1925

Roosevelt Wild Life Bulletin

Charles C. Adams
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RELATION OF WILD LIFE TO THE PUBLIC.

BIG GAME ANIMALS OF THE YELLOWSTONE.

FOOD OF THE YELLOWSTONE TROUT.
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EDMUND HELLER, A.B. .....................Roosevelt Game Naturalist
MILTON P. SKINNER, B.S. .....................Roosevelt Field Naturalist

*Including only those who have made field investigations and whose reports are now in preparation.
**Resigned as Station Ichthyologist October 1, 1921.
THE RELATION OF FORESTS AND FORESTRY TO HUMAN WELFARE

"Forests are more than trees. They are rather land areas on which are associated various forms of plant and animal life. The forester must deal with all. Wild life is as essentially and legitimately a part of his care as are water, wood and forage. Forest administration should be planned with a view to realizing all possible benefits from the land areas handled. It should take account of their indirect value for recreation and health as well as their value for the production of salable material; and of their value for the production of meat, hides and furs of all kinds as well as for the production of wood and the protection of water supplies.

"Unquestionably the working out of a program of wild life protection which will give due weight to all the interests affected is a delicate task. It is impossible to harmonize the difference between the economic, the aesthetic, the sporting and the commercial viewpoint. Nevertheless, the practical difficulties are not so great as they appear on the surface."

HENRY S. GRAVES,
Former Chief Forester, U. S. Forest Service.
Recreation, Vol. 52, p. 239, 1915.

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"The discovery of new species and races based upon the study of preserved specimens of game animals, has already progressed very far; but the more attractive field which includes the habits of the game remains yet to a great extent unexplored. This field is peculiarly open for investigation to big-game hunters, and to all other men who go far afield and obtain first-hand knowledge of the conditions under which the game animals live. The closet naturalist, with his technical knowledge of the structure of animals, can be trusted to perform the work of classification to a mathematical degree of precision; but we cannot obtain from him a trustworthy account of the behavior of animals in their natural environment, or learn from him the value to the animals of the various structures or characteristics which he has shown them to possess. Much knowledge regarding the habits of game is acquired by the successful sportsman. Yet it is often infinitesimal in quantity compared to what may be acquired if the outdoors observer will direct his investigations along the broad lines covering the life history of the species with which he comes in contact. To carry out such investigations successfully it would be necessary to spend many hours and days, perhaps even weeks and months, observing certain individuals or family groups of game. This is quite beyond the limits of time allotted the average sportsman. Nevertheless much can be learned by the collected evidence from many fragmentary observations providing only these are accurate. A great mass of accurate fragmentary observations will often spell far more progress in investigations of this kind than the observations of a few trained individuals over an extended period of time."

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THE RELATION OF WILD LIFE TO THE PUBLIC IN NATIONAL AND STATE PARKS*

By Dr. Charles C. Adams,

Director, Roosevelt Wild Life Forest Experiment Station,

Syracuse, New York.

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INTRODUCTION AND ASSUMPTIONS

The value of wild life in our State and National Parks depends directly upon what we are willing to do to make proper use of it. If wild life is neglected or ignored little benefit will be derived from it, and if, on the other hand, it is carefully cared for and the public is intelligently encouraged to appreciate it, much benefit will be derived from it. As in the case of most things it is of the greatest importance to realize that we can get from wild life only what we are willing to put into it. If you know a park where little is derived from wild life you know one at once in which little has been done for it.

A second fact of basic importance is that the welfare of wild life in the parks will depend fundamentally upon the welfare of the parks as a whole. Their interests are mutual and interdependent, and we must not expect wild life to be cared for and appreciated if the parks as a whole are not. Our main practical point is to strive to see that the wild life of our parks receives all consideration that

*A revision, with additions, of Adams, '23.

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it fairly merits, and in accomplishing this the best interests of the parks will be promoted. I have no plea for the special consideration of wild life.

Generally speaking I fear that too many of our park administrators think of wild life mainly when it conflicts with their visiting public, that is, when an animal disturbs or injures the park visitors. In the Palisades Interstate Park poisonous snakes, leeches, mosquitoes and "water bloom" are examples of this sort of unpleasant relation between the public and the native organic population of the park. But this is only one aspect of the animal problem. In addition to this protective phase there is as well an even more important one which concerns the active interest in parks caused by the presence of wild life. We have in the United States thousands of small and large local and national organizations devoted to and centering about some branch of natural history. There are bird clubs, flower clubs and entomological societies of great variety. Then there are literally hundreds of sportmen's and outdoor organizations of all kinds, a large number of which take a healthy and sane interest in wild animals. In the aggregate these people make a considerable assemblage who can be depended upon, under proper leadership, to take much interest in wild nature in these parks and work for its welfare. So far as known to me no systematic effort has been made to interest and enlist the support of all such organizations. In England this class of people has for a long time been one of the main supporters of the large public parks. Thus Buxton ('84, pp. vi-vii) writes:

"I find that the most intelligent interest is taken in our woodlands by those who there pursue their studies in one or other of the branches of Natural History. Many of them are of humble station; but as members of societies, which are very numerous in London, of botanists, ornithologists, fungologists and microscopists, they are enthusiastic searchers into nature. I have therefore added some chapters on the different forms of life which they may expect to find in the course of their rambles."

While I shall refer mainly to wild life I wish it clearly understood that this implies also a proper living environment for it, in order to be assured of its best utilization by the public. This involves natural living conditions when living free, and suitable conditions when confined.

Although speaking primarily of animals I believe that the general principles discussed apply to many other features of nature, including the geography, geology, the plants and the scenery:
phases of nature to which, except the scenery, we have not yet given adequate attention.

It will help clear up the point of view from which I have discussed the park problem, to state definitely the assumptions upon which I have based my remarks. Probably some will not agree with me on certain of these points. I hope that those who do not accept them will see the need of a thorough discussion of these points, and that later they will assist in elucidating them. For brevity I will state them without discussion as follows:

1. The publicly owned National and State Parks are devoted solely to the public welfare. The wild life in them is public property and should harmonize with all other uses of the parks. 

2. This social ideal includes the recreational, educational, scientific and aesthetic interests, and should exclude all commercialization of the parks.

3. The main criterion of proper use is that which is harmonious with permanent or sustained use—to pass on to future generations, unimpaired, the natural resources of the parks. The present generation has no honest claim to more than a fair share.

4. The ideal and the practical must be combined in order to harmonize with the preceding.

5. These parks, to be maintained upon a permanent basis, must remain primarily a wilderness,—at least our National Parks, and most State Parks should strive for at least a part of their area to be reserved for that purpose.

6. All the wild parks should exclude from within their boundaries all plants and animals not native to the region. These areas cannot be passed on to future generations unimpaired, if they are periodically stocked with exotics.

**RELATION OF WILD LIFE TO THE PUBLIC**

The most important relation of animals to the public is their attractiveness to park visitors. The silent grass-lands and forests without birds and other animals lose much of their charm to a host of people who will never become bird students. The presence of beaver dams and lodges, and the prospect of seeing these animals at work, are powerful attractions in the Adirondacks and in the Yellowstone. The mere presence of bears (Plate 25), buffalo, elk, deer or moose has an appeal that no intelligent person, at all acquainted with the public in the presence of these animals, can doubt (cf. Grinnell and Storer, ’16). And these attractions lose none of their charm even in the midst of the most wonderful
scenery; in fact, as a rule, the scenery only adds to their charm. I believe that this relation is now generally recognized among all who have given thought to this subject. At present the practical problem is how to devise means of bringing together wild life and the public under the most favorable conditions. The following are the most prominent methods which have been suggested and used, but the truth is that none of them has been thoroughly tested out in more than a few features.

**Guide Books and Other Publications.**—Our National Parks have been particularly fortunate in the character of their chief champions who have given us a series of books of remarkable value. The writings of John Muir are a permanent contribution to our literature, and will speak of the value of wild nature through the ages to many coming generations. The published guide book, as a method of presenting nature and wild life to park visitors, is a means deserving of much study and worthy of generous support. In spite of this being a well-known method its application to our parks has not made much progress; only a few experiments along this line have been tried out, and generally these have been limited to catalogues and lists with a few notes, descriptions, and observations on animal habits. This method has long been out of date with modern teachers of outdoor biology in our best colleges, where plant and animal ecology is taught. These lists of animals have their place and a certain value, but they should be held in the background, as it is now clearly recognized that this is not the most successful method.

It is a great mistake to assume that there is only one kind of popular guide. There are many avenues of approach which have not yet been explored and experimentally studied. These include the aesthetic approach, that of the amateur naturalist, the student of nature-study, that of teachers and leaders of youth of all kinds, and finally that of the very superficial park visitor, who must also be approached from various angles. Not only should the literary style vary with the method, but type, half-tones, maps and colored plates must all be enlisted in a program to entertain and enlighten the visiting public.

One of the most attractive guides published on an American park is that by Safford: *Natural History of Paradise Key and the Near-by Everglades of Florida* ('19). The illustrations, half-tones, maps and colored plates of this guide are a model in many respects. Another recent and very attractive guide book assembled by Hall ('21) for the Yosemite National Park, is evidently modeled
Relation of Wild Life to the Public

after Nature and Science on the Pacific Coast (P. Elder and Co., San Francisco, 1915) which set a new standard. The first of these park guide books, by Chittenden, on the Yellowstone, has much real merit even today. In this connection attention should be called to a recent book by Downing (’22) on the Chicago region. Although not written primarily for the Cook County Forest, which is in reality a large forest park, it serves as a nature guide manual for that region.

It has too often been assumed that our only need is for popular literature on the wild life of our parks. But there is also an urgent need of detailed information of a scientific character, as well as of a technical nature concerning the administrative problems of parks. We urgently need a great variety of publications, including the popular, scientific and technical; and some persons must continuously stress the need of the less popular publications, because the success of our parks cannot be assured without a basal up-to-date knowledge of the facts of nature in them.

We continually meet with critics of the technical and scientific publications, and often similar criticisms of the popular. The critic of the non-popular literature does not realize that most of this has been written by those who on their own time and expense have made these studies and naturally feel free to choose how they shall present their results. Those who are eager for the popular accounts can secure these also, without question, if they are willing to pay the necessary price. There are many naturalists who would gladly make the studies and prepare popular reports, provided the facilities were given them to do the work. An understanding and a reasonable expectation from each group would lead to better mutual understanding and appreciation. For my own part I feel that the public is really getting a generous supply of help compared with what they have put into such work. Too often we expect to harvest where we have not planted.

The New York State College of Forestry and its Roosevelt Wild Life Forest Experiment Station have definitely experimented with popular bulletins on birds for park and forest visitors. One has been prepared for the Palisades Interstate Park, a second for the Adirondack region—both by Silloway (’20a, ’23)—and a third, by Saunders (’23), for the new Allegany State Park south of Buffalo. Another very attractive type of handbook on birds, arranged for use as one tours the Yellowstone National Park, is by M. P. Skinner (’25), formerly Park Naturalist there. This author has made a special study of the tourists’ interests as well as of the
birds themselves. His *Yellowstone Nature Book* (’24) also shows skillful treatment applied to the general natural history of the Park. We are deliberately experimenting, as I have said, with several methods of approach in these popular guides. Birds are particularly adapted for such experiments on account of the widespread popular interest in them. There is an active, strenuous type of person who gets his pleasure while on the way, in pursuit of the birds. The eye-minded and the ear-minded student, each makes best progress by a different approach. Then there is also the contemplative attitude, the aesthetic as well as that of the understanding, so beautifully blended in Muir. Of course there are those who feel that we should ignore such differences in persons, but that is dodging the problem instead of solving it. These tendencies are by no means limited to bird study, for they are of general application. The papers in this number of the *Bulletin* by Heller (’25) and Muttkowski (’25) are examples of similar popular accounts of fish and mammals in the Yellowstone. Nor does the plea for economy in publications hold, because it is one of the first obligations to adapt our park methods to a large public, and particularly to that kind of public which will best appreciate the parks.

Experiments are also needed on guide booklets to the natural history of trails. These booklets must be the result of outdoor study and should be made to fit special trails and localities. The whole technique of laying out these trails is a virgin field awaiting detailed investigation. A special knowledge of natural history, particularly of ecology, is one of the essentials for such work. The marking of the trail must be expanded to include an intelligent labeling of what can be seen along it. This work must not be overdone and thus disfigure the trails, but the labeling of noteworthy geologic and geographic features, plant colonies, striking individual trees, and the haunts of certain animals, will have a wonderful influence in stimulating a healthy and intelligent interest in outdoor nature. Wild life interests will fit into such a program beautifully, but as you will see, it will be useless to urge this for wild life alone, as these various outdoor interests are all bound up so closely that all will best progress together.

**Lectures, Excursions and Nature Guides.**—Oral leadership in the form of lectures, conducted field excursions, and guides, has already made a beginning in some of our parks. Lectures have easily led because speakers have been easier to secure than the various kinds of leaders needed for field parties and because larger numbers can be accommodated. By all means these lectures should
be primarily limited to the particular park and to teaching appreciation of it. The conducting of field parties is difficult work, requires special training, both in subject-matter and method (Adams, '10, '21), and is I believe destined to become one of the most important methods of assisting the public. I believe that it is a great mistake to assume that the public can grasp only the simplest facts and relations, and that it is useless to attempt to give the larger conceptions. I do not think that this is true even of lectures, because with proper accessories, slides, maps and models, much can be done. Field excursions can often be planned to present the larger and more striking conceptions to wonderful advantage. Not enough is made of these larger ideas, so that often the public feels that to know the name of an animal, a plant, or a rock is all there is to science, and is wholly unaware of the existence of the larger ideas (cf. Adams, '10, pp. 119–121). I believe that adequate guide leaflets, guides on the trails, and properly placed trails, will do as much if not more for the intelligent appreciation of wild life and the parks than any single method (cf. Mills, '20).

Lecturing with pertinent slides, moving pictures and other appropriate equipment, can accomplish a great deal when large numbers of people are concerned; but it can never take the place of the field guide. The lecture is particularly suited to those spending very limited time in our parks; but those who camp, or who tour slowly either by auto or on foot, have in the main other ideas and needs. In the Palisades Interstate Park, Mr. P. M. Silloway conducted field excursions for bird study (1918) and Prof. T. L. Hankinson and I conducted similar excursions about the lakes and introduced groups of boys to the wonders of animal life in the waters. We all cooperated in laying out trails and marking them. The primary emphasis was placed upon aiding people to get outdoors, observing, thinking and enjoying themselves, because fundamentally it is supervised nature work first, followed by the self-directed kind, which leads to the best results in the long run. In the case of city visitors, who do not know the country, and do not know what to do in a strange place, they naturally gravitate back to and demand city diversions, but under skilled leaders much progress can be made toward getting them away from these deep-set habits (cf. Adams, '21).

In the Yosemite National Park, Dr. H. C. Bryant began field excursions and lectures, for both adults and children, in 1920, and these have been keenly appreciated (cf. Twenty-sixth Biennial Report, California Fish and Game Commission, pp. 80-82, 1921).
In this work Dr. L. H. Miller, by his wonderful reproduction of bird music and its interpretation to the public, has opened up a new world to the park visitor.

**Museums, Libraries and Zoological Exhibits.**—It is only the advanced administrators of our parks who have become fully alert to the needs of museum-libraries and living zoological exhibits in our parks. It is rarely recognized among these officials just what this implies, and they do not always realize that such a combination of museum, zoological exhibit and library should be planned very differently from the corresponding city institutions. By all means its exhibits should be rigidly confined _solely to the resources of the particular park_, and it should be primarily intended to stimulate visitors _to go out into the park itself_ and see as never before. But in the case of the animal exhibit, it is better to do nothing whatever than to make a failure of it. The library should supplement the museum and be particularly selected to encourage an outdoor acquaintance with the park. I have elsewhere emphasized the main features of such a local museum (’08a). The plans of Graves (’19) for a "Nature Library" are easily adapted to particular parks. Such a library should be viewed broadly as containing photographs, facilities for lantern talks, and moving pictures. Such a museum-library or its branches, should be so located that it will become the natural meeting place for all information about our parks. The facilities of the museum-library, supplemented by field work and lectures, will make it the natural headquarters for the guide service.

The zoological exhibit in the park should be devoted exclusively to the kinds of animals natural to the region, and in this it is in striking contrast with a city zoological garden. Too much emphasis cannot be put on this point. The basic idea of such a collection is to give the visitors, in a limited time, a good close-up view of the native animals, and to encourage their interest in them as they tour the parks or camp there (Adams, ’21a, p. 70).

No opportunity should be lost in teaching this visiting public the _reasons_ and methods necessary to properly care for and appreciate animals. Our parks’ only safety, in the long run, is an intelligent and appreciative public. They must therefore know the reasons for park rules and regulations, and the better they are understood the greater the chances of their being respected and obeyed.

A moment’s thought will show almost anyone that to meet adequately the needs of the public along the lines here suggested will necessitate a special staff of well trained persons.

The park which has so far made the most progress with a museum
and zoological exhibits is the Canadian Rocky Mountains Park at Banff, where Mr. Harlan I. Smith has written the best handbook so far published by any park museum ('14).

**ADMINISTRATIVE ASPECTS OF WILD LIFE**

The administrative aspect of the wild life in our parks is a large and important subject. The problem of properly caring for and using wild life to the best advantage in our parks is becoming increasingly more serious and difficult. With the increasing number of park visitors new problems are coming up all the time. As intensive use threatens to wear out the parks recovery can be secured through decreasing the congestion—by enlarging the parks, or by temporarily closing parts of them. With increasing population there is always a tendency to encroach upon the wilderness. Thus to maintain park wildernesses can only be accomplished by a struggle, and the eternal vigilance needed to preserve our liberty is the same price that must be paid for the free, wild nature of the wilderness. The wilderness, like the forest, was once a great hindrance to our civilization, but now the tide has turned and wildernesses and forests must be maintained, even at much expense, because human society needs them. Not infrequently have I talked with enthusiastic friends of our parks, who feel that in this struggle the odds are so much against the parks and their wild life, that there is perhaps no use to continue what they feel to be a losing fight. But it seems to me that this is only another aspect of that constant struggle for any high ideal—the only kind worth striving for; this is not at all a peculiar feature of our park and wild life problems.

European experience furnishes us with a number of notable examples of wild areas highly valued because so little of the original conditions remain there. For in spite of the unfavorable situation the appreciation of these original conditions has not yet died out. This is worthy of special mention because of the fear one hears expressed that this is a hopeless cause. In several European countries there are active organizations and endowments devoted to this cause, and even governmental bureaus devoted exclusively to it (cf. Ahrens, '21; Conwentz, '09).

Some of the main administrative problems concerned with wild life are: the maintenance of this resource, including the complete protection of the associated vegetation; the formulation of policies; and the education of the public on wild life interests and the perpetuation of their ideals.
Maintenance of Wild Life.—The maintenance of wild life in parks, in a normal, healthy state, is a relatively new art in America. This involves adequate protection, by rules, rangers or police, and by all the educational devices available. But this protection is not all a question of restrictions, for there is the productive and constructive aspect. Favorable conditions must be maintained, so that the animals will breed normally. If fishing is permitted, the maintenance of the stock in the streams must be looked after continuously, and the supply maintained. Careful supervision of all this must be given and definite policies followed, or great blunders will be made and much damage will be done. A competent park official should supervise all this fish work.

At present, administrators are in a difficult position because of the lack of definite ideas, policies, and public sentiment to support definite programs, and the frequent changes of officials favor a lack of continuity in policies; and furthermore, with such a wobbling policy little is learned from experience.

Education of Park Officials.—At present, the parks suffer to a large degree because they are necessarily in the hands of administrators who, because of their lack of special training, we must consider as amateurs. We have had no profession for this line of work, and some who have had the most training are to be feared to a corresponding degree, because of preconceived, formal ideals, which they with almost religious zeal, slip into the wilderness parks. The ideal of a wilderness park is beyond their ken, because their approach has been from another angle. These persons are of course welcomed in formal city parks, but in our large National Parks, and in the wild parts of State Parks they are liable to be a menace. In the training of such men there has been no adequate recognition of the wild life problems or appreciation of the wilderness.

