

REPRODUCTION AND HABITAT USE
BY SAGE GROUSE
IN CANADA

1998 Year End Report For:
1998 Sage Grouse Funding Partners

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ABSTRACT

Sage grouse (*Centrocercus urophasianus*) are the largest of all North American grouse and depend on sagebrush (*Artemisia spp.*) for diet and protective cover. This association with sagebrush has limited the range of the sage grouse to the range of sagebrush. In Canada, sage grouse are at the northern edge of the species' range, occurring only in extreme southeastern Alberta and southwestern Saskatchewan. Lek surveys indicate that Canadian sage grouse have experienced a 90 % decrease from numbers maintained in the mid 1980s. Reproductive success and habitat use by sage grouse (*Centrocercus urophasianus*) were investigated in southeastern Alberta in the first year of a two-year study. Radio telemetry was used to monitor nest success, nesting habitat selection, and clutch size, as well as survival and summer habitat use by both male and female sage grouse. The average sage grouse nest contained 8 eggs and was found in sagebrush with only 4.5 % canopy coverage. Only two of six (33 %) of sage grouse nests were successful in producing a clutch of at least one egg. An artificial nest predation experiment indicated that a lack of grass height and forb coverage was associated with decreased nest success. Mortality rates for females was 14 %, while male mortality was 33 %, and may be as high as 75 %. Building on data gathered in 1998 will help to address the population decline.

PROJECT RATIONALE

Sage grouse (*Centrocercus urophasianus*) are strongly associated with sagebrush (*Artemisia spp.*) habitats within the prairie ecozone. Historically, sage grouse occurred in British Columbia, Alberta, Saskatchewan and 16 U.S. states, but today they have been extirpated from British Columbia and five states (Braun 1998, see Figure 2). The long-term decline seen in sage grouse populations across their range was originally due to the direct loss of sagebrush steppe associated with grassland habitats. This has been reduced by more than 50 percent (2.5 million ha) since the early 1900s (Patterson 1952, Eng and Schladweiler 1972, Braun 1995). The eastern subspecies (*C. u. urophasianus*) is found at the northern edge of its range in extreme southeastern Alberta and southwestern Saskatchewan (Figure 1). Historically, sage grouse occupied approximately 100,000 km² within the two provinces, but today occupy a maximum of 6,000 km² (Figure 1). The range contraction within Canada is also related to habitat loss.

Both Alberta and Saskatchewan still support reproductively active sage grouse populations, yet springtime lek surveys indicate that populations have experienced a 90 % decrease since the mid 1980s, reaching an all time low in 1997 with only 549 to 813 individuals (Aldridge 1998). Consequently, Alberta closed the sage grouse hunting season in 1996 for the first time since 1967 (Aldridge 1998). Further, in 1997, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) listed sage grouse as a 'Threatened' species, and in 1998 this listing was upgraded to 'Endangered,' reflecting the imminent extinction of the Canadian sage grouse population.

Many factors may be contributing to the Canadian sage grouse population decline, including 1) reduced reproductive success, and 2) reduced survival of post-fledged young and/or adults. Habitat degradation or fragmentation, disturbance, predation pressure, reduced nest

success, and climatic change all influence reproduction and survival. Several studies have found that adult hens have greater reproductive success than yearlings (Wallestad and Pyrah 1974, Connelly et al. 1993). However, Schroeder (1997) found no age-related differences in nesting attempts or breeding success. In his North-central Washington study, Schroeder (1997) found that clutch size was considerably higher than had been previously reported for other areas, and hens were also more likely to renest if their first nest was destroyed. Overall, sage grouse in North-central Washington were found to have a greater reproductive effort than to other populations that have been studied. This population was declining, but has recently stabilized. It is similar in size to the declining Canadian population and will make a valuable comparison for data gathered on reproductive success.

