A PLAN FOR THE MOOSE IN MANITOBA

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AND

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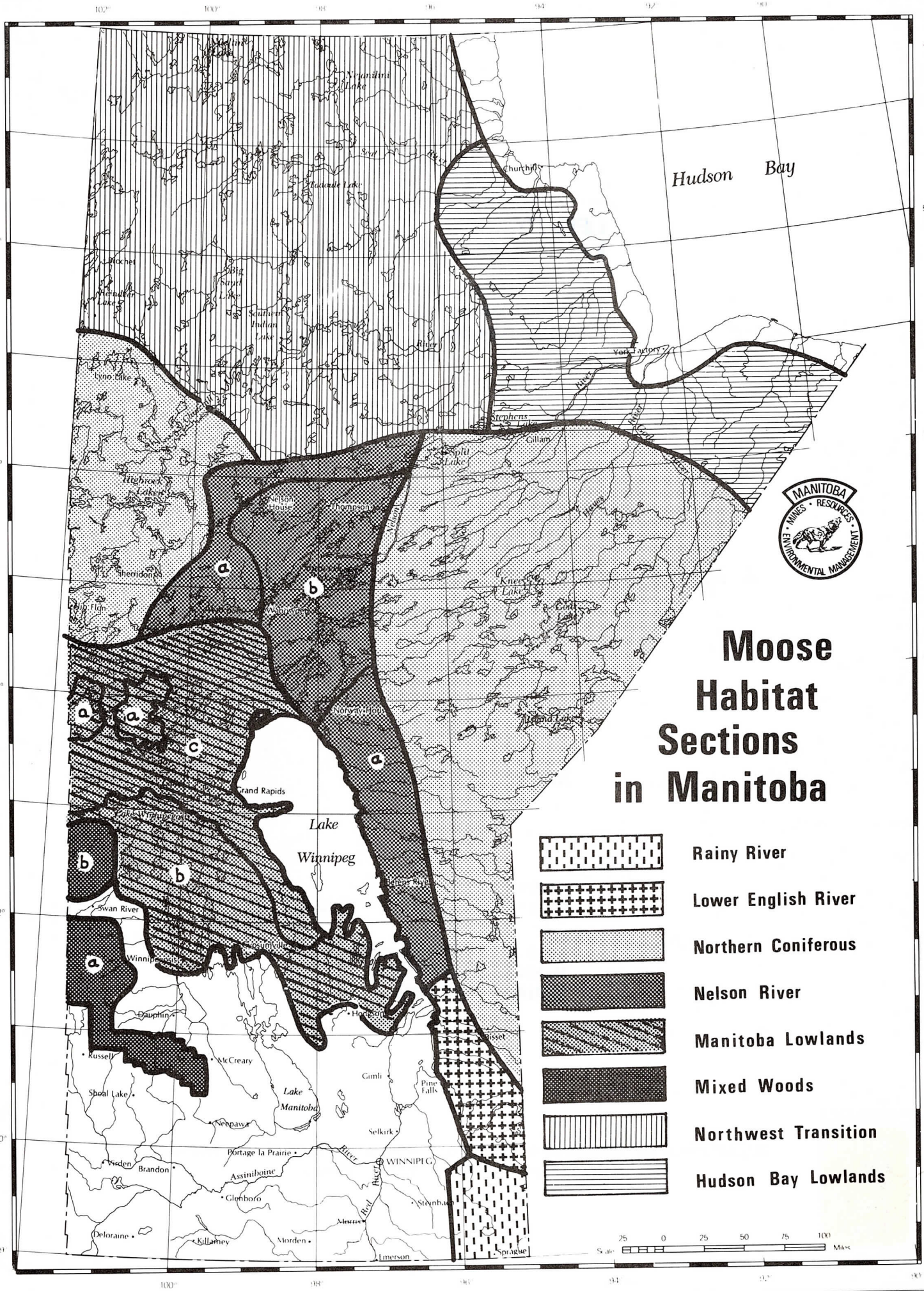
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INTRODUCTION

At a meeting of wildlife staff of the Department in spring, 1975 to discuss the needs for wildlife planning work, it was decided that the highest priority for such work should continue to be on deer and waterfowl. Moose was identified as a planning need, but of a lesser urgency. However, because of temporary staffing problems at that time and a feeling that a moose planning exercise might be a shorter, more straightforward task than the others, a decision was made to proceed with moose as quickly as possible. Early in the summer of 1975, Mr. Murray asked J. L. Howard to proceed with arrangements for a moose planning project. R. A. Larche was added to the planning team in August, 1975.

Up to that time, no clear terms of reference had been provided, except that it was generally felt that a moose plan should identify and offer solutions for current and future problems associated with moose habitat, biology and use. Accordingly, a project outline was drawn up incorporating objectives to cover these subjects, to analyze the Department's current moose management effort, and to identify what inputs were needed to manage the province's moose.

On August 27, 1975, we met with Regional Wildlife Biologists to discuss and revise the project outline. Following that meeting, another outline was drawn up and presented to Messrs. Bossenmaier, Barr and Murray. Approval was received to proceed with a moose planning exercise with objectives as follows:

1) to foresee and identify future problems facing the moose,

2) to point out ways of preventing these problems before they develop,

3) to recommend policy to guide moose management in the future,

4) to indicate specific areas where research effort on moose will enhance our management capabilities,

5) to identify a set of procedures for the sound, scientific management of moose in the years ahead.

HISTORY

The moose (Alces alces americana) has been in the past and continues to be an important part of Manitoba's natural resources. Bryant (1955) presents a good summary of the early historical records of moose distribution in the northern part of the province. That summary indicates that substantial moose range expansion and increase in numbers has occurred in northern Manitoba since the early days of the fur trade. Moose hides were early reported as a common item of trade with the Hudson Bay Company, but these may all have come from the James Bay forts. Henry Kelsey, the first inland explorer from Hudson Bay in 1690-2, made no reference to moose until he had passed completely across northern Manitoba and was 6 days southwest of Carrot River. There he reported a moose killed by the natives and this is believed to be the first recorded reference to moose in the western Hudson Bay drainage area. Bryant's work concludes that well into the 1700's, the northern limit of moose range probably did not extend beyond a line through Cross Lake, the south end of Setting Lake and on to Cumberland House.

During the 1800's the fur trade expanded into all areas of the province. Although lightning-induced fires have always occurred on the

moose range, this increased human activity caused a great increase in forest fires. Robert Bell (1880) reported huge tracts of forest had been recently burned in the God's, Oxford and Island Lakes area. Moose first appeared at Island Lake in 1890-1910. Tyrrell (1902) refers to fires having burned large areas of forest south of Sipiwesk Lake as far west as Birchtree and Cranberry Lakes. There is little doubt that fires during this century played an important role in providing suitable habitat for range expansion.

Bryant cites observations of continued range expansion in the 1900's, with the first moose seen at South Indian Lake in 1915 and the first moose shot on the Seal River north of Southern Indian Lake in 1920. The northern and eastern range expansion, which has now advanced to the limits of the Boreal Forest, is believed to be the result of normal but very slow post-glacial range re-occupation. The process was greatly accelerated by man's activities in the fur trade era which created huge amounts of suitable new moose habitat by burning the mature coniferous forests.

While man's activities in the north are partially responsible for moose range expansion there, the reverse has occurred on the southern portions of the range. Prior to extensive human settlement and agricultural development, moose were abundant in nearly all the forested lands of southern Manitoba. Many of the pioneer settlers depended heavily on moose and other big game for sustenance in the early stages of farmland development. However, the combination of heavy, uncontrolled harvest of moose by settlers and habitat destruction through agricultural development rapidly eliminated this animal from most of its former southern Manitoba range.

Seton (1953) in speaking of the north slope of the Turtle Mountains, states that he was assured by Mr. A. S. Barton of Boissevain, on September 13, 1904, that "There are now no moose there; the last moose had been killed recently." J. P. Turner (1906) voiced his concern for the future of moose in southern Manitoba, and states that "Now there are probably 500 moose killed annually by people from the cities and towns, who know little more of the animal than its appearance along a rifle barrel."

Although moose have been eliminated from agro-Manitoba except where small tracts of suitable habitat have been maintained e.g., the Turtle Mountains and Spruce Woods, other kinds of development have been beneficial to the moose. The early logging industry, operating along the fringe of agricultural development, converted large areas of mature evergreen forest into early seral stages of plant succession and vastly improved moose habitat quality. As in the north, increased incidence of wild fires associated with man's activities also caused temporary improvements in moose habitat quality. Such areas that have been improved by logging and fire and not subsequently developed for agriculture are now our most productive moose range in the province.

The early recorded information on moose harvested by humans does not begin to show the total number of animals taken. Agricultural settlers, foresters, trappers, prospectors, fishermen, in fact everyone who lived and worked in Manitoba's woodlands took moose as needed for food, in many cases without benefit of licence. The number of moose taken by licenced hunters was small compared with that taken by unlicenced hunters "living off the land." In more recent years, this trend has gradually reversed, and now the bulk of the moose harvest is taken by licenced recreational hunters.

ACKNOWLEDGEMENTS

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INVENTORY

MOOSE HABITAT SECTIONS OF MANITOBA

Manitoba possesses a variety of broad ecological regions each with a differing capability for moose production. This capability is dependent on both biotic and abiotic environmental components. Figure I (inside front cover) displays these broad ecological sections. The placement of boundaries was determined by synthesis of published accounts of forest regions, topography, surficial geology, soils and drainage (Rowe 1972, Erhlich 1963, Weir 1960 and Zoltai 1970). General descriptions of each habitat section follows and size of each section has been determined (Table 3).

Two major biophysical zones of Manitoba have been excluded from this discussion: the tundra region along the Hudson Bay Coast and the prairies of southwestern Manitoba. Both these areas support pockets of moose such as at Button Bay, Spruce Woods and Turtle Mountain; however, as moose numbers and use are not large, they have not been described.

1. Rainy River Section

In southeastern Manitoba a region of mixed woods occurs on an area of mostly flat to undulating terrain. Stands of jack pine (Pinus banksiana) occur on drier sites particularly following fire. In more moist locations, black spruce (Picea mariana), tamarach (Larix laricina) and eastern white cedar (Thuja occidentalis) form the major overstory species. Balsam poplar (Populus balsamifera), white spruce (Picea

glauca), white elm (Ulmus americana), basswood (Tilia americana), Manitoba maple (Acer negundo), bur oak (Quercus macrocarpa), and trembling aspen (Populus tremuloides) are other important species of the region. Important species of the shrub layer include red-osier dogwood (Cornus stolonifera), saskatoon (Amelanchier alnifolia), mountain maple (Acer spicatum), high-bush cranberry (Viburnum spp.), willow (Salix spp.) and mountain ash (Sorbus decora).

