

Maternal Investment Partitioning of Bighorn Sheep: Do Chronic Shedders Exhibit an Inferiority Complex?

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ABSTRACT Life history theory predicts how natural selection should shape the way iteroparous individuals such as bighorn sheep (*Ovis canadensis*) should partition resources to optimize their survival and reproductive success. Reproduction is energetically costly due to maternal care, provisioning milk intake, and vigilance. Maternal care results in a fitness deficit for the dam causing a maternal investment trade-off between current reproduction and the long-term survival of the dam. In species in which male reproductive success exceeds that of females, extra parental investment would favor sons over daughters. The Trivers-Willard hypothesis predicts that dams in superior health will invest more heavily in the progeny sex with greater expected lifetime reproductive success. Adult ewes housed at the South Dakota State University Captive Wildlife Research Unit have known *Mycoplasma ovipneumoniae* shedding histories; thus, animals used in this study vary relative to their health status. Our research objective was to compare offspring investment and progeny sex ratios of individual bighorn sheep females as a function of the overall time in our study in which they actively shed *M. ovipneumoniae*. We predicted that bighorn sheep dams will differentially partition parental investment based on the female's current pathogen shedding status, with shedding-negative ewes investing greater resources in offspring than would shedding-positive ewes (that latter strategy would conserve resources for subsequent reproduction). We also predicted that shedding-negative females would differentially partition greater resources to male than to female lambs in order to increase reproductive payoff, whereas shedding-positive ewes would produce more female than male lambs (females being less costly to raise than males).

To categorize each ewe by shedding status, we used individual serial samples collected from 2014–2015 to estimate overall *M. ovipneumoniae* apparent prevalence, using 1 of 3 classes: Negative ($\leq 25\%$), Intermittent (26–74%), or Chronic ($\geq 75\%$). From May–September 2015, we recorded the duration and frequency of suckles allowed by ewes categorized as shedding-negative ($n = 8$), shedding-intermittent ($n = 6$), and shedding-chronic ($n = 4$) ewes. We indexed daily maternal investment by estimating the amount of milk allocated to lambs. We did this by multiplying the mean suckling duration by the mean “ewe rate” (acts-per-active-hour). We used analysis of covariance (ANCOVA) to investigate the effect of pathogen shedding status on the weekly means of rate and duration of suckles. These means were weighted by number of successful suckles to account for *M. ovipneumoniae*-associated lamb mortality. We recorded lamb

sex and used a Pearson's χ^2 test to determine if *M. ovipneumoniae* shedding-negative ewes produced a greater number of male progeny than shedding-chronic ewes.

Our preliminary findings suggest that maternal investment was similar among the 3 shedding groups, i.e., that *M. ovipneumoniae* pneumonic infected ewes exhibited more fitness plasticity than previously supported in the literature. Infected ewes invested as much in their offspring as did uninfected ewes. Our preliminary results indicated no difference in progeny sex born to ewes of varying health status, suggesting that shedding-positive ewes may favor current reproduction over long-term survival. Identifying life history trade-offs between *M. ovipneumoniae* shedding dams and investment in their offspring provides information critical to management of declining bighorn sheep populations.

Biennial Symposium of the Northern Wild Sheep and Goat Council 20: 103-104.

KEY WORDS disease, maternal investment, *Mycoplasma ovipneumoniae*, pathogen, progeny