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This paper summarizes information from the literature and personal observation to present an overview of the effects of predators on big game populations. Specifically it examines control of prey populations, culling of inferior prey, and stimulation of prey productivity. Food habit investigations were omitted because of the impossibility of evaluating the impact of predation by this approach because of a lack of population data.

Control of Prey Populations

A population is controlled (whether by predation or another means) when total deaths equal or exceed births. This control stabilizes populations and keeps them within the limits imposed by their habitats.

Populations of most species of native ungulates have periodically irrupted and then quickly declined the past 100 years (Keith 1974). This was a result of decimation of predator populations (Leopold 1943) and/or a major discrepancy between existing population levels and food supplies and cover (Riney 1964). Keith (1974) indicated interactions between these two forces make it difficult to determine which is the most important, but he cited numerous examples that implicate a lack of predation as the chief cause of the irruptions.

The effect of predation on populations of large ungulates is most objectively evaluated by predator control, but this method has produced varying results. Jones (1949), in Texas, was unable to demonstrate a difference in pronghorn antelope (Antilocapra americana) fawn survival between treated and untreated areas. He attributed the lack of treatment effect to ineffective predator control. Later investigations in the same general area (Bailey 1973, Uzzell 1973) revealed a marked increase in pronghorn net productivity where coyotes (Canis latrans) were intensively removed. Similar investigations in Arizona (Arrington and Edwards 1951), Utah (Udy 1953), and Wyoming (Yoakum 1968 as interpreted by Knowlton 1968) attributed increases in net reproduction and in total pronghorn populations to intensive coyote control.

Predator control varied in effectiveness of alleviating depredations on young deer (Odocoileus spp.) and caribou (Rangifer tarandus). Longhurst et al. (1952) found no evidence that fawn survival increased where coyotes were trapped heavily compared to the control area. Beasom (1974a, 1974b) reported an approximately 300% and 400% increase in white-tailed deer (Odocoileus virginianus) net fawn production during a 2-year period on a study area in Texas. The deer population density increased by about 28% on the treated area and declined by about 12% on the untreated area. Daniel (1975) found an inverse correlation between coyote abundance and percent fawn production. Although he noted a higher net fawn production on the treated areas, deer population density did not increase above that on the untreated areas each year. It is not known where the density level of the deer herds in these two Texas studies were located in relation to the carrying capacities of the respective habitats, so it is difficult to relate the reported density change differences to this important factor. In Newfoundland, Bergerud (1971) found that intensive lynx (Lynx canadensis) control on one study area was followed by an approximately 100% increase in caribou calf survival by fall compared to an untreated area. Data on the change in caribou population density between the areas were not available.

In general, predators have the potential to curtail most ungulate populations when proper circumstances prevail. Errington (1946) suggested that canid predators can control ungulate populations by preying mostly on the young, because of the relatively low productivity of large herbivores. Allee et al. (1949) generalied that, to control any population, the net productivity input must be curtailed. The level of predation on big game populations in any area is doubtless a result of the density of the predator population, the behavioral reactions of the game animals, the food predilections of the predator, and the abundance and quality of alternative foods for the predator.

Although predators apparently influence ungulate populations, unlimited population growth in the absence of predation has not been demonstrated. When the population reaches or surpasses the habitat carrying capacity, further growth is slowed by other mortality factors. Controlling predatory animals to increase an already high ungulate population would be fruitless.

Culling of Inferior Prey

A common view is that predators serve to maintain healthy prey populations by culling the sick and weak or otherwise inferior individuals. Mech (1970) included young prey animals as biologically inferior. This discussion, however, does not consider all young animals to be biologically inferior.

Selection of strong or weak prey depends on the hunting habits of the predator. For example, stalking predators, such as cats, usually kill by surprise attack, which is relatively independent of the condition of the prey (Hornocker 1970, Hirst 1965). Predators which chase, and elicit a flight response from their prey, such as wolves (Canis spp.) and spotted hyenas (Crocuta crocuta), tend to take a disproportionate number of poor condition animals as prey (Mech 1970, Kruk 1972). The coyote cannot be assigned either category because of its diverse hunting patterns and feeding habits. It probably hunts big game by the chase-kill method (Murie 1940). This hunting behavior killed a disproportionate number of old, injured or young deer. Although reports of coyotes killing full grown, healthy wild ungulates are common, they are probably the exception. Size alone, since they rarely hunt in groups larger than two (Fox 1971), would preclude a coyote's preying on adults of most native North American ungulates. Coyotes feed mostly on small mammals and birds but will sometimes kill deer and other large animals, usually young or weakened individuals (Mech 1970).

Coyotes reportedly prey heavily on adult deer in winter when prey body condition presumably declines (Murie 1940, Knowlton 1964, Knowles 1976). Coyote predation at this time may be disproportionate toward adult males because they are physiologically exhausted from the rut as well as the poorer food conditions (Knowlton 1964, Beasom unpublished data). Hood (personal communication), while conducting a telemetry study to investigate deer movements in South Texas, noted a similar disproportionate coyote predation on collared adult bucks from late winter to early spring.

Coyote predation on pronghorns indicates that this predator does not take disproportionately more unfit ungulates (Bruns 1970). Murie (1940) presented several accounts of pronghorns easily outdistancing coyotes on unfenced ranges within Yellowstone National Park. However, coyotes apparently have learned to use fences (especially net wire) to capture even healthy pronghorns (Knowlton 1968).

Stimulation of Prey Productivity

Some predation can stimulate productivity and actually lead to larger populations of prey (Howard 1974). The idea is that populations regulated within the limits imposed by available food supply are more productive, in terms of young produced per adult female, than unregulated populations. Errington (1946) showed that reproductive success was inversely proportional to population size. White-tailed deer also may be more productive at low densities than at high densities (Teer et al. 1965).