ORIGINAL OBJECTIVES

The overall objective of this study is to collect data on the population dynamics and ecology of sage grouse in Canada (both Alberta and Saskatchewan). The goal of this research is to determine, from a proximate perspective, why the Canadian sage grouse population is declining. This will then allow the population decline to be addressed, and speculations related to causes of the problem to be made. The primary focus of this research was to be on hens, assessing their reproductive success, and the survival of hens and their broods, in an attempt to understand the reasons for the decline in population numbers. Habitat use by sage grouse at various life history stages throughout the various seasons was also to be documented in an attempt to determine the importance of specific habitat regimes. Specifically, the objectives were to:

- 1) determine reproductive success of females as adults and young of the year. i.e. clutch size, nest success, breeding success, fledging success, chick survival etc.

- 2) determine rates of survival for post fledged young and adults.
- 3) monitor movements of hens and cocks to assess habitat selection and thus determine the importance of certain habitats throughout different life history stages and different seasons; specifically nesting habitat and brood rearing habitats, summer foraging sites, and winter habitat.
- 4) compare the life history strategies of Canadian sage grouse with southern conspecifics i.e. Washington.

OBJECTIVES ACHIEVED

The pilot year of this study was very successful. Due to limited number of sage grouse in Saskatchewan, the study area was limited to Alberta, where sage grouse are more concentrated. Annual lek counts were performed in Alberta. All historically active leks were monitored at least twice for signs of activity during the breeding period, with all active leks being monitored weekly. Birds were captured and radio transmitters were successfully fitted to both hens and cocks. However, the winter of 1997/98 was extremely mild, which resulted in breeding activities occurring earlier than usual. This meant that the peak of female attendance at leks was occurred early in April, and limited the time available to capture females. Provincial authorities also had concerns about the potential disturbance that actively trapping at and around leks would have, and thus trapping began cautiously which may have also contributed to fewer hens being captured than anticipated. With respect to the four previously listed objectives, the following was accomplished:

- 1) data was gathered on clutch size, nest success, and breeding success; only one brood was identified and followed for just a short period
- 2) survival rates were determined for only adults
- 3) habitat selection at nest sites, and summer roosting sites for both hens and cocks was identified; winter habitat is currently being identified

STUDY AREA

The study area is about 3,000 square km in size and is located in the southeastern corner of Alberta, south of the Cypress Hills and east to the Saskatchewan border (Figure 1). This area represents the core range of sage grouse in Canada and is composed of semi-arid mixed-grass prairie, with an abundance of silver sage (Aldridge 1997). The prairie in this region is essentially flat, often interrupted by vast coulees that lead to numerous small creeks and river tributaries.

METHODS

Lek counts were conducted from April to May at all previously known sage grouse leks to obtain population estimates. Both hens and cocks were trapped by spotlighting with a long handled hoop net (Giesen, *et al.* 1982) or in walk-in traps (Schroeder and Braun, 1991).

Necklace style radio transmitters (Holohil Systems Inc., Carp, Ontario) were affixed to both hens and cocks.

Once released, sage grouse were tracked using a 5-element Yagi antenna and Telonics scanning receiver (Telonics Inc. Mesa Arizona). Birds were located using triangulation techniques until visually observed. Attendance of cocks at leks was monitored, and once they began leaving the leks in late May/early June, they were relocated weekly and habitat measurements were performed (see below). Hens were located and visually observed every other day during the nesting period (Musil *et al.* 1994, Schroeder 1997) in order to estimate the date of nest initiation and incubation, and allow for nest fate to be determined. When approaching a nest, observers remained at least 30m from the nest site (see Schroeder 1997). Nest locations were recorded in UTM's, and the data gathered will be analyzed in relation to broad scale habitat features using Geographic Information Systems (GIS) technology, and

potentially using remote sensing techniques. Nest fate was determined and various measures of reproductive success were estimated.