Another source of difficulty is the lack of trained rangers and nature guides in our parks. Men are needed who have not only a special familiarity with a special subject matter, but as well with the ideals of parks. Until very recently we have had no provision for such training in our educational system, and not until adequate provision has been made for this can we expect the detailed work in the parks to be wholly satisfactory. A complete technical staff is needed for our parks, but this fact must be generally recognized before young men will devote themselves to the park profession, and the public must appreciate it fully enough to provide for it in the appropriations.
Need of Formulating Policies.—At present our parks are in great need of definitely formulated policies, even if they are of a provisional nature (cf. Waugh, '18; Hill S. Graves, '20). Recently, in connection with efforts to establish new National Parks, the need of bringing out the distinctive characteristics of such areas, compared with National Forests and other public uses of lands, has led the "Council on National Parks, Forests and Wild Life" of New York City (an informal group interested in these problems), to formulate their ideas. This has resulted in a policy leaflet revised to Oct. 25, 1923, while in the same year the Boone and Crockett Club, of New York City, formulated a policy with regard to the protection of big game in the West, which includes the National Parks. Such constructive efforts deserve hearty commendation, but we should bear in mind their provisional character because they have not been based upon the prolonged investigation which their merit warrants. A recent valuable summary of the National Park Service, outlining its history, activities and organization has been compiled by Cameron ('22). The recently organized "National Conference on Outdoor Recreation" is in a position to do excellent work for this cause.

The Forest Service has issued in mimeographed form, from the District Foresters’ offices at Albuquerque, Denver and Ogden, "Fish and Game Handbooks," in which certain of the Forest Service policies for wild life are carefully outlined. These policies are naturally not the same as those of the National Parks, but they have much in common; and these handbooks will prove to be of much value to any serious student of the whole park problem who wishes to work out a similar manual for the different National Parks.

A broad, general policy for the parks is not enough; it should be comprehensive, but at the same time it should be worked out in as much detail as is possible, so that in time we will have for our National Parks a manual corresponding, is some respects, to the Use Book of the Forest Service. Each State Park or park administration should have a similar policy, which should be published and made a part of the educational data available to the public. It will then be accessible for criticism and improvement. Of course, as many park executives are without adequate help, are liable to political interference, and their tenure short, they are frequently liable to neglect the formulation of these policies, and depend solely upon the laws establishing the parks. Without general policies we can not expect detailed, well-worked-out plans for wild life. Today we have no such published program for the wild life of our Na-
tional Parks, not even for the fish, which might be expected to precede that for other kinds of animals. The U. S. Fish Commission, in the early days, had no conception whatever of the Yellowstone as a wilderness park, with the fish life maintained as nature left it, and for this reason the Commission was favorable to stocking the waters with various species of exotic fish, and of stocking the streams thoroughly above all falls, where uninhabited by fish, and likewise the isolated lakes. A recent Commissioner of the U. S. Bureau of Fisheries, Dr. H. M. Smith (17), has sketched a fish cultural policy for Glacier National Park, and has urged that different waters should be reserved for different kinds of fish; that there should be no promiscuous planting; that the introduction of non-indigenous species should be prohibited; and that stocking and fishing should be conducted on a definite policy, which should rest with the federal Bureau of Fisheries. Several of these are admirable recommendations. In my own opinion, however, it would be very unwise to take the administration of the fish out of the hands of the Park officials and place it in the hands of the Bureau of Fisheries, even if the Bureau showed, as it has not in the past, an adequate appreciation of this resource as it should be preserved in National Parks. The Park officials should develop their own staff to handle the fish problems, and they should be more than merely fish culturists, because this work involves many broad biological problems involving other animals than fish, and requiring the ability of trained naturalists. Certain aspects of the fish cultural problems in the Yellowstone have been described by H. M. Smith (20), and Smith and Kendall (21). In the report of the Director of the National Park Service for 1920, p. 312, it is stated that in the Grand Canyon National Park, “Bright Angel Creek has been stocked during the year with eastern brook trout.” Whether this was done by the Park Service or the Bureau of Fisheries is not stated, but it is just such blunders that should be avoided.

The attitude of the present U. S. Bureau of Fisheries, and of the Park Service itself, has improved somewhat, but still they have, in the main, adhered to the older policies and standards of making angling available everywhere, rather than to maintaining original wild preserves. I have no doubt that this policy has grown up without much deliberation on their part and certainly not after considering the future value for educational and scientific purposes, of large areas of wilderness waters. The idea that forests with big game animals should be maintained as a wilderness, and that there is an advantage in natural wild waters, appears to be a new conception
for our parks. Some of the same persons who are very eager to maintain a wilderness for certain purposes have never recognized that others are equally interested in an untouched aquatic wilderness.

Attention has already been called to the need of trained park officials to look after the fish, who are more than fish specialists, and who can fully appreciate the ideals of the Parks, and as well have an extensive knowledge of other Park animals. For example, one of the latest publications of the U. S. Bureau of Fisheries clearly shows this need. Dr. W. H. Rich, Assistant in Charge of Scientific Inquiry, has recently pointed out (Progress in Biological Inquiries, 1923, pp. 8-9, 1924) the results of an investigation made by the Bureau of the relation of the white pelican to the trout in Yellowstone Lake, as follows:

"The pelican colony on Yellowstone Lake in 1922 was found to number between 500 and 600 birds, from which about 200 young resulted. For the six weeks of their sojourn on the lake they subsist almost entirely upon the black-spotted trout, the toll taken by each pelican during the season amounting to about 350 fish, and involving, besides, a large loss in trout eggs through the destruction of the breeding fish.

"The pelican represents a strange and interesting ancient type of bird life and it is not desired to exterminate it in the Yellowstone Park, where it is of much interest to tourists. Measures have been recommended, however, for the regulation of its numbers through the destruction, by proper authorities, of a percentage of the eggs deposited on the breeding grounds in the park. The recommendations are now under consideration by the Bureau of Fisheries and the National Park Service."

Let us look into this situation a little further. The U. S. Commission of Fish and Fisheries, the predecessor of the Bureau of Fisheries, established a trout egg collecting station on the shore of the West Thumb of Yellowstone Lake, in 1901, and nine years later (see Report of Acting Supt. Maj. H. C. Benson for 1909, pp. 8-9) the Acting Superintendent reported that over 33,000,000 eggs had been taken. This was the most important egg collecting station for these trout in the world, and the eggs were shipped throughout the neighboring states so that by 1917 the depletion of the small streams between the Thumb and the Lake Hotel was recorded. In 1918 the pelicans and gulls were condemned for serious injury to the trout, and in 1919 it was suggested that a reduction be made in the number of pelicans. The Park Superintendent now recognized the depletion of the waters and the need of increasing fish egg
plantings within the Park. At this time the practice of allowing the hotels and camps to take trout for table use was prohibited, this taking effect on August 15, 1919. During that summer alone there had thus been used commercially over 7,500 pounds of trout, in spite of the fact that the act of dedication, March 1, 1872, states that the Secretary of the Interior was instructed to "provide against the wanton destruction of fish and game found within said park, and against their capture or destruction for the purpose of merchandise or profit." In 1921 about half the eggs collected were planted in the Park. In 1922 the Bureau of Fisheries conducted its investigation of the pelicans, resulting in the official statement already quoted from Rich, suggesting a reduction of their numbers. During the 22 years that records have been published of egg collecting in this lake, over 187,000,000 trout eggs have been taken, of which an unknown but relatively small number—about 32 millions—were planted in the Park, and of these, 21 millions were planted in 1922 and 1923. The waters are now clearly recognized as becoming depleted. This is clearly and primarily due to the too extensive egg collecting, and to the commercial use of trout on tables; and secondarily, to excessive angling; and lastly, and least of all, to the pelicans and the gulls. The general practice of depleting waters about fish cultural stations, which Kendall ('24) has pointed out, has been in full swing here with its injurious effects, and indicates very clearly that our National Parks are not the places to locate such general fish collecting and distributing stations. The Park authorities have now restricted the shipping of eggs out of the Park, have prohibited commercial use of trout by hotels and camps, and are making greater restrictions on angling. This, I think, fairly states the background needed for consideration of the relation of the pelicans to the trout. Certainly, if angling is to be continued, and to be maintained with the increasing numbers of Park visitors, a fish cultural plant is absolutely necessary; but it should be conducted solely from the standpoint of the welfare of the Park, and not as a general public utility and for commercial use. This was advocated in 1901 and 1902 by Major Pitcher, Acting Superintendent, in his annual reports.

Is this large colony of pelicans worth careful preservation, from the standpoint of future generations of Americans? From several standpoints the pelicans are unique birds, entitled to careful protection, as there are certainly only a very few places, and possibly none outside of Yellowstone Park, where their preservation can be
assured. The true status of the pelican, from the public standpoint, cannot therefore be determined solely by its status in the Park. What are the probabilities of its permanent preservation elsewhere? Dr. F. M. Chapman has already pointed out the precarious situation of their other breeding grounds (see *Camps and Cruises of an Ornithologist*, pp. 379-380, 1918). The real purpose of the National Parks is to preserve in them what can best be maintained there. These birds require isolated, protected islands for breeding, just such conditions as exist in Yellowstone Lake. If the Yellowstone Park is to live up to its past reputation as our leading wild life preserve the public must feel assured that they are in safe keeping and cannot be menaced by excessive fish egg collecting, commercialization of trout for hotels and camps, or by excessive angling.

The destruction of a certain amount of trout by the pelicans is a necessary phase of the maintenance of wild life in the Park, just as is the growth and protection of forage and the cutting of hay in relation to the maintenance of elk and bison, or the destruction of insects and rodents by the bears, or even the collection and planting of trout eggs. Before any restrictive or drastic measures are taken it is eminently wise to have much more complete information about them. When trout eggs were first collected in the Park the supply was considered "inexhaustible," but now we know better. The breeding of pelicans, about which we know very little, is vastly more difficult than that of trout, so that at present the only safe method is to greatly increase a proper kind of fish culture, and to absolutely prohibit the shipment of trout eggs outside of the Park. There is an abundance of eggs to stock the Park waters and to feed all the pelicans and the gulls. Furthermore, it will be necessary to make greater restrictions on the catch, as we know how to do this, rather than to interfere in any way with the pelicans, about which we know so little, and whose future is precarious.

**The Wilderness Policy.**—The Council of the American Association for the Advancement of Science, at the Toronto meeting in December, 1921, passed the following resolutions, which have a very direct bearing on the policy of our National and State Parks in maintaining their native plants and animals in natural conditions. These resolutions read (*Science, N. S.*, Vol. 55, p. 63, 1922):

"Whereas, one of the primary duties of the National Park Service is to pass on to future generations for scientific study and education, natural areas on which the native flora and fauna may be found undisturbed by outside agencies; and
Whereas, the planting of non-native trees, shrubs or other plants, the stocking of waters with non-native fish, or the liberating of game animals not native to the region, impairs or destroys the natural conditions and native wilderness of the parks;

Be it Resolved, that the American Association for the Advance-ment of Science strongly opposes the introduction of non-native plants and animals into the national parks and all other unessential interference with natural conditions, and urges the National Park Service to prohibit all such introductions and interferences.”

The Ecological Society of America, a leading organization of naturalists interested in outdoor natural history, has also passed similar resolutions (Ecology, Vol. 3. pp. 170-171, 1922).

In spite of the public announcement of these resolutions, only recently it was announced by a representative of the National Geo-graphic Society that he planned to secure plants from Tibet, “suitable for planting in Glacier National Park” (Science, N. S., Vol. 58, p. 460, 1923).

As the importance of maintaining wild, natural parks, is not sufficiently appreciated, it is worth while to briefly summarize some of the main reasons for this policy:

1. With our increasing population wild lands and their native population of plants and animals are decreasing at an alarming rate. Much of Europe has undergone this demolition. The public has heard much of the decrease of insectivorous birds, because of their relation to forest and agricultural crops, and sportsmen have become aroused about fish and game, but there are many other plants and animals, also of great value, in defence of which we hear little. Even educators have become but slightly alert to the danger of teaching about nature only in cultivated fields and artificial parks.

Wild lands, with their native plants and animals, are as worthy natural monuments as are other valuable features in our parks. These have great scientific and educational value (cf. Grinnell and Storer, '16). Today, all wild lands and wild waters tend to become more remote so that before long they will be inaccessible to the average citizen. Sportsmen and anglers are being shut off from private lands and in turn they have begun plans to reserve wild public lands for hunting and fishing. We readily grant the validity of this, but our educational needs for children and scientific needs of both children and adults are certainly not a less worthy reason for the preservation of wilderness lands and waters.

2. If parks are to be managed so that they may be passed on to
future generations unharmed, they must in the main remain wild. No one can safely assume that he is able to tell how valuable these regions will become in the future, when properly stocked. When once a plant or an animal becomes extinct it is beyond human power to restore it. We can well afford to play safe in such matters. Sir Harry H. Johnston, a member of the Honorary Advisory Council of the Roosevelt Wild Life Station, has very well said that:

"The world will become very uninteresting if man and his few domestic animals, together with the rat, mouse, and sparrow are its only inhabitants. Man's interests must come first, but those very interests demand food for the intellect. Aesthetically, the egret, toucan, bird of paradise, grebe, sable, chinchilla, and fur-seal are as important as the well-dressed woman. The viper, lion, tiger, crocodile, wolf, vulture, and rhinoceros have all their places to fill in our world picture. They are amazingly interesting, and therefore their destruction should only be carried out to the degree of keeping them in their proper sphere."

The whole situation is thoroughly sized up by H. G. Wells in his *Outline of History*, as follows:

"But there will be no diminution of adventure or romance in this world of the days to come. Sea fisheries and the incessant insurrection of the sea, for example, will call for their own stalwart types of men; the high air will clamour for manhood, the deep and dangerous secret places of nature. Men will turn again with renewed interest to the animal world. In these disordered days a stupid, uncontrolled massacre of animal species goes on—from certain angles of vision it is a thing almost more tragic than human miseries; in the nineteenth century dozens of animal species, and some of them very interesting species, were exterminated; but one of the first fruits of an effective world state would be the better protection of what are now wild beasts. It is a strange thing in human history to note how little has been done since the Bronze Age in taming, using, befriending, and appreciating the animal life about us. But that mere witless killing which is called sport today, would inevitably give place in a better educated world community to a modification of the primitive instincts that find expression in this way, changing them into an interest not in the deaths, but in the lives of the beasts, and leading to fresh and perhaps very strange and beautiful attempts to befriend these pathetic, kindred lower creatures we no longer fear as enemies, hate as rivals, or need as slaves. And a world state and universal justice does not mean the imprisonment of
our race in any bleak institutional orderliness. There will still be mountains and the sea, there will be jungles and great forests, cared for indeed, and treasured and protected; the great plains will still spread before us and the wild winds blow. But men will not hate so much, fear so much, nor cheat so desperately—and they will keep their minds and bodies cleaner."

3. Original or virgin conditions are particularly suitable for teaching and for scientific study (Adams, '08, p. 147; '13, pp. 23-35), because they are relatively simpler and less confused than when man interrupts the natural order by his confusion and destruction (cf. Sumner, '20; Sheldor, '20). We have learned that the natural behavior of animals in nature is very different from those caged and in confinement. Our large animals are of the greatest interest in our parks, and any complete scientific knowledge of them necessitates that they be studied in the wild state. The public must therefore provide the proper conditions for them in order to derive the most from them, both from a popular and a scientific standpoint (cf. Hahn, '13, p. 171). No animal can be thoroughly understood independent of its normal environment. It is therefore not enough merely to preserve these animals in zoological parks and in cages. Confined animals have a great educational value, without doubt, but they are not an adequate substitute for wild animals in nature. There must also be a permanent wild supply to maintain the zoological gardens of the world.

Although there are considerable areas of the National Forests which are likely to remain virgin wilderness, this is not a sufficient guarantee that we will have all we need. The chances are that in the near future silvicultural foresters will, with increasing emphasis, strive to retain valuable examples of representative virgin forests within our National forests and State forests, in their original condition for special study. These areas will also act as preserves for many animals, but they will not necessarily provide for the larger animals unless they coincide, as they well might, with wild life preserves. Some foresters have already observed the need of a forest "wilderness" as a part of the recreational policy of the National Forests (Leopold, '21), and others for the purpose of teaching and investigation (Ashe, '22; Pearson, '22), and if such areas give complete protection to both plants and animals great progress will be made. The grazing of domestic animals must be restricted or excluded from such preserved areas or the herbaceous vegetation will soon be greatly modified (Korstian, '21). The experiences in the
National Forests clearly show just what will certainly happen in our National Parks, from the wilderness point of view, if they are not strictly guarded. These experiences also clearly show that great caution must be exerted, even with the present customary grazing in our National Parks. Without question this should be prohibited, and the forage should be reserved for the game in the Parks. Until prohibited, the grazing should be under the close supervision of a range ecologist. The same ideas apply even to living and dead trees, that at any time may be cut in these National Parks. At present we have only one official park forester in the great National Parks, and very few connected with State Parks; and not all foresters are alert as to the value of virgin forests. European experience (Conwentz, '09, pp. 118, 131) has clearly shown that the clear cutting of forests is very harmful to many kinds of native plants, and this is equally true for many animals, for we know that the vegetation exerts a powerful influence upon most forest animals.

In some State Parks commercial forest management is practiced, and this is very desirable under certain circumstances if the commercial forests and the preserves are well balanced, and if provision is made for corresponding management of the preserved areas. At present, great caution must be observed not to confuse the management of these two types of forest. A proper balance should be secured, and then the commercial forest might well be made a source of supply for the local wood-using industries, and a means of securing revenue for the maintenance of the whole park (Adams, '21, p. 64). In time, the park authorities may find it necessary to charge a small fee for their use, and a forest park with funds from the timber and from a fee or license for the use of the preserve, might secure enough revenue to do much more constructive work than one depending solely upon taxation and gifts. This possibility is so important that it deserves more attention than it has received in the past. The new Allegany State Park in New York was planned upon such a program.

The chances are that National Parks will never be numerous enough and widely enough distributed to give us a sufficiently large sample of our native flora and fauna to meet all scientific needs. This is one reason why State Parks in the East are in a position to do much more, on the whole, than National Parks. But it is not enough, as has been said before, simply to preserve the species. We need, just as imperatively, samples of their normal habitats; and to make
these safe, the samples must be fairly large and widespread, or devastating fires or incompetent officials are liable to cause an excessive loss. There should not be too much concentration.

An excellent example of the need of natural conditions for scientific studies is seen in the case of the timber line on mountains. A few years ago the American plant ecologist, Shaw, was making a special study of the causes of the high timber line on mountains and pointed out that:

"Most of the work on the subject of timber line has been done in Europe, and there the conditions are peculiarly unfavorable. For in the Alps and Pyrenees, the timber line has been greatly modified by human agencies. When an observer has first to decide whether that which is before him is due to natural causes or not, his conclusions stand a double chance of error. Certain European workers have published elaborate tables showing the precise altitude of timber line and other facts of vegetation for parts of the Alps. When it is remembered that flocks and shepherds have played a considerable and not easily determined part in bringing about present conditions, the value of such tables is less apparent. A study of wooded mountains where conditions are entirely undisturbed would, therefore, seem desirable ... So far as first-hand knowledge goes, I may say that in a walking trip of several weeks through the Alps, I had much difficulty in finding an illustration of timber line that was beyond suspicion of being artificially caused. I did, however, see the shepherds pulling up little trees near timber line in a manner which left no room for speculation as to its efficiency." (Plant World, Vol. 12, pp. 63-64, 65; 1909.)

ENDOWMENT FOR EDUCATION AND RESEARCH

The greatest advances in science and education are today made by the combination of private endowments and public support. Our Smithsonian Institution was no doubt an influential agent in teaching Mr. Carnegie and Mr. Rockefeller the value of endowments for research. The American Museum of Natural History and the New York Zoological Society are examples which show that semi-public institutions, supported by taxes and by endowments, make the most rapid and constructive advances in their respective lines. The Palisades Interstate Park, supported and built up by private gifts and State funds from both New York and New Jersey, under the guidance of Mr. George W. Perkins taught
the whole world the use of a great public park for the peoples’ welfare along several new lines. This method of combining private and public support seems at present to appeal to the idealism of large-minded men and makes it possible for such institutions to make the greatest progress. It is important to note that in such a plan no great success can be secured unless there can be enlisted in the cause men of real practical idealism of a very high type, combined with sound practical judgment. Without such leadership routine work can be conducted along conventional lines but no great advances can be expected.

The time has come when we must begin an educational campaign for large endowments for the educational and scientific work in our National and State Parks. Of course, much can be done by cooperation with various individuals, the colleges, universities, and scientific societies, particularly with some of the State universities, especially if urgent requests are made to them for cooperation. They are likely to respond best when sought. But it is likely to take some time for these institutions to become acquainted with this phase of work, as most of them, even today, have but a faint realization of outdoor biological problems and their application to parks. Fortunately there are a few marked exceptions.

The parks need such funds primarily for three purposes:

1. They need a technical scientific staff to solve their own scientific problems as much has they need lawyers and engineers. The need exists—but it is only slightly realized,—and in the main only those who are taking a broad view of the situation are aware of the conditions.

2. They need an educational staff to build up their local museum-library, for nature guides, and to supplement and aid in the training of rangers, who should also be trained men. This staff should be the mainstay for popular lectures,—lantern and moving picture lecturers who will arouse intelligent appreciation of the resources of the parks.

