

Diener. *Oxytoma* cf. *alaskana* Smith occurs in the uppermost part of the range of the last fauna and the zone of *Monotis subcircularis* overlies the *Halobia* zone.

A small specimen of *Waldthausenites* was found in talus and comes from somewhere in the lower part of the *Halobia* zone. *Thisbites* occurs just below the range of *Distichites*.

Many of the above mentioned ammonoid genera have a wide range over the earth, including

the Mediterranean, Indian, East Indian and American Pacific coast regions. Genera like *Juvavites*, *Anatomites*, *Tropites* and *Sirenites* have a wide distribution. *Malayites*, *Waldthausenites* and *Dimorphites* have been recorded from Mediterranean and East Indian localities, *Himavatites* from Indian and East Indian localities and *Helicites*, *Distichites* and *Cyrtopleurites* from Mediterranean, Indian and East Indian localities.

REVIEW

FUR-BEARING MAMMALS OF CALIFORNIA, THEIR NATURAL HISTORY, SYSTEMATIC STATUS, AND RELATIONS TO MAN. By Joseph Grinnell, Joseph S. Dixon, and Jean M. Linsdale. Contribution from the Museum of Vertebrate Zoology, University of California. University of California Press. Berkeley. 1937. In two volumes, pp. xii, 777, figs. 345, plates 13. \$15.00.

The State of California ranks second in size among the States of the Union, its length from north to south about 780 miles, breadth varying from 150 to 350 miles, and its total area 158,297 square miles, of which 2,205 are water surface. The coast line is more than 1,000 miles long. Mount Whitney, 14,502 feet, is the highest summit of the United States, excluding Alaska, while Death Valley reaches 480 feet below sea level, and Salton Sink 275 feet below sea level. California has the greatest variety of temperature and rainfall in the United States, with rich, broad alluvial valleys, snow-clad mountain tops, varied by desert valleys and the noblest forests and largest trees in the world. The animal life is accordingly varied, and the California fur-bearing fauna includes some form of nearly every genus found in the United States and representatives of most of the Canadian groups.

Out of some 460 species and subspecies of free-living mammals now known from California, 68 are dealt with as being properly "fur-bearers." The carnivora are by far the most important including the extremely valuable otters, fisher, martens, mink and foxes; the Rodentia, to which belong the beavers and muskrats, come next in importance; the Marsupialia, represented by the introduced opossum, and the Pinnipedia, containing the fur seals long vanished from the shores of California, are least important.

The three men whose names appear on the title pages of these volumes are thoroughly familiar with their broad subject with its many

angles—historical, scientific, economic, and aesthetic. The senior author, Professor Joseph Grinnell, has been Director of the Museum of Vertebrate Zoology for many years, and has had field experience from Arctic Alaska to Lower California. Mr. Dixon has had only a few less years' field experience in the same field, both with the Museum of Vertebrate Zoology and later with the United States National Park Service, and Dr. Linsdale of the Museum of Vertebrate Zoology has also had extended experience with Western mammals, both from a field and systematic standpoint.

The two volumes are profusely illustrated, including thirteen full page colour plates showing nineteen species from originals by Major Allan Brooks, and 345 text figures, mostly from photographs, with some wash drawings in black and white by Major Brooks, and line drawings done chiefly by Mrs. Frieda L. Abernathy and Miss Anna Hamilton. Major Brooks is better known to the general public as a bird artist, as his drawings have had a wider circulation in that field, but the reproductions of his work in these volumes, as well as other examples of his work which the reviewer has been privileged to see, seem to place him at the head of illustrators of North American mammal life. The books are extremely well arranged, well printed in clear type on good paper, and the illustrations are well selected and reproduced in the best style of the printers' art.

These volumes have been based on the entire mass of material accumulated in the Museum of Vertebrate Zoology, consisting of skins, skulls, and other parts of the animals concerned, manuscript field notes, and correspondence covering a period of twenty-five years. The published literature has been searched, and experienced and reliable hunters and trappers of the State have been sought out and interviewed, and the records of the active California Fish and Game

Commission containing the reports of the licensed trappers of the State for several years have been made available. From the outset of the enterprise, Mr. Dixon went into the field as often as possible to run down records, to obtain first-hand information, specimens and photographs, and by meeting old-time trappers obtained a great mass of information which would otherwise have been lost, as some of the California mammals, notably all of the seven races of grizzly bear which were formerly found in the State, have become extinct within the memory of men now living, and a few others, as the southern wolverine and the fisher have become very rare in the State of California as well as in most other parts of the United States. As a result of Mr. Dixon's field laboratory work on the food of mammals, records of more than 2,500 stomach examinations of fur-bearers have been incorporated in this treatise.