After nesting efforts ceased, nest site characteristics were measured (see Commons 1997; Klebenow 1969, Musil *et al.* 1994, Wallestad and Pyrah 1974). At each nest site, the percent sagebrush canopy coverage, as well as the percent coverage of grasses, forbs, non-forageable forbs, other shrubs and bare ground/dead materials within a 1 m squared quadrat centered on the nest was measured (Daubenmire 1959). The mean maximum height of the aforementioned variables was also calculated for each plot. To determine if habitat characteristics near nest sites are important, eight additional dependent non-random 1 m squared plots were placed at 7.5 and 15 m in each of the four ordinal directions and the same measurements were performed. A modification of Canfield's (1941) line intercept method was used to estimate the live sagebrush canopy coverage along four 15 m transects radiating from the nest site in each ordinal direction (see Commons, 1997). A similar set of habitat characteristics were also taken at a set of plots at a randomly related site, 100 to 500 m in a random direction from the nest site (dependent random plots). The dependent non-random plots represent non-nest site characteristics within the same 'stand', and the dependent random plots represent non-nest site characteristics from different 'stands'.

An artificial nest predation experiment was also performed to identify key habitat features associated with nesting success as part of Tammy Seida's B.Sc. Honours Thesis. Eighty nests containing two plasticine eggs and one chicken egg were placed around four active sage grouse leks. Similar habitat measurements to those described for actual nests were performed at artificial nests.

Cocks were also followed to determine summer habitat use. Each week, hens, with or without broods, and cocks were located and triangulated until visualized (Musil *et al.* 1994, Schroeder 1997) and the same habitat measurements described for nest sites were performed.

PRELIMINARY RESULTS AND DISCUSSION

Lek counts were conducted from 11 April, 1998 to 21 May 1998. High counts over the strutting period resulted in a maximum count of 147 cocks on eight active leks in 1998. This was an increase from 121 cocks observed on seven active leks in 1997 (Figure 3). A similar trend was seen in Saskatchewan, where a maximum of 144 cocks were counted on 12 active leks in 1998, compared to 61 cocks on 10 leks in 1997 (Wayne Harris pers. comm., Figure 3).

Increased over-winter survival of birds due to lack of snow cover and the mild winter of 1997/98 on the prairies likely resulted in the population increase.

Based on these counts, the 1998 Canadian sage grouse spring population is estimated at 873 to 1293 individuals. This estimate is based on an assumed spring sex ratio of two females per male, that counts represent 75 % of all cocks associated with leks, and that 90 % of leks are located and surveyed. Overall, the 1998 population estimate was higher than the 1997 estimate, but the Canadian-wide population is still approximately 80 % below levels maintained in the mid-1980s (Figure 3).

Trapping during the breeding season resulted in 39 sage grouse being captured. A total of 30 adult (2 plus years) and five yearling cocks were captured and three adult and one yearling hens were captured. Twenty adult and three yearling cocks, along with all four females were fitted with radio transmitters. In the late summer, one yearling hen, two adult hens, and one juvenile cock were captured and fitted with transmitters.

Over the course of the summer, six of the radio collared adult males and one of the yearling males were killed by canid predators, as identified by tooth marks left in transmitters and leg bands. Ten other males were not seen after dispersing from leks in the spring, and they were also likely killed by predators. Mortality rates for cocks are considerably higher than for females (Clait Braun pers. comm.), due to the physically demanding costs associated with displaying at leks during the breeding season. One yearling and two adult hens were captured late in the summer and were affixed with radio transmitters. In the fall of 1998, one yearling female and the juvenile male captured in the summer were killed by canids. Thus far, 8 of 24 radioed cocks (33 %) and one of seven radioed hens (14 %) were killed by predators. The mortality rate for the cocks may however be as high as 75 % if the additional ten missing cocks considered dead.

Sage grouse are the largest of all North American grouse (Johnsgard 1983), with adult males throughout the core range averaging 2400g to 3200g during the breeding season (Beck and Braun 1978, Dalke *et al.* 1963, Eng 1963, Patterson 1952). Masses of birds captured in Alberta during the breeding season averaged 3071g for adult males (n=30); 1662g for adult females (n=2); 2420g for yearling males (n=5); and 1514 for yearling females (n=2). Sage grouse are at the northern extent of their range in Canada, and it may be necessary for birds to put on more mass to survive the extreme conditions they encounter northern limits.

