

AN ADVISORY COMMITTEE PROCESS TO PLAN MOOSE MANAGEMENT IN MINNESOTA

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ABSTRACT: Concern over the decline of moose in Minnesota led to a Legislative Session Law mandating that the Department of Natural Resources (DNR) develop a Moose Management and Research Plan (MMRP). Prior to developing the MMRP, the DNR was required to form a Moose Advisory Committee (MAC). The MAC met 8 times from August 2008-July 2009 and provided management and research recommendations to the DNR in a 45-page report available on the internet. This paper details the MAC process and serves as a reference for agencies that find themselves in a similar management circumstance. Procedural decisions, planning needs, and development of the final report are discussed herein.

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The 2008 Minnesota Legislature through Session Law (Chapter 368, Section 76) mandated that the Minnesota Department of Natural Resources (DNR) convene a Moose Advisory Committee (MAC) to make moose (*Alces alces*) management and research recommendations to the agency. These recommendations will be used by the DNR to develop a legislatively mandated Moose Management and Research Plan (MMRP) written by the DNR personnel. The purpose of this paper is to describe the MAC process, provide insight as to how issues were structured, and identify problems and potential improvements with the process. Recommendations made by the MAC are included when necessary to provide the reader with adequate background to interpret advantages and disadvantages of the process. The biological and management basis for recommendations is discussed in the MAC report (Peterson et al. 2009) and will be

further addressed in the MMRP. All authors of this paper were members of the MAC, with the exception of the lead author who served as secretary to the MAC.

Historical records indicate that moose have been present in appreciable numbers in northern Minnesota since before 1885 (Peek et al. 1976). As the region was settled, unrestricted hunting and habitat changes associated with logging reduced moose numbers to very low levels, resulting in closure of the moose hunting season in 1922. Moose population surveys have been conducted since the 1920s, with aerial surveys the primary monitoring method since 1959 (Karns 1982). Moose increased from the 1930s-1970s and formed 2 disjunctive populations located in northwest and northeast Minnesota (Fig. 1). A biennial moose hunting season was established in 1971, and seasons were managed separately for the northwest and northeast populations

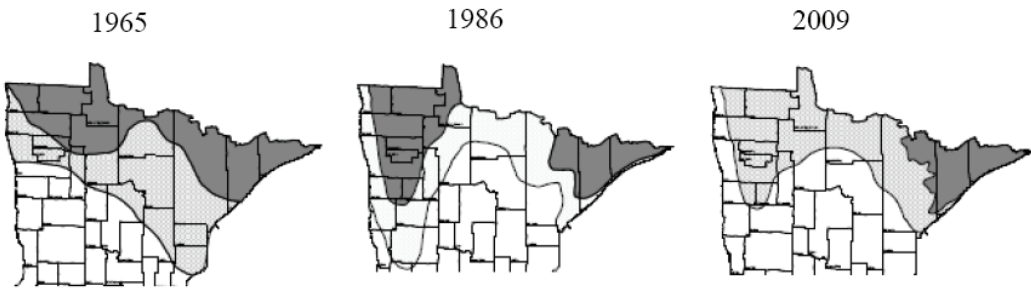


Fig. 1. Moose range in Minnesota, 1965-2009. Dark gray and light gray areas indicate high and low moose population density, respectively (Lenarz, MNDNR, unpublished data).

(MNDNR 1990); the hunting season was changed from biennial to annual in 1993. The hunting season in northwest Minnesota was closed in 1997 because of a dramatic decline in the population. Moose hunting has continued in northeast Minnesota but harvest by state-licensed hunters was restricted to bull-only in 2007.

The previous moose management plan was written by the DNR Division of Fish and Wildlife in 1990. The northeast moose population was estimated to have increased from 2,631±989 to 6,558±3160 (mean ± 90% CI) from 1971-1986; the northwest population was estimated at about 4,000 animals in 1990 (Minnesota Moose Management Plan 1990). In the 1990 plan, the DNR managers recognized that moose populations had increased throughout the mid-1900s and that previous growth rates would likely not continue as land use and habitats changed.

