

**Arctic Borderlands Ecological Knowledge Cooperative:**

**1) analysis of caribou related questions 2008-2014**

**2) update of key climate indicators**

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## INTRODUCTION

The Arctic Borderlands Ecological Knowledge Cooperative (ABEKC) has been conducting interviews in communities within the range of the Porcupine Caribou Herd (PCH) for almost 20 years (Figure 1). An analysis of community interviews between 2001-2007 summarized survey indicators associated with caribou (Russell et al 2013a). When that analysis was done the Porcupine Herd had been assumed to be declining based on a number of population estimates between 1989 (178,000 caribou) and 2001 (123,000 caribou). Between 2001 and 2010 (when the analysis was completed) a number of census attempts failed due to logistical reasons. The results of the Borderlands analysis indicated that communities were reporting an increasing trend in 1) caribou health, 2) availability, and 3) communities' ability to meet their needs with respect to caribou harvest. Subsequently, a 2011 population estimate of 169,000 caribou supported community observations. Russell et al (2013a) concluded that the use of community interviews provided a valuable alternative data source during periods when surveys are not conducted, and at minimum could augment agency estimates of the status and trends in caribou populations when aerial surveys are successfully conducted. Since 2011 the PCH has continued to grow based on population estimate of 197,000 in 2013 (Caikoski 2014). This report provides an updated analysis of community-based caribou indicators (2008-2014) to build on the previous analysis (2001-2007). Both interview periods are reported here.

Climate does play a complex role in the condition, abundance, distribution and accessibility of caribou. In this report we use the opportunity to update key climate indicators for the pre interview period (1979-2000), and the two interview reporting periods: 2001-2007 and 2008-2014.

## METHODS

In this analysis we present an analysis of four questions that were consistently asked for the two reporting periods (Questions 1,2,3 and 5 below) as well a question that was only asked during the latest reporting period (Question 4 below). Respondents were asked:

1. Did you Hunt? (Yes, No). We determined the percent of "Yes" responses.
2. Did you Meet your needs? (Yes, No). We determined the percent of "Yes" responses.
3. Observations of seasonal body condition of caribou (excellent, good, mixed, fair, poor). Because excellent and fair weren't consistently asked over the 13 years, we collapsed the classes into good (good+excellent), average (mixed) and poor (fair+poor). We then developed an index consistent with Russell et al (2013a). The Condition Index (CI) was determined as:  $CI = 3 * \%GOOD + 2 * \%AVERAGE + \%POOR$

4. From 2009/10 respondents were asked “size” of caribou (muscular/fit/strong, skinny/lean, fair, fat). We collapsed the classes into good (muscular/fit/strong+fat), average (fair) and poor (skinny/lean). We then developed an index consistent with Russell et al (2013a). The “Size” Index (SI) was determined as:  $SI = 3 * \%GOOD + 2 * \%AVERAGE + \%POOR$
5. Based on your observation for each season, were there more, equal or fewer Porcupine Caribou (bulls, cows calves) over the last year than usual? We created a relative abundance index for each season and cohort. Our Abundance Index (AI) was calculated as:

$$AI = \%LESS + 2 * \%SAME + 3 * \%MORE$$

The Circumpolar Rangifer Monitoring and Assessment (CARMA) Network’s climate database (Russell et al 2013b) was updated to cover the period 1979-2014. We summarized climate for six key indicators:

- 1) snow depth March 31 on winter range. March 31 was chosen to represent peak snow depth just prior to spring melt conditions
- 2) snow on ground May 15 on spring range. Caribou are close to calving grounds by mid May and May 15 snow conditions captures to progress of spring melt
- 3) growing degree days on calving grounds June 10. Griffith et al (2002) related early calf survival with the amount of new green vegetation on the calving ground. Growing degree days by the 10<sup>th</sup> of June captures the progress of green-up on the calving grounds.
- 4) July average drying conditions on summer range. Caribou summer range is often subject to drying conditions, which results in rapid loss of forage quality during the critical period of milk production and replenishment of fat and protein reserves in the cow.
- 5) Cumulative oestrid index August 31 on summer range. Insect harassment can result in reduced forage intake and use of poorer quality insect relief habitat. Oestrids (bot and warble flies) usually harass caribou from late June to August and the cumulative index at the end of August is an index of summer exposure to oestrids.
- 6) Mushroom index on fall range. In years of high mushrooms caribou can obtain much needed highly digestible nitrogen in their diet just prior to the breeding season.

Data are reported as a 3-year running average with the data point representing the last of the 3-year average (i.e., data for 2000 would represent the average of 1998-2000).

## RESULTS

### Interviews:

Number of people interviewed: The number of people interviewed increased slightly averaging 144 per year for the current analysis period (2008-2014) compared to 134 for the period 2001-2007 (Table 1). The only significant change among the reporting periods was the lack of interviews in Kaktovik in the latter period (Table 1.)

**Figure 1 Map of communities participating in Borderlands interviews**

**Table 1. Breakdown of the average number of people interviewed in communities within the PCH range in 2001-2007 and 2008-2014**

| Community             | 2001-2007 | 2008-2014 |
|-----------------------|-----------|-----------|
| <b>Aklavik</b>        | 36        | 30        |
| <b>Arctic Village</b> | 20        | 16        |
| <b>Fort McPherson</b> | 20        | 18        |
| <b>Inuvik</b>         | 28        | 29        |
| <b>Kaktovik</b>       | 8         | 0         |
| <b>Old Crow</b>       | 20        | 17        |
| <b>Tsiigehtchic</b>   | 20        | 18        |
| <b>Tuktoyaktuk</b>    | 19        | 19        |
| <b>TOTAL AVERAGE?</b> | 134       | 144       |

Body condition: People were asked whether they observed caribou in good, mixed or poor condition during the four seasons. During fall the body condition index increased on average from the 2001-2007 period to the 2007-2014 period (index  $230 \pm 23.2$  versus  $267 \pm 17.8$  respectively; Figure 2). A similar increase was reported for the spring season (index  $199 \pm 23.3$  versus  $227 \pm 33.2$  respectively; Figure 3). There was a suggestion that fall condition peaked in 2011-2012 compared to a peak in 2009-2010 during the spring season.

