ALBERTA

LANDS - FORESTS - PARKS - WILDLIFE

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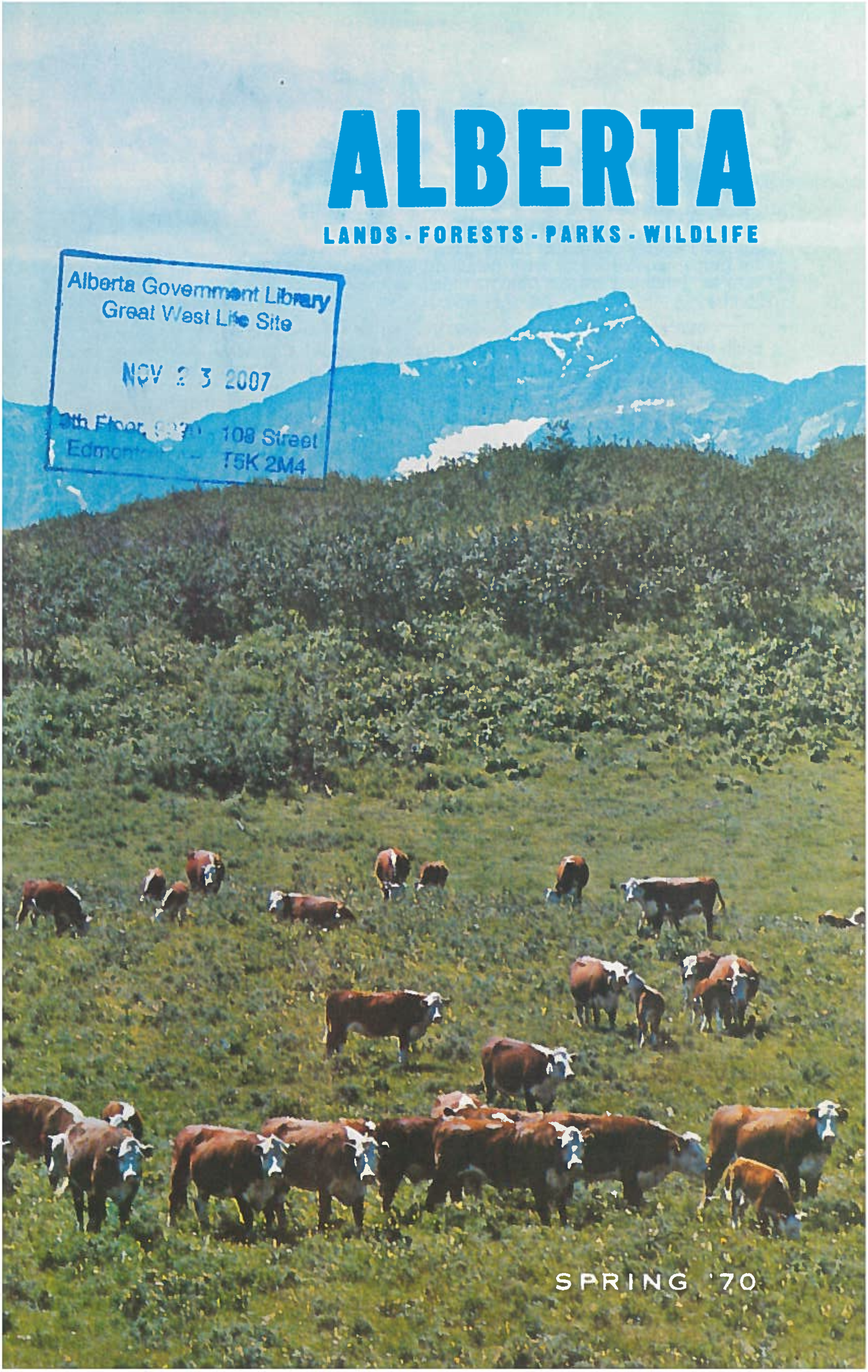

SPRING '70

Conservation Quote:

"Many of us spend our lives in prisons, not locked into stone walls but locked out of hills, fields, streams and trees. We can be imprisoned by people, ringed about with demands, as drivers who are hemmed by others into an inhuman traffic flow, dammed or released by the flicker of colored lights.

We have our mental prisons too: all of us are penned by slogans and picketed by mass opinion. Perhaps there must be a general acceptance of universal goals and public aims. But no man can comprehend himself if he is never alone — in an atmosphere that was not created by other men. It is a lonesome business, this being human, but no man is an individual until he can tolerate solitude.

Let us not be mystical about outdoor values; we need open spaces because we must face ourselves in the mirror of nature and see a clear reflection. These are the real outdoor values: to be not only alone, as we so often are on crowded streets, but untouched by people, unconfined by traffic lights or the strictures of others. We need that which is real in a primal sense: earth beneath our feet, wild grasses, a tree that grew untrimmed, a fire for which we have cut the wood, flames uncontained in a fireplace surrounded by walls.

All of us need outdoor values, need to seek for that which has been for a long time, in order to find ourselves, to become individuals.

This is as much a part of our cultural heritage as the cities are, and much more the origin of our species."

DAN SAULTS

Published by the Department of Lands and Forests,
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Edmonton, Alberta.

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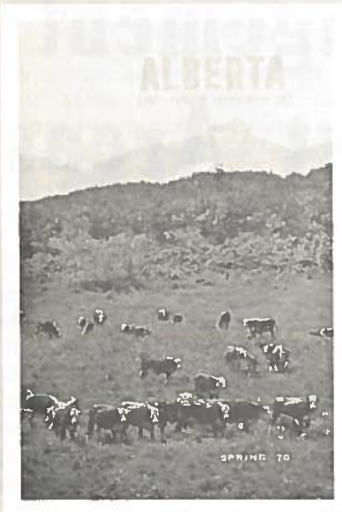
ABOUT OUR COVER



Modern forest management has adopted the multiple use policy as a cardinal principle. Multiple uses consist of water, timber, range forage, recreation and wildlife. All of these have their own place in the overall management plan—on a sustained yield basis.

Cover — Alberta Govt. photograph

ALBERTA

Lands - Forests - Parks - Wildlife

Vol. 13, No. 1 Spring 1970

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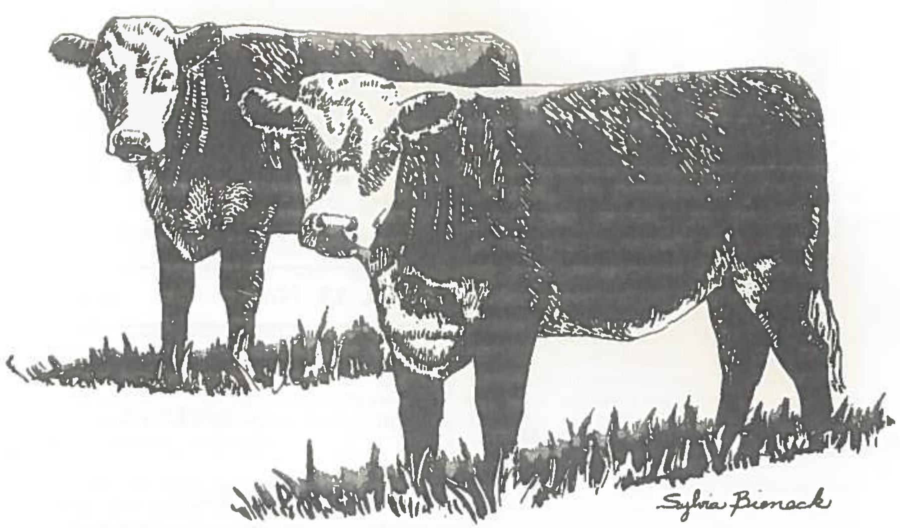


Range Management in the Forest Areas

BY GEORGE H. MADURAM, P.AG.

"Range management is the science and the art of procuring maximum sustained use of the forage crop without jeopardy to other resources or uses of the land" — A. W. Sampson. "This is the field of range management, the science and art of obtaining maximum livestock production from range land consistent with conservation of the land resources" — Stoddart and Smith. Therefore, in a broad sense, range management is the art and science of utilizing range forage for (maximum) livestock production on a sustained yield basis, consistent with the conservation of other resources and without endangering other uses of land. Any range manager should be aware of all the other uses (water, timber, recreation and wildlife) and be able to adopt a policy of multiple use in his work. He should strive to obtain sustained yield in the form of beef from the range forage and not create conflicts between other uses.

Grazing should not be allowed in an area where reforestation is being carried out by planting trees in cleancut areas. Stocking rate should be adjusted where there is appreciable amount of wildlife population. Grazing is not allowed in areas which are used as catchment areas for drinking water supplies to towns, where recreation is very predominant, and where wildlife exists in great numbers.

The forest area in the province is referred to as the green zone and is divided into 11 administrative "Forests". The three southernmost Forests form what is known as the Forest Reserve, which was created mainly for the protection of watersheds located in that area. Up to 1968, Alberta Forest Service looked after grazing in the Forest Reserve only. Grazing in the other 8 Forests in the green zone was administered by Lands Division with some consultation with the Alberta Forest Service. Since 1968, Alberta Forest Service has been responsible for the administration of grazing in all of the green zone within the Forest Management Units.

As Forest Reserve comes under The Forest Reserves Act and its Regulations, and grazing has been administered by Alberta Forest Service for a long time, the intensity of administration of grazing is different from that adopted in the green zone not within the Forest Reserve. Further, grazing in the green zone outside of the Forest Reserve is administered under The Public Lands Act.

Within the Forest Reserve there are 96 range allotments. Each allotment is divided into convenient distribution units. These allotments are surveyed and resurveyed periodically and range management plans are written and revised. At present the department is trying to adjust stocking rates by means of reading permanent transects and pace transects in allotments where we have fairly recent range survey data.

A range survey is carried out by taking stock or making an inventory of range vegetation and range condition. It takes into account soil, slope, wildlife, trees, shrubs, grasses and poisonous plants. The proportionate areas covered by different vegetation types and the different kind of grasses are noted. A range management plan consists of three parts. Part one relates to the specific area (allotment); part two relates to general principle of range management (this is the same for all areas); and part three is a map of the allotment showing the range vegetation types and their areas. The first part describes the area and the distribution units. Season of use and system of use are suggested and the location of water troughs, salt blocks and drift fences are indicated. The stocking rate and the movement of cattle are shown in this section of the plan. The map shows the boundaries of distribution units, drift fences and suggested locations of salt and water. It also shows the respective areas and stocking rates for the distribution units.

Forest Reserve

Grazing privileges are given out to the public under Temporary Permits, Annual Permits and On and Off Permits. All of these permits are issued by the Forest Superintendents. Grazing leases are not issued within the Forest Reserve. Temporary permits are issued to all newcomers. Annual permits are issued to those who had temporary permits consecutively for three years and proved to be satisfactory range managers. Annual permit holders are assigned preference quotas. On and Off permits are issued to those who want to use the Forest Reserve area along with their private land as one unit. In this case the permittee authorizes the Forest Superintendent to have full control over grazing in both his deeded land and the portion in the Forest Reserve.

Within the Forest Reserve each allotment has its own range management plan. The Forest Ranger makes periodic inspections of the allotments and sends

Fig. 1. A fence line contrast of good and poor range

LANDS AND FORESTS PHOTO

in four inspection reports per year on all the allotments. The Forest Land Use Officer at Forest Headquarters looks after grazing in addition to other duties. Whenever the Forest Ranger or the Forest Land Use Officer feel that something should be done to improve grazing conditions, they contact the permittee and advise him what to do.

Green Area

In the green zone outside the Forest Reserve, there are about 250 leases and about 100 permits and a few head-tax permits. Normally grazing leases are issued for five years only, but under exceptional circumstances ten-year leases are issued. The grazing season in the green zone is considered to be from June 1st to October 31st. Within the Forest Reserve in many allotments the opening date is much later than June 1st, due to range condition, a larkspur problem or high altitude.

Some of the conditions for obtaining grazing permits or leases are: need for Crown land grazing, nearness to the area, being in the livestock raising business on a continuing basis, and possession of sufficient land to winter livestock.

In the green zone at present, there are no range management plans established for the leases or permits. The Forest Rangers make periodic inspections and make one inspection report for each lease or permit. The Forest Land Use Officers along with the District Rangers are now in the process of making range management plans for grazing leases.

The department has not launched any large range improvement program in the green zone. Grazing lessces are occasionally permitted to do some clearing, breaking and seeding to grass. Very little is done to kill poisonous weeds by the use of herbicides. However, advice is given to ranchers and farmers as to how to live with some of the poisonous plants. Wherever arrowgrass is present, livestock men are advised to give plenty of salt to their stock so that they may avoid these saltish plants. In the case of larkspur, cattlemen are advised to follow these 8 rules: 1, Feed animals with an extra dose of phosphorus along with other minerals during the winter months. 2. Truck the animals to the range. 3. If trailed, trail them at an easy pace and feed them on the way with hay and other supplements. 4. On arrival at the range, feed them with hay for a few days. 5. Distribute the animals evenly over the whole range, avoiding areas infested with larkspur. 6. Give adequate mineral supplement throughout the grazing season. 7. If possible, control the poisonous plants by repeated spraying or grubbing, or fence off areas where the infestation is heavy. 8. Above all, delay grazing such areas.