In general, the scientific and educational staffs should be distinct because the two kinds of work can not be done at the same time, and the staff can not be expected to divide its attention successfully. An executive does not expect his lawyers or engineers to drop their work at any moment and give a popular talk, or to conduct other extraneous work, and the same applies to the scientific staff.

3. The educational and scientific staffs should be large enough to include certain men who could devote their whole time to the
practical and technical problems that demand immediate attention, closely related to the administrative, rather than to the scientific or educational aspects of park work. The main reasons for advocating this as a distinct group is that in practice it is rare that sufficient funds can be obtained to secure men who are versatile enough to cover so large a field. Furthermore, research is a special kind of work that requires uninterrupted attention to secure the best results (cf. White, '23, pp. 23–25); it is therefore safer to plan for larger staffs.

It is generally difficult in administrative circles to appreciate that first-class men who are willing to have their work continually interrupted by all sorts of administrative breaks can only rarely be secured. These men must, to get the best results, be protected from such interruptions. It is the administrator's first business to adopt methods that will permit his organization to solve its problems, and this is one of his duties which too often is undervalued.

To provide for such a staff for our Parks will necessitate a considerable endowment. To be concrete, the Yellowstone and the Yosemite alone now need a full million dollars each, the income of which should be devoted exclusively to research and education in these respective Parks. These funds should be independent of the scanty Congressional appropriations and would tend to make them much more effective, and they would do much to educate the public in an intelligent use of such parks. Who will question for a moment that today we would not have the Katmai National Monument had it not been for the scientific investigations which have been made and are being continued by the National Geographic Society under the leadership of Griggs?

The Palisades Interstate Park needs just such an endowment and such a staff, as I learned when cooperating with the Commissioners as a representative of the Department of Forest Zoology in the New York State College of Forestry. During the seasons of 1918 and 1919 the field parties of the Department of Forest Zoology and of the Roosevelt Wild Life Forest Experiment Station conducted their investigations on wild life in this Park (Adams, '19). This was done through Mr. George W. Perkins, in immediate cooperation with Mr. Edward F. Brown, Superintendent and later Director, of the Camp Department of the Park. Later, a short time before Mr. Perkins' last illness, a plan was presented to him for field studies to be conducted cooperatively by the Park Com-
mission and the Roosevelt Wild Life Station. The idea was to conduct just such investigations and demonstrations as had already been started in the Park during the previous seasons (cf. *Roosevelt Wild Life Bulletin*, Vol. 1, p. 53, 1921).

Our party began work there by making a study of the fish, as a basis for properly managing the waters (cf. Adams, Hankinson and Kendall, '19), and preparing guide booklets on birds for the park visitors (Silloway, '20). But we were soon importuned to study some method of controlling the leeches in one of the most frequented bathing lakes, and incidentally controlling the mosquitoes (by means of fish), and finally to aid in the control of the algae causing "water bloom" which also annoyed the bathers. These investigations were made by Moore ('22, '23), and Smith ('24). In the effort to control the "bloom," it was found that the copper sulphate also killed the fish. It then became a study of how to harmonize all these interests, and this series of problems could not be solved without the aid of scientific men. It will be seen that these are relatively new kinds of park problems, and that they are a direct result of intensive use occasioned by the proximity of the Park to our largest city. These new park activities are due primarily to Mr. Edward F. Brown's ideas of camp development which Mr. Perkins accepted (cf. Jessup, '19, p. 159) and organized in the Park on such a large scale that it became the largest camping park in the world (cf. Silloway and Brown, '20).

The main advantages which the public will derive from such a staff of experts ought to be self-evident. It is rarely that one must show that a lawyer or engineer is needed for a technical problem, but how to gain similar assistance for the educational, scientific and like problems in the parks is not quite clear, even to some of our best park leaders. This is natural when we recall that most of those engaged in park work have gone into it without a professional park training, and for this reason, although they may have a special interest and experience in some phase of the work, as a rule they do not have a comprehensive grasp of the problems, or the technical knowledge needed for many diverse undertakings. For these reasons it is worth while to summarize some of the major advantages of such a professional staff:

1. Trained men are necessary for scientific, educational and technical work. They must have the time and facilities to master these problems and to adapt them to the situation. We have
no reason to expect scientific services free, and the public has no
more right to expect that such technical services will be contributed,
than legal or medical aid. Moreover these men must be devoted
exclusively to their own special work.
2. The wild life of the parks requires constant, all-year-round
attention. A great number of our parks will be more and more
patronized the year round when the people become educated to
it. With this increasing patronage there will constantly develop
new problems for solution and supervision.
3. It is only such a staff that can be expected to present, in
suitable popular form, the natural history resources of the parks.
These popular accounts should be presented from many angles if
a large public is to be reached to advantage. It is a common
error to assume that there is only one popular form of approach;
a multiple approach should be carefully cultivated by different
types of students and authors.
4. There are certain problems of park administration that should
first be solved as scientific problems, and then executed under
technical supervision, such as the care of fish, game and birds,
mosquito control, and the management of the forests. These are
examples of the problems, which, with increasing use, the natural
resources will require. They call for a kind of supervision which
the average executive can not be expected to know about, and yet
these are just the points that a special staff will know about, and
their advice and help are therefore necessary.

In concluding these remarks on the need of endowments it is
important to emphasize that the management of wild life is a
more or less elusive subject for the public and the administrator to
understand; and it cannot be understood merely by inspection—
it must be known intimately. Otherwise, great damage may be
done by neglect or ill-advised measures before it is realized that
anything is wrong.

The real difficulty is that wild life and its problems suffer from
just the same cause as the human animal in our democratic system
of environment. As Walter Lippmann has recently said: "For the
troubles of the press, like the troubles of representative government,
be it territorial or functional, . . . go back to a common source:
to the failure of self-governing people to transcend their casual
experience and their prejudice, by inventing, creating, and organ-
izing a machinery of knowledge. It is because they are compelled
to act without a reliable picture of the world, that governments, schools, newspapers and churches make such small headway against the more obvious failings of democracy, against violent prejudice, apathy, preference for the curious trivial as against the dull important, and the hunger for sideshows and three-legged calves. This is the primary defect of popular government, a defect inherent in its traditions, and all its other defects can, I believe, be traced to this one.” (Public Opinion, pp. 364-365, 1922. New York.)

SUMMARY

In concluding this discussion, I wish to summarize my main points as follows:

1. We will derive benefit from wild life in our parks in direct relation to what we devote to it. We need to recall that living organisms respond readily to fair treatment.

2. In general, wild life can prosper only with the parks as a whole.

3. Wild life is a very valuable resource in any wild park, and it is generally so recognized by the public.

4. The National Parks should remain a virgin wilderness for educational, scientific and recreational purposes.

5. State Parks should retain wilderness areas, as well as include commercial forests, the proportion depending somewhat on local conditions.

6. In relating the wild life to the public a variety of experimental popular publications is advocated. Technical reports are needed for park officials. We need a distinctive park literature.

7. Field excursions conducted by carefully trained guides are advocated, to develop trails and a trail literature, and as one of the best methods for teaching the appreciation of natural resources.

8. A museum-library, devoted exclusively to each particular park, should be equipped for exhibits, lectures, demonstrations, lantern slides and moving pictures, to arouse interest primarily in the local park. This should be the headquarters for the guide service.

9. A local zoological exhibit, of the park animals only, would stimulate interest in the wild life of the park, but it should not be conducted like a city zoological garden.

10. The maintenance of a virgin wilderness park is a very difficult, but not a hopeless problem, if intelligent public sentiment is developed in its behalf.
11. Specialized education and training of park officials of all kinds is urgently emphasized. As a means to this end park policies should be formulated and published with a full explanation of park ideals.

12. The far-reaching importance of preserving original habitat conditions for plants and animals, from the educational, aesthetic, scientific and recreational viewpoints, is strongly emphasized. The value of State Parks in this plan is very important.

13. To develop public appreciation and conservative utilization of parks, large endowments are needed to supplement public support. The greatest progress is made where public and private aid is combined with high and practical idealism. A movement should be started for endowments for educational and scientific work in both National and State Parks.

14. Park endowments are perhaps one of the best means of developing a technical staff for our parks. The preservation of wild life and other natural resources requires supervision by such specialists.

15. A fact-finding or research organization is a necessity, not a luxury, in dealing with park wild life problems, and will make it possible to apply the scientific method to their solution.

16. Wild life suffers from the major defects of our democratic system of control, and its welfare depends fundamentally upon improvements in this system.

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NATIONAL PARKS POLICY AND WILD LIFE

"The service thus established shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations hereinafter specified by such means and measures as conform to the fundamental purpose of the said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

An act to establish a National Park Service, and for other purposes. Public—No. 235—64th Congress, (H. R. 15522); 1916.

"For the information of the public an outline of the administrative policy to which the new Service will adhere may now be announced. This policy is based on three broad principles:

'first, that the national parks must be maintained in absolutely unimpaired form for the use of future generations as well as those of our own time;

'second, that they are set apart for the use, observation, health, and pleasure of the people; and

'third, that the national interest must dictate all decisions affecting public or private enterprise in the parks.'"

FRANKLIN K. LANE,

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PLATE 26. THE GRIZZLY, OR SILVERTIP, OF THE YELLOWSTONE WILDERNESS.
THE BIG GAME ANIMALS OF YELLOWSTONE NATIONAL PARK*

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1. Introduction.
2. Grizzly Bear or Silvertip.
3. Black, Brown or Cinnamon Bear.
5. Mountain Coyote.
6. Cougar or Mountain Lion.
7. Elk or Wapiti.
8. Yellowstone Moose.
10. White-tailed Deer.
11. Mountain Sheep or Bighorn.
12. Bison or Buffalo.
13. Prong-horned Antelope.

INTRODUCTION

One may have a preconceived idea that people who visit the Yellowstone National Park center their interest on the geysers that spout and play and fill them with awe by their wonderful hydraulic displays. Nothing, however, is farther from the truth. The summer tourist probably is most fascinated by the sight of the two species of Park bears. The black or brown bear is a friendly animal and a never-ending source of wonder and amusement; and the shy but powerful grizzly expresses in every move-

*This is the second of a series of papers on the wild life of Yellowstone National Park which has been made possible by gifts to this Memorial Station from the joint friends of Theodore Roosevelt and of wild life conservation. The initial aid for this plan came from Mr. Howard H. Hays, President of the Yellowstone Park Camps Company. Mr. Heller and his assistant, Mrs. Hilda Hempl Heller, contributed their services; Mrs. Corinne Roosevelt Robinson and an anonymous friend contributed funds; and Mr. Kermit Roosevelt loaned his naturalist's camera for the photographic work. I gladly avail myself of this opportunity on behalf of the Roosevelt Wild Life Station to thank these persons most heartily for their cooperation. (Cf. also Roosevelt Wild Life Bull., Vol. 1, No. 1, pp. 96-99.)— THE DIRECTOR.
ment an alertness and a spirit of independence that instantly commands respect. The tourist's conversation follows the promptings of his heart, and bear talk flows from his lips far oftener than any regarding the geysers or other inanimate objects.

The accent is on bears, rather than other animals, only because the bears are seen more frequently and are easier to scrape acquaintance with, either along the highway or in the vicinity of the camps and hotels. Almost any species of large mammal is more alluring to the visitor in Yellowstone Park than even the geysers, notwithstanding the wonderful and varied displays of these natural gushers.

It is doubtful whether the men who fifty years ago set aside a wilderness square about the geysers for their official protection ever dreamed that these four boundary lines would one day enclose the greatest game refuge in the country. Today, Yellowstone Park harbors more big game animals and in greater variety than any other park or wild life sanctuary in the United States. And yet unfortunately its present boundaries and its altitude are such that it is almost impossible as an all-the-year-round game refuge. It was an accidental circumstance, a geographical providence, that some of our big game mammals originally ranged in summer in the great geyser region and were thus allowed to live their lives and reproduce their kind in relative seclusion. It is, however, a strange paradox which compels us to starve and freeze some of these game animals annually in order to preserve the remainder. For the Yellowstone is actually a cold storage Park: for six months of every year. From December to late April or May it is covered by a heavy mantle of snow which chills the grazing animals and buries the vegetation on which they depend for sustenance.

The bears have partly solved the problem of winter by hibernating; but no bear can endure hibernation more than five or six months, and the first of April usually marks the end of his winter sleep. About that time Bruin emerges into the white world of early spring with an aching and hollow interior, and straightway visits his favorite hotel, which he finds closed, silent, and absolutely lacking in hospitality. He must either feed on the carcasses of elk and other game that have succumbed to the cold or lack of forage during the winter, or else wander down and out of the park to the snowless lower country where he can dig roots or secure small animals. A bear's life is not too easy in the Yellowstone, even
Fig. 46. The old Canyon Ranger Station. This was replaced in 1922 by a commodious log building combining the ranger headquarters with a tourist recreation hall.

Fig. 47. A "Snowshoe Cabin" for winter ranger patrol, near the Park boundary on Upper Yellowstone River, in the heart of the best moose country. Secretary of the Interior Fall and party, September, 1921. Peaks of "The Trident" in background.
Fig. 48. Chief Ranger Woodring starting on a trip of inspection to the station at Hellroaring Creek on the range of the northern elk herd.

Fig. 49. Some of the men on the permanent ranger staff. These are the hardy mountaineers who guard the big game animals of the Yellowstone and make the lonely winter patrols of the Park boundaries.
though he is a pensioner at the hotels and camps during the tourist season. There is always a hard spring to weather if he remains in the Park; but if he wanders outside he must dodge the bullets of ranchmen as best he can until with the coming of June the Park hostleries open and he can return to his happy summer home in the forests near their refuse dumps.

The hoofed animals, being less fortunate by nature than the bears, must struggle through the winter precariously, but if the snows are not too deep and the grass too sparse beneath, they manage very well. Park officials now have the awkward problem thrust upon them of saving or preserving game animals in great numbers in an area which Nature never intended for a winter game refuge. Every fall the Park staff has a hard fight to prevent the herds of elk and the diminishing band of antelope from wandering out of the Park into the neighboring States where they are sure to be destroyed in one way or another, legally or illegally. This exasperating situation can be remedied in only one way, that is, by enlarging the Park to the north and to the south along the lines of march of the downward migrating animals, so as to include sufficient winter range to enable them to survive the severest season. This proposed enlargement of Yellowstone Park, making a better geographic unit, will enable the ranger force to more readily protect the game from hunters who now line the boundaries during the open season and strive to slaughter every individual and band that ventures outside in search of food.

In the fall of 1921, I visited a National Park, the Yellowstone, for the first time. At the invitation of Dr. Charles C. Adams, Director of the Roosevelt Wild Life Forest Experiment Station of the New York State College of Forestry, I engaged in a preliminary survey of its big game animals for this institution. I had met with the game species of the Yellowstone elsewhere in the hunting field years ago and had collected most of them as specimens for our natural history museums, but I have never before passed time more pleasurably and profitably than in this present natural history investigation. I learned more about the habits of the animal species observed during these few months than in all my previous hunting experience.

As our oldest and best stocked game sanctuary Yellowstone Park is an ideal field for the study of large mammals. For forty years elk, bison, antelope, mountain sheep, deer, moose, bear and beaver have lived here in comparative safety, and their protection is now almost absolute so long as they do not stray outside the Park.
They exist under very nearly original conditions, and their real characteristics and habits can be studied in their natural environment to great advantage by the sympathetic lover of wild life. To a hunter-naturalist there is no more attractive field for study than that of the habits and behavior of these game animals,—creatures that have been systematically pursued and have withstood extermination chiefly by their admirable intelligence in the uneven struggle against man.

My explorations and investigations in the Park covered a period of some fifteen weeks in late summer and autumn, August 13 to November 17, 1921, with the exception of a fortnight in October (the 8th to 21st) spent with Hon. Stephen Mather, Director of the National Park Service, on a motor trip to the canyons of Utah and the north rim of the Grand Canyon of the Colorado. While I was absent from the Yellowstone on this latter journey, my wife, Mrs. Hilda Hempl Heller, remained in the Park engaged in animal photography in the Lamar Valley and in the Mammoth Hot Springs district. Mrs. Heller assisted me in photography and field work throughout my stay in the Park, with the exception of the last three weeks, which I spent alone.

The routes we traversed in the Park totaled over 1200 miles, of which less than 100 miles were made by saddle-horse and the rest by motor car. About thirty days were spent in mountain climbing and following the trails on foot. Our operations were limited to central Yellowstone Park in the vicinity of the highways that connect all the camps and hotels. The principal tourist camps were visited and the bulk of our time was devoted to making the acquaintance of the game animals which haunt the neighborhood of these resorts, particularly Camp Roosevelt, Canyon Camp and Mammoth Camp. Several trips were also made to the Buffalo Ranch on the Lamar River. Mr. Howard H. Hays, President of the Yellowstone Park Camps Company, was our good host at the camps, and he and his staff assisted us in many ways. We are indebted to him for many motor rides and for much personal good cheer, his spirit typifying the good fellowship and democracy of the West.

Mr. Chester Lindsley, the Assistant Superintendent of the Park, met us at the West Yellowstone entrance and drove us through the Park to Mammoth Hot Springs, formerly the military station of Fort Yellowstone. Our first day took the form of an elaborate initiation, a tour of over 120 miles with short stops at famous
Fig. 50. A two-year-old "cinnamon" bear at Camp Roosevelt, Yellowstone Park. The black bears clamber up the trees with the agility of a cat, but adult grizzlies are unable to climb, and their cubs rarely do so.

Fig. 51. A game of hide and seek. The author hiding from a "cinnamon" bear at Camp Roosevelt. The brown or cinnamon bear is merely a color phase of the black bear.
Fig. 52. A mother black bear and cub dining on garbage "a la carte." Many bears live in the vicinity of the camps and hotels during the summer as a result of protection, and feed daily at the refuse dumps.

Fig. 53. Young bears stalking the caretaker’s cabin at Camp Roosevelt. Note the barbed wire entanglement on roof of log storehouse. In the fall, just before hibernating, both black bears and grizzlies frequently break in where food is stored.
geysers and colorful springs and waterfalls, and included a ride along the shores of beautiful Yellowstone Lake during a sudden hail squall of great violence. We had begun our journey in the bright sunshine of a summer’s morn and had viewed almost every species of hot water display, and then at noon a hailstorm overtook us and we were shown what cold water and ice could do! After lunch at the Lake Hotel we continued our journey over the meadows of Hayden Valley, following the meandering Yellowstone River to its Grand Canyon. We viewed the canyon between showers. It is a beautiful mass of soft yellow coloring, a natural work of art, due to chemical disintegration of the lava rock. The simple beauty of this canyon abyss with its great waterfall has been often misstated and exaggerated in print. It requires no kaleidoscope of colors to describe its beauty. It has a charm all its own, a yellowness that is soft and dominant, and proportions that gladden the eye. We reluctantly stole away from this fascinating canyon and drove into a second hailstorm before reaching Norris Geyser Basin where the youngest and most active of the geyser children play. The place was a mass of steam issuing in many small jets, with one great voice, the Black Growler, dominating the smother of white vapor. Darkness closed down on us at the Golden Gate, a few miles from our destination at Mammoth Camp.

Two days later we were welcomed by Superintendent Horace M. Albright, during a breathing spell in his task of preparing his estimate of the annual budget for all the National Parks. He is a conscientious public servant with a multitude of duties to perform, official and social, which do not permit him a single moment of leisure during the summer tourist season. Throughout our stay in the Park he gave us the use of Park facilities and the assistance of his ranger staff (see figs. 46–49), as well as his own personal attention whenever he could spare time from his official duties. Superintendent Albright is a good father to the game animals, solicitous of their welfare and protection at all times. He regards this last refuge of the grizzly, the vanishing antelope, and the remaining great moose, elk and buffalo herds as a sacred trust. Very efficient game protection is being built up; but the Superintendent’s rule is not absolute within the Park, for not a few of the things permitted by the National Park Service pass without his approval. He needs a free hand if the rarer and more valuable animals are to be immune from persecution, the first consideration in the effort to perpetuate these species.
The photographs accompanying this article were for the most part taken by the author with the naturalist's graflex camera which Mr. Kermit Roosevelt used during his expeditions with his father to Africa and South America, and which he generously loaned for the present study. Figure 52 has been reproduced already in *The Minds and Manners of Wild Animals* by Dr. Wm. T. Hornaday, p. 130, 1922; figure 61 has appeared in *The World's Work*, Vol. 45, p. 109, Nov., 1922; and figure 92 was published in *Natural History*, Vol. 22, No. 3, p. 230, 1922. A number of original photographs secured by other observers, and kindly furnished for use in this paper, have been duly credited to them.

I am greatly indebted to Mr. Milton P. Skinner, until recently official Park Naturalist, for numerous suggestions and points of fact drawn from his twenty-five years of painstaking and accurate records of Yellowstone mammals. Also to Mr. Edmund J. Sawyer, present Park Naturalist, from whose drawings, based on two summers’ observations of the Yellowstone bears, plates 25 and 26 have been reproduced.