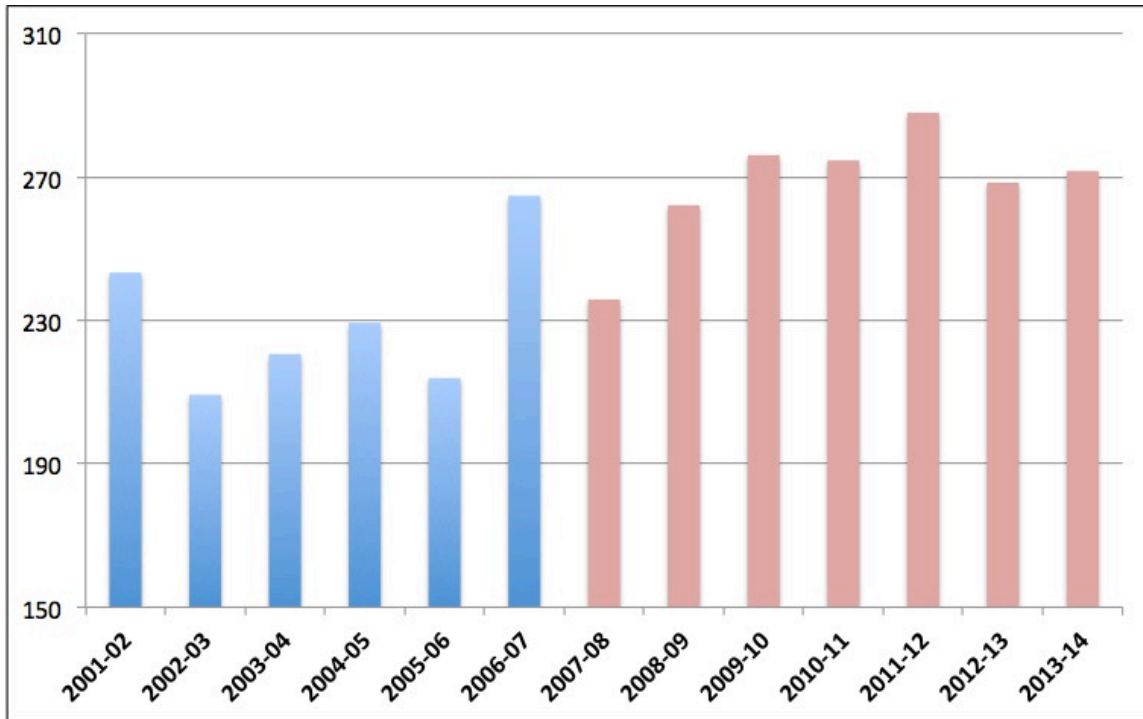


Figure 2 Body condition index in Fall

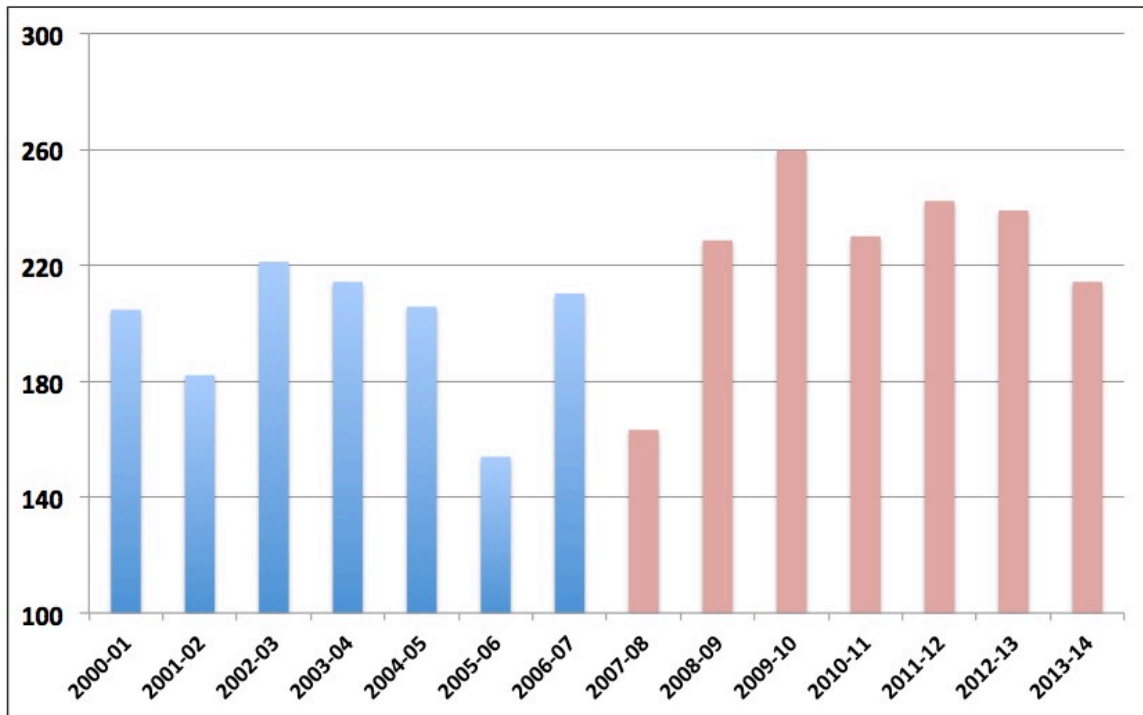


Figure 3 Body condition index in Spring

Meeting needs: While the PCH was growing in the early 2000s, respondents indicated that they increasingly met their needs (Figure 4). During the latter period (2007-2014) no trend in meeting needs was evident and in 2013-2014 the lowest percent of respondents indicated that they met their needs (39%). On average there

was little difference between the reporting periods ( $65.3 \pm 12.5$  for 2001-2007 compared to  $64.7 \pm 5.5$  for 2007-2014).