Three objectives were outlined in the 1990 plan based on population estimates from 1986: 1) increasing moose populations 15-20% by 1992, 2) continuing a moose harvest on a biennial basis, and 3) increasing opportunities for non-consumptive use of moose. Strategies to achieve moose population goals included habitat management efforts specific to each region, public education, and balancing moose harvest with increasing hunter demand.

After development of the 1990 plan, the northwest moose population (~4000) declined to about 100 animals in 2007 (Lenarz 2007); hunting of the northwest herd was discontin-

ued after the 1996 season. Mortality in the northwest population was associated primarily with parasites and infectious diseases (Murray et al. 2006). Despite the cessation of hunting and intensive habitat management designed to benefit moose, the population in northwest Minnesota has almost disappeared. The decline in the past 20 years was somewhat correlated with a warming temperature trend (Murray et al. 2006).

The northeast moose population was estimated at 7,593±1761 (mean ± 90% CI) in 2009, and 5,528±1318 in 2010 (mean ± 90% CI). Other data also suggest that this population is declining; for example, the proportion of calves and calf:cow ratios observed during surveys have declined steadily since 2001 (Lenarz 2009a). A VHF radio-telemetry project to determine the rate of non-hunting mortality was initiated in 2002 because survival rates and causes of mortality were unknown. By 2008 this research indicated that the non-hunting mortality rate of adult bulls and cows was substantially higher than reported elsewhere in North America, and was similar to the high mortality rate of adult cows during the decline in northwest Minnesota. Modeling of natality and mortality indicated that the population was declining an average of 15% annually (Lenarz et al. 2010), yet until 2010, the point estimate of the annual survey did not indicate decline. As in the northwest, much mortality of adult moose in the northeast appeared to be non-traumatic and probably health related. Indices of January and late

spring temperatures were correlated with the variability in seasonal and annual survival of adult moose (Lenarz et al. 2009).

Hunting of the northeast herd continues by both state-licensed and tribal hunters. State-licensed hunters have harvested an average of 109 bulls annually since the DNR adopted bull-only hunting in 2007 (Lenarz 2009b). Tribal harvest has averaged about 45 moose, mostly bulls, in the same period (M. Schrage, Fond du Lac Resource Management Division, pers. comm.). Hunting success for state-licensed hunters has steadily declined from >80% in 2001 to 48% in 2008 (Lenarz 2009a, b); success rate of tribal hunters has also declined (M. Schrage, Fond du Lac Resource Management Division, pers. comm.). Harvest quotas for state-licensed hunters are currently very conservative, targeted at bulls, and remove about 2% of the estimated fall adult population (Peterson et al. 2009).

The decline of the northwest population and concern for that in the northeast led to increased public awareness and demand for management. The DNR and other partners had already initiated investigative and regulatory action to address moose declines. However, the intensified concern for the future of moose in Minnesota led to legislative direction for further agency action. During the winter of 2007-2008 the Minnesota Deer Hunters Association spearheaded legislative involvement when they expressed concern over the decline of moose in the northwest and possible decline in the northeast. In response, the Legislature mandated the DNR to develop a plan identifying high priority management and research needs for moose, and to present a progress report to the Legislature by 15 January 2009 (2008 MN Legislature Ch.368, SF 2651, Article 2 Section 76). The law also directed the DNR Commissioner to form a committee of moose experts to provide management and research recommendations to the DNR. The result of these actions was the MAC, formed in August 2008.

MOOSE ADVISORY COMMITTEE

A DNR ad hoc steering committee consisting of DNR staff, Native American natural resource agencies, the United States Forest Service, and other stakeholders selected MAC members in June 2008. Members were chosen to include expertise of federal, state, and tribal wildlife managers, county land managers in moose range, social scientists, and stakeholder groups from across northern Minnesota. The committee was asked to provide information and recommendations for the MMRP to be developed by the DNR. The MAC provided the DNR with insight into the moose problem in both northwest and northeast Minnesota, and proposed possible management and research solutions in its final report (Peterson et al. 2009). There were a total of 18 MAC members including 5 DNR employees, 2 tribal biologists, and 4 research scientists, 3 of whom were associated with the University of Minnesota and 1 from Michigan Technological University. The remaining 7 committee members were from stakeholder groups including The Nature Conservancy, the Superior National Forest, the Minnesota Forest Resources Council, the Lake County Land Department, the Minnesota Deer Hunters Association, the Minnesota Chapter of the Wildlife Society, and a resort owner. The DNR steering committee asked Dr. Rolf Peterson (Michigan Technological University) to chair the MAC because he is a respected biologist with a long history in moose research and was not associated with the DNR. The DNR steering committee believed that a non-Minnesotan member of the MAC would have few preconceived notions about the problems associated with Minnesota moose and/or potential solutions. The Chair was absent from two meetings at which Dr. Ron Moen (University of Minnesota) led the proceedings. Because of this and his other work for the MAC, Dr. Peterson recommended Dr. Moen as Co-Chair and the MAC affirmed this position.