2. Lower English River Section

To the north of the Rainy River section is another region of mixed woods. This area has a general low relief which is irregularly interrupted by morainic ridges, precambrian rock outcrop and deltaic depositions. Mixed forest cover predominates although a greater percentage of conifers occurs than in the Rainy River section. White pine (Pinus strobus) and red pine (Pinus resinosa) are lacking, and eastern white cedar is far less common. Mixed stands of trembling aspen, balsam poplar and white spruce are common. Jack pine is present on drier sites and shallow bogs are occupied by black spruce and tamarack. Balsam fir (Abies balsamea) and white birch (Betula papyrifera) are also found in association on mixed sites. Shrub species include red-osier dogwood, high-bush cranberry, blueberry (Vaccinium spp.), mountain maple, alder (Alnus spp.), hazelnut (Corylus spp.), pin cherry (Prunus pensylvanicus), saskatoon, sumac (Rhus glabta) and choke cherry (Prunus virginiana).

3. Mixed-Wood Section

The Duck Mountain, Riding Mountain and Porcupine Mountain areas are noted for their rough topography and mixed-wood vegetation. On the higher elevations of the Porcupines the trend is towards a coniferous vegetation with black spruce predominating. This is a result of the more northerly climate and higher elevations which separates it from the rest of the area.

Mixed woods of trembling aspen, balsam poplar, white birch, white spruce and balsam fir is the most common vegetation type. Jack pine stands with very little understory occur on sandy areas or dry till soils while black spruce occurs on the higher elevations. Common shrubs include hazelnuts, willows, dwarf birch, rose (Rosa spp.), choke cherry, pin cherry, saskatoon, high-bush cranberry, red-osier dogwood, and soap-berry (Shepherdia canadensis).

4. Manitoba Lowland Sections

This section occupies the Interlake region and the area north-west of Lake Winnipeg. The northern and eastern boundaries follow the division between the Precambrian and the Paleozoic regions, and the Cretaceous escarpment forms the western boundary. Because of the lime-stone substratum much of the soil has low fertility and tends toward humic gleysols and organic profiles. The section is subdivided into three regions on the basis of soils. The Saskatchewan River Delta area (A) has rich alluvial soils supporting a mixed vegetation and is a region with one of the highest capabilities for moose in the province. The southernmost sub-section (B) is predominantly poorly drained or leached

organic soils which supports scrubby stands of hardwoods, predominantly aspen. The northernmost sub-section (C) has organic soils predominantly supporting coniferous vegetation.

Black spruce and tamarack prevail on the poorly drained organic sites. On well drained alluvial sites, white spruce, balsam poplar, trembling aspen with occasional white elm, green ash (Fraxinus americana), Manitoba maple and eastern white cedar may occur. On disturbed sites with poor limestone soils scrubby stands of aspen prevail. Common species in the understory include willow, red-osier dogwood, high-bush cranberry, saskatoon, alder, choke cherry, mountain maple, hazelnut, rose, silver-berry (Elaeagnus commutata), and bearberry (Arctostaphylos uva-ursi).

5. Nelson River Section

Along the east shore and north end of Lake Winnipeg, the land was covered by glacial Lake Agassiz and a deposition of clays and sands was laid down which resulted in levelling of the irregular precambrain surface. As a result of this levelling, drainage is very restricted over vast portions of the area and organic soils have developed on these lacustrine deposits. However, at the north end a region of well-drained clay deposits (B) developed and this resulted in an area of higher fertility and higher capability for moose production.

Dominant vegetation of the region is black spruce forest and black spruce - tamarack swamps. On better drained locations white spruce, balsam poplar, white birch, trembling aspen and balsam fir may occur. The shrub understory differs little from the northern coniferous section tending to have a greater abundance of the more hydrophytic species.

6. Northern Coniferous Section

To the north and east of the Lower English River Section is the broad belt known as the Northern Coniferous Section. This section is split into two discontinuous units by the northward extension of the Lake Agassiz lowlands (Nelson River Section). The area is underlain with precambrian bedrock which has undergone intense glaciation resulting in irregular relief with parellel rock ridges inter-spaced with poorly drained depressions or narrow lakes. Where soil conditions are adequate, reasonable vegetation development occurs. Black spruce is found in association with jack pine on the drier sites and in association with tamarack in the poorly drained areas. Mixed stands of white spruce, balsam fir, trembling aspen and balsam poplar occur on some favourable sites. The understory is often poorly developed and sparse. Ground cover includes labrador tea (Ledum groenlandicum), bog rosemary (Andromeda polifolia), bog laurel (Kalmia polifolia), crowberry (Empetrum nigrum), baked-apple-berry (Rubus chamaemorus), leatherleaf (Chamaedaphne calyculata) and sphagnum and feather leaf mosses. Characteristic shrub species include red-osier dogwood, willow, dwarf birch (Betula glandulosa), alder and saskatoon.

7. Northwest Transition Section

In northwestern Manitoba a zone of subarctic open woodland occurs. The land possesses low relief with precambrian rock out-cropping and intervening water-filled depressions. Much of the tree growth is reduced because of climate, thin soils and frequent fires. Open stands of dwarf trees are intermixed with areas of bog, muskeg and rock outcrop.

The most abundant tree species is black spruce, while white spruce occurs on well drained sites and tamarack is common in wetter locations. White birch, stunted trembling aspen and balsam poplar also occur. Much of the area has a very open ground cover of lichens, sphagnum or featherleaf mosses. Where more herbaceous covers develop, dwarf birch, willows, labrador tea, blueberry, rock-cranberry (Vaccinium vitis-idaea), crowberry and baked-apple are common.

8. Hudson Bay Lowlands

In northeastern Manitoba there is a poorly drained region of low relief except for a series of beach ridges which occur inland from the Hudson Bay. This region is bounded on the south and west by the division between the Precambrian and Paleozoic bedrocks and on the north by the Hudson Bay or tundra regions. Vast areas of swamps, bogs and muskegs occur. Where forests do occur, open stands of black spruce and tamarack are found within a pattern of open fens and muskegs. On the few areas where drainage is developed, white spruce, balsam poplar and white birch occur. The ground cover of the region is predominantly sphagnum and on drier sites the reindeer mosses occur. Willows, alders, dwarf birch, labrador tea, blueberry, rock-cranberry, crowberry, bearberry and bog rosemary occur in the shrub layer or in communities without an over-story.

PRESENT AND FUTURE LAND USE

Manitoba's moose range lies beyond most of man's intensive land use activities. Most of this land is Crown owned and use is generally for low intensity purposes.

One of man's major activities affecting moose range is forestry. Approximately 650 square miles are annually logged, primarily within the Rainy River, Lower English River, Mixed Woods or Manitoba Lowland sections. Commercial species sought are spruce (white and black), jack pine and aspen. Logging activity results in changes in plant species and age composition which are generally beneficial to moose. By 1985, the area annually cut will increase to approximately 1,200 square miles (A. Kotowytz pers. comm.).

Forest fires are another important factor in the creation of early seral stages of forest growth. These fires have played a significant role in affecting the distribution and abundance of moose. The average annual area burned in the last 10 years has been approximately 100,000 acres. Fire detection and suppression efficiency will improve and it is anticipated the annual average area burned will be reduced to 50,000 acres (A. Jeffrey, pers. comm.).

Parks branch is another major land user and within the moose range there are eight parks totalling 4,115 square miles. These parks generally provide high quality moose range and have developed access which permits utilization of the resource. An additional ten parks totalling 5,534 square miles (Table 1) are proposed for Manitoba's moose range. Proposed Parks Branch policies of restricting utilization of forest resources, coupled with effective fire control programs will result in deterioration of habitat quality due to succession.

Table 1. Park lands in moose range.

Existing Parks	Area in square miles
Riding Mountain National Park	1,195
Duck Mountain	491
Clearwater	224
Grass River	882
Whiteshell	1,065
Hecla Island	90
Grindstone Point	80
Paint Lake	88
	4,115
Proposed Parks	
East Side National	1,383
Whiteshell Extension	1,081
Lake St. George	168
Kawinaw	119
Long Point	107
Partridge Crop	376
Wabishkok Lake	73
Athapapuskow Lake	654
Granville & Hughes Lakes	919
Porcupine	654
	5,534
Total	9,649

Large hydro-electric developments being undertaken will affect habitats along the Nelson and Churchill Rivers drainage systems. Portions of these developments have been approved while the decision to proceed with others awaits evaluation of impact studies. Wildlife evaluations are contained in five separate reports (Didiuk 1975, Koonz et al in press, and Slaney 1973 a,b,c). Numbers of moose within each section are summarized in Table 2. These impoundments will result in a lessening of numbers within the immediate area.

Table 2. Number of moose on lands within hydro diversion routes.

Development Section	No. of Moose	Source
Lake Winnipeg	not mentioned	Slaney 1973 b
Outlet Lakes	4,000	Slaney 1973 a
Lower Nelson	low	Didiuk 1975
Upper Churchill	87	Koonz (in press)
South Indian	46-92	Slaney 1973 b
Lower Churchill	low	Slaney 1973 c
Rat-Burntwood	200-400	Slaney 1973 c

A power transmission line from the Upper Limestone Rapids generating site to Dorsey Station near Winnipeg has been proposed. Two alternate routes are presently being assessed; one route is from Upper Limestone, southwest to Minago River, then south through the Interlake to Dorsey Station (approximately 580 miles long). The other route is straight south from Upper Limestone, east of Lake Winnipeg, then southwest to Dorsey Station (approximately 560 miles). Due to clearing

operations and programs to suppress tree growth, this development may enhance moose browse. Final assessments must await knowledge of exact route, width of cut, and habitat manipulation practices.

Access is generally well developed in areas such as Provincial Forests and Parks but much of the remainder of the moose range is inaccessible by conventional means. Proposed new roads expected within the next ten years include one from Thompson to Churchill, another from Cross Lake to the Thompson Highway and a third from Manigotogan to Berens River. These road developments will increase moose browse and utilization.

Agriculture developments have significantly affected the distribution of moose. The breaking of lands in southern Manitoba created new habitats unacceptable to moose. The utilization of brush lands by cattle results in lower moose numbers due to destruction of browse by livestock. In the next decade agricultural expansion may include formal pasture developments at Whitemouth Lake (5,760 acres), Saskeram (4,040 acres), Basket Lake (acres), and Carrot River (8,910 acres) as well as a general grazing thrust on lands in the Westlake and Interlake Region (G. Sommers, pers. comm.).

The acreage of land adversley affected by man in the next ten years is minor when viewed as part of the total moose range. However, many of the future changes are occurring in the same areas in which man now uses the moose resource to its fullest. This may cause shortages of moose in accessible areas, and we may have to look to remote less productive areas to maintain present moose harvests.

HOW MANY MOOSE?