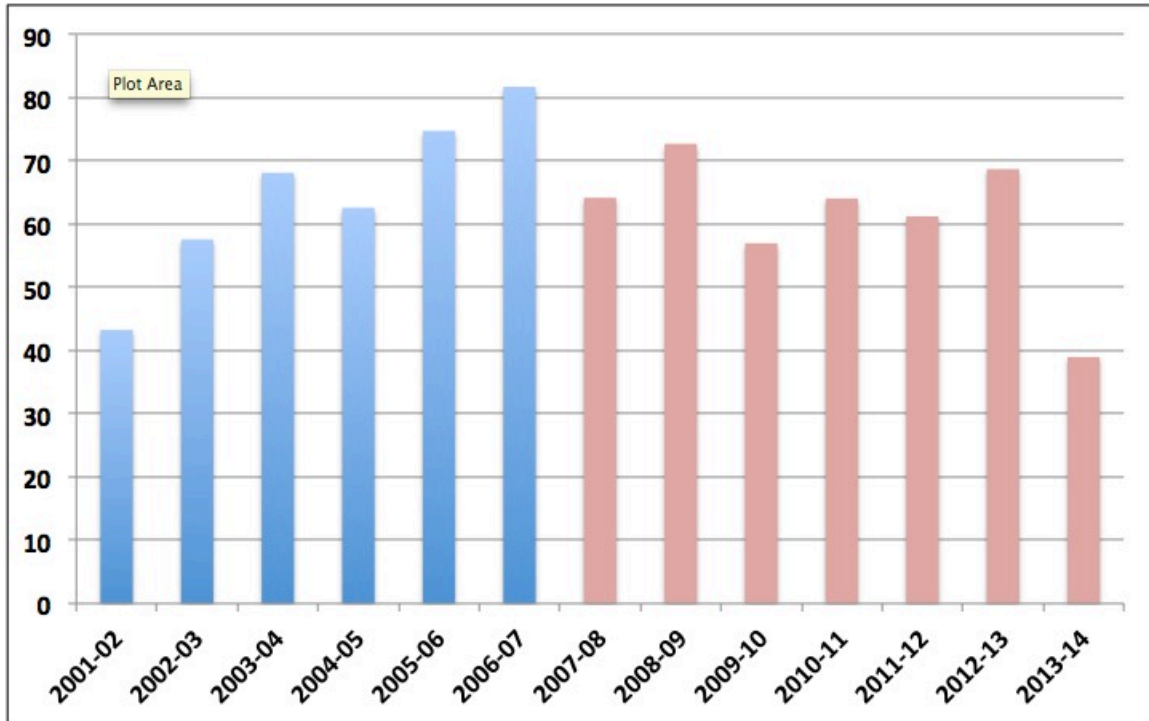


Figure 4 Percent of respondents that met their needs

Did you hunt: We noted a decline in the percent of respondents that hunted during the latter reporting period ( $86 \pm 6.8$  for 2001-2014 compared to  $75 \pm 9.3$ ; Figure 5).

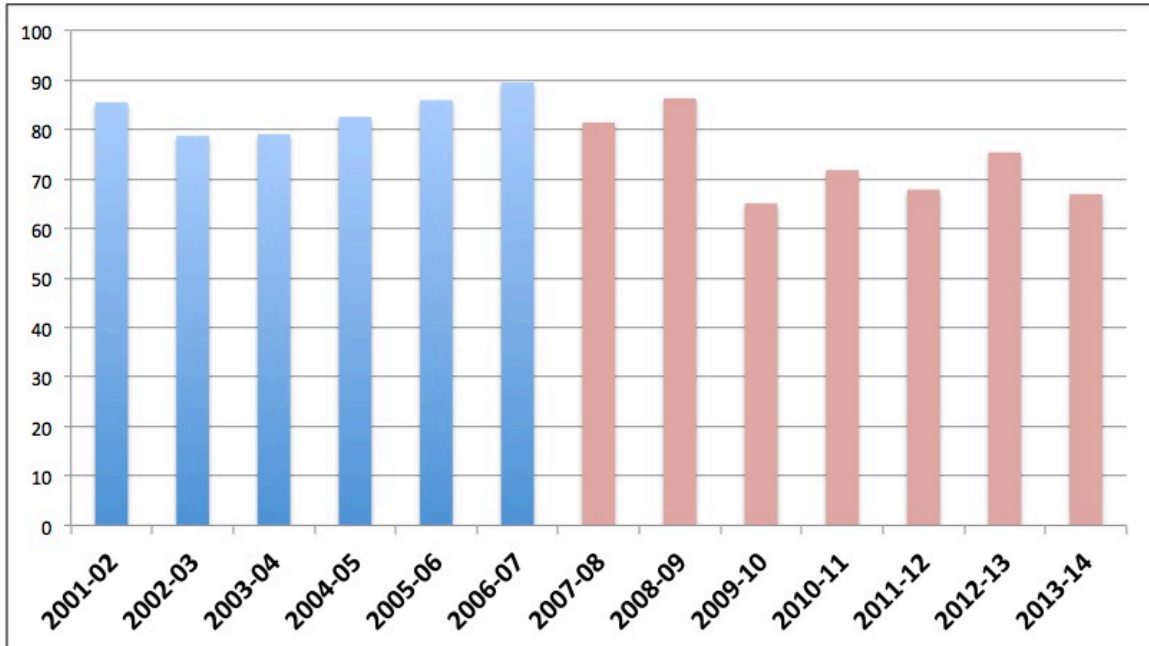


Figure 5 Percent of respondents that hunted

Size: A question on the “size” of caribou that reflected an overall impression of the health of the animals was added in the last five years of interviews and was included in our analysis. From that analysis our metric “size index” peaked in 2010-2011 and has declined in both fall (Figure 6) and spring (Figure 7).

