Protocol Development Summary

Protocol: Dall's sheep

Parks where this would be implemented: CAKR, GAAR, KOVA, NOAT

Justification/Issues being addressed:
Dall's sheep (*Ovis dalli*) occur throughout the alpine areas of ARCN parks, and the Brook's Range is the northernmost extent of their range. The National Park Service is mandated by the Alaska National Interest Lands Conservation Act (ANILCA) (Section 201 (4)(a)) "to protect . . . populations of . . . Dall's sheep" (Section 201 (4)(a)), "to provide the opportunity for continued subsistence uses" (Section 801 (4)), and "[to conserve] natural and healthy populations" (Section 814(1)). Dall's sheep can be legally hunted in all of the ARCN units by qualified subsistence users, and sport hunting for sheep is permitted in the preserve portion of Gates of the Arctic and in Noatak National Preserve. For park visitors, Dall's sheep are the most reliably viewed large mammal within the parks because they do not migrate and they are more numerous than are moose, wolves, bears or muskoxen.

ARCN harbors a substantial proportion of the world's population of Dall's sheep, which was estimated at 100,000 animals in 1990 (Valdez and Krausman 1999). In the early 1980s, Singer (1983, 1984) estimated 15,000 Dall's sheep in the approximately 41,000 km^2 of sheep habitat in the ARCN park units. In 2005, 2006, and 2007 aerial surveys were conducted to update the population estimate based on stratified random sampling of survey units. In 2005, 9950 sheep (±2568 95% CI) were estimated for the region; 9304 sheep (±3265 95% CI) in 2006; and 8115 sheep (±3134 95% CI) in 2007 after the minimum count for those survey years were analyzed using Gasaway et al. (1986). Dramatic changes in Dall's sheep populations, such as the decline observed in the Brooks Range in the 1990s, have been attributed to environmental conditions, such as severe winters (Brubaker and Whitten 1998, Lawler 2004). Sheep population trends are a good indicator of local environmental change because of the stationary nature of sheep and their sensitivity to environmental conditions.

Specific Monitoring Questions and Monitoring Objectives to be Addressed by the Protocol:
Some of the specific monitoring questions that will be addressed by this protocol include:

1. What is the abundance of Dall's sheep in ARCN?
2. What is the sex and age composition of sheep at two areas of high management concern in ARCN (Itkillik Preserve in GAAR and Baird Mountains in NOAT)?
3. Are sheep diets changing in these two selected areas?

Our specific objectives are to:

1. Determine status and long-term trends in Dall's sheep abundance across ARCN where there is available sheep habitat.

2. Determine status and trends in Dall's sheep sex and age composition at two areas of high management concern in ARCN (Itkillik Preserve in GAAR and the Baird Mountains in NOAT).
3. Determine long-term trends in Dall's sheep diets in the Itkillik Preserve and Baird Mountains.

Basic Approach:
The first two objectives are the top priorities for the Dall's sheep monitoring program. The third objective provides valuable information regarding the health and status of Dall's sheep populations in two areas of high management concern. These two areas are of high management concern because the majority of Dall's sheep hunting pressure in ARCN occurs in these two areas. Data collected in these two areas will provide valuable information regarding the status of local sheep populations that may be representative of regional trends, but these objectives will be approached adaptively depending on funding and time allocated to this vital sign over the life of the ARCN I&M program.

Surveys for abundance and distribution will be done on a tiered basis. Tier 1 involves intensive surveying in two reference areas in ARCN where there is relatively high sheep density, long term population datasets, sport hunting pressure and more easily accessible survey areas: Itkillik Preserve in GAAR and Baird Mountains in NOAT. For these two areas, aerial direct count surveys will be conducted using small, fixed-wing aircraft with one pilot and one observer. These areas will be surveyed as a census every three years. Sightability during aerial surveys may vary considerably from year to year suggesting the need to utilize a sightability index when estimating sheep populations from survey data. Udevitz et al. (2006) determined a sightability index for Dall's sheep in the Baird Mountains that will be applied to Tier 1 surveys.

Tier 2 surveys will be conducted ARCN-wide on a less frequent basis (every 5 years) to update the population and distribution estimates for the region. Tier 2 surveys will be conducted using distance sampling theory (Buckland et al. 2001) with the goal of generating abundance estimates for two target sampling areas:
1) GAAR as a whole, and
2) delineated sheep habitat in WEAR (NOAT, CAKR, KOVA).

Contour transects will be selected randomly throughout each study area to provide an abundance estimate for the entire park/unit. These methods will also provide annual sightability estimates which have been problematic in the past. The plan is to alternate distance sampling between the two areas so that each is sampled at least every five years.

Interest in monitoring Dall's sheep is not restricted to ARCN. The Central Alaska Network (CAKN) also lists Dall's sheep as a vital sign and has investigated different methodologies for monitoring. The feasibility of using distance sampling for Dall's sheep is unknown. For this reason, we will collaborate with CAKN to develop methodology that can be utilized by both networks. In years 2009 and 2010 we will test contour transects as a means of estimating abundance using distance sampling and we will compare our results to the abundance estimates derived in 2005, 2006 and 2007 from

stratified random sampling of the region.

Ground surveys are also planned in the Itkillik Preserve (GAAR) and the Baird Mountains (NOAT) to monitor sheep diets. Fecal pellets will be collected where sheep are observed to be actively grazing both in the late winter and in the summer post lambing. The pellets will be analyzed using microhistological methods to examine diet composition during those seasons. Integration with the Vegetation and Soils vital sign will provide insights into Dall's sheep diets and will provide valuable information for researchers. Our understanding of Dall's sheep ecology will be improved by correlating Dall's sheep abundance and composition trends with climate, weather, and snow monitoring data. This vital sign will also be linked with the Subsistence/Harvest vital sign.

Principal Investigators and NPS Lead:
The principal investigators for developing this monitoring program will be Kumi Rattenbury (ARCN Ecologist) and Josh Schmidt (CAKN Data Manager).

Development Schedule, Budget, and Expected Interim Products:
ARCN began a network-wide Dall's sheep survey in 2005 with sampling in the summers of 2005, 2006, and 2007. Population estimates have been derived for the network using Gassaway et al. (1986). Field work in FY 2008 involved census aerial surveys of the Itkillik Preserve and Baird Mountains, although the Baird Mountains could not be surveyed due to weather. The protocol will be developed on the following schedule:

- December 2008: Draft protocols and SOPs of census and microhistological work ready for peer review
- Summer 2009: Field test methodology ($60,000).
- Fall 2009: Evaluate and modify methodology for contour transects.
- Summer 2010: Final field testing of methodology ($20,000).
- December 2010: Draft protocols and SOPs for contour transects completed.
- Spring 2011: Complete protocol reviewed, finalized and implemented.

Literature Cited:
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