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REPORT TO THE BOARD OF GAME

ON

LYNX MANAGEMENT

ALASKA DEPARTMENT OF FISH AND GAME

DIVISION OF GAME

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CONTENTS

EXECUTIVE SUMMARY

Concern regarding the potential overharvest of lynx populations has been expressed in recent years. The reasons for this concern stem from a suite of several factors: lynx and snowshoe hare populations are currently at the low phase of the cycle in most areas; during the low phase lynx recruitment is very low; pelt prices are extremely high (average $600); the increased incentive to harvest lynx may result in trapping pressure high enough to keep lynx at low levels in some areas, even when hare populations increase.

It is difficult to evaluate the effects of harvest on lynx population fluctuations because of problems with surveying/censusing a generally solitary, secretive and cyclic furbearer. Population dynamics and changing characteristics of trapping should be considered when evaluating management options.

At this time trapping pressure in more remote, non-road-connected areas of Alaska is probably not high enough to require intensive management of lynx harvests. In areas where trapping pressure is higher, and may have the potential to reduce lynx populations to undesirably low levels, more responsive management is recommended. We believe that a "tracking harvest strategy" provides adequate protection for lynx populations from potential overharvest as well as the greatest long-term benefit to consumptive and non-consumptive users of lynx. Under a tracking strategy, rates of harvest are altered in response to changes in population growth or decline. Various ways to regulate harvest were examined, including altering season lengths and timing, methods and means restrictions, bag limits, and quotas. We concluded that varying season lengths is the most practical method for regulating harvest of lynx in Alaska.

Based on our analysis, the department has recommended that lynx seasons be closed in areas with the most trapping pressure (Units 7, 11, and 13-16), reduced in accessible areas with less trapping pressure overall (Units 9, 17, 19, 20A-D and F, 21, 24, and 25C), and extended in areas where hare populations and the percentage of kittens in the harvest have been increasing (Units 12, 20E, and 25 (except 25C)). As lynx and hare populations increase in coming years, seasons will be re-opened or extended in other road-connected units.

INTRODUCTION

Lynx pelt prices have skyrocketed during the last 15 years from an average of $50 in 1971 to more than $600 apiece during the last 2 years. Currently, lynx populations are at a cyclic low and the increased trapping pressure associated with extremely high pelt prices has many people concerned that the lynx populations may be kept at undesirably low levels instead of increasing when hare populations increase.

Because of evidence that lynx populations in some areas of Alaska are currently undergoing high harvest pressure, perhaps unlike that in the history of the state, the department has been trying to evaluate the effects of this harvest and reviewing options for managing lynx in Alaska.

The purpose of this paper is to provide the Board of Game with information about why people are concerned about lynx now, what the department recommends be done to alleviate these concerns, and why we think these strategies are the best options available.

LYNX MANAGEMENT POLICY

The Furbearer Use Management Policy, adopted by the department and endorsed by the Board of Game in 1980 states that:

> The department recognizes the constitutional mandate of the State of Alaska to manage lynx on the sustained yield principle for the benefit of the resource and the people of the state, and also recognizes that national and international interests must be considered. There are many beneficial uses of lynx. At present, hunting and trapping of lynx for their economic value, constitutes the major use of lynx in Alaska, and in most areas lynx will be managed for optimum sustained yield of economic benefits. Lynx are valued as food in some areas. Recreational uses of lynx include hunting and trapping, photography and being aware of or observing lynx in natural interactions with their environment. Nonconsumptive uses such as viewing and photography are relatively limited due to the secretive habits of the lynx, which is not often seen, even when abundant. However, people enjoy seeing the lynx's distinctive tracks during winter. The lynx is an interesting and valuable component of Alaskan ecosystems. All human uses will be best served by striving to maintain healthy lynx populations over the long term.

BACKGROUND

Although some research has focused on understanding the 8- to 11-year cycles of lynx and snowshoe hares, there are many aspects of lynx ecology that are not well understood. Lynx are difficult to study because of their generally solitary, secretive habits. In addition, because of their cyclic populations, long-term lynx studies are necessary to thoroughly evaluate lynx ecology. When evaluating management strategies for lynx, it is important to consider the following factors and how they influence population fluctuations.

Lynx Population Dynamics

Lynx abundance is closely tied to the cyclic abundance of snowshoe hares and to a lesser degree other small game. Lynx populations (and those of other predators dependent on snowshoe hares) are characterized by 8- to 11-year cycles of abundance and scarcity, usually lagging 1 to 2 years behind those of hares (Fig. 1). This well-documented fluctuation is highly variable and influenced by many factors, including habitat conditions, other predators, and possibly trapping. Lynx cycles are not always synchronous over large areas, but in Alaska peak abundance of lynx in most areas occurs within a 2-to 3-year period.

Declines in the snowshoe hare population are driven by successive hare-food and hare-predator interactions. Peak hare densities are followed by periods of starvation and malnutrition in concert with predation to produce high mortality (Keith et al., 1984). Because lynx have an affinity for this cyclic prey, rates of lynx reproduction, mortality and emigration/immigration are constantly fluctuating, thus the increase and decrease in lynx populations.

Lynx reproductive rates change with changes in snowshoe hare densities. Lynx have a great capacity to increase when hares are abundant because they breed as yearlings and litter sizes average 3-4 kittens/female (O'Connor 1984). However, when hares are scarce, most yearling females don't breed and litter sizes are 1 kitten/female or less.

Lynx mortality includes trapping and non-trapping mortality. Although we have fairly accurate records of the number of lynx harvested in recent years, the effects of mortality of lynx due to trapping and hunting are difficult to assess. Lynx are relatively vulnerable to trapping, and there are some indications that due to increased movements, a greater proportion of the population may be harvested when lynx numbers are low than when they are high. However, because of the difficulty in estimating lynx populations over larger areas, we have not been able to estimate what proportion of

the population annual harvests represent in Alaska. Non-trapping mortality rates have not been well-documented.

Large-scale movements of as much as several hundred miles have been documented by trappers and by studies of radio-marked lynx. Limited dispersal of young lynx is probably common in growing populations, but emigration of large numbers of lynx, including adults of both sexes, seems to be associated with food shortage during initial declines in the hare population. These movements may speed the dispersal of lynx to areas where prey are still available. For example, in recent years trappers have reported movements of large numbers of lynx between the western Yukon Territory to the upper Tanana Valley, eastern Unit 25 and Unit 20, and from eastern Unit 25 to northern Unit 25.

The interaction of these population parameters changes during different phases of the cycle. Lynx in increasing or high populations are characterized by relatively small home ranges, limited daily travel by individual lynx, a high reproductive rate among adults and yearlings, and high survival of kittens, with kittens sometimes exceeding 30% of the harvest. Lynx move into marginal habitat where hares and other prey are temporarily available.

As hare populations decline, lynx reproductive rates also decline, lynx may emigrate in large numbers in search of prey, and some lynx, especially juveniles, may starve. As a result, lynx numbers decline rapidly after the hare population declines.

Lynx in declining or low populations are characterized by relatively large home ranges and more extensive daily travel. Distribution may be limited to pockets where small game remains relatively abundant. Reproductive rates and survival of the few kittens that are produced are low. Kittens may comprise only 3% of the harvest (O'Connor 1984).

Lynx populations in most parts of the state are now at or near their cyclic low. Trapper reports and harvest records suggest that peaks in hare numbers occurred between 1978-79 and 1981-82 in most areas with populations reaching cyclic lows by about 1983-84 (Fig. 1). Lynx numbers have followed a similar pattern, peaking between 1980-81 and 1982-83, and reaching lows between 1983-84 and 1986-87. Hare numbers began to increase in 1986-87 in the Tanana and Yukon basins and lynx pelt measurements suggest an associated increase in the occurrence of kittens in some populations. Thus, the lynx-hare cycle is just entering the increasing phase in some areas.

Because hare and lynx populations are currently low or just beginning to increase in many parts of Alaska and western Canada, the movement of large numbers of lynx is not likely to be significant during the next few years. However, lynx movements will probably play an important role in determining the long term population status by augmenting reproduction in local areas.

Lynx Distribution and Habitat

Lynx are widely distributed in Canada and Alaska, and also occur in isolated populations near the U.S.-Canada border in several of the lower 48 states. In Alaska major expanses of optimum lynx habitat occur in the eastern half of the Interior, but other good habitat occurs in more isolated pockets elsewhere.