In order to carry out good range management, training the field staff and enlightening the grazing public are essential. Therefore, staff training and extension work go on on a continuing basis. Forest Rangers are met individually, or in groups or in annual meetings, and principles of range management are explained to them. Seminars are conducted on individual subjects like range grasses, poisonous plants, range improvement and range condition. A simple identification key for over twenty common range grasses is prepared for field use. Also, an easily understood score card for assessing range condition is prepared and is being used by all field staff. Further, a small book on Range Management has been written for field staff and is being used extensively within and outside Alberta.

Grazing lessees and permittees are generally contacted in groups during their association meetings. On such occasions the film "Food for Thought" and a set of range management slides are shown and explained to them. Forest Rangers meet them more often and discuss the range and its conditions. There are two professionally qualified foresters at headquarters to look after range management in the forest areas of the province.

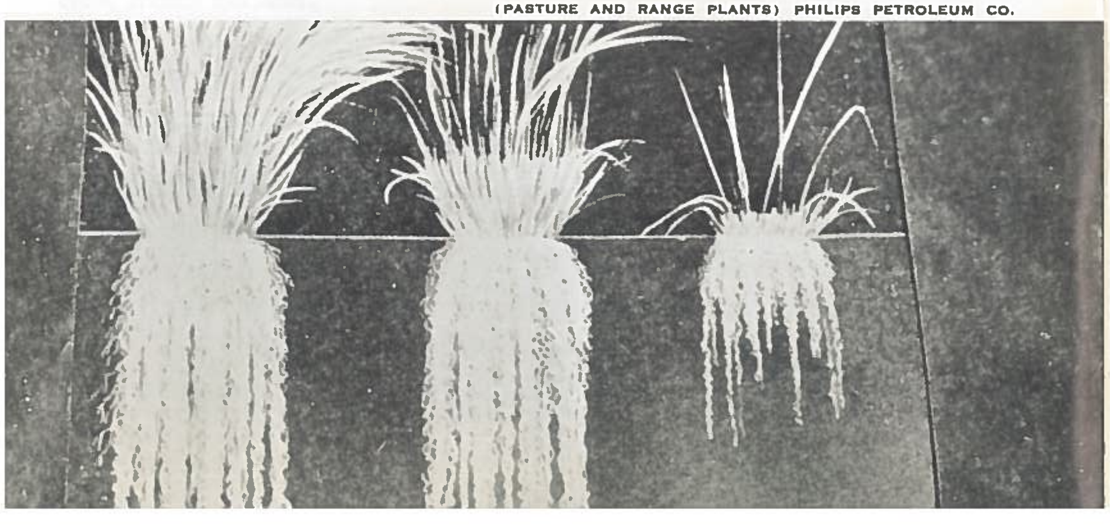


Fig. 2. Effect of over-grazing on the root systems of grasses
(PASTURE AND RANGE PLANTS) PHILIPS PETROLEUM CO.

LANDS AND FORESTS PHOTO
Fig. 3. Tall larkspur, poisonous to cattle

GREEN AREA — 1968 FIGURES

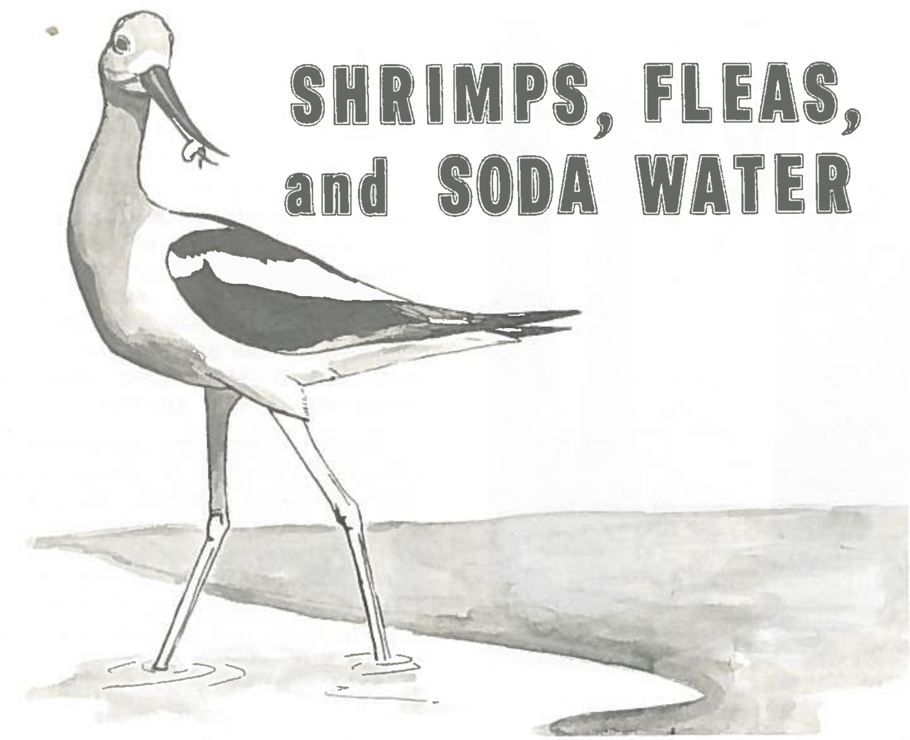
Name of Forests	Grazing Leases No.	Grazing Leases Area	Grazing Leases AUM's	Grazing Permits No.	Grazing Permits Area	Grazing Permits AUM's
1. Edson	15	?	2,690	34	?	3,040
2. Whitecourt	21	15,452	4,250	6	1,368	525
3. Lac La Biche	16	9,633	3,605	6	1,238	335
4. Slave Lake	18	11,897	3,445	12	1,930	710
5. Grande Prairie	56	103,576	21,625	4	8,000	1,600
6. Athabasca	—	—	—	—	—	—
7. Footner Lake	—	—	—	—	—	—
8. Peace River	?	12,809	4,295	?	2,140	940
9. Clearwater-Rocky	63	41,606	15,125	20	7,163	3,195
10. Bow River	55	75,948	21,000	18	50,988	11,052
11. Crowsnest	—	—	—	—	—	—
TOTAL			76,035			21,397

Total use in Animal Unit Months = 97,432 AUM's

FOREST RESERVE — 1968 FIGURES

1. Crowsnest Forest	47 Allotments	44,556 AUM's
2. Bow River Forest	34 "	34,660 "
3. Clearwater-Rocky Forest	15 "	6,010 "
	96 Allotments	85,226 AUM's

One Animal Unit Month = A Cow Month = Grazing required for one cow for one month.



SHRIMPS, FLEAS, and SODA WATER

BY R. STEWART ANDERSON
CANADIAN WILDLIFE SERVICE

When it comes to natural waters, Alberta has fewer lakes and ponds than Ontario, fewer rivers than British Columbia and, of course, no ocean at all. However, any deficit in quantity is more than compensated for by diversity in Alberta waters. This diversity is reflected by the wide range of salinities occurring in provincial waters. Salinities range from 2 p.p.m. (parts per million) in some alpine lakes in Jasper National Park to about 100,000 p.p.m. in some saline prairie lakes. By comparison, Calgary or Edmonton drinking water usually contains 200 to 300 p.p.m. dissolved salts, while ocean water has a salinity of from 35,000 to 37,000 p.p.m. Lakes are usually considered to be "saline" if the total dissolved salt concentration exceeds 500 p.p.m (Edmondson 1963).

The Habitat

Many of the saline prairie waters in Alberta are soda lakes and sloughs and have moderately high alkalinities. Casual observers and nearby residents are often under the impression that such waters are virtually sterile or "dead" and useless. One such unnamed lake (Fig. 1), about 100 acres in area, occurs near the hamlet of Keoma. The lake lies about 25 miles north-east of Calgary or 5 miles east of Bruce Lake.

Although sounding of the lake has not been done, it is unlikely that depths exceed 6 feet at any time. The pH reading for the water is usually about 9.5, indicating a moderate level of alkalinity (7.0 is neutral, below 7.0 is acid, 7.0 to 14.0 is alkaline or basic). Total alkalinity concentrations as high as 5,000 p.p.m. make the water feel soapy to the touch. The alkalinity is mainly due to the presence of soda salts, sodium bicarbonate, sodium carbonate, and sodium sulfate, which together make up over 95% of the total dissolved salts in the lake. Prairie winds keep the waters well stirred and so turbid that one's hand disappears from view at as little as one inch beneath the surface. Summer temperatures reach 75°F or more most years, and the lake freezes to the bottom each winter.

In contrast to the many nearby low-salinity lakes and sloughs with organic mud bottoms and extensive rooted vegetation, both submerged and emergent, the saline lake has a sandy bottom and no higher plant life. It has no surface inlet or outlet. Similar to most natural prairie waters, the water level may vary considerably during the summer and from year to year. Mr. John German, who has farmed near the lake since 1926, reports that he has never seen the lake dry.

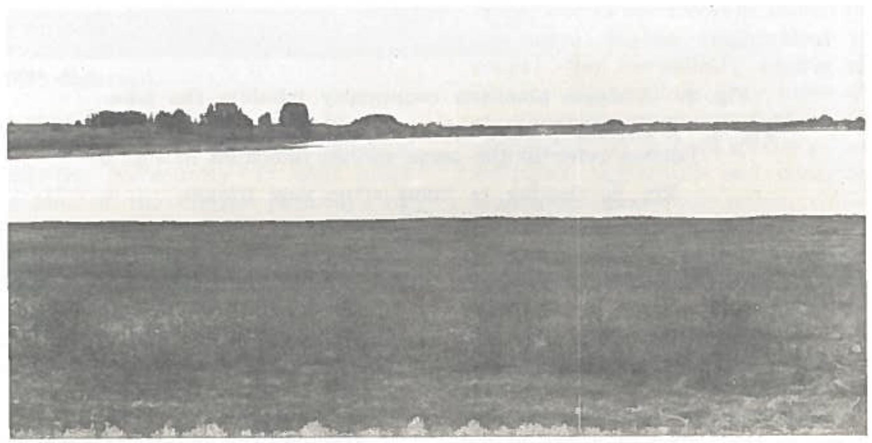
The Community

Although avoided by most animals, including men, the saline lake is far from unvisited and uninhabited. Gulls frequently visit the lake, and marbled godwits *(Limosa fedos)* and American avocets *(Recurvirostra americana)* nest near the lake (see Salt and Wilk 1958). Frequently these birds can be seen gathering insects and crustaceans along the shore. Just under the water's surface and unapparent to the casual observer because of the extreme turbidity, a rather dense plankton community (Fig. 2) enacts its life drama.

Essentially, the aquatic community consists of two whitish anostracan or "fairy shrimp" species *(Branchinecta gigas* and *B. mackini)*, one whitish cladoceran or "water flea" species *(Daphnia similis)*, two bright red copepod species *(Diaptomus nevadensis* and *D. sicilis)*, one or two species of red water mites, a corixid or "water boatman" species, a few chironomid or "midge" larvae of species characteristic of alkaline waters, and one rotifer or "wheel animalcule" species *(Brachionus pterodinoides)*. Diatoms, filamentous and other algae, protozoans, and bacteria occur in the plankton as well as in or near the bottom sediments, where the ostracodes *(Cyprinotus glaucus* and *Limnocythere sappaensis)* are found. The photograph in Fig. 3 will give the reader an idea of the relative sizes of the most numerous planktonic species, and the sketches in Fig. 5 give a better indication of the detailed appearance of the animals.

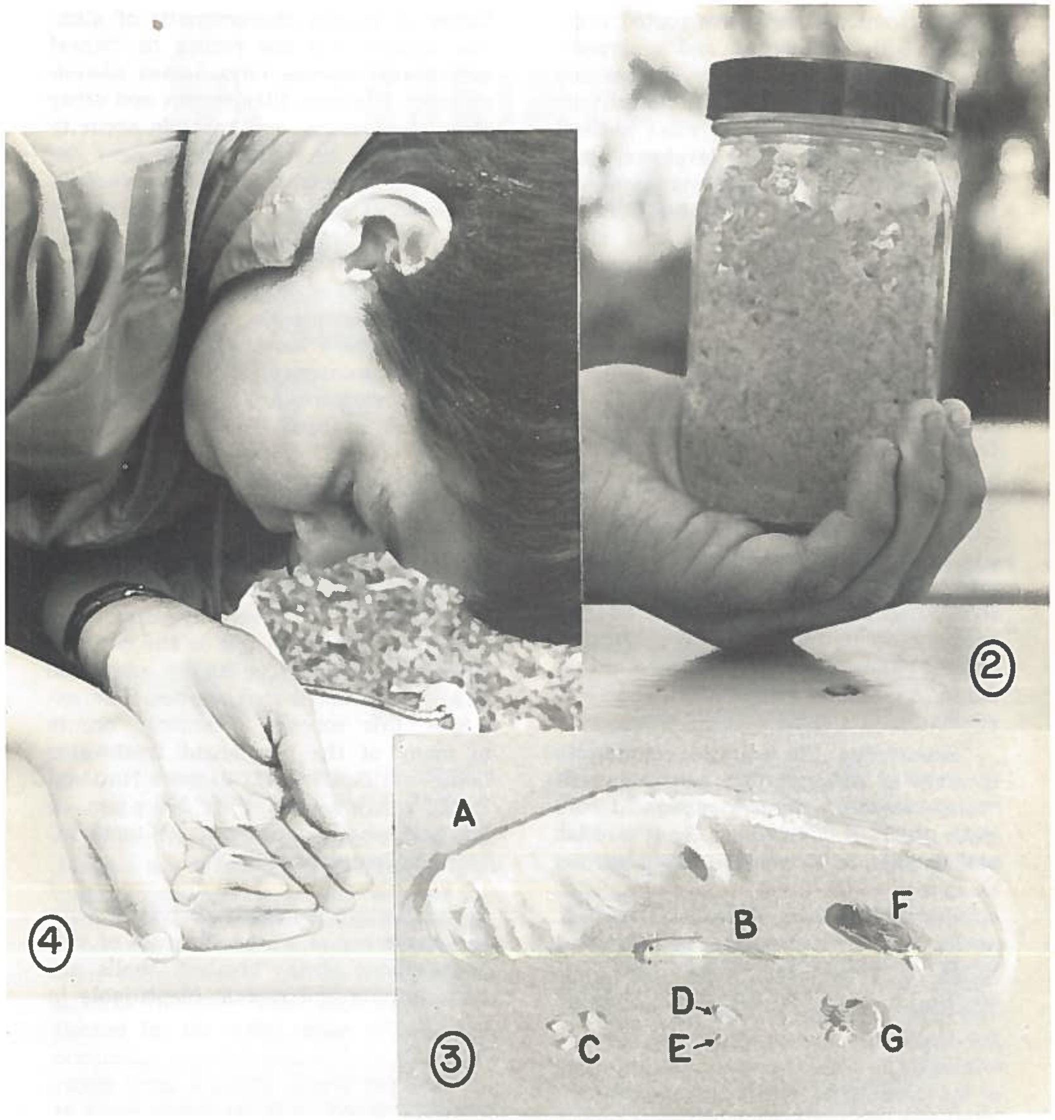
Fairy shrimps are characteristic of temporary waters. The larger species in this lake *(B. gigas*, up to 3 inches long, Fig. 4) is rather unusual and one of the largest aquatic invertebrates to be found in the province. In general, the aquatic species found in the lake are restricted in their distribution to the saline-alkaline environment. The most notable exception to this is the copepod *(Diaptomus sicilis)*, a highly adaptable and widely distributed species. For example, this copepod commonly occurs in many of the permanent freshwater lakes of Banff and Jasper National Parks where salinities are 200 p.p.m. or less and where summer water temperatures seldom exceed 50°F.