Through the 1960's, Manitoba used an extensive series of transect-type aerial surveys over much of the important moose range to collect data

on annual population changes. Theoretically, this type of aerial survey should indicate changes in moose abundance, since the straight line transects cut randomly across all different habitat types, giving a sample count of moose in each habitat type.

It gradually became realized, however, that there are some serious problems associated with transect surveys over typical moose habitat. Unless carefully controlled, there is a danger of over-estimating moose numbers by including animals in the sample count that are outside the transect strip. Conversely, under estimation may occur due to observers not being able to pick out all the moose in the denser habitat types. Because these aerial surveys were not precise enough to give us accurate measurements of the relatively small annual changes in moose population, they were for the most part abandoned by 1970.

However, for current moose management purposes, there is a strong need to establish average moose densities (and therefore, moose population estimates) for the several moose habitat types and management units in the province. Therefore, the following attempt is made to indicate present moose densities and numbers in the province, based on the best information available from Regional Wildlife Managers. In several cases moose density estimates are based on our old transect aerial surveys. It appears obvious that a better method of moose inventory is needed if we are to manage moose on a quantitative basis now and in the future.

Table 3 illustrates our current estimates of moose density and population in each of the moose habitat sections described earlier in this report. It is recognized that there are differences in moose

density even within a habitat section. For example, for the southern-most sub-section of the Manitoba Lowlands, we have density estimates of 0.85 moose/mile^2 (G.H.A. 14), 0.19 (G.H.A. 15) and 0.37 (G.H.A. 21). Where such differences exist, we have applied an average density to represent the entire habitat section.

Table 3. Size of habitat sections and estimated 1974/75 winter moose densities and population in each.

Habitat Section	Size of Area	Moose/Mile^2	Population
Rainy River	2,600	0.11	300
Lower English River	4,000	0.35	1,400
Mixed Woods-Porcupine Mts.	1,100	0.45	500
- Duck & Riding Mts.	3,100	1.0	3,100
Manitoba Lowlands - (a)	1,500	1.0	1,500
- (b)	9,400	0.75	7,050
- (c)	10,500	0.75	7,875
Nelson River - (a)	12,000	0.25	3,000
- (b)	9,900	0.50	4,950
Northern Coniferous	59,500	0.25	14,875
Northwest Transition	55,700	0.10	5,570
Hudson Bay Lowlands	20,300	0.05	1,000
Total	189,600	0.303	51,120

Recent average density estimates for the provincial moose range are available from Ontario (0.35 moose per square mile), Saskatchewan (0.62 - 1.25 moose per square mile) and Alberta (1.0 moose per square mile). It would seem from these figures that our estimates are conservative, however a better estimating method is needed before this

assumption can be verified.

Predicting future moose populations is a difficult task considering the problems of estimating present populations or of predicting future habitat changes and their affects. Short term changes in moose densities will occur due to adverse weather conditions or in areas of overharvest. In the long term, however, moose numbers will depend upon qualitative and quantitative habitat changes which take place. The present and future land use section identifies that a minimal decline in habitat quantity may occur due to agricultural and hydro expansion. The combined positive and negative affects of man's differing activities on habitat quality will tend to cancel each other out. The changes which are to take place on the overall moose range (189,600 square miles) are minimal when viewed as a percentage of the total range. In light of this it is probable that moose populations of 1985 will be approximately the same as today.

UTILIZATION OF MOOSE

1. Native Harvest

The second largest users of moose are native hunters. Estimated provincial harvest of moose by Indians is 13 - 14 hundred animals; Table 4. These estimates are based on field staff information on known number of moose kills.

Table 4. 1974/75 moose harvest by natives.

Area	Moose taken	Comments
Gypsumville-Ashern	200-240	Estimates, based on known kill of 25-30% of these amounts
Grand Rapids	40-48	
Pine Falls	67-80	
Bissett	37-44	
East L. Winnipeg	100	Estimate, no good data available.
Valley River	10	
Skownan	44	
Camperville	12	
Crane River	-	
Ebb & Flow	-	
Pelican Rapids	17	All taken in the Mafeking area.
Big Eddy	7	
Easterville	5	
Indian Birch	7	East of Swan Lake
Pine Creek	8	Cowan-Minitonas
Lizard Point	1	
Moose Lake, The Pas	175	
Cross Lake, Snow Lake, Sherridon	85	
Remainder, Northern Region	480	
Southeastern Manitoba	21	
Provincial Total	1316-1384	

Harvest generally occurs on an opportune basis, i.e., when hunters happen to chance on a moose during the course of other activities (C. H. Payne per. comm.). This type of harvest occurs year round. Specific hunting trips are also made in late summer and early winter time periods.

Native hunting generally occurs in the area immediately surrounding the native communities and along waterways leading from it. In many instances these particular areas may be overharvested and populations are kept at low numbers because of ease of access to them.

Because native hunters do not purchase hunting licences the magnitude of the demand for moose is poorly understood. The populations of northern native communities and need for moose meat per family ($2\frac{1}{2}$ moose/family of five) is known, however. Projecting these figures across the northern moose range a demand for 10,660 moose exists (C. H. Payne per. comm.). Table 4, however, illustrates we are falling far short of this demand.

Some new concepts relative to moose use are now being developed for northern communities and some interest has been shown by native groups. Moose ranching involves the raising of moose under semi-domesticated conditions for meat production. Another concept, community wildlife management areas, involves the maximization of wildlife production around communities for the use of those communities. Although both concepts are unproven they provide alternative means of meeting the native needs.

2. Resident Sport Hunting

Resident sport hunters use the moose resource more than any other group. The number of resident moose licences issued has steadily increased from a low of 207 in 1947 to over 10,000 in 1973 (Table 5). The introduction of a quota number of hunters per hunting area and a computer draw in 1974 cause a slight decline in the number of licences issued that year.

Table 5. Numbers of resident licence sales, 1947 to 1974

Year	No. of licences sold	Year	No. of licences sold
1947	207	1961	4,034
1948	367	1962	4,607
1949	358	1963	3,952
1950	383	1964	3,849
1951	?	1965	3,685
1952	?	1966	4,987
1953	669	1967	7,139
1954	628	1968	6,605
1955	637	1969	6,775
1956	954	1970	6,362
1957	1,275	1971	7,200
1958	1,146	1972	8,245
1959	1,872	1973	10,798
1960	2,509	1974	9,147

Management aimed at sport hunting has greatly changed over time. In 1908, the whole province was open for bulls only in December. A two dollar licence was valid for one deer, moose or caribou. Until 1933 a two or three week bulls only season was held near the end of November or first weeks of December. In 1930 the province was divided into two regions, north and south of the 53rd parallel, but seasons remained identical till 1933. At that time early moose hunting was introduced south of the 53rd parallel during the last week of September and

first week of October. The two-week winter season continued as before. In 1937 game hunting areas were established. The southern zone was divided into three areas with an early season east of Lake Winnipeg. In 1943 and 1944 an additional early season was held in an area north of 53rd, west of Highway 10 and south of The Pas. The two-week winter season continued in the rest of the province. In 1945 the only closed season occurred as a result of low moose numbers (Annual Report, 1946). In 1946 the moose hunting season reopened north of the 53rd parallel for a winter hunt. This type of a season remained in effect till 1953. At that time the first cow moose hunting was permitted in The Pas - Cranberry area during the winter season. Also in 1953, three moose hunting areas were established and since then more zones have been added almost yearly. By 1960, thirteen hunting areas were established with differing season lengths within each area. During the late fifties increasing liberalization occurred permitting female moose in some areas to be harvested. From 1955 till 1967 separate licences were issued for early and late hunting seasons. In 1961 party hunting and metal tagging seals were introduced. The metal seals were replaced with dated tags in 1966. In 1969 graduation from a hunter safety course or previous hunting experience was necessary to purchase a licence. Also in this year designated snowmobile routes were introduced to reduce conflicts between snowmobile hunters and foot hunters as well as to control access in high use areas. In 1974, a licence quota system for each management area was introduced and licences were issued by computer draw.

Estimates of licenced moose harvest (Table 6) were derived from licence returns till 1965 when a hunter questionnaire was introduced. Sex and age ratios of the provincial harvest (Table 7 and Figure 2) show a trend towards an increase in calves harvested.

Table 6. Estimated moose harvest, resident and non-resident, 1914-1974.

Year	No. of moose harvested	Year	No. of moose harvested
1914	2,633	1946	42
1915	1,742	1947	41
1916	1,561	1948	80
1917	1,419	1949	69
1918	1,528	1950	213
1919	2,212	1951	183
1920	1,473	1952	182
1921	697	1953	278
1922	450	1954	293
1923	278	1955	339
1924	321	1956	707
1925	382	1957	1,027
1926	493	1958	1,032
1927	669	1959	1,644
1928	580	1960	1,966
1929	666	1961	2,285
1930	685	1962	2,514
1931	423	1963	2,711
1932	268	1964	2,221
1933	221	1965	2,366
1934	131	1966	2,748
1935	143	1967	3,978
1936	100	1968	2,846
1937	158	1969	2,781
1938	181	1970	3,205
1939	252	1971	4,346
1940	222	1972	2,649
1941	224	1973	3,948
1942	220	1974	1,819
1943	250		
1944	263		
1945	closed		

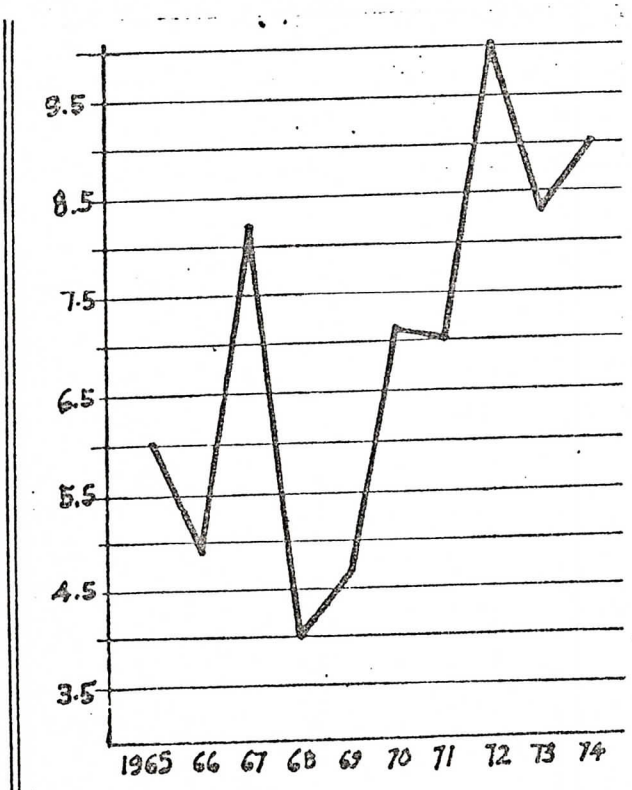
Table 7. Number of bulls/100 cows, number of calves/100 cows, number of calves/100 adults harvested 1965-1974 by resident hunters.