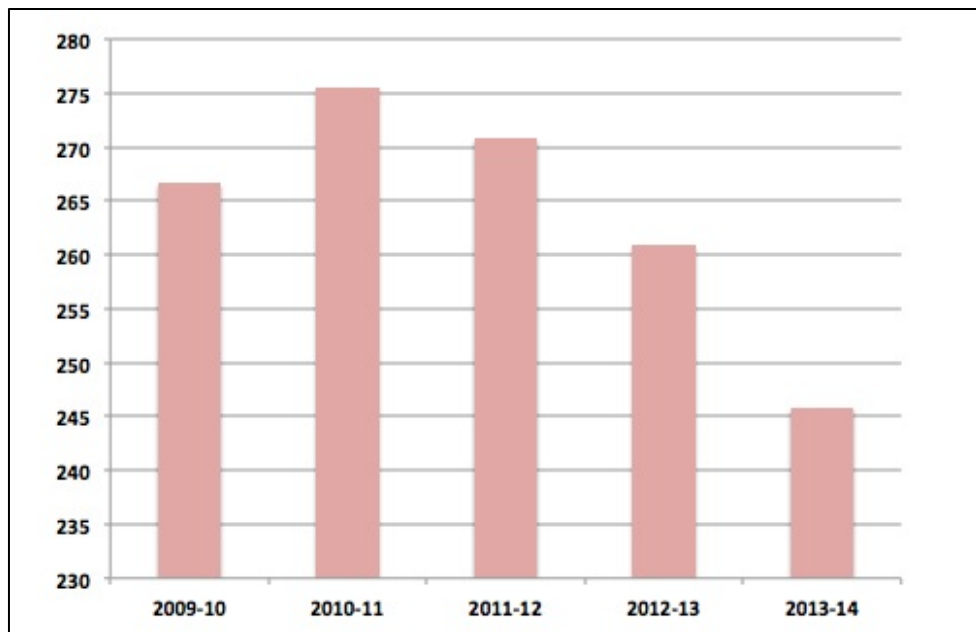


Figure 6 Body size index in Fall

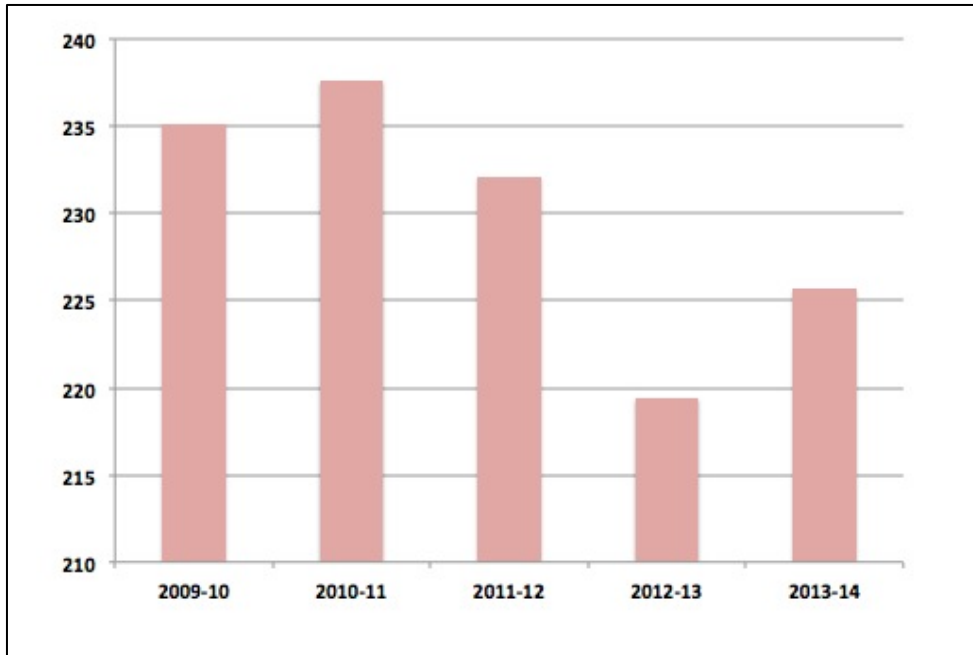


Figure 7 Body size index in Spring

Abundance: Caribou abundance was also addressed in the last four years of interviews. Respondents were asked if cows, calves and bulls were more, same or less abundant than the previous year (Figure 8). Although there were no obvious trends we did note that 2011-12 interview was a year of reduced abundance for all seasons and cohorts. Among cohorts cows were the least variable in annual abundance (Figure 8).



