individuals even broke their necks by frantically flying into the fences. Certain pen-rearing ventures in Western Canada are known to have ended in almost complete failure, while others, again, have been successful. Individual or group temperament in captivity appears to be markedly variable in character.

Experiments conducted by Mr. D. H. Bendick, Grathside Game Farm, Leduc, Alberta, have been very encouraging. In a letter of April 3, 1939, he states that the Chukar Partridge has been reared there successfully, that it is very easy to handle and takes kindly to captivity. In the pens it has been found much less wild than the Hungarian, though fully as furtive and excitable after liberation. The Chukar breeds freely in confinement and produces a high percentage of fertile eggs. One hen will lay as many as 60 eggs in a season, but clutches last delivered are too late to be of use in the Alberta climate.

The chicks are said bo be easily reared and soon become very tame. When mating and nesting the following spring their habits are more secretive; at this time they normally retire to brushy tracts for concealment. When the broods are nearly full grown, however, they often return to the original surroundings where safety is assured. Like the Hungarian, the Chukar Partridge is monogamous. The male assists in incubation and if accident claims the female he will hatch and rear the young himself. Mr. Bendick mentions that these birds are extremely hardy. Twice during the winter of 1938-39 there were spells of 50° below zero weather which they endured with apparent enjoyment while completely ignoring available shelter for the night.

Mr. A. G Cunningham, Director of Game and Fisheries for Manitoba, has informed me that his branch has been experimenting with Chukar Partridges since the year 1935. Reasonably good success has been experienced. During the winter of 1937-38 about 130 birds were carried over. In May, 1938, 44 Chukars of both sexes were released at four different points within the province. The remainder were retained for egg-laying purposes and then liberated in the fall. In the spring of 1939, a little over 100 adult birds were in captivity, which were hatched during the summer of 1938. Some of these will be set free in the spring of 1939. According to reports, the birds which were released during the spring and fall of 1938 withstood the succeeding winter with very little mortality.

Information regarding Saskatchewan introductions had been kindly provided by Mr. E. S. Forsyth, Game Commissioner for that province. The first Chukar eggs were secured in 1937. These were hatched under the direct supervision of Mr. E. Howie at the Mental Hospital, Battleford, and Mr. T. Grice, caretaker of the Wild Animal Park, Moose Jaw. Fair success followed at the former point when 35 birds from 50 eggs were raised to maturity. Apparently as the result of faulty incubation, the Moose Jaw experiment was less encouraging with the production of only 10 or 12 birds from the same number of eggs. The next spring some of the Battleford birds were released in the Mental Hospital Game Preserve and there is definite knowledge that at least one covey was successfully produced that season in a wild state.

In the spring of 1938 Saskatchewan Game Branch decided to go further into the matter of raising Chukars and established a game farm for the purpose at Beaver Creek, near Saskatoon. Some 400 eggs were purchased by the Provincial Government and a number by private individuals. Though hatching results were very favourable, many of the young birds died before reaching maturity. With the determination to succeed, the Game Branch is following up experiments by securing more eggs for the season of 1939. It is thought that this species should adapt itself to Saskatchewan conditions as readily as did the Hungarian Partridge and, if so, that it will prove to be a very valuable asset to Western Canada.

## *THE ROLE OF THE PREDATOR**

*By P. A. TAVERNER*

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THE BATTLE of wild life conservation is being fought. All forces are united as to the necessity of safe-guarding our natural heritage, but each school of thought advances its own panacea and the forces of good intention find divisions in their ranks that nullify much of their efforts. Nowhere is this more evident than in the opposed attitudes of different blocks towards the subject of predation. One group argues vehemently that

every creature saved from the claws and jaws of natural raptors is one more that can be devoted to man's use or to the prosperity of the favoured species. The other postulates that the predator is a normal and necessary factor in the economy of nature and its elimination would be disastrous to the end in view. The school that regards itself as being "common sense" and "practical", views its opponent as doctrinaire, theoretical and sentimental; the other school prides itself on its scientific caution, its wider field of vision and more exact knowledge of biological reaction.

Wild-life management is not far removed from domestic stock breeding, the fundamentals are the same and the same basic laws hold good for both. In one the proceedings are fairly well understood and systematized, and it requires only the transference of its proved principles to the other to produce similar effects.

Under optimum conditions all life increases in a geometrical ratio. If the process went on indefinitely without hindrance, shortly there would not be room in creation for all the living beings. This is true of all life, wild or domestic, —flies, mice, lions and elephants. That this result does not occur is proof that of those born, a large proportion is inevitably doomed to early death. The agencies that bring this about are various but absolutely certain. They may be, limitations of food supply, climatic conditions, predators, disease or other unsuspected factors. We can recognize a number of them but their relative importance, either alone or in combination is, in many cases, too complicated for ready analysis. We do know, however, that under any given set of conditions, there is an optimum of population, the resultant of many plus and minus factors, beyond which numbers can not be maintained.

This is axiomatic to the stock-raiser who must keep his herds or flocks down to the supporting limits of his land and equipment. He must limit his stock to the number his acreage will support throughout the season and that can be sheltered against the severest inclemencies likely to be experienced. Increase beyond this definite number must be disposed of in one way or another or else the welfare of the whole will be endangered, for it is not only the over-stock that is affected by over population; but the entire association, all creatures directly involved and the land they occupy. The latter becomes exhausted and its carrying capacity is lowered. Upon the excess population that must be removed, the stockman relies for his subsistance-profit. In its removal he becomes the predator and, having carefully controlled other depopulation factors, makes his predation the ultimate and critical one.