Year	Bull/100 cows	Calves/100 cows	Calves/100 adults
1965	314	25.0	6.0
1966	172	13.4	4.9
1967	177	26.1	8.2
1968	304	20.0	4.0
1969	231	15.6	4.6
1970	276	15.0	7.1
1971	246	24.1	7.0
1972	228	33.3	10.1
1973	191	24.0	8.3
1974	216	28.4	9.0

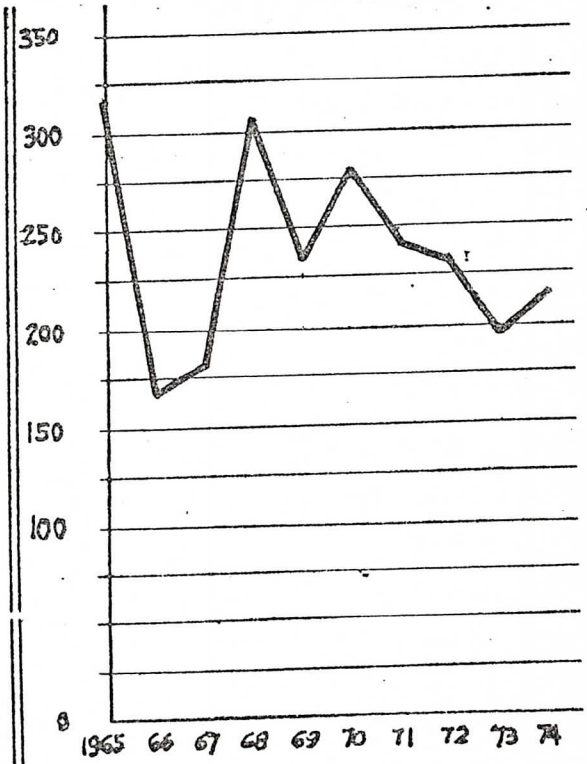
Since 1956 the success rates of Manitoba hunters has varied between 18 percent and 90 percent (Table 8). Success rates prior to 1965 are probably inflated as they are derived from voluntary licence returns. However, even the later data indicates a definite decline in success. The number of days hunted per moose harvested has varied between 8.5 and 27.3 days and also reflects declining success. During this period many new hunters began hunting moose and in part this decline reflects their lack of hunting skills.

The distribution of hunters and hunter-days (Figures 3 and 4 and Tables 9 and 10) is dependent on ease of access, distance from place of residence, and relative moose densities. Over 45% of the hunters

Fig. 2 Sex and Age ratio of Moose harvest, average 1965-1974



Number of calves / 100 adults harvested,



Number of bulls / 100 cows harvested,

hunted either in The Pas, Duck Mountain, Interlake or east side of Lake Winnipeg areas during the 1968-73 period. The distribution of the harvest (Table 11) reflects hunter distribution and moose densities.

Table 8. Success rates of resident hunters.

Year	% hunters successful	No. of hunter days per moose harvested
1956	74	
1957	81	
1958	90	
1959	88	
1960	78	
1961	57	
1962	55	
1963	69	
1964	58	
1965	64	12.4
1966	55	14.1
1967	56	10.2
1968	38	12.6
1969	33	12.2
1970	45	8.5
1971	51	10.5
1972	25	21.6
1973	32	17.0
1974	18	27.3

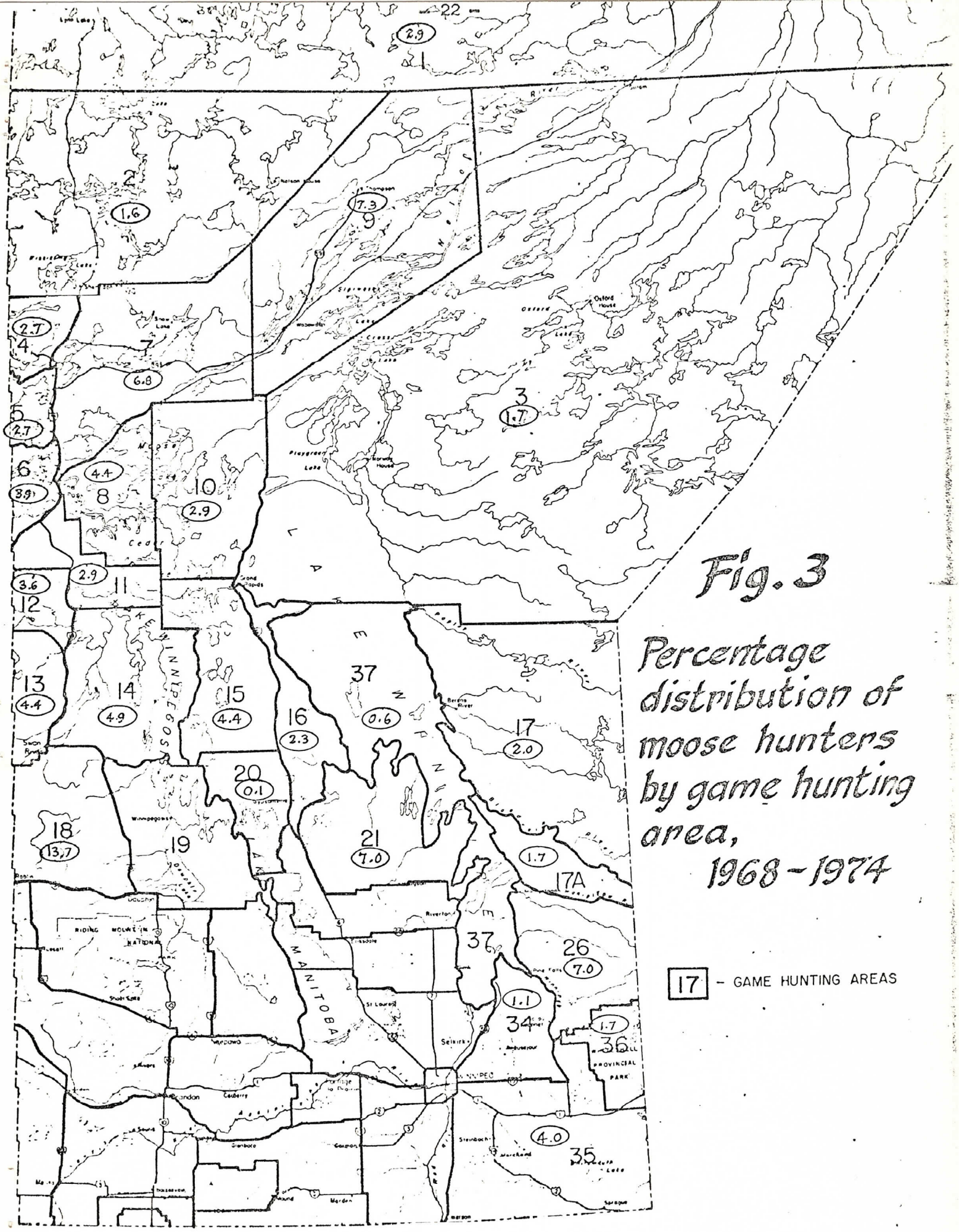


Fig. 3

Percentage distribution of moose hunters by game hunting area, 1968-1974

17 – GAME HUNTING AREAS

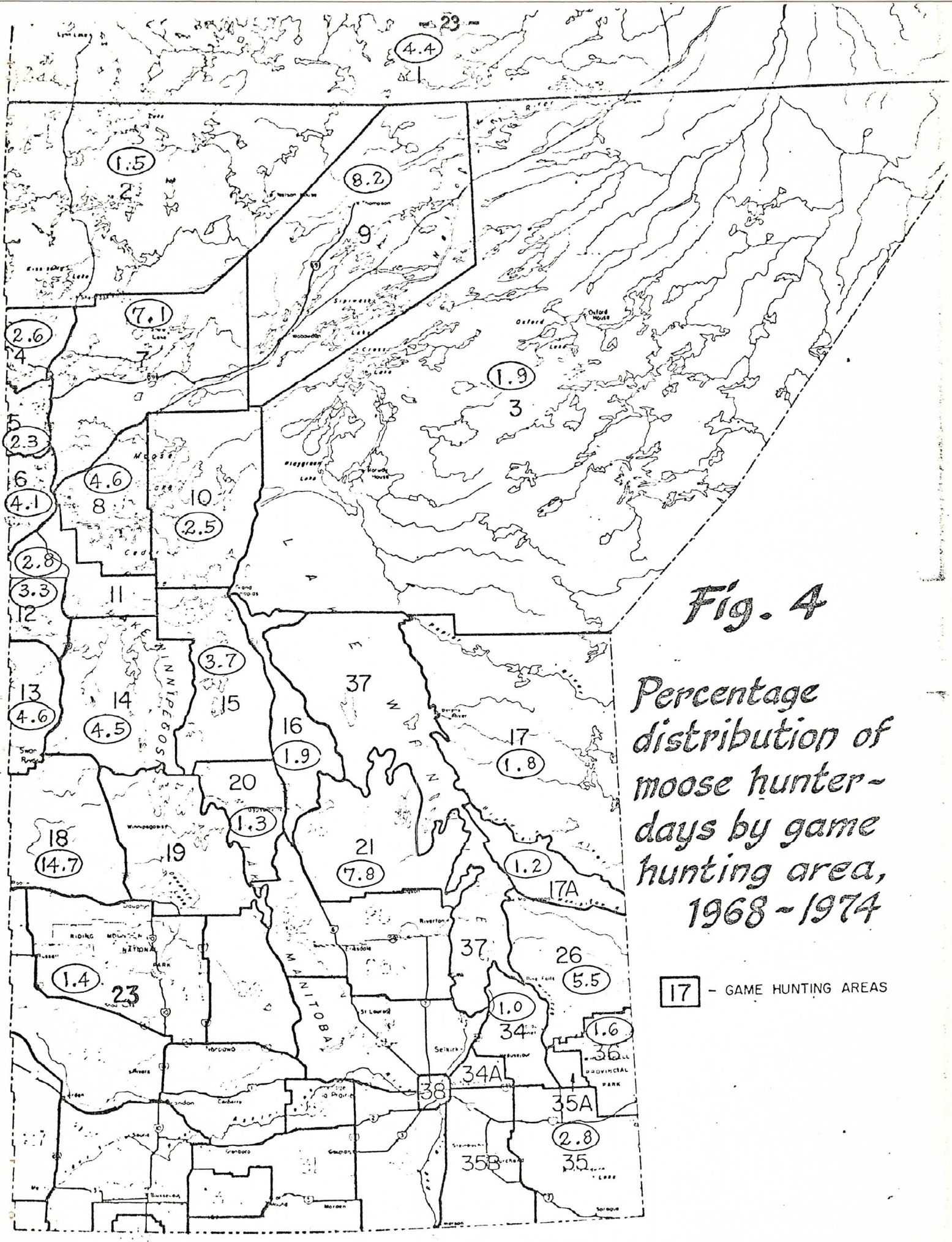


Fig. 4

Percentage distribution of moose hunter-days by game hunting area, 1968 - 1974

17 – GAME HUNTING AREAS

Table 9. Number of resident moose hunters/game hunting area.