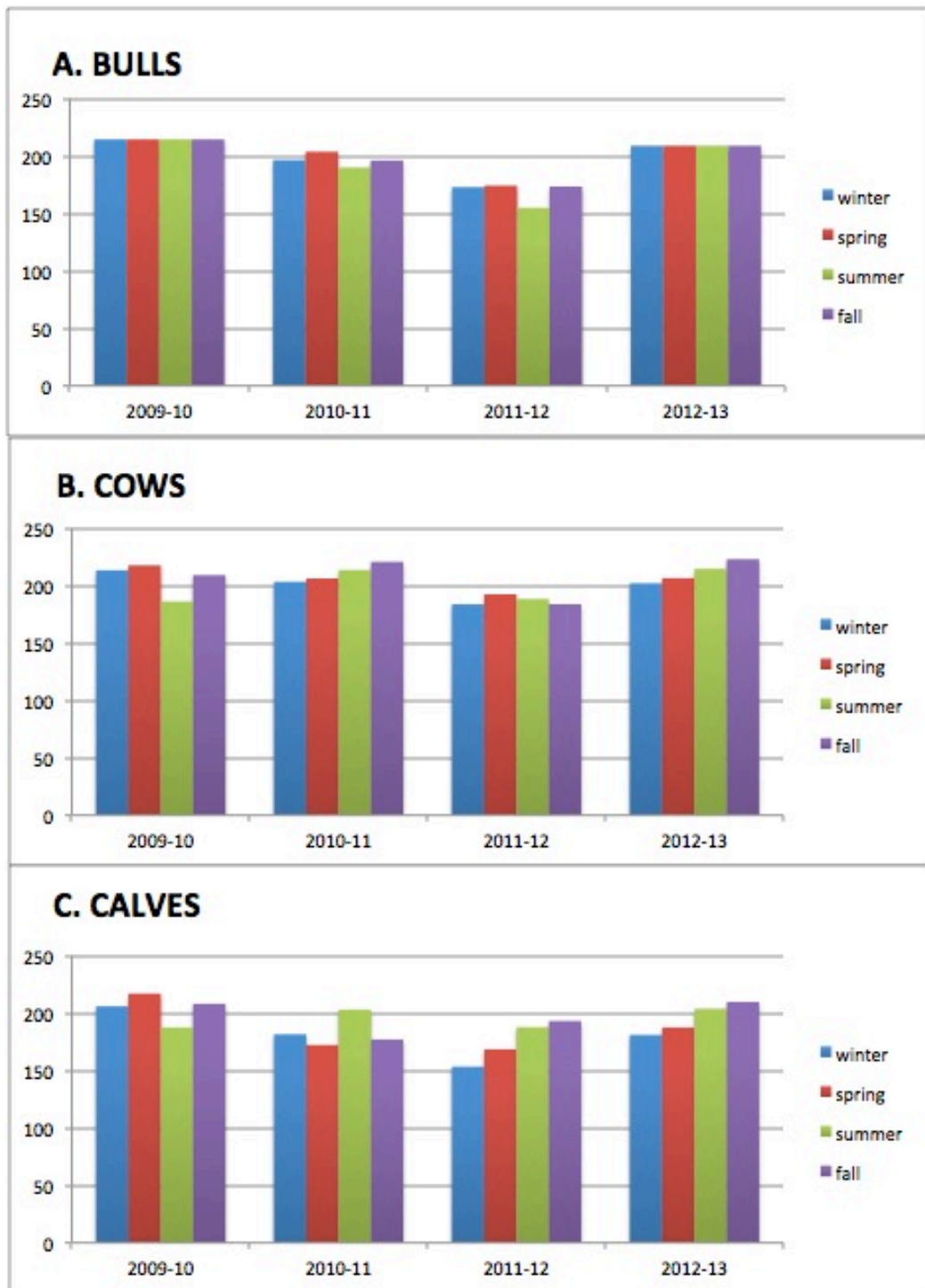


Figure 8 Seasonal abundance of A. Bulls, B. Cows and C. calves compared to last year

## Climate indicators:

### Winter range:

Snow depth on March 31 has shown a declining trend since 1990 (Figure 9). For the 2001-2007 reporting period average depth was 25.5 compared to 25.2 for the 2008-2014 period.

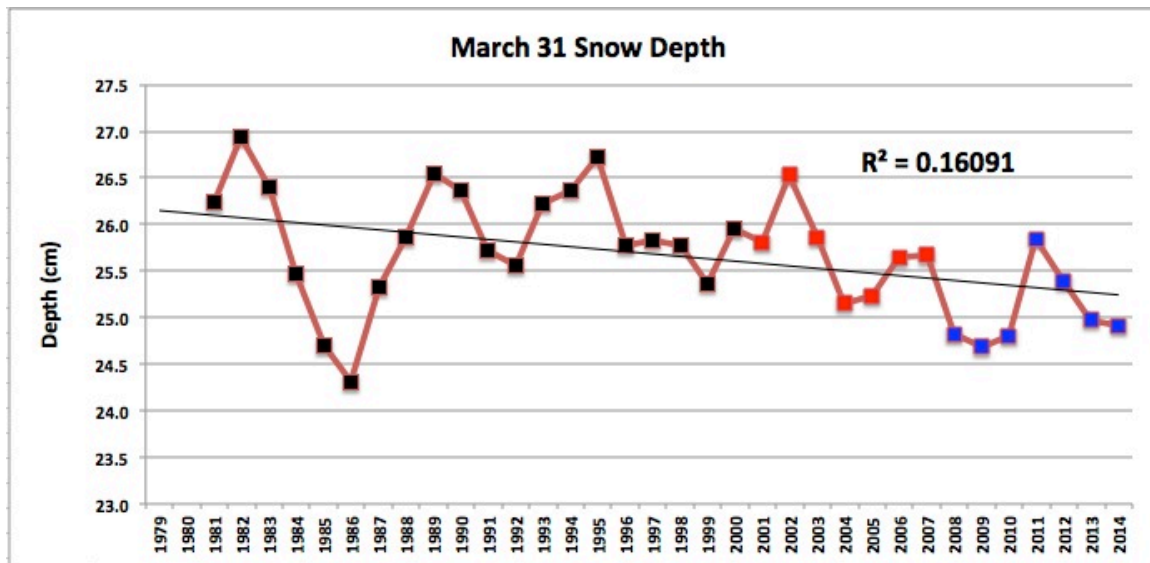


Figure 9 Snow depth (3-year running average, cm) on March 31 for the PCH winter range (red markers represent the 2001-2008 interview reporting period; blue markers the 2008-2014 period).

### Spring range:

Snow on ground in mid May indicated the progress of snowmelt on the spring range. We note two peaks in depth in the mid 1980s and the early 2000s. The 2008-2014 period has shown a slow increase in depth (average 10.2 cm) compared to a declining trend in the 2001-2007 period (average 9.8; Figure 10) although average depths are similar.

