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IMPORTANCE OF WILDLIFE RABIES CONTROL

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ABSTRACT: Rabies in animals has been known in North America for over two centuries, and whether the disease was initially present in wild species or was introduced by dogs, it has been known in skunks for almost a century and a half. Today more rabies cases in wild animals are reported than in domestic animals, and a considerable proportion of both human and domestic animal exposures to the disease are the result of wild-animal contact. The most useful techniques for controlling wild animal rabies today are methods that reduce contact between infected individuals and susceptible individuals; these involve the manipulation of populations, most often by direct reduction methods. Such techniques have proved effective in controlling or eliminating the disease; they are most effective when the area involved is small and/or isolated by barriers.

The effectiveness of animal reduction programs on rabies is limited by the range of the animals involved, of ingress from surrounding areas for animals incubating the disease, and the continuity of the program; at least two maximum incubation periods of the disease must have elapsed as insurance that incubating animals are not left to serve as a new nucleus of infection.

Rabies control programs for wild species have not yet threatened any species with extinction, nor are they likely to in the future.

Rabies has been recorded in North America since the mid-18th century; the disease was reported from Virginia in 1753 and North Carolina in 1762 (Steele, 1967). Whether wild species infected domestic animals or were infected by dogs, or whether the disease existed in both dogs and wild animals independently has never been determined. The first case of skunk rabies was reported in 1826 from Lower California (Johnson, 1959), and the disease was common in skunks in Kansas in the 1870's (Hovey, 1874). A brief summary of the skunk rabies problem and protective devices in Arizona in the early 1900's are presented by Kennedy (1961). The outbreak of coyote rabies in the western states in the 'teens and its control have been described (Records, 1932). The first case of fox rabies in New York State in 1941 started an epidemic, which still continues as an endemic situation (Linhart, 1960).

Today wild animals account for over 75 percent of the total animal cases of the disease in the United States (NCDC, 1969). Bat rabies was first diagnosed in this country in 1953 (Venters, et al., 1954) and has since been reported from all of the 48 contiguous states. Raccoon rabies has spread from Florida into the southern half of Georgia. The relationship between dog and coyote rabies in an epidemic situation in Baja California in recent times was described at the United States-Mexico Border Public Health Association meeting in San Diego (Cocozza and Malaga, 1962). All in all, our wildlife rabies problem has increased during the past two decades, while dog rabies declined by more than 95 percent (Parker, 1969).

Dogs, because of their close association with man, are still the largest single source of rabies exposure resulting in human deaths. However, in the years 1956 through 1969, 10 of the 31 cases of rabies (32 percent) for which the exposure source was known or a most probable source determined have been the result of rabies virus transmitted by wild animals. In addition to the seriousness of wildlife rabies from a public health point of view, the economic problems need to be considered. Not only must persons bitten by wild animals in an area infected with rabies be concerned about their health, they must bear the financial burden of expensive and time consuming preventive treatments. Another economic burden is the loss of livestock from rabies transmitted by wild animals. In the several states where I have had personal experience, including most of the northern and the southwestern states, most if not all of the rabies in large domestic animals is either known or thought to be the result of the bites of rabid foxes, skunks, and to a somewhat lesser degree coyotes and bobcats. Bats, although thought to be responsible for no less than six human cases of rabies, are not now known to be a threat to livestock in this country. Their relationship to rabies in other wild species is not clear. Direct evidence is lacking but there is some epidemiologic evidence that interspecies transfer of the virus may occur between bats and other species under certain circumstances (Constantine, 1962).

Rabies is a disease that requires direct contact between the infected animal and susceptible animal for spread (with the possible exception of the very limited ecological conditions of certain bat caves as described by Constantine (Ibid.)). At this time, rabies control programs are based on the rather simple concept of reducing this level of contact, by reducing either the number of infected animals or the number of susceptibles. The latter augments the former, and again it is simple in concept (but not at all in practice): immunize those that are desired and eliminate the balance. While we now have the tools with which to immunize our pets (Kaeberle, 1958) and to a degree our large domestic stock, we must at this time rely on reduction of susceptibles in controlling rabies in our wild species. I want at this time to emphasize a word in the previous sentence, reduce, and stress that this does not mean elimination of species, since, as I shall outline, we have controlled rabies by reduction, and no rabies control program has yet eliminated a species or for that matter even threatened one.

Reduction of susceptibles has been attempted by several means. The most successful means involve outright destruction. These techniques are well known and need only be mentioned: shooting, trapping, and poisoning. Less successful have been attempts to control populations through the use of reproduction inhibitors (Linhart, et al., 1968). The success in controlling canine rabies in this country has been due largely through the widespread use of immunizing agents (Parker, 1969); therefore, it may be presumed that some modified form of vaccination might be equally valuable in wild populations in the future. The concept of immunizing wild populations on a large scale has been proposed, but the inherent technical and fiscal problems have yet to be solved.

Man's assumption of environmental control of this continent and indeed this planet demands that a rational balance between the natural environment and a human oriented environment be maintained. This may require that reasonable controls be applied to serious threats to the health of people and animals, especially when experience over a period of years indicates that such controls have not constituted a serious threat to any species considered desirable. However, ways must be found to effect control of devastating diseases, such as rabies, over wide areas, using techniques that will not endanger any species but that will enhance all of man's interests.

