



## **An Exploration of Metabolomics to Assess Physiological States in Bighorn Sheep**

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**ABSTRACT:** Wildlife biologists have limited and relatively crude tools for assessing the health, physiology, and nutritional condition of bighorn sheep and other wild ungulates yet physiological attributes of an animal play a fundamental role in susceptibility to disease, reproduction, probability of survival, and can provide insights into the relative quality of landscapes occupied. Nuclear Magnetic Resonance spectroscopy (NMR) is an emerging technology that can identify and quantify a large suite of biological molecules (metabolites) in a blood serum sample that are products of a wide range of physiological processes. NMR-based metabolomics is being aggressively developed in the fields of human medicine and agriculture animal production in the pursuit of discovery of disease biomarkers and to detect metabolic shifts in a myriad of physiological pathways that can be bioindicators of nutritional and other environmental stresses. To explore the potential of this technology for wildlife management we collected 949 serum samples from 14 wild bighorn sheep herds in Montana and Wyoming, as well as samples from two captive research herds. These samples represented animals suspected of experiencing a range of physiological conditions including gradients in dietary intake, degree and duration of starvation, and transitions from a healthy to a disease (pneumonia) state. Sample processing and assay techniques were refined, and we successfully developed a library of 81 metabolites that can be accurately identified and quantified. We report on our analyses of these metabolic profile data to develop a 'health panel' to assess physiological states in bighorn sheep to inform restoration and management.

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**KEYWORDS** Bighorn sheep; *Ovis canadensis*; Nuclear Magnetic Resonance spectroscopy; physiology; metabolites; health; health panel; nutritional condition.