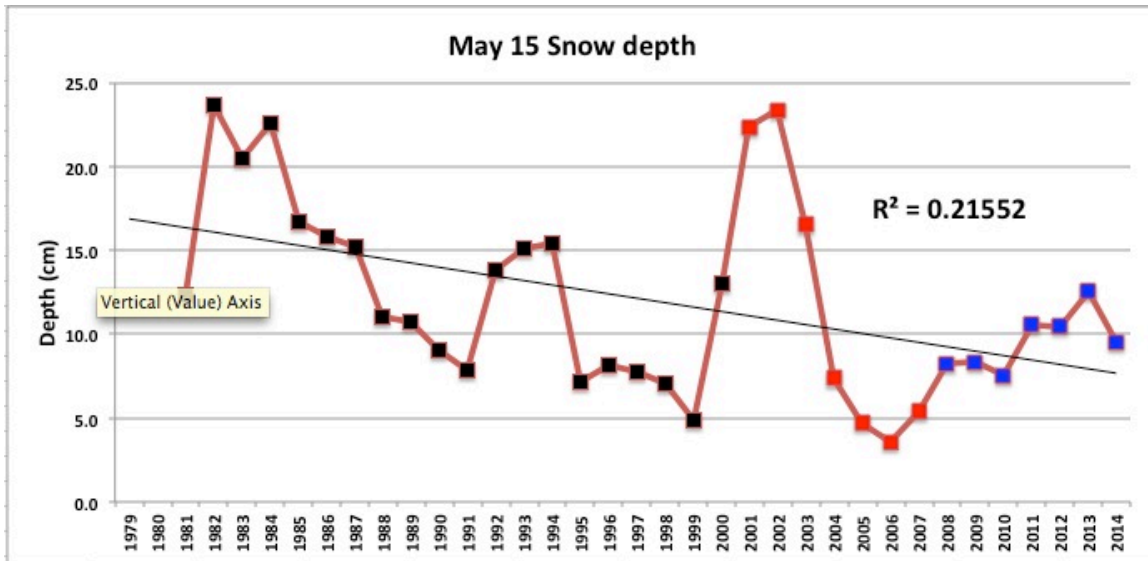


Figure 10. Snow depth (3-year running average, cm) on May 15 for the PCH spring range (red markers represent the 2001-2008 interview reporting period; blue markers the 2008-2014 period).

The growing degree-days on June 10 indicate the potential plant phenology stage just after the peak of calving in the PCH. Figure 11 indicates that there was an increasing trend from 2001 to 2011, declining to present day. We also see a gradual increasing trend throughout the climate record, peaking in 2011.

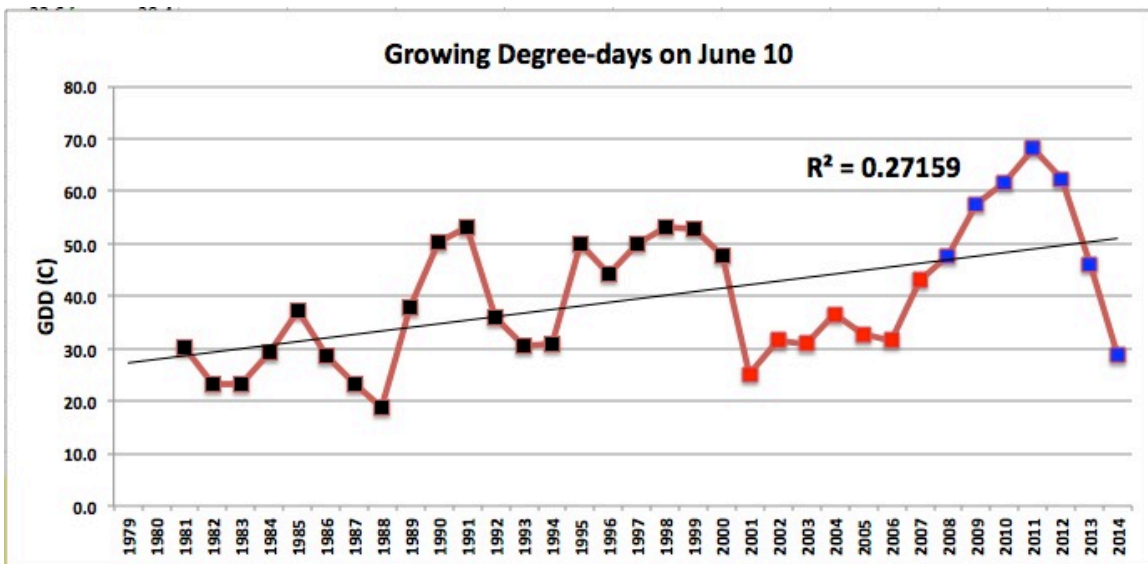


Figure 11. Growing degree-days on June 10 for the PCH calving grounds (red markers represent the 2001-2008 interview reporting period; blue markers the 2008-2014 period).

### Summer range:

Our index of summer drought conditions is important to estimate forage quality and quantity. Compared to the late 1980s and 1990s the decades in the 2000s are characterized by more favourable drought conditions (Figure 12), thus potentially better forage conditions.

