eligible to compete for the prize. (3) The work submitted must include personal observations and experiences collected by the candidate in general practice, and a high order of excellence will be required. If no essay entered is of sufficient merit no award will be made. (4) Essays, or whatever form the candidate desires his work to take, must be sent to the British Medical Association House, Tavistock Square, London, W.C.1, not later than December 31st, 1931, and the prize will be awarded at the annual general meeting of the association to be held in London in July, 1932. (5) No study or essay that has been published in the medical press or elsewhere will be considered eligible for the prize, and a contribution offered in one year can not be accepted in any subsequent year unless it includes evidence of further work. (6) If any question arises in reference to the eligibility of the candidate, or the admissibility of his or her essay, the decision of the council on any such point shall be final. (7) Each essay must be typewritten or printed, must be distinguished by a motto, and must be accompanied by a sealed envelope marked with the same motto, and enclosing the candidate's name and address. (8) The writer of the essay to whom the prize is awarded may, on the initiative of the science committee, be requested to prepare a paper on the subject for publication in the *British Medical Journal* or for presentation to the appropriate section of the annual meeting of the association. (9) Inquiries relative to the prize should be addressed to the medical secretary.

FORTY-SIX species of birds that inhabit the Himalayas have been received by the Roerich Museum, New York City, in the first group of ornithological collections to be sent from Urusvati, Himalayan Research Institute of the Roerich Museum, at Naggar, Kulu, Western Himalayas. The species include the griffon, giant mountain bird of prey, the sacred crane of India, the lammergeyer or bearded vulture, the horned owl, the moorhen, hoopoo, sun birds, orioles, rose-fringed parrots, the long-tailed paradise fly-catcher and the monal, whose feathers shade from copper green and purple into a light brown tail. The birds were obtained by the two biological expeditions sent out under Dr. Walter Koele. The first went through the Kulu Valley and Lahul, across the Rothang Pass. The second went into Rampur Bashahr through the Sutlej Valley. An ethnographic-archeological-linguistic expedition is also being conducted in Lahul by Dr. George Roerich.

# DISCUSSION

## THE CONTROL OF PREDATORY MAMMALS

THE United States Bureau of Biological Survey, in the attempt to control predatory mammals and obnoxious rodents, has adopted policies which have caused the naturalists and conservationists at large grave concern for some years. As far back as 1924, the American Society of Mammalogists, at the annual meeting held in Cambridge, April 15–17, protested against the survey policy of extensive campaigns of predator destruction, and at subsequent annual meetings the mammalogists have maintained a practically unanimous stand against the field practices of the survey as far as they relate to drastic control measures.

Far from heeding what has been tantamount to a nation-wide protest, the survey has steadily built up such an extensive and powerful control machine that to-day our western wild life is confronted with the most serious crisis in its history. Realizing that the time for passive criticism had passed, the Society of Mammalogists, at the New York annual meeting of May, 1930, appointed a special committee on the problems of predatory mammal control, instructing this committee to attempt a critical investigation of actual conditions in the field, in which the committee personnel would cooperate as far as possible with special investigators from the survey.

The committee was able to conduct joint and independent investigations during 1930–31, which involved an itinerary of more than 12,000 miles in the Western United States. Although the region to be covered is so vast, and the conditions so complex, that these studies can be considered as only a start upon the research which should be made into the life-histories of our western mammals and their relations to habitat, to vested interests and to the public in general, nevertheless enough was accomplished to confirm the society in its belief that undue value was being placed upon the claims of destruction done by mammals and that the control policies of the survey were placing an excessive toll upon all wild life in the attempt to control a few species.

The committee presented its report at the annual meeting held in Philadelphia on May 14, 1931. After discussion, the report was adopted by the membership with only two dissenting votes. It is no secret that some of the naturalists in the survey employ are much concerned over a policy with which they are not in accord and which has been continued and developed in response to powerful lobbies backed by special interests. From a small beginning, the control activities of the survey have been rapidly increased until they have assumed a dominating influence upon the conduct of the survey. It is not difficult to understand how research and study into faunal relationship have been relegated to a post of minor importance,

as the swelling appropriations for the slaughter of predators and rodents have demonstrated the success of this latter activity as a means of securing support from a Congress, ready to listen to any tale touching upon the interests of the live stock owner or agriculturist.

