Introduction

Of all the books or pamphlets containing information about rattlesnakes, two that have probably most influenced or guided public ideas on the subject were written by men who certainly never saw a rattlesnake in its native habitat, and may not even have seen one alive. These authors were Oliver Goldsmith and the Rev. John G. Wood, neither a naturalist, both rather inaccurate and credulous compilers, but each with the gift of interesting popularization. So cherished were their natural histories—first published in 1774 and 1851, respectively—that they appeared in unnumbered editions; they were reissued, reprinted, revised, enlarged, pirated, and quoted without credit. They were read avidly by the children of successive generations and remained the standard natural-history reference works in many British and American homes down to the present century.

What made these and similar works so deservedly popular was not so much their vivid descriptions of the animals themselves as the information on their habits and the places where they live, often exemplified by stories of human encounters with them. It was not entirely the fault of these authors that many of their accounts were inaccurate, for naturally they were dependent for their information on travelers abroad who had had opportunity to make field observations. The compilers had no way of winnowing actual observations from myths and tales the travelers brought back. This difficulty of separating fact from fiction is particularly formidable in

the case of rattlesnakes, creatures whose very nature invites exaggeration. Many rattlesnake stories still believed today date back to misunderstood incidents of colonial days, or to tales invented at the campfire to spoof a gullible traveler.

Purpose

This book is written to outline our present knowledge of rattlesnake habits and life histories. It includes numbers of field observations from varied sources in the hope that it may aid in the correction of some of the dubious accounts long current in popular natural histories.

I have no desire to exaggerate the importance of rattlesnakes in the scheme of nature, or in their influence on mankind. To people going afield they constitute a relatively minor danger, yet the hazard is sufficient, or is believed to be, to cause many persons to suffer almost continuously from fear of rattlers when in the woods or brush. An unexpected encounter with a rattler has broken up many a picnic party; the fear of meeting one has kept many another from ever leaving home. Those most familiar with these snakes learn to take them in their stride; they soon find that, compared with man-made hazards, rattlesnakes constitute a negligible danger.

Along with their danger, real or imagined, rattlers are of economic value to the farmer or stock raiser, for they are predators on injurious rodents. They are handsome yet sinister creatures, with curious ways of life. They are expert performers on a musical instrument they themselves cannot hear. I infer from the conversations of visitors at the San Diego Zoo, from letters of inquiry, and from the frequency of rattler items in the newspapers, that the general interest in them is great. In fact, throughout this book I have dwelt to a considerable extent on the relationships of rattlesnakes and men, for certainly one of the most remarkable aspects of rattlesnakes has been their effect on people. Quite apart, and often quite different, from their existence as reptiles in the forest or desert, rattlesnakes have had an existence in the minds of men—in unnatural natural history, in myth and folklore, in primitive medicine, and even in aboriginal religion. Certainly, the rattlesnake of song and story is a creature that quite surpasses nature. It is my hope that this book may lead to a better understanding of rattlesnakes, and this objective can be achieved only by including a survey of some of the less accurate ideas, their sources, and their deviations from field experience—as well as the factual information available. What people have thought about rattlesnakes and why is, in its way, as interesting as the snakes themselves are in another.

Sources of Information

In compiling these life histories of rattlesnakes, I have used four sources of information: (1) correspondence with field observers and naturalists; (2) published accounts; (3) studies of captive rattlesnakes made at the San Diego Zoo; and (4) the personal observations of the writer in the field and laboratory.

Data from Correspondents. There are certain people whose occupations keep them out-of-doors and in continuous contact with nature. They become naturalists in the best sense of the word. When they meet a rattler in the field it's a part of the day's work, not something to form the basis of a sensational story. Their observations are usually sound and accurate, in the aggregate comprising a volume of material far beyond the field notes of even the most fortunate and active herpetologist. What these observations may lack in coordination and continuity, they make up for in the corroborative evidence of their widespread sources.

Prior to the preparation of this book, I sent more than three thousand questionnaires on aspects of rattlesnake life to a variety of outdoor people, including National Forest rangers, U.S. Fish and Wildlife Service employees, Soil Conservation Service workers, National Park naturalists and rangers, and state game wardens and patrol officers. Other inquiries were sent to a list of field naturalists, hunters, trappers, stock and poultry raisers, county agricultural agents, and others likely to have firsthand information on the subject.

During the past years I have carried on an extended correspondence on the subject of rattlesnake life histories and habits with amateur and professional herpetologists who have had much experience with these snakes. From them I have also secured many useful observations.