The distribution of many species of ostracodes can be closely correlated with the chemistry of water. Because of this and because their "bivalve" shells are very durable and remain identifiable in



R. S. ANDERSON

Fig. 1. Shallow, alkaline lake east of Keoma, Alberta



R. S. ANDERSON

Fig. 2. A dense plankton community inhabits the lake

Fig. 3. A size comparison of the most numerous zooplankters
Letters refer to the same species indicated in Fig. 5

Fig. 4. Getting to know some new friends

sediments for thousands of years, ostracodes have become important "biological indicators" in the study of paleozoology and quaternary geology (see Delorme 1967, and other papers).

Often during the summer, the density of the zooplankton animals is readily apparent in the form of a rim of red along the shore. This is due to large numbers of the smaller copepods which congregate there. In late June or July, a narrower whitish line may occur along the shore, and this line consists of accumulations of *Branchinecta gigas* eggs.

Community Ecology

Although the invertebrate community of the saline lake is relatively small

in terms of numbers of species present, the size difference among the component species are larger than those found in most natural waters. To many ecologists, size differences between species are useful indications of differences in feeding habits of food sources. In this lake, the diversity of body sizes and the small amount of overlap between the different size categories suggest that few ecological or food "niches" exist in the lake, but that these are quite distinct.

It is not uncommon for many general references to consider all fairy shrimp and all diaptomid copepod species to be filter feeders, and to assume all corixids to be herbivores. Some recent studies by the author and others have shown that certain species among these animals are active predators. Although *Branchinecta gigas* probably feeds primarily on *B. mackini* (White 1967, White *et al.* 1969), the redness of the gut contents of many freshly captured animals suggested that copepods were eaten as well Mature *B. gigas* females were found to clear two-quarts of lake water containing 1000 mixed fairy shrimps, copepods, and daphnids in less than a week. In the lake, many adult copepods of the larger species were observed grasping smaller copepods in their appendages, and subsequent experiments indicated that these predators may consume as many as 3 or 4 small copepods per day. Corixids were observed to attack both copepods and immature or damaged fairy shrimps. The water mites preyed on copepods, although few interactions were actually observed.

A simplified "food net" (Fig. 6) illustrates some of the food relationships within the community. It also gives some idea of the diverse pathways by which energy and nutrients are recycled within the aquatic environment. In general, a "food net" is more efficient than the longer classic "food chain" because shortcuts and fewer "links" result in less energy loss (see Hartland-Rowe 1967). Furthermore, it is to the adaptive advantage of a species to be able to fit into a "food net" at more than one trophic or nutritional level.

Community Development

The first species to mature and reproduce in the lake after the ice disappeared were *Branchinecta gigas* and *Daphnia similis*. The first of these matured, produced eggs, and died by the end of June, whereas the second species produced several more generations during the summer. The smaller fairy shrimp, *B. mackini,* matured about a month later than *B. gigas* and then disappeared. Both species of copepods began to produce eggs in late July and egg laying continued into August and September. Although all crustacean species appear to overwinter as eggs, the insects may overwinter in the sediments as adults or subadults (in the corixids) or as larvae (in the chironomids). The corixids in the lake develop from eggs laid early in the season and near-mature insects can be seen breaking the surface of the water in September, prior to leaving the aquatic environment for a brief aerial sojourn.

Because of the simplicity, stability, and relatively slow growth rate of the community, the saline lake bears a closer biological resemblance to arctic and alpine waters than to prairie waters. This slowness and simplicity appear to be associated with harsh or extreme environmental conditions to which few species are suitably adapted. Whereas the saline lake, like alpine and arctic lakes, may have a roster of no more than 12 or 15 invertebrate animal species (exclusive of the single-celled protozoans), the low-salinity prairie slough or pond may contain 30 or more species of planktonic crustaceans alone, to say nothing of 100 or more species of insects, mollusks, segmented and unsegmented worms, rotifers, water mites, hydra, and others. However, the numbers of each of the few species present in the saline lake are usually much greater than the numbers of each of the many species present in the neighboring sloughs and ponds. Similarly, succession and development are slow in the saline lake, whereas the communities of the sloughs and ponds may be almost unrecognizable from one visit to the next.

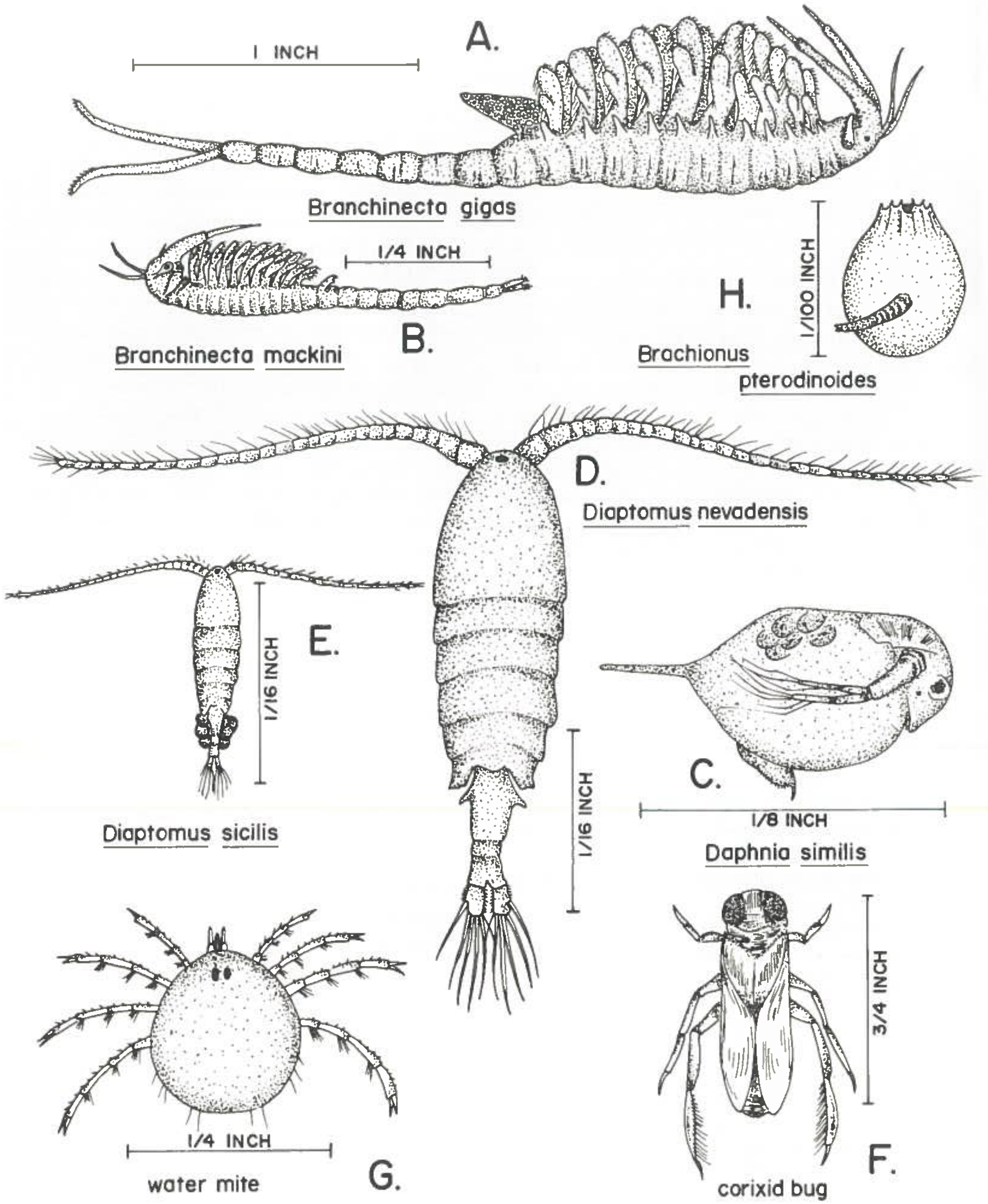


Fig. 5. Sketches of some of the species

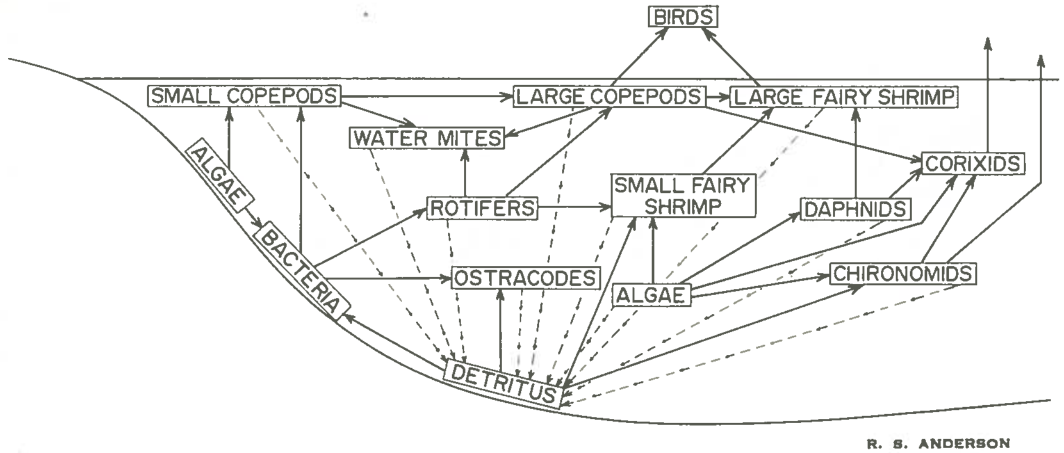


Fig. 6. Simplified illustration of the "food net" concept. Broken-line arrows indicate return of waste products and dead organisms to the detritus.

What Value Have Aquatic Studies?

What goes on in a lake or is produced from it may be no more important than what we can learn from it. The simpler the community, the easier it is to study some of the fundamental variables affecting the growth and development of the living organisms comprising the community. Many of the general principles derived from the study of harsh aquatic environments and their inhabitants will be of value in the understanding of complex communities in more amenable environments.

Community changes as shown by inventory studies carried out over long periods in natural habitats can be indicative of habitat destruction by pollution or other undesirable environmental change. That we must learn from our past mistakes was clearly illustrated in this magazine recently. In his paper on the history of Cooking Lake, Nyland (1969) pointed out that ignorance and lack of foresight have resulted in the near death of an important Alberta watershed. An "ounce of prevention" is not only better than a "pound of cure", but much less expensive. As politicians, industrialists, scientists, and government agencies are discovering in their groping for a curé for the "illness" in Lake Erie and some other natural waters, the cost of reclamation is prohibitive and the value of destroyed habitat is immeasurable. The recognition of "healthy" waters, diagnosis of the "illness", and the prescription of a "cure" will have to be based on an adequate knowledge of the aquatic environments and communities concerned.

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alberta hunter training and conservation program

The Information and Education Division in co-operation with the Fish and Wildlife Division offers the Alberta outdoorsman a course in Hunter Training and Conservation.

The primary intent of this program is to promote more conscientious participants in all aspects of outdoor recreation.

Although the course deals mostly with hunting and fishing, topics on general conservation and safety are covered.

The Hunter Training Section of the Information and Education Division co-ordinates the course and course material with the regional and district Fish and Wildlife Officers.

Community minded organizations conduct courses in their respective areas under the guidance of the district Fish and Wildlife Officer.