The legislature mandated that the DNR consult with key stakeholders to develop a management plan that included, but was not limited to the northwest population. After thorough discussion by the MAC concerning the viability of this population, it was determined that its low numbers limited management and research options, hence management and research of moose in northeast Minnesota became the main focus of the MAC. The first MAC meeting was held in September 2008 and monthly meetings occurred in January–July 2009 to discuss recommendations and the format of the final report for the DNR. The report was presented in August 2009 and addressed biology, hunting, tourism, cultural value, and other aspects of the moose populations in northeast and northwest Minnesota.

The MAC hosted a Summit on 8 December 2008 to gather information about moose from biologists asked to participate from other jurisdictions including North Dakota, Michigan, New Hampshire, Manitoba, and Ontario. Prior to the Summit they were provided a list of questions that addressed several potential areas of focus (Table 1); those unable to attend submitted written answers. These biologists provided information about population status, management practices, how climate change was affecting moose in their jurisdictions, and how broader issues like climate change were incorporated into their management plans. They also summarized data about population trends, changes in distribution, harvest, calf:cow ratios, survival rates, health issues, and deer (*Odocoileus virginianus*) numbers in their respective management regions for the past 10 years or longer. Question and answer sessions open to all invited guests, DNR staff, MAC members, and members of the press allowed wildlife veterinarians, researchers, biologists, and other stakeholders to offer different perspectives and insight into the moose situation in Minnesota.

Prior to the start of the Summit, members of the press were invited to a media session in

an effort to open the lines of communication with the public about the moose situation in Minnesota and the intentions of the DNR and the MAC. The media session was attended by 4 print media, 1 radio, and 1 television station. Continual press releases and a second media session at the presentation of the final report to the DNR were planned; however, there were no further press releases and only the second media session occurred.

On 9 December 2008 the MAC met with the invited biologists to discuss issues brought forth in the previous day's meeting. Question and answer sessions following presentations at the Summit were available as reference material to identify potential areas of focus. One outcome of the Summit was the general consensus (among both MAC members and invited biologists) that Minnesota had substantially more data available on moose population fluctuations and survival rates than most surrounding regions because of decades of aerial surveys, collection of harvest data, and northwest (Murray et al. 2006) and northeast research projects (Lenarz et al. 2009). Members of the MAC also felt that the problems currently faced by moose warrant new research and that continued monitoring of the population was essential.

Discussion of how climate change may facilitate the emergence and increase the prevalence of disease on the landscape was also a focus of the MAC and wildlife veterinarians. Both the physiological influences on moose and the movement of new disease vectors in association with increasing temperatures and other climatic changes were addressed; need for additional research on emergent diseases was noted. Brainworm (*Parelaphostrongylus tenuis*), a parasitic nematode commonly found in white-tailed deer (Anderson 1964), was discussed most because brainworm infection is commonly reported to cause mortality in moose. Additional discussion points included development of habitat management plans tailored to the needs of moose given the possible

Table 1. Questions provided to presenters prior to the Moose Summit in Duluth, Minnesota, 8 December 2008.

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1. Speaking in the context of moose in your agency's management area (state, province, or tribal lands area) in the past (particularly the past 10 years, but longer is great) and present, please describe via narrative, data, or maps, as appropriate:
 - a) population trends
 - b) distribution changes
 - c) harvest
 - d) calf:cow ratios
 - e) survival rates
 - f) deer numbers and indices

 2. Description of how the above information is determined in your state or province.

 3. Briefly describe moose management, monitoring, and research strategy in your state or province

 4. What health issues are of concern for moose in your state or province?

 5. What trends in habitat are important for moose in your state or province?

 6. What are the current moose habitat and management strategies in your state or province?

 7. Please list, in order of priority, the top 3 issues for moose management
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impacts of climate change, and the feasibility of continued harvest considering biological viability and public opinion. Climate change received a great deal of attention during the summit and throughout development of recommendations because moose in Minnesota are at the southern edge of their geographic range. The importance of additional research on calf survival and the possible emergence of historically rare diseases in relation to climate change were raised during discussion.