Because of the lynx's affinity for snowshoe hares, lynx habitat quality depends largely on the ability of a given habitat to support populations of hares, and secondarily, of grouse and ptarmigan. In addition, alternate prey such as caribou, sheep, foxes, beaver, ground squirrels, and microtine rodents may be important in sustaining lynx in certain areas when hares are scarce so their habitat may periodically be important.

In Alaska, the largest expanses of productive lynx habitat are mixed-forest in which fire governs habitat diversity by reinitiating plant succession at varying intervals. Mid-successional vegetation stages that develop following burns can provide excellent habitat for small game, and therefore lynx, especially when burns produce a diverse habitat mosaic that includes some mature spruce and hardwood forest, forest regrowth, riparian shrubs, and other habitat types.

Alpine shrub thickets near timberline are an additional habitat type that is important to lynx. In these areas, snowshoe hare and other small game populations appear to be either not cyclic or not in phase with cycles in forested lowlands, thus providing lynx with food during periods of food scarcity elsewhere.

The eastern portion of Unit 25, generally regarded as the largest expanse of good lynx habitat in the state, exemplifies the importance of fire and habitat diversity in maintaining the productivity of interior Alaska's forests (Stephenson 1984). Low precipitation and high summer temperatures create an extreme fire climate in that area. There is a higher proportion of shrubs and hardwoods than in areas farther south and west where fire suppression has been in effect for a longer period.

The quantity and quality of lynx habitat in Alaska has changed since the early part of the century. In the early 1900's, miners commonly set fires to clear vegetation that might have hidden evidence of mineral deposits or impeded mining operations. In addition, naturally occurring wildfires ran their courses unchecked except for attempts to protect a cabin or village. These events created excellent habitat for lynx and their prey throughout much of interior and southcentral Alaska during the first half of this century. This habitat, however, has declined substantially since the mid-1900's due to fire suppression, although the degree of decline is not known. The quality of the alpine shrub thicket habitat is relatively stable and has not been affected to the same degree as have lowland areas where fire is essential for maintaining habitat productivity.

Characteristics of Trapping

In the early part of this century, most trappers lived in very small communities or in remote locations that were sites of mining activity in the summer and served as base camps for trapping in the winter. Few areas of suitable habitat lacked traplines. Trappers walked, snowshoed or used dog teams to run their lines. Lynx and other furbearers that benefit from successional vegetation types were abundant as a result of extensive excellent habitat created by fire.

These conditions changed very little until the late 1940's and early to mid-1950's when fur prices dropped to low levels for furbearers such as beaver, lynx, marten, mink, and red fox. Many people stopped trapping during this period of 20 or more years of low prices. Families that previously spent winters in outlying trapping cabins, instead remained in villages or larger communities during the winter to seek alternative sources of income.

In the early 1970's, fur prices increased to a point where people could once again make sufficient income in winter from trapping, however other major changes were taking place in Alaska that affected people's decisions to trap or not trap. Development of oil, the Alaska Native Claims Settlement Act (1971), and the Alaska National Interest Lands Conservation Act (1980) all affected local economic conditions, alternative sources of income, and access to resources. Therefore, although fur prices rose in the 1970's, alternative winter employment opportunities probably discouraged some people from trapping as a primary source of income. Mandatory school attendance for children and various amenities of life in small communities have also affected decisions about how and where to spend the winter. Compared with the first 50 years of this century, trapping and trapping conditions have undergone many changes.

During the last 25 years, the following important changes have also occurred: Alaska's human population increased substantially; people now live and spend most of their time in communities rather than in the "bush"; the road network expanded, including small road systems in the vicinity of some villages; fire suppression became increasingly effective as more money, firefighters, and technology were employed, thus, habitat in unburned areas has become less favorable for hares and lynx; snow machine replaced snowshoes and dog teams as the main mode of transportation on traplines (except in coastal areas where boats are used); the number of residents licensed to trap increased (Fig. 2); and, in the last few years, very high pelt prices and the state's declining economy have probably increased interest in trapping as an income supplement. For example, the number of active trappers (based on mandatory documents submitted to the department) rose 28% between the 1985-86 and 1986-87 regulatory years.

Some characteristics and conditions of trapping have changed very little. Even though Alaska does not have a formal or legal system of registered traplines, in rural areas traplines are regarded as traditional and/or are accepted as belonging to particular trappers, trapping families, or villages and this informal system limits the number of trappers. In other areas, especially along the main road-connected portions of southcentral and interior Alaska (all or parts of Units 7, 11, 12, 13, 14, 15, 16, and 20), in addition to the well-established traplines, trapping also occurs on a first-come, first-served basis, and many lines overlap. It is these latter, heavily trapped areas that are of particular concern with respect to lynx management.

Harvest management strategies for lynx and other furbearers must consider harvest pressure and changing trapping conditions, in addition to information on the status and trends of furbearer populations.

Lynx Trapping Seasons:

Since 1926, the open season for lynx trapping has varied considerably in Alaska. Season lengths have ranged from 5½ months to complete closures statewide.

Current seasons in Alaska are listed below.

Units 1-5	Dec 1-Feb 15	No limit
Units 6, 9, 17, 18	Nov 10-Mar 31	No limit
Units 7, 15B, and 15C	Dec 15-Jan 31	No limit
Unit 15A	No open season	
Units 11-14, 16, 20, and 25	Dec 1-Jan 31	No limit
Unit 19	Nov 1-Mar 31	No limit
Unit 21	Nov 1-Feb 28	No limit
Units 22, 23, and 26	Nov 1-Apr 15	No limit
Units 24	Nov 1-Mar 15	No limit

With the exception of recent reductions in trapping seasons in some Interior game management units and closures on the Kenai, the current lynx regulations evolved years ago during a 20- to 25-year period of low fur prices and during a time when opportunities for earning money during the winter by means other than trapping were increasing. Trapping conditions in many areas were much different than at present.

Lynx Harvests:

Indices of the numbers of lynx harvested prior to 1977-78 are available from the number of pelts exported from Alaska; however, this only provides a minimum estimate because not all pelts were exported. From 1939-1945, the number of lynx exported remained relatively low and pelt prices for lynx and other furbearers increased coincident with World War II (Fig. 3). Following World War II, prices paid for pelts declined for most species, but especially for long-haired furs like lynx and red fox. By the early 1950's prices had dropped to extremely low levels (e.g., lynx $3; red fox less than $1). Declining or low prices prevailed for most species during the next 15-20 years. Trapping effort declined with the drop in prices. Despite this reduced trapping effort during the 1950's and 1960's, cyclic lynx harvest peaks were moderately high and increasing, which probably reflected both an increase in lynx numbers and an increase in trapping effort as pelt prices rose in the 1960's and Alaska's human population expanded. In the mid-1960's pelt prices increased again for nearly all furbearers, some more dramatically than others.

Fur prices increased rapidly in the early 1970's, as did the number and mobility of trappers. Harvest during both the peak and low phases of the lynx cycle were higher during this period. This could reflect either a higher proportion of the population being harvested, or the same proportion being harvested from a higher population.

Since 1977-78, all lynx pelts in Alaska have been required to be sealed, which has provided the department with the most accurate estimates of harvest possible. From 1977-78 to 1982-83, the number of lynx pelts that were sealed statewide rose from approximately 2,000 to a peak of approximately 5,700, then declined steadily to approximately 1,200 in 1986-87 (Fig. 4).

Peak harvest was considerably lower in the 1980's than in the 1960's or 1970's despite continued high prices, suggesting that the availability of lynx was reduced. Several factors may have contributed to this lower harvest. In some areas, such as the Tanana River drainage, hares appeared to be less abundant in the 1980's than in the 1960's and 1970's. Consequently, fewer lynx may have been produced, or survival

of kittens may have been lower in this area during the most recent cyclic high. Strong hare highs during the 1980's occurred in some areas, however, including Units 24 and 25. The 1980's peak was also probably lower because of a reduction in the land available to trap due to the 1980 passage of the Alaska National Interest Lands Conservation Act, heavy snowfall that reduced trapping efficiency in 1984-85, and because the trapping season was shortened from 4-4½ months to 2 months in the eastern portion of the state (GMU's 12, 20, 25) during 1985-86 and 1986-87.