Instructor's courses are conducted by the Hunter Training Officer with the assistance of Fish and Wildlife Officers.

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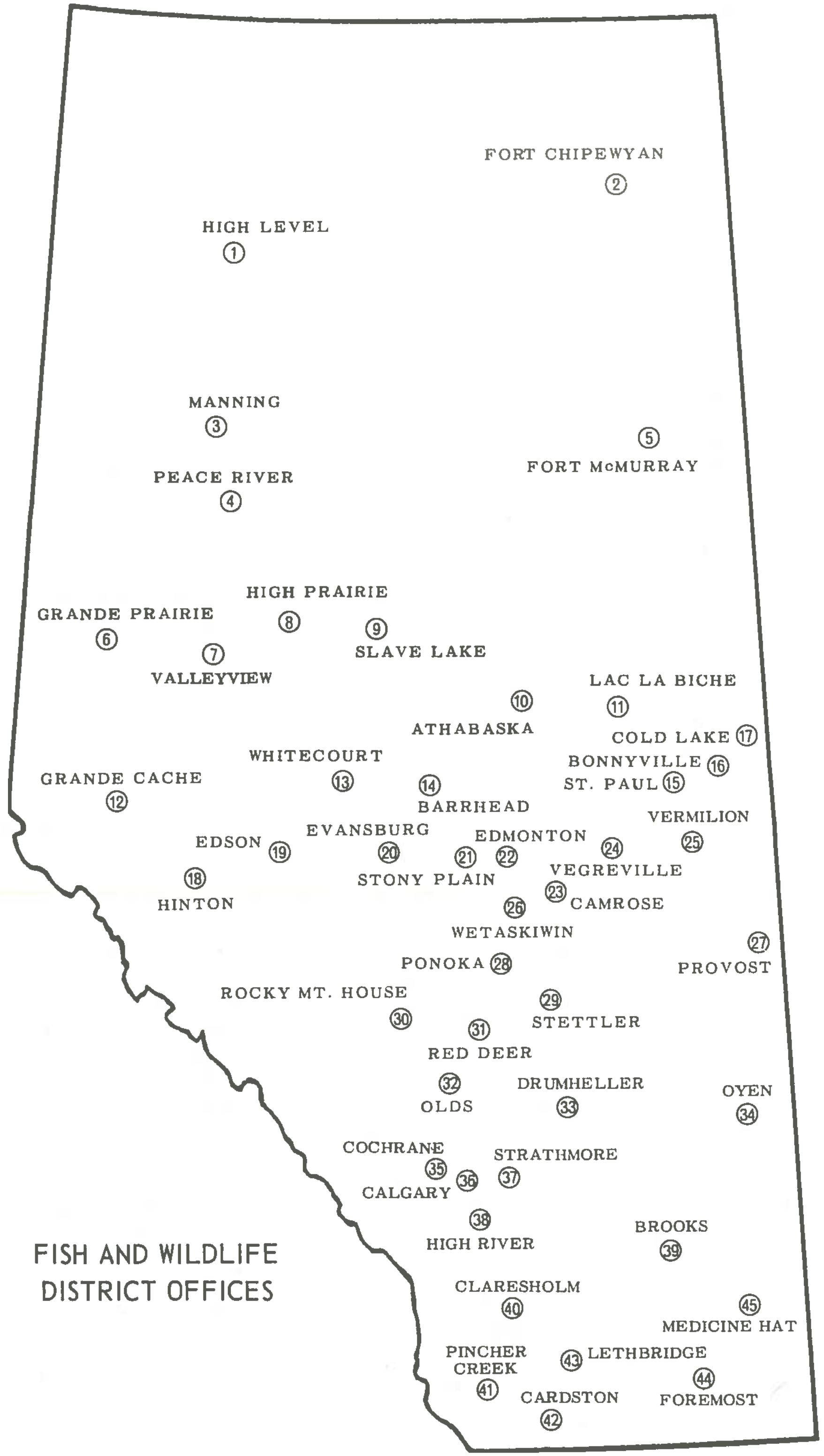

ALBERTA HUNTER TRAINING - CONSERVATION INSTRUCTORS

The district Wildlife Officer and the Hunter Training - Conservation section of Education and Information are deeply indebted to the following Hunter Training-Conservation Instructors:

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Elmer Kaiser
Wilfred Joseph Chateau
Howard Merry
R. L. Bernier
Albert Kaiser
Bryan R. Shantz
Murray Smith
Gerald Stephen Porrier
Gordon M. S. Brown
Robert A. Little
Raymond Eherer
Robert E. St. Laurent
Joseph Smith
Mike Reichert
Donald D. Hill
Roy Kaiser
George J. Heck
Oliver N. Nelson
Nils Kvisle
Earl R. Kinsella
M. O. Faizul Hosein
Stanley Clapp
Edward James Aden Tingey
Eugene Zelmer
Leslie Alderman
A. R. Whitbeck
Richard A. Pellern
Leo V. Markwart
Vernon Simpson
Eber Waite
George King
Ernest Odegard
Kenneth R. Clouston
Keith Cameron
Gerald Ness

George Biron
Lars Brandvold
Robert C. Hedderick
Jim Holmwood
Phil Hochhausen, Jr.
Bruce Ferguson
R. E. Carlson
Allan L. Akre
Jim Reinbold
Selmer C. Syverson
Gary Peterson
Herbert Biever
Gerald Allan Martin
Elmer Schielke
Donald John Cann
John G. Towle
Calvin J. Stutela
John E. Strutton
G. F. Patrick
Lynn Kelly
Jack Lafay
Robert Charles Gillespie
Randolph A. Wileman
Eddie Aronitz
Barrie S. Abraham
E. (Ted) Caswell
(Jack) J. E. Arnold
Al Curtis (A. H.) Curtis
Gordon Huolt
George Allenbrand
Nestor P. Hryciw
Jack L. Morton
Ernie Krucik
Edward Horbasenko
Peter Marcichiw
Michael Zelez
Ronald A. Kupcanko
Steve Sorochan
Frank Thomas Fraser
Ed. Kunz
Duane W. Barrus
Dee W. Barrus
Charles C. Bartlett
E. A. Scully
Duncan Lloyd
Larry Holland
Yvonne Landry
Sam McGee
William A. Porter
George F. Reti

John D. Phillips
Bert E. Reed
Keith E. Schrader
Bruce Spence
Lyle H. Walker
Peter J. Benson
Marcel Droessaert
Robert Faulds
Rex Gray
Karen Leigh Heath
John William Holowaychuk
Donald A. Nickolson
Kenneth G. Landers
Ricard T. McCullough
Mike Craddock
Joe W. Lozoway
Sam E. Smolyk
Francis G. Schulte
Donald Chapman

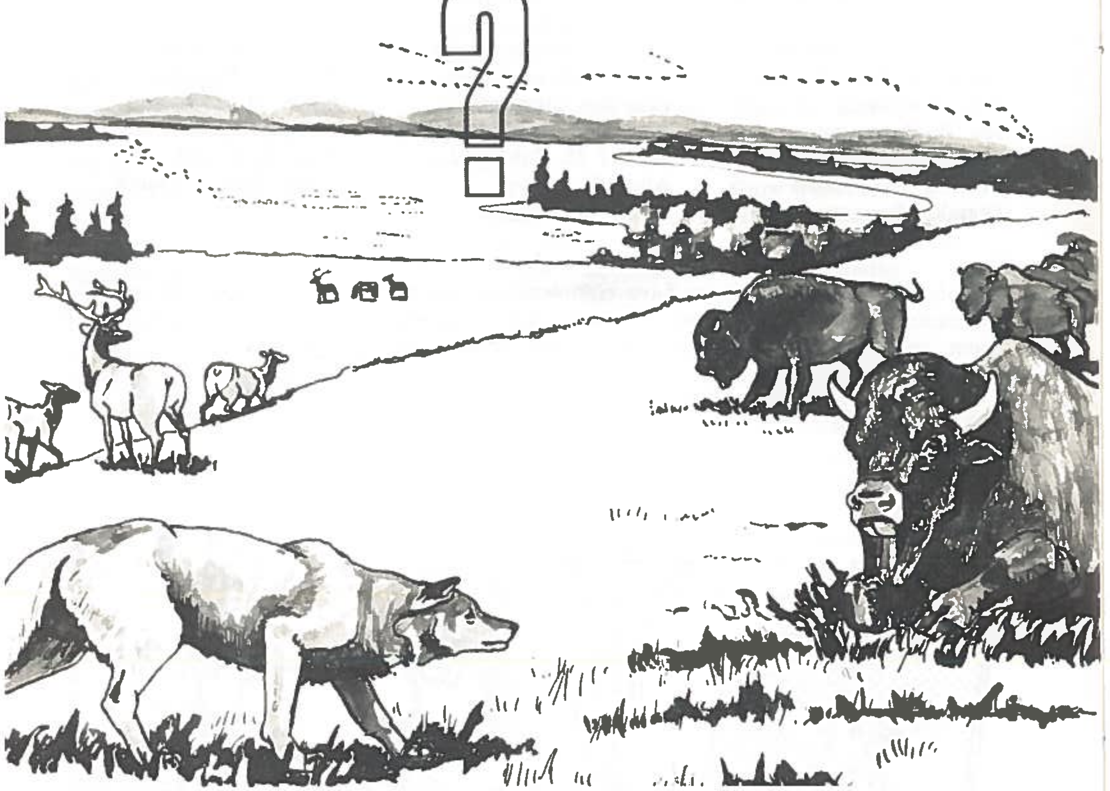
Charles Whitbeck
Francis Bovencamp
J. R. Bovencamp
F. G. Martin, Jr.
Keith Reed
Cecil Lloyd Day
Rev. E. G. Miller
George Shupack
Dave George William
Darrel Lloyd Perkins
Darwin H. Clark
J. R. Appleby
Douglas James Smith
Ernest Have Haug
Craydon Clements
Raymond Tetreau
Walter M. Zukiwski
Alex G. Elder
Roger S. Johnson

Leonard Steinbrenner
Euclid J. Landry
Susie Holland
Clarence Meisner
John Wieler
Warren D. Geldert
Trudy Halabisky
A. J. Trepanier
Chuck Hunter
Eugene W. G. Kramps
Lucien P. Provencal
Anne L. Croukalos
Basil Reg Knight
Ken W. Basarab
Elton M. Clements
Joe Fedechko
Alex Desmond
Ernie Robert Pslyk

All of the above instructors have completed a "Refresher" course and are qualified to conduct "Hunter Training - Conservation" courses in your area. Please contact them, or your district Wildlife Officer for course dates and details.

The above list includes all instructors requalified up to and including January 19th 1970. Future lists will follow.

MIQUELON LAKE



BY EDO NYLAND

In this second article by Edo Nyland on the history of the Beaver Hills area, the particular problem of the degradation of Miquelon Lake is examined in closer focus. Some of the information provided here, the loss of many natural features, and the drop in water level, was revealed in the author's article in the Fall, 1969 issue of this magazine. Because of the number of readers who responded favorably to the first report, Mr. Nyland readily agreed to submit this second study of the problem. —Ed.

It lies at the south end of the Beaver Hills, just 28 miles southeast of Edmonton, and 12 miles north of Camrose. I should say the lake used to be there, because it no longer is. What is left is the skeleton of a once majestic lake now shown on the map as three small lakes. Only the three deepest spots still hold water, the surface of which is now more than 17 feet below what it used to be in the year 1901.

Miquelon Lake's history is well documented. Ever since the first settlers came to Alberta, descriptions have been

E. NYLAND

This slough was once part of Miquelon Lake when the water level was 17 ft. higher

made of its beauty, richness in wildlife and fine beaches. Early conservationists like Frank Farley, Tom Randall, Dr. R. M. Anderson, Dr. Dewey Soper and many others have left us writings which allow us to trace the decline of this once beautiful lake.

1875 is a date to remember. The bison, shaggy king of the prairies, was still numerous around Miquelon Lake. The safety of the spruce forests and the plentiful water supply attracted them by the thousands. The seemingly endless prairie stretched to the south, still untouched by the homesteader's plow. But the white man was there already. One of them, Matthew Cook who was born in 1840, lived most of his life on the shores of Buffalo Lake. He knew Miquelon Lake well. He made his living freighting goods, which took him many times over the old trails between Winnipeg and Edmonton. Trading, trapping and hunting were part of his life. His recollections of the early days give us a good picture of this area so amazingly rich in wildlife.

In 1875 when the buffalo were still plentiful, the plains grizzly also made its home here. Wolves would come and go with the buffalo, as did the magpies which were particularly fond of hunting parties and the resulting refuse of the hunt. Whooping cranes would fly over "like a white cloud in the sky".

Passenger pigeons were very common. Matt Cook and others would trap them because they were considered a great delicacy. Pigeon Lake was named after these birds because tens of thousands would nest in the woods surrounding the lake. Even antelope could be seen occasionally in open places south of Miquelon Lake. Mule deer were plentiful around the lake. Elk (Wapiti) were found in several herds in the Beaver Hills near all the major lakes. At that time it was the only part of Alberta where large numbers of these animals occurred.

Many other animals made their homes near Miquelon Lake. Beavers, muskrats and otters were plentiful and had been the main reason for the establishment of the first Fort Edmonton, which was known as Beaver Hills House by the Indians and was located near the present site of Fort Saskatchewan. Cougars, coyote, lynx, fox and many of the smaller fur bearers were trapped regularly. Waterfowl would use the lake in spring and fall in unbelievable numbers.

