

BIOLOGICAL STANDARDS AND GUIDELINES FOR PREDATOR CONTROL IN ALASKA: APPLICATION OF THE NATIONAL RESEARCH COUNCIL'S RECOMMENDATIONS

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Predator control aimed at reducing wolf and bear populations while attempting to increase densities of ungulates for hunters has been a highly controversial issue in Alaska for decades. Much of the controversy centered around methods of control including the use of poison, bounties, aerial shooting by private pilots, helicopter shooting by state employees, and snaring. Other issues including the quality of data used to justify, implement, monitor, and evaluate control programs were also part of the debate. In recent years as the controversy broadened to include large-scale programs and intense political involvement, issues related to standards and guidelines for predator control became more prominent. In 1995 Governor Tony Knowles requested that the National Academy of Sciences conduct a review of past control programs and provide recommendations for future efforts. This review was conducted by the National Research Council (NRC 1997) and addressed biological and socioeconomic issues. It contained seventeen broad conclusions with sixteen recommendations. Of these, eight recommendations applied to the biological aspects of the review. In addition, the review contained a section with decision-making guidelines. Contained in the report were many recommended biological standards and guidelines. This review was the first comprehensive attempt to provide standards to guide Alaska's decision makers in the complex process of ensuring that sound science was incorporated in predator control programs.

Following the release of the NRC report the state of Alaska, Department of Fish and Game (ADFG) applied some of the recommended standards to design of a predator control program in the McGrath area of interior Alaska (ADFG 2001). Shortly thereafter, Frank Murkowski was elected governor and the McGrath program plus several additional areas were approved for control. Approval for other areas is pending. The purpose of this paper is to evaluate the recent predator control programs in relation to the NRC's recommended biological standards and guidelines. The central question I attempted to answer is, do these programs incorporate the NRC's suggested decision-making measures and is science-based management being applied?

A Brief History

Following World War Two when Alaska was still a U.S. territory, a federal poisoning and aerial shooting campaign began (Harbo and Dean 1983). By the mid-1950s it had greatly reduced wolf numbers in much of southcentral and interior Alaska. Wolves persisted in some areas largely because the country was extraordinarily vast and remote. In the Nelchina Basin near Glennallen, a 20,000 square mile area, only one pack remained, reportedly spared for study. Aerial shooting on the North Slope reduced wolves to very low levels and they remained low for decades.

After statehood in 1959, the controversy over poison was so intense that it was permanently banned by the new state legislature (Harbo and Dean 1983). Aerial shooting and bounty payments continued through the 1960s. Large numbers of wolves were taken and numbers remained low. After passage of the Federal Airborne Hunting Act in 1972 and termination of the bounty, wolf numbers increased as ungulate populations declined following eruptions in the 1960s (Van Ballenberghe 1985). In some cases there were spectacular crashes evidently precipitated by severe winters and accelerated by predation and overhunting. For example, the Nelchina Caribou Herd declined from 90,000 in 1962 to 8,000 in 1972. The Tanana Flats moose population south of Fairbanks went from 23,000 to 2,800 during 1965-1975 (Gasaway et. al 1983).

By the mid-1970s hunters, faced with declining ungulate populations, demanded wolf control in several areas and ADFG responded by proposing helicopter-shooting programs. Despite legal challenges, these programs accounted for 1,300 wolves at a cost of \$824,000 between 1976 and 1983 (ADFG 1983). By 1984 considerable public opposition to state-sponsored control programs largely terminated them. However, taking of wolves by private pilots, termed land-and-shoot hunting, continued. This served as de facto wolf control in certain areas where terrain features were suitable.

In the early 1990s controversy flared again as a new administration proposed another round of helicopter wolf shooting. Governor Walter Hickel received more than 100,000 letters of protest. A wolf-snaring program emerged as a substitute to aerial shooting but also provoked international protests as video footage documented wolves chewing their frozen feet caught in snares.

