

the complexity of changes at multiple sites over the full life cycle of migrant birds is daunting, and these 12 papers help chart a roadmap for future study. Many of the papers illustrate and describe conservation strategies that may be employed to enhance future survival of migratory species, while most also include suggested avenues of additional research.

As anthropogenically enhanced climate change alters the ecosystems of Earth, the more we can learn about the responses of the biota of the planet the better humans can plan to protect the avifauna and other creatures of our world. *Phenological Synchrony and Bird Migration* will be a valued addition to the libraries of ornithologists, climate scientists, and anyone with an interest in understanding both how the birds are doing and how we can best plan for their continued existence.

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WOLVES ON THE HUNT: THE BEHAVIOR OF WOLVES HUNTING WILD PREY.

By L. David Mech, Douglas W. Smith, and Daniel R. MacNulty; with supplementary online video by Robert K. Landis. Chicago (Illinois): University of Chicago Press. \$50.00. xiii + 187 p. + 28 pl.; ill.; author and subject indexes. ISBN: 978-0-226-25514-9 (hc); 978-0-226-25528-6 (eb). 2015.

The wolf is one of the most widespread large carnivores of the Northern Hemisphere. If only for this reason, it is important that we understand the species' effects on the prey it hunts and the landscapes it roams. It seems most of us already think we do: whether we have seen wolves in the flesh, on a screen, or in a children's book, we have an idea of its role in the world. The wolf kills more than it eats, some say, and it decimates prized game herds. The wolf culls the sick and the weak, others say, and it keeps the world green by eliminating hungry herbivores. Whoever we are—scientist, rancher, park ranger, or laic—our ideas of this animal are strong, and often they conflict.

One common attribute of our wolf myths is that we rarely if ever cast prey as main characters. But that is to overlook the extraordinary physical and cognitive capabilities of large herbivores—and of wolves in struggling routinely to overcome them. If we underestimate prey animals in ecology, we risk overestimating predators' impact on prey populations and on landscapes. After all, cascading effects must, in the case of the wolf, transmit *through* some rather potent prey.

In my time studying wolf-elk interactions, I saw both sides of this coin. One winter a six-year-old male wolf I had collared turned up dead, encircled by elk tracks and blood. He had one dark hole in his

groin and another in his armpit. A bull elk had sunk antler tines into his body then tossed him to die in the snow. Within weeks I found a bull elk—perhaps the same one?—dead in a nearby ravine, entangled in down timber. His greasy, cream-colored bone marrow suggested he was in top shape. The remainder of the pack had simply caught him in the wrong place, at the wrong time. The wolf seemed to me a predator whose potency depends—potently—on the conditions of its hunt.

This extraordinary book, *Wolves on the Hunt*, captures that complexity very beautifully. The authors are three of the most experienced wolf biologists in the world. They have conducted many fundamental studies of wolf biology and together they have seen wolves actively hunting more than anyone in their field. The volume centers on rigorous analysis but is enriched and enlivened by firsthand observations and photographs that are meticulously curated to help readers see the hunt for themselves. The result is an already classic account of an archetypal predator-prey interaction. But, to me, the book's most important value may be to demystify the wolf at the very same time it builds our respect for the animal and its sophisticated prey. That is the greatest honor the creatures within its pages can be paid.

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NEUROBIOLOGY

THE ANCIENT ORIGINS OF CONSCIOUSNESS: HOW THE BRAIN CREATED EXPERIENCE.

By Todd E. Feinberg and Jon M. Mallatt. Cambridge (Massachusetts): MIT Press. \$35.00. xx + 366 p.; ill.; index. ISBN: 978-0-262-03433-3. 2016.

The focus of this book is to identify when and how sensory consciousness (SC) first appeared in the evolutionary records of vertebrate as well as invertebrate life forms. Four dimensions to SC are separately explored: *sensory qualia*; the subjectively experienced *unity* of SC; the *intentionality* or external-world references of qualia; and *mental causation*, that is, how SC monitors as well as initiates changes in the external world. Minimal neurobiological requirements for SC to appear are a nervous system with interconnected nerve cells, a sufficient level of neural complexity, coded representations, plus the subjective awareness of these representations. The survival benefits of SC were more complex behaviors associated with assessment of environmental inputs for appropriate predatory and/or evasive actions.