As an instance of this doubt upon the part of some of the survey personnel that the policy of the survey toward predators should be defended, the remarks and conclusions of one of the survey's own investigators was read at the annual meeting. The chief of the biological survey had shown his fair-mindedness in the joint investigations by exchanging field reports with the special committee of the mammalogists. These remarks drew attention to the propaganda disseminated through survey channels and which was designed to paint certain species of mammals in the blackest tones and to create a desire for destruction wherever the public was lukewarm to these practices of the survey.

During the discussion a member from Canada pointed out that a political boundary should not change the biological principles involved in this problem and remarks by others showed that no such tax upon wild life was either exacted by Canada or deemed necessary to protect her farmers and drovers.

After summarizing the conclusions and opinions of the committee as based upon extensive data, the committee recommended to the society the following resolutions, which were passed, as stated above.

(1) That the society strongly urges the Biological Survey that the use of poison as a control measure against predatory mammals be drastically curtailed, with the view of complete suspension of poisoning as soon as it is reasonably possible.

(2) That the society deplores the propaganda of the survey which is designed to unduly blacken the character of certain species of predatory mammals, giving only part of the facts and withholding the rest, and which propaganda is educating the public to advocate destruction of wild life.

(3) That the society asserts the claim of the great nature-loving public to a voice in the administration of our wild life resources, and challenges the right of a federal organization, such as the Biological Survey, to consider only the interests of a very small minority, the live stock interests.

It will be noted that the special committee has concerned itself chiefly with the problems raised by predatory mammal control. While these questions have been of paramount importance in the past, the employment of more deadly poisons against rodents, with a consequent more ruthless threat against all the animal life of the region where these operations are in force, has thrust forward the entire subject of the control policies of the survey as a topic of vital importance to every true conservationist.

Dr. Jean M. Linsdale, in the *Condor* of May, 1931, has written an account of the use of thallium as a poison against the ground squirrel in California. This is a calm statement of findings and must impress the reader as an investigation conducted without bias or prejudice. Dr. Joseph Grinnell, in the same publication, in commenting upon Linsdale's data, figures that in four years, in California alone, not less than 50,000,000 animals other than ground squirrels have been killed through these operations. This extermination has been carried on either under the direction or with the cooperation of the Bureau of Biological Survey and, during these years of thallium poisoning, spokesmen of the survey have been assuring the Society of Mammalogists that the taking of wild life was a regrettable duty and that, as far as it was humanely possible, every protection was being given to non-injurious species. The exposé by Linsdale shows how far the survey had been curtailing control activities at the time these pronouncements were made. As a fitting climax to the drama of thallium, the United States Department of Agriculture, in Bulletin No. 238, April, 1931, written by Munch and Silver (the latter in the survey), discusses the use of thallium in rodent control and concludes with these significant words:

> Thallium is a cumulative poison of high toxicity and is without taste, smell or other warning property. It should not be recommended to the public as a rodent poison. Where the use of thallium is found necessary for the control of highly resistant species of rodents, it should be entrusted only to persons who understand its dangerous qualities and who will exercise appropriate care in handling it.

When 602,728 pounds of grain poisoned by thallium are scattered in California in one year, 1929 (*vide* Linsdale), one wonders what constitutes "appropriate care."

Dr. Witmer Stone, in an editorial in the *Auk*, July, 1931, page 477, expresses the attitude of all of the ornithologists who are informed on the matter, when he stresses the danger to bird life from such campaigns as the thallium drive of California. He concludes: "If ever the 'appeal of the bird itself' needs our support it does so now."

The list of societies and opinions cited above might be greatly extended and organization after organization has gone on record as opposed to the present control policies of the Biological Survey. This criticism is not the utterance of a few fanatics, as some of the survey champions would have one believe, but rather it is the most universal formal statement of

opinion which has ever been expressed upon any activity of the survey.