Game hunting area	Number of moose hunters						
	1968	1969	1970	1971	1972	1973	1974
1	213	247	220	275	244	394	
2	43	145	37	92	231	303	
3	43	87	147	311	203	121	
3a						197	
4	156	247	122	348	298	318	
5	142	174	220	385	448	106	
6	156	174	171	275	244	287	
6a		131	146	220	271	61	
7	440	538	600	806	597	712	
8	327	262	416	330	407	682	
9	568	785	477	513	610	1,015	
10	85	189	245	330	244	485	
11	156	174	330	256	244	409	
12	355	276	269	311	339	409	
13	454	320	245	256	475	651	161
13a						8	
14	241	436	232	458	556	727	652
15	298	305	281	458	258	273	
15a	99	29	24	128	109	136	
16	256	378	196	311	122	15	
16a			24				
17	426	131	61	147	95	242	125
17a		189	122	128	190	273	

..... con't.

Table 9. (continued page 2)

Game hunting area	Number of moose hunters						
	1968	1969	1970	1971	1972	1973	1974
18	881	1,236	1,187	1,099	1,085	2,015	
19	43	58	24		14	2	
19a						15	
20	71	102	37	73	27	30	
20a				18		1	
21	355	538	440	733	733	1,030	
23	14		24	37	54	61	
23a			61	73	41	91	
25	14		24	18		8	
25a			12	18			
25b				18		1	
26	810	698	514	476	529	788	
34	142		24	220		227	
34a						1	
35	298		37	348	298	424	
35a	14		24	18	27	30	
35b				18	122	500	
36	57	160	135	165	109	318	
37			12	165	41	106	
37a						1	
Total	7,157	8,009	7,140	9,835	9,021	13,473	

Table 10. Number of resident moose hunter man-days recreation per game hunting area.

Game hunting area	Number of man-days recreation						
	1968	1969	1970	1971	1972	1973	1974
1	1,946	916	685	1,411	2,297	2,773	
2	128	363	122	348	972	1,432	
3	199	334	551	916	972	515	
3a						818	
4	696	305	245	1,411	1,428	1,742	
5	426	771	722	1,521	1,561	273	
6	454	552	526	898	1,369	1,273	
6a	511	582	538	861	1,148	629	
7	1,749	1,294	2,594	3,884	3,180	3,318	
8	1,307	683	1,113	1,127	1,174	4,970	
9	3,181	3,780	1,615	2,950	3,857	3,227	
10	256	640	624	1,118	898	2,129	
11	668	654	905	879	1,207	2,098	
12	1,846	989	832	1,466	1,472	939	
13	2,571	727	746	1,053	2,238	3,023	1,001
13a						22	
14	1,179	1,483	575	1,411	2,341	3,144	3,443
15	952	1,250	624	1,429	876	1,386	
15a	170	87	208	385	456	424	
16	937	1,338	624	861	508	68	
16a			49				
17	1,562	349	171	531	250	1,280	616
17a		567	440	238	928	432	

..... con't.

Table 10. (continued page 2)

Game hunting area	Number of man-days recreation						
	1968	1969	1970	1971	1972	1973	1974
18	4,502	4,711	4,576	4,580	5,580	9,409	
19	99	116	24		29	6	
19a						30	
20	170	2,239	98	238	74	30	
20a				55		1	
21	1,094	2,486	1,676	3,151	3,946	5,212	
23	14		196	165	559	258	
23a				403	398	1,106	
25	28		49	55		32	
25a			208	37			
25b				37		2	
26	3,054		2,337	1,539	2,562	3,045	
30			86				
34	639			715		848	
34a						6	
35	1,079		86	1,374	1,207	1,273	
35a	14		49	72	88	45	
35b				18	236	894	
36	227	538	502	751	390	1,197	
37			24	660	118	227	
37a						1	
Total	31,658	27,754	24,420	38,548	44,319	59,537	

Table 11. Estimated number of moose harvested per game hunting area, resident.

Game hunting area	Number of moose harvested						
	1968	1969	1970	1971	1972	1973	1974
1	85	73	61	110	73	61	
2	43		12	37	73	45	
3	28	44	73	110	59	76	
3a						61	
4	85	44	24	165	15	106	
5	71	58	110	165	73	15	
6	28	44	73	73	44	91	
6a	14	15	86	55	59		
7	99	87	184	293	73	76	
8	128	160	171	165	88	76	
9	128	204	98	165	132	166	
10	57	29	98		15	91	
11	43	15	135	73	29	121	
12	156	116	184	275	103	121	
13	156	58	86	128	59	166	40
13a						1	
14	71	145	110	183	234	424	164
15	114	58	147	165	44	121	
15a	28	15			15	15	
16	57	116	122	55 126	NIL. N.R. -6	NIL	
16a			24				
17	43	15	12	55	44	76	28
17a		15	24	18	59	15	

..... cont'd.

Table 11. (continued page 2)

Game hunting area	Number of moose harvested						
	1968	1960	1970	1971	1972	1973	1974
18	540	552	538	586	279	666	
19	14	15	12			1	
19a							
20	28	15	12	18			
20a						1	
21	156	102	196	238	147	318	
22							
23			12			15	
23a				37			
25						2	
25a							
25b							
26	156	247	220	147	117	212	
27							
30							
34	43			110		45	
34a							
35	114			128	73	151	
35a							
35b					59	106	
36	28	29	49	37	88	30	
37				73		30	
37a							
Total	2,513	2,271	2,873	3,664	2,054	3,501	

Nearly all moose hunting occurs on Crown lands and conflicts with other land users is relatively minor. Timber cutting may occur but worker safety is assured by temporary closure of access roads and hunter education through warning signs. Provincial Parks now provide approximately 20% of the hunting opportunity. If additional proposed parks are approved this figure would rise to over 37% (Table 12). Parks policy in regard to hunting is being reviewed and possible restrictions may arise. If this should occur it would have serious impact on provincial hunting opportunities.

As previously noted, two distinct hunting periods occur; the fall or trophy season and the winter season. From 1956-1967 separate licences were issued for each period except in 1963. Twenty-three percent of the hunters purchased licences for the early season (Table 13) and the trend was towards more participation in it. In 1974, 56% of the hunters reported hunting in the early season or in both early and winter seasons. Hunter success, however, has generally been higher in the winter season (Table 14).

During the period 1965-69, 17% of the moose hunters were Winnipeg residents although Winnipeg's population was greater than 50% of the provincial total (Table 15). Winnipegers participated less because of a greater distance from hunting area and a lack of experience and traditional moose hunting. Winnipeg hunters had a lower success rate, took more days to get a moose and hunted less days than rural hunters (Table 16).

Since 1961, party hunting for up to 5 hunters has been permitted. Hunters had the option of purchasing party or individual licences till 1969 and 42% of the hunters chose party licences. Since 1970 all licences have included the party hunting privilege and actual party

Table 12. Moose hunting in parks.

Existing parks	No. of hunters	Man-days of recreation	Moose harvested
Duck Mountain	908	3,961	337
Clearwater	18	71	5
Grass River	390	1,731	99
Whiteshell	170	646	44
Grindstone Point & Lake St. George	271	1,266	72
Paint Lake	54	335	17
Sub-Total	1,811	8,010	574
Proposed parks			
East Side National	233	1,069	70
Whiteshell Extension	327	1,107	82
Kawinaw	136	514	22
Partridge Crop	70	436	21
Wabishkok	100	509	27
Athapapuskow	122	523	36
Porcupine	428	1,757	107
Total	3,217	13,925	939
Total Province	9,649	37,480	3,236

Source: Larche, 1975.

Table 13. Percentage of hunters purchasing licences for early season, 1956-67.

Year	%	Year	%
1956	15	1962	25
1957	16	1963	no separate licences issued
1958	27	1964	27
1959	16	1965	34
1960	21	1966	26
1961	20	1967	25

Table 14. Hunter success rates early and winter seasons.

Year	Early season			Late season		
	% hunters successful	No. of days per moose	day/ hunter	% hunters successful	No. of days per moose	day/ hunter
1965	55	12	4.6	60	13	4.8
1966	38	9	4.4	52	16	3.2
1967	44	13.8	6.1	51	8.8	4.5

Table 15. Percentage of moose hunters resident in Winnipeg.

Year	% Winnipegers		
	Early season	Late season	Combined
1965	12.7	6.1	6.7
1966	11.8	12.0	12.0
1967	29.5	17.8	20.6
1968			16.1
1969			21.7

hunting size in the field included up to seven hunters (Table 17).

The relative success of a hunter hunting in a party is not different than if he hunted alone, Table 18. The success of a party in getting a moose will increase as party size increases because of combining individual probabilities of success.

Table 16. Success rates of Winnipeg vs rural hunters.

Year	% success Winnipeg	Day/ moose	Days hunted	% success rural	Day/ moose	Days hunted
1965	33.3	10.3	3.4	68.9	7.9	4.8
1966	23.4	11.3	2.7	52.4	6.8	3.6
1967	33.6	10.2	3.5	55.5	8.6	4.7
1968	24.7	17.6	4.6	60.0	11.9	4.7
1969	21.8	?	?	36.7	?	?

Table 17. Percentage of hunters hunting in different sized parties.

Information Source	Party Size 1	2	3	4	5	6	7	8
1974 Questionnaire	54	25	9	8	3			
The Pas (1972)	19	34	26	8	9	4		
G.H.A. 14 (1974)	5	35	28	32				
G.H.A. 26 (1974)	n/a	35	15	24	14	14	3	
G.H.A. 36 (1974)	34	37	8	7	7	5	2	
G.H.A. 36 (1975)	14	46	12	16	5	5	-	2

Table 18. Success per hunter relative to party size.

Study Area	Party Size 1	2	3	4	5	6	7	8	Total
The Pas (early)		4	10	8	0	17	36	25	?
(winter)		23	28	25	23				
Area 14	100	54	67	38					55
Area 26	?	24	14	12	25	28	57	20	
Province (questionnaire)	18	27	23	22	42			22	
G.H.A. 36 (1974)	5	16	20	19	20	50	14		
G.H.A. 36 (1975)	67	23	20	25	8.3	-	37		

3. Non-resident Sport Hunting

Another consumptive user group is the non-resident sport hunter, primarily Americans. This hunting opportunity has been encouraged since the early days of game management and was identical to the resident hunting program till 1951, although higher licence fees were charged. During the period 1951 - 1955, non-resident moose hunting was not permitted. In 1955, hunting was again allowed but was restricted to the early season in Northern Manitoba. In 1959, non-resident opportunity included both fall and winter hunting in northern Manitoba. Over the next few years opportunities increased for fall and winter seasons in the north and north Interlake areas. 1974 brought a dramatic change in the non-resident program. Licence numbers were limited (500) and hunters were required to hunt through an outfitter and use guides; only 14 game hunting areas were open while 33 areas were open to residents.

