

Contrasting seasonal and aseasonal environments across stages of the annual cycle in the rufous-collared sparrow, *Zonotrichia capensis*: Differences in endocrine function, proteome and body condition

González-Gómez P.L.

Echeverria V.

Estades C.F.

Perez J.H.

Krause J.S.

Sabat P.

Li J.

Kültz D.

Wingfield J.C.

The timing and duration of life-history stages (LHSs) within the annual cycle can be affected by local environmental cues which are integrated through endocrine signalling mechanisms and changes in protein function. Most animals express a single LHS within a given period of the year because synchronous expression of LHSs is thought to be too costly energetically. However, in very rare and extremely stable conditions, breeding and moult have been observed to overlap extensively in rufous-collared sparrows (*Zonotrichia capensis*) living in valleys of the Atacama Desert—one of the most stable and aseasonal environments on Earth. To examine how LHS traits at different levels of organization are affected by environmental variability, we compared the temporal organization and duration of LHSs in populations in the Atacama Desert with those in the semiarid Fray Jorge National Park in the north of Chile—an extremely seasonal climate but with unpredictable droughts and heavy rainy seasons. We studied the effects of environmental variability on morphological variables related to body condition, endocrine traits and proteome. Birds living in the seasonal environment had a strict temporal division of LHSs, while birds living in the aseasonal environment failed to maintain a temporal division of LHSs resulting in direct overlap of breeding and moult.

Further, higher circulating glucocorticoids and androgen concentrations were found in birds from seasonal compared to aseasonal populations. Despite these differences, body condition variables and protein expression were not related to the degree of seasonality but rather showed a strong relationship with hormone levels. These results suggest that animals adjust to their environment through changes in behavioural and endocrine traits and may be limited by less labile traits such as morphological variables or expression of specific proteins under certain circumstances. These data on free-living birds shed light on how different levels of life-history organization within an individual are linked to increasing environmental heterogeneity. © 2018 The Authors. Journal of Animal Ecology © 2018 British Ecological Society

life-history stages

proteomics

seasonality

stress

testosterone

thyroid

annual cycle

body condition

environmental cue

environmental gradient

gene expression

heterogeneity

hormone

life history

morphology

passerine

proteomics

seasonality

testosterone

Atacama Desert

Bosque Fray Jorge National Park

Chile

Coquimbo

Animalia

Aves

Passeridae

Zonotrichia capensis

proteome

animal

Chile

life cycle stage

season

sparrow

Animals

Chile

Life Cycle Stages

Proteome

Seasons

Sparrows