Printed Material. My second source of information has been published material. I have examined a large number of books and articles, either about rattlesnakes or containing pertinent incidental statements on their habits. Some of these I have quoted verbatim; to many others I have made reference, summarizing the authors' observations or conclusions.

The literature on rattlesnakes is extensive, for not only are there many technical articles on the subject, but there are general natural histories, books of travel, medical journals, ethnological reports, nature magazines, hunting and fishing periodicals, and, finally, Sunday supplements, all containing material of interest, if not always of sound value.

Observations at the Zoo. Although artificial conditions under which captive specimens live may distort their behavior patterns, it is still possi-

ble to gain many facts of value by observing them. Of this we have taken advantage at the San Diego Zoo, where thousands of rattlesnakes of many species have passed through our hands since 1922. The exhibit series at the Zoo comprises only a part of the many specimens kept under observation. Feeding and mating habits, venom yields, shedding, and other activities have been recorded, some of which can only be studied in captive specimens. C. B. Perkins, who was in charge of the collection since 1932, and his successor, Charles E. Shaw, have been unusually successful in simulating natural conditions, and their efforts have been rewarded with new records of longevity and of breeding in captivity. Under their supervision many original or confirmatory data on rattler habits have been secured.

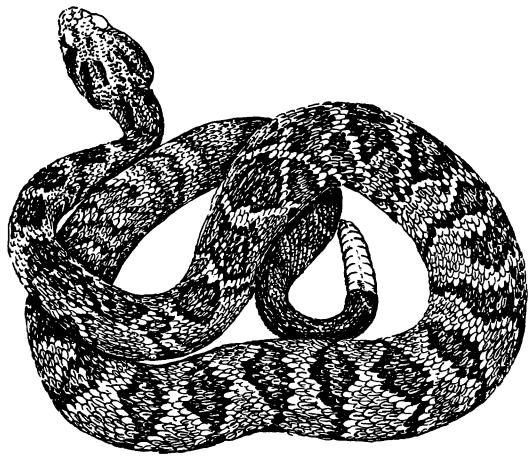
Personal Field and Laboratory Experiences. Occasionally, in judging the dependability of articles on rattlers, I have wondered about the extent of the experiences of the authors and the backgrounds of their statements. Since many of my readers may mentally raise the same question respecting the validity of this compilation, I trust I may be pardoned for summarizing my own experience.

I have been interested in rattlesnakes for more than sixty years and during the past forty have put in whatever spare time has been available in a study of snakes in general and rattlers in particular. Some of this work has been in the field—for I have collected extensively in the Southwest—but more in the laboratory. In connection with these studies, some of which have been published, I have accumulated scale counts, color notes, and measurements from about 12,000 rattlesnakes, of which some 7,500 were preserved in my own study collection. I have seen specimens of all the kinds of rattlesnakes known to exist today, most of them alive. In the course of a venom-gathering program, I extracted the venom from somewhat more than five thousand live rattlers.

My training, however, has been in engineering, rather than in biology or medicine, and my lack of technical training in these fields has placed certain obvious limitations on this work. Particularly, the reader will find little on the physiology of the rattlesnakes, a subject I should be ill-equipped to discuss. However, much material is available elsewhere for readers with a particular interest in this aspect.

CHAPTER ONE

Status



It is sometimes surprising to learn the extent to which the public may misunderstand basic terms. Thus, although the term "rattlesnake" is familiar to every American, it is astonishing to find what different ideas people have as to the kinds of creatures included by the term. To obviate this confusion, and to permit the nonherpetologist to orient himself with respect to the position of rattlesnakes in the snake world, the summary below is presented.

Classification and Nomenclature

Animals are classified by division into groups of successively narrowing scope. Thus the animal kingdom is divided into a few main groups, first into phyla, then the phyla into subphyla, and these, in turn, into classes. One of the classes of the subphylum Vertebrata, of the phylum Chordata, is the class Reptilia, which includes all the reptiles, living and extinct. Following down the line of increasingly restricted categories toward our ob-