Finally, grateful acknowledgement is here made to those who generously contributed the funds that made possible this preliminary survey of the big game of the Park. An anonymous friend of Colonel Roosevelt and of the Station donated $1000 to defray expenses of the field work. Mrs. Corinna Roosevelt Robinson, who had accompanied her brother Theodore Roosevelt on one of his expeditions to Yellowstone Park, also contributed. The initial support for this project came from Mr. Howard H. Hays whose camps furnished us board and lodging without charge during the tourist season. The warm interest of all who cooperated in one way or another is deeply appreciated by both the author and the Roosevelt Station.

**GRIZZLY BEAR OR SILVERTIP**

*Ursus horribilis imperator* Merriam

The sight of a wild free grizzly bear in the Yellowstone excites more awe and admiration in us than does that of any other wild animal. It is here still possible for the tourist to behold that most feared of all American animals, the grizzly or silvertip in his native wilderness. Every evening at sunset you will find gathered on the slope above the Canyon Hotel garbage dump a large party of people, waiting hushed and excited, to get a glimpse of the grizzlies coming to their favorite feeding place. To see the great bears suddenly emerge from the forest in the dusk and come galloping along, their
Fig. 54. "Old Black Joe," one of the huge black bears at the Canyon garbage dump. It is said that none but a full grown grizzly can master this 500-pound giant.

Fig. 55. Black bears enjoying themselves amid the ruins of delicatessen. They usually come to the dumps at mid-day, but the grizzlies wait until evening.
Fig. 56. A friendly "cinnamon" bear being studied by Mrs. Heller and Dan Beard at Camp Roosevelt. It is dangerous to feed any Park bears out of hand; they should never be approached closely except by one familiar with their uncertain moods. The safest rule is to "Leave 'em alone!"

Fig. 57. A Camp Roosevelt bear that helped the author take many bear portraits.
rangi forms showing absolute fearless and power in every movement as they approach, is the grandest sight in Yellowstone Park.

The grizzly is the undisputed master of the animal world in which he lives. Then why does he wait until sundown to make his appearance at the dump where none may dispute his possession? He is now by instinct nocturnal, and a century-long education through persecution by hunters and other armed men, has made him extremely cautious. The grizzly's bump of caution has grown so large that his awesome glory has almost departed. In the old days he feared no man or beast, and stalked at will over our western plains unmoved by the sight of any enemy. His brain, however, has received many shocks since the Wild West was settled, and today he is as cautious and wary as he once was bold. For fifty years he has lived under more or less complete protection within Yellowstone Park, but his intelligence is not keen enough to grasp the fact that here he is safe from the attacks of men, and that the Park is his whenever he chooses to take possession. Unhappily, his experience whenever he passes the boundary quickly destroys any confidence he may have gained. He remains a hungry monarch in a land of plenty. All day he lies dozing in his lair or ranges the solitudes of the lodgepole pine forests of the Park plateau (fig. 90), while the black and brown bears are feeding merrily on fresh-dumped garbage. At sunset he stalks boldly forth into the open and gallops to the dump where, following the daily visits of the black bears, perhaps only a few bones and empty tins await him. What the grizzly needs is more confidence in man while within the Park sanctuary, and recognition of the fact that man is no longer an enemy but a friend. How can we educate this great crafty American mammal to a realization of his social possibilities? Food has not proved to be the magic lure for him that it is for most animals, the spur that impresses the memory,—he has not yet learned the dinner hour. Can we awake him to a diurnal diet and to the "early bird catches the worm" sort of philosophy? Were he protected outside as well as inside the Park, this might be possible.

Today there are less than fifty grizzly bears in Yellowstone Park. The former Park Naturalist, Mr. M. P. Skinner, who is highly expert in census field work, puts the number at forty, which is probably a conservative estimate. Grizzly bears are today no more abundant than they were fifty years ago when the Park was established; they are perhaps less numerous. They apparently wander out of the Park and are killed at a greater rate than they breed. These are
the sad facts! How can we safeguard the grizzlies now living inside the Park under protection, so that an increase in numbers will be assured in their only stronghold now left in the United States? Placing food on the dumps after sunset would be one solution, as it would give the grizzly a fair share of the food that should be his, and it would also give him low down in the pit of his stomach a conviction that the Park is his home. The greatest aid in procuring a stay-at-home grizzly would be spring feeding by the Park Service from about April 1, when the bears emerge from hibernation, to June 20, the opening date of the hotels and camps. The spring is the saddest time of the year for the bears, who emerge from their hibernation gaunt with hunger and with a determination to forage to the ends of the earth if necessary in order to procure food. If the Park Service would expend a few dollars in bread for them it would doubtless be rewarded by a stay-at-home and more sociable and visible type of grizzly bear.

Stopping the shooting of grizzlies outside the Park is difficult, owing to the sentiment against bears and against game protection in the Rocky Mountain States, and owing more, perhaps, to the value of the hides and the sport to be found in shooting big game. Nevertheless, laws should be passed and enforced in all the states bordering on the Yellowstone Park prohibiting the shooting and trapping of these animals. Only such individuals as are proved to be cattle killers should be destroyed, and then only by special orders from the game warden, and by members of his own staff, not by the stockmen or others who may report the presence of marauding grizzlies. It is only occasionally that grizzlies become cattle killers, and such individuals should of course be prevented from doing damage. The indiscriminate slaughter of bears is stupid and brutal. At Canyon Hotel dump you may often see horses and grizzlies in the closest proximity to one another. The horses know that they are safe, or they would not approach a grizzly within fifty feet or less.

The grizzly bear has suffered more than any other large game animal of the United States. His natural range is now practically reduced to one small spot, the Yellowstone Park. He deserves our protection on account of his great scientific and educational interest, as well as because he is a thrilling feature of the original wilderness, and he should therefore be given at least as much consideration and protection as the other game animals. The intense popularity of the wild bears in the Yellowstone is undoubted proof of the high regard in which they are held by our people generally.
Fig. 58. The caretaker and one of his friends at Camp Roosevelt. These two have a mutual understanding and never take any undue advantage.

Fig. 59. Exploring the camp yard for possible tidbits. This cinnamon bear, with her litters of cubs, has been a leading attraction at Camp Roosevelt for several years.
Fig. 60. This scene may be witnessed any day at Camp Roosevelt where the wild bears may be observed and photographed at will, to the great delight of all visitors.

Fig. 61. A black bear sitting astride a limb in a grotesquely man-like fashion,—not a common proceeding. Nothing is more fascinating than the bears’ droll antics.
Grizzlies are usually pictured by writers as ferocious, solitary brutes, "carrying a chip about on their shoulders" wherever they go. Such statements are due to defective knowledge and false invention. Any person who has read James Capen Adams' account (cf. The Adventures of James Capen Adams, Mountaineer and Grizzly Bear Hunter of California, by Theo. H. Hittell, 1911) of the two grizzly bears, a male and a female, which he trained to accompany him in the hunting field, to carry packs, to be as docile as dogs, is furnished with a truer picture of the grizzly's character originally than that to be obtained in our modern books of hunting lore which paint this animal as extremely ferocious and dangerous in order to magnify the hunter's bravery in encountering him. He is no more dangerous than man's persecution compels him to be. But this does not mean that in his present state of mind this shy and wary giant is to be trifled with, or that the Park visitor can attempt any advances with impunity. The grizzly must be left severely alone, if he is to be saved as a species, and if he is to remain most useful as a type of primitive wilderness life.

In regions where the grizzly is hunted he may frequently travel alone, but the grizzlies in the Yellowstone appear to live in families (see pl. 26) for several years at a time, and are seldom solitary. That they live together as a rule and are sociable, may be considered a natural characteristic. Some of the old males may lead a solitary, cantankerous life, but such are the exception. "The Galloping Six," who have passed into Park history and legend, illustrate the grizzly's sociability. These six bears are said to have been adults of average size who were always seen together. They perhaps represented two families of young, three being the normal number in a litter. The Galloping Six were seen associated together in the Park for several years and the various thefts of food they committed are well remembered by the rangers.

My introduction to the Park grizzlies occurred on my first visit to the Canyon on August 26. I visited the Hotel garbage dump at sunset and watched with the waiting crowd of hushed and expectant tourists under the guardianship of Ranger Woodring. Just as it was growing almost too dark to see, the forms of two grizzlies came galloping out of the shadows of the pines and across the open meadow to the feast. Several black bears which had possession at the time discreetly vanished. The two grizzlies never faltered, but came running up the hill and hurriedly sought out the food possibilities. A few moments later another pair of grizzlies appeared, com-
ing from the same direction as the first two. These came on at a
gallop and as they neared their fellows the two first-comers gave
way a little, while the strangers sought out a satisfactory dining
place for themselves. Soon a third pair of grizzlies appeared, galloping
toward their feeding brethren from the same direction. At
sight of these last two the four that were feeding ceased and stood
back, allowing the newcomers to approach and choose an eating
place. Then all six settled down to sorting over the garbage peace-
fully together. This procedure was evidently grizzly etiquette.
The six animals were adults and of equal size, and were easily
distinguishable from the black bears even in the dim light by their
high shoulders or "humps" and their saddle-shaped backs. We
waited a quarter of an hour longer, whispering our remarks to one
another so as not to disturb the shadowy monsters scarcely two
hundred feet away. No more grizzlies came, and darkness settled
down on the silent landscape.

A few nights afterward I saw ten grizzlies come to the same
dump. One old grizzly with three cubs, this year's litter, came early
just as the sun had sunk behind the dark pine-clad plateau. She
approached slowly, being a cautious mother with a large family to
fend for. She preceded her cubs a few yards and ascended the re-
fuse dump. Later, the young ones were allowed to come up. Soon,
however, her peace was broken by the appearance of the six grizzlies
seen the night before, who came trotting along quite unconcerned.
The mother moved away hurriedly with her cubs and gazed warily
at the six as they nosed warily about among the tin cans. The babies
stood up on their hind legs and stretched their wee necks to have
a look at their big brothers. Finally, the mother made the cubs stop
where they were while she went forward to feed and mingle with
the six grizzlies now in possession of the dump. The young ones
were well trained and sat patiently waiting in silence. As grizzly
bear cubs do not usually climb trees they have little defense against
members of their own species except by running. They are always
in greater danger when they break parental discipline than are
black bear cubs who can more readily climb to safety. On several
other occasions I watched the grizzlies come to the dump, but never
saw them solitary.

The Yellowstone Park staff should guard their grizzly bears as
their most precious possession and should not allow any to be
taken from the Park for any purpose, under any pretext. No
museum should be allowed to kill specimens for scientific or exhibi-
Fig. 62. A tired cub resting high up in a Douglas fir, while its mother forages below. Black bear cubs always scamper up the nearest tree at the least sign of danger, or at a signal from the mother.

Fig. 63. Seeking shelter in a pine tree during a September snowstorm. Two adult bears at peace in the same tree is unusual, except in an emergency.
Fig. 64. A bull elk during the rutting season of late October, ranging in the sagebrush of Swan Lake Flat.

Fig. 65. A bull elk with fully developed antlers in October among the aspen groves of the Lamar Valley.
tion purposes, nor should any zoological garden be allowed to trap breeding females for stocking its dens. Every effort should be made by the staff to preserve the few grizzlies still remaining in the Park and to encourage them to live wholly within the Park and rear their offspring there. At the same time we should try to secure their protection in all the surrounding National Forests. Under present conditions they are in danger of sudden extermination. Last season, grizzlies came to only two out of the ten or eleven garbage dumps where black bears feed regularly, namely at Canyon and Lake Hotels, and the rangers who had these two dumps in charge reported in all only some 25 individuals during the whole season as visiting the dumps. Under these circumstances it is surely high time that the Park Service grant no more permits for the slaughter or capture of grizzlies. An effort should at once be made by the management to guard them most strictly until they become more generally distributed over the reserved area, so that they can daily visit most of the garbage dumps and be seen by a majority of the tourists instead of by only a few. Some day we may thus have a surplus of grizzlies in the Yellowstone Park, and when that happy time arrives a few of the bears may be legitimately captured for zoological gardens and museums.

**BLACK, BROWN OR CINNAMON BEAR**

*Ursus americanus* Pallas

There is no more appealing animal in the Park than the black bear. His is a popularity based on his friendship for man, and is well deserved. His gentleness and confidence in the people he meets with (see figs. 56, 57) and his diurnal habits and love of camps and hotels, makes him an easily found and observed animal. The black bear is the only large mammal that is seen and photographed by many visitors, for the deer and elk though more abundant are timid forest folk, and the grizzly is a nocturnal rambler and very seldom seen in broad daylight. The most marvelous bit of animal psychology I noted in Yellowstone Park was the intelligence displayed by the black bears in their not unfriendly advances toward man and the sagacious manner in which they accept his profferings of food (fig. 58). They are better mannered and more reserved in the presence of food than even that noble animal the dog. The display of restraint necessary to keep in check a hunger-born instinct to rob and take by force the food offered them at arm’s length by weak,
frail humanity is really remarkable in a wild, free-wandering bear! The black bear who has tamed himself deserves all the encouragement we can give him as well as our friendship and protection. The Park management is protecting the black bears against the tourist, as they are really too friendly and confiding toward undisciplined, thoughtless humans, who are sometimes tempted to tease and play practical jokes on good-natured bears and thus irritate them to the point of committing murder. It should be borne in mind that bears are wild animals of uncertain mood and can not be safely fed out of hand by the visitor. To quote the emphatic warning of Park Naturalist Skinner: "LEAVE 'EM ALONE!" Some tourist is sure to unwittingly tantalize some bear by displaying food to him and keeping it just out of his reach. A savage attack by the bear is often the dire result.

Your own pet dog, when feeding, would probably not permit such liberties; why should a wild bear? No zoological garden permits visitors to feed or tease its animals, for the best of reasons. Moreover, it is their very wildness that gives the bears their charm, and nothing would be less desirable in a wilderness park than to domesticate its wild denizens. The Park management has stationed rangers at all the garbage dumps to see that this rule against tourists feeding or annoying the bears is obeyed.

The black bears deserve a thousandfold the protection and the food that is given them, but they are still far less numerous than they should be, and are to be seen with certainty at only a few places along the loop highway. But, as indicated in our discussion of the grizzly, only an enlarging of the Park, or thoroughgoing protection in the surrounding National Forests, will result in a permanent increase in the number of bears. At Upper Geyser Basin, the Lake, and the Grand Canyon, they frequent the hotel garbage dumps (figs. 54, 55) together with the grizzlies. But at Camp Roosevelt they may be observed and photographed at close range during any hour of the day (fig. 60), and their droll antics and fascinating ways are a continual delight to the onlooker.

The black, brown and "cinnamon" bears—all merely color phases of the same species—are remarkable tree climbers (figs. 61-63) and the dense conifer forests are their ever-ready refuge. It is most amusing to watch a pair of cubs go scampering up a tall fir at a quiet signal from the mother, or when thrown into a temporary fright by some imaginary danger. Plate 25 represents a typical family of black bears in their Yellowstone home. In the vicinity of Camp Roosevelt their well-worn trails and the marks of their
Fig. 66. An elk trail through the lodgepole pine forest on a ridge beside Lost Creek. Such trails often parallel the deep ravines, crossing at favorable points.

Fig. 67. A group of elk cows and their calves in aspen woods near Mammoth Hot Springs in winter.
Fig. 68. A band of cow elk in the snows of late November at Mammoth. This open cedar grove was severely browsed by elk during a starvation period, the winter of 1919-1920.

Fig. 69. An elk herd (males and females) in the Upper Gardiner Valley in late November.
powerful claws on the tree-trunks are to be found all about. The presence of such universally interesting animals should by all means be encouraged and they should be allowed to become more plentiful, but kept in their wholly wild and natural state.

There are in Yellowstone Park probably less than 150 black bears. The former Park Naturalist, Mr. M. P. Skinner, estimates about 125, and my observations in 1921 would lead me to consider this figure a fair one. I did not meet with more than thirty different individual bears in three months' study and search. The black bears fail to increase in numbers for very much the same reason that the grizzlies do. Special feeding in the late autumn, after the hotels and camps close, would keep them inside the Park at a time of year when they must eat heartily and store up fat for their long hibernation of four or five months of winter. They cannot hibernate successfully unless in fat condition and they should not be forced by lack of food to hibernate outside the Park. The killing of black bears in states bordering the Park should be absolutely prohibited, as they almost never become cattle killers (though they occasionally kill sheep and pigs) or interfere seriously with the sort of agriculture practiced by the farmers of the Rocky Mountain states. Yellowstone Park unfortunately produces very little bear food except grass and the roots and bulbs of a few herbs, and in the lower valleys mice, ground squirrels, and other small mammals. Berries are far from abundant and there are no mast or nut producing trees or bushes in the Park from which bears can secure much food. In Yellowstone Park the hotels and camps close by September 20, thus suddenly cutting off their artificial food supply. This is a very serious and unpractical joke to play on the gentle and confiding bears, who have been led to expect their regular daily rations. Thereupon Bruin becomes a burglar (see fig. 53), or failing in his raids for food he often leaves the Park on a foraging expedition from which he probably will never return. We should, moreover, not forget that well-fed bears are more likely to be well-behaved bears. Their house-breaking depredations in the Park are all committed in the autumn after the hotels have closed and the bears are left foodless. A few hundred dollars spent annually by the Park Service for suitable bear food would keep the creatures at home during the critical period, and also restore their confidence in the Park as a land of plenty and a safe haven at all seasons.
GRAY WOLF

*Canis mexicanus nubilus* Say

Does not the wolf also deserve a place in the Yellowstone Park? He is the noble or ignoble hero of much of our literature. Who would not give a year of his life to see a wild wolf or a whole pack of wolves trailing down an elk or deer? The carnivorous animals that kill their prey are always our choice in story and in the hunting field. If they were not killers that show pluck and courage we should not admire them. But since we admire the wolf and are thrilled by his exploits why not tolerate him, at least in our wilderness parks? Great elk herds are not conducive to a balanced piece of nature without the wolf to add fire and alertness to their lives. Protected like cattle the elk become like cattle. Herds of hoofed game, without the presence of a few carnivorous beasts whom they fear, lose much of their character and interest. Should we not be glad to pay for a wolf's mere presence and his "demoniac" howl with one or two elk a month as food?

There are but few wolves now remaining in the Yellowstone; they are almost exterminated in a land where at least their voice should be heard. I was saddened last year in Yellowstone Park not to hear a wolf howl. Northern Michigan and Wisconsin outdo the Yellowstone as a wilderness in which the howl of the wolf is still a woodland melody. In that land of forest and swamps he howls nightly. He lives afar from the ranch of the stockman, and no lumberman or forest owner fears him or wishes to accomplish his extermination. I hope some day to see a pack of wolves in full cry after their hoofed quarry and see with my own eyes how they pull down their game. I do not advocate the support of many wolves in our parks, but a few would help secure a condition of balance amid our wild life and maintain the alertness of the game animals.

MOUNTAIN COYOTE

*Canis lutes Merriam*

A very much maligned animal in the Yellowstone Park is the coyote. Here he dwells in the one place where protection should be afforded him, in a Park where all the hoofed denizens get a fairly square deal, a chance to lead their normal lives to a normal finish. What a National Park should in general aim to be is a balanced piece of nature, where we see nature as it was before the coming
Fig. 70. A band of cow elk in the Gardiner Valley in early winter. The characteristic gait is a rapid trot, the muzzle being held high.

Fig. 71. "Billy," the gelded elk that for several years frequented Camp Roosevelt and the Lamar Valley in summer, migrating to Mammoth in winter. The abnormal antlers were soft and were never shed; one had been accidentally broken.
Fig. 72. Lost Lake, near Camp Roosevelt, now a favorite haunt of moose. The lake is bordered with a zone of yellow water lilies. A beaver lodge may be seen at the right.

Fig. 73. A bull moose feeding in the outlet creek of Bridger Lake, near the headwaters of the Upper Yellowstone and just outside the present Park boundary. Note the long bell or dewlap hanging from the throat.
of the white man, with no foreign species of animals inserted and no native ones excluded. How can we have a balanced Yellowstone Park with the coyotes excluded? The coyote may occasionally kill a fawn, but only rarely. He is really a mouse catcher and you may see him daily in the Park meadows searching for mice. He is our weirdest carnivorous mammal and deserves a place in our parks and our hearts. Anyone who has heard the song of a coyote, that uncanny medley of diabolic sounds, realizes that he is a most unusual animal, a serenader of really great charm and baffling melody. One coyote sounds like a whole pack, either of coyotes or of evil spirits, according to your mood. Ernest Thompson Seton has justly sung the coyote’s praise, and there is no man of our generation whose sentiment in natural history has received wider acceptance.