When disturbed, the noise of thousands of birds taking off was described as the sound of rumbling thunder. Frank Farley, who came to the lake as early as 1892, wrote that the area had been known throughout the world as a hunter's paradise.

But 1875 was the end. Within two years the buffaloes, wolves, grizzlies and pigeons were all but wiped out. Even that first gallant conservation effort, the famous Buffalo Ordinance of May 22, 1877, could not save the king of the prairies. The ordinance came too late. That same day the Prairie and Forest Fire Ordinance was passed. It could not save the extensive spruce forests from destruction. The 1880's did to the Miquelon Lake area what the early 1890's did to the north end of the Beaver Hills. Settlers clearing land by fire wiped out the forests. In a few short years a heritage was lost.

But some people did care. As early as 1889 the father of western Canadian Forestry, E. F. Stephenson, advocated the establishment of Forest reserves. He managed to save a large part of the Beaver Hills from the plow when in 1892 the center part was reserved as the Cooking Lake Timber Reserve to become Alberta's first "permanent" forest reserve in 1899. Miquelon Lake missed being included in this reserve because of the then well established practice of grazing and the lack of sawlog size timber.

But even before Stephenson advocated the forest reserves, western Canada's first waterfowl sanctuary was established in 1887, at Last Mountain Lake in Saskatchewan. It is typical that Alberta's first waterfowl preserve should be in the Beaver Hills. In 1911, Ministik Lake, only a few miles north of Miquelon, received this distinction, but Miquelon was not far behind; on May 18, 1915, this lake and all vacant lands surrounding it were reserved for this purpose by Ministerial Order. A proper assessment of the value of the area was made by Dr. R. M. Anderson in 1917. In his report he mentioned the abundant duck population, the cormorants and great blue herons but regretted that the pelican colony had been destroyed. A settler who had been doing some fishing in the lake considered the fish eating pelicans competitors and parked his pigs on the nesting island. In one stroke one of our largest colonies was destroyed.

In other ways the first two decades of the 20th Century had been hard on birds. It had been a period of mass slaughter of waterfowl in the U.S.A., Mexico and Canada. The market gunners of the south with their punt guns, large muzzle loading shotguns mounted on the stern of punts, killed millions of birds every year.

E. NYLAND

Land clearing in Miquelon watershed. Converting forest land to pasture causes water to gather and sit in puddles and evaporate

Canadians rightfully asked why they should protect the birds, only to save them for the markets in the United States. This destruction, however, did not go unchallenged.

The second decade of the 20th Century witnessed the first nation-wide conservation argument. The slaughter of our migratory birds in the south caused a popular uproar and demands for government action, not unlike our present outcry against pollution. A first step was taken in the United States where the Federal Migratory Bird Law was passed in 1913. This law served a good purpose in that it emphasized the need for international co-operation. On July 7th, 1913, the U.S. Senate requested the president to propose to governments of other countries the negotiation of a convention for the protection of migratory birds. Dr. C. Gordon Hewitt was the Canadian representative in the early discussions leading towards international agreement. On May 31, 1915, an Order-in-Council was passed stating that the Canadian Government was in favour of the proposed treaty, and consequently The Migratory Bird Convention Act was signed on August 16, 1916. It provided for a closed season on migratory game birds during nesting time, an open season of three and one-half months and a year round closed season on insectivorous birds. The successful conclusion of this agreement was perhaps the most important step ever taken in the history of bird protection. It was agreed upon in the nick of time. It affected over one thousand species of birds, many of which would have been eliminated without this agreement. Conservationists and governments were greatly encouraged by this success and a nation-wide effort was made to make the improvements permanent. On June 15, 1920, both Miquelon and Ministik Lakes were declared permanent bird sanctuaries.

In 1921 one of the most dedicated conservationists in Alberta was placed in charge of Miquelon Lake. Frank L. Farley, writer, teacher, homesteader and real estate salesman, got the sanctuary off to a beautiful start. Under his effective protection which lasted for 10 years, the future for the waterfowl reserve looked bright. His glowing accounts of his trips by canoe across the lake, his observations of bird arrival and nesting dates, his untiring efforts to teach the children appreciation for all that lives made him one of the greatest conservationists in Alberta's history. He had his problems with trespassers, fires and the odd timber stealing, but by and large his supervision was effective.

Another name forever associated with Miquelon Lake is that of Dr. Dewey Soper. His first introduction to this most excellent waterfowl area was in May, 1922. As a young biologist he studied the wildlife of the sanctuary together with Frank Farley. Their records of birds observed, their many reports and letters have mostly been preserved and make this the best documented bird sanctuary in Alberta.

Dr. Soper is still as active as ever. His recent evaluation, 47 years since he saw it first, is a post mortem of the lake. It is now mostly grass covered lake bottom and muddy shoreline.

Another true conservationist whose name will remain attached to the lake is Tom Randall. He visited Beaver Hills Lake in 1922, worked at Miquelon in 1927, was a park warden in Elk Island Park for several years before the last war and worked at Ministik Lake for Ducks Unlimited as temporary sanctuary keeper.

Lake Levels

The lake levels at Miquelon have had their ups and downs. The lake probably has behaved in a cyclical manner ever since the glaciers retreated. For a few decades the lake would be high, with enough overflow to fill a fair-sized creek; then would come a period of low

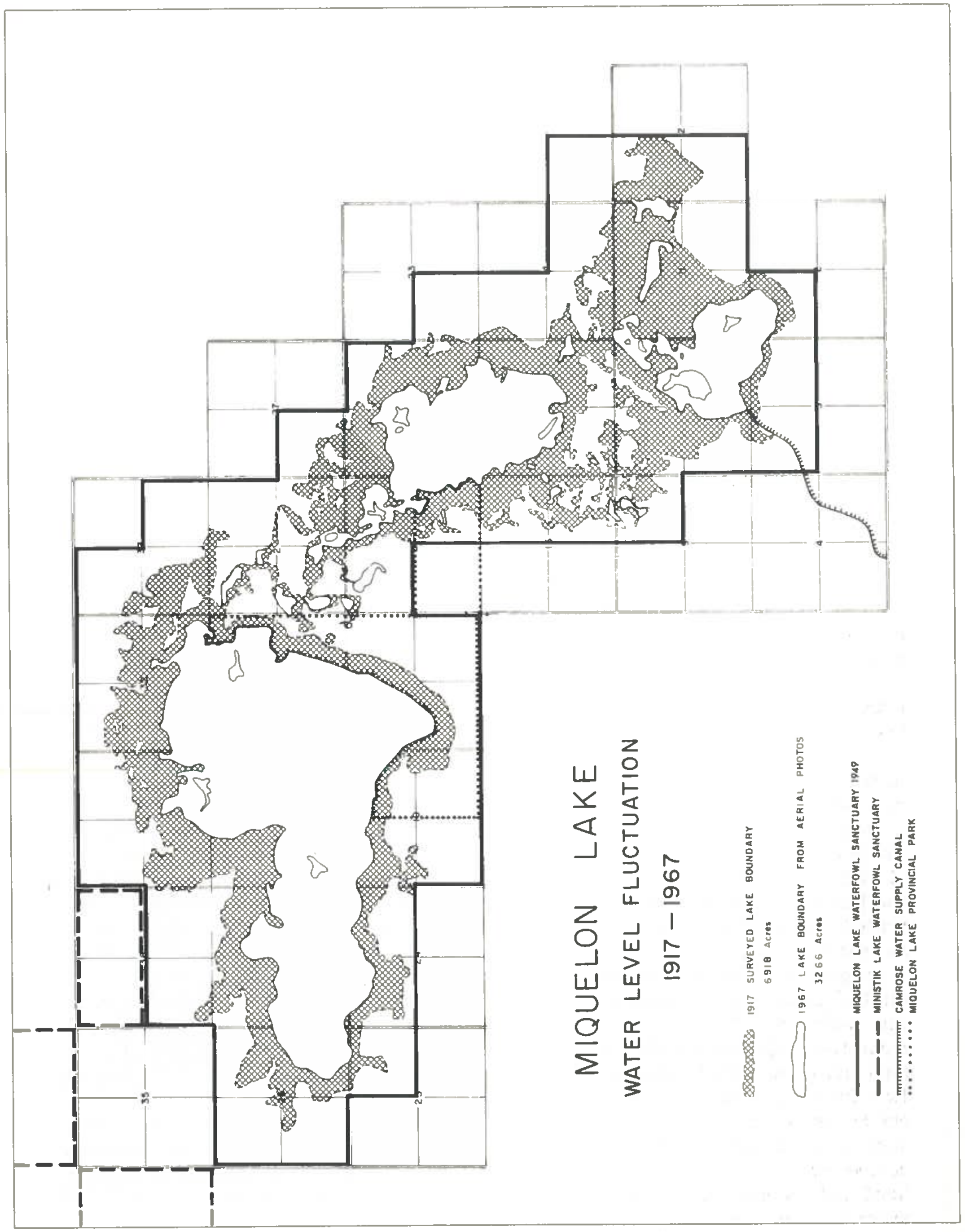
E. NYLAND

Deepest part of the canal which drained Miquelon Lake, seen from the road fill

precipitation, and the lake level would drop and the creek dry up. One such low occurred around 1865 during a period of very low rain and snow fall. The heavy rains around 1875 restored the lake and the creek. The 1880's again were fairly dry years, about 14 inches annually, and although the lake level wasn't too much affected, the creek dried up.

The 1890's recorded average precipitation of just over 17 inches and the lake remained in good shape. The legal survey conducted in 1893 by A Bourgault established the boundary of the lake, but no outlet is shown on his map. The heavy rainfall of 1899 filled the lake up, but the extraordinary precipitation of 1900 and 1901 (27 inches each year) restored the lake and filled all sloughs, swamps and depressions to capacity. There was water everywhere. The small outlet of the lake became a big creek. Miquelon is the highest of a series of many water connected lakes all draining into the North Saskatchewan River. The rains filled Oliver Lake, then Ministik, Cooking Lake, Beaverhills Lake and on to the North Saskatchewan River through Beaverhills Creek, which at that time was a real river, 120 feet wide and at least 6 feet deep. The water kept flowing for 21 years until the fairly dry years of 1921 and 1922 slowed it down. No mention of a noticeable drop in lake levels was made until 1925. A settler had slightly deepened the outlet of the lake, but the big blow did not come until about 1927 when a water shortage in the Camrose town reservoir was temporarily solved by digging a canal through the height of land south of Miquelon Lake to divert water into Stony Creek. There appears to have been no permission given for this diversion. The move was, to say the least, ill-advised. Miquelon Lake has an extremely small watershed or catch-basin and could not stand the drain. When in 1928 the lake level dropped lower than the control weir, the canal was dug deeper with the help of heavy machinery until, on the height of land the canal was close to 20 feet deep. In 1901 the highest lake level was about 2,520 feet. In 1917 the surveyors established an elevation of 2,518 feet. This was reduced another 8 feet by 1929, creating large mudflats and sloughs where the lake once was.

One side effect was that the newly dry lake bottom formed an ideal seed



bed for Canada Thistle, seeds of which had blown over from nearby homesteads. In 1927, Tom Randall, who homesteaded near Camrose, was hired to mow and dispose of the thistles. This thistle control was to become an annual ritual and provided subject matter for many a meeting of local farmers disgusted with the seed blowing from the lake shore. They blamed the lake although the seeds originally had come from their own farms. Suggestions were made to drain the lake and get rid of the nuisance. But reason prevailed. Spraying of the thistles along the shore was kept at an absolute minimum and another effort to damage Miquelon was temporarily averted. In the meantime the lake had become so low that the expense of deepening the canal, which also would have made it longer, was considered not economical. In the 1940's, a fill was placed in the canal, which had been dry for several years, in the hope that a period of increased rainfall would restore the lake.

Fishing

The lake had long been known for its abundant fish population. The presence of large cormorant and pelican colonies were the result of this. Northern pike, yellow perch and brook sticklebacks were present, and it was no problem to catch a canoe full of pike in a fairly short time. Farmers from Camrose would come with nets and catch a wagon load of fish in a single day. There appears to have been no shortage of fish until the "dry thirties" when the increase in salinity of the lake prevented the hardening of fish eggs and normal reproduction.

Miquelon Lake has many springs, mostly below, but, some also above the waterline. The water discharge from these springs contains noticeable amounts of soda and sulfates. Evaporation from the lake concentrated these chemicals so much, that solid objects such as rocks and buffalo skulls were coated with an inch or more of rock hard soda stone. Considering that the average rainfall is about 17 inches and evaporation is estimated to exceed 21 inches each year, the level of the lake must go down if no run-off water is received from the surrounding watershed. The run-off has obviously been insufficient. The latest elevation reading in 1969 was 2502.49 or 17½ feet below the high water mark of 1901. The water level still has not stabilized but instead keeps dropping about one-half foot each year. Still, the depth of the large lake is close to 15 feet in one spot.

Of the chain of lakes in the Beaver Hills, only Miquelon and Hastings Lakes do not have complete depletion of dissolved oxygen during the winter. This is due to greater depth than the other lakes, and as a result, these two lakes are the only ones in which some fish can survive. Even so, a winter of heavy snow causes an excessive kill of fish because light cannot penetrate to the oxygen producing vegetation under the ice.