Many programs for the control of rabies in wild animal populations by population management have been tried, some with very notable success. One of the oldest in this country is the New York State fox control program, which was initiated in 1946. The concept of the control effort evolved from one of population reduction in the infected area to one of containment of the disease by an artificial barrier of low vector-density. In a description of the program it was noted that those familiar with the program (both program personnel and supervisors and an Interdepartmental Rabies Committee with representation from the State Departments of Agriculture and Markets, Conservation, Education and Health) felt "that the present approach is the best one available" (Linhart, 1960). A somewhat similar program was put into operation in Virginia; however, opposition from groups opposed to fox trapping often hampered its operation. The summary and conclusions of a paper describing this program include the following: "The rabies incidence was drastically reduced in the 7 counties initially trapped, and although no attempt was made to establish a causal relationship between trapping and the lowered incidence, there was strongly suggestive evidence that such a relationship existed" (Marx and Swink, 1963). In late 1963 an outbreak of skunk rabies began in and around Carlsbad, N. M.; by April 1965 a total of 40 cases had been reported. The outbreak was controlled by a concentrated poisoning program to reduce the skunk population, and no cases of skunk rabies were reported in the area for over 3 years. Cases in bats were recorded during this period in the area, and skunk cases have been reported in adjacent counties. Another very successful program of skunk rabies control by population reduction was reported from Ohio (Schnurrenburger, et al., 1964).

A completely successful program for the elimination of rabies in several species, including feral dogs and other wild species, was conducted on the Island of Guam in 1967. Wholesale destruction of dogs living under semi-wild conditions and vaccination of pets interrupted the chain of infection (Glosser, 1968). No cases of rabies have been reported from the Island since the program, although a dozen cases were confirmed by two laboratories during the outbreak and many more were thought to have occurred.

Perhaps one of the most interesting recent control programs was started in San Diego County, California, as a result of an outbreak of rabies in wild animals which began in 1966. Over 100 cases of rabies have been reported (90% in wild species) in a rather circumscribed area in the south central part of the county. The outbreak was considered a northward extension of a recognized wildlife rabies problem in Mexico in adjacent Baja California (near the

town of Tecate and south through the Valle de las Palmas and adjacent areas to Ensenada). The program was a massive effort to reduce the number of recognized vectors of rabies in an area about 50 miles east, north and west of Tecate, California. After about 6-1/2 months of trapping, a marked decrease in the number of rabies cases was noted, and certain groups advocated that the program be discontinued. Although the responsible health agencies at the local, state, and federal levels concurred that the program should be continued, it was stopped. Soon after, a child was attacked by a bobcat outside his home near Lakeside, San Diego County. The bobcat was killed, and evidence of rabies was demonstrated in its brain. Signs of rabies developed in the boy, and he died after an unusually long clinical illness (Morbidity and Mortality Weekly Report, 1969). This program has been reinstated, but with a further decline in reported cases, pressures are being mounted to discontinue it again. Rabies is noted for having long and variable incubation periods--up to 15 months have been reported in foxes (Schmidt and Sikes, 1968). To discontinue control efforts before the passage of two maximum incubation periods chances leaving unrecognized animals incubating rabies to perpetuate the disease.

The effectiveness of animal population manipulation as a means of rabies control is influenced by several factors, the three most important are: (1) the range of the individuals which may be incubating the disease (which, if our knowledge of dog rabies can be extrapolated to other species, may be several times the "daily activity range" of the species in question, especially when we consider that the "daily activity range" as commonly used is nothing but an arithmetic mean of the recorded ranges of a limited number of animals); (2) the disease status of the surrounding areas and therefore the chance for ingress of individuals incubating rabies; and (3) the maintenance of a selective population reduction program for at least two years.

The effects of any wildlife rabies control program are measurable by various criteria: the absolute reduction of cases of rabies in animals and exposures of humans to the disease, the control of the disease over a given area for a given period of time (reduction of incidence to the number of cases and exposures that the people in the area are willing to live with), and eradication of the disease, which is the most desirable goal. The concept of eradication is perhaps only tenable today and with today's techniques when the outbreak is limited to a restricted geographic area such as an island or an isolated (by natural or man-made boundaries) area of a larger land mass. The listed criteria must also take into account the natural history of the species involved, for control in foxes must certainly be evaluated in a different manner from control in bats.

In summary, wild animal disease is the most important part of the rabies problem in the United States from a numerical point of view, and as such remains as a constant threat not only to the public health but also to the animal economy of the country. With today's techniques, controlling the disease over large areas (state or regional blocks of land) is not practical, but control over isolated outbreaks in smaller units, such as counties, is not only practical but has been accomplished. While ways are being sought to control rabies over vast areas of the continent, previously uninfected areas can be protected by population management of involved wildlife species. It must be emphasized that such activities must be pursued for a sufficient length of time over a wide enough area or their effect may be lost. It must be noted that in all the years of control activities directed against any of the known rabies hosts or vectors, no species has been threatened with extinction, nor is there any evidence that, using today's techniques at any reasonable level of application, extinction is likely to occur.

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