The coyote is shot on sight in the Yellowstone because the Park officials have not yet conceived the idea of balance in nature. They have striven to have a park filled with elk and other hoofed game to the exclusion of other interesting animals, or at least they have placed emphasis on various species as worthy of preservation and condemned or looked indifferently on others. Any coyote caught killing fawns or lambs should, it is true, be separated from his spirit at the point of a bullet as an undesirable denizen. The Park rangers love to have some live object on which to try their markmanship and the coyote is their legitimate prey under the present rules. I do not blame the rangers. They have the hunter’s instincts strongly developed and their love for animal life was acquired or developed in the hunting field, where the prevailing idea has been to save only the hoofed game, and solely for the hunter’s own killing and use.

As a finale I wish to add that the song of the coyote is more welcome to me and dearer to my heart as a real expression of wild life than the songs of most birds. While in the Yellowstone Park I heard several coyotes sing, and the voice of one I listened to in a canyon was much amplified in volume and positively startling. As they sing, their sharp little muzzles are pointed straight up heavenward in the most approved ecclesiastical way. Any normal mouse-hunting coyote (an animal with the voice of a devil as well as that of a bird) should receive the protection and encouragement of everyone.

COUGAR OR MOUNTAIN LION

*Felis concolor hippolestes* Merriam

How can we sympathize with an animal which is by habit stealthy, exceedingly crafty but cowardly, usually voiceless, and which preys wholly on game animals for its livelihood? We could forgive it for
feeding on game, because it is a carnivore, but how can we be friendly toward an animal that can neither be seen nor heard? As far as the Yellowstone Park is concerned, some people ardently interested in wild life may feel that the cougar might well be dispensed with, as this is a region where he cannot actually be observed under natural conditions. But his tracks at least may be seen occasionally in the snows of winter, and while there are ordinarily no great thrills to be gotten out of observing spoor, the mere fact that such a great beast, the largest of our cats and self-sufficient in the face of all man’s hunting arts, exists unseen in our Parks, adds a glamour that pleases the imagination of all who love to camp or follow the wilderness trails. A few cougars still exist in Yellowstone Park and their absolute extermination may perhaps never be permitted; nor need this be regretted, for we do not yet know how valuable to science and interesting to the public any species of wild animal may prove to be. And as any form of wild life once extirpated can never be brought back, we should not deliberately press a campaign of utter extermination.

There is at least one place in the United States where the cougar should be treated as a sporting animal and not poisoned as “vermin.” On the rim of the Grand Canyon in Arizona he is hunted successfully with hounds by sportsmen. The cougar in that region furnishes some of the grandest thrills to be had in the hunting field in America. He, himself, is never dangerous, but following him on the rim of those dizzy cliffs which mark the mile-deep canyon requires courage and steady nerves. The cougar often takes refuge below the rim of the canyon and the sportsmen who follow him must dismount and descend the cliffs on foot and rout him out of his hiding place. Such hunts take place amid the grandest canyon scenery in the world and on a pine-forested plateau ranging from 6000 to 9000 feet in altitude.

Mule deer are abundant in the forest bordering the canyon, and the cougars seem by no means able to make any diminution in their rapidly increasing numbers. Sportsmen would be glad to see the Government desist from attempting wholesale destruction of the cougars and save them for the chase. Many come annually to hunt mountain lions in this wonderful region of canyons. Resident guides like Jim Owen, who piloted Colonel Roosevelt to the lairs of the cougars on several of the Colonel’s hunts, have trained hounds for the purpose of assisting and encouraging such sport. Why should the Government spend its money in destroying a noble sport by exterminating an animal that is economically harmless in a region like the Grand Canyon where stock raising is not now permitted
Fig. 74. A calf moose feeding on aquatic plants in Southeast Arm, Yellowstone Lake.

Fig. 75. A bull moose and two calves ranging along Trail Creek, Upper Yellowstone Valley. A characteristic moose habitat, with three zones of vegetation,—marsh grass, willow thickets, and dense spruce forest.
Fig. 76. A cow moose and twin calves, on the south shore of Yellowstone Lake.

Fig. 77. A cow moose and calf feeding on water plants, Upper Yellowstone Valley. Lodgepole pine forest in background.
on the commercial scale formerly allowed? Many outdoor enthusiasts have enjoyed cougar hunts on the rim of the Grand Canyon and our hunting literature is filled with tales of their adventures. Nor is it always the chase that ends in a killing that is most memorable. When the cougar has been treed or brought to bay, the camera sportsman is sure to get some thrilling photographs, the best sort of trophy of his adventure and one that does not tend to deprive others of like opportunities.

ELK OR WAPITI

_Cervus canadensis_ Erxleben

More care is lavished annually on the great elk herds of Yellowstone Park than on any of the other big game species. The Park management takes a laudable pride in having maintained large numbers of the elk in the face of very great difficulties. The story of the rangers' desperate struggle year after year to save the elk from the hunters lining the boundary and eager for slaughter, is vividly described in Hal Evarts' _Passing of the Old West_ (1921). The results of the Park protection policy are encouraging, as these animals still far outnumber all the other species of big game combined. With the proposed southward enlargement of the Park, which it is hoped Congress will provide for in the very near future, the safety of at least the southern herd will be assured for all time.

The summer tourist notices elk trails everywhere in the forests and on the open hillsides, often deeply worn by thousands of hoofs along the main migration routes (fig. 66); but he seldom sees the animals themselves, as they are ranging on the higher slopes at that season. If he were to visit the Park in late autumn, however, he would find the valleys dotted with many hundreds of them. In severe winters they are fed on hay cut and stacked in these valleys the previous summer. The wapiti do not thrive on willow browse like the moose, but when hard pressed in winter they commonly resort to the aspen woods (fig. 67) where they gnaw the green bark of the trunks to eke out a scanty fare.

To me, the finest spectacle in Yellowstone Park is that of the rival elk bulls bugling and fighting in the autumn for the possession of their harems. The heavily antlered males are exceedingly noble in carriage, especially when traveling at speed, muzzle pointing straight forward and the great antlers lying back along the sides. Their characteristic gait is a rapid trot (fig. 70).

Early snows in the Park are a source of great danger to the elk herds, which then wander past the boundaries in spite of the patrols
of rangers desperately striving to keep them in. Once outside the Park during the open hunting season the elk are shot by the local sportsmen in great numbers. The year 1919 was one of the most disastrous. Following a year of drought and scant forage, early snowstorms that autumn drove the elk out of the Park, and some 10,000 of them were killed. The ranger force could do nothing to prevent the slaughter of elk that had escaped into the territory of the adjacent states, even within the National Forests. They viewed this most recent slaughter with great sadness and dismay, for they who should have the power to protect their herds in fall as they had in summer, no matter where they strayed, were legally helpless. The Park officials had feared just such a catastrophe and had warned against it for years. In his annual report, prepared in the summer of 1919, only a few months before the blow fell, Superintendent Albright stated the critical nature of the situation as follows:

"Every person in this country who is interested in the conservation of wild life, who wants to see a supply of big game sustained, who wants Yellowstone National Park to hold its prestige as a great natural preserve, should give attention to the problem confronting us at the present time in caring for the elk. The time is coming when a terrible, long, cold winter is going to kill the Yellowstone elk herds if existing conditions outside the Park are maintained. That time may be the coming winter; however, it may be a winter of ten years hence. No one can say when this calamity will strike us, but those of us who know conditions about this Park realize that the extinction of the elk is inevitable unless these conditions are changed."

Under state game laws permitting the shooting of elk in November, a series of early winters would result in cutting the elk herds down to but a few bands. No elk shooting whatever should be allowed within the area surrounding Yellowstone Park where these animals winter habitually or normally. Failing such legislation, the open season should be shortened and placed at an earlier date, so that early winters will not force the elk out of the Park at a time when hunters are allowed to shoot them. Wyoming has befriended the elk and passed laws protecting them, and has given them some security in their winter home in Jackson's Hole. The Montana law was fortunately considerably ameliorated following 1919, but the herds are still in great danger.

This year, 1921, the elk remained on their summer range in the high forests within the Park until October 24. From that date herds were to be seen continually in the region about Fawn Creek and
Fig. 78. Antlers from a "winter-killed" moose on the Upper Yellowstone. The prongs have been gnawed off by porcupines or other rodents.

Fig. 79. A mule deer buck and his does resting on the "parade ground" at Mammoth Hot Springs. An autumn scene.
A pair of mule deer in autumn at Mammoth Hot Springs. Mule deer quickly lose their shyness on the approach of winter.

A band of mule deer on the “Community House” lawn at Mammoth.
Fig. 82. "In sanctuary." Mule deer at Mammoth Hot Springs chapel.

Fig. 83. "Old Molly," a pensioner in winter at the kitchen doors of the Mammoth Hot Springs community.
Fig. 84. Twin mule deer fawns at Mammoth, experiencing their first snowstorm.

Fig. 85. A mule deer stag in late November. The "last look," a deer habit which gives the sportsman a standing shot and would be fatal beyond the Park boundary. Note the double-branched antlers and white rump patch.—diagnostic marks of this species.
Snow Pass. They grew daily more abundant and the bugling of the bulls filled every valley. By November 20 they appeared on the flats bordering the Gardiner River at Mammoth, where I saw numerous bands (figs. 68-70), and sometimes as many as a hundred individuals in a day. This locality is only four miles from the northern boundary of the Park. The autumn of 1921 was unusually mild and open, and the first permanent snow came about November 18. The danger of elk leaving the Park in even mild autumns is considerable, as was shown by their close approach to the north line at this season.

At Camp Roosevelt, so remarkably well located for the study of wild life, the summer visitor until recently was likely to see "Billy," the interesting gelding elk, the only actually "tame" big game animal in the Park (fig. 71). He roamed up and down the Lamar Valley in summer, but spent much of his time at Camp Roosevelt, where although mischievous, he was a great favorite. In autumn he migrated to Mammoth Hot Springs, but never consorted with other members of his species. (See also Journal of Mammalogy, Vol. 4, 1923, p. 252, for a brief history and photographs of this elk, by M. P. Skinner.)

YELLOWSTONE MOOSE

*Alces americanus shirasi* Nelson

The moose are perhaps doing better than any other of the large mammals. Not only are they holding their own, but they are apparently increasing in numbers and enlarging their range. From the extreme upper Yellowstone River and Lake region which is their chief stronghold (figs. 73-77), they have been spreading out gradually during the past twenty years. Now they are to be found on Fawn Creek in the Gallatin Range; in the Bechler River region,—part of the Snake River drainage; on Upper Slough Creek, tributary to the Lamar River; scattered through the Blacktail Deer Creek and Camp Roosevelt region (fig. 72); and in other sections where suitable swampy areas occur. I observed a number of moose this year (1921) while accompanying Secretary of the Interior Fall's party on a journey along the Upper Yellowstone River to the southern boundary of the Park (fig. 47). In this region we saw in two days' travel over the regular trail from the Lake to the boundary, fifteen moose the first afternoon and at least four the following day. The moose showed little fear of us; in fact they seemed to have as much confidence in humanity as range cattle. The sight of these great deer standing solitary on the edge of the forest or feeding in family parties in the willow thickets bordering the Yellowstone River en-
thrilled us, and it made our ride that first day an unforgettable adventure. To even come upon one of their heavy antlers while riding the remote wilderness trails gives zest to the trip. The skeletons of winter-killed wilderness are occasionally to be seen. Figure 78 shows a ranger bringing in a skull and attached antlers of a winter-killed specimen. One frequently finds antlers of moose, elk and deer that have been similarly gnawed by porcupines, pine squirrels or other rodents.

A great step forward in game conservation will have been made if the Park Service is given charge of the extreme upper headwaters of the Yellowstone River, which are an important part of the moose range and unquestionably belong to the Park topographically. The explorations and the photographic studies of moose made by Mr. George Shiras, 3rd, in this general region in 1908 to 1910 (see National Geographic Magazine, July, 1913, pp. 868–834) indicate the necessity of eventually adding the Upper Yellowstone basin to the Park to safeguard this superb mountain species. In 1921, Wyoming permitted fifty moose to be killed in this nook of territory, and these fifty moose were virtually taken from Yellowstone Park. They were killed for no legitimate purpose but to satisfy a few venison-hungry cattlemen. There was no sport concerned in shooting them, for they were as tame as cattle. Such moose should be fully protected and allowed to live their natural lives. They are fair game for the adventurous summer explorer with his camera, and should furnish keen pleasure to hundreds of people annually who travel thousands of miles and spend much money in this region to see a primeval wilderness, rather than fall victims to a few local ranchmen. In 1922 Wyoming again permitted fifty bull moose to be killed, with the result that their cows went unmated and produced no calves, as the moose is not polygamous in habit.

MULE DEER

Odocoileus hemionus (Rafinesque)

From the standpoint of the Park visitors mule deer are a feature chiefly of Mammoth Hot Springs. In winter they are absent from nearly all the Park area except the northernmost district which has the lowest valleys; though Mr. Skinner informs me that a few bands winter between the geyser basins and elsewhere on the Park plateau. There are always a few to be observed in the vicinity of Camp Roosevelt and in the country lying between there and Mammoth, and tourists sometimes see them in the edges of the forest along the
Fig. 86. A mule deer in the rutting season during October.

Fig. 87. A white-tail buck, at Mammoth. Unlike the mule deer it has single-beam antlers and a broad tail. White-tailed deer are shy even in winter, and only a few are now left in the Park.
Fig. 88. A white-tailed deer (in front) and a mule deer in company in the fall.

Fig. 89. The same pair of deer. Note the absence of a white rump patch and the broad tail of the white-tailed deer (at right), and the narrow, black-tipped tail of the mule deer.
roads throughout the Park. At Mammoth in the fall the mule deer reigns supreme. He and his family take possession of the deserted lawns and carefully crop the grass as short as any lawn mower could (figs. 81, 82). Deer are browsers, also, but to see a band of them at work on the lawns of Mammoth one would never suspect them of any food habit other than grazing.

About September 12 they began to appear on the hillsides near Mammoth either singly or in family parties. At this time they visited the lawns only at night, spending the daytime in the adjacent woods and pine forests. After the Park season closed, September 20, they grew bolder and visited the lawns during the day. Later they became actual residents and remained about the houses day and night. Often I saw them lying down at night on the lawns, sometimes actually in front of the doorsteps of the occupied houses of the Yellowstone Park staff.

When the permanent snows came in mid-November there were some fifty individuals about the houses and lawns of Mammoth village. Many of these deer were the offspring of such famous old beggars as "Ash Can Pete" and "Molly the First" (fig. 83), familiar to all the villagers in winter. The old bucks in mid-November carried fine large antlers (figs. 85, 86) and were then engaged in social pursuits, flirting and fighting. There was remarkably little fighting, however, so far as could be seen. Nearly every buck knew his place in the social scale, and the lesser bucks simply moved away, and kept out of range of the stronger when they appeared. Feeding bread, apples, and other food to deer by hand was a pleasant and usually a harmless pastime at Mammoth. Feeding several deer at once was slightly dangerous, owing to the possibility of one of them suddenly, in a fit of jealousy, striking out at another and at the donor with his fore feet.

The fawns are timid little sprites and retain the racial fear of man. They never show the confidence in him that is displayed by their parents, which forget their fears and feed freely from his hand with the coming of autumn. The mule deer are a pleasure to all the Park residents. During the long winter months they are daily visitors to the snow-bound community at Mammoth. The only other Park animals that approach the mule deer in popularity are the cub bears who entertain summer visitors with their droll antics. The mule deer appear to be safely holding their own in the Yellowstone Park; but we have learned that with every one of these big game species appearances are liable to be deceiving. Year by year they
seem to be becoming gradually tamer until now they have reached a stage of semi-domestication which asserts itself chiefly in the winter season. Like the elk they are shy in summer, keeping out of sight in the forested areas, and are only occasionally seen by tourists. These two members of the deer family give the visitor in summer who would go in quest of them off the noisy highways plenty of exercise for the hunter's instincts and woodcraft. This condition of affairs, highly desirable in several ways, is ideal for the practice of trailing and wild life photography, and is being utilized as an educational feature for the boys who spend their summers camping in Yellowstone Park. A National Park should never be made a zoological garden. It should harbor only its own natural fauna in normal numbers and should be a sanctuary where the animals are to be sought rather than a place where they are on exhibition.

**WHITE-TAILED DEER**

*Odocoileus virginianus macrourus* (Rafinesque)

The graceful little white-tailed deer inhabit the country about Mammoth Hot Springs and elsewhere at the north end of the Park, in the valleys of the Gardiner and Yellowstone Rivers. They are the wood nymphs of the Yellowstone, gentle but timid (fig. 87), and show no such familiarity with man as their larger cousins the mule deer. Their tribe is not numerous, for apparently less than fifty live inside the Park. I saw only some fifteen individuals during two months' observation in the late autumn of 1921 at Mammoth, where one might find small family groups of these exquisite creatures about the lawns at dusk every evening. They were easily approached and gentle, but more nervous than mule deer and did not come to the kitchen doors to be fed as did many of the latter. In the daytime it was rare to see the females on the lawns. They remained hidden in grassy hillside nooks, while an occasional white-tail buck might be found associated with the mule deer about the human habitations (figs. 88, 89).

The winter in the Park is evidently too severe for the white-tail deer. When the landscape about Mammoth became white with snow, and winter really settled down to stay, they were no more to be seen, though ordinarily a few are observed throughout the winter. Evidently they moved down the valley of the lower Yellowstone where the climate is warmer, but unfortunately protection from hunters is much less or entirely wanting there. Doubtless it is the killing of the deer outside the Park that keeps their numbers at so low an
Fig. 90. Grand Canyon of the Yellowstone, and Lower Fall, 308 feet high. Mountain sheep trails lead down the precipitous slopes to the river; and the dense lodgepole pine forests on the plateau are the summer home of the grizzly bear.

Fig. 91. Lower end of the Grand Canyon, near Tower Fall. The canyon rim is one of the favorite winter homes of mountain sheep. This is where Roosevelt and Burroughs camped and watched them descend the cliff's 600 feet to the river, in April, 1903.
Fig. 92. Bighorn sheep scenting danger. They may be seen occasionally from the touring buses as one passes over Mount Washburn.

Fig. 93. Bighorn rams grazing on the dry hillsides in late autumn.
Fig. 94. A group of old rams grazing through the snow on a sagebrush flat.

Fig. 95. A band of old rams, closely bunched like domestic sheep, crossing a plateau.
Fig. 96. Part of the so-called "tame herd" of Buffalo in the Lamar Valley in September, 1921. Secretary Fall’s party observing the herd.

Fig. 97. A closely packed herd, including all ages, at the buffalo ranch in the Lamar Valley. Specimen Ridge in the background.
Unfortunately, deer cannot be held and grazed within the Park through the winter as can the antelope, as they will go higher on the hills and around or over the fence built across the valley flats to restrain the latter.

MOUNTAIN SHEEP OR BIGHORN

Ovis canadensis Shaw

The bighorns or mountain sheep are a source of much anxiety and concern to the Yellowstone Park staff. Their numbers have decreased rapidly since former times, but whether they are still declining is not known. My attempts to find them in summer and fall were not very successful, and I feel that they are, next to the white-tailed deer, the rarest hoofed game in the Park. In 1907 they were estimated by the rangers at 260, in 1910 at 150, and in 1916 at about 110. What their numbers are at the present time we can only guess. I saw in three months' search some 28 individuals, 12 of which were ewes and young lambs, and 16 were adult rams. The ewes had a fair proportion of lambs with them and seemed to be increasing normally. The rams were seen in late November after several heavy snowstorms. I should say that 100 bighorn sheep would be a very liberal estimate for Yellowstone Park, an area that should harbor at least 1000, after forty years of protection. * *

It is somewhat difficult to sift evidence concerning the decrease in the number of sheep. It is doubtful if many wander out of the Park as they are usually local in habitat and are not affected in the least by the severity of the winter weather. These animals are not nervous, and inhabit regions where they are not subject to molestation. They eat hay which is placed near Gardiner Canyon road in winter, but they do this merely as a change in diet and not because they are in want of food. There may be some killing of these native sheep by poachers in the eastern portion of the Park, but not to an extent that would account for their diminished numbers.