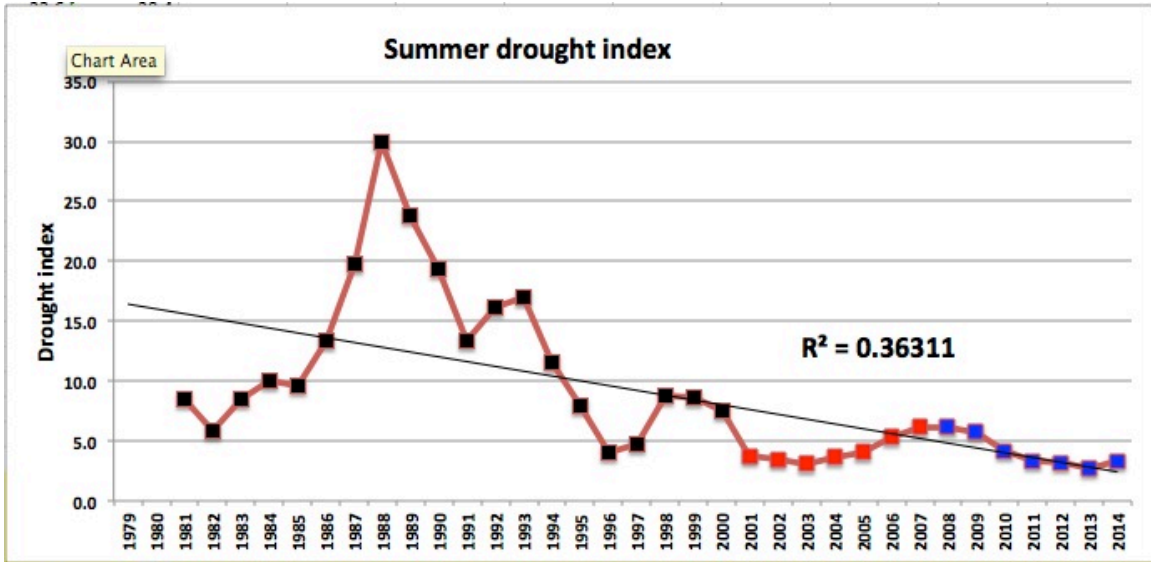


Figure 12. Summer drying index on PCH summer range (mean daily index in July) from 1979-2014 (red markers represent the 2001-2008 interview reporting period; blue markers the 2008-2014 period).

There was a slight increasing trend in Oestrid index since 1979. Currently the levels are similar to high values in the 1990s. For the interview reporting periods (2001-2007 and 2008-2014) a generally increasing trend has been occurring.

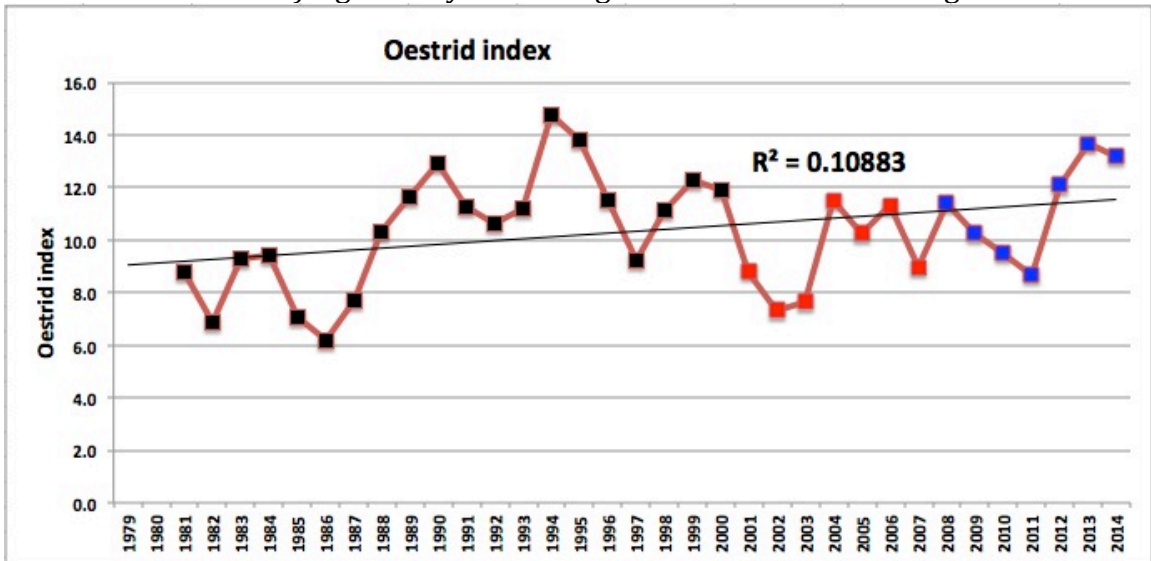


Figure 13. Cumulative oestrid index to August 5 on PCH summer range from 1979-2014 (red markers represent the 2001-2008 interview reporting period; blue markers the 2008-2014 period).

**Fall range:**

Mushroom can provide a valuable source of protein for caribou in late summer and fall after the senescence (lignification) of forbs, shrubs and graminoids, especially

considering the high nitrogen levels combined with high digestibility (Launchbaugh & Urness 1993). For adult females increased levels of nitrogen in the diet entering the breeding season can lead to improved chances of ovulating and getting pregnant. Figure 14 indicates an increasing trend from 1986 to 1998 followed by relatively stable conditions since 2001.