Fur trapping and fur trading have gone through several phases in California, beginning before 1785, when the Spanish authorities first issued regulations governing the taking of sea otter skins. The Russians had worked south from Alaska by 1812 and the Russian-American Company continued operations independently until 1830 and under control of the Mexican government until 1841. In 1826 at least three parties of Americans arrived overland to trap beaver which were exceedingly abundant at that time, and trapping parties for the Hudson's Bay Company seem to have entered California from the north every year from 1828 to 1846 in search of beaver. Upon the discovery of gold in California, all of the trappers seem to have temporarily given up their interest in furs, but by that time the supply of fur animals had been so reduced that their former numbers were never completely recuperated. In the second half of the nineteenth century trapping was extended to the remaining and less conspicuous kinds of fur-bearers. By the end of the century the fur-bearing animals had become so reduced in numbers that an effort was made to save them from extinction.

The authors give two chapters which deserve attention, one on the effect of Mammals upon Man, and the other on The Effect of Man upon Mammals, and have handled the questions with impartiality. The carnivores that most often attack grazing animals are the coyote, wildcat, mountain lion, and black bear. Cultivated fruits may be eaten by coons, skunks, opossums, coyotes, gray foxes and bears. Irrigation ditches are often affected by muskrats and beavers, and the larger predators are continually blamed for inter-

ference with the hunters' privilege of killing game animals, and campaigns of elimination are carried on with more or less success from some points of view, but with seriously detrimental effects on other interests. Some species, as mountain lions, coons, skunks, wildcats, and coyotes show remarkable powers of environmental resistance under Californian conditions and can withstand heavy losses in numbers from varied causes.

The automobile and the great extension of roads into wilderness areas have opened new localities to trappers and made possible the use of longer trap lines. One man with a truck was able to run more than 100 settings and cover 50 or 60 miles daily, whereas previously the best he could do with horse and buggy was 30 to 40 settings and 15 to 20 miles a day. On the other hand, the advantages of the motor car to the trapper are offset to some degree by the expense of running the car, which eliminates small profits. Also, motor car trappers tend to stay near the roads. However, there are vast numbers of boys, farm hands, and others in rural communities who trap in a small way, and the aggregate of the catch is impressive, although the average income from trappers reporting was only approximately \$160 annually. The most valuable catch over a period of years (1920-1924) was from striped skunk and coon, the fancy furs being too rare to add much to the figures.

The authors believe that the chief cause for depletion of fur-animal populations in many localities in California and especially in the southern part of the State is poison put out for squirrels. As a rule, the fur animals die of secondary poisoning from eating the poison-killed small mammals, or of starvation caused by a too thorough removal of the smaller animals. The facts available show that where ground has been poisoned extensively and repeatedly, almost every animal upon which the fur-bearers depend for food is killed. In addition to the direct influence of poisoning operations on uncultivated ground, the heavy grazing of domestic stock which has been prevalent upon the mountain slopes has limited the production of furs from many wild areas by reducing the quantity of the annual growth of grasses and other plants, especially the seed-producing ones. The effects of overgrazing are intensified in years of unusual drouth. The authors consider that forest fires have burned up food supplies so that locally and temporarily populations of fur animals have been affected adversely, but that over long periods of time a large area will support larger populations of fur-bearers if the uniformity of the

vegetation has been broken, even by fire, than in a mature forest.

It goes without saying that these volumes contain a mine of information for any mammalogist or field ecologist. The technical descriptions are done in a workmanlike manner and the accounts of life histories or habits are fascinating reading. The work will also be indispensable to all who are interested in conservation and what is now known as "wild-life management." Nearly every species which can be classified as a "fur-bearer" has its "good points" and its "bad points," and discussions of these can be highly controversial, the heat of the arguments being as a rule inversely to the amount of factual knowledge possessed by the participants.

The larger number of the species are carnivorous and to a considerable extent predatory, and these habits bring them into direct conflict at times with stock-raising interests or with a certain type of sportsmen who believe that all kinds of "game" mammals or birds are sacrosanct and created for the especial benefit of human predators who ignore the widely spread value of the fur-bearers as a source of supplementary income to small farmers and ranchers who trap in their spare time, and the much greater value

of the predatory species in removing diseased, unfit, or overcrowded game species in many areas, and their tremendous service in keeping down the hordes of rodent pests—gophers, ground squirrels, woodchucks, rabbits, and mice of numerous species—which devastate farm lands and grazing districts.

This work has been extremely successful in treating all these difficult questions in a judicial manner, and should be in the hands of every State and Provincial game board or commission, wildlife management teacher or student, sportsmen's organizations, college library, and every public library that can afford it. It is of especial interest to all Canadians who are interested in wildlife, as many parts of Canada are comparatively "new country," and it should be enlightening to read the history of the wildlife of California from early times to the present day, showing the effects of mining, ranching and farming, lumbering, and trapping, resulting in the downfall and unfortunate extinction of some species and the persistence of others in the face of civilization, and the measures which have been taken to preserve a wise balance between the diverse and complicated factors which affect the wildlife and its environment.—R.M.A.

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