Harvest trends may not always reflect population trends; thus, inferences about population status based on harvest data must be drawn with caution. Annual changes in harvest reflect the interaction of many factors including lynx abundance, lynx pelt value, the number and effort of trappers, season length, changes in access and mobility of trappers, and weather. For example, from 1929-1932 lynx pelt exports sharply declined (Fig. 3) coincident with a decline in pelt prices for most furbearers (including lynx) and a worldwide economic depression. Did the decline in lynx exports reflect a declining lynx population or a declining harvest due to the market crash and low pelt prices? Reductions in the quantity and quality of lynx habitat may explain some of the declines observed in lynx numbers and harvest; lynx distribution may also be more limited than during the first half of the century, thus making populations more susceptible to trapping.

Although the magnitude and timing of peaks in lynx harvest differ between game management units (Figs. 4 and 5), the synchrony among several contiguous units suggests that lynx harvest strategies can be applied over broad areas of the state.

MANAGEMENT STRATEGIES

Concern regarding the potential overharvest of lynx populations has been expressed in recent years. The reasons for this concern stem from a suite of several factors: Lynx and snowshoe hare populations are currently at the low phase of the cycle in most areas; during the low phase lynx recruitment is very low; pelt prices are extremely high (average $600); this increased incentive to harvest lynx may result in trapping pressure high enough to keep lynx at low levels in areas where pressure is high, even when hare populations increase.

However, it is hard to answer the question about the effects of harvest on lynx population fluctuations. We have good estimates of harvest but not of population size due to the difficulty in surveying/censusing a cyclic, elusive furbearer.

Thus, we don't know what proportion of the population is being harvested. We also need to better understand the importance of refugia and emigration/immigration for replenishing areas that have been intensively trapped.

Because of these concerns, we want to manage lynx conservatively in areas with high trapping pressure. Of the factors determing lynx population fluctuation (reproduction, mortality, movements) the only one we have control over is trapping mortality. The following section discusses options for influencing harvest.

Regulatory Options

How can we increase or decrease the lynx harvest? Adjustments in the number of lynx harvested can be attempted in several ways including changes in seasons, methods and means, bag limits, and quotas. Lynx trapping regulations should be formulated with the following issues in mind:

Season Length

1. Liberal seasons in all phases of the cycle. This management approach is widely employed for furbearers throughout much of North America, especially in the lower 48 states. It works best with species that have high reproductive rates which enable it to recover quickly from a low population level or with a species that is not harvested very intensively. This would also be a feasible option if trapping is "self-regulating", which means that as the species becomes less abundant, the "law of diminishing returns" comes into play; trapper effort decreases as success declines. Trappers stop trapping or switch to trapping other species that are more abundant and do not trap for that species again until there is sufficient sign to warrant their effort.

   Liberal seasons during the low phase of the lynx cycle may result in lynx populations staying relatively low in heavily trapped areas, even when hare populations increase. Over large portions of Alaska poor access limits harvest pressure, and lynx from untrapped areas may disperse and help repopulate areas where lynx numbers have been significantly reduced.

   Liberal seasons maximize both the opportunity to trap lynx and the short-term lynx harvest. Lynx have high reproductive rates when hares are abundant; thus, unless the population is harvested very intensively, liberal seasons should still allow for a sustained yield. Liberal seasons may result in lower long-term harvests and keep local lynx populations very low in areas where

trapping pressure is high, such as along road systems and close to communities. Under these conditions, it may be difficult to assure a sustained yield harvest and in particular to optimize long-term economic benefits with liberal seasons when hare and lynx populations are low.

2. Conservative seasons in all years of the cycle. This option establishes a one- or two-month season through all phases of the lynx cycle. Lynx would likely be underharvested during the high phase of the cycle and slightly overharvested during the low phase. Lynx would be caught incidentally when the season for lynx is closed, but seasons for other furbearers are open. Incidental catches would be highest in years when lynx are abundant.

   Trappers could anticipate a consistent season each year and would have to take measures to avoid catching lynx during the closed season even when lynx were abundant. Some of these measures (see Methods and Means) would reduce opportunity to take other furbearers and, therefore, also reduce economic benefits.

3. Variable seasons keyed to lynx abundance (tracking strategy). Caughley (1977) described a management option called a "tracking strategy", where rates of harvest change directly with rates of population increase and harvest is curtailed when the population is declining. He suggested this option for harvesting populations in a fluctuating environment. Brand and Keith (1979) illustrated with a model how curtailing lynx trapping during 3 years of the population decline increased the long-term lynx harvests. Lower harvests during the low phase would leave more lynx as breeding stock to produce offspring when hares increase.

   The timing of lynx population cycles varies by several years within the state (Fig. 5), so it would be necessary to monitor these differences. It would be desirable to eventually establish harvest levels for large geographic areas based on the status of the lynx population in relation to the status of prey populations and other factors such as weather, trapper density, and pelt price. Regulations would be established for specific conditions in various parts of the state. It would also be desirable to establish a schedule for implementing future regulations so that resource users would know in advance what to expect.

   A tracking strategy would provide good harvest opportunity and economic benefits to the public when lynx

are increasing or high, but would curtail opportunity and economic benefit when lynx are declining or scarce. Criteria to adjust lynx seasons using a tracking strategy should include objective and subjective information. The lynx-hare, predator-prey system is influenced by many variables, described earlier; therefore, it is impossible to easily establish the timing and duration of lynx seasons in all areas. Several parameters would be monitored to signal decision points for this tracking strategy, including the percentage of kittens in the harvest, lynx and hare population sizes and trends, and trapping pressure.

4. Conservative seasons in some areas, liberal seasons in others (retain existing regulations). The current regulatory regime reduces season length in some areas of the state, retains long seasons in other areas, and temporarily eliminates harvest only on the Kenai Peninsula where, because of the peninsular geography, population increases would occur more slowly if the lynx population were overharvested. This regulatory scheme was adopted by the board for the 1985-86 regulatory year.

   Some people do not think the current regulations give lynx the necessary relief in areas with heavy trapping pressure. Other trappers think the different season lengths for adjacent units are unfair. For example, Unit 20 has a two-month season, Unit 19 has a five-month season, and Unit 21 a four-month season. Similarly, Unit 25 has a two- month season, but Unit 24 has a 4 1/2-month season.

5. Statewide closure until lynx are abundant. This option would provide lynx populations with maximum protection but would eliminate all opportunity to legally harvest lynx. The number of incidentally caught lynx would be greatest under this management option.

   This approach would be contrary to sustained yield management and would unnecessarily preclude economic benefits in large areas of Alaska because some populations of lynx are capable of supporting continued harvest.

Timing of season:

1. Pelt primeness. Lynx pelts are fully prime between early December and mid-February, and those taken earlier or later are often only half as valuable. To maximize economic return, lynx seasons should coincide to the greatest extent possible with the period when pelts are fully prime.

2. Survival of orphaned kittens likely increases as winter progresses. In this respect, a one-month season in January would be preferable to a December season, for example.

3. Incidental take. Because lynx are relatively vulnerable to trapping and are sometimes caught in traps set for other species, incidental take is a problem wherever lynx trapping seasons are shorter than those for many other terrestrial furbearers. Modified trapping methods can be very successful in minimizing the problem (see Methods and Means).

   Incidental take is greatest where a variety of small and medium-sized furbearers are trapped in the same area, which includes most of interior and southcentral Alaska. Incidental take is less of a problem on much of the Kenai Peninsula, for example, where foxes and marten are generally scarce.

   Enforcement problems that result from incidental catches can be handled in a variety of ways. Other jurisdictions have established provisions that allow trappers to turn in incidentally caught lynx without penalty. In some cases, the trapper is paid a modest "handling fee" for turning in the pelts of animals caught out of season.

Methods and Means:

The number of lynx caught incidentally can be substantially reduced by refraining from setting traps in areas where lynx normally travel, and by not using visual attractors, "cubby" sets and certain lures (beaver castor and catnip). The use of wolverine gland lure or urine appears to reduce incidental catches of lynx in wolverine sets. In some places, including Ontario and Alaska, individual trappers have developed and successfully employed simple techniques to release accidentally caught lynx.

Establishment of a maximum trap size for land sets before and after the lynx season would allow the taking of smaller furbearers such as marten and fox, while reducing the take of lynx, which are more often caught in large traps. However, this approach might also reduce the efficiency of capturing fox. Large snares could be used for the taking of wolves during periods closed to lynx trapping.

