"The trout can eat only the prey which it can see and capture"

like, where the quail found adequate food, shelter and the satisfaction of all its needs, just as do the aquatic insects under stones. The quail seldom leave their cover. Under ordinary conditions predators such as fox, cats, hawks, and so on, capture only the exceptional individual quail which, like the insect, becomes accidentally "exposed." This and other evidence shows that in order to keep eating, some major predators may have to patrol ten to twenty miles to get food for a day, and even then often sleep on an empty stomach.

Many other examples can be given to show, as do the above, that major and minor predators must lead a daily life of steady expenditure of energy if they are to feed. The habits of the prey give the highest measure of protection against a predator, and the bulk of a prey species leads a life free from the danger of predation.

In the light of this knowledge, it is most difficult to believe that predation under normal circumstances has any significant control over the balance of nature, that is the balance of numbers under natural conditions. Elton in England by analysis of the fur returns of the Hudson's Bay Company has shown cyclical fluctuations in the numbers taken of pelts of different fur species and that, for example, as the return of rabbit skins rises over a period of years, this is paralleled by a rise in the number of fox and other predator pelts. Under the old idea of predator-prey relationship, this was interpreted as a simple cause and effect—more rabbits to feed more foxes; but it is becoming clear that the increase in the numbers of the various species is not based on a simple food-chain effect. It is not a sequence of events but a single event happening equally with each species brought about by a common and still unknown factor operating at the same time on all the species concerned.

A new attitude to, and understanding of, the predator-prey relationship is valuable to us in New Zealand. The disappearance of many native animals from some areas, and the reduction in numbers in others, is often blamed on introduced predators; but if predation is to continue to that extent, then the predator must be able to invade and destroy the prey inside the protection of its cover and its habits. This would be a far less likely cause of local or general extinction than if at the same time or independently human activities destroy the cover and force the prey to either change its habits, or die. Few species, in North America the woodchuck is a famous example, have changed their habits to the extent that they can survive deprived of their original natural cover. On the other hand, if the contest is to the death, the predator will come to starvation long before the prey is wiped out, a situation which is the same whether the predator preys on one species or many, for as the number of prey diminish, the predator must expend an increasing amount of energy to catch its daily food until the expenditure of energy exceeds the value of the food taken. The predator starves to death, but there will still be some of the prey left to breed, and the prey will survive.

We commonly regard many of our pest species as reaching pest proportions because here they are freed from predator and other forms of biological control. Few stop to think that the possum and wallaby in Australia were essentially without a primary predator control. Arboreal in habit, the possum was free from major control by the dingo, or from the eagle and other predatory birds which, in many cases, are really carrion eaters. It is more than hard to pick any Australian animal which could have exerted control in the old sense over the possum. The wallaby was, like the bob-white quail, protected by its habits and its cover, in this case a country sufficiently open that the wallaby could detect a predator and escape before being seized.

Now that we can devalue the status of the predator and of the food supply as major forms of biological control under ordinary conditions, we must look to other factors for the answer to our pest problems. From field experience we can be confident that disease is not an ordinary primary controlling factor. We can be equally confident that there is a primary controlling factor which can be determined only when we bring to bear on our problems a new enquiry unfettered by traditional thought.