els, and to make the argument maximally relevant to the evolution of physiology, behavior, and social structure, researchers concerned with how this problem is dealt with focus upon the simplest known human societies. Answers come from anthropologists, geologists, and human biologists, including nutritionists.

Following a conference in 1982, de Garine and Harrison assembled this collection of papers on management of scarcity and uncertainty in the food supply of humans in a range of low-technology societies. The contributors are a cosmopolitan group, distinguished scholars from Europe, North America, and India. It is too bad that publication was delayed so long, as this book had important contributions to make to the field as it was five years ago.

The societies brought into the analysis include some of the standard subjects of case studies—Bushmen, Pygmies, Inuit. Among those who study these well-known hunter-gatherer societies there is increasing awareness that "pure" subsistence is rare and that trade and sale of services to neighboring food producers are the rule rather than the exception. The paper by Wilmsen and Durham is particularly good on this point. Bailey and Peacock outline the reactions to scarcity for the Efe Pygmies, and Bahuchet and Pagezy report on the Aka Pygmies and Zaire's Twa peoples, respectively. Food storage by hunter-gatherers is identified by Testart as a major dimension of variation, and Hladik, Harrison, and Stini each provide an essay on the all-important base-line concept of seasonal variability in food. Huss-Ashmore and Thomas provide a framework for analyzing uncertainty among highland peoples that seems to be generally useful.

The researchers in this volume reject the old functionalist argument from necessity wherein many features of small-scale societies were considered to be explained by the need for an equal food distribution ("otherwise the people would die out"). Empirical studies of ongoing societies, however, have revealed how difficult it is to actually measure food produced or consumed by individuals, even in very small groups. To understand the supply of food, one needs to know the mix of species consumed during the varying seasons of the year and the substitutability of those species. In addition to seasonal variations in food supply, seasons vary from year to year and on longer cycles that may or not be predictable. The sum of species or total biomass of food varies, but also the definition of what is meant by food and the relative inputs of plants and animals and of human energy, in the form of storage, preserving, processing, reconstituting, and so on. The process is enormously complicated in even the simplest societies.

And the distribution of those food resources to individuals and subgroups is also complicated. Since food may be obtained in a wide range of sites and may be consumed in private as well as in public, it requires an army of observers or a very cooperative population to find out what people are eating and where they are getting it. The editors advise researchers that a focus on body fat and other anthropometric measures is more efficient than attempting to measure calories.

The papers in this volume resist easy summary: they reflect the difficulties of fieldwork among populations that are rapidly changing and highly variable in their responses to food shortages (and surpluses) even if and when they are not undergoing rapid "modernization" and incorporation into larger social units.

Some of the other groups reported on in this collection are Hausa (Watts), Turkana pastoralists (Little *et al*), and the "peripatetic" peoples of Afghanistan (Rao and Casimir). The non-producers of food, including the hunter-gatherers, the forest-products traders, peripatetics (such as Gypsies), social bandits, and raider-warriors, are generally characterized by more efficient harvesting strategies, the use of buffers against uncertainty in the form of stored food and "stored" interpersonal obligations, and passing shortages on to other groups by appropriating their food supply. The food producers, herders, horticulturalists, and peasant or tribal-level agriculturalists are generally practicing less efficient means of assuring a steady input of food, as production must exceed consumption not only to provide for seed or stock, but also to offset losses due to insects and rodents in storage, catastrophic floods or droughts, and warfare, which is often another way of describing raids by others attempting to appropriate surplus. Attempts to shift shortages to others more often involve hierarchically arranged groups within food-producing societies than other ethnic groups, as in the case of non–food-producers. But this kind of generalization is premature while researchers are in the midst of documenting the details of how uncertainty in the food supply is coped with through weeks, months, seasons, years, and longer cycles of hardship and plenty. This volume contributes much toward an understanding of the details of some ways in which humans manage uncertainty.

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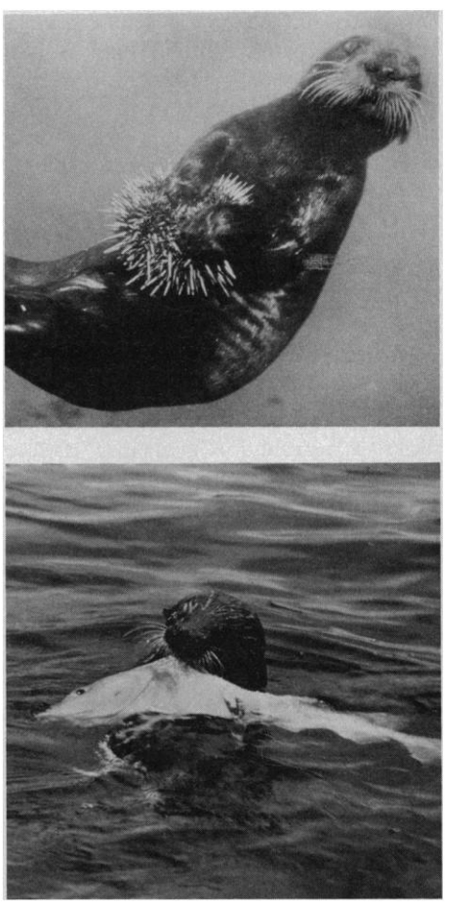
Effects of a Predator

The Community Ecology of Sea Otters. G. R. VANBLARICOM and J. A. ESTES, Eds. Springer-Verlag, New York, 1988. xvi, 247 pp., illus. $89.50. Ecological Studies, vol. 65.

