

Heterogeneity in Risk-Sensitive Allocation of Somatic Reserves in Bighorn Sheep

RACHEL A. SMILEY, Haub School of the Environment and Natural Resources, Wyoming
Cooperative Fish and Wildlife Research Unit, Department of Zoology and Physiology,
University of Wyoming, 804 E Fremont Street, Laramie, WY, 82071, USA, rsmiley2@uwyo.edu

BRITTANY L. WAGLER, Haub School of Environment and Natural Resources, Wyoming
Cooperative Fish and Wildlife Research Unit, Department of Zoology and Physiology,
University of Wyoming, 804 E Fremont Street, Laramie, Wyoming, 82071, USA

TAYLER N. LASHARR, Haub School of Environment and Natural Resources, Wyoming
Cooperative Fish and Wildlife Research Unit, Department of Zoology and Physiology,
University of Wyoming, 804 E Fremont Street, Laramie, Wyoming, 82071, USA

KRISTIN A. DENRYTER, Alaska Department of Fish and Game, Palmer, AK, 99645, USA

THOMAS R. STEPHENSON, Sierra Nevada Bighorn Sheep Recovery Program, California
Department of Fish and Wildlife, 787 N Main Street, Suite 220, Bishop, California, 93514, USA

ALYSON B. COURTEMANCH, Wyoming Game and Fish Department, 420 N Cache Street, Jackson,
Wyoming, 83001, USA

TONY W. MONG, Wyoming Game and Fish Department, 2720 St. Highway 120, Cody, Wyoming,
82414, USA

DARYL LUTZ, Wyoming Game and Fish Department, 260 Buena Vista Drive, Lander, Wyoming, 82520,
USA

DOUG MCWHIRTER, Wyoming Game and Fish Department, 420 N Cache Street, Jackson,
Wyoming, 83001, USA

DOUG BRIMEYER, Wyoming Game and Fish Department, 5400 Bishop Boulevard,
Cheyenne, Wyoming, 82006, USA

PATRICK HNILICKA, US Fish and Wildlife Service, 170 N First Street, Lander, Wyoming, 82520, USA

BLAKE LOWREY, Fish and Wildlife Ecology and Management Program, Department of
Ecology, Montana State University, Bozeman, Montana, 59718, USA

KEVIN L. MONTEITH, Haub School of Environment and Natural Resources, Wyoming
Cooperative Fish and Wildlife Research Unit, Department of Zoology and Physiology, University of
Wyoming, 804 E Fremont Street, Laramie, Wyoming, 82071, USA

ABSTRACT: Patterns of food quality and availability, when combined with energetic demands in seasonal environments, shape resource acquisition and allocation by animals and holds consequences for life-history strategies. Long-lived species with extensive maternal care, regulation of somatic reserves can occur in a risk-sensitive manner, wherein resources are preferentially allocated to support survival at the cost of investment in reproduction. We investigated how Rocky Mountain bighorn sheep (*Ovis canadensis*), an alpine mammal in a highly seasonal environment, allocate somatic reserves (i.e., energy and protein) across seasons. We hypothesized that, in accordance with the risk-sensitive resource allocation hypothesis, accretion and catabolism of somatic reserves would be regulated relative to pre-season nutritional state, reproductive state, and vary among populations in accordance with local environmental conditions. We monitored seasonal changes of percent ingesta-free body fat (IFBFat) and ingesta-free, fat-free body mass (IFFFBMass) in three populations of bighorn sheep in northwest Wyoming between 2015 and 2019 through repeated captures of female sheep in December and March of each year in a longitudinal study design. Allocation of somatic reserves was risk sensitive and varied

relative to the amount of somatic reserves an animal had at the beginning of the season. Regulation of fat reserves was sensitive to reproductive state and differed by population, particularly over the summer. In one population with low rates of recruitment, sheep that recruited offspring lost fat over the summer in contrast to the other two populations where sheep that recruited gained fat. And yet, all populations exhibited similar changes in fat catabolism and risk sensitivity over winter. Deviations in magnitude of risk sensitivity across seasons may be indicative of sufficiency in seasonal ranges to meet energetic demands of survival and reproduction. Risk sensitive allocation of resources was pervasive suggesting nutritional underpinnings are foundational to behavior, vital rates, and ultimately, population dynamics. For species living in alpine environments, risk-sensitive resource allocation may be essential to support reproduction and survival.

Biennial Symposium of the Northern Wild Sheep and Goat Council 23:51-52; 2022

KEY WORDS: Rocky Mountain bighorn sheep, body fat, body mass, energetic demands, Wyoming.