Table 19. Numbers of non-resident moose hunters, 1947 to 1974.

Year	No. of hunters	Year	No. of hunters
1947	84	1961	213
1948	61	1962	443
1949	70	1963	731
1950	135	1964	563
1951	closed	1965	563
1952	closed	1966	770
1953	closed	1967	1,092
1954	closed	1968	1,018
1955	17	1969	1,018
1956	40	1970	996
1957	74	1971	1,699
1958	105	1972	1,992
1959	138	1973	1,683
1960	220	1974	208

Numbers of non-resident hunters (Table 19) since 1947 have varied from a low of 40 in 1955 to over 2,000 in 1972. The upward trend in licence sales abruptly declined with the restrictions of 1974.

The distribution of hunters, man-days of recreation and harvest tends to reflect more the changes in open hunting areas than hunter choice (Tables 20, 21 and 22). Non-resident hunters have approximately the same success as residents but hunt more days and take longer to get a moose (Table 23).

Table 20. Estimated number of non-resident hunters/game hunting area.

Game hunting area	Number of moose hunters						
	1968	1969	1970	1971	1972	1973	1974
1			5	5		14	
2	57	27	62	66	123	256	
2a							23
3	26	16	10	44	67	14	
3a						161	
4	10	16	36	22	67	57	35
5	52	120	36	159	202	114	
6	62	163	99	153	107	100	
6a	21	16	10	38	22	7	
7	140	147	109	247	415	306	34
8	218	283	285	406	247	320	
9	52	65	31	22	84	142	1
10	73	87	114	214	264	242	63
11	31	44	36	132	45	100	-
12	21	11	31	121	129	107	
13	26	27	5	27	118	85	
13a						7	
14		33	16	55	123	85	24
15	62	60	52	143	337		
15a	16	27	21	93	112		
16	36	44	31	115	180		
17	42	22	42	104	118	256	41
17a		33		5		14	

...con't.

Table 20. (continued page 2)

Game hunting area	Number of moose hunters						
	1968	1969	1970	1971	1972	1973	1974
18	10			11			
20	5		10	16			
21	10	11					
26	5	5	5				

Table 21. Number of non-resident moose hunter man-days recreation per game hunting area.

Game hunting area	Number of man-days recreation						
	1968	1969	1970	1971	1972	1973	1974
1			36	71		57	
2	327	233	425	433	701	1,377	
2a							173
3	156	152	26	236	365	157	
3a						797	
4	47	103	119	143	471	512	315
5	244	876	156	965	1,004	683	
6	322	778	659	910	471	633	
6a	73	82	57	151	118	43	
7	608	555	508	644	2,098	1,978	224
8	1,096	1,584	1,588	1,984	1,310	1,793	
9	260	305	156	93	426	868	5

....con't.

Table 21. (continued page 2)

Game hunting area	Number of man-days recreation						
	1968	1969	1970	1971	1972	1973	1974
10	364	446	757	1,014	1,346	1,337	380
11	119	191	270	578	191	534	
12	57	27	208	784	712	534	
13	73	174	5	93	617	605	
13a						43	
14		201	57	203	679	370	143
15	338	403	316	570	1,548		
15a	73	142	93	356	393		
16	208	229	233	444	679		
17	265	98	182	586	600	1,956	249
17a		158		27		64	
18	68			66			
19						50	
20	31		47	55			-
21	36	22					
22	57						
26	21	5	16				
Total	4,843	6,764	5,914	10,406	13,729	14,391	1,489

Table 22. Estimated number of moose harvested per game hunting area, non-resident.

Game hunting area	Number of moose harvested						
	1968	1969	1970	1971	1972	1973	1974
1			5	5			
2	26	16	31	44	56	57	
2a							5
3		11		5	34	7	
3a						36	
4		5	21	11	6	14	11
5	16	38	10	49	34	21	
6	10	71	67	49	6	14	
6a	5	5		11			
7	42	60	5	60	73	50	5
8	78	142	42	153	56	85	
9	31	38			28	28	
10	26	22	5	82	90	43	10
11		5	21	38	11		
12			31	22	50	14	
13		5			34	14	
13a							
14		11	16	5	11	7	3
15	47	33	26	44	39		
15a		5	5	16	11		
16	16	27	16	44	6		
17	16	5	26	44	50	57	
17a		11					

...con't.

Table 22. (continued page 2)

Game hunting area	Number of moose harvested 1968	1969	1970	1971	1972	1973	1974
18	5						
19							
20	5		5				
21	5						
22							
26	5						
Total	333	510	332	682	595	447	34

Table 23. Comparison of resident and non-resident hunters, average 1968-73.

	% success	days hunted	days/moose
Resident	36.7	4.9	13.4
Non-resident	34.5	6.7	19.3

Non-resident hunting has been encouraged because of the economic return to rural communities. Studies of the non-resident expenditures in 1962 found on the average that $400.00 was spent for each moose harvested or approximately $200.00 per hunter. During the 1974 season non-residents

hunted through outfitters and had average expenditures of $635.50. With 225 hunters hunting and only 33 moose harvested this results in an average expenditure of $4,323 per moose harvested.

PROBLEM IDENTIFICATION

MOOSE HABITAT

Since settlement of Manitoba large acreages of moose habitat have been converted to other land uses, primarily agriculture. To expect such lands in southern Manitoba to revert to moose production is unrealistic in light of present values in society.

As pointed out in the sections on land use and moose numbers, moose habitat is relatively secure from permanent loss. However, some special habitat problems do exist which deserve mentioning. Advancing forest succession over much of the moose range, and in particular in areas of high potential for moose production and use, is occurring causing a decline in the quality of moose habitat. Losses from conflicting uses such as hydro and grazing developments and the increasing size of forestry clear-cut operations will also cause habitat deterioration.

MOOSE BIOLOGY

Moose in Manitoba are subject to the usual array of fatal accidents. Collisions with cars, trucks and trains, and drownings resulting from falling through thin ice on lakes, rivers or ponds are the most common. The magnitude of such accidents is unknown, however, their importance to the overall population dynamics of the moose herd is considered minimal.

The common moose parasites found in other parts of its range have been recorded in Manitoba. Winter ticks (Dermacentor albipictus)

are known to occur in large numbers on individual moose and are associated with extensive hair loss and mange-like appearance. Hydatid cysts in the visceral organs, particularly the lungs, are another common parasite of Manitoba moose. The larval form of the tapeworm (Taenia krabbei) is frequently found in the skeletal muscles or heart. Although not particularly debilitating to the moose, it does cause concern to sportsmen who find the small, single-larva cysts in the flesh of his animal.

Two parasites of moose deserve special mention. The meningeal worm (Parelaphostrongylus tenuis). It normally occurs in the adult form in the cranial cavity of white-tailed deer. Other cervids, including moose, can be infected with the parasite and the effects can be traumatic. The symptoms in moose are well known and need not be elaborated on here. The second parasite of special interest is the liver fluke (Fascioloides magna). Moose are not well adopted as a host for this parasite, and much tissue damage occurs when the fluke invades healthy moose liver.

Lankester (1974) studied the frequency of both these parasites in moose from southeastern Manitoba. Although they are both considered to be more abundant in the southeast than in other parts of the moose range in the province, they are potentially serious parasites of moose wherever moose and deer range overlap. More work should be done to determine the full range of these two parasites in the Manitoba moose population, and to learn what effect they have on physical condition and reproductive performance of the host animal.

The problem of predation on moose needs to be mentioned, but there are very few data to indicate how serious it is. Bears and wolves

are the most obvious predators of moose. There is no question that both these species take moose, particularly calves in the summer months. However, the December aerial survey data on calf survival would indicate that this is not a serious problem in most parts of the moose range. Even in the area east of Lake Winnipeg where low calf counts are the rule, the poorer reproduction may be caused by basic habitat deficiencies as much as by predation on calf moose by wolves or bear. Predation on adult moose would not seem to be a serious problem at present. More data on wolf and bear food habits and hunting behaviour are needed before their importance as moose predators is fully understood in Manitoba.

An interesting question lies in whether the changes in moose sex and age ratios caused by hunting have any significant effect on reproductive performance. Theoretically, the maximum reproductive output will be realized when a moose herd contains a high proportion of primeaged, experienced bulls to service all cows in their late September - early October estrus period.

Hunting activity by man can effect this ideal in several ways. During the mating season when fall bulls-only hunting seasons are held, heavy hunting pressure can disrupt the courtship behaviour of a pair of mating moose, who need to be together for approximately two days to complete the courtship "program". Bulls-only seasons reduce the number of adult males in relation to the number of females and any-moose seasons also result in more males than females being harvested (Table 7).

The combined result of all these factors can be a moose population with a high percentage of young animals which have not reached

their reproductive peak, with female moose considerably outnumbering males, and with a high proportion of young, reproductively inexperienced animals in the male segment of the population. With Manitoba's generally low moose density, it would seem that this could result in some cow moose not being bred in the first estrus, or possibly not even in the second or third periods.

The data available from our December aerial sex and age surveys (Tables 24 and 25) do not yet suggest a serious inbalance in sex ratios of Manitoba moose, although a downward trend in bulls is indicated. Nor does the information on moose calf survival to six months (derived from these same surveys) indicate any general problems with reproduction (Table 26). The area east of Lake Winnipeg, where moose reproductive success is being retarded by other factors, is an exception. Nonetheless, in light of the concern expressed by other agencies about bulls-only moose harvest programs (Baker 1975), we would be wise to watch for the development of reproductive problems, especially in areas of heavy hunting pressure like the Duck Mountains.

Table 24. Proportion of adult male moose observed in December aerial surveys, northern and western regions.

Year		Game hunting areas						Total
	5 & 7	6	8	12	13	14	18	
1970 # Males		51	163	46	38	64	50	412
# Females		55	132	103	63	105	90	548
Males/100 Fem.		93	123	45	60	61	56	72.5
1971 # Males		44	51	24	31	64	25	239
# Females		43	30	79	63	117	72	404
Males/100 Fem.		102	170	31	49	55	35	59.2
1972 # Males		29	59	25	13	46	34	206
# Females		68	113	49	23	94	68	415
Males/100 Fem.		41	52	65	73	50	50	50.9
1973 # Males	31	28	42	38	24	67	36	266
# Females	26	72	129	89	43	119	79	557
Males/100 Fem.	119	39	33	43	56	56	46	47.8
1974 # Males	42	52	43	18	2	41	32	- 230
# Females	51	91	98	65	28	141	76	550
Males/100 Fem.	82	57	44	28	7	29	42	41.8

Table 25. Proportions of adult male moose observed in December aerial surveys, eastern region.