Following the summit, 6 subcommittees with 4-6 members each were formed to focus on areas of importance identified at the Summit: Harvest, Deer Management, Social Dimensions, Habitat Management, Research, and Communication. MAC members volunteered to serve on subcommittees based on their expertise and personal interest, and served on more than one if they wanted. The MAC Co-Chairs identified members whom

they thought should lead the subcommittees with input from subcommittee members; those members were then asked by the Co-Chairs if they would accept the role of subcommittee chair. The expectation was that each subcommittee would discuss key issues likely to arise in the future; each subcommittee developed recommendations and provided background information corresponding to their topic. Subcommittees posted drafts of their sections to a message board or e-mailed documents among MAC members prior to MAC meetings. Subcommittees led discussions explaining their sections during MAC meetings to allow the entire MAC to comment and make suggestions about all sections.

Subcommittee Recommendation Development

No formal guidelines were used by subcommittees for how their sections of the

report should be written. Most communication among subcommittee members was via e-mail, with conference calls or personal meetings as needed. The subcommittee chairs wrote most of the initial draft of the report and delegated some sections to different subcommittee members. Initial drafts of recommendations were circulated among subcommittee members for revisions and agreement before presentation at a MAC meeting. Recommendations were based on issues raised during the Summit and from the information and expertise provided by subcommittee members. After making revisions based on feedback from MAC members, subcommittees submitted final drafts to the MAC for discussion and approval. Recommendations in the report were organized by subcommittee section.

Harvest -- This subcommittee recommended that moose hunting of the northeast population continue because no evidence pointed toward a significant impact on the estimated population of 7600 moose. This did not imply that harvest levels were sustainable because if current population trends continue, harvest will decline. Underlying the recommendations was the implicit desire to continue the moose hunt at lower levels while maintaining hunter satisfaction. The subcommittee recommended biological and social thresholds where harvest should be stopped within management units and statewide. For example, it was recommended that the state should stop hunting if the bull:cow ratio was <67 bulls:100 cows for 3 consecutive years. Noting that moose hunting is a once-in-a-lifetime opportunity, they recommended closing the season if average hunter success dropped below thresholds in individual management units or across the entire range. Hunter success is typically lower in zones within the Boundary Waters Canoe Area (BWCA); therefore, the MAC recommended closing zones within the BWCA if average hunter success over 3 consecutive years was <10%. In other zones where hunter success is typically higher,

season closure was recommended if success was <20% for 3 consecutive years. Closure of the hunting season across all of northeastern Minnesota was recommended if success was <30% for 3 consecutive years (Peterson et al. 2009). It was also suggested that hunters be polled about their expectation of success. Recommendations were set for each threshold for when hunting could resume if certain conditions were met.

Deer Management -- Recommendations by this subcommittee were divided into deer harvest management and research on deer-moose interactions. Recognizing that uncertainty remains about the relationship between *P. tenuis* and response in moose populations, the subcommittee took a precautionary approach. Harvest management recommendations included limiting deer populations to fall pre-hunt densities of <10 deer/mi² where deer and moose ranges overlap, and to ban deer feeding within moose range. The deer subcommittee also raised the issue of additional research concerning deer-moose interactions; recommendations were incorporated by the research subcommittee.

The deer population in Minnesota was managed for growth beginning in the mid-1970s with a system that allowed for annual hunting seasons. That system provided for selling antlered deer licenses over the counter and a finite number of antlerless permits available through a lottery. Starting in 2005, deer in northeast Minnesota have been managed to reduce their population based on stakeholder and public input that deer populations were too high. The growth of the deer population within the moose range, and the uncertainty surrounding the extent to which moose succumb to diseases and parasites associated with deer on the landscape, led the MAC to recommend further research concerning moose-deer interactions. Specific research needs included identifying causes of moose mortality, and how changes in deer density and gastropod populations affect the prevalence

of brainworm. A second set of recommendations on deer-moose interactions in northwest Minnesota was added as an appendix in the MAC report.

