with stronger coordination, as called for here, the investment could provide substantial dividends to the state's citizens through improved management of the resource base.

CONCLUSIONS ON PROPOSED RESEARCH FACILITY

The foregoing discussion leads to the inescapable conclusion that fish and wildlife research in all parts of the state is barely adequate to address a good number of current management problems and needs. It likewise is clear that research efforts to help develop management strategies for the future to offset increasing human demands and pressures, conflicts in land uses, etc., are limited. DNR/DF&W equipment is inadequate; most physical facilities are antiquated by any standard; funds are insufficient; and staffing has eroded, except for a few people added in fisheries in mid-1986.

Some relief for physical facilities will be provided by construction underway for the regional headquarters at Brainerd, and by the proposed new facilities on the regional office grounds at Bemidji, scheduled to begin following completion of the building at Brainerd. To the degree that space needs are ultimately accommodated, conditions should be improved for the Wetland Wildlife Group and fisheries research biologist at Bemidji and the Research Scientist-Warmwater and fisheries research biologists at Brainerd.

Discussion and analysis of the need to relocate the Farmland Wildlife Group from Madelia have taken place. A final decision appears to be in limbo because construction funds may have to come from the constrained Game and Fish Fund rather than from capital improvement appropriations. A decision needs to be made, for as long as indecision exists, improvements of facilities at Madelia are unlikely.

From the standpoint of current staffing statewide, research is most deficient in support personnel. This is true for both fisheries and wildlife. For fisheries research, six NRS 1s (90 percent) hired in mid-1986 should help. This became possible with expanded D-J funds. On the other hand, there is little likelihood of more support staff for wildlife research in the near future, given pending budget reductions, unless new sources of funds are identified.

The feasibility of a new fish and wildlife research facility in northeastern Minnesota must be examined in relation to need. Second, if need exists, where does it rank in relation to other research needs statewide?

Wildlife research for the northeastern area (Region II) presently is conducted from the Grand Rapids DNR regional headquarters. The facilities are adequate (Table 1) and located reasonably in relation to the area's most productive forest habitats, particularly for white-tailed deer. The exception would be in the eastern portions of the Superior DMU, where habitat favors moose populations.

If additional research funds and staff become available, other needs for wildlife studies can be satisfied. Some potential areas of research are: (1) ecology of brushlands; (2) regeneration of white cedar; (3) impacts of forest fragmentation on nongame species; (4) forest predator/prey relationships (moose and bears, for example); (5) effects of deer management on moose survival; and (6) life history, harvest, trends, etc., of forest furbearers. Such projects, if undertaken, can be handled effectively from the Grand Rapids regional station. For any projects that require fieldwork at some distance from Grand Rapids (moose, for example), there would be advantages in having facilities available, at least on a seasonal basis and preferably on a full-time basis.

Fisheries research needs of northeastern Minnesota, relative to a new station, are comparable to those for wildlife. For the present level of effort, the Grand Rapids, Grand Marais and French River locations are functional. There

Table 1. Some characteristics used to evaluate facilities at the Grand Rapids Regional Headquarters and Ely Area Office.

Evaluation factors	Grand Rapids Regional Headquarters	Ely Area Office
Physical facilities		
Structural	Good, relatively new.	Old, makeshift, heating inferior, below safety standards.
Space accommodations		
Current	Adequate to good.	Poor.
Expansion	Some possible.	Limited.
Service		
Laboratory	Wildlife - good, especially autopsy.	None.
	Fish - wet lab facility limited.	None.
Library	Good.	Virtually none.
Clerical	Adequate.	Minimal.
Equipment		
Computers	Good.	One.
Vehicles	Adequate, central motor pool	Barely adequate.
Current research effort	All fish and wildlife in the coniferous formation and half the deciduous formation.	None directly. Should focus on the unique features of the Area, including parts of Lake Superior.
Community aspects		
1981 population	Grand Rapids proper - 7,247 people.	Ely proper - 5,219 people.
Outreach	International Falls - 120 miles.	International Falls - 131 miles.
	BWCA - 100 miles.	BWCA - 5 miles.
	St. Paul - 179 miles.	St. Paul - 239 miles.
	Transition zone - adjacent.	Transition zone - remote.
	Iron mining - 20 miles.	Iron mining - within southern part.
Special concerns		
Iron mining downturn	Limited impact on immediate vicinity.	Severe long-term impact on community.
Motor restrictions in BWCA	Limited impact on immediate vicinity.	Severe immediate impact on community.

is, however, a definite need to upgrade laboratory facilities. Those research needs pertaining solely to northeastern Minnesota and not being addressed now are in or immediately adjacent to the BWCA. For these, Region II's fisheries research stations are not strategically located. As with wildlife, additional station facilities would be appropriate.