The near extinction and subsequent reexpansion of sea otter (*Enhydra lutris*) populations along the west coast of North America represent one of the true success stories for conservation efforts yet have resulted in a number of controversies for environmental managers and for modern ecological theorists. This volume is an expansion of a 1985 symposium of the Western Society of Naturalists, the intent of which was to review research on the community effects of sea otters, to present the scientific controversies in an open forum for discussion, and to point out where critical information was missing. Field experiments and correlative studies demonstrated that sea otters have large effects on several prey populations, including sea urchins, crabs, clams, and abalone. Otters are thus candidates for "key-



Sea otters with prey. *Top*, carrying a sea urchin to the surface in California; *bottom*, eating a fish in Alaska. [From M. L. Riedman and J. A. Estes's chapter in *The Community Ecology of Sea Otters*; photographs by Richard Mattison and Jane Watson]

stone" species status, exerting "strong interactions" within their biotic community, in the parlance of current ecological theory. Their removal from a community, and their introduction to a community that has been without them for many decades, should thus cause major changes in community structure. In the simplest proposed scenario, based on several clear experimental studies, otters consume sea urchins that would otherwise decimate kelp populations. Urchins feeding on kelp change the nearshore rocky subtidal zone from a lush and speciose kelp bed community into a more two-dimensional and less species-rich "urchin barrens," a vast wasteland of crustose coralline algae that can resist urchin grazing indefinitely.

Stable sea otter populations might be considered beneficial to such a community, making it more like the community that was present before intense human perturbation. Kelp beds provide refuge for multitudes of fish of numerous species, owing in part to the greater habitat complexity (three dimensionality) and possibly to greater primary productivity and a rich kelp detritus-based food chain (as discussed here by Ebeling and Laur and by Duggins). Communities without otters provide abundant large urchins, abalone, and other delicacies important to sport and small commercial fisheries. Such effects are evident and demonstrable in rocky subtidal habitats, yet otters also persist along coastlines dominated by soft sediments. In the first review of otter effects on soft-substrate habitats, Kvitek and Oliver argue that otters prey preferentially on the smaller near-surface clams, whereas large clams have a refuge in deep burial. Otters do not necessarily eliminate commercially important bivalve populations even after many years of coexistence. Basic controversies for management are: can sea otter populations be allowed to expand as they are now doing, or be introduced to new sites, without decimating desirable prey species? and do otters in fact act as "keystone" predators, necessary for maintaining healthy kelp bed communities, or are there other equally important factors controlling urchin populations and thus accounting for long-term variation in kelp cover (questions expounded by Levin). Certain authors (for example, Foster and Schiel) argue that field experiments are very site-specific and cannot yet be generalized to the whole coast. Nonetheless, the effects of urchin populations on algae and other benthos (for example, mussels, reported on by VanBlaricom) are easily and repeatedly demonstrated (Estes and Harrold; Laur, Ebeling, and Coon), and the changes in urchin populations following otter range expansion are equally clear.

Overall, this volume accomplishes its goals admirably. It presents a concise and informative review, attempts a synthesis (in fact, alternate syntheses), and points out the gaps in our knowledge of an important ecological system, the shallow subtidal zone of the west coast of North America. One concern that leaps from the pages is the inadequacy of the current approach to funding community ecological studies, which usually focus on single sites and short time periods. The result has been that no study addresses sufficient geographic variation, and studies covering more than a few years are severely limited as to which aspects of the community are studied. The outcome of this shortsighted policy is predictable; perturbations occur where there is no adequate prior information (baseline), and management decisions must be made on the basis of fragmented field studies. Even when such studies are elegant and experimental, their limited spatial and temporal scale becomes alarmingly evident when attempts are made to apply their conclusions on a larger scale. Given these generally recognized problems, the authors of this volume have nonetheless pulled together a diverse body of information that has immediate utility for anyone interested in marine ecology, theoretical ecology, conservation biology, and environmental management.

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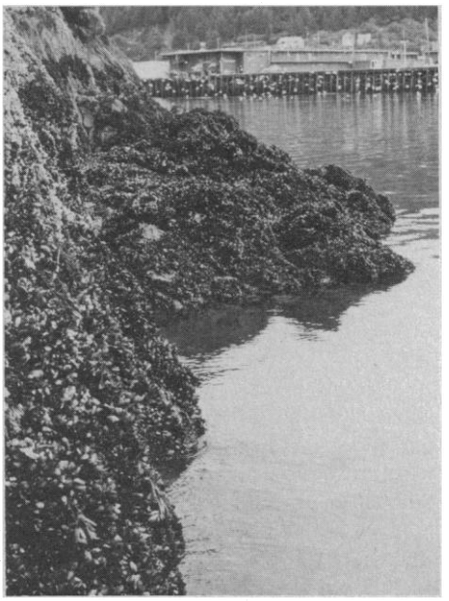

"Dense intertidal cover of *Mytilus edulis* at Spike Island, Prince William Sound, in autumn 1984. This site had been completely stripped of mussels, apparently by foraging sea otters, during winter 1979–1980. Mussel cover . . . was nearly zero in April 1980." [From G. R. VanBlaricom's chapter in *The Community Ecology of Sea Otters*]

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