In the 1990s political involvement in control issues increased greatly. In 1994 hunting and trapping interests successfully lobbied the state legislature for an “intensive management” bill that mandated efforts to restore depleted ungulate populations to former levels of abundance. The bill’s clear intent was a strong emphasis on predator control. In 1996 a ballot initiative banning public land-and-shoot wolf hunting passed by a large margin. Efforts by the legislature to resurrect the public’s use of airplanes to shoot wolves resulted in a referendum in 2000 that again banned this practice.

In 2003 and 2004, after a decade largely free of major predator control programs, a new state administration headed by governor Frank Murkowski approved four new programs involving the use of private pilots to shoot wolves with airplanes. These areas total about 30,000 square miles with several hundred wolves scheduled to be shot initially and undetermined others to follow in subsequent years. In addition, hunting and trapping seasons, bag limits, and methods of take for wolves in these and most other areas of the state were liberalized. In certain areas of the state seasons run from mid-August to May, there are no trapping bag limits, and wolves can be pursued and shot from snowmachines. Currently, hunters and trappers take about 1,500 to 1,700 wolves annually excluding those taken in control programs.

Black, brown, and grizzly bear populations are also scheduled for reduction in certain areas. In March 2004 the state Board of Game (BOG), a seven-member body that promulgates hunting and trapping regulations and sets predator control policies, revised its bear conservation and management policy to include a section on predation. Methods and means the board may consider applying include relocation, sterilization, use of electronic equipment for communication between hunters, sale of hides and skulls, trapping, baiting with human-derived foods as an aid to hunting, same-day airborne taking, and diversionary feeding. Efforts to reduce bear numbers by lengthening fall hunting seasons, opening spring seasons, increasing bag limits, and eliminating hunting tag fees have occurred during the past two decades in certain areas where bears were thought to be preying on moose at high rates.

Previous Standards and Guidelines

Although poorly documented, the standards and guidelines used by ADFG and the BOG for predator control in several wolf control programs during 1976-1983 included preparation of “issue papers.” These consisted of reviews of the available data including sex and age ratio information for ungulates, predator population status and trend, harvest information for predators and prey, predator-prey ratios, and crude information on habitat condition and trend. Except for certain areas where research resulted in ungulate population estimates using fixed-wing aircraft, reliable population estimates for ungulates were generally unavailable. Winter wolf population surveys based on aerial track counts and observations of live animals were supplemented with trapper reports to estimate wolf numbers.

At that time the BOG adhered to a policy prohibiting poison. It allowed private pilots to take wolves in certain areas under a permit system in accordance with Federal Airborne Hunting Act provisions, and directed ADFG employees to take wolves by helicopter shooting where feasible (ADFG 1983). BOG policy prohibited total elimination of wolves in the control programs, and often specified leaving twenty percent of the pre-control wolf population.

Despite these guidelines, there were no formal requirements in the predator control regulations requiring certain types of data or standards for data quality necessary to justify control. Nor were there protocols for implementing, monitoring, or evaluating control programs.

In the late 1980s the BOG adopted an “emergency” standard for justifying control programs. Under this standard wolf control would be infrequent and not applied unless prey populations were demonstrated to be at low densities and were unlikely to recover absent control. Protocols were established to determine if wolf predation was limiting ungulates rather than some other factor. Control programs would cease when prey populations had recovered. The BOG rescinded this standard by 1991 in order to accommodate proposed helicopter shooting of wolves under a zoning program as part of a strategic wolf management plan. In certain zones, ungulates would be managed at high densities and wolf numbers would be kept low.

The intensive management statute passed in 1994 mandated new standards for management of ungulates. These were based on restoring “depleted” populations to former levels of abundance, but depleted was undefined. Predator control could be applied at any level of ungulate abundance, low, medium, or high, with the overall goal of increasing opportunity for hunters, and to manage ungulates exclusively for high levels of human consumption.

Under Governor Tony Knowles, three broad standards were mandated for control programs. Control would be based on sound science, it would be economically justifiable, and it would have broad public support. These standards precipitated debate on what constituted sound science and who determined science quality, and on methods of measuring public support.