Regulations on methods and means would be difficult to enforce because of the remoteness of many traplines. Clearly, the cooperation of trappers in the use of

selective trapping techniques is essential to the success of improved management efforts for lynx as well as other furbearers.

Bag Limits:

Bag limit restrictions could be implemented in an attempt to reduce the harvest of lynx. However, with the exception of 20-30 trappers in Unit 25, in the last 3 years, less than 2% of 1100-1600 successful lynx trappers in Alaska harvested more than 5 lynx each, so the harvest would not be substantially reduced with a bag limit of 5. Compliance with bag limits of less than 5 may be limited and difficult to enforce.

Quotas:

A quota of lynx harvested could be established but would be difficult to implement. Pelts would have to be sealed a short time after taking so the department could effectively monitor harvest. This would be unfeasible for many trappers in remote areas. It would also be difficult to convey information about a closure to trappers in remote areas.

Other Considerations:

A regional approach to lynx management may be more appropriate than localized management because lynx sometimes move long distances in search of food. The overall welfare of lynx populations in large areas depends in part on lynx dispersing from small areas of abundance. Regulations that apply to large areas will inevitably result in some small areas with an abundance of lynx having restrictive seasons and also pockets of low lynx numbers having more liberal seasons; however, this is unavoidable from a practical point of view. Another advantage of consistent seasons over large areas is that when seasons in adjacent areas differ, trappers in more restrictive areas tend to resent the idea that "their" lynx are being trapped by someone else.

The areas with the most need for more intensive management are areas where trapping intensity is high (i.e., road-connected areas near large communities), hare and lynx populations are low, and the consequences of overharvest are the most long-term and severe (i.e., Kenai Peninsula).

Enforcement of trapping regulations is difficult because trapping often occurs in large remote areas. Regulations should be simple and as consistent from area to area as possible.

CONCLUSIONS AND RECOMMENDATIONS

Based on the preceding analysis, we believe that the best approach to proper management of lynx harvest is to adjust seasons rather than methods and means, bag limits, or quotas. Furthermore, we believe that season length should be set based on trapping pressure on lynx, which falls into two basic categories. In non-road-connected, more remote units, trapping pressure is probably not high enough at this time to warrant restrictive seasons. In these areas we recommend a more liberal, consistent season throughout the lynx cycle (Table 1).

In road-connected areas, we are concerned that trapping pressure may be high enough when lynx are at a cyclic low and pelt prices are high to prevent lynx populations from increasing as rapidly or as much as desired, even when hare populations increase. These areas may require more intensive monitoring and management to ensure that optimal populations are sustained.

Based upon our analysis, the department recommends implementation of a tracking strategy for those areas where trapping pressure is most likely to significantly affect lynx population cycles. In these areas, seasons could be set according to the relative abundance of lynx and hares. This option has a low risk of management error and is reasonably practical, fair to resource users, and enforceable. It is consistent with furbearer management policies adopted in 1980. Although this tracking strategy will reduce short-term harvests for some trappers, we believe that the long-term harvests will be higher. If our approach proves to be overly conservative, future liberalizations of seasons can largely compensate trappers for their short-term losses. If, however, we err by being too liberal, it would be more difficult to compensate for overharvest of lynx in a short period of time.

Finally, as an aid to evaluating the management alternatives presented in this paper and the department's recommendation to institute a tracking harvest strategy, a summary of management actions taken or being considered by other jurisdictions with significant populations of lynx is presented in Appendix B.

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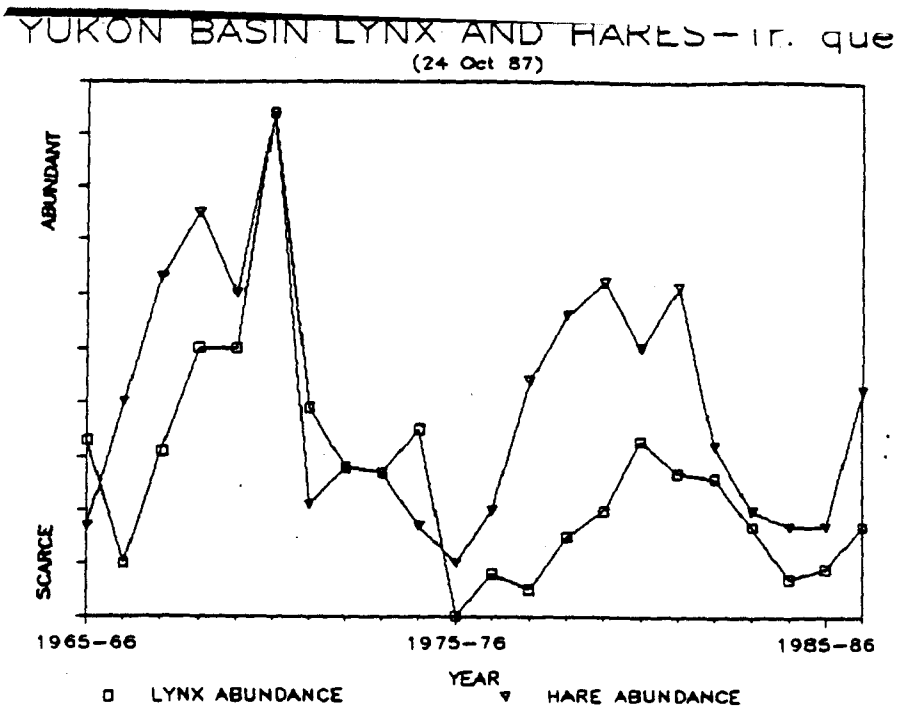

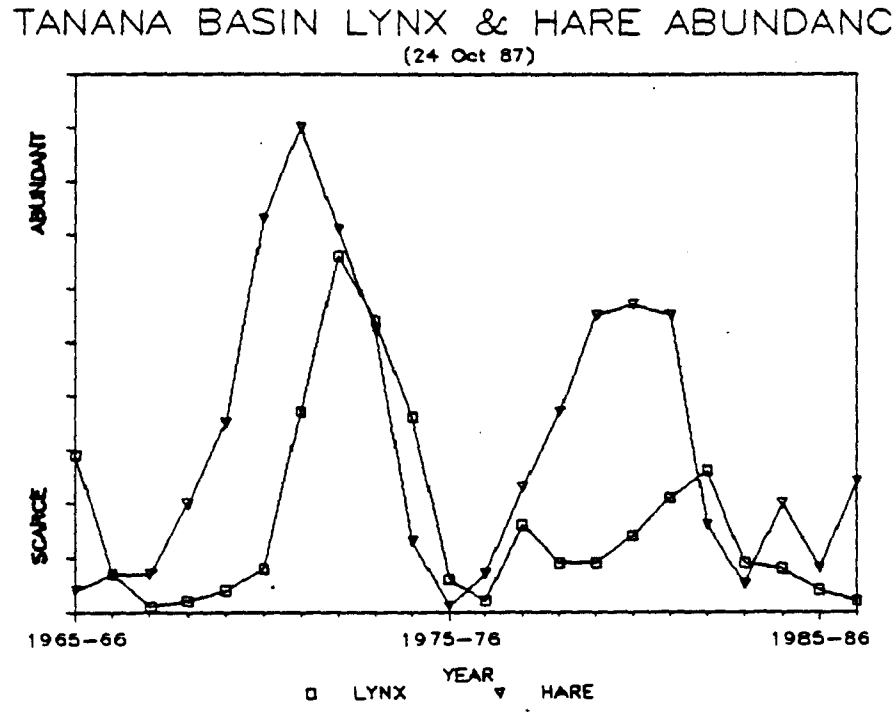

Fig. 1. Relative abundance of lynx and snowshoe hare populations in the Tanana and Yukon Basins based on results of trapper questionnaires, 1965-66 through 1986-87.