Social Dimensions -- This subcommittee drew attention to the economic, social, and cultural impacts of the MMRP. Moose hold an iconic status in Minnesota and benefit local economies that depend partly on hunters and tourists visiting moose range, and they are part of the cultural identity of Minnesota and regional Native American tribes. Moose are socially and culturally important to residents and visitors that have come to expect moose in the north woods; losing the opportunity to view moose could result in a substantial loss of tourism income and cultural value. The economic effects are difficult to quantify but include the loss of revenue generated by license sales, the sale of curios to tourists, and lodging. Implicit in the formation of the MAC was the recognition of the importance of moose in Minnesota; however, no subcommittee was specifically devoted to economic issues associated with moose. This apparent oversight occurred during subcommittee development, although the social dimensions subcommittee did recommend economic research including a survey to determine the economic and cultural value of moose in Minnesota.

Habitat Management -- This subcommittee recommended that habitat management for moose occur in areas of highest moose density. Due to differences in landscape and land use between northwest and northeast Minnesota, specific habitat recommendations were made for each region. Although moose habitat in Minnesota is generally not regarded as limiting, the committee recommended management strategies that focus on smaller spatial areas. Specific habitat recommendations were rather limited, as this was a key research need.

Research -- This subcommittee developed research recommendations about population dynamics, diseases, deer-moose interactions, and habitat requirements. These recommenda-

tions were not prioritized beyond the need for continued surveys of the northeast population as a minimum. It was recognized that monitoring was not a management solution, and that improvement of monitoring techniques was required for adequate, long-term population evaluation. The MAC recommended that moose research receive top priority at the DNR, and much of the proposed research was focused on questions raised by managers responsible for moose and their habitat. The MAC recognized the importance of management decisions as the basis for sound research; however, research can also guide management when populations decline. For this reason, the MAC indicated that emphasis should be placed on creating a sound biological basis for management decisions.

Communication -- This subcommittee developed recommendations on how information should best be presented and disseminated widely to the public. A concern was that the public would view certain MAC recommendations and actions by the DNR as contradictory. For example, the recommendation to continue hunting of the northeast population could be viewed as a contradictory response to managing a declining population. Increasingly specialized habitat management for moose and the proposed reduction of the deer herd also appeared at odds with the recommendation that moose hunting is still biologically supportable in northeast Minnesota (Peterson et al. 2009). The goal of the subcommittee was to suggest how to document, justify, and communicate moose management information to the public, and many biological, social, and economic factors influenced their recommendations. The subcommittee also tried to highlight areas of possible future controversy, including political reactions as a result of unrealistic public expectations, conflict between consumptive and non-consumptive users, and the willingness of the public to pay to maintain moose in Minnesota.

Additional Recommendations

Subcommittees did not address all issues concerning moose management, and certain issues crossed subcommittee boundaries. Funding for moose management and whether to recommend classifying moose as a Species of Special Concern, or a state listed Threatened or Endangered species were addressed by the entire MAC.

Funding -- Funding was not identified initially as a section in the report and no related subcommittee was formed; however, the MAC recognized that their recommendations for additional management and research efforts would require funding. Committee members discussed related content during monthly meetings and the section was fashioned based on that input. There is currently no dedicated funding source for moose in Minnesota; moose management funds are allocated through the DNR Game and Fish Fund that is funded through the sale of hunting and fishing licenses.

The MAC recommended that non-traditional sources of funding be sought to alleviate costs associated with increased management and research. Much of the rationale for this recommendation stems from the fact that moose hunting in Minnesota does not generate substantial revenue, whereas non-consumptive user groups constitute a much larger percentage of the population and economy, and arguably should assist in funding moose management and research. The MAC recommended that the DNR work closely with the legislature to ensure that moose exist in Minnesota for the foreseeable future; related funding, dedication of staff and resources, and other investment in research would be indicative of the value of moose to Minnesota.