All three radio collared adult hens nested, but only one of the adults had a successful nest with all seven eggs hatching. She disappeared shortly after her clutch hatched, and was seen approximately 10 km away from her nest site in mid-summer. It is likely that her brood was killed by predators. The only radio collared yearling female was tracked for just three days before she disappeared from her lek of capture and was not seen again. Clutch size for sage

grouse typically averages between seven and nine eggs (Anonymous 1997). In this study, clutch size for three radio - marked hens and two other unmarked nests averaged eight eggs. Only two of six sage grouse nests (five first nests and one re-nest) were successful, resulting in a nest success rate of only 33 %. Although sample sizes are small, nest success in Canada is lower than that found in Wyoming (43 %, Patterson 1952) but is comparable to what Schroeder (1997) found for sage grouse in Washington.

Sage grouse almost exclusively nest under sagebrush, with a dense sagebrush canopy coverage (20 to 50 %) and taller shrubs with heights ranging from 17 to 79 cm being preferred (Klebenow 1969, Patterson 1952, Wallestad and Pyrah 1974). Sagebrush canopy coverage around nest sites in Canada averaged 4.5 %, with an average coverage of 43 % over the nest bowl. Shrub height over the nest bowl averaged 52 cm. While sage grouse may be selecting the most dense sagebrush to nest under, the overall density of sagebrush within the vicinity of nests may not be sufficient enough to obscure nests from predators. Grass coverage averaged only 19 % immediately surrounding sage grouse nests, with an average mean maximum height of 18 cm. Gregg *et al.* (1994) found that tall grass (≥ 18 cm) was also important for sage grouse nests to be successful. More powerful statistical inferences will be made after the second year of this study when additional nesting data will be gathered.

In addition to data gathered on actual sage grouse nests, Seida (1998) found that only 17 of 80 artificial sage grouse nests (21 %) were successful. Grass height and forb coverage were the most important factors determining nest success of Seida's (1998) artificial nests. The height and percent coverage of sagebrush however did not affect the nests' success, as has been found in other areas for both artificial and natural sage grouse nests (DeLong *et al.* 1995, Gregg *et al.* 1994, Wallestad and Pyrah 1974). *A. cana* shrubs may be fairly ubiquitous throughout the

Canadian range, and thus other variables such as grasses and forbs become more important for protection from predators. It appears that the lack of residual cover to obscure nests from predators may be decreasing sage grouse nest success in Canada. Although sample sizes are small, Canadian sage grouse may be experiencing reduced reproductive success related to below optimal nesting habitat and predation.

Paired vegetation measurements were made at summer use sites and corresponding random sites for 72 male and female sage grouse locations. Both male and female sage grouse roosted in areas that had a sagebrush canopy coverage of about seven percent, compared to only three percent at random sites. It would appear that sage grouse are selecting more dense patches of sagebrush during the summer. Data collection in 1999 will allow more precise statistical inferences to be made on habitat preferences.

CONTINUED RESEARCH

The focus of this research is to understand the factors regulating sage grouse abundance at the northern edge of the specie's range. This will help to address the population decline and to develop management strategies for the continued existence of the species in Canada. Winter sage grouse movements are presently being monitored, and will continued through 1999 in an attempt to identify potentially limiting winter habitat. This spring and summer, efforts will be focused on capturing and radio-collaring females to increase data on reproductive ecology (nesting success and habitat preferences, clutch size, brood size and survival etc.) as well as summer habitat preferences. The population will again be monitored during the spring through the continuation of lek surveys, and male sage grouse movements, habitat use, and survival will

also be monitored. This research should help in the development of management strategies to aid in the recovery of sage grouse in Canada.

RECOMMENDATIONS

Cattle grazing is a common way of life throughout the Canadian Prairies. However, intensive grazing will greatly reduce the height and percent cover of both grasses and forbs. Effective but cooperative management strategies with land owners need to be devised to increase the residual grass and forb cover in areas where sage grouse nest. Approximately 90 % of all sage grouse nests occur within 3.2 km of a lek (Braun, *et al.* 1977). Thus, working with landowners to limit grazing during the breeding season within a 3.2 km radius surrounding all leks would greatly benefit sage grouse in Canada. These strategies are being successfully undertaken in some areas of the United States (Clait Braun pers. comm.).