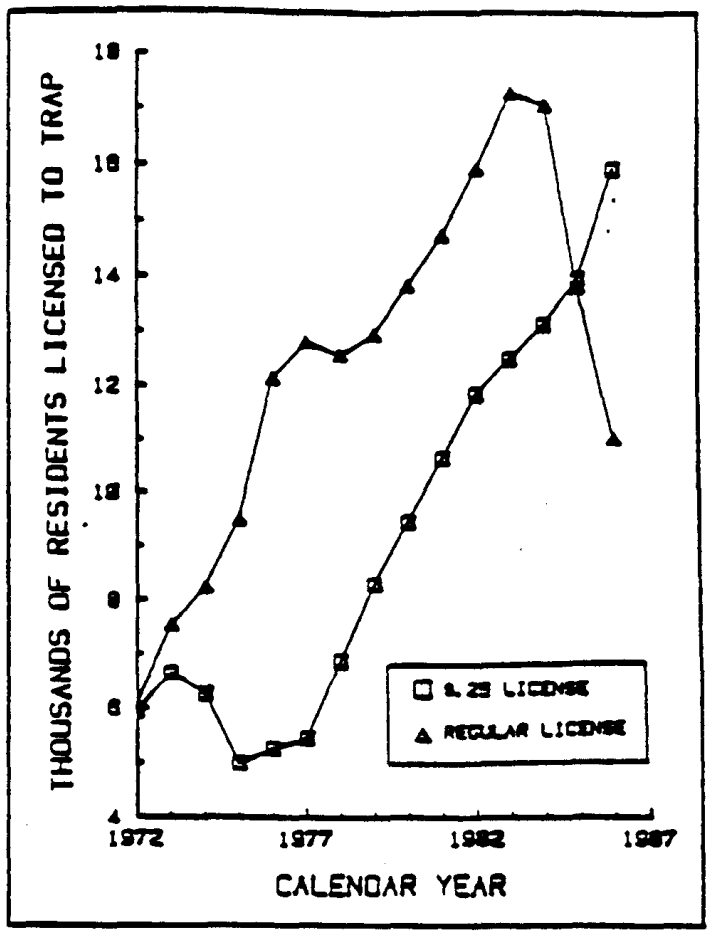

Fig. 2. Number of Alaskans licensed to trap, 1972-1986.

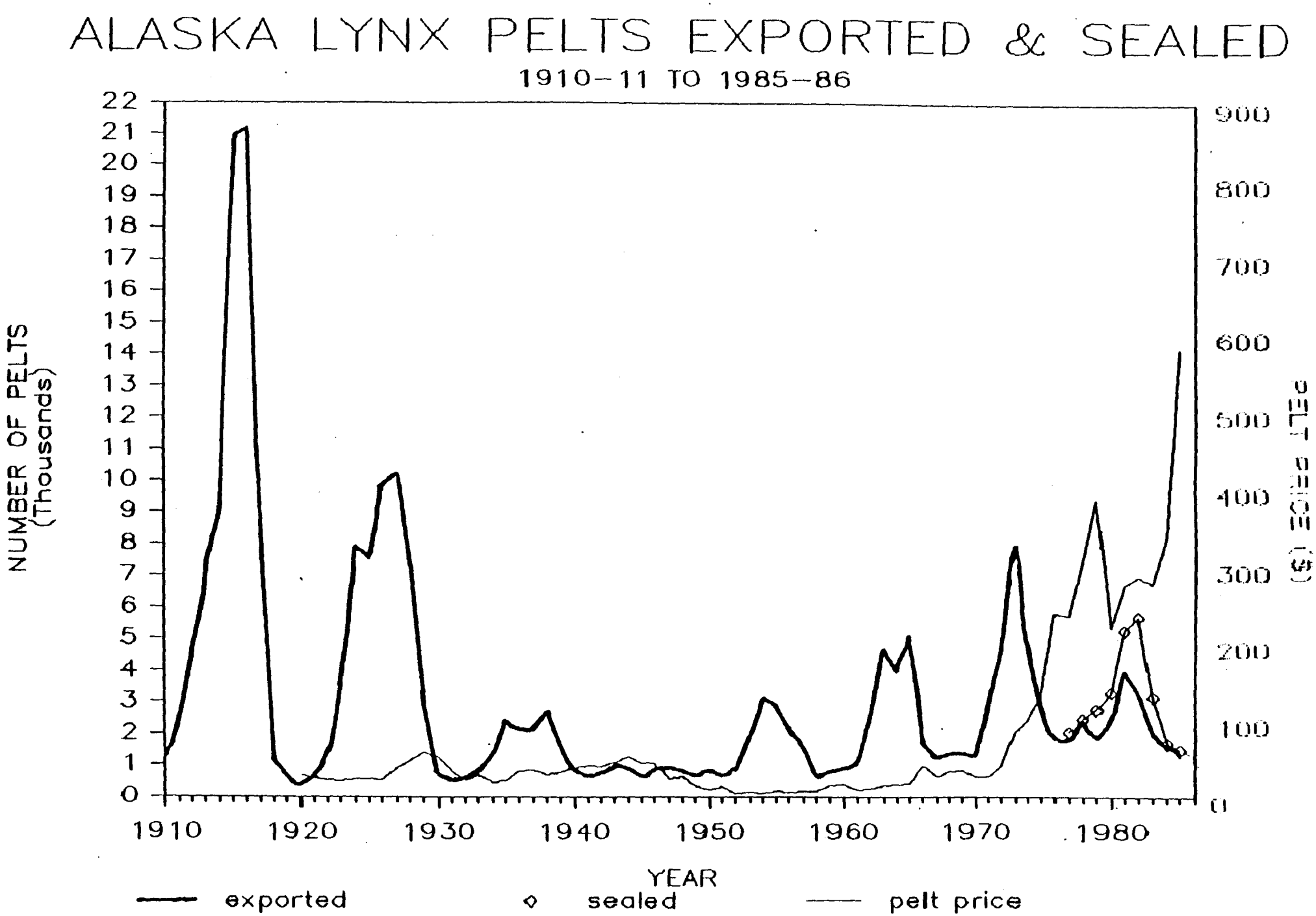

Fig. 3. Number of lynx pelts exported from or sealed in Alaska compared to pelt price, 1910-11 to 1985-86.

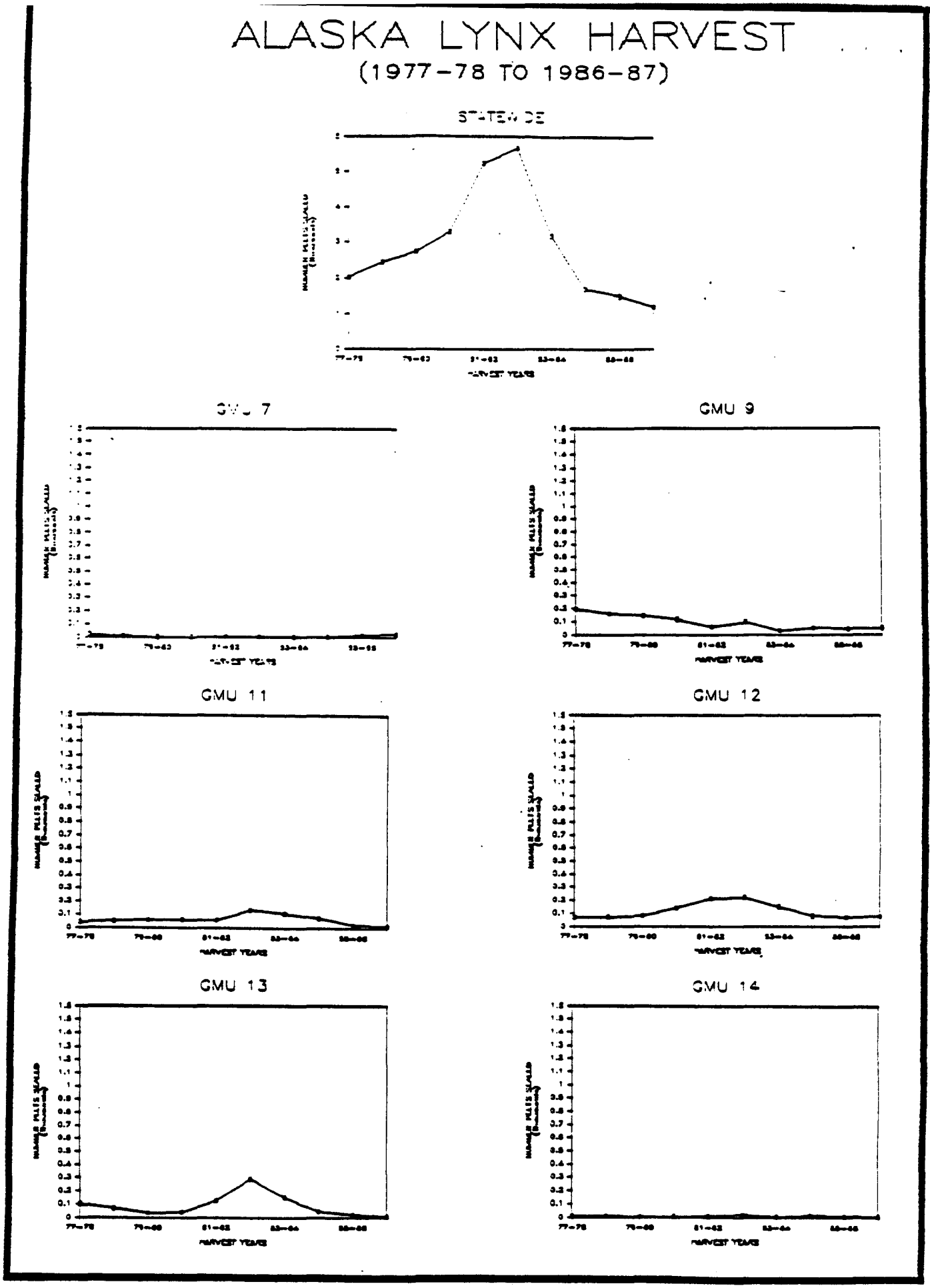

Fig. 4. Lynx harvest (based on pelt sealing records) for Alaska and selected game management units, 1977-78 through 1986-87. See Appendix A for data.