Legal Status of Moose -- Minnesota has 3 categories of state listed species: Endangered, Threatened, and Species of Special Concern (SSC). Status as SSC is uncommon and indicates a species with unique or highly specific habitat requirements that deserves careful

monitoring. Species on the periphery of their range and species that were once Threatened or Endangered, but are recovering, may also be listed as SSC. The DNR updates the state listed species list about once a decade. The review process was underway during the MAC process, and moose were being considered for listing. As a result, the MAC had an opportunity to make a recommendation on the status of moose in Minnesota and whether or not moose should be listed as SSC.

Discussion initially revolved around whether or not the MAC should formally address the issue and their recommendation. The DNR Endangered Species Coordinator provided information about the listing process and what the designation of SSC, Threatened, or Endangered would mean for moose. Because the discussion resulted in little progress, it was decided that 2 committee members would prepare statements arguing for or against the recommendation to list moose as SSC.

The statements were discussed and voted on at the next MAC meeting where it was recommended to list moose as SSC by a slim majority (9 for, 8 against, and 1 abstain); the final MAC report contains a section expressing the majority opinion with important caveats. There was a consensus among committee members that moose should not be listed as Threatened or Endangered based on the definitions in Minnesota Statutes (2007: Section 84.0895). The review process for listing species is so infrequent that MAC members worried a designation would not be reversible in the event of changing circumstances or unforeseen consequences. Some committee members felt that listing moose as SSC could lead to management decisions influenced by political agendas, and some thought it would help provide resources for research and monitoring.

Completing the MAC Report -- Prior to the May 2009 meeting, subcommittee sections were compiled into a single document and edited by the MAC Co-Chairs to create

consistency among sections. An executive summary written by the MAC Co-Chairs outlined a brief history of moose in Minnesota, the goals of the MAC, and the vision statement. Short summaries of each subcommittee section were written and a tentative timeline for implementation of recommendations was provided in the document. The committee agreed that providing clear and concise summaries of each section would aid understanding by a general audience. It was decided that potentially controversial recommendations should be discussed briefly at the beginning of the report. The entire document was posted for all committee members to read and went through a cycle of review; final editing was by the Committee Co-Chairs.

Conclusion of MAC

At the request of the DNR, the MAC scheduled a meeting where the final document was presented on 18 August 2009. Subcommittee chairs were asked to provide brief presentations outlining their sections, and MAC and DNR representatives discussed the content of the report and moose management in Minnesota. Many members believed the committee should remain intact and be available for questions concerning their recommendations and the framework of the plan until the MMRP was completed. MAC members also believed it would have been beneficial to have broader participation by the DNR leadership at this meeting. Unfortunately, the DNR commissioner planned to attend but was unable; as a result, there was only a single DNR representative who had not regularly attended MAC meetings.

The goal of the MAC during this process was to provide the DNR with a realistic view of the future for moose in Minnesota given the challenges faced with survival on the southern edge of their range in the midst of climate change. One alternative discussed but not included in the report was the recognition that it may not be economically possible to

maintain a moose population in Minnesota long-term. However, the MAC believed that moose would be present in the foreseeable future, and should be managed assuming such, and that goals and recommendations should be focused accordingly. The general attitude of the MAC at the final meeting was best described as hopeful. Most members were of the opinion that the recommendations were realistic and would prove helpful in providing guidance for future management and research of moose in Minnesota. As of January 2010, the DNR was writing the MMRP based on recommendations in the MAC report; the MMRP will be available for public comment when completed.

DISCUSSION

The MAC consisted of both DNR and non-DNR members who provided perspectives from a range of disciplines including wildlife management and research, social science, forestry, local government, tribal natural resource agencies, and the tourism industry. Non-DNR members provided knowledge and perspectives from communities and stakeholders affected by DNR moose management. MAC members were requested to represent their own opinions and not those of their respective agencies and organizations, but some DNR and non-DNR committee members found this difficult. Specifically, the DNR representatives provided input for the final product, but were not always comfortable in that role.

Incorporating MAC recommendations into the MMRP is at the discretion of the DNR. Many MAC members expect that much of the report will be included in the MMRP, in part because subcommittee recommendations were thorough and had basis in the literature wherever possible, and the DNR representatives provided input on agency practices and limitations when recommendations were discussed. Agency practices and limitations were not viewed as biasing or limiting to the process by MAC members. Possible altera-

tions to MAC recommendations in the MMRP may be due to fiscal limitations, legal requirements, or other factors that impact the DNR. Presumably, substantial difference between MAC recommendations and the MMRP would require strong justification given that the MAC had strong DNR representation.