NRC Standards and Guidelines

The NRC review (NRC 1997) addressed two basic questions:

- 1) In attempts to understand interactions between moose and caribou and their habitats and predators, have appropriate types of data been gathered, and has enough been learned from past research to identify the information needed to enable us to predict quantitative responses of prey populations to predator control efforts?
- 2) What critical data gaps exist in our scientific understanding about these populations, and what would be needed to fill them?

The committee reviewed past and present control programs, Alaska’s biomes, people, and wildlife species of concern, predator-prey interactions, wolf and bear management experiments and evaluations, socioeconomic implications of predator control, and decision making. The resulting report included nine major biological conclusions and eight recommendations. Many of the specific points included in the recommendations provide the basis for suggested standards and guidelines for predator control programs. These include:

- 1) Wolves and bears should be managed with an adaptive management approach.
- 2) Management actions should be planned so it is possible to assess their outcome.
- 3) Managers should avoid actions with uninterpretable outcomes or low probability of achieving stated goals.
- 4) The status of predator and prey populations should be evaluated before predator reduction efforts occur.
- 5) Carrying capacity of the prey’s habitat should be evaluated.
- 6) There should be more attention to experimental design and monitoring of results.
- 7) Changes in the population growth rate of prey and in hunter satisfaction should be monitored.
- 8) The scope of studies of predators and prey should be broadened.
- 9) Better data on habitat quality should be collected.

- 10) Better data on bear ecology should be collected.
- 11) Development of long-term data sets should continue.
- 12) Better data on bear foraging ecology and population ecology should be collected.
- 13) Better data on quantitative and qualitative habitat changes should be collected.
- 14) Better data on long-term consequences of control should be collected.
- 15) The use of controlled fire for increasing the carrying capacity of moose habitat should be further investigated.
- 16) Decision makers should be more sensitive to signs of over-harvest.
- 17) Decision makers should be more conservative in setting hunting regulations and designing control efforts.
- 18) Future management experiments should be based on more thorough assessment of baseline conditions and should be designed so the causes of subsequent population changes can be determined.
- 19) All control actions should be viewed as experiments with clear predictions.
- 20) Control actions should be designed to include clearly specified monitoring protocols of sufficient duration to determine whether or not predictions are borne out and why.

The NRC review also contained a section on decision-making that reiterated several of the standards and guidelines listed above and provided additional standards (NRC 1997:128-130). The first suggested step in deciding whether or not to reduce predators was to identify reasons for wanting more ungulates. These include biological emergencies, subsistence emergencies, lifestyle and recreational hunting demands, and viewing and tourism demands. Next, the unmet demand should be quantified and the extent to which ungulate numbers must be increased should be determined. Population models and cost-benefit analyses should provide estimates of the extent and duration of management actions necessary to meet the projected demand and to estimate costs of predator reduction.

Once these issues have been addressed, ecological investigations should be conducted to assess the likelihood that predator reduction will achieve desired goals. Necessary data include:

- 1) Historic population trends of ungulates, including an assessment of data reliability and factors other than predation that affected numbers including weather, habitat changes, and hunting.
- 2) Current ungulate population trends, an important first step best determined by monitoring adult survival using radiotelemetry combined with a precise series of censuses.
- 3) Emigration studies to determine if animals are leaving the area.
- 4) An evaluation of habitat condition to determine where the ungulate population is in relation to carrying capacity. Studies of winter severity, ungulate body condition, growth rates, body fat indices, and pregnancy rates may be necessary.
- 5) Studies of predator ecology are necessary to determine the densities of wolves and bears and their major seasonal foods. Studies should determine which species

might be depressing ungulate numbers, and how difficult and expensive would reduction be for each species in a given area.

- 6) Limiting factors must be determined in order to assess the importance of predation in relation to weather, habitat quality, hunting and other factors.
- 7) Ecological consequences of predator control should be identified. Negative, long-term consequences might outweigh short-term increases in ungulate numbers.