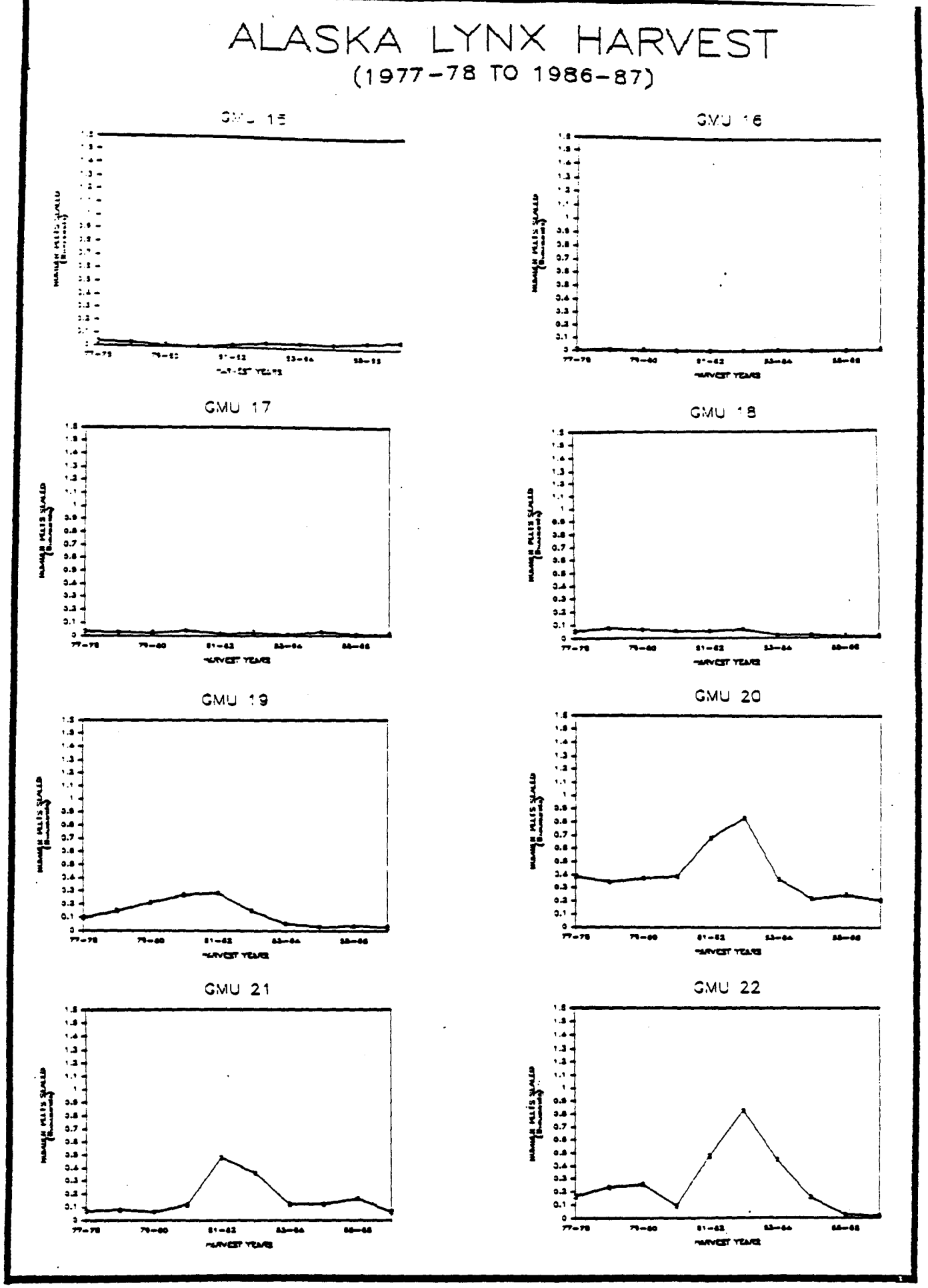

Fig. 4. Continued.

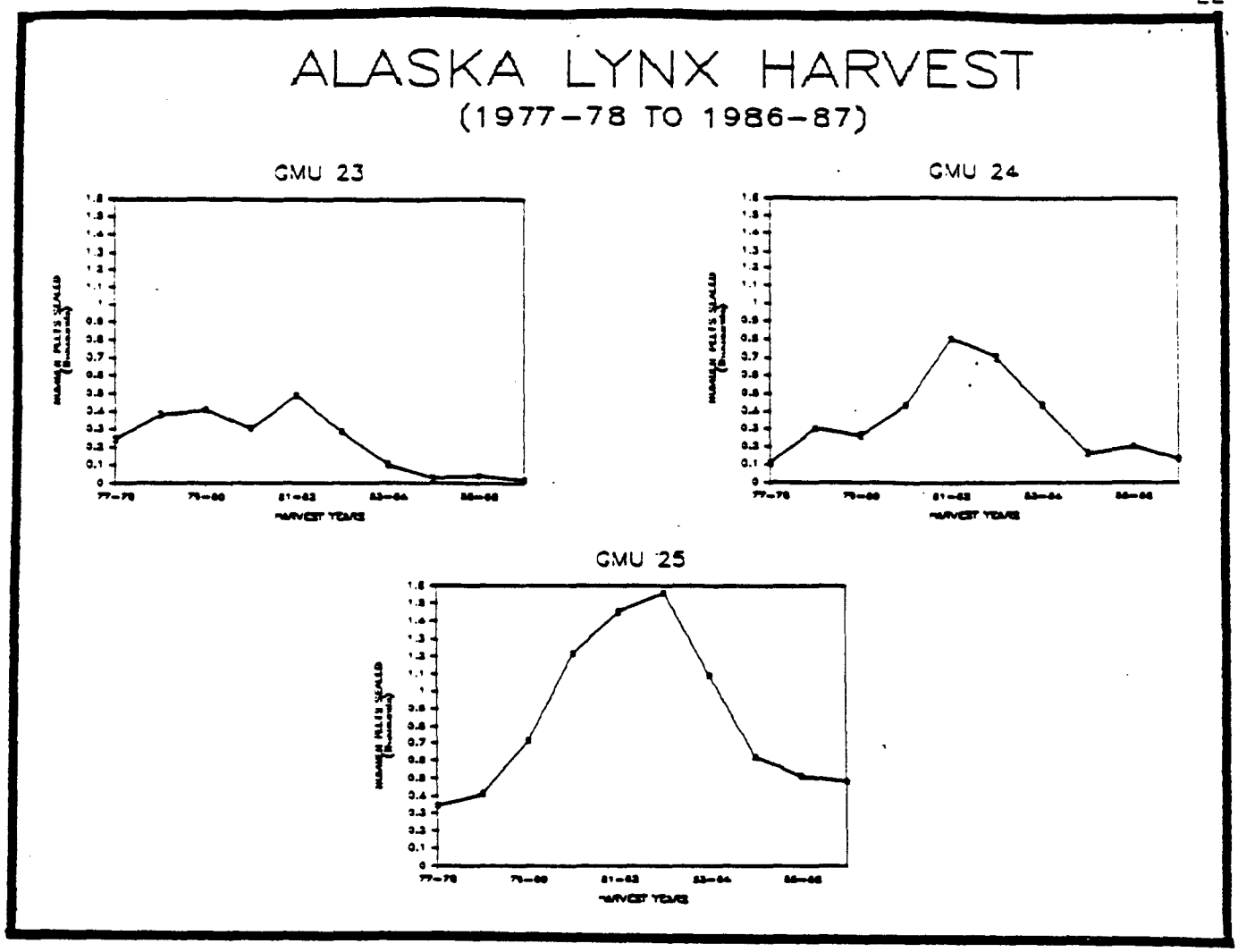

Fig. 4. Continued.