The reason that seems most plausible is that the bighorns were infected by "scab," contracted from tame sheep that were driven through the Park. Scab is caused by a mite, and in domestic sheep is not a fatal disease. To the bighorn it seems to be deadly. The ears are attacked first, and become closed, rendering the animal deaf. Tales came to us of sheep country in the Hoodoo Mountains in the

*The last of the white-tailed deer seem to have disappeared from the Yellowstone Park in 1923.
* In 1923 the bighorns were definitely seen to be increasing, over fifty being reported in one band on Specimen Ridge in August.
eastern portion of the Park, where many mountain sheep skeletons lie bleaching, supposedly those of victims of the scab epidemic. This epidemic was apparently at its height in 1916. We heard also that some of the animals were captured and transported in wagons to a dipping vat, and dipped. Most of the sheep dipped were said to have died, whether from scab or fright seemed to be a question. The animals that came under my observation in 1921 were in excellent pelage, and, so far as I could see, were free from disease. I regret that I had no opportunity to make a careful study of the problem of the disappearance of the sheep, or to check the authenticity of the rumors mentioned above. I believe that a careful investigation of the matter by a naturalist of experience would give us material by which to plan means to help them regain their normal numbers. I understand that domestic sheep may no longer be driven through the Park on account of the danger of transmitting their diseases to their wild relatives. But the native species will always be exposed to infection because of the fact that lone bighorn rams occasionally join flocks of domestic sheep for a few weeks at a time. Nevertheless, exposure to such infection should be cut down to a minimum.

Bighorn sheep are a source of much interest to tourists who motor or tramp over Mount Washburn, where a small band or two are occasionally seen from the roadside. One of their favorite ranges, except in midsummer when they usually seek the high and inaccessible peaks, is along the rim of the Grand Canyon near Tower Fall (fig. 91). It was at this point that President Roosevelt and John Burroughs camped in April, 1903, and watched the mountain sheep descend the canyon precipices to the river 600 feet below. John Burroughs has related their experiences most interestingly in his book entitled *Camping and Tramping with Roosevelt*.

The bighorns of the Yellowstone make excellent subjects for the skillful camera hunter (fig. 92),* for they are equally picturesque in the storms of winter or amid the mountain crags of their summer home.

The old rams which I encountered in the snow late in November were exceedingly fearless and unconcerned, more trustful even than horses and cattle (figs. 94, 95). These old fellows have an air of great solemnity and dignity, and their massive horns and heavy bodies give them an appearance of great strength and determination, the reputation for the latter quality, however, seldom being deserved.

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*This photograph was awarded third prize in the exhibition of mammal pictures held at the American Museum in New York City, May, 1922.
Fig. 98. Part of the buffalo herd crossing the Lamar River in September, the huge old bulls leading the way.

Fig. 99. Old bison bulls held temporarily in the big corral at Mammoth in midsummer. These bulls approximate a ton in weight and are swift and dangerous antagonists.
Fig. 100. A rear guard of the buffalo herd crossing the Lamar Valley in winter. The storm-swept heights of Specimen Ridge and the Fossil Forest beyond.

Fig. 101. At the buffalo ranch in winter, where the "tame herd" now numbering about 600 is fed in immense corrals. In spring the herd is released and disperses to its natural grazing range on the mountain slopes.
BISON OR BUFFALO

Bison bison (Linnaeus)

The safety point in the campaign to save the buffalo from extermination has long since been passed, and today these animals are almost as easily reared and managed as domestic cattle (fig. 101). The so-called tame herd of the Yellowstone, now numbering over 600 head, is increasing rapidly. There appears to be practically no disease among these bison at present, although several years ago an epidemic broke out which killed a number of the animals. This was diagnosed as hemorrhagic septicemia, a recurrent malady sometimes mistaken for "blackleg," and the calves are now vaccinated annually against the disease. Bison are apparently immune to the "blackleg" of cattle.

The buffaloes are very hardy and endure the severe winters of Yellowstone Park without loss from exposure and freezing. Nearly all of the cows breed annually and the death rate among the calves is low. Therefore, it may eventually become a problem as to what to do with the increase of the "tame herd," although the other National Parks and National Forests within the natural range of the species should harbor a considerable number to advantage. Many state game preserves and parks also will no doubt afford suitable range for bands of buffalo. Such areas should take care of the surplus breeding stock for many years. Zoological parks, on the other hand, are well stocked and require very few additional bison. The maintaining of private herds by wealthy stockmen has received a setback recently, owing to the considerable expense involved. If the ranger force were allowed to use the surplus male buffaloes in the form of beef it might be good economy; but this would be attended by grave risks, and would set a dangerous precedent. Under the present regulations of the Park none of its animals can be killed for food. The castration of excess bulls has been resorted to, but this of course does not reduce the number of calves born. It has proved very unsatisfactory, moreover, because the altered animals are inclined to fight the cows and otherwise act abnormally toward their fellows. They are merely disturbers and the herd would be better off without them. Considering the small number of bison now existing in the country, it would seem a safer procedure to disperse any surplus from the Yellowstone herd to other localities in their natural range, rather than destroy them. The sudden outbreak of disease in the winter of 1918, destroying thirty-
six animals in a single epidemic before it could be controlled, and a similar sudden outbreak in March, 1922, when fifty-two buffalo died and the entire herd was threatened, indicates the still uncertain situation with respect to the safety of the species.

The tame herd, although it is of pure bison stock, was originally recruited from several sources. The Goodnight herd in the Panhandle of Texas furnished three bulls. Another band of eighteen bison came from the Flathead region of Montana. There is some Colorado bison blood in this tame herd, as well as a little from the Yellowstone Park wild herd; and a single bull of the woodland bison, racially distinct from the others, is said to have been introduced. A similar mixture occurs in the wild bands of buffalo now ranging the Kaibab Forest. These are the remnant of a herd gathered from several localities and introduced there by "Buffalo" Jones for the purpose of experimental breeding some years ago. The plan proved impracticable, and all the animals were removed except about twenty which were too wild to be rounded up. This remnant has recently been re-located; and one of the band is said to be conspicuous because of its white face.

The above cases represent an undesirable condition. The cattle breeder's practice of mixing strains should not be followed when dealing with wild animals for wilderness parks and preserves, as the strains from different localities may represent various races and subspecies. A mongrel stock is of little scientific and educational interest. On the other hand, there need be no fear of deleterious effects from inbreeding the buffalo. Such inbreeding is constantly occurring in nature. The mixing of wild stock is wholly at variance with the ideals of our National Parks,—wilderness areas set aside for their features of supreme national interest to be maintained in their wild and original state. This preservation of original natural conditions must apply to the large mammals and other wild life, no less than to the forests and mountain scenery.

The wild herd is the real bison prize in the Park, and every effort should be made to preserve it in a wild state and without admixture from the other stock. This large band is derived from the original remnant of our great western herd and owes its preservation to the fact that it was composed of individuals which voluntarily or under pressure from the hunters on the plains chose to winter in the Yellowstone Park region and did not join the great herds on their annual migration south in autumn. The descendants of these non-migratory bison today constitute the only original wild herd in the United States. Owing to their hardy nature they are able to winter success-
Fig. 102. An antelope buck guarding his harem in September on the summer range in the Lamar Valley. The antelope usually keep to the open range, unlike the deer in summer.

Photo by Edmund Heller.

Fig. 103. The antelope on their winter range along the Gardiner River flats, November 18, 1921, just after the first snows in the valley.

Photo by Edmund Heller.
Fig. 104. Part of the antelope herd in their present winter home, along the Gardiner River flats, at 5,400 feet, the lowest elevation in Yellowstone Park. Electric Peak, the highest point in the Park, towers nearly 6,000 feet above.

Fig. 105. The entire antelope herd in the Gardiner Valley near the Park boundary, November 15, 1921.
Fig. 106. A band of prong-horned antelope, showing their characteristic bounding gait and flaring rump patches.

Fig. 107. Frightened antelope, showing the appearance of the long, white hair of the rump when erected. This "flaring" is an alarm signal to other antelope.

Fig. 108. An antelope with fully developed horns in October, a month before the horns are shed. Note the smooth white rump patch, indicating that the animal is not disturbed.
Fig. 109. Weathered shells of antelope horns, the tips of which have been gnawed by rodents. These are cast in late autumn.

Fig. 110. An antelope that has recently shed his horns. The horn cores and new sheaths, their basal half covered with fine hair, as they appear in November.
fully in their restricted range near the hot springs in the valley of Pelican Creek, at an elevation of 8000 feet. Mr. M. P. Skinner states that "here they manage to gain a scanty living from the grass freed from snow by the interior heat. Aside from deep snow this valley is a good place for them, affording as it does good protection from the bleak, wintry winds that sweep across the Park plateau. In summer they have ample grazing in secluded nooks." (See *The Hoofed Animals of the Yellowstone*; in *Amer. Museum Journal*, Vol. 16, 1916, pp. 86–95.) These bison are a pure indigenous stock living aloof in the wildest areas of the Park, entirely self-supporting, and still free from the epidemics that constantly threaten the imported mixed herd. They now (1922) number about 100 and are evidently doing well, having increased about forty per cent since 1917, when they are said to have numbered 67 animals.

As the buffalo range in scattered bands on the high mountain slopes in summer, very few Park visitors see the main herd. But a "show herd" of about twenty splendid animals is kept at Mammoth in an extensive pasture during the tourist season (fig. 99), and thousands of people have full opportunity to observe and photograph them to best advantage. These bison are returned in the fall to the Lamar Valley, where the entire tame herd is rounded up in the vicinity of the "buffalo ranch" for the winter (figs. 96–98). Here the calves are vaccinated against disease, and all are fed during severe weather on hay cut and stacked at the ranch.

**PRONG-HORNED ANTELOPE**

*Antilocapra americana* (Ord)

In the natural range of our antelope northern Yellowstone Park represents the extreme upper limit of summer distribution. It was never intended by nature as a year-round home for these animals. No prong-horns wintered in the Yellowstone in the old days when they could exercise their migratory instincts and travel down from the foothills each autumn to snowless plains for their winter residence. Holding the antelope in the Park in winter seems a rather cruel procedure, but heretofore it has appeared to be the only means of saving them. If it were possible to herd them like cattle, or allow them to drift lower down to some favorable warm valley for the inclement season, they could lead a far happier life and their increase might be assured. This experiment of letting them down to a ranch below the Park was tried in the winter of 1922–1923, with apparent success. But on the other hand the prong-horn
is too nervous an animal for such treatment, and there is the added danger of the whole herd becoming suddenly scattered and lost forever. If the Park boundary could be extended even a few miles north along the Yellowstone Valley, this would probably save the antelope. It would also assist in the protection of the deer and the precious herds of elk, now in a precarious situation.

It appears to be principally because of the severity of the winters that the Yellowstone antelope are gradually diminishing in number. In 1912, it was estimated that there were about 300 in the Park, and today there are less than 200 all told. How long will they last in case their Park range is not extended down the Valley? None of the other remaining bands in the United States has such severe climatic conditions to meet as those wintering below Mammoth Hot Springs, but for one cause or another they are all apparently tending rapidly toward extermination. On the other hand, the Yellowstone herd receives better protection from poaching than those outside the National Parks. The American antelope is very sensitive and nervous in disposition and fails to breed regularly when reduced in numbers or disturbed. If placed in confinement, as in a zoological garden, it soon dies. In order to preserve our antelope they must be kept in large herds and carefully guarded from all disturbing influences. They are easily driven from their range, the approach of a single person or unusual object being sufficient to stampede and scatter them over a wide area. On various occasions portions of the Park herd have broken away over the northern boundary and been destroyed. Such losses account in part for the diminished numbers of the present herd. No person or institution should now be permitted to shoot or take antelope anywhere for any purpose whatsoever. Every animal in the few existing bands is needed to help build up the race to a point where it will breed normally and re-establish its former numbers. A safe margin should always be maintained to allow for possible accidents to so sensitive a species.

No game animals in America are worthier of preservation than the antelope. Their home is the open plains, where they would be visible to everybody traversing their habitat. No more lovely sight ever gladdened the eye of a traveler than that of a band of these spritely pink and white creatures. Their eyes are unusually large for the size of the animal, and their color pattern is strange and very beautiful (figs. 108, 110). Prong-horns have a peculiar bounding gait (fig. 106) and are capable of tremendous speed. When frightened they "heliograph" their alarm to their companions by reversing the white hair of the rump, which reflects the sunlight in mirror-
Fig. 111. A buck antelope which has shed its horns, showing the cores over which the new pronged sheath develops. Beyond him stands a doe with characteristic tiny horns.

Fig. 112. The archway at the northern entrance to Yellowstone Park, dedicated by President Roosevelt in 1903. The boundary fence across the Gardiner River flats at this point helps to hold the antelope (but not the elk and deer) from migrating down the valley to their natural winter range, where they would be slaughtered by Montana hunters.
like fashion and is visible for a long distance (fig. 107). In habits they are polygamous, one buck usually being in possession of five to twelve females which he drives before him. The excess of bucks is usually noticeable close by, associated as they are in bachelor parties waiting for a chance to break into society and displace any patriarch whose fighting ability is declining.

The American prong-horned antelope shed their horns, which are hollow like those of true antelope. But these animal's alone among hollow-horned ruminants exhibit this characteristic of shedding. A new horn has already begun to form under the old shell so that the animals are never really without horns (figs. 110, 111). It was my good fortune to be with the Yellowstone herd daily during this period when the horns were lost, and photographs were taken on consecutive days to verify the field observations. The shedding process started in the first week of November and within a fortnight all the bucks had dropped their old horns. Several pairs of shed horns were found on the range at this time.

I first observed the Yellowstone antelope on their summer range in the Lamar valley in mid-September. The young are born in June; and those which I saw in September were half the weight of the parents, nearly as tall, and much more alert and fleet of foot. At that date the animal's appeared to be in harems and this condition was maintained until October 10, when they gathered in larger bunches and migrated down the valley close to the town of Gardiner, where they formed a large herd within the four-mile fence extending across the Gardiner valley at the Park boundary. Here, on a range but a few hundred acres in extent, most of them spend the winter (figs. 104, 105). The winter of 1921-1922 was severe and about 125 of the animals died of exposure or were killed by beasts of prey which trapped them in the crusted snow along the boundary fence.

For a more detailed account of this remarkable species, based on this study in the Park in 1921, the reader is referred to *The Vanishing Race of Pronghorns*, by Edmund and Hilda Hempl Heller (Truel, Vol. 41, No. 2, June, 1923, pp. 5-10). For the most complete account of the Yellowstone antelope, see *The Prong-horn*, by M. P. Skinner (Journal of Mammalogy, Vol. 3, No. 2, May, 1922, pp. 82-105), and a revised reprint of this, 1924.

As the Yellowstone region comprises our last great wild life refuge, outside of Alaska, the loss of such vanishing species as the antelope and grizzly bear, or the last small herd of truly wild buffalo,
would be a calamity; for nothing holds the popular interest in this great Park more than its wonderful display of animal life. The bordering states of Montana, Wyoming and Idaho should therefore cease their indefensible practice of maintaining open shooting seasons near the Yellowstone Park borders. This practice is equivalent to poaching on the Park preserve, for the large mammals are influenced in their movements not by the purely artificial boundaries of this area, but by the natural topography of the country. The citizens of the surrounding states derive a large and rapidly increasing annual revenue from the Park tourists, and they should be foremost in giving protection to the game which wanders into their territory. If they are actuated by no higher motive, at least it would be good business for them to protect "the goose that lays the golden egg."

If adequate measures are taken to study and save the large mammals at the present critical stage, it will mark the beginning of constructive management of a wild life resource invaluable alike to science and to educational recreation in our parks. But the danger of complete loss and the extreme difficulty of restoration of the diminishing herds is realized by few people. Every visitor to the Yellowstone should feel a personal responsibility and solicitude for its wild animals, as for its other priceless treasures, and should take a keen interest in the problems of their true appreciation and their preservation for all time.
WILD LIFE AND DEMOCRACY

"Above all, the people, as a whole, should keep steadily in mind the fact that the preservation of both game and lesser wild life—by wise general laws, by the prohibition of the commercialism which destroys whole species for the profit of a few individuals, and by the creation of national reserves for wild life—is essentially a democratic movement. It is a movement in the interest of the average citizen, and especially in the interest of the man of small means. Wealthy men can keep private game preserves and private parks in which they can see all kinds of strange and beautiful creatures; but the ordinary men and women, and especially those of small means, can enjoy the loveliness and the wonder of nature, and can revel in the sight of beautiful birds, only on terms that will permit their fellow-citizens the like enjoyment. In other words, the people as a whole through the government, must protect wild life, if the people as a whole are to enjoy it. This applies to game also."

Theodore Roosevelt and Edmund Heller.
Life Histories of African Game Animals,

WILD LIFE RESEARCH IN THE YELLOWSTONE

"This whole episode of bear life in the Yellowstone is so extraordinary that it will be well worth while for any man who has the right powers and enough time, to make a complete study of the life and history of the Yellowstone bears. Indeed, nothing better could be done by some of our outdoor faunal naturalists than to spend at least a year in the Yellowstone, and to study the life habits of all the wild creatures therein. A man able to do this, and to write down accurately and interestingly what he had seen, would make a contribution of permanent value to our nature literature."

Theodore Roosevelt.
Fig. 113. View down the rapids of the Yellowstone River at the entrance to the lower part of the Grand Canyon, below Tower Fall, showing the "palisades" and the rock columns known as "the needles."
THE FOOD OF TROUT IN YELLOWSTONE NATIONAL PARK*

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INTRODUCTION

Through the courtesy and cooperation of the Park authorities, the Yellowstone Park Camps Company, and the Roosevelt Wild Life Station, the writer during the summer of 1921 was enabled to make certain studies of the trout streams of Yellowstone Park, particularly those of the northeastern section. The study extended through four months—from June 20 to September 10,—covering the critical period of the year, since the conditions during these months largely determine the propagation of trout and also of their natural food supply.

*Contribution from the Roosevelt Wild Life Forest Experiment Station, and from the Zoological Laboratory, University of Idaho, Moscow, Idaho.

This is the third of a series of papers on the wild life of Yellowstone National Park which has been made possible by gifts to this Memorial Station from the joint friends of Theodore Roosevelt and of wild life conservation. The initial aid for this plan came from Mr. Howard H. Hays, President of the Yellowstone Park Camps Company. I gladly avail myself of this opportunity to thank Mr. Hays and Dr. Muttkowski on behalf of the Roosevelt Wild Life Station for their contribution and cooperation in this investigation. (Cf. also Roosevelt Wild Life Bull., Vol. 1, No. 1, pp. 96-99.)—The Director.
While dealing specifically with the trout streams of Yellowstone Park, the facts here presented have a much wider application. It is an axiom that like causes beget like results. In a broad sense the mountain trout streams of the Park and their fish are typical of the trout streams throughout the Rockies. The writer has had the opportunity to make comparisons of physical conditions, and to some extent of the biological conditions, in several of these states. In the region studied, the conditions affected but a single species of trout—the native redthroat, cutthroat, or blackspotted trout (*Salmo clarkii*)—the only one found in the northeastern part of the Park.

The present account is not in any sense complete, as it deals with only a few phases of the work, certain summaries presented in a form believed to be of most interest and value to the general reader. The technical, detailed report is to follow at a later date.

The illustrations accompanying this paper, with the exception of figure 113, are reproduced from photographs taken in 1921 by the author.

**FISHES AND THEIR ENVIRONMENT**

There are at least two points of view in dealing with fish,—that of the fish and that of the fisherman. A fish wants something to eat, and the fisherman, aside from a secondary "sporting" interest, wants to eat the fish. What the fisherman thinks we know pretty well. But no one has as yet succeeded in interviewing a fish directly to find out what he "thinks" about the matter. Indirectly, scientists have frequently forced fish to give us information by placing them under special, controlled conditions. This method is called experiment. To this is added observation. By combining the results gained by the two methods a good deal of information has been accumulated regarding a fish's habits, his likes and dislikes, and something of the world in terms of a fish's life.

Let us summarize briefly the conditions under which a fish lives. Water is supposedly transparent. But have you ever looked at the under side of the surface film of water in an aquarium? Seen from an acute angle, this surface film is not at all transparent, but acts as a mirror, reflecting the objects beneath. The more closely the angle of vision approximates a right angle the less the mirroring, and the greater the transparency. There is a further difference whether one gazes toward the sunny or shaded side of the water. A fish can see objects outside of the water, provided these are fairly above him, at an angle of view not exceeding 45 degrees, or within
Food of the Yellowstone Trout

an arc of approximately 90 degrees. Beyond that point the surface film becomes a mirror to the fish. These points can be easily tested by any person with sufficient courage to keep his eyes open under water for a few seconds. There is a slight difference in a stream where the surface is mobile, as in rapids. Here the effect is primarily that of a "freak" mirror, constantly moving like a dish of agitated mercury or molten silver or lead, with bright streaks and dark bands, the bands being transparent places.

To the fish, then, the water surface is in good part a mirror, through which he cannot see; but he does see objects beneath him reflected plainly in the surface mirror—upside down, of course. This is an advantage, for it aids him to find the food in the water, to come upon his prey suddenly, unobserved, and from an unexpected angle. It is also to his disadvantage, for while it aids him in finding his prey, it exposes him to his enemies in the water, putting him in the position of prey. It places him at the further disadvantage of not being able to see external enemies, such as man, birds, and fishing mammals, except through the circumscribed area directly above him. And finally, the mirror tricks him into accepting bait that is poked through the surface mirror while preventing him from seeing the fisherman on the shore who is offering the bait.