Being a lekking species, sage grouse are a unique sight on the prairies, and it is not uncommon to see naturalists sneaking up on a sage grouse lek in Canada, in the hopes of taking the perfect photo. However, sage grouse are extremely sensitive to any disturbances, and once these birds are flushed off of a lek, they will not return to resume breeding activities until the next day. Continual disturbance can result in birds abandoning traditional mating grounds. Due to the close association of nests with lek sites, disruption of breeding activities may also detrimentally affect nesting sage grouse. Therefore access to leks needs to be controlled.

Habitat fragmentation and disruption of the remaining sage grouse habitat is also a problem in Canada. Very little suitable habitat for sage grouse remains, and these areas need to be protected from disturbances. Sage grouse are extremely sensitive to developments on the prairies, and in some case will avoid all habitat within 1.6 km of certain developments. Oil and

gas extraction is extremely active within the range of sage grouse on the Canadian Prairies. Even though sensitive wildlife areas have been identified to the government, the financial gain of placing an oil well on top of these sensitive areas can outweigh the cost of disturbing the habitat and the associated wildlife. Since sage grouse are a non-migratory species in Canada, they appear to fall under provincial authority. However, Provincial Wildlife Agencies are only able to “recommend” against activities that will ultimately harm Endangered species. The catch is that land owners also gain financially from oil and gas activities, and biologists need to maintain good land owner relations to allow them to continue research on private and crown leased lands, and to work with land owners for the benefit of the sensitive wildlife. With as few as 873 individuals, the Canadian sage grouse population is extremely sensitive to any stochastic event. The longer it takes to begin working with land owners to protect habitat surrounding the remaining active sage grouse leks, the more likely that sage grouse will become extirpated from Canada.

It is important that we continue to gather data on the reproductive ecology and habitat use by sage grouse in Alberta. This will help identify problems related to the population decline and will aid in the development of management strategies to prevent the extirpation of sage grouse from Canada.