There definitely are pressing needs for additional fish and wildlife research in northeastern Minnesota, as well as elsewhere in the state. In fact, those unmet needs are of such magnitude that they exceed DF&W's present and near-future research capabilities.

DF&W's newly initiated long-range planning effort is in the process of identifying, evaluating and finalizing research needed to achieve plan objectives for a number of fish and wildlife species, populations and habitats. Although still of a tentative nature and awaiting refinement, draft lists of fish and wildlife research needs cover studies similar to those conducted in past years, but would expand research to meet needs for both more-intensive management and new directions. But it is obvious that all of those additional research needs cannot be addressed through existing research capabilities.

What is most needed in the northeastern area and statewide are increased funding and staff, and adequate facilities and equipment at existing DNR/DF&W fish and wildlife research stations. It is important to remember that these needs are the norm for every activity within the DF&W, including research. Every research location is grossly deficient in a number of items--physical, facilities, equipment, funds and/or staff.

For the above reasons, the Study Team found no compelling reasons for constructing a new, multimillion dollar fish and wildlife research center in northeastern Minnesota or any other region of the state. At this time, the highest priority is the upgrading of facilities, funding and staff for those research efforts now in place. Such improvements are needed in northeastern Minnesota, as well as in other regions.

There are some decided disadvantages in opting to construct a large, separate research center in the northeastern area. Although the Legislature may provide a one-time appropriation for capital improvements, more funds would be needed subsequently. This option would require unrealistic shifting of personnel, operation and maintenance (O&M) money, and equipment to the area from other regions and stations, which have none to spare. Such weakening shifts could be avoided only through a long-time legislative commitment to provide the new funds annually to staff and operate the proposed new research center. That commitment has not been made for on-going research programs, and the Study Team found little evidence to believe or assume that it would be made for this proposed center. In all likelihood, O&M funds for the proposed new research center would come from existing DF&W budgets and staff that are now stretched too thin.

Fish and wildlife research capabilities, other than those of the DF&W, exist in the northeastern area. Minnesota already supports a sizeable research establishment--the Natural Resources Research Institute, associated with the UM-Duluth. This Institute has eight scientists with expertise in fish and wildlife of northern Minnesota. Within the UM-Duluth structure there are five other scientists in the Department of Biology. Added to this are scientists at the UM-St. Paul campus willing to conduct research in key locations throughout Minnesota. With these two institutions, plus the research and management program of the DNR, it appears to the Study Team to be illogical to add yet another sizeable separate research facility in northeastern Minnesota to compete further for already limited state funds. The pressing need is for better coordination, beyond some individual efforts initiated to date, among the various state, federal and private entities that have research and/or management responsibilities for fish and wildlife in northeastern Minnesota. The DNR should take a more active leadership role in that coordination, since under state law it has the

primary responsibilities for fish and wildlife resources and their public uses.

The Study Team was mindful of the uniqueness of the BWCA and adjacent areas. It supports the southern extension of the boreal forest with its full complement of animals, particularly carnivores (e.g., wolf, fisher, bobcat, marten, etc.). This fragile landscape and its ecological communities require careful, sensitive management. Its equally unique soft-water lakes are prime candidates for degradation from acid precipitation. Even with these compelling facts in mind, it is the Study Team's opinion that a new, large, separate research center is beyond the DF&W's capabilities to operate and maintain, given its many other responsibilities and needs. The prospect of receiving added O&M funds for a large center is remote, based on information received in this study. If built and if O&M funds are not forthcoming from new sources, it would have to be operated and maintained at the expense of other facilities that are inadequate in most respects. The statewide research effort likely would be downgraded, rather than improved, with the proposed new center.

There is an opportunity in northeastern Minnesota, and specifically the Ely area, for investment of new RIM funds for capital improvements that would be most cost effective and address present and future management/research needs, which are substantial. A number of these needs were identified in DNR's Office of Planning report "Recreation Development Opportunities--Edge-of-the-Wilderness Area." From the fisheries standpoint, additional fishing opportunities could be provided by adding new boat ramps at large lakes, brushing trails to small lakes and upgrading existing access sites. With greater fishing pressure, there is a need for more-intensive management, especially of identified trout lakes.