However, there is little data to establish the importance of predation in stimulating productivity in big game. In a California study, Longhurst et al. (1952) reported slightly more mule deer fawns produced on an area where coyotes were uncontrolled than where they were controlled intensively. These results are unique to the literature; all similar studies have shown no change or more young produced under a predator control regime.

The different findings about effects of coyote predation at stimulating productivity in game probably result from three factors. First, the extent of control achieved was not assessed. Second, a distinction should be made between gross and net productivity. The predator may well stimulate gross productivity (number born) by predation on adults but reduce net productivity (number surviving through some point in time) by predation on young. Third, carrying capacity invariably was not assessed. Predation would stimulate gross productivity more if population density is at or above carrying capacity than below.

Stimulation of gross productivity in big game by predation would be a selective advantage to the predator which preys most heavily on the young. Predation on the young probably would create an older population than if the predation were distributed proportionately or equally across all age classes. Since the most productive deer herds are comprised largely of the older age classes (Teer et al. 1965) and on good range (Short 1972) (both of which are caused by predation), coyote predation could be a cause. Obviously, enough young must survive to replenish older age classes or this system could not be perpetuated.

Summary and Conclusions

Loss of habitat and habitat degradation have the greatest effect on game populations. Although habitat improvement may provide the greatest long term benefit to game populations, habitatalteration is not always feasible. In such situations, management should be able to apply feasible alternatives, including predator control, if justifiable.

Intensive population control of certain predatory animals can lead to at least short term population increases of most big game. The primary function of management is to develop ways to producing a harvestable surplus of animals each year rather than stockpiling animals. The potential effectiveness of predator control in a game management program should be evaluated in relation to this fall surplus. The harvestable surplus need not be increased if an excess already exists or is not being properly utilized.

LITERATURE CITED

Allee, W. C., H. E. Emerson, O. Park, T. Park, and K. T. Schmidt. 1949. Principles of animal ecology. W. B. Saunders, Philadelphia, Pa. 837pp.

Arrington, O. N., and A. E. Edwards. 1951. Predator control as a factor in antelope management. Trans. North Am. Wildl. Conf. 16:179-193.

Beasom, S. L. 1974a. Intensive short-term predator removal as a game management tool. Trans. North Am. Wildl. and Nat. Resour. Conf. 39:230-240.

______. 1974b. Relationships between predator removal and white-tailed deer net productivity. J. Wildl. Manage. 38(4):854-859.

Bergerud, A. T. 1971. The population dynamics of Newfoundland caribou. Wildl. Monogr. 25. 55pp.

Bruns, E. H. 1970. Winter predation of golden eagles and coyotes on pronghorn antelopes. Canadian Field Nat. 84:301-304.

Errington, P. L. 1946. Predation and vertebrate populations. Q. Rev. Biol. 21:144-177, 221-245.

Hailey, T. L. 1973. Causes and degree of mortality of the Trans-Pecos antelope herd. Tex. Parks Wildl. Dep. Prog. Rep. Fed. Aid Proj. W-57-R-20. 4pp. (multilith).

Hirst, S. M. 1965. Ecological aspects of big game predation. Fauna and Flora. 16:3-15.

Hornocker, M. G. 1970. An analysis of mountain lion predation upon mule deer and elk in the Idaho Primitive Area. Wildl. Monogr. 21. 39pp.

Howard, W. E. 1974. The biology of predator control. Addison-Wesley Pub. Co., Inc. 48pp.

Jones, P. V., Jr. 1949. Antelope management. Tex. Game Fish 7(12):4-5, 18-20, 24-25, 28-29.

Keith, L. B. 1974. Some features of population dynamics in mammals. Proc. Intl. Cong. of Game.Biol. 11:17-58.

Knowles, C. J. 1976. Observations of coyote predation on mule deer and white-tailed deer in the Missouri River Breaks, 1975-1976. Pages 117-138 in Montana deer studies. Montana Dep. Fish Game. 170pp. (lithograph).

Knowlton, F. F. 1964. Aspects of coyote predation in South Texas with special reference to white-tailed deer. Ph.D. Thesis. Purdue Univ., Lafayette, Ind. 198pp.

______. 1968. Coyote predation as a factor in management of antelope in fenced pastures. Proc. Biennial Antelope States Workshop. 3:64-73.

Kruk, H. 1972. The spotted hyena: A study of predation and social behavior. Univ. of Chicago Press, Chicago. 335pp.

Leopold A. 1943. Deer irruptions. Wisc. Conserv. Bull. 8(8):3-11.

Longhurst, W. M., A. S. Leopold, and R. F. Dasmann. 1952. A survey of California deer herds, their ranges and management problems. Calif. Dep. of Fish Game Bull. 6. 136pp.

Mech, L. D. 1970. The wolf: The ecology and behavior of an endangered species. The Natural History Press, New York. 384pp.

Murie, A. 1940. Ecology of the coyote in the Yellowstone. U. S. Nat. Park Serv. Fauna Series 4. 206pp.

Riney, T. 1964. The impact of introduction of large herbivores on the tropical environment. I.U.C.N. Pub., New Series 4:261-273.

Short, H. L. 1972. Ecological framework for deer management. J. Forestry 72:200-203.

Teer, J. G., J. W. Thomas, and E. A. Walker. 1965. Ecology and management of white-tailed deer in the Llano Basin of Texas. Wildl. Monogr. 15. 62pp.

Udy, J. R. 1953. Effects of predator control on antelope populations. Utah State Dep. Fish Game, Fed. Aid Div. Publ. 5. 48pp.

Uzzell, P. B. 1973. Antelope management in Texas. Tex. Parks Wildl. Dep. 11pp. (multilith).