Another point is that fish are more or less near-sighted and do not recognize objects unless they move. Further, a good deal of scientific evidence indicates that fish are color-blind, that they do not see colors as we do. To fish, all colors apparently must be more or less shades of gray, much as to a color-blind person. If this is true, in just what way are colored flies so useful when used as bait for fish, since fish are not supposed to recognize colors as we do? Again, since a fish generally strikes from below and sees the colors of bait against light, of what use are colors under such conditions? To test this, let the reader try to recognize colors of an opaque object held against light. Whether a fish recognizes colors as such, or merely as shades of gray, is as yet an unsettled question which offers splendid opportunity for experimental study.

For the observer who wishes further information on this interesting subject, the following references are suggested:


Marvels of Fish Life, as Revealed by the Camera, by Francis Ward. 2nd ed., pp. 1–106. London, 1912.

THE FOOD OF THE NATIVE REDTHROAT TROUT

The habits of fishes are as varied as those of terrestrial animals. Fish are carnivores, first of all. But the different kinds of fish have their preferences in the way of food. A silver bass is primarily a surface feeder, that is, he prefers to pick his food from the water's surface or from plants near the surface. Both the large-mouthed and small-mouthed black bass are chiefly plant feeders, selecting their food from plants, while the crappie is more or less an indiscriminate feeder, although he really prefers the muddy bottoms. The trout, in general, are clean feeders; that is to say, they do not like to skim the bottoms, but prefer to catch their prey when the latter moves through the water.

In mountain trout streams the rapidity of the current limits the make-up of the fauna to such animals as are adapted to withstand strong currents. In rapids one finds no leeches, no worms (except flat-worms), no air-breathing insects, nor crustaceans (crayfish, water-fleas, etc.). This limitation means that the food supply is confined to such plants and animals as can withstand the strong current either by strong clinging or propelling devices. It also means that the fauna consists of relatively few species, which generally are present in enormous numbers. It means further that the diet of the fish inhabiting such streams is limited to these items—primarily and that, humanly speaking, the diet must become monotonous.

The food of trout can be conveniently classed into two types: water bait, which is the normal supply found in the water, and surface bait, consisting of insects and other animals that have fallen into the water and become "water trapped." This latter condition applies when an insect's wings become water-logged or so adhere to the surface that the insect cannot rise from it. This surface bait may be of various types, such as ants, grasshoppers, beetles, moths, butterflies,—in fact, anything that a sudden gust of wind may carry onto the surface. It may even include frogs, mice, worms, and other stray land animals.

The Water Food.—The normal food of trout streams, comprising the water bait, is represented in the main by three groups. Named in the order of their importance, for trout streams only, these are the Perlóidea or stone-flies, the Ephemeroptera or May-flies, and the Trichoptera or caddis-flies.

Stone-flies.—The Perlóidea or stone-flies are the most conspicuous fish food item in the Yellowstone streams. In this respect, these
Fig. 114. Stone-fly nymphs from the Yellowstone River near Yellowstone River Bridge.

Fig. 115. A stone-fly nymph (*Pteronarcys californica*) which has just come out of the water and is crawling up a rock to a sheltered spot for transformation to the adult insect. Photo July 25.
Fig. 116. Salmon colored stone-flies (*Pteronarcy\textit{c}s \textit{californica}*) "emerging" from the larval skins. In the upper specimen the larval skin has just split; in the lower one the head and legs are free. Photo July 25.

Fig. 117. Stone-flies "emerging" on a rock near Yellowstone River Bridge. Some of the dried cast larval skins are sticking to the rock. Photo July 6.
streams, especially where there are trout, are like other mountain streams. Indeed one may say that the life of trout streams as far as the fish are concerned is absolutely dependent on stone-flies. They are indispensable in the natural propagation of trout. While in the water, they are more or less flattened, six-legged creatures (fig. 114), varied in color and size, and generally may be found under stones or clinging to them, busily searching for food. Hence they are known to zoologists as “stone-flies.” Most of them are carnivores in the aquatic stage: they eat other insects, flatworms and other aquatic animals, and even turn cannibal, eating their own kind or their young. Curious to say, the largest and most conspicuous species of the stone-flies (*Pteronarcys californica*) found in the rivers of Yellowstone Park is almost entirely herbivorous, eating the various algae and diatoms off the rocks, and also bits of wood and bark that come down the stream.

Beginning with July, the stone-flies “emerge,” that is, they crawl out of the water onto the shore or on exposed rocks, split the larval skin, draw out the thorax, head, legs, and finally the abdomen, and expand their two pairs of wings (see figs. 115-116). They generally come out in enormous numbers from early morning till early afternoon. After the wings are dried, which takes from ten to fifteen minutes, they fly toward some upright object. Naturally, any person standing or moving along the stream will be taken for a convenient resting place by the stone-flies, much to the delight of the trout fishermen who encounter flights of these beautiful creatures.

According to local habit, these stone-flies are known by various names in different sections of the country. Thus, they are called willow flies, trout flies, mountain flies, salmon flies, yellow flies, river flies, red flies, black flies and so on, according to color, place of occurrence and the fish found in the particular neighborhood.

Stone-flies are almost wholly confined to rapid streams (figs. 117-119), as their distribution is controlled by the degree of aeration of the water. Since wave action along the shores of lakes provides fair aeration, stone-flies are found also along lake margins, although not in such profuse numbers as in the mountain streams. They are but seldom found in quiet streams or ponds and then only in relatively small numbers.

After becoming winged they generally spend the day in short flights and in copulation (figs. 120, 121). In the dusk of the evening they fly upstream for considerable distances and then oviposit. This is not a nuptial flight, for mating appears to precede the flight,
but an instinct to go upstream for better distribution, which is more readily understood in view of the fact that the eggs are formed into a loose clump of 200 to 300 by the females and these clumps are washed off in the current to scatter as they may. The adults do not live more than three or four days. More, however, are eaten by the birds, both dusk-flying and day-flying species, than die naturally; and also by snakes, frogs, spiders, and even by ground squirrels. At the flight period one finds thousands of wings torn from the stone-flies and scattered along the shores of the streams,—evidence of destruction by their enemies. The hot sulphur springs along the Yellowstone River (see fig. 122) account for the death of other thousands. Whatever the attraction the springs exert upon the stone-flies,—whether heat, odor, or color,—this much is certain: hundreds of the insects fly to the springs and are literally boiled.

The transformation period lasts about ten days for a single species. After that, only isolated stragglers come from the water to transform into winged adults. However, as there are some eight to ten species of stone-flies in Yellowstone Park alone, and the total period of transformation covers some six weeks with slight overlapping, one may find stone-flies for a good part of the summer. Of these the large salmon-colored stone-fly \((Pteronarcys californica)\), growing to a length of two and one-half to three inches, with a wing expanse of four inches, is the most numerous and conspicuous. After that, the sizes dwindle down through the black stone-fly \((Acroneuria theodora)\), two by three inches, the yellow stone-fly \((Acroneuria pacifica)\), one and one-half by three and one-half inches, the dusky stone-fly \((Perla verticalis)\), one by two inches, to the green stone-fly \((Alloperla linosa)\), which is barely half an inch long and has a wing expanse slightly exceeding an inch. Only the first three can be called abundant. The transformation periods of the salmon-colored and yellow stone-flies coincide, and occur early in July, that of the black stone-fly not till early August. As regards these dates, one important fact should be noted; namely, transformation appears to be largely dependent on the temperature of the water. Where a stream is open the water will heat more rapidly from the sun than where a stream flows through steep-walled canyons. Thus, in the Yellowstone and Lamar rivers the stone-flies in 1921 transformed much earlier in sunlit open places than in the canyons. In the open stretches of the Yellowstone River between the Grand Canyon and the Lower Canyon (the “Needles,”—see fig. 113), transformation occurred nearly a week earlier than in the canyons proper. This was true also for the black stone-fly. This species transformed a week earlier in the
Fig. 119. Rapids just above Yellowstone River Bridge, on Cooke City road. Detail of foreground shows lesser rapids and pockets which form the feeding grounds of young fish. Photo Aug. 15.
Fig. 120. Stone-flies in characteristic clusters, often as many as twenty individuals, in crevices of rocks along the lower Lamar River. (See also figure 131 for general habitat.) Photo July 6.

Fig. 121. Stone-flies mating on shore grass along the Yellowstone River. Photo July 6.
open Lamar River, Gardiner River, and the meadows of Slough Creek, than in the gorges of the Lamar, Slough Creek, and the much-shaded Lava Creek.

Another factor possibly is the light which may stimulate the species to transform in early July. By this is meant both the light of the shores and the light that penetrates the water. It has been noted that in open, sunlit places transformation occurs earlier than in the gloomy canyons. The amount of light to penetrate the water is variable. The spring floods carry great quantities of sediment which hinders the penetration of light. This makes the situation equally difficult for fish and for the fisherman. For where the one cannot see much in the line of prey in the water, the other cannot see the fish, nor pick the likely places to cast. Perhaps this turbidity accounts for the fact that when the floods recede and the water grows clearer the trout are hungry and "rise" more readily to bait; for it is obvious that the gloom resulting from the turbidity makes hunting difficult for the fish, and at a time when he needs an excess of food for the propagation of his kind.

On the other hand, it has already been remarked that certain species of stone-flies, such as the black and green stone-flies, do not emerge until August, hence long after the floods have receded and the water has clarified. Whichever the factor may be that chiefly stimulates transformation, whether light or temperature, prolonged study and experimentation are needed for its definite determination.

From the examination of hundreds of stomachs of trout, especially the cutthroat trout (Salmo clarkii), it is evident that stone-flies, both in their larval stage in the water and after transformation, form about 90 per cent of the food of the trout. The foregoing merely confirms what others have found as regards the dependence of fish life in rapid streams on stone-flies for food. It is a curious fact that some of the mountain streams which have a very low representation of stone-flies will not support fish life, or at least trout life.

May-flies.—The second and third groups, namely the may-flies and the caddis-flies, are variable in their representation and appear to change their position of importance according to the stream. In the Lamar River, for instance, the caddis-flies outnumber by far the may-flies, while in the Yellowstone River, Lava Creek, and other streams the may-flies are more conspicuous numerically. Whatever the cause of this variability, they appear to be equally abundant in the fish stomachs.

May-flies are otherwise known as day-flies or shad-flies. They have their names from the fact that they live but one day in the adult or
winged stage, live only to reproduce and die, or to fall a prey to birds, mice and other animals. In the streams of the Middle West they are important as scavengers. They generally emerge in enormous numbers, but for one day only, and then they are gone. In some streams in Europe it has been noted that certain species emerge on definite dates; in fact, within stated hours on a given day, year after year. Much speculation, but little evidence, exists as to the factors which control this remarkable synchronism.

In their aquatic stage the may-flies are of varied form, some of them very flat and found under rocks (fig. 123), some swimming about with quick, minnow-like darts, and some with elaborate gills by means of which they propel themselves. All have gills for breathing air from the water, some of the gills being thread-like, others flat, and still others attached to slender stalks like leaves to a branch. Some have elaborate processes on their heads for burrowing. These, however, are found primarily in muddy streams, and in lakes and ponds. In the mountain streams none of the burrowers occur.

After transformation, the adults have two pairs of wings, the fore wings large and triangular, the hind wings very small and inconspicuous, indeed, sometimes entirely absent. Also, they generally have from two to three fine tail filaments.

In the mountain streams, their transformation is spread over a considerable period, so that they are but little noticed. In the more temperate and quiet streams they transform in one mass and fill the air for a brief period for one or two days, and then disappear.

Caddis-flies.—The third group, the caddis-flies, derive their name from the fact that nearly all of them, in their aquatic stage, build cases from bits of stone, wood, or fibers, or weave a net which they attach to stones. These cases are infinitely varied in form, and from the standpoint of craftsmanship are intensely interesting. In the mountains one finds three types especially abundant. The first is that of the "barnacle" caddis-worms (Rhyacophila sp.), which build their cases in large clusters from tiny stones (see fig. 127). The second is that of the "picket" caddis-worms (Limnephilus sp.), which build square cases of neatly paralleled series of plant fibers. Since the cases are fastened to the support by their bases and stand out at right angles, the name "picket" is quite appropriate (figs. 126, 127). The third type is made up of extremely minute particles of sand and secretion gummed together to form a conical, gently-curved cornucopia about half an inch in length. Just before transformation, caddis-flies, like moths and butterflies, go through a resting period, called the "pupal" period, in which the change from grub to winged
Fig. 122. One of the hot sulphur springs along the Yellowstone River. This particular spring lies at the base of a hollowed rock shown in upper middle of figure 119.

Fig. 123. May-fly nymphs from the Lamar River; four times actual size. Middle specimen turned over to show the "sucker" on under side, by means of which this particular species clings to rocks.
Fig. 124. An adult may-fly with a parasitic worm emerging from the caudal end. Enlarged eight times. Note the loop formed by the parasite within the abdomen of the host.

Fig. 125. An association of caddis-worms in their cases, attached to a wet rock. Four types of cases are shown on this overturned rock on the margin of Lost Creek. Photo July 27.
adult takes place. During this pupal period the "cornucopia" caddis-worm (*Leptocerus* sp.) seeks the under side of rocks; there the individuals cluster together, forming prickly patches which resemble a cluster of dead spruce needles or the spines of a porcupine (figs. 128, 129).

Still another species of the mountain waters builds itself a network which it anchors with stones (*Hydropsyche* sp.). The net is in the shape of a funnel, with a sieve across the wide end, and the smaller end directed downstream.

In the grub or larval stage the caddis-flies are particularly interesting because of their manifold structures. They resemble caterpillars; in fact, they are the nearest relatives of the moths and butterflies. They have tufts of filaments on their bodies, a head and six legs resembling those of caterpillars, and two posterior legs provided with hooklets which serve as grapples or claws to anchor the worms in their cases.

In the mountain streams none of the caddis-fly species are free swimmers; that is, their cases are all fixed. What migrating they do, is done slowly and laboriously. In the lakes, ponds and quiet streams one may find species with square or spiral cases swimming about freely.

After transformation the adult caddis-flies resemble tiny moths. Indeed, they are often mistaken for moths, even by scientists, and have been thus described. They like to gather on the rocks along the shores of streams, where they run back and forth briskly, or fly about the rapids, alighting on the water's surface and flying up into the spray. They may even dive into the water, for the water does not wet their wings and body. Only prolonged submergence will water-log them.

**The Surface Food.**—Besides these main items of the normal trout diet in the mountain streams, the so-called "water bait," there is the surface drift or surface bait of water-trapped animals, chiefly insects. This comprises especially the weak fliers such as moths, ants and grasshoppers, while spiders, centipedes, mice, and other animals may occur. But the life of a trout stream is dependent on its normal inhabitants, not on the odds and ends which a kind wind or accident may provide. It is only during the brief summer period that surface bait becomes important; and for a period of four to six weeks the fish are largely dependent on this type of food for their existence. That the emergence of their natural water bait, with the resulting depletion of this primary food supply, should be synchronous with the summer flights of ants, moths, grasshoppers and other poor
flies that are easily water-trapped, is one of many instances of the admirable provisions of nature.

Indeed, this is carried still further at this period. At this time the minute life of the shore waters, especially the shore diatoms, flat-worms, chironomids, and the young stages of may-flies, stone-flies and caddis-flies, receives a tremendous impulse and becomes quite prominent. At this period also the young of trout, suckers and other fish in the mountain streams can be found in the shore pools and shallow rapids feeding on the minute organisms in these places. Here lies the remarkable coincidence: the simultaneous appearance and growth of fish fry and of a protected food supply for its use. For the older trout are unable to get into these shallows, which therefore offer both protection and food to the young fish (figs. 119, 130).

From the foregoing it is evident that there exist only two well-marked periods in the annual cycle of mountain trout streams, namely, a "water food" period covering nearly eleven months of the year, and a "surface food" period, occurring during the summer, and lasting from four to six weeks. This is the period when trout, as anglers put it, "rise to bait." These same periods might also be called flood and ebb periods, or flood and drought periods, from the fact that high water lasts from October to July, while the ebb or low water stage of the summer is really very brief.

With the fall rains the brief low water stage ceases and the conditions revert to those existing during winter and spring, and continue to the time of emergence described, that is, about the first week of July.

**FEEDING HABITS OF THE TROUT**

From the examination of fish stomachs it is possible to deduce much about the food habits of fish. First, fish will take food that is easily captured; secondly, that which is accessible with difficulty; and lastly, strange and unusual food. Of the food available in mountain streams, stone-flies and may-flies are most easily obtained and constitute the major portion of the food eaten. Here, too, the eggs, fry and fingerlings should be listed, as fish are cannibals when opportunity offers; and trout are no exception, but will eat other fish just as greedily as will bass. Caddis-flies, well protected by virtue of their tough attached cases, and moreover, even more inaccessible on account of the appressed structure of many cases, rank in the second category, and for that reason constitute a much smaller item of fish food than the other two groups of insects. However, they
"Picket" caddis-worms in their square cases, showing characteristic position and attachment. On wet boulders along the Lamar River. Photo July 25.

Caddis-worms along the Lamar River, left stranded by recession of the stream. Two types are here shown—"picket" caddis-worms (*Limnephilus*) and "barnacle" caddis-worms. Photo Aug. 8.
Fig. 128. "Cornucopia" caddis-worms in a cluster on a rock during pupation period. Lost Creek, July 19.

Fig. 129. A closer view of the same cluster of cornucopia caddis-worms shown in figure 128. Note the resemblance to pine needles.
are used extensively as food by the stone-flies and may-flies, and in this respect become as important, though indirectly so, as their enemies. Among strange and unusual foods can be listed the surface bait.

In general, fish are opportunists as far as their food is concerned. They eat what animal food is available, regardless of the origin. As a result, if one knows the animal life of a particular region, one can tell from the stomach contents where a fish has fed. In a lake, for instance, the plant and animal life is distributed in regular “zones,” most animals limiting themselves to particular depths. Some are found only on the shores, others on the vegetation in the shallows, still others only in the muck at considerable depths. With a knowledge of the animals found in these various zones it is possible to learn a good deal about the food habits of a fish, his migrations, and his food preferences.

On the whole, fish are indiscriminate in their choice of food as far as quality is concerned. They like to feed in a particular region, and stay there until satiated. Thus, when feeding from plants, they eat whatever they can find there; and once they begin to feed from plants they continue feeding there until their hunger is satisfied. At periods of plentiful food, fish do not migrate while feeding.

Curious to say, it often happens that a fish may find a certain type of food so much to his liking that he will seek only that type. This may be worms, leeches, snails, back swimmers, caddis-worms, or other kinds. Thus, we may find stomachs filled with dozens of individuals of one type of animal, such as crayfish or snails. Even more striking, one may find stomachs filled with highly distinctive cases of some particular species of caddis-worm.

This predilection for some particular food is more often observed in the case of surface food than in water bait. I have found fish stomachs, including trout stomachs, gorged with hundreds of specimens of a single type, such as ants, grasshoppers, dragon flies, caddis-flies, orl flies, may-flies, midges, etc., indicating that the particular fish had taken a fancy to this special type of food, and had hunted assiduously for the delicacy. There is nothing abnormal in such a predilection, not more so than in the case of a boy who makes a meal off desserts, be it ice cream, or fruit, or cake. But right there, in the longing for the unusual, lies the weakness of the feeding habits of fish, the trait which lays them open to capture by the angler. Since the unusual attracts, anglers have made use of this phenomenon in the types of flies selected by them.
A fish is easily deceived, for he is not very observant. His eyesight is poor and he recognizes things chiefly through their movements. For instance, when an angler uses a fly, the fish is supposedly deceived by three factors,—form, pattern, and movement. In the matter of form and pattern the fish's vision is too weak and near-sighted to recognize the bait for what it is. He is used to certain distorted images which impress him more through motion than by any other factor, and he captures or tries to capture such a moving object. But it is also the unfamiliar, the unusual, which tempts fish, perhaps more than the customary objects. How else can one explain the presence of blocks of wood, of straws, twigs, leaves and the like, in fishes' stomachs? On more than a dozen occasions I have found blocks of wood in trout stomachs. In at least half the cases there was not the remotest resemblance in the shape of the block to any type of surface bait. An irregular cube has no resemblance to any insect, while an oblong bit might well have the approximate outline of a stone-fly or a grasshopper. But it was probably the strangeness, the unusualness of the block of wood which attracted and tempted the trout. The most interesting feature of these instances was that in only one case were the blocks of wood taken by a hungry fish; that is, only once were the blocks of wood the sole stomach content. In all other instances, blocks and sticks were gulped by fairly well-fed fish. One might say that they were taken as a sort of salad or dessert, indicating that their novelty tempted the fish.