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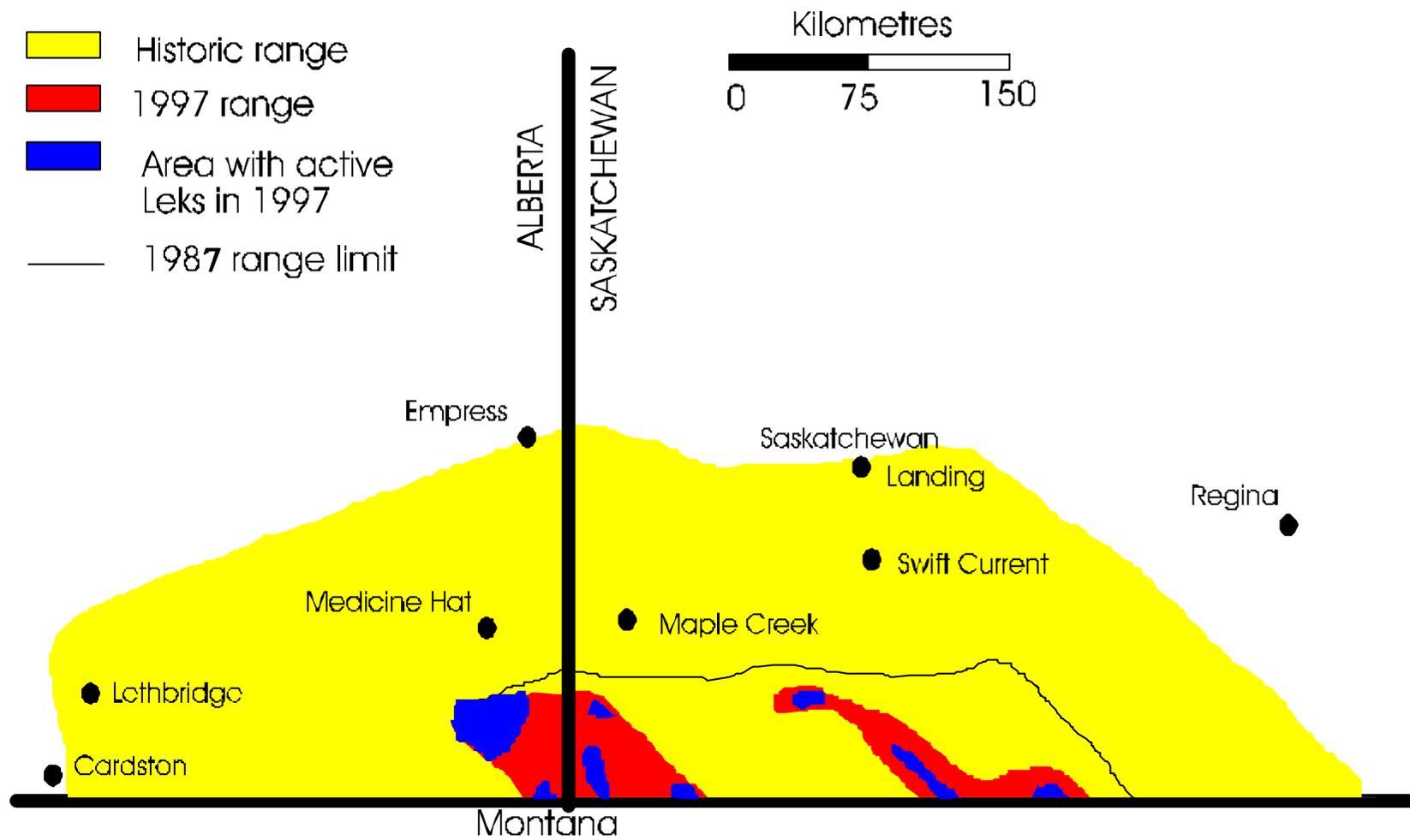


Figure 1. Range of sage grouse in Canada. Historical range is based on anecdotal sightings of birds prior to the 1960s. The present (1997) range is based on the locations of known active leks in 1997. The 1987 range limits are shown to illustrate the range contraction.



Figure 2. Current and known historic distribution of sage grouse. 'E' represents the eastern subspecies (*Centrocercus urophasianus urophasianus*) and 'W' represents the western subspecies (*C. u. phaios*). The current distribution is not continuous and is more fragmented than indicated. (Adapted from Johnsgard, 1983).