When the natural resources were turned over to provincial control in 1930, the services of Frank Farley, who received $10.00 per month for his work, were dispensed with. The depression had started and extreme austerity was necessary. The immediate result was an increase in illegal killing of both waterfowl and big game, the stealing of timber and uncontrolled burning. Ten years of dedicated protection was undone in a short time. The formerly inviolate area was invaded by cattle and horses. The animals ate the vegetation which was so badly needed as cover by nesting birds. Bert Williams, keeper of Ministik Lake, tried to provide some supervision. He was paid by Ducks Unlimited, an American organization dedicated to conservation of waterfowl. However, he lived too far away to give adequate protection.

Today, illegal hunting still goes on within the sanctuary despite the control efforts of the Department of Lands and Forests. Cattle still graze the shores and occasionally eat the sago pond weed upon which the ducks depend for food.

With the arrival of more prosperous times came the powerboat, and it became commonplace to see a 40 or 50 hp. boat race through flocks of feeding or resting birds and disturb many nesting ducks. Section 8 of the Migratory Bird Sanctuary Regulations states that nobody shall carry on in the sanctuary any activity that is detrimental to migratory birds.

Recently land clearing operations and slough drainage projects in the watershed have affected the run-off. These previously timbered lands used to provide a reliable source of water for the springs in the lake, which now flow only intermittently.

Another threat to the lake came when nearby oil wells were in need of water-injection to maintain oil production. One company requested permission to pump water from the lake for this purpose, but the presence of a biologist of the Canadian Wildlife Service stopped this threat just in time.

Since 1927, the decline of Miquelon Lake has been a series of tragedies. Water diversions, forest fires, illegal hunting, grazing of cattle in the nesting areas, extensive land clearing and the use of power boats — have all worked together to obtain the final result, the needless destruction of a wonderful heritage. And it all happened in a lifetime.

Dr. Soper, after visiting the Lake in July, 1969, wrote the following:

"For a onetime bird sanctuary the conditions are shocking indeed. In general, it is sickening to see the degeneracy about the Lake involving water level, exposed flats, cattle grazing and widespread sense of impairment and ravages of time. There can be no justification for the shooting and killing in the sanctuary. From the viewpoint of the conservation of birdlife the situation at Miquelon Lake has undergone such a lamentable decline that the end result is hard to believe. To fully appreciate what has taken place, it is of advantage to have been an 'old timer'. If Frank Farley could come back to see Miquelon Lake as it is today he would be shocked by the amazing decline in the water level and the vastly reduced bird population compared with the riches of a half century ago. What sad changes have been wrought in a brief 47 years."

How long can we sit back and watch the wonders of nature be destroyed.

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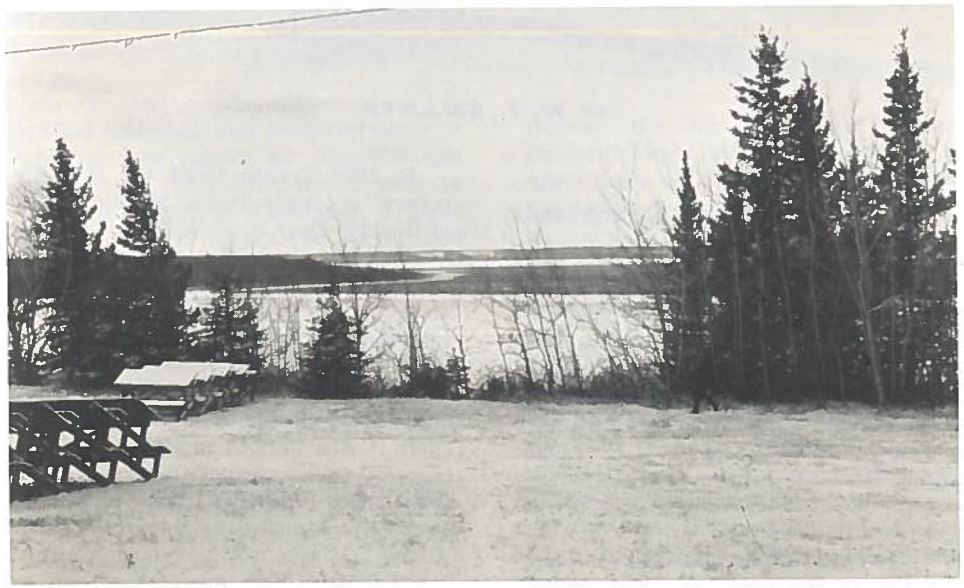
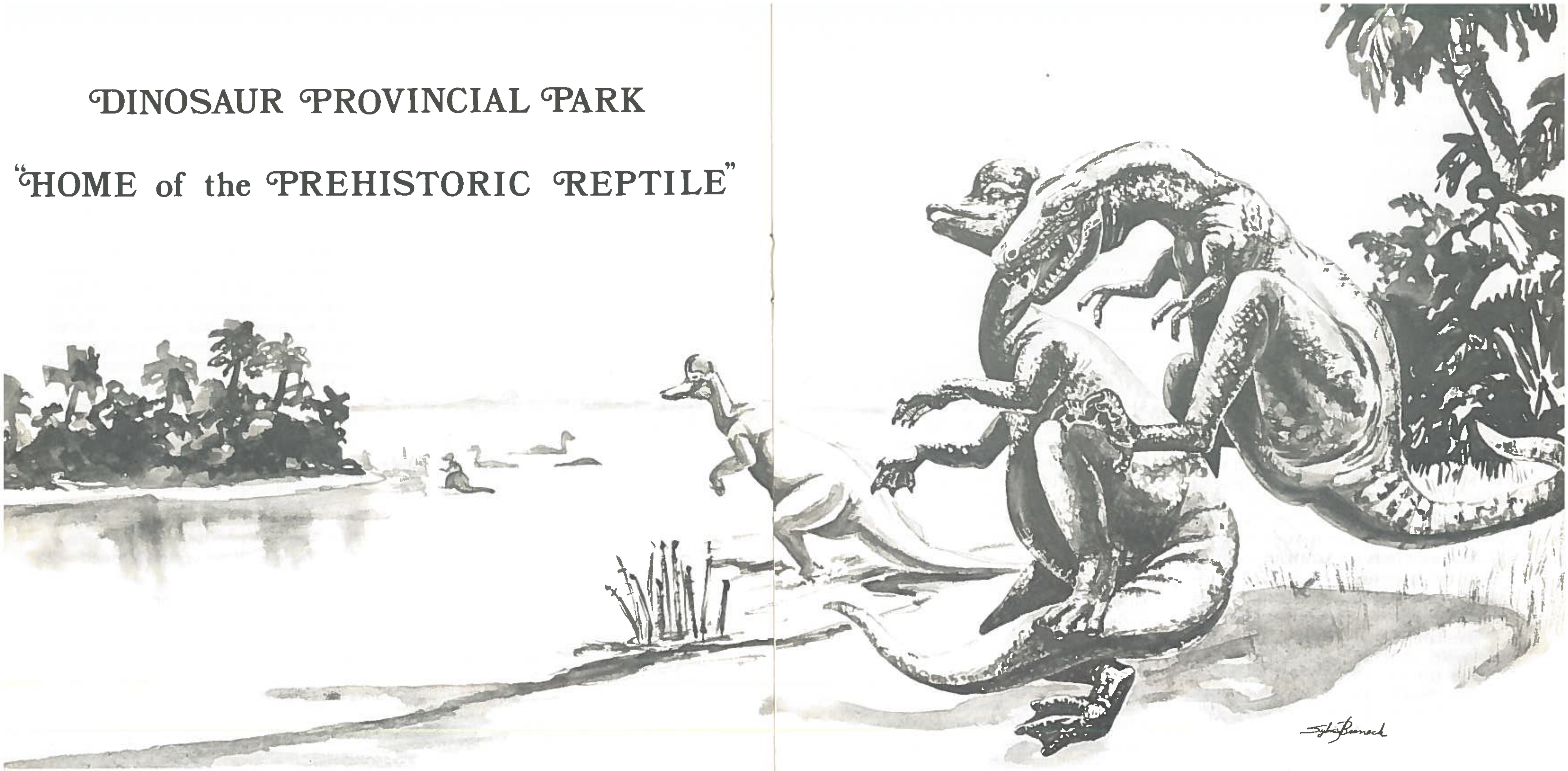


E. NYLAND

View of Miquelon Lake from Miquelon Provincial Park

DINOSAUR PROVINCIAL PARK

"HOME of the PREHISTORIC REPTILE"



BY W. T. GALLIVER

Recent History

The discovery of one of the greatest dinosaur beds in America located in the Red Deer Valley of Alberta was precipitated by the first dinosaur discovery in Saskatchewan in the 1870's by a Canadian geologist and naturalist, Dr. George M. Dawson. Further field investigations by Dawson in Southern Alberta in 1875 led to additional discoveries of Cretaceous dinosaur bones. One of Dawson's assistants, J. B. Tyrrell, who had worked with him on the Boundary Survey which terminated in 1895, decided to devote his life to the study of fossil geology and joined the Geological Survey.

In 1884 Tyrrell made the first discovery of fossil bones in the Valley of the Red Deer River which led to other notable finds including the partial skull of a carnivorous dinosaur. This precious and unprecedented fossil was tediously removed with crude equipment and packed out by wagon across the badlands, up to the rim of the prairie and across the plains to Calgary. From there it was shipped to Ottawa for preparation and preservation. Like some of the earlier Canadian discoveries, this skull was brought to the attention of Alfred D. Cope, world renowned American authority and one of the founders in the science of paleontology. Cope

studied this skull and described same as what is now known as Albertosaurus sarcophagus. This discovery of such an excellent specimen stimulated a great deal of interest within the survey and led to many more scientific expeditions to this fossil rich area.

Dinosaur bones were found in abundance and the area between Steveville and Dead Lodge Canyon was to become famous in the annals of dinosaur collecting.

In 1888 another geologist, Thomas C. Weston, was sent to the Red Deer River for the specific purpose of collecting dinosaurs. It was Weston and his party who were the first of many to take advantage of the river's course through the rich fossil field between Steveville and Dead Lodge Canyon by using boats as bases for operations for their geological work. In 1897 Lawrence M. Lambe, a member of the Geological Survey of Canada, was sent to Alberta on routine work to draw illustrations of fossils. Lambe was so impressed with the area that he returned next year with some assistants to search for and excavate fossil bones of dinosaurs. As Lambe was not well acquainted with the necessary special collecting techniques, his expedition was only moderately successful. His efforts, however, marked an important milestone in the development of the rich dinosaur beds of Alberta as he not only collected the bones of dinosaurs, but also studied, described, and interpreted them. It was through his efforts working in conjunction with the American Museum of Natural History that he demonstrated that the fossils from the Red Deer River area which are found in two principle horizons or geological levels — the Oldman Formation and the Edmonton Formation above, were older than the late Cretaceous dinosaurs of the Lance Formation, at that time the most completely known of all the Cretaceous dinosaurs. It was Lambe's publications and conclusions that set the stage for the remarkable explorations of Brown and the Sternbergs of later years. Lawrence Lambe had truly opened the eyes of the paleontological world to the significance of the dinosaur-bearing sediments along the Red Deer River.

The golden years of exploration were to climax in the Canadian Dinosaur Rush along the Red Deer River from 1910 until 1917. It was during this period that Barnum Brown and the Sternbergs, father and sons, drifted down the river and explored and excavated along the cliffs with phenomenal success.

Barnum Brown, a graduate of the University of Kansas, gained his experience in the field of paleontology in Nebraska, South Dakota and Wyoming. While working on the staff of the American Museum of Natural History, he had given some thought to the possibility of working the fossil beds along the Red Deer River as he was familiar with the earlier discoveries made there through the publications of Lawrence Lambe.

The event that brought about Brown's expedition to Alberta was the visit of an Alberta rancher from the valley of the Red Deer River to the American Museum in New York in 1909. During his visit the rancher recognized the similarity between the fossils on display in the museum and the bones he had found on his ranch. This rancher's report so impressed Brown that he arranged for a visit to the Red Deer valley during the summer. His preliminary exploration of the area convinced him that he should now turn northward from Montana to Alberta to seek paleontological treasures along the Red Deer River. At Red Deer, Alberta, Brown set to work making preparations for the river trip. He proposed a variation on the method used by Weston and Lambe by which he intended to float down stream on a large barge capable of carrying a fully established camp on its decks. Provision was also made for additional room and buoyancy for transportation of heavy fossils. The barge or flat boat was constructed with a twelve-foot beam and a length of 30 feet. At the middle of the barge a large wall tent was erected complete with sheet iron stove with a black chimney which poked through the roof of the tent. With ample deck space the barge was steered with two 20′ sweeps one at each end of the barge. This flat boat or scow was similar to the ones used in earlier days to float down the Mississippi carrying produce from the upper reaches of the Ohio to New Orleans. The barge was successfully launched at Red Deer and Brown and his assistants were soon floating down stream towards the fossil fields.

By summer's end the flat boat was piled high with fossils encased in their burlap and plaster jackets collected from the Edmonton Formation of late Cretaceous age.

The quantity of dinosaurs obtained proved so impressive that Brown again returned to the Red Deer River in 1911 with equally gratifying results. During this second summer he transferred his attention further down river to the older Oldman Formation where he collected dinosaurs for several successive summers. As a result of this field work Brown collected representative collections of dinosaurs through an appreciable segment of geologic time, greatly enhancing the importance and significance of his efforts.