Next, management options should be identified that increase ungulate reproduction and survival or decrease predation rates. These include habitat manipulation to improve the quantity, quality, or distribution of habitats; non-lethal control methods for predators including diversionary feeding, sterilization, and translocation; selective removal of individual animals or wolf packs; timing of removal to increase efficacy; assessment of removal methods to identify those that are most humane, efficient, cost effective, and politically acceptable; and identification of removal locations to concentrate actions in critical areas to maximize effectiveness while minimizing effects on predator populations.

Finally, predator reductions must be monitored with protocols of sufficient magnitude, duration, and geographic extent to show clear results. The report noted that most past programs resulted in unclear results. Pre-treatment and post-treatment monitoring was sometimes insufficient, non-experimental areas were not maintained, and weather conditions were often poorly measured. “Wherever possible, predator control programs should be incorporated into a reviewed experimental design to ensure that knowledge is one of the benefits of the reduction program” (NRC 1997:130).

Application of NRC’s Recommended Standards, 2000-2001

The first extensive effort to apply the NRC’s recommended predator control standards and guidelines came in 2000 and 2001 when Alaska addressed a long-standing demand for wolf control by residents of McGrath on the Kuskokwim River in Interior Alaska. In 1995 the BOG received reports from local residents that moose numbers had declined greatly from high levels in the 1970s and wolves were thought to be keeping moose numbers from increasing. Preliminary data collected by ADFG indicated a moose:wolf ratio of 12:1. The BOG approved a control program to take 80% of the wolves in the area but the program was not implemented, nor were similar plans approved subsequently. Governor Tony Knowles appointed a stakeholder’s group called the “Adaptive Wildlife Management Team” in 2000 to review the issues and to provide recommendations to the ADFG Commissioner.

The team found that the current moose population in the area (estimated at 869) was insufficient to support the harvest demand of 130-150 annually. ADFG biologists estimated that 3,000-3,500 moose could provide the desired harvest and the team adopted this and the desired harvest as population and harvest goals (ADFG 2001). The team recognized that there were significant needs for additional data, notably the extent of bear predation on neonate moose, quality of moose habitat in relation to moose body condition and pregnancy rates, movements of moose in the area, and more precise estimates of

moose, wolf, and bear numbers. ADFG biologists prepared a detailed study plan that was peer reviewed by eight qualified experts including some outside Alaska.

The team recommended a program of wolf and bear reduction involving wolf trapping by local residents followed by aerial shooting (ADFG 2001). Bear hunting by local residents would be encouraged if bear predation on neonate moose was found to be important. Moose hunting seasons in a portion of the area would be closed until the moose population increased. Studies and monitoring efforts would be designed to fill data gaps. The entire program would be conducted in an adaptive management context. The team would reconvene periodically to review progress and suggest alternate approaches as necessary.

ADFG's Commissioner approved the plan early in 2001 with the provision that aerial shooting of wolves would be done by ADFG employees using helicopters rather than by private pilots in fixed-wing aircraft. The BOG approved the plan, but before it could be implemented in autumn 2001 a moose census indicated 3,660 moose in the area versus the previous claim of 869. Clearly, previous estimates were based on faulty censuses done under poor conditions and moose numbers were actually much higher than expected. Plans to reduce predators were suspended in light of this new information.

In general many of the NRC's recommendations were followed in designing this program but there were important exceptions. Predator reduction was to begin immediately rather than be delayed pending additional data despite very limited information on key components including the extent of bear predation. And, wolf control, bear reduction, and moose hunting closures were to be simultaneously applied thereby confounding interpretation of results and complicating assessment of the relative importance of these limiting factors.