All management plans and their creation are subject to criticism, and the MAC process is likewise open to specific criticisms. Media were invited to the Summit and the presentation of the final report to the DNR. Monthly meetings, however, were only attended by MAC members and the DNR planning personnel who provided process coordination. The meetings were technically open to the public but were not advertised, effectively making them closed. This approach made it possible to work efficiently, and also allowed MAC members to focus on specific discussion topics. This decision was made by the MAC with guidance by the DNR planning personnel; some MAC members felt that this approach reduced opportunities for media attention. The Social Dimensions subcommittee drew attention to the need for management decisions to be transparent, which seemed contradictory to the MAC process that was not advertised openly. The MAC process was designed to provide DNR input and direction for the MMRP from a specialized group with specific knowledge about moose. The DNR viewed the MAC as the first step in a larger process with regard to developing the MMRP; after its completion public comment will occur and likely entail personal knowledge, the MMRP, the MAC report, and contrasts among them.

Recommendations of the MAC were directed at the DNR, which is obligated to respond to the general public about the moose population and its management. It will be challenging to communicate with stakeholders not trained in wildlife or fisheries management as to why continued moose hunting by state-licensed and tribal hunters will have little effect on the moose population or its decline.

Unlike many game species in Minnesota, much social interest in moose is related to culture and tourism. Importantly, the MAC recommended study of the economic and cultural value of moose in Minnesota and to incorporate those values into the MMRP.

Funding will be a key issue for implementation of MAC recommendations if they are adopted in the MMRP; unfortunately, stakeholder groups failed to recognize a dedicated funding source for moose research. However, 2 unique sources of money are available in Minnesota including the Legislative-Citizens Commission on Minnesota Resources (LCCMR) that has had approximately \$25 million from Minnesota's Environment and Natural Resources Trust Fund to spend annually on a variety of habitat and research projects. The second source, the Lessard-Sams Outdoor Heritage Commission (L-SOHC), is allotted 33% of a tax increase from a constitutional amendment passed during the 2008 election (~\$90 million annually) that may be spent only to restore, protect, and enhance wetlands, prairies, forests, and habitat for fish, game, and wildlife. Thus, projects relating to research/monitoring could be funded by LCCMR and habitat restoration/enhancement could be funded by both LCCMR and L-SOHC.

Tribal natural resource agencies that manage Native American harvest of moose under existing treaty rights in Minnesota were not obligated to consider recommendations in the MAC report because treaty hunting rights are not regulated by the state, and tribal members are not required to adhere to state hunting regulations. Discussion at MAC meetings considered tribal harvest, however such discussion was largely informal and the MAC determined it was not obligated to address tribal harvest in its recommendations. Tribal governments and the DNR historically have a good working relationship and have cooperated in moose management and harvest programs (Edwards et al. 2004). Two tribal biologists were MAC members because of this relationship and their

expertise in moose biology.

Cooperation between land management agencies within moose range in Minnesota will be critical in the future. Much of the current range is part of the Superior National Forest, with major holdings by state, county, and private landowners. Forest management practices by the USFS and the DNR influence moose range and habitat. The MAC highlighted the importance of cooperation between these agencies, and the need for the Fish and Wildlife Division and the Forestry Division within the DNR to cooperate, especially in areas considered best moose habitat.

The MAC process led to a targeted set of recommendations for moose management in northeastern Minnesota by placing knowledgeable moose biologists and wildlife professionals in a formal setting. This group was instrumental in developing and proposing recommendations necessary for the DNR to develop its MMRP (Peterson et al. 2009). MAC members felt that current monitoring efforts need to continue in Minnesota, and that additional research and management efforts are critically needed before decline occurs in the northeastern population such as occurred in the northwest (Murray et al. 2006). The MAC process described here provides a reasonable framework for public agencies to address controversial wildlife management issues of high public concern, and importantly, produced the MAC report that provides the foundation to address the decline of moose in Minnesota.

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