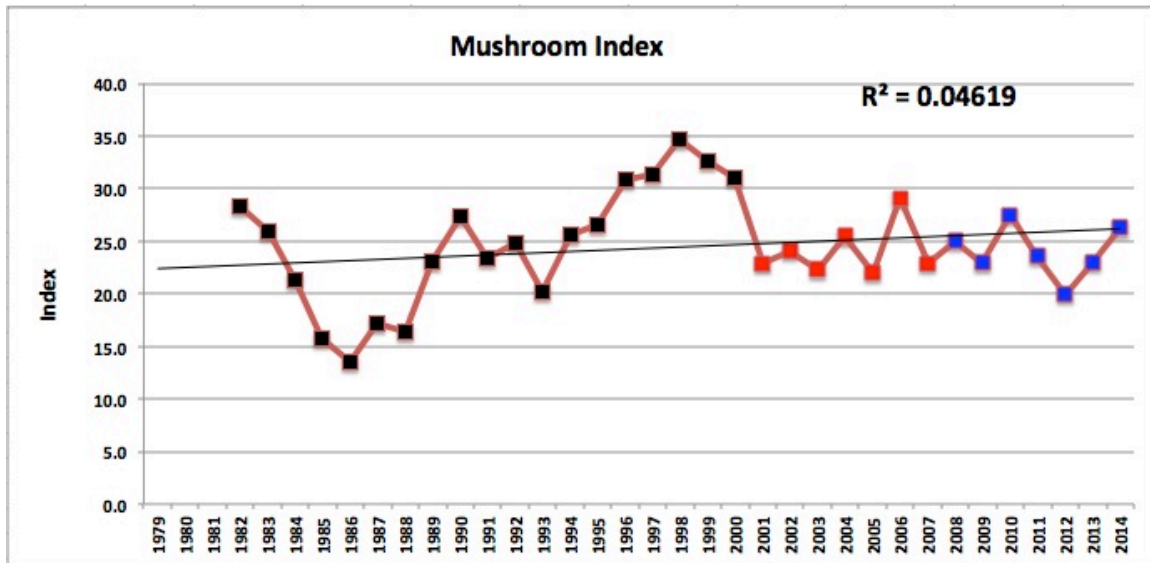


Figure 14. Annual mushroom index on PCH fall range between 1979-2014 (red markers represent the 2001-2008 interview reporting period; blue markers the 2008-2014 period).

## DISCUSSION

### Interviews:

During the ABEKC reporting periods (2001-2007; 2008-2014) the PCH has increased from 123,000 to 197,000. As reported by Russell et al (2013a), interviews between 2001-2007 supported this population increase with respect to increasing 1) availability, 2) meeting harvest needs and 3) caribou health among PCH user communities participating on the ABEKC interviews. In this present update, as the PCH increased through the latter period (2007-2014) to 197,000 we note that although availability and meeting needs remained high, estimates did not track the increasing trend in caribou numbers. We assume that these results could reflect a threshold population size above which caribou availability and the ability of hunters to meet their subsistence needs do not increase. There remain a number of reasons, not related to population size, that prevents hunters from meeting their needs and which do not result in increased caribou availability.

In contrast to high indicators for availability and meeting needs, our analyses indicated that the body size of caribou is showing initial signs of decline. Other studies have shown that adult females have on average reduced body size within 5 years before population peaks (Couturier et al 2010). Thus these results may

indicate that the PCH is close to peaking in abundance again and within the next one or two population censuses results could indicate lower population estimates.

#### *Climate indicators:*

Analysis of climate data indicated a:

- decreasing trend in winter snow depth
- more variable but generally declining trend in mid May snow depths, although a noticeable peak in 2002
- generally increasing trend in June 10 growing degree-days although peaking in 2011
- currently low index for summer drying in contrast to high drying conditions in the late 1980s and 1990s
- increasing trend in oestrid index with current values similar to 1990s peak
- increasing mushroom index from 1989-1998 followed by relatively stable conditions throughout the 2000s.

A number of these more recent climate trends are consistent with better habitat conditions within the range of the PCH. Reduced winter snow depths, earlier spring melt, earlier green-up, low values for July drought conditions all would enhance forage acquisition and quality. With respect to observations within communities, we would have to combine regional climate conditions with the timing and spatial extent of annual movements of caribou to more confidently link community observations with the broader range conditions.

## **MANAGEMENT IMPLICATIONS**

An integrated monitoring program that considers information from a variety of sources enhances management of migratory caribou populations. Russell et al (2013a) reported on seven years of community interview data that indicated that the PCH was a healthy, growing herd. These observations were made in the absence of population data due to a number of environmental, logistical and herd distribution problems. Subsequent surveys estimated that the herd was growing, verifying interview response data. The herd has continued to grow and our current analysis provides another seven years of community observations. These observations indicate that although the herd has continued to grow, the availability of caribou and the ability of hunters to meet their needs have not tracked this further population increase. One possible explanation is that beyond a certain population size other factors such as time on the land, logistics, economics or herd distribution may become a regulatory factor with respect to harvest success. Of possible significance in our analysis is the hint of declining caribou “size”, known to precede a peak the herd abundance. We would recommend that interviews continue to be a valued component of an integrated monitoring program.

CARMA's climate data has not been a consistent data source used as part of an integrated monitoring program, indicators can help to interpret agency and community observations. Although it was beyond the scope of this report we did note a number of significant trends in the climate record which can be used to help explain the abundance and condition of the PCH.

## Acknowledgements

*To be written.*

## REFERENCES

Caikoski J. 2014. 2013 Surveys of the Porcupine Caribou Herd – parturition, post-calving, and photocensus. Unpublished Memo 10 pp

Couturier S, Otto RD, Côté SD, Luther G, Mahoney SP. 2010. Body size variations in caribou ecotypes and relationships with demography. *J. Wildl. Manage.* 74(3): 395-404

Griffith, B., D. C. Douglas, N. E. Walsh, D. D. Young, T. R. McCabe, **D. E. Russell**, R. G. White, R. D. Cameron, and K. R. Whitten. 2002. The Porcupine caribou herd. Pages 8-37 *in* D. C. Douglas, P. E. Reynolds, and E. B. Rhode, editors. Arctic Refuge coastal plain terrestrial wildlife research summaries. U. S. Geological Survey, Biological Resources Division, Biological Science Report USGS/BRD BSR-2002-0001.

Launchbaugh, K.L.&Urness, P.J. 1993: Mushroom consumption (mycophagy) by North American cervids. *Great Basin Naturalist* 52: 321-327.

Russell, D. E., M. Y. Svoboda, J. Arokium, and D. Cooley. 2013a. Arctic Borderlands Ecological Knowledge Cooperative: can local knowledge inform caribou management? *Rangifer*, 33, Special Issue No. 21, 2013: 71–78

Russell, D.E., P.H. Whitfield, J. Cai, A. Gunn, R.G. White and K. Poole. 2013b. CARMA's MERRA-based caribou climate database. *Rangifer*, 33, Special Issue No. 21:145-152.