The Components of the Family CROTALIDAE

Genus	Common name	Distinguishing characteristics	Habitat
Crotalus	Rattlesnakes	With rattles; small scales on crown	North and South America
Sistrurus	Massasaugas and pigmy rattlesnakes	With rattles; large plates on crown	North America
Lachesis	Bushmaster	Without rattles; small scales on crown; small scales under end of tail	Central and South America
Bothrops	New World pit vipers	Without rattles; small scales on crown; large scales under end of tail	Mexico to South America
Trimeresurus	Asiatic pit vipers	Without rattles; small scales on crown	Asia
Agkistrodon	Moccasins	Without rattles; large plates on crown	North American, southeastern Europe, and Asia

jective, the rattlesnakes, we find the subclass Diapsida, then the order Squamata, and, finally, to separate the lizards from the snakes—for both are included in the Squamata—the suborder Serpentes, to which all snakes, venomous or harmless, belong. Suborders, in turn, are divided into families, and among others, under Serpentes, is the family Crotalidae or pit vipers, so called because of their possession of a remarkable sense organ visible externally as a facial pit, placed below and back of the nostril. By this family designation, pit vipers are segregated from true vipers of the family Viperidae, which have no pits, and which, incidentally, do not occur in the New World.

The next category below the family level is that of genus (plural: genera). As our narrowing categories are now bringing us close to the two genera of rattlesnakes, their position with respect to their nearest relatives can best be clarified by recourse to the table above which presents a summary of all the genera belonging to the family Crotalidae.

Now we are in a position to define the term "rattlesnake" properly. Rattlesnakes are pit vipers—popular name for the whole family Crotalidae—belonging to the genera *Crotalus* and *Sistrurus*. They are found only in the Western Hemisphere. All possess rattles. All are venomous, although, by reason of differences in size and other characteristics, there is a wide difference in the degree of danger from their bites. All are rather heavy-bodied and have broad heads. They are of various colors and are marked by blotches or by cross bands along the back.

Above all, the crucial characteristic that distinguishes rattlesnakes from all other snakes—even from other pit vipers—is possession of the rattle. This is a loosely articulated, but interlocking, series of horny rings

at the end of the tail, which, when vibrated, produces a hissing sound. All rattlesnakes have rattles, and no other kind of snake has them. No snake is a rattlesnake because it is shaped like a rattler, or because it has blotches like those of a rattler, or because it is venomous, or because it is found among rattlers, or because it will coil like a rattler, or because it will vibrate its tail as does a rattler. Many harmless and venomous snakes have some or all of these characteristics, but lacking rattles, they are not rattlesnakes. (The term "rattler," as used in this book, is a short and popular synonym for rattlesnake; the term "rattle" refers only to the noise-making device at the end of the tail.)

Even when born rattlesnakes have a blunt segment called a prebutton, which, although soundless, is quite different from the pointed tail end of other young snakes. It is true that rarely—maybe once in a thousand—a rattler is found that has lost the end of its tail (including the rattle) in some accident. But in such cases there is no difficulty of identification because of the short stubby tail that remains, provided, of course, it has the other characteristics of a rattlesnake.

The two genera of rattlesnakes, *Crotalus* and *Sistrurus,* differ in the nature of the scales that cover the crown—the forward half of the top of the head. In *Sistrurus* this area is covered with large plates, usually nine in number and regularly arranged in cross rows thus: two-two-three-two, from front to rear. In *Crotalus* the crown is covered by small scales, usually quite irregularly disposed, particularly from the eyes rearward; although each eye generally has a single large plate (the supraocular) above it.

The genus *Crotalus* is the more important of the two; it includes the most species, the largest and most dangerous snakes, and ranges over much the greater territory. But the members of the genus *Sistrurus* are

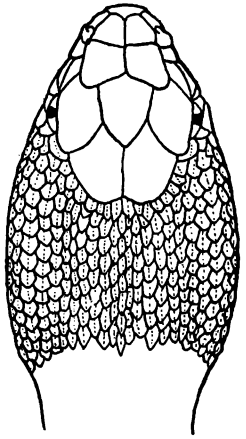


Fig. 1 Dorsal head plates of *Sistrurus* (*S. catenatus*)

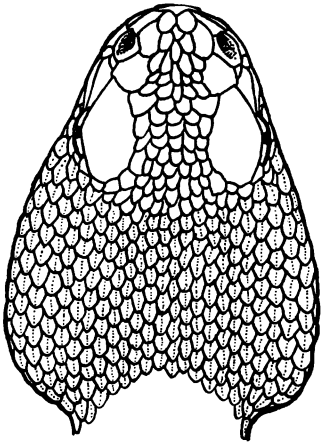


Fig. 2 Dorsal head scales of *Crotalus* (*C. atrox*)

just as deserving of the name rattlesnakes, although, to distinguish them, they are generally referred to as massasaugas or pigmy rattlesnakes. Sometimes they are called ground rattlesnakes, not a particularly apt name as all rattlesnakes are ground dwellers.