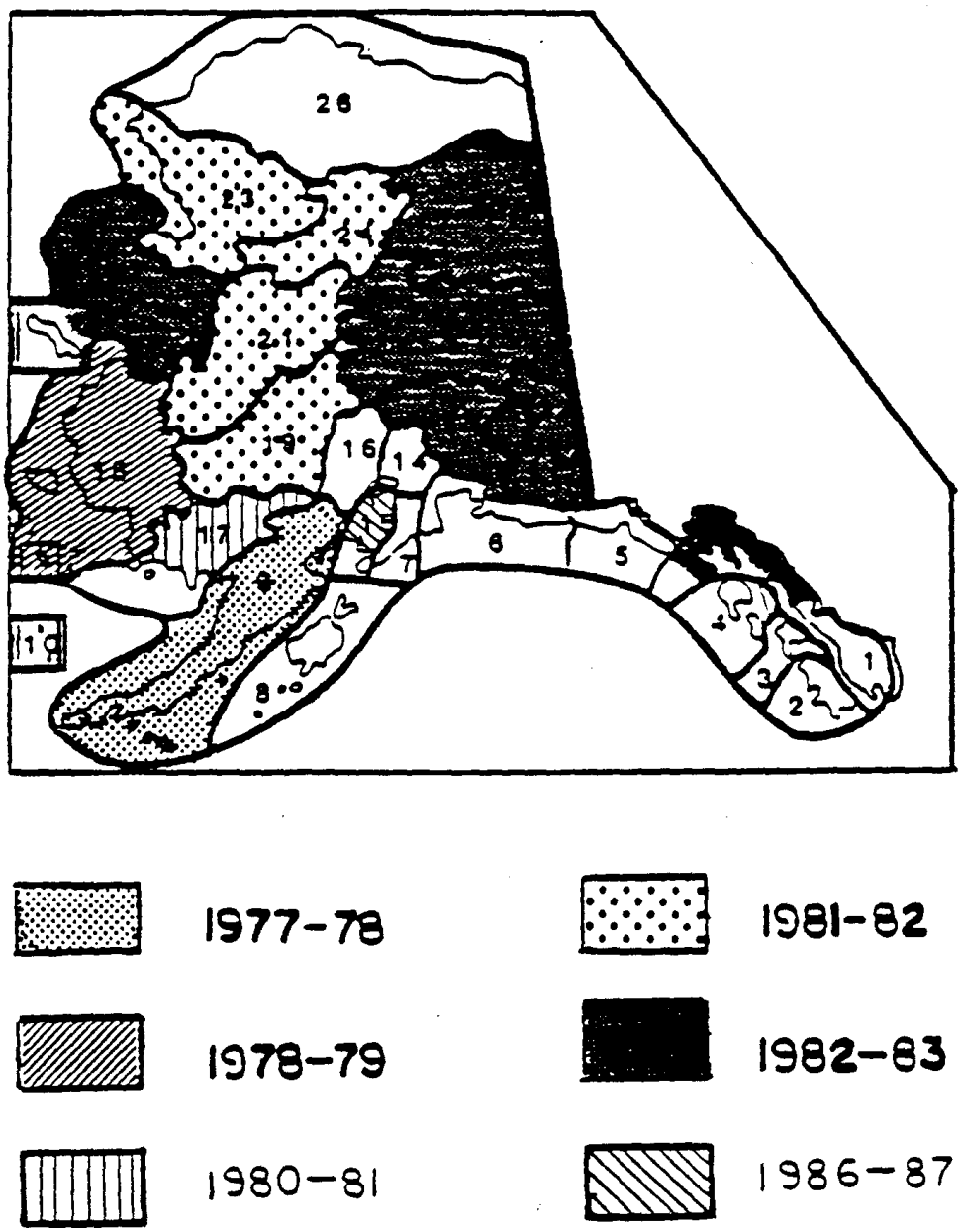

Fig. 5. Year of the peak in lynx harvest (number sealed) in game management units in Alaska between 1977-78 and 1986-87. Only units with 25 lynx or more in peak years are shaded (see Appendix A).

Table 1. Recommended trapping seasons for lynx in Alaska, 1987-88.

Season length	GMU's	Comments	Season dates
Closed*	6, 7, 11, 13-16	Harvest intensity greatest (high number of trappers) Accessible by highway or adjacent to accessible area Hares low Near large communities Habitat quality variable	--
1 month*	20 (except 20E), 25C	Harvest intensity high Accessible by highway Hares low but increasing Near large community Habitat generally good	Dec. 15-Jan. 15
2 1/2 months	1-5	Virtually all lynx caught are dispersing from interior areas Habitat generally lacking Closure dates uniform with most other species	Dec. 1-Feb. 15
3 months*	12, 20E	Accessible by highway Hare population increasing rapidly Near small communities Percent of lynx kits in harvest increasing Habitat generally good	Nov. 1-Jan. 31
3 1/2 months	9, 17	Relatively low trapping pressure, not accessible by highway Most lynx habitat in National Park Service land Absence of definitive lynx-hare cycle Closure date uniform with seasons for fox, marten, mink, wolverine	Nov. 10-Feb. 28
4 months	19, 21, 24, 25A, 25B 25D	Least amount of trapping pressure Most of this area inaccessible by highway Habitat quality generally good to excellent Closure dates uniform with most other species	Nov. 1-Feb. 28
4 1/2 months	18	Pulses of lynx when Interior populations peak No real "cycles" Habitat generally lacking Closure dates unifrom with most other species	Nov. 10-Mar. 31
5 1/2 months	22, 23, 26	Pulses of lynx when Interior populations peak No real "cycles" Habitat generally lacking Closure dates uniform with most other species	Nov. 1-Apr. 15

* Tracking strategy.

Appendix A. Alaska lynx harvest from 1977-1978 through 1986-87 based on counts of sealing certificate data from mandatory sealing (data current as of 10/1/87).

	SEASON									
Unit	77-78	78-79	79-80	80-81[a]	81-82	82-83	83-84	84-85	85-86	86-87
1	1	--[b]	1	--	--	39	15	2	1	1
2	--	--	--	--	--	--	--	--	--	--
3	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--
5	--	--	--	1	--	5	3	--	2	--
6	7	1	--	1	1	--	1	1	2	7
7	19	12	--	--	3	4	2	2	14	23
8	--	--	--	--	--	--	--	--	--	--
9	196	159	145	119	61	98	27	52	45	50
10	--	--	--	--	--	--	--	--	--	--
11	42	51	58	62	58	137	111	76	22	16
12	73	75	85	139	214	224	150	82	73[c]	78[c]
13	105	70	36	41	127	290	153	48	23	9
14	8	9	5	6	7	23	6	15	8	6
15	32	31	13	3	21	37	37	28	47	52
16	6	8	6	2	2	5	10	1	2	6
17	36	30	25	41	16	25	12	29	8	13
18	56	79	66	55	55	67	23	23	13	8
19	98	150	215	271	283	147	54	30	33	26
20[d]	390	346	376	389	683	831	369	221	251[c]	209[c]
21	71	82	65	122	484	364	121	123	166	62
22	163	238	261	90	474	827	446	154	23	18
23	247	386	408	302	490	286	103	26	41	16
24	109	303	262	432	798	698	430	162	203	127
25[d]	347	415	712	1,216	1,452	1,564	1,092	618	513[c]	484[c]
26	9	1	--	--	10	4	2	3	5	--
UNK[e]	--	--	--	1	4	16	--	--	--	--
Total	2,015	2,446	2,739	3,293	5,243	5,691	3,167	1,696	1,495	1,211

[a] Alaska National Interest Lands Conservation Act passed in 1980 and closed some areas to trapping.

[b] "--" indicates no lynx were sealed.

[c] Lynx trapping season reduced from 4-4½ mos. to 2-3 mos.