The repercussions of the control policies of the survey are many and varied. The mouse plague of Kern County, California, 1926–7, has been attributed, with reason, to the poisoning of predatory mammals, a natural control over the numbers of mice. The fur trade is concerned over the fur-bearers needlessly killed by survey poison squads. A strong argument against extermination or near-extermination campaigns can be advanced on esthetic grounds for surely a young, faunally rich country like the United States does not wish the great open spaces swept clear of all wild life in order to make the West a sheep man's paradise. The American public should love its wild life and want it preserved in its original entirety as far as is reasonably possible.

But unless nature lovers throughout the length and breadth of the country assert themselves and demand a pause in this organized slaughter, the Biological Survey will continue to develop the technique of destruction and to expand along the lines which have proved to be such a bureaucratic success. The survey is subjected to great pressure by the forces working for specialized control; it is placed in an exceedingly awkward position. The conservationists must exert an even greater pressure against the control policies of the survey in order to accomplish any useful end. For awkward as is the plight of the survey, the lot of our wild life is even more precarious.

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## FITTING THE CURVE OF THE DIMINISHING INCREMENT TO FEED CONSUMPTION-LIVE WEIGHT GROWTH CURVES

IN a recent paper,[1] Hendricks, Jull and Titus suggested a method of interpreting the results of feeding experiments by means of the curve of the diminishing increment. The senior author felt that the method might be more useful to workers in animal nutrition if the curve of the diminishing increment could be accurately fitted by some rapid method.

The most rapid method of determining the constants in the equation:

$$W = A - Be^{-kF} \qquad (1)$$

proposed up to the present time, is, perhaps, the method of arithlog plotting used by Brody.[2] However, it has been the experience of investigators at the U. S. Animal Husbandry Experiment Farm, Beltsville, Md., that, in many instances, it is difficult to judge accurately which value of the constant, A, makes the values of log $(A - W)$ lie most nearly along a straight line, when plotted against the corresponding values of F as abscissae.

The writer has tried a method of approximating the values of the constants which appears to give much more accurate results than the method of arithlog plotting.

The differential form of equation (1) may be written:

$$\frac{dW}{dF} = C - mW \qquad (2)$$

in which, $C = kA$, and, $m = k$. If finite increments are substituted for the infinitesimals of the Calculus, equation (2) becomes:

$$\frac{\Delta W}{\Delta F} = C - mW \qquad (3)$$

in which the ratio, $\frac{\Delta W}{\Delta F}$, represents the gain in live weight, per unit feed eaten, over a short interval of time, and W represents the average live weight of the animal during that interval of time, calculated by taking one half of the sum of the live weights at the beginning and at the end of the interval.

The values of the ratio, $\frac{\Delta W}{\Delta F}$, for consecutive intervals of time, lie along a straight line, when plotted against the corresponding values of W as abscissae. A simple linear equation of the form, $Y = aX + b$, may be easily fitted to such a set of data by the method of least squares.

It is readily apparent that the slope of the fitted straight line is $-m$. The intercept of the line on the axis of ordinates is C, since when $W = 0$, $\frac{\Delta W}{\Delta F} = C$. The intercept of the line on the axis of abscissae gives the mature weight of the animal, since when $\frac{\Delta W}{\Delta F} = 0$, $mW = C$, and $W = \frac{C}{m}$, or A. The value of the constant, B, in equation (1) may be calculated by subtracting the initial weight of the animal from the mature weight, A.

The writer fitted equation (3) to data obtained from two lots of chickens which had been weighed each week up to the age of one year. The values of C, which Hendricks, Jull and Titus (*loc. cit.*) have interpreted to represent the true efficiency of the feed for growth, were found to be 0.343 and 0.355, respectively. The corresponding values, calculated after carefully "adjusting" the constants of the integrated

[1] Walter A. Hendricks, Morley A. Jull and Harry W. Titus, "A Possible Physiological Interpretation of the Law of the Diminishing Increment," SCIENCE, 73: 427–429, 1931.

[2] Samuel Brody, "Growth and Development with Special Reference to Domestic Animals. III. Growth Rates, Their Evaluation and Significance," *Mo. Agr. Expt. Sta. Bull.* 97, 1927.