A number of opportunities exist for managing wildlife that requires additional attention. Declining markets for wood products have reduced cooperative forest cutting programs that benefit certain wildlife. If wildlife favored by young forests are to be maintained, the DF&W will need to apply more direct

habitat management, such as prescribed burning. Opportunities also have been identified for managing ruffed grouse, woodcock and waterfowl. A number of furbearers, particularly lynx, bobcat, fisher and marten, offers new challenges for research and management, as does a variety of nongame species.

The Ely Area Office is strategically located to undertake needed management/research in northeastern Minnesota. The existing building provides marginal office space for nine management personnel (six fisheries and three wildlife). To accommodate these people, three stalls in the garage attached to the main building were converted to office space. Even with this remodeling, the accommodations are substandard. Currently, there is no room for research personnel to be stationed in the Area Office on a seasonal or permanent basis or to have access to a desk during inclement weather.

Area Office facilities at Ely are so unsatisfactory (Table 1), given the level of management/research needed, that the Study Team recommends that no DNR construction be considered in the area before the Area Office is replaced with a new facility. It is a reasonable alternative to a large, separate research center and could serve the needs of a diverse group of natural resource managers and researchers. Laboratory space is presently needed by fisheries personnel for water quality studies that are part of routine lake surveys, special studies that may be needed in acid precipitation research, and as a research substation or station for Grand Rapids.

Even if no research personnel are stationed permanently in Ely, staff operating out of the Grand Rapids regional office on a seasonal basis can make use of laboratory space at Ely for collecting and processing field collections. Office space also would be available to project personnel on an as-needed basis.

Sufficient office space should be provided for the nine management personnel (fish and wildlife) now in the existing substandard facilities, other DNR people (Forestry, for example) in the area, and seasonal and/or permanent

research staff. A new facility should provide a fully modern laboratory with chemical hood; gas, air and vacuum jets; walk-in freezer; necropsy table; and carcass track. Unlike a large, separate research center, a new Area Office built using RIM funds would not be an additional financial burden to DF&W. O&M costs are being incurred for the existing substandard Area Office facilities. These costs now in DF&W's budget merely would be transferred to a new building. Also, O&M costs could be shared by other DNR Divisions to the extent they make use of the new building.

During this review, information was obtained on the proposed large, separate research center from the Provost of Vermilion Community College located in Ely, Minnesota. This institution provides two-year educational courses in technical environmental programs. Were a DNR research center to be constructed on the campus grounds, the College graciously has offered to provide: (1) land at no cost; (2) utility cost savings; (3) central switchboard; (4) security and maintenance/cleaning (DNR to pay one building and grounds worker); (5) DNR employee use of college food services; and (6) duplicating and printing services.

The Study Team acknowledges that certain potential advantages and economies of scale would be possible for a proposed large, separate research center on the College property. However, rather than a separate research center, a new Area Office is of greater need to satisfy both management and research requirements. The DNR already has land for the building. Since such a building would be predominantly management oriented, it should have high visibility to and easy access by the public. These requirements would be met better on DNR land. Anticipated volumes of activities by DNR staff and the public could be disruptive to student activities on campus, as well as vice versa. Locating the Area Office on DNR land would not hinder working cooperatively with the College whenever possible, including use of students seasonally in management/research activities.

The obvious pressing need in the northeastern portion of Minnesota is for a new management/research Area Office in Ely. If constructed with RIM funds, the building would not unduly strain the already tight Game and Fish Fund. Monies now being used to operate and maintain the substandard Area Office could be shifted to the new Area Office.

There are major alternative opportunities to strengthen research efforts in the northern area without constructing a new, separate research facility. Space could be made available for research personnel in existing facilities through a cooperative agreement (1) with the USDA Forest Service for use of its buildings near Ely, or (2) with the University of Minnesota for use of part of the large building at Duluth, now used only partially by NRRI. These well-located facilities could be supplemented with rented space, fixed or mobile--such as a house trailer, as needed. The Study Team believes these alternatives, in combination with space for research personnel in the proposed new Area Office at Ely, would constitute the best approach to strengthen fish and wildlife research and management in northeastern Minnesota.