Year		Game hunting areas										
		15	16	17	17a	20	21	26	34	37	Hecla	Total
1970	# Males	48	5	-	-	2	62	-	-	-	-	117
	# Females	67	7	-	-	6	60	-	-	-	-	140
	Males/100 Fem.	72	71	-	-	33	103	-	-	-	-	83.6
1971	# Males	49	15	-	30	4	105	45	-	18	22	288
	# Females	73	9	-	29	4	120	62	-	26	36	359
	Males/100 Fem.	67	167	-	100	100	88	73	-	64	76	80.2
1972	# Males	63	9	17	15	9	94	64	34	24	47	376
	# Females	146*	9	26	14	20	121	55	39	20	39	489
	Unid. Adults	-	-	154	50	-	-	183	-	-	-	387
	Males/100 Fem.	-	100	-	-	45	67	-	87	120	111	76.9
1973	# Males	38	9	34	5	18	193	22	22	24	53	418
	# Females	52	6	37	22	13	296	48	49	23	27	573
	Unid. Adults	87	-	98	56	-	-	198	-	23	28	490
	Males/100 Fem.	-	150	-	-	138	65	-	44	-	-	80.0
1974	# Males	11	-	17	1	9	33	5	9	4	22	111
	# Females	36	-	7	3	15	54	31	31	7	18	202
	Unid. Adults	125	-	40	22	22	189	152	54	23	61	688

* Some anterless males included.

Table 26. Moose calves in the population observed during December aerial surveys.

Area (G.H.A.)	1970		1971		1972		1973		1974	
	Calves per 100 females	Calves per 100 adults	C/100♀	C/100A	C/100♀	C/100A	C/100♀	C/100A	C/100♀	C/100A
5 & 7	-						58		57	
6	87		77		19		49		57	
8	101		47		42		51		71	
12	53		44		61		28		48	
13	57		44		31		26		68	
14	60		48		68		37		39	
18	47		46		56		49		49	
BIRCH 1.							71		54	
15	95.5		50.7					31.6		22.2
16	28.6		33.3		55.6			27.3		
17								19.4		12.5
17A								30.1		11.5
20	50.0		50.0		35.0			38.8		43.5
21	75.0		60.8		43.3		65.2			21.7
26			54.8		109?			14.9		18.1
34					48.7		57.1			37.2
37			61.3		21.0			27.1		25.8
HECLA			50.0		61.5			26.9		20.8
E.REG.AVE.		41.5		30.5		20.5		29.0		26.5

UTILIZATION

The paramount problem regarding the use and management of moose is the inadequacy of our population data. For 1974 and 1975 moose hunting seasons, recommendations on specific numbers of moose to be harvested from specific areas were required based on our knowledge of current moose populations. As can be gathered from the section dealing with moose numbers, our present knowledge of population levels is not adequate to make sound recommendations on area harvest quotas nor to assess the effects of past hunting seasons on the population. More information is also needed on adult sex ratio and age composition of the various herds before we can properly assess the effects of past hunting seasons. Although some age information is collected at check stations and through voluntary contributions of lower jaws by hunters, these samples are too small to conclude the age composition of the moose herd. It would also be of value to collect reproductive tracts from hunter harvests but this is presently not feasible due to limited hunter knowledge of moose anatomy. Until we can measure changes in moose population levels, sex ratios and age composition with reasonable accuracy, management to maximize use of the resource is limited.

There are several problems in the area of collection of moose harvest data. There are very few locations in the province where we can "capture" all the moose hunters at a checking station. The best method we now have for gathering province-wide data on numbers and distribution of moose taken is the hunter questionnaire survey. Moose harvest estimates for each game hunting area derived from this survey have wide confidence limits (as high as $\pm$ 46% for some of the smaller

areas). In addition, this survey is completed much too late to use in determining moose hunting regulations for the next season.

Access to the moose resource is a problem in some remote portions of its range. However, most of the productive moose habitat in the province has sufficient access through a combination of roads and highways, waterways and designated vehicle routes. We have been reluctant in the past to open up new access facilities in some of the popular areas for fear of increasing moose hunting pressure leading to over-exploitation of the resource. New access in underharvested areas, however, could be a method of spreading out the hunting activity more uniformly. This would improve both moose harvest distribution and quality of hunting experience.

A more serious access limitation may be developing on lands reserved for Parks or forest product harvest. Presently this problem is limited to a ban on moose hunting on the highly productive moose range on Hecla Island Provincial Park, Riding Mountain National Park, and fall moose hunting in the Abitibi cutting areas northeast of Pine Falls. If these kinds of restrictions are extended to other productive units of moose habitat, this problem could develop into one of our most important ones in providing moose hunting opportunity in the years ahead (Table 12).

Departmental staff frequently receive complaints from moose hunters about unsportsmanlike behaviour on the part of other hunters. Disturbance of their hunting activity by aircraft, snowmobiles or power boats is a frequent type of complaint, especially from hunters who take particular trouble to get back into some isolated location. Poor hunting ethics and behaviour contribute in many ways to a reduction in the enjoyment of the moose hunt, and may cause wastage of game

through wounding or improper field handling. Upgrading of the average moose hunter's attitudes and abilities would help to eliminate these problems.

With the kinds of sport hunting opportunity we are now offering the public, we are not getting full recreational "mileage" from the moose resource. Archery hunting of moose is very limited in Manitoba, and hunting with primitive firearms such as muzzle loaders is almost non-existent. Although there are not large numbers of people who wish to hunt moose with these inefficient weapons, we should be encouraging this kind of sport hunting under circumstances where they do not have to compete with moose hunters equipped with modern, high-powered rifles.

One final problem related to the use of moose is the growing public concern about sport hunting in general. Anti-hunting sentiment has not as yet interfered with our moose harvest programs. If this public concern continues to grow, however, we may soon face difficulty maintaining moose sport hunting as we know it today.

PROBLEM SOLUTION

MOOSE HABITAT

In areas of high production potential it is feasible to undertake habitat improvement projects. The conversion of mature habitat to early seral stages by the use of fire, cutting or special forest logging equipment will do much to enhance the carrying capacities of these areas.

Another approach to enhancing moose habitat is through integration with forest development programs. Forestry is a major land use and by slight modification of some harvesting procedures, a significant increase of habitat quality could be obtained. For example, much of the forest harvesting programs are clear-cuts ranging in size from a few acres to several hundred. Moose, however, will not venture into cutover areas from protective cover more than 100 meters in spruce (Hamilton & Drysdale, 1974) or 350 yards in aspen (MacLennan, 1974). The introduction of limits on the size and shape of cutovers would improve their usefulness to moose.

Forestry-wildlife integration is needed in the area of fire control. Present forestry policy is to suppress all fires within the fire protection area. If this policy were altered to one that would allow fire in non-commercial forest areas, a definite increase in habitat quality would result.

Potential exists for assuring moose habitat needs are recognized if wildlife personnel participate in the land use planning process. By having other planners recognize moose and moose habitat value in the initial planning stages, plan modifications may be obtained to minimize negative impacts.

MOOSE BIOLOGY

In regard to the effects of disease, parasites or predators on welfare of the moose, for the time being all that should be done is increase our monitoring effort to learn more about the significance of these factors. Larger collections of moose heads, lungs and livers from hunters would be useful to assess the overall importance of parasites. Summer collections of wolf and bear scats would improve our knowledge of moose calf predation by these species. This latter activity should only be undertaken in areas where our December aerial surveys indicate perennially low percentages of calves in a local population of moose. If these monitoring efforts show that parasites or predators are causing serious problems for the moose, then research projects should be directed at finding solutions.

We do not, at present, have evidence that indicates poor reproduction in areas of heavy bulls - only hunting pressure. However, because of the concern expressed by other agencies (removal of prime breeding males, interference by hunting with the mating ritual, etc.) we should be examining this potential problem more closely in Manitoba. This is probably the most useful area of moose research that could be undertaken at present in Manitoba. Collection of female reproductive tracts and lower jaws would provide answers to questions such as the following. Is there a significant difference in moose conception rates between areas heavily hunted during the bulls - only season (eg. G.H.A.18) and ones with no bulls - only season (eg. G.H.A.26)? What is the relative contribution of each female age class to overall reproductive output? Is a high percentage of young bull moose, i.e., few prime-aged mature bulls, detrimental to moose conception rates? What do initial conception

rates compared with calf counts the following December tell us about pre - and post - parturition mortality rates? The answers to all these questions would help us decide such things as do we need to eliminate or control bulls - only moose hunting in Manitoba.

UTILIZATION

To manage this resource effectively on a quantitative basis, our prime need is for soundly-based annual moose population data. The development and implementation of a survey method that will provide a reliable annual population estimate for each management area is therefore vitally important. An aerial survey technique is the most likely one and work has begun on its development at present. However, we should do more testing of other techniques such as pellet group counts to see if they might provide the necessary data at lower cost.

Moose populations do not normally change radically from year to year. Therefore, we should not need to do a population survey in each management area each year. It may be sufficient to survey each area every third year. To stay within manpower and budget limitations, these surveys should be set up on a rotational basis, with one-third of the management areas being surveyed each year. More experience may show that we can extend the interval between surveys to five years.

To more carefully assess the effects of hunting on our moose herds, we should continue to monitor changes in adult sex ratio (December aerial surveys) and in adult age composition (jaw collections from hunters). With this supply of data collected annually, and a re-estimation of total moose numbers in each management area every third or fifth year we should be in a good position to recommend annual moose

harvest quotas and to assess the effects of hunting programs on the herds.

We should continue to use moose hunter check stations. Their prime objective should be to gather reproductive and age data and specimen material (moose reproductive tracts, lower jaws, parasites, etc.). In areas where check stations are not feasible and we have a need for such data, we should further develop our public relations program to encourage hunters to bring in the specimen material. Compulsory big game registration should not be necessary at the present time, but should be kept in mind as a technique to gather more biological specimen material as our management needs increase.

Although our remote moose hunting areas are not highly productive, they do have pockets of local moose abundance that could be used more than at present. To provide better access for moose hunters to use these areas, we should encourage the establishment of hunting and fishing lodges as well as fly-in outfitting facilities, for the use of both resident and non-resident hunters. Increased availability of competent hunting guides is also a necessary part of the development of such facilities in remote areas.

Regarding the problem of hunting access restrictions on timber berths and park lands, we should continue to negotiate with these other users of the land in order to develop moose hunting programs that will be acceptable. Archery and/or primitive firearm hunting might be useful alternatives for areas where we cannot carry on our regular firearm hunting programs.