Brown's expeditions along the Red Deer River for two seasons was completed with the knowledge and approval of the Geological Survey of Canada, but not since the work of Lambe a decade earlier had any effort been made at collecting fossils along the Red Deer River by the Survey, or by any Canadian museum. Finds made by Barnum Brown were too spectacular to ignore and the Director of Geological Survey of Canada

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Sternberg and sons on the Red Deer River setting out to explore Dead Lodge Canyon

decided to make collections on its own behalf.

Fortunately for the survey and for the entire Canadian dinosaur fossil collection field, Charles H. Sternberg and his capable sons were available to undertake a dinosaur hunting expedition. Charles H. Sternberg and his son George were in fact in Ottawa in the spring of 1912 setting up some of the specimens which had previously been sold to the Geological Survey. The elder Sternberg was appointed as Chief Collector and Preparator for the survey working under the direction of Lawrence Lambe. The field campaign was formulated and Sternberg commenced his first season of work in July of that year assisted by his three sons.

The Sternbergs worked the first field season with the combined facilities of a team and a field wagon he had brought from Kansas and a row boat which had been constructed in Calgary. Utilizing this equipment they operated by land and water with their base camp set up near Drumheller from where the Sternbergs explored the cliffs and badlands exposures of the Oldman Formation. Their exploration that summer was highlighted by the discovery of some very fine skeletons of duck-billed dinosaurs.

In the meantime Barnum Brown continued his explorations between Steveville and Dead Lodge Canyon, about 75 miles downstream from Drumheller. It was from this part of the river in 1912 that Brown's discoveries exceeded anything he had collected the two previous seasons. Among his excavations was a skeleton of a crested duck-billed dinosaur *(Corythosaurus)*, and a skeleton of the horned dinosaur *(Monoclonius)*. As this area proved so successful, Brown concentrated his efforts there in future years. So it was that 1913 found Brown, as well as the Sternbergs on the river between Steveville and Dead Lodge Canyon.

Because he was so impressed with Brown's method of operation from the Red Deer River, Charles Sternberg obtained a large flat-boat on which two tents were set up end to end. Their party also had the added luxury of a motor boat with which to pull the scow back and forth along the river. The Sternbergs, after an adventurous trip down stream, set up camp three miles below Steveville not far from where Barnum Brown had already established his camp. From these two camps strategically located, a friendly competition existed in one of the world's richest dinosaur collecting grounds, but none the less the rivalry between the two parties stimulated both expeditions to put forth their very best efforts. Both parties were operating in a region where

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Hauling dinosaur bones collected by Barnum Brown out of the valley of the Red Deer River

there were enough fossils for all and their discoveries in that summer of 1913 were spectacular.

A careful survey and map of the Red Deer River between Steveville and Dead Lodge Canyon about 10 miles to the east compiled by Charles Sternberg shows that 100 dinosaurian skulls and skeletons have been collected from this area. These include some of the finest late Cretaceous dinosaurs ever to be excavated, many of which are to be seen on display in New York, Toronto and Ottawa. Although the full extent of the collections made in 1913 by both parties was yet to be realized the prolific occurrence of dinosaurs in this fossil field continued to astound the collectors. During that season the Sternbergs collected two skeletons of the crested duck-billed dinosaur *(Corythosaurus)*, other duck-billed forms as well, armoured dinosaurs, the carnivorous Gorgosaurus and some fine horned dinosaurs including a skeleton *(Chasmosaurus)* with skin impressions and the spectacular spiked-skulled form, *(Styracosaurus)*.

The discovery of a dinosaur with the impressions of the skin was important although not new to the paleontological world, as the Sternbergs had discovered two such dinosaurs five years earlier. The four Sternbergs had been working in South Wyoming and George Sternberg discovered the remains of a duck-billed dinosaur which when excavated revealed an exact cast of the skin impression perfectly preserved. This is the famous dinosaur mummy now in the American Museum of Natural History in New York. A second specimen with the skin was also discovered by the Sternbergs at the same place and is now in the Senckenberg Museum in Frankfurt-am-Main, Germany. A number of dinosaurs have been found with skin preserved in the Red Deer River area. One notable specimen is that of a crested duck-billed dinosaur *(Corythosaurus)* and partial skeleton of a horned dinosaur *(Monoclonius)* collected here by Barnum Brown.

Preceded by Barnum Brown the Sternbergs moved 5 miles down river to establish a camp at Little Sand Hill Creek at the upper end of Dead Lodge Canyon where more than 50 specimens were collected during the next three seasons. This area, in the words of

Charles H. Sternberg, was the "Richest of all the camps in the Belly River Series in Dead Lodge Canyon". Brown continued his work in the Dead Lodge Canyon area through 1914 - 1915 while the Sternbergs continued to work the area through to 1916 - 1917.

The elder Sternberg resigned from the Geological Survey in May 1916 and during that year he and his son Levi continued their work in the fossil fields of the Red Deer River. That summer they were collecting on behalf of the British Museum while the brothers George and Charles M. Sternberg remained with the Geological Survey of Canada. The eldest and youngest Sternbergs continued to have good luck and excavated two excellent skeletons of duck-billed dinosaurs as well as other materials. The dinosaurs were shipped east to be placed on board a steamer the "Mount Temple", bound for Britain. At this point the good fortunes which seemed to attend the efforts connected with the Red Deer River dinosaurs came to an end. The Mount Temple was torpedoed and the dinosaurs went to the bottom of the Atlantic. This was indeed a tragic loss and one of the few instances of fossils collected for museums failing to reach their destinations.

During 1917 Charles H. and Levi Sternberg again worked along the Red Deer River where they collected three fine skeletons — one of the duck-billed dinosaur that they sent to the San Diego Museum, a beautiful carnivorous dinosaur *(Gorgosaurus)* which was eventually named in honor of Sternberg and an armoured dinosaur — the latter two being acquired by the American Museum of Natural History. During this field season of 1917, while Charles H. and Levi Sternberg were collecting along the Red Deer River, a rival expedition was in the vicinity under the leadership of Charles M. Sternberg, working for the Geological Survey.

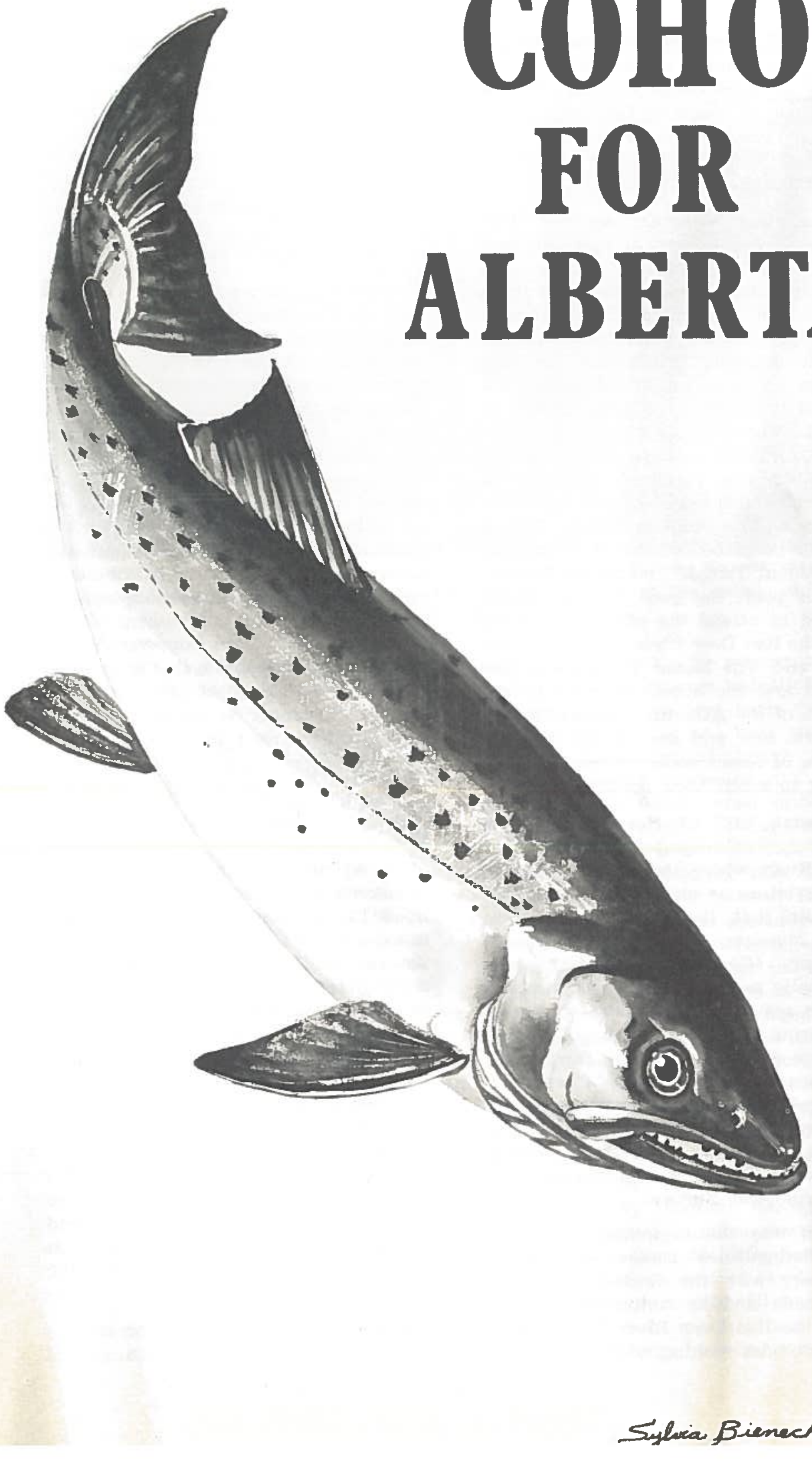
This was the beginning of a long and distinguished career by Charles Sternberg with the Geological Survey of Canada and he continued to work along the Red Deer River for the next three decades making additional collections of dinosaurs principally in the area of Dead Lodge Canyon. George Sternberg, the eldest of the brothers, returned also on various occasions to explore this rich fossil area of Alberta as an independent collector. His brother Levi later joined the staff of the Royal Ontario Museum in 1919 and was instrumental in building up the fine collection of dinosaurs now to be seen in Toronto.

For both Charles M. and Levi Sternberg the Red Deer River became something of a life career. In addition to his collecting activities Charles became involved in research of his extensive fossil collections and publication of his results, carrying on this phase of his work upon the death of Lawrence Lambe in 1919. The close of the 1917 field season saw the end of the Canadian Dinosaur Rush, as well as the end to the high excitement of going into a strange and unknown region in search of paleontologic treasures. Some of the romance has also vanished, for with the passing of the years there have been improvements in roads and transportation that has spelled the doom of the old flat boats and wagons. No longer do the fossil hunters drift down the river scanning the bluffs for likely collecting spots. No longer do they camp on large paleontological arks and no longer are they truly part of the river.

Today the badlands exposures of the Cretaceous beds between Steveville and Dead Lodge Canyon have been established into the Dinosaur Provincial Park. Several fossils have been exposed in place under the guiding hand of Charles M. Sternberg and shelters have been constructed to protect them. This truly rich fossil field — one of the most productive in the world for the remains of dinosaurs, can now be visited in ease and comfort even by the casual tourist. If the visitor has some acquaintance with the history of exploration as has been partly outlined in these pages, he may gaze out across the sunlit cliffs and badlands and think back perhaps with some nostalgia to the golden days of the Canadian Dinosaur Rush.

References — Men and Dinosaurs
By Edwin H. Colbert

COHO FOR ALBERTA



BY R. J. PATERSON, SENIOR MANAGEMENT BIOLOGIST

Alberta's first experimental introduction of coho salmon will be made in Cold Lake next May. The Fish and Wildlife Division are hoping that this will provide a significant stimulus to Alberta's sport fishery and particularly to the area northeast of Edmonton.

Cold Lake lies in an area of many lakes, lakes which support large populations of pike, perch and walleye *(pickerel)*. Many of these lakes yield fish to trophy size and most are relatively unfished. Cold Lake itself, however, is different from most other lakes in the area, which are shallow, warm and productive. It is deep (maximum depth about 370 feet), relatively cold and unproductive. It produces few pike, very few walleye and small numbers of lake trout. It contains, however, a good population of ciscoes *(tullibee)*, and also of whitefish.

The coho salmon fishery in the Great Lakes, particularly Lake Michigan, is by now famous. The first introductions several years ago started a sport fishing bonanza. The salmon grew in two years to give large (12 - 15 lb.) sporty fish that attracted anglers from great distances. The secret of this phenomenal growth lay in the huge population of alewives, a small fish not too different in size from the ciscoes of Cold Lake.

We have no idea how fast the coho may grow in Cold Lake, nor how satisfactory they will find this much smaller lake. Coho have not so far been tried in waters this far north where their basic diet would be the cisco. For this reason we are keeping our fingers crossed.

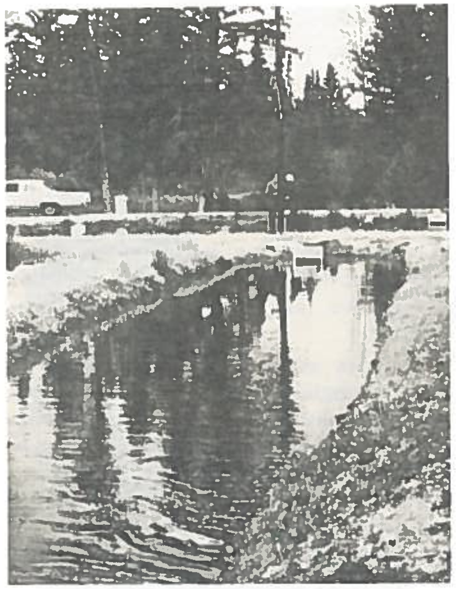
This is an experiment from which Alberta anglers have much to gain and nothing to lose. As with all experiments it is important that data be collected so that results may be assessed and improvements or changes made where necessary. So that the experiment could be properly designed, a visit was made to Michigan last July to help Alberta fishery staff to benefit from that state's experience.

