

Wild animals in poorer body condition sleep less to forage more

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The allocation of time spent sleeping and foraging is a trade-off in wild animals, and the balance determines body condition, physiological recovery, predation risk, and ultimately survival and reproductive success. However, the variation of time-activity budgets with body condition (fat stores) has only been measured as cross-sectional "snapshots". Using multiple bio-logging tags on 14 elephant seals for over 3000 days, we showed that animals in poorer (skinnier) body condition prioritize foraging over sleeping to recover fat stores for the next breeding season. We measured time allocated to sleeping by characterizing behavioral sleep, foraging success by counting feeding events from jaw-motion recorders, and locomotory costs by measuring flipper beat activities from stroke loggers, in relation to fat stores (\propto body density) by quantifying the sinking (or floating) rate during non-active "sleeping" dive segments. Skinnier seals incurred greater locomotory costs during each dive due to a biomechanical effect of negative buoyancy, which resulted in shorter foraging dives and fewer feeding events per dive. To compensate, skinnier seals responded by sleeping less and foraging more each day to accumulate fat stores. Additionally, the number of dives each day increased due to the shorter duration of dives, and incurred extra surface recovery time. Increased time at the surface may increase predation risk from white sharks and killer whales that remain within shallower depths. These results demonstrate a fundamental mechanism of how and why skinnier seals adjust time-activity budgets to break out of the negative feedback loop stemming from decreased fat stores and negative buoyancy. Given that sleeping and foraging govern the daily lives of all wild animals, monitoring daily ethograms along with body condition can provide a critical insight into how tightly behavioral plasticity links with individual health, fitness, and population dynamics.