This is strictly comparable to wild-life conditions where the production exceeds the supporting and protecting powers of the environments. The surplus must be weeded out, if not by one cause, then by another. If one control is reduced, another takes its place; if none other is active, predation assumes major proportions When all normal controls fail, disease is almost certain to step in. In the case of predation a nice adjustment of balance of forces is evident. Potential predation in one form or another is almost always present in nature; there are always hungry things looking for food. When a species is scarce, predation is ordinarily a passive factor; when the species becomes common, predation increases. When, through the reduction of other factors, the species becomes over-abundant, predation may assume major proportions. Thus over-predation is usually an indication of over-production in relation to the environment.

The familiar argument enters here. Why, with our wild-life should we not replace natural with human predation as is done in domestic over-production? Why not eliminate the natural predators and take their share for our own use? Instead of supporting, hawks, owls, etc., why not let us have the over-plus? Superficially this sounds so logical that it is small wonder that it is regarded as indisputable. The facts, however, are that natural predation and that of the stock-man are essentially different from that of the sportsman. The stock-raiser in eliminating his supernumerary animals carefully takes the least promising of his stock. The natural predator by unconscious selection captures, on the average, the weaklings and least efficient. Thus both help to build up the constitutional stamina and resistance of the residue by the elimination of the unfit. The sportsman on the contrary, endeavours to take the best of the hunted,—the largest goose, the highest plumaged bird, the deer with the greatest antlers or the biggest and finest bear, leaving the culls to perpetuate the species. Even where no conscious discrimination is used and he takes the run of species, the bad with the good, his effect is not genetically constructive. Wherever he makes choice the effect is destructive; his average is either nil or detrimental, never beneficial.

Superficially it may seem that the killing of individuals for the good of the race is rather a paradox; yet that is just what the experienced stockman finds necessary if he is to keep up or

build up the standards of his herd. It is just as important for him to dispose of scrubs, weaklings and the diseased as it is to acquire good stock. The best of herds will, eventually, deteriorate if careful elimination is not practised; all the more rapidly if the best, not the poorest, of the stock is eliminated. The strongest wild strains would also similarly degenerate were it not for a selective pressure from natural enemies; a pressure the sportsman exerts in an opposite direction. The natural predator is a strengthening element in wild-life economy, the sportsman a weakening one and it is questionable whether any compensation that he initiates makes up for his degenerating influence.

It is granted that under certain circumstances of time, place and conditions, predation may be too heavy for some species to withstand. This is practically always the result of an unbalance in environment in relation to population. All species have evolved under certain stresses of releases. Had predation not been compensated for by other factors, this or that form could never have developed. Threatened by their enemies, species learned how to make use of their environment and develop powers to guard against them. Thompson Seton has said that every species has some great advantage or else it could not exist; that every species has some great weakness or no other animal could survive. Under natural conditions and generations of adaptations the strength of one is compensated for by the weakness of the other. The fact that few animals through ages of evolution have entirely freed themselves from individual fear of raptors is highly suggestive that predation is an important condition of racial success and that without it progress would have been tremendously slowed or impossible. Without the wolf at his heels, the horse would never have developed or retained its fleetness and without the hawk the partridge would not have obtained its camouflage. The principle works today just as it has in times past.

One of the principal mechanisms of predator-defense is shelter to which to flee in moments of danger or in which to rest or to raise young in comparative safety. Where this is absent in pratical proximity to fields of normal endeavour, such as feeding grounds, a species is under a heavy handicap to its enemies. Burn, reap, or graze away all the long grass, drown or drain the reed beds, level the forest, clear away all the brush and tangle while restricting necessary food supply to exposure, and decimation or worse is likely to prevail against the species adapted to them. Given adequate shelter and the normally strong of any species can take care of itself against its hereditary foes. As for the weaklings, it is better to let them go. The problem in such cases of unbalanced environment is not the raising more unprotected stock to feed carnivores but in restoring favourable habitat against them, thus retaining the necessary services of the predators under circumstances that increase the favourableness of their selection.

Another moot question often brought up by a limited and special clientele is that of artificially produced over-plus populations. Wherever there is unprotected food in abundance there we can expect an influx of predators to consume it. They may be cats or rats or skunks or hawks or parasites, but if you bait a place you can expect the baited to come. Some of these as cats and rats and other camp-followers of man are just as artificial to the natural scheme as is the congestion that attracts them. These are foreign hazards, cannot plead as natural predators and are without the pale of this article, but even forms that are normally inocuous, in the presence of easy prey, may develop unsuspected food habits. All animals take, within the limits of acceptibility, the food that is easily obtainable and are no more inclined to overexert themselves in winning their daily bread than is man. Thus on game farms, fish hatchery pools and other artificial concentrations we may expect unusual and perhaps serious predation. It is another example of an over-loaded environment. The game-keeper or fish-keeper can be expected to protect his charges, but should he do so by wholesale destruction of forms that are of value to the broader, more numerous interests of the community at large? We should certainly expect him to devise methods that would not penalize the whole country for the sake of his individual interest. The cost of protection under these restrictions may be considerable, even perhaps at times greater than the project can economically carry but, after all, he who would raise oranges in the Arctic must consider the cost of glass houses before he proceeds with his venture.

The conclusion seems plain that the predator occupies an essential position in the scheme of nature that cannot be replaced by any other agency: that probably one of the greatest disservices man can do for the game he hunts is to destroy his rivals, the predators, the agents that exercise the only selection that compensates for his own deteriorating influence.