The foregoing has its practical application. When fish are well fed they may rise to bait, but less to grasp it than to look it over. Every fisherman has seen some coveted fish rise thus, examine the bait, roll over lazily, and return to his retreat. However, if the bait be unusual, a fish may be led to bite if he is convinced that the lure offered is some particularly juicy morsel which should be a fitting wind-up to his meal. The more the bait offered resembles some moving surface bait, the more likely is the trout to strike at it.

As emphasized before, a fish is near-sighted, and even close up his vision is poor; he sees objects more or less distorted. On top of all this he is not particularly intelligent, but rather stupid. It takes him a long while to learn a simple fact, and hence he is easily deceived. If the fly because of its resemblance to a regular food item does not attract, try the unusual. This should be particularly effective when the fish has fed, or is partly satiated.
HINTS TO ANGLERS IN YELLOWSTONE PARK

Your Attitude.—In older days man hunted because he required food. Modern conditions have supplanted hunting by the domestic breeding of animal's, so that a sufficient food supply is at hand. Moreover, agriculture has encroached on nature's fastnesses to an extent that these cannot possibly propagate a sufficient food supply in the natural state. The hunting instinct, engendered because of necessity for so many generations, must naturally be slow to die out. So man still loves to hunt, be it big game, fish — for fishing is but hunting in the water,—flowers, or little game, such as insects and still smaller things. For years hunters have realized that game is getting scarce, that it is more difficult to stalk, and that the cost of hunting is fast increasing. But because there is no longer any real necessity for hunting, it follows that our inherited attitude should be modified to conform to the new conditions. This change is already evidenced in the attitude of the conservationists, of the nature lovers, and of sportsmen.

What is a sportsman? The popular and correct idea of such a man is that he hunts for the pleasure of the hunt, for the thrills he receives in pitting his ingenuity against that of the quarry he seeks. He possesses discrimination; he does not kill wantonly, he does not slaughter, he is moderate in the amount of game he hunts. He is not cruel, but kills his catch at once and does not let it suffer needlessly. His bag is made up of choice specimens rather than of many; he seeks quality, not quantity. He will not countenance "mass killing," as in the case of dynamiting streams or even catching the legal limit when that is obviously too high. He is eminently a man who believes in the "square deal," for himself, for others, for the things he hunts. A splendid ideal, this synthetic conception of the sportsman! And he is not a phantasm, but a reality; he is made up of you and me, of the best that is in all of us.

Fishing is the one type of hunting that is still available to all of us, and the only kind that can possibly be allowed in our National Parks. Big game and wild life of all kinds are becoming more and more restricted to natural strongholds, some of them difficult to reach. But fish! They travel in the waters that pass our very doorsteps. Thus a source of both food and pleasure is easily available. Fish as a reserve food supply are unfortunately too little esteemed. Few people, even well informed citizens, realize and appreciate the food resources of the waters in the United States. Generally, people
fish with little thought of where the fish came from and whether more are to follow.

Yet even with all the tremendous resources of inland waters, game fishing, that is, for fish that battle fiercely with the angler, has gradually become restricted to the less accessible places. Trout fishing has always largely been confined to turbulent streams and mountain lakes. But how often does one hear the regretful exclamation: "Fished out!" The angler himself is to blame; not he individually, but his kind. There have been many fishermen, but too few sportsmen. In the wonderful trout streams all through the Rockies we see the same discouraging results. In the populated areas the streams are now fished out, while in distant but readily accessible regions the numbers and size of the fish have decided'y decreased. Throughout Idaho, for instance, the mountain streams in their lower reaches have been fished so thoroughly that a two-pounder trout has become a rarity. The old settlers tell of four- and five-pounders, even of eight-pounders, but the present generation does not know them. True, the streams are still plentifully restocked, chiefly through the efforts of the fish hatcheries: but what are the chances of a trout against thousands of anglers when each wants to catch his legal limit every day, regardless of whether he can use them all? No propagation, natural or artificial, be it ever so thorough, can keep pace when anglers catch at the rate of sixty to a hundred fish a day.

Just consider for a moment what it means to raise a trout under natural conditions! The eggs are laid in great numbers in shallow rapids, to be carried passively by the current. They become trapped in the interstices between the rocks and there go through their development. But before this the eggs may become the prey of larger fish; they may be crushed between rocks, or silted over; they may be carried by the flood water to some lateral pool, to dry up later with the pool or perish from lack of aeration; or they may become a prey to parasites or to a fungus (Saprolegnia) that attacks the eggs of almost any freshwater animal.

If the eggs survive, they hatch into fry that carry their food with them in a small yolk sac. When this stored food, received from the parent, is used up by the fry they hunt the shallows in quest of small insects, diatoms and other minute food. But here they are exposed to predacious insects and larger fish, to the action of molar agents, such as winds, waves and currents, all of which combine to render their life precarious. Parasites, too, lurk in the shallows. Everything considered, it is surprising that so many do survive. But it takes
Fig. 130. An eddy of the Lamar River about 500 yards above its mouth. The shallow, pebbly pools at left are favorite feeding places for the young of trout, minnows and suckers. Photo July 16.

Fig. 131. Shore of the Lamar River about 150 yards above its mouth. The "holes" formed by the eroded rocks are favorite spots for adult trout. Photo July 22.
Fig. 132. Panoramic view above confluence of Yellowstone and Lamar Rivers. Cooke City Road and bridge across the Yellowstone, at right; Lamar River valley in middle distance. Photo Aug. 8.

Fig. 133. Junction of the Yellowstone and Lamar Rivers at low water stage. View downstream; Yellowstone River at left, Lamar entering at right. In the spring the boulders in the foreground are under water. Photo Sept. 5.
several years for trout to attain a good size and weight, and the angler should appreciate that it is the excessive toll he exacts that prevents fish from reaching a real "fighting" size.

Trout of large size are happily still available in Yellowstone Park. One- or two-pounders are quite abundant in the streams, while larger fish, of four and even five pounds, hide in the more inaccessible "holes" of the Yellowstone, Lamar and other rivers. But these last are only for the truly elect—the sportsmen who will take risks and pains for the opportunity to match their skill and wits against those of the wary trout. Figures 131 to 133 show some of the favorite trouting haunts in the delightful Camp Roosevelt region where this particular study was made.

Fishing in the Park is a pleasure that appeals to many of us. But if that pleasure is to continue in this "nation's playground," it must be limited for each of us so as to be shared by the many. Unrestricted fishing—"butchery"—would be the more applicable word—is destructive no matter where it occurs. To preserve the opportunities of the Park—indeed, of every natural resource, there and elsewhere—there is needed the support of every public spirited citizen. Fishing is a splendid sport, one that should remain to us in the future as well as now. Truly, then, what fishing we do should be in the spirit of fair play, of moderation, of consideration for others,—this is the attitude of the true sportsman.

How to Fish.—The following points may be of use to amateur fishermen. They are based on the conditions noted in the first part of this discussion:

1. Stand low on the shore and cast your line far out, holding the rod low.

2. Keep moving. If the fish do not rise after a few casts, move to another spot. As a rule you cannot sit still and fish successfully for trout, as one does for perch or herring. Trout are not quite so stupid as most other fish; they cannot afford to be.

3. Let your fly strike the water sharply and quickly; do not dangle your bait. Trout cannot be treated like perch. They do not "nibble"; they make up their minds and strike quickly, or not at all.

4. When the fish is hooked, play him with a steady line. Take up the slack; but above all, do not jerk. The steady pull does the trick.

5. Pull the fish well up to the shore before you ease the line. Otherwise, he may manage to slip the hook and get away.

6. Should you enter the stream, see that your shadow does not lie with the current.
Bait and Flies.—Many interesting things may be learned about the habits of fishes by a little careful study of natural and artificial lures.

1. Note whether insects are being carried by the stream. Try to see what insects are abundant on the shore and use some of these for bait.

2. When hooking an insect, hook it in the axis of the body through the top of the thorax. The hook should enter behind the thorax and come out in front behind the head. In this way the destruction of the insect’s brain and nervous system is avoided and the bait will struggle when striking the water,—hence an additional element to deceive the fish. Do not pierce the head, or hook through the underside; for the brain of an insect lies near the top of the head and two connections go to the nerve cord, which lies in the thorax and abdomen, on the “belly” or ventral side. If you hook the brain or cord, death or paralysis will result and the bait will not be so attractive. Hooking through the thorax is best, because that part of an insect is firmest, since its strong plates are needed for the attachment of the leg and wing muscles.

3. When you have caught your first fish, kill it by striking it sharply on the front of the head, or by thrusting a knife blade through the neck to sever the spinal cord. Examine the stomach contents and note whether it comprises a general mixture or if some particular insect is more abundant. Then select that type for bait. Or if you prefer an artificial fly, try one which seems to bear some resemblance to the bait eaten.

4. A hungry fish will accept almost anything in the line of bait. After mid-morning, however, greater care must be used in choosing baits or flies.

5. A satiated fish will refuse the regular diet, but, like human beings, he does not despise something choice in the way of dessert. Some lure that seems strange and looks palatable may often entice a surfeited fish to bite.

6. When you have caught sufficient fish for a meal, and are still keen for the sport, try for some situation that requires special skill. Try for some old Methuselah and see if you can outwit him. Since he is too wise to be lured by ordinary methods, you may have to resort to unusual tactics. All animals, like men, have their trait of curiosity, and an old and wary trout is not exempt. In such cases, do not make your approach too obvious. Bait or flies that appear easy to capture will not tempt him. Try an unusual bait, and make it require some effort on the part of Methuselah to get it.
Food of the Yellowstone Trout

**Your Catch.**—The following suggestions are important for beginners in the gentle art of angling:

1. It is not necessary to catch the legal limit to prove yourself a good fisherman. The true sportsman looks for quality, not quantity. Quantity does not necessarily indicate skill,—only some luck, and greed.

2. Kill your fish as soon as you have caught him, and before cleaning. There is no need of causing useless suffering. The habit of cruelty to animals engenders the habit of cruelty to men.

3. If your trout is below legal size, carefully disengage it under water, taking care not to rub off the slime which is the protective covering of the fish.

4. Do not allow your catch to lie in the heat of the sun, or decomposition will set in. Clean and pack the fish before returning to camp, burying the offal so as to leave no disagreeable traces for those who follow you.

5. When packing trout to take back to camp, wrap each one separately in coarse grass and see that they lie compactly so that they will not jolt. If loose, even slight movements of your body will jar and bruise them, and they will speedily become soft and unappetizing.

6. Weigh and photograph your trout; and possibly you may also wish to write a permanent record of your fishing adventure. In retrospect, this frequently proves to be the most satisfying part of one's catch.
THE FIELD-NATURALIST’S WORK

The average field-naturalist tends to become a collector of specimens rather than an investigator of the ways of animal life. His ambition is to collect the specimens as soon as he can, and as many as he can; and fearing lest each specimen shall escape him and be lost, he neglects the opportunity to observe it in life and to learn something about its habits and its ways. Often he takes this attitude from the institution for which he is working. It desires a great series of specimens which he feels he must secure. Yet the collecting of a large series of specimens, and the bringing them home in satisfactory shape, should be only a small portion of the field-naturalist’s work. Skins and skulls are useful, but skins and skulls and measurements and proportions tell us only a little about the living animal. Most of us wish to learn something about its ways of life.

George Bird Grinnell.

Foreword, Roosevelt Wild Life Bulletin,
Vol. 1, No. 1, p. 9; 1921.

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CURRENT STATION NOTES

THE NATIONAL OUTDOOR RECREATION CONFERENCE

The pioneer spirit of Americans and their love of the outdoor life has given us an interest and a tradition which has been of the greatest National importance. To foster this spirit and to encourage intelligent coordinated leadership in these matters was evidently the primary aim of President Coolidge’s Outdoor Recreation Conference. The field is so vast and the number of organizations concerned so great that it is almost impossible to keep abreast with the movement. To facilitate the interchange of ideas, to formulate broad general policies, and to develop harmonious relations was thus the logical need championed by the President. The Conference met at Washington May 22, 23 and 24, 1924, and was composed of delegates representing 128 organizations.

The Conference was a great success and the President and his associates are to be congratulated most heartily indeed for its outcome. The Executive Chairman, Col. Theodore Roosevelt, handled the situation admirably and was ably assisted by Mr. Charles Sheldon, a Washington sportsman-naturalist, who seems to have been a moving spirit in initiating this good work.

Eighteen committees were in session, covering important aspects of the field, including fish, game and fur-bearing animals, birds, parks, forests, pollution, lands, and other topics. These committees were called upon to summarize present conditions, and to present constructive recommendations.

The outcome of the Conference is a permanent Advisory Council of 100, which will cooperate with the President’s Committee.

Some of the outstanding resolutions deserve mention. One supported the ideal that our National Parks must be completely protected from economic use, and preserved in a “condition of unmodified nature.” The National Forests are set aside for permanent forest uses on the non-agricultural land, including recreation, and attention was called to the fact that the U. S. Forest Service is particularly qualified to administer the wild life of these forests. The importance was stressed of the basic need for surveys and inventories as a means of determining bag limits of birds, and the need of
sanctuaries in connection with all public shooting grounds. Special emphasis was given to the need of non-political State game commissioners, of trained staffs, long tenure, and broad administrative powers; that campaigns for the extermination of predatory animals be discouraged except as authorized by State and Federal experts; that all sportsmen should cooperate with scientific institutions to make the results of their hunting available for study and record; that the annual volume of game killing should be reduced by the shortening of the open season, and by the reduction of bag limits "by large amounts where necessary"; that for a sound basis for the administration of fishery resources scientific investigations are needed; and that Federal legislation should prevent interstate shipment of black bass. The menace of water pollution was stressed from the standpoint of recreation and fish culture, as well as the indiscriminate drainage of lands, without careful preliminary study of the situation in each case.

Not since President Roosevelt called the National Conservation meetings at Washington has public attention been directed to the vital need of a sane policy toward these resources. Furthermore, the social or welfare aspect of conservation was not so clearly expressed then as at this Conference. In those earlier conferences the economic aim was dominant, but at this Conference the welfare aspect was in the foreground. An important step has been taken and it deserves the support of everyone.

**THE ROOSEVELT WILD LIFE STATION AND THE CONFERENCE ON OUTDOOR RECREATION**

The Roosevelt Station was well represented by several of its members at President Coolidge’s Conference. The Executive Chairman was the Honorable Theodore Roosevelt; Mr. Chauncey J. Hamlin was Chairman of the Committee to effect Permanent Organization, and Dr. George Shiras, 3rd, was a member of the same Committee. Dr. Frank M. Chapman was a member of the Committee on Birds. These are all members of the Honorary Advisory Council of the Wild Life Station. Dean Franklin Moon was a member of the Central Resolutions Committee, and the Director of the Station was a member of the Committee on Birds. Dr. Hugh P. Baker, former Dean of the College during the period in which the Roosevelt Station was established, was a member of the Committee on Survey and Classification of Recreation Resources. The Director was the official representative for the Wild Life Station, and also a delegate
for the Ecological Society of America and the American Society of Mammalogists.

Papers or addresses were read at the Washington Conference by Hon. Theodore Roosevelt, Dr. Frank M. Chapman, Dean Franklin Moon, Mr. Chauncey J. Hamlin, and the Director of this Station.

In the Permanent Organization, which was an outgrowth of the President's Conference, the following Station members are included on the President's Committee: Hon. Theodore Roosevelt, and Mr. Chauncey J. Hamlin, Chairman of the Conference. Mr. Hamlin is also a member of the Executive Committee, as is also Dr. George Shiras, 3rd. Other members of the Advisory Council of the Conference are Dr. Frank M. Chapman, Dean Henry S. Graves, Dr. George Bird Grinnell, Mr. Chauncey J. Hamlin, Dr. George Shiras, 3rd, and Dean Franklin Moon.

THE SUMMER FIELD PARTIES

During the past summer field season (1924) the Roosevelt Station field parties have been engaged in investigations on wild life in New York State. Dr. Charles E. Johnson, who made the earlier survey of the Adirondack beaver (Roosevelt Wild Life Bulletin Vol. 1, No. 2), has continued this study, making a complete circuit of the region. Mr. Bradford A. Scudder devoted the season to a preliminary study of the status of Adirondack deer. This seems to be the first study of this character to be undertaken. These men were assisted by an able volunteer assistant, Mr. Julius M. Johnson. Dr. Alfred O. Gross has devoted his attention to an intensive study of the Ruffed Grouse in the lower Hudson Valley. Reports are now in preparation on the results of these studies. Dr. W. C. Kendall and Mr. W. A. Dence extended their studies of Adirondack trout.

The Director of the Station spent July, August and September visiting the National Forests and National Parks of the Southwest and on the Pacific Coast. He visited the District Forest offices at Albuquerque, San Francisco, Ogden and Denver, as well as the Southwestern Forest Experiment Station, the Great Basin Range Experiment Station, and the Fremont Forest Experiment Station. Special attention was given to seeing as much of field conditions as time permitted, with particular reference to wild life, research, grazing, recreation, and general Forest and National Park policies.

The National Forests visited were Carson, Coconino, Tusayan, Kaibab, Sequoia, Stanislaus, Sierra, Wasatch, Manti, and Fremont, and the National Parks were the Grand Canyon, Sequoia, and the
Yosemite. With regard to the Forests he was particularly impressed with the serious and widespread over-grazing, with few exceptions the relative paucity of game, and with the keen appreciation on the part of local forest officials of the importance of game and of forest recreation in its relation to securing public support for general forestry purposes. He was pleased to note the widespread recognition of the severe menace of over-grazing. The urgency of greater financial support for silvicultural research was very evident, and the need of extending research to other fields of forestry than silviculture and grazing was equally evident. Several serious administrative difficulties have arisen because of this lack of adequate research and publication regarding wild life and other problems. The enthusiasm and devotion of the Forest and Park officials was a very encouraging feature. The relatively rapid increase in the number of Park Naturalists, shows a growing appreciation of the importance of this aspect of Park work.
THE ROOSEVELT WILD LIFE MEMORIAL

As a State Memorial

The State of New York is the trustee of this wild life Memorial to Theodore Roosevelt. The New York State College of Forestry at Syracuse is a State institution supported solely by State funds, and the Roosevelt Wild Life Forest Experiment Station is a part of this institution. The Trustees are State officials. A legislative mandate instructed them as follows:

"To establish and conduct an experimental station to be known as 'Roosevelt Wild Life Forest Experiment Station,' in which there shall be maintained records of the results of the experiments and investigations made and research work accomplished; also a library of works, publications, papers and data having to do with wild life, together with means for practical illustration and demonstration, which library shall, at all reasonable hours, be open to the public." [Laws of New York, chapter 536. Became a law May 10, 1919.]

As a General Memorial

While this Memorial Station was founded by New York State, its functions are not limited solely to the State. The Trustees are further authorized to cooperate with other agencies, so that the work is by no means limited to the boundaries of the State or by State funds. Provision for this has been made by the law as follows:

"To enter into any contract necessary or appropriate for carrying out any of the purposes or objects of the College, including such as shall involve cooperation with any person, corporation or association or any department of the government of the State of New York or of the United States in laboratory, experimental, investigative or research work, and the acceptance from such person, corporation, association, or department of the State or Federal government of gifts or contributions of money, expert service, labor, materials, apparatus, appliances or other property in connection therewith." [Laws of New York, chapter 42. Became a law March 7, 1918.]

By these laws the Empire State has made provision to conduct forest wild life research upon a comprehensive basis, and on a plan as broad as that approved by Theodore Roosevelt himself.

Form of Bequest to the Roosevelt Wild Life Memorial

I hereby give and bequeath to the Roosevelt Wild Life Forest Experiment Station of The New York State College of Forestry at Syracuse, for wild life research, library, and for publication, the sum of .................., or the following books, lands, etc.
1. The Control of Blood-sucking Leeches, with an Account of the Leeches of Palisades Interstate Park........Dr. J. Percy Moore.
3. Acanthocephala from the Fishes of Oneida Lake, New York.....
   Dr. Harley J. Van Cleave.
4. Current Station Notes......................The Director and Editor.

1. Ecology of the Plankton Algae in the Palisades Interstate Park, Including the Relation of Control Methods to Fish Culture........
   Dr. Gilbert M. Smith.

1. The Status of Fish Culture in Our Inland Public Waters, and the Role of Investigation in the Maintenance of Fish Resources......
   Dr. William C. Kendall.
2. Current Station Notes......................The Director and Editor.

1. The Relation of Wild Life to the Public in National and State Parks.
   Dr. Charles C. Adams.
2. The Big Game Animals of Yellowstone National Park........
   Mr. Edmund Heller.
3. The Food of Trout in Yellowstone National Park........
   Dr. Richard A. Muttkowski.
4. Current Station Notes......................The Director and Editor.

2. Current Station Notes......................The Director and Editor.