[d] The boundary dividing Game Management Units 20 and 25 was moved southward in 1981 and resulted in approximately 6,700 mi^2 being added to GMU 25 and subtracted from GMU 20.

[e] Unspecified location within the state.

Appendix B. Lynx management in other jurisdictions.

Lynx management in much of Canada is becoming more conservative in response to increased trapping pressure and recent information indicating that reduced harvest during lows can enhance both lynx numbers and harvest.

A system of individual registered traplines and group registered trapping areas is used in northern Canada, but general trapping areas on private lands are also common. Individual registered traplines generally foster sound fur conservation practices, because it is in the best interest of each trapper to provide for a sustainable harvest from year to year. Registered traplines allow the use of harvest quotas as an effective management tool. Where group trapping areas or general trapping prevails, the attitudes of trappers and the problems encountered in regulating harvest are similar to those in parts of Alaska. It is not the department's intent, however, to promote registered traplines in Alaska, because there are many other factors to be considered with such a system.

Labrador

Although the lynx population in Labrador is at a cyclic low, the low human population, limited access, and rugged terrain there have led management authorities to conclude that trapping is not currently capable of depressing lynx numbers to unacceptable levels. The trapping season extends from October 15 to March 31.

Newfoundland

Trapping pressure in Newfoundland is relatively high, and lynx management has become progressively more conservative. During the past three winters trapping seasons have been November 1-February 28, November 1-January 31, and November 1-December 31, respectively. The shortest open season was accompanied by a closure for half of the island. A complete closure has been instituted for 1987-88.

Although trappers requested a bag limit of one incidentally-caught lynx (snaring is prevalent), management authorities believed that this would allow too great a harvest. Incidental catches must be handed over to authorities. A telemetry study involving ten radio-marked lynx is being initiated to evaluate the possibility of protecting lynx in isolated pockets during lows rather than closing larger areas. Neither Newfoundland nor Labrador have a system of registered traplines; however, Newfoundland is considering such a system.

New Brunswick

In New Brunswick and on Prince Edward Island, lynx have been totally protected for many years after near extirpation by about 1950. Lynx have continued to be scarce in New Brunswick, but from six to ten are caught incidental to other trapping each year. New Brunswick does have a large bobcat population which relies largely on cyclic snowshoe hare populations as a prey base. Management of bobcats is similar to management of lynx. Bobcat and lynx management has a high priority in the province, and wildlife managers are trying to institute more conservative seasons (currently October 15-January 31) and perhaps temporary and partial restrictions on snaring, which is a predominant trapping method. A mandatory carcass collection provides important biological data on bobcat populations. Trappers are resisting this idea and have not yet accepted changes in furbearer management designed to address changes in fur populations, trapping technology, trapping methods, and the fur market. The province will initiate a program of bobcat track counts in an effort to monitor population trends. New Brunswick does not have a registered trapline system, but fur managers believe that some system of regulating the number of trappers in certain areas would be beneficial to furbearer management.

Nova Scotia

As a result of steadily declining harvests beginning in 1971, the lynx season in Nova Scotia was closed during 1975 and 1976. After the season was reopened in 1977 with a quota of two lynx per trapper, extensive research was conducted on Cape Breton Island for three years. The hare population crashed during 1979-80 and there were no lynx kittens in the 1979-80 harvest. As a result, the season was closed and remained closed through winter 1986-87. Both hare and lynx populations increased during this closed period, but there are no immediate plans to reopen the lynx season because the lynx population is isolated and now occupies a relatively small range. Bobcats immigrated to the island from the mainland in the mid-1950's following construction of a causeway, resulting in interspecific competition between bobcats and lynx. Bobcats expanded their range while the lynx range contracted.

Quebec

The Quebec lynx population is thought to be adequate to meet the current level of harvest. Two major research projects have been conducted which may lead to future modifications to trapping seasons and the establishment of quotas where required.

Ontario

In Ontario, where furbearer management has been relatively sophisticated for many years, a recent study recommended a closure of lynx trapping during the three- to four-year low in the cycle. Accordingly, zero trapline quotas were established for most of the province for 1984-85, 1985-86, and 1986-87. Trappers were extremely cooperative despite high pelt values. Because selective trapping techniques were widely used, only 40-45 lynx were taken incidentally each year; about 300 lynx were caught annually during past cyclic lows. Both hare and lynx numbers have recently increased, and some liberalization in regulations will occur during the 1987-88 season, with quotas of one or two lynx per trapline being the rule. Ontario's system of management allows a general open season to be maintained but harvest is regulated through trapline quotas, which are set annually at the field level.

Manitoba

Although season length has been gradually reduced since 1974-75, in 1984-85 lynx harvest in Manitoba reached the lowest level in 35 years (419 pelts). Field observations of lynx and hare sign showed that both were scarce. As a result, a province-wide closure occurred in 1985-86. A quota system was instituted in 1986-87 which allows the take of one or two lynx per trapline or a specified number in some areas. Areas with marginal habitat will remain closed for several years.

The recent restrictions have successfully reduced the harvest, and lynx appear to be recovering in good habitat.

Saskatchewan

In Saskatchewan, lynx management is following a course similar to that of Manitoba. The season was closed for 1987-88 and the closure will probably be maintained through 1988-89. Although limited information is available to assess lynx population status, declining harvests and other information suggest that lynx numbers have been somewhat depressed by trapping, and restrictive measures are warranted. Although a provision for registered traplines exists, most of the 3,000 licensed trappers operate in group trapping areas. Lack of precise information on lynx population density made the use of quotas impractical and caused the season to be closed instead. A shortened season was also judged to be ineffective because it would foster extensive "bootlegging." The province has not established an elaborate system to accommodate incidental catch other than to state that accidentally-caught lynx can be turned in without penalty, with the proceeds of the sale going to the government. This approach was taken in view of the experience in Manitoba where a $50 handling fee was originally

established for trappers accidentally catching lynx. Political pressure resulted in this being raised to $200, which constituted an incentive to trap lynx. Saskatchewan chose to take a firm stand on incidental catch and thus avoid opening the door to this sort of problem.

The last peak in hare numbers in Saskatchewan occurred about 1978-79. The recovery of hares has been prolonged and numbers did not increase noticeably until the present. Increased hare numbers, combined with a closed lynx season, should allow lynx populations to increase significantly during the next two years.

Alberta

In Alberta, as in much of Canada, overtrapping of lynx in the early 1900's may have depressed populations. Populations appeared to recover during the period of low fur prices in mid-century, and high cyclic harvests were observed during the 1960's, 1970's, and 1980's. However, increasing harvests during population lows and a decline in the peak harvest of the 1980's led to proposed reductions in seasons, including closures over large areas, for 1983-84. Despite active support from the Alberta Trappers' Central Association and a majority of fur buyers, this proposal was not adopted due to political intervention by certain groups. Since 1984 a three-month lynx trapping season has been in effect. In response to a formal resolution by the Alberta Trappers' Association, lynx management was again reviewed and a closure (zero trapline quota) was recommended. However, government officials deemed this to be politically unacceptable, and less stringent measures are now proposed. These measures include a one and one-half month open season with quotas of zero-to-two lynx per registered trapping areas. Quotas would be established based on area size, remoteness, and the relative abundance of lynx. The proposal includes a requirement that lynx caught incidentally out of season be surrendered to the province. The trapper will receive $50 for handling the pelt and proceeds from pelt sales will be deposited in a wildlife trust fund. The current proposal also calls for compulsory registration and pelt measuring (similar to Alaska's sealing program) beginning in 1988-89. There is strong general support among trappers for these measures, but the proposed harvest quotas are opposed by some native groups.

British Columbia

Lynx harvests in British Columbia are being closely monitored, but it appears that the extensive mountainous terrain in the province limits access sufficiently to allow lynx populations to cycle normally. However, the lynx season was recently shortened from November 1-February 28 to November 15-

February 15. The situation in British Columbia is in contrast to that in the adjacent prairie provinces where, because of less rugged terrain combined with trails created during mineral exploration, access is relatively good.

Yukon and in the Northwest Territories

In the Yukon and in the Northwest Territories, cyclic lynx harvests have not exhibited the progressive declines observed in much of the remainder of North America. This is probably due to the very low human population, low trapping pressure, and the existence of registered traplines. The Yukon has, however, shortened the lynx trapping season from November 1-March 31 to November 1-February 28.