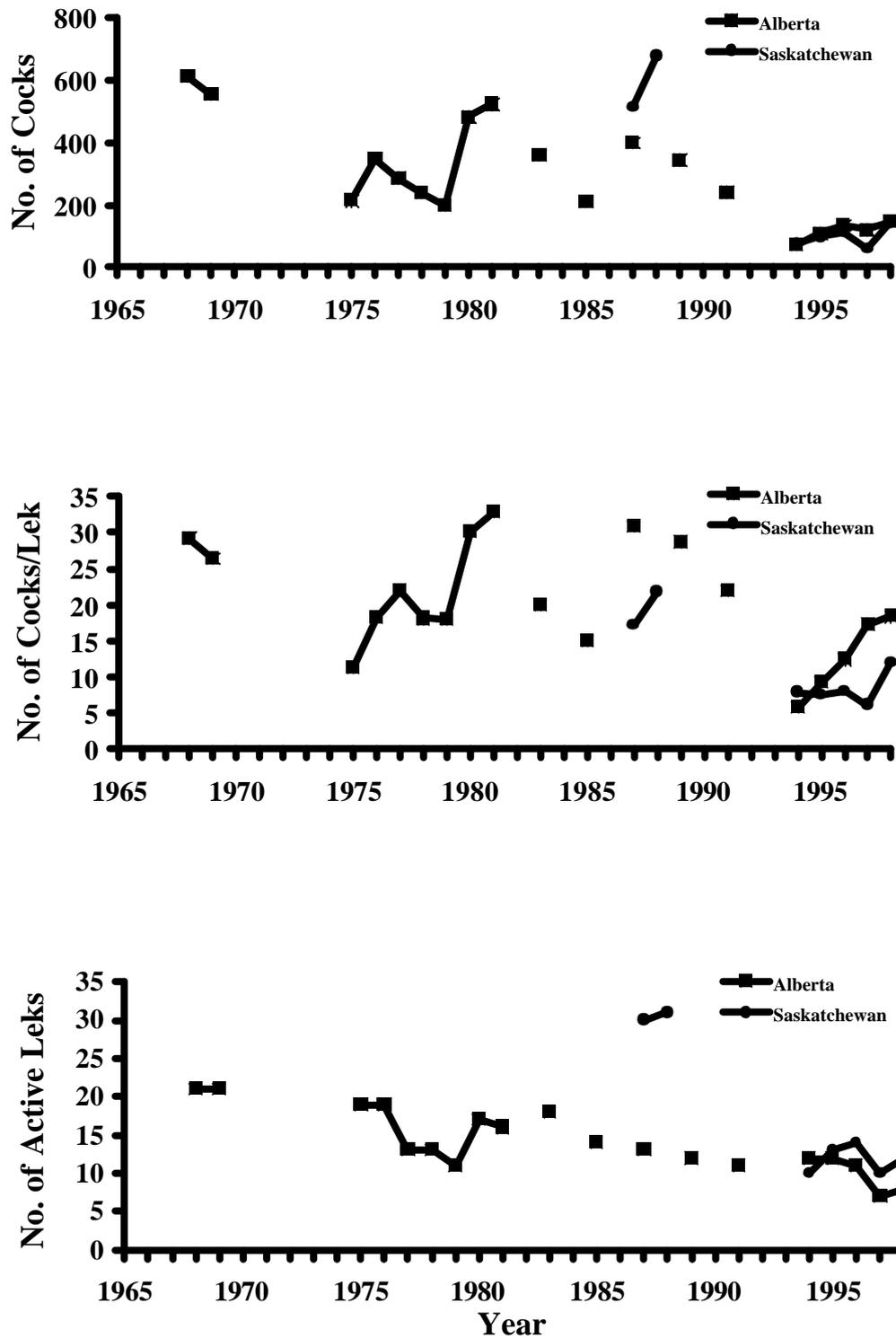


Figure 3. Population trends for sage grouse in Alberta and Saskatchewan over the past 30 years based on the number of cocks, number of cocks per lek, and number of active leks. Years sampling efforts of less than eight leks surveyed are not included.

APPENDIX A

A detailed list of all press releases related to sage grouse research in 1998.

Press Releases Related to Cameron L. Aldridge's M.Sc. Thesis Work on Sage Grouse in Canada

DATE	PRESS RELEASE	AUTHOR	TITLE
March 27, 1998	The Saskatoon StarPhoenix	Colette Derworiz	Shrinking ranks of sage grouse baffles researchers
April 1998	CBC NewsWorld (T.V.)		Sage Grouse
April 9, 1998	The Regina Leader-Post	???	Sage grouse population in rapid decline
April 17, 1998	Calgary Herald	Monte Stewart	Researcher gets funding to track nesting sage grouse
May, 1998	Regina Sunday Sun	Frank Flegel	Getting Closer to the Vision
May, 1998	CBC News (T.V.) Alberta & Saskatchewan	Gary Sieb	Sage Grouse
May, 1998	CBC Radio		Sage grouse
May, 1998	QR77 Radio; Calgary & Edmonton		Sage grouse
May 3, 1998	Lethbridge Herald	???	Future uncertain for once-vibrant population of sage grouse
May 7, 1998	The Western Producer	Michael Raine	Sage grouse listed as endangered
Spring, 1998	The Third Degree; U of R Alumni Magazine	Erika Smishek	Research aims to reverse sage grouse saga
December 1998	Nature Views; Nature Sask. Newsletter	Cameron L. Aldridge	Status of sage grouse in Canada.