Most of the popular moose hunting areas now have well-established systems of designated vehicle routes. These serve to increase hunter access and dispersal throughout the hunting area, but limit the ways in

which the vehicle, particularly the snowmobile, may be used in hunting. We should continue to expand this form of hunter access and control into all areas where heavy hunting pressure along existing roads causes hunter conflicts and uneven moose harvest distribution.

Regarding the supply of moose available for annual harvest and the demands being made on it by all Manitoba users, the first step that needs to be taken is to improve the quality of our moose inventory method. With better inventory data, we can better determine whether the combined demands of native and sport hunter harvest exceed the available supply. If shortages exist, we should look at the feasibility of habitat improvement projects. However, such projects should not be undertaken before a careful cost-benefit assessment is carried out. If habitat improvement cannot increase the supply of moose to meet all demands, then limitations on the numbers and distribution of moose harvest must be imposed. Ideally, these limitations should apply to all consumptive users of the moose resource, but for the time being, the harvest of moose by native people is uncontrollable. The remainder of the allowable harvest should then be allocated on an equal opportunity basis to all other user groups in Manitoba.

We should continue to recognize the non-resident moose hunter as a legitimate user of the resource. We think primarily of the moose as a resource for the recreational use of Manitobans, but economic use by Manitobans is also recognized. Under the present system of licencing the non-resident moose hunter, which forces him to use lodge or outfitting facilities and requires him to employ guides, we are getting excellent economic return for very few moose taken. In 1974, 221 non-resident hunters spent $138,500 in Manitoba for 1,463 days of hunting recreation and took 33 moose. There is now a limit of 500 non-resident

moose licences available, but we should be prepared to increase this (to perhaps 10% of total sport hunting licences available) as more lodges gear up to cater to this type of client.

To raise the level of ethical behaviour of the moose hunter in the field, to make him more able to assist us in the collection of biological specimens, and to increase his awareness of conservation and moose management principles, we should be developing a comprehensive training course for moose hunters. As an incentive to take such a course, we could offer the graduates assurance of getting a moose licence in the G.H.A. of his choice. At some future time, when large numbers of hunters had completed the course, only graduates of the course could hunt in select areas. This process, carried on for a number of years, would gradually upgrade the capabilities of the average moose hunter and could eventually result in all active moose hunters being graduates of such a course.

In addition, the further development of designated vehicle routes and aircraft landing sites would minimize the unsportsmanlike and/or illegal use of all vehicles.

If we wish to increase recreational use of the moose resource, we can start by providing some hunting seasons in specific areas exclusively for archery and/or primitive firearm hunters. As stated earlier, there is not presently a large demand for these low-efficiency types of hunting opportunity in Manitoba. Provision of special hunting seasons for archery and black powder rifles should encourage people to take up these forms of moose hunting. This would help to increase the number of days of recreational hunting for each moose killed.

Another possible way to increase recreational use would be to

allow wilderness moose hunting camps, where a small "club" of hunters could enjoy the fellowship and pleasure of hunting and camping together annually in a wilderness setting. These camps would of course also be useful for sport fishing and other outdoor recreation pursuits.

To curb public anti-hunting sentiment, the first step should be the upgrading of the moose hunter's skills and level of ethical behaviour, so that there is no longer anything to criticize in the way he hunts. The training course for hunters mentioned above should attempt to accomplish this. Also, we need to take care that nothing in our moose hunting regulations promotes unsportsmanlike use of the resource.

Finally, publicity to illustrate what moose hunting is all about would be useful in cutting down public opposition to the sport. Publications showing the characteristics of the average moose hunter and his activities during the hunt would help the public to understand the pleasures of this form of outdoor recreation. It should also be pointed out that moose populations are being maintained not just for hunting use but also for year-round use by other outdoor recreationists, such as hikers, canoeists, skiers and photographers.

RECOMMENDATIONS

POLICY

The following policy recommendations are put forward as guidelines for the overall management of the moose resource. The application of these policies may vary somewhat from one area to another, but in general, it is hoped that they can be followed closely.

1) One of our main objectives should be to maintain on all portions of the Manitoba moose range what we consider to be the optimum sustainable population through the most critical period of the moose's annual cycle. Critical winter habitat conditions for the moose should in all cases determine what maximum numbers can be supported.

2) Maximum moose populations should be used to provide for maximum use by all Manitobans. Fully stocked range will allow the maximum annual moose harvest to be taken by consumptive users. It will also provide maximum opportunity for the non-consumptive user to observe and photograph moose and their sign in the wild.

3) The allocation of consumptive use of moose available for harvest annually should be on the following basis.

a) Harvest by Treaty Indians for their own use for food is uncontrollable, and this portion of the harvest must be subtracted before any other allocations are made.

b) The remaining allowable harvest should be allocated to all other Manitobans on an equitable basis. Among Manitoba's resident moose hunters, it is recognized that there are some whose interest in hunting is almost exclusively recreational, and others who are solely interested

in taking a moose for its meat value. However, most Manitoban moose hunters enjoy hunting for a varying combination of these two interests. While a few of them are recognizable as purely sport hunters or purely meat hunters, it is practically impossible to separate most of them into recreational or subsistence groupings. Even if we could, it does not seem appropriate that one group should have higher preference over the other in the use of moose, since the resource is common property of all Manitobans.

c) We should recognize that economic use of the moose resource is equally valid with recreational or other uses accepted by the Department. In line with this, we should allow non-resident moose hunting in most, if not all, areas where resident hunting is allowed. To ensure that non-resident moose hunting results in appropriate economic return to Manitobans, we should continue to make non-residents use guides and lodge or outfitting establishments. A maximum of 10% of all moose hunting licences should be available to non-resident hunters, thus protecting 90% of the licenced hunting opportunity for Manitobans.

5) Our management regulations should encourage increased recreational use of the moose resource wherever possible. Offering increased archery moose hunting opportunity, offering special moose hunting licences for two or more hunters to take only one moose, or other such steps to increase the man-days of hunter recreation per moose taken would be useful.

6) Conversely, if future data collection shows that individual moose hunting success is increasing in party hunting situations, then we should take steps to prevent one member of the party from killing more than one moose.

7) Predator control for the benefit of moose is an acceptable aid to management in some cases. While we should not forget the beneficial role that predators play in natural selection in the moose species, we also recognize that large populations of wolves can become a limiting factor. In some areas, these moose could otherwise be used for human harvest. Where these conditions are known to exist, some form of predator control is justified, especially in areas where calf survival is seriously reduced by predation. Where predator populations and predation is high, we should encourage commercial trapping and sport hunting as much as possible before employing conventional predator control techniques.

8) With the steady increase in man's activity on the Manitoba moose range, modifications of their habitat will continue. Some of the changes are good, some are bad, but nearly all of them happen without major input from the people who manage moose in the province. It will become increasingly important for us to coordinate our interests in moose habitat with the interests of those who intend to use the land for other purposes. Only by so doing can we get the best possible benefits for the moose as more and more developments take place on its range.

MANAGEMENT

The following summary of management procedures is recommended as the basic requirements to manage Manitoba's moose herds on a sustained yield basis. For the most part, this is an annually recurring sequence

of activities. For convenience, the cycle commences with projects carried out during the moose hunting seasons.

1) Hunter check stations carried out during the any-moose season, will collect biological material (lungs, liver, heads, etc.) to determine prevalence of disease and parasites and age class composition of the harvest. Special projects should be undertaken at specific times and locations to collect female reproductive tracts, as part of an overall research project on moose reproduction. Biological specimens collected at checking stations and through other contributions from hunters to be analyzed during February and March, and a report summarizing data from the last hunting season to be completed by April.

2) Enforcement effort, as required to maintain acceptable compliance with hunting regulations, to be carried out through the year. Conservation Officers, on their enforcement patrols, to collect as many lower jaws as possible from harvested moose.

3) Aerial moose sex and age surveys, to determine adult sex ratios, and calf survival to age of six months. Surveys to be completed as quickly as possible after good snow cover is present and not later than December 15 to minimize the problem of anterless males. Three or four representative sample areas of the moose range in each Region should be sufficient to survey each year. Each sample count of moose should be at least 100 animals and not more than 200. Report to be completed by end of May.

4) Moose hunter questionnaire survey to be conducted annually

immediately after the end of the any-moose hunting season, sampling hunters with sufficient intensity to get harvest estimates within ± 20% confidence limits for each moose management unit. In addition to standard questions on days hunted, kill success, location of kill etc., the questionnaire should be used when the need arises to gather such special information as differential hunting success for different sizes of hunting parties. Report to be completed by the end of January.

5) Aerial moose population survey to be conducted in January each year over one-third of all moose management units (i.e., all units surveyed once every three years) to obtain a reliable estimate of over-wintering numbers in each management unit. Methodology to be worked out over the next year and to be fully operational by the 1976/77 winter. Technique to be used consistently and carefully each year thereafter. Report on this project to be completed by the end of May.

6) Pellet group counts, as a possible alternate technique of estimating moose populations, may be carried out, especially in areas where aerial population surveys are particularly difficult. We should make comparisons between aerial surveys and pellet group counts on a test area, to see if the later method might be a cheaper but equally accurate method of estimating moose numbers.

7) Recommendations on allowable moose harvest and number of licenced hunters for each management unit to be submitted from each Region by end of March. Reports on checking station, hunter questionnaire, aerial and other population survey projects to form the basis for these recommendations. Native harvest of moose also needs to be considered in

quotas for licenced hunters.

8) Procedures for allocating moose hunting licence quotas to be completed, with good publicity coverage and distribution of application forms by May 24.

9) As an ongoing year-round project, Conservation Officers and others working in the field should be collecting as much data as possible on moose losses to disease, accidents, native kill and other forms of uncontrollable harvest.

10) We should continue to use the Game Hunting Areas as our basic units for moose management. The present combination of some of these areas into the larger "moose units" should be satisfactory for the near future. However, as we gather better information on moose populations in each area, we may soon want to assign a specific number of hunting licences to control moose harvest at an appropriate level for each area.

RESEARCH

There does not, at present, appear to be a need to undertake a large number of high priority research projects in Manitoba. Work on the five listed below will assist in our understanding of moose population dynamics, movements, habitat requirements and utilization by native peoples. Only the first two are considered high priority.

1) Age-specific female moose reproductive biology on areas of heavy and light bull moose hunting.

2) Vegetative regeneration and moose use on cut-over forest areas in Manitoba.

3) Re-occupation by moose of heavily-hunted habitat along access routes after hunting season.

4) A comparison of the aerial census and pellet group count techniques as a means to determine moose populations in Manitoba.

5) Comprehensive review of the kinds of use, and the numbers of moose being used by native people in Manitoba.

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