The next lower category below the genus is the species, the fundamental unit of the divisional system. Each species is given a name composed of two parts, the first indicating the genus to which it belongs, the second the specific name applicable only to that species. (Examples: *Crotalus viridis* and *Sistrurus catenatus.*) Species, in turn, for the purpose of further segregation, may be divided into subspecies or races, in which case a third term, the subspecific name, is added. (Examples: *Crotalus viridis oreganus* and *Sistrurus catenatus tergeminus.*) Often in longer works, where the same subspecies is repeatedly mentioned, only the initials of the first terms may be used and even these are omitted if there is no sacrifice of clarity. (Example: *C. v. oreganus,* or, simply, *oreganus.*) There is a rule requiring that technical names below the family level be italicized. Generic names are always capitalized; specific and subspecific names—in zoölogy, but not in botany—are never capitalized, even though derived from proper names.

The question arises as to how species and subspecies are segregated: upon what bases are they differentiated? Species are populations that interbreed naturally; they cannot or will not interbreed with members of another species with which they may conjointly occupy a territory, and thus each preserves its separate identity and genetic integrity.* It is found that these groups of rattlers—these species—differ from each other in one or more of a variety of ways: in adult size, in bodily proportions, in male organs, in pattern and color (the most obvious but not always the most valid difference), in bone structure (especially of the skull), and, finally, in squamation—in the number of scales in certain series, and in their relative sizes, positions, and the contacts made with other scales. For rattlesnakes—in common with other snakes—are not clothed with scales haphazardly arranged like pebbles scattered on a beach. On the contrary, within each species the scales follow, with considerable consistency, certain patterns of size, number, and arrangement. Scale differences are the most practical for purposes of classification, and most identification schedules or keys are largely based on them, as well as on color and pattern.

A List of Rattlesnake Species and Subspecies

The list of rattlesnakes—that is, the number of species and subspecies—is continually growing, as new kinds are discovered in areas hitherto little explored, or as species are divided into more subspecies through the recognition of previously unnoted geographical divergences

*Rarely there may be crossbreeding or hybridization, especially under the unnatural conditions of captivity.

in characters. Nearly half of the subspecies now accepted have been described within the last thirty-five years. As of the present date, thirty-one existing species and seventy subspecies are recognized. Some are large, dangerous snakes while others are small with a less serious bite. Some are found in considerable numbers near populated areas or are distributed over wide territories. Others are restricted to a single island. Still others, although found on the mainland, occur in districts difficult of access to naturalists or collectors, so that only one or two specimens may ever have been seen by any herpetologist. There follows a list of the species or subspecies of rattlesnakes at present recognized as being valid:

Rattlesnakes of the Genus *Crotalus*

C. adamanteus. Eastern diamondback rattlesnake
C. atrox. Western diamondback rattlesnake
C. basilicus basilicus. Mexican west-coast rattlesnake
C. basilicus oaxacus. Oaxacan rattlesnake
C. catalinensis. Santa Catalina Island rattlesnake or rattleless rattlesnake
C. cerastes cerastes. Mojave Desert sidewinder
C. cerastes cercobombus. Sonoran Desert sidewinder
C. cerastes laterorepens. Colorado Desert sidewinder
C. durissus durissus. Central American rattlesnake
C. durissus culminatus. Northwestern Neotropical rattlesnake
C. durissus terrificus. South American rattlesnake
C. durissus totonacus. Totonacan rattlesnake
C. durissus tzabcan. Yucatan Neotropical rattlesnake
C. enyo enyo. Lower California rattlesnake
C. enyo cerralvensis. Cerralvo Island rattlesnake
C. enyo furvus. Rosario rattlesnake
C. exsul. Cedros Island diamond rattlesnake
C. horridus horridus. Timber rattlesnake
C. horridus atricaudatus. Canebrake rattlesnake
C. intermedius intermedius. Totalcan small-headed rattlesnake
C. intermedius gloydi. Oaxacan small-headed rattlesnake
C. intermedius omiltemanus. Omilteman small-headed rattlesnake
C. lannomi. Autlán rattlesnake
C. lepidus lepidus. Mottled rock rattlesnake
C. lepidus klauberi. Banded rock rattlesnake
C. lepidus morulus. Tamaulipan rock rattlesnake
C. mitchellii mitchellii. San Lucan speckled rattlesnake
C. mitchellii angelensis. Angel de la Guarda Island speckled rattlesnake
C. mitchellii muertensis. El Muerto Island speckled rattlesnake