The Fish

Coho salmon are by nature a marine species. Each species of Pacific salmon has a well-defined behavior pattern which has evolved over a long period of time. Similarly, each race of salmon has a particular behavior pattern speci-

C. HAGLUND

Cold Lake contains a large population of ciscoes, small fish which should provide ample food for coho salmon



R. J. PATERSON

Raven Rearing Station

ally adapted to the stream from which it originates. The whole life history of the fish is geared so that it arrives at its natal stream at a particular time to spawn.

Coho salmon have a three-year life history. The first of these is spent in freshwater, in a stream. During their second spring they move into the ocean as smolts and remain there until the fall of their third year, when they return to their natal stream to spawn. It is during the summer prior to spawning that these fish gather off-shore and are harvested by sport fishermen. When these fish are restricted to freshwater, a large lake is substituted for the ocean environment, but the fish's behavior pattern remains very similar. The salmon may stay scattered and in deeper water early in their second summer, but become more vulnerable to angling as they congregate closer to their natal stream.

The Program

Alberta's first introduction will consist of approximately 100,000 fish given to us as eyed eggs by the State of Alaska in the fall of 1968. These fish were raised first in our hatchery in Calgary and subsequently at the Raven Rearing Station so that they will be 5 - 6 inches in length when planted. Their growth rate must be controlled at this stage so that they do not mature too early and spawn after only two years rather than three. This first year of life in the hatchery takes the place of the year the fish would normally spend in a stream. They are then released in the lake as smolts.

So that the young fish are oriented to a natural stream they will be held for several weeks in a pond near the mouth of the Medley River, a tributary to Cold Lake. This pond will be fed with Medley River water. After release the fish will be followed throughout the summer by means of echo sounders and nets to gather data on their movements, their growth and their feeding habits. It is hoped that the fish planted in 1970 will gather in the vicinity of the Medley River mouth during the summer of 1970. These Alaska fish approach their spawning stream earlier than fish from more southerly latitudes. They may therefore, be available for angling fairly early in the summer. Experience in Michigan has shown that these fish do not grow as large as Columbia River fish; we should therefore be satisfied if they reach 4 - 6 lbs.

So that the two stocks may be compared, Alberta is currently obtaining a similar number of coho from the State of Oregon; these fish will be stocked in the spring of 1971 and would be available to the angler in 1972. Comparison of results from these two introductions will indicate which of the two stocks is best suited to life in Cold Lake and which will support the best fishery.

Limits

Initially it is planned to permit a daily catch limit of five fish. This will be similar to that applied in the province of Saskatchewan, where some introductions have recently been made.

Possible Problems

Will there be a conflict with the commercial fishery? Alberta currently has a commercial fishery for ciscoes in Cold Lake, which are utilized as mink feed, and a winter fishery for whitefish. It is not expected that any significant

number of coho will be taken in the whitefish fishery, as they will not be large enough during their second winter to be taken in 5½" mesh nets. There may, however, be some conflict with the cisco fishery, in which smaller mesh nets are used. This may necessitate some restrictions on the cisco harvest and these fish may, in the long run, have to be harvested by other methods, such as seines.

What will happen to the salmon when they enter the spawning stream?

Once salmon enter a stream to spawn they no longer rise to a lure and their eating quality deteriorates. They die as soon as they have spawned. It is unlikely that coho would successfully spawn in the Medley River or the offspring survive to return to the lake. It is therefore proposed to harvest the fish as they enter the stream, while they are still in prime condition. Sufficient spawn would be taken for future restocking and the remainder would be disposed of for commercial sale. Thus if the present commercial fishery is forced to reduce its harvest it may be possible to substitute some coho salmon for this, a fish species which would be a prime attraction on the market but which would be otherwise wasted if left to run upstream.

Is there any likelihood of DDT in Cold Lake cohos?

It is not known whether this will be a problem. Although areas adjacent to Cold Lake have received some treatment with pesticides, drainage from Cold Lake Air Base, the only large community in the area, does not enter Cold Lake. Pesticide sampling is, however, being carried out as a precautionary measure.

Summary

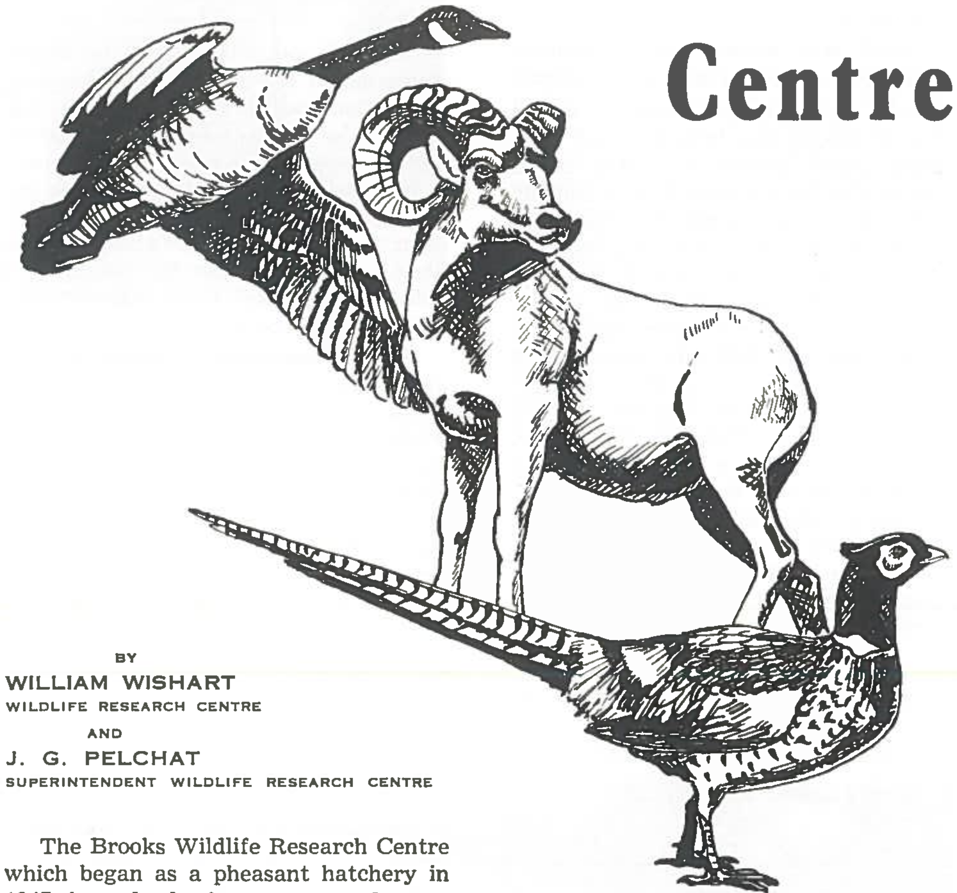
There is much hestitation in fishery circles about the dangers of introducing exotic fish species, and rightly so. The question of coho salmon introduction has been examined carefully and there is no possible risk of upsetting the environment. If for any reason the experiment fails to produce a fishery we will have lost very little, as the fish stocked will soon die and their offspring are unlikely to survive.

If the experiment is successful there are other lakes in the province that could prove to be more suitable for cohos and could produce bigger and more valuable fisheries. It is important that this be treated as an experiment and as a barometer to further use of the species and that its potential for Alberta be adequately assessed. It could prove to be one of the most significant events to Alberta's fisheries for many years.

C. HAGLUND

Shoreline of Cold Lake. The lake is 370 feet deep in spots, and appears to be ideal habitat for cohos

BROOKS Wildlife Research Centre



BY

WILLIAM WISHART
WILDLIFE RESEARCH CENTRE
AND
J. G. PELCHAT
SUPERINTENDENT WILDLIFE RESEARCH CENTRE

The Brooks Wildlife Research Centre which began as a pheasant hatchery in 1945 has slowly been converted to a research station during the past few years. Since the hatchery began, it has been visited annually by hundreds of tourists and busloads of school children. In the past, the facilities at the hatchery have been used occasionally by biologists and various institutions for fact finding projects. In recent years most of the activity at the station has been directed toward research, with particular emphasis on pheasants. Research activities have also been extended to include waterfowl and bighorn sheep.

PHEASANT RELEASES

The pheasants from the station have been used in various ways to evaluate the pheasant stocking program. It was found that hunters took fewer pheasants from early fall releases than from releases made just prior to opening day. In the latter case, Alberta hunters harvested up to 60% of the cock pheasants released. Although the hatchery provided approximately 4,000 pheasants annually for the past 25 years, the contribution to the yearly provincial pheasant kill

was about one percent. As with wild pheasants, fall and winter mortality (60% - 95%) took most of the survivors. Early fall releases of pheasants have been deemed uneconomical unless birds are released immediately prior to the open season.

Spring releases of hen pheasants are presently being investigated by using genetic marks or color phases as tracers of hatchery stock. Three distinct color phases, black, yellow and red are being used to distinguish hatchery offspring from the wild offspring (see back cover). The black phase pheasant is referred to as the "Melanistic", the yellow phase as the "Formosan" and the red phase as the "Mongolian" type. The Alberta ring-necked pheasant closely resembles the "Chinese" or "grey-rump" type. The results of these colored introductions as a measure of the contribution of spring-released hatchery birds are still being investigated.

A more recent development of pheasant releases has been to winter trap wild birds, hold them over winter and release them back to their place of origin in the spring. By using the isotope "Calcium 45" as a means of tracing the offspring, it has been found that following their release the winter captives made a significant contribution of young to the fall population of wild pheasants. Winter trapping and releasing in the spring appears to be a promising technique in pheasant management.

PHEASANT NESTING

Pheasants like most animals are governed by the law of inversity; i.e., when their numbers are high their production is low and when their numbers are low their production is high. In the case of pheasants, the mechanism controlling production may be related to the availability of suitable nesting sites. At Brooks various numbers of pheasants were placed in ½ acre pens containing nesting cover and allowed to breed and nest throughout the spring and summer. Where overcrowding occurred, production was low because of hens not incubating eggs that were laid either helter skelter or in dump nests. One hen attempted to incubate a conglomerate of 30 eggs in one nest (Figure 2) with no success. The significance of the experiment was that a few hen pheasants produced as many young as a large number of hens in the same amount of space. Thus, protection of hens in the fall hunting season may result in a surplus of hens in the spring that do not contribute significantly to the total nesting success.

W. WISHART

Figure 2. Hen No. 29 attempting to incubate a dump nest of 30 eggs.

W. WISHART

Figure 3. Aging pheasants by measurement of the first primary.

"SACRED COWS"

Pheasants are the only game birds in Alberta that can be readily separated into cocks and hens. As a consequence the hen pheasant has been protected from hunting while all other female upland birds have never been protected. Nevertheless, the other upland birds continue to thrive in spite of an annual fall hunting season on either sex. Banded pheasants from Brooks Research Centre have been used as population estimators for the past few years as an aid in a study at Scandia and Rainier to determine the effect of either sex pheasant seasons. Preliminary results indicate that hunters select for cocks in spite of the either sex season and as a consequence the maximum harvest of hens during a complete hunting season is not likely to exceed 60%. This maximum loss of

W. WISHART

Figure 4. Canada goose goslings, one day old on the left and one week old on the right.

hens due to hunting would be less than the average annual natural loss of 75%. A complete season on hen pheasants will be required to confirm the implications resulting from the Saturday hen seasons held in the past.

AGING PHEASANTS

For many years game managers have separated adult from juvenile pheasants by the spur size of the cocks or the depth of the bursa (a small pouch above the vent that occurs in both sexes). However, the main weakness of both the bursa and the spur as aging criteria is that their reliability becomes questionable after late fall and midwinter; i.e., the depth of the bursa of juveniles progressively continues to decrease and the length of the spur of the juvenile cocks continues to increase as the birds become older. At Brooks a new and reliable aging technique that can be as useful in the spring as in the fall was developed by using measurements from the first primary feather of the pheasant wing (Figure 3). The first primary was selected because its growth is complete when the juveniles are approximately one-half adult size. Thus, the juvenile primary is unlikely to be as large as an adult primary that is grown about the same time of year. Investigations are now being conducted on methods of aging adult pheasants beyond the age of one year.

PESTICIDES

Although volumes have been written on the adverse effect of pesticides on wildlife, much of the picture remains unclear particularly with respect to the animals near the beginning of the food chain. Pheasants are near the beginning of the food chain and are considered both primary and secondary consumers since they feed on both plants and insects. It is generally known what levels of certain pesticides will kill pheasants, but considerably less is known about the sublethal effect of most pesticides on laying, fertility, and hatchability of eggs or on survival of young. A case in point is the recent discovery of mercury in the tissues of Alberta pheasants. Aside from a possible public health problem it is not known what effect mercury has had on pheasant production in Alberta. The Brooks Research Centre could provide an excellent facility in helping to determine the effects of mercury on pheasants.

WATERFOWL

Some waterfowl biologists have stated that geese will some day outnumber the common mallard. They reason that landowners will