Predator Control Programs 2003-2004

Frank Murkowski was elected Governor of Alaska in November 2002 and shortly thereafter appointed five new members to the seven member BOG. One of the BOG's first actions was to review the McGrath program. In March 2003 the board approved a predator control program for the McGrath area incorporating several important changes from the previous plan (BOG 2003a). Aerial shooting of wolves by private pilots under permits issued by ADFG replaced the proposed helicopter-shooting program conducted by ADFG employees. About 35-45 wolves were thought to be in the control area and all were scheduled to be shot. Bears were to be translocated after capture by ADFG personnel. The Adaptive Wildlife Management Team was disbanded. Subsequently, the wolf control area was doubled in size and the moose population goal was doubled with no in-depth assessment of habitat conditions or carrying capacity. The harvest goal for moose in the area was increased from 130-150 to 400-600. And the peer-reviewed study plan designed to guide research and monitoring was shelved.

A second predator control program was approved in 2003 for the Nelchina Basin (Game Management Unit 13, hereafter Unit 13) (State of Alaska 2004a). Unlike other areas of

concern, moose in Unit 13 remained at moderate densities following declines from higher levels in the 1980s (BOG 2003b). But the BOG approved a control program there under provisions in the intensive management statute to restore ungulate populations to former levels of abundance. About 140 wolves in the control area were scheduled to be shot by private pilots. Moose hunting seasons would continue during the control program. In accordance with previous research indicating heavy bear predation on moose in this area, liberal bear hunting seasons and bag limits continued, but no other explicit measures to reduce bear numbers were approved. No study plan was required and no additional data collection was specified in addition to annual surveys conducted to obtain routine management information. Limited data on habitat quality were available indicating persistently heavy use of important browse species by moose in several areas, but carrying capacity was assumed sufficient by the BOG to support additional animals.

During winter 2003-2004 seventeen wolves were taken near McGrath by aerial shooting with eleven more taken by trappers. Private pilots took 127 wolves in Unit 13. In spring 2003, 90 bears were translocated at McGrath with 35 additional bears moved in spring 2004.

The BOG approved two additional predator control programs in March 2004. These include an area in Upper Cook Inlet near Anchorage (Unit 16B). Moose numbers and harvests were thought to have declined during the past ten years while wolf numbers increased (BOG 2004a). No quantitative data were available on the impact of wolf predation on moose numbers. Bears were suspected to be important predators of moose but no quantitative data were available. Habitat conditions and carrying capacity were unknown. Despite firm resistance by ADFG, the BOG approved a wolf control program using private pilots under permit to take about 80% of the wolves in the control area beginning in autumn 2004 (State of Alaska 2004b). Moose hunting seasons remained open and no further steps to reduce bear numbers were approved. A study plan was not required and no additional data collection was specified other than annual surveys for routine management information.

The second program approved in 2004 was in Game Management Unit 19 (Unit 19) in the Central Kuskokwim River area of interior Alaska. Moose numbers in this area apparently declined during the 1990s but crude estimates suggest moderate densities persist relative to other areas in interior Alaska (BOG 2004b). As is the case for Unit 16B, no quantitative data exist on the extent of wolf predation on moose, on the impact of bear predation, or on moose habitat quality and carrying capacity. The BOG approved a control program using private pilots to shoot wolves in this area beginning in autumn 2004 (State of Alaska 2004c). Moose hunting seasons were not closed. No further steps were approved to reduce bear numbers other than through continuation of liberal hunting seasons and bag limits. A study plan was not required and no additional data collection was specified other than that gathered for routine management.

The four areas approved by the BOG for predator control in 2003-2004 (McGrath, Unit 13, Unit 16B, and Unit 19) total about 30,000 square miles. Private pilots with permits to shoot wolves may take up to 500 wolves in winter 2004-2005. This is in addition to

wolves taken in routine hunting and trapping seasons that in recent years accounted for 1,500-1,700 animals.

How well do the predator control programs approved in 2003-2004 conform to the NRC's recommended standards and guidelines? In general these programs differ significantly from the process used in 2000-2001 to design a control program in the McGrath area. For example, two of the new areas (Unit 13 and Unit 16B) did not involve a citizen's planning team. The Unit 19 program was preceded by a team convened to review the issues, but the level of biological detail involved was substantially less than for McGrath. By disbanding the McGrath team the BOG lost the opportunity for future valuable input, including that from two residents of McGrath who served on the team from the outset.

In the case of McGrath, much of the groundwork was complete by 2003 as a result of the team's efforts. However, the decision was made to proceed with wolf control despite the 2001 moose census that indicated nearly four times as many moose as estimated earlier. Studies in progress at McGrath on moose calf mortality, bear translocation, and moose population characteristics continued through 2004. Similar studies are not in progress in any of the other areas, nor did the BOG identify the need for such studies when it approved additional programs despite obvious data deficiencies.

The BOG failed to recognize the importance of filling data gaps and was willing to proceed with insufficient data on several key components of predator control programs including current, quantitative data on predator and prey numbers. This ignored the NRC guideline of evaluating the status of predator and prey populations prior to predator reduction. Furthermore, it risked repeating the mistakes of certain past control programs where prey numbers were greatly underestimated and wolf control was suspended when adequate censuses occurred. The BOG's approval of wolf control in Unit 16B despite warnings from ADFG that data were nonexistent or insufficient is particularly alarming.

The BOG also retreated from the McGrath model's approach of requiring study plans that provided protocols for implementing, monitoring, and evaluating predator control actions and for conducting additional studies. Peer review of the McGrath plan in 2001 by biologists outside ADFG with no stake in the plan's outcome resulted in several ADFG additions to the revised plan. Similar reviews of plans for other areas, if they had been required, would undoubtedly have resulted in improved designs.

An important NRC finding was that most previous predator control programs in Alaska and Canada had unclear outcomes, in part because the programs were primarily management actions based on particular assumptions about predator-prey dynamics. These programs were not designed to test those assumptions. "As a result, less has been learned from these experiments than would have been possible had they been better designed and executed, and if the results had been more extensively monitored" (NRC 1997:5). By continuing to implement similar management programs with insufficient monitoring, recent BOG actions will result in more unclear outcomes and continued inability to improve the design of future programs.

A consistent and often repeated concern in the NRC review pertained to ungulate habitat quality and carrying capacity issues. Obviously, predator reductions will not result in increased ungulate numbers if the necessary habitat to support more animals is lacking. In theory, all predators could be removed with no response in ungulate numbers if habitat quality was poor. There is extensive literature linking ungulate nutrition, body condition, growth rates, pregnancy rates, and survival to habitat quality. Furthermore, winter severity can lower carrying capacity as snow buries forage and increases the energy costs of movement. The NRC review recognized these important ecological relationships and their significance to predator control programs, and provided suggested guidelines for incorporating them in management actions. The BOG's approach in approving recent control programs was to accept crude, qualitative information and broad generalizations on habitat quality and carrying capacity rather than requiring quantitative data. This is a serious breach of recommended standards.

In general, the BOG's recent approval of programs to reduce wolf and bear numbers in an attempt to increase ungulates represents a retreat from the sound science standard in place in Alaska during the past decade. Arguably, most of the important biological standards and guidelines recommended by the NRC (1997) have not been followed. The NRC strongly recommended that predator control should be done as adaptive management, that management actions should be planned so that outcomes are clear, and that programs with a low probability of success should be avoided. Contrary to NRC recommendations, the BOG has begun a process where there is less attention to experimental design and monitoring of results and more reliance on anecdotal and qualitative information to justify control programs. This approach jeopardizes progress made during the past two decades in applying science-based management to the controversial practice of predator control in Alaska.

Finally, a fundamental, underlying problem in applying recommended biological standards and guidelines to predator control in Alaska is the state's intensive management statute. This 1994 law requires a political standard aimed at restoring depleted ungulate populations to previously attained levels including historical highs. In many cases such highs resulted from eruptions linked to large-scale predator control in the 1950s and 1960s. Peak populations were clearly unsustainable and restoring them now is likely unattainable. Furthermore, estimates of the magnitude of peak populations, even those reached as recently as the 1980s, are often little more than guesses and are often inflated.

Despite these problems, the BOG, guided by the intensive management statute, has consistently set ungulate population and harvest objectives at high levels, or, as was the case in McGrath, raised previous objectives absent data on habitat quality and carrying capacity. The net result of this is to commit the BOG to approving perpetual predator control programs that chase unattainable objectives. The current programs will likely repeat the pattern of the past wherein wolf and bear control triggered ungulate eruptions followed by habitat damage and sharp ungulate declines. Alaska's record of managing eruptions and declines is poor. Poorly managed populations that erupt and decline risk long-term ungulate sustainability, protection of habitat integrity, and predator population

viability. This highlights the NRC's guideline that if ecological consequences of predator control are not identified, negative, long-term problems might outweigh short-term increases in ungulate numbers.

SUMMARY

Despite a history of predator control programs in Alaska going back to the late 1940s, biological standards and guidelines used to justify, implement, monitor, and evaluate such programs have been inconsistent and variable. Early efforts included preparation of issue papers that consisted of data reviews and presentation of management oriented information. Data quality was highly variable and data gaps were common. Approved predator control programs were often management actions that lacked protocols for monitoring and evaluating results. Consequently, most of the programs had unclear results.

In the late 1980s an emergency standard was included in the regulations. This directed that wolf control would be infrequent and applied only when ungulate populations declined to low levels with the expectation that they would remain low absent wolf reduction. Protocols were designed to establish that predation rather than other factors including severe winters, habitat problems, or hunting was the primary limiting factor. Predator control would cease when ungulate populations had recovered.

The emergency standard was abandoned when a state statute requiring intensive management of ungulates passed the legislature in 1994. This mandated restoring depleted ungulates to former levels of abundance, largely through predator control, without reference to actual habitat status. Predators could be reduced at any level of ungulate abundance with the overall goal of increasing opportunity for hunters.

In 1997 a National Research Council review of past programs included nine major biological conclusions and eight recommendations. Many of the specific points included in the recommendations provided the basis for at least twenty suggested standards and guidelines for predator control programs. In addition, the review provided seven broad categories of data required to conduct ecological investigations to assess the likelihood that predator reduction will achieve the desired goal of increasing ungulates.

The first comprehensive effort to apply the NRC's standards occurred in 2000-2001 when an adaptive management planning team designed a program to rebuild a moose population near McGrath in interior Alaska. The proposed plan included recommended studies to gather additional data and called for a peer reviewed study plan to devise protocols for monitoring and evaluating management actions. Management was to occur in an adaptive context thereby following one of the NRC's most important recommendations. Before management actions were initiated a moose census revealed nearly four times the number of moose as previously estimated. Predator reduction was delayed as a result.

In 2003-2004 a new state administration approved three new predator control programs and opted to proceed in the McGrath area. These predator control areas total about 30,000 square miles with up to 500 wolves expected to be taken by private pilots in winter 2004-2005. The new programs departed from the previous model for McGrath in that planning teams were not involved, study plans were not prepared, and studies to supplement weak or missing data were not designed. Qualitative data on predator and prey numbers, habitat quality, and carrying capacity were used in lieu of quantitative data. The Board of Game approved predator control in one area against the advice of Department of Fish and Game biologists who indicated that they lacked key data to justify the program.

The Board of Game's recent approval of programs to reduce bear and wolf numbers in an attempt to increase ungulates represents a retreat from earlier programs that incorporated most of the NRC's major biological standards and guidelines. Arguably, most of those standards are not now being implemented. There is now less attention to experimental design and monitoring of results and more reliance on anecdotal and qualitative information. This approach risks unexplainable or unclear results at best, and wasted effort with failure of ungulate numbers to increase at worst if undetected factors rather than predation are limiting.

Alaska's intensive management statute is a major barrier to implementation of the NRC's recommendations. Efforts to chase unattainable population and harvest objectives with poorly designed predator control programs risk long-term sustainability of ungulates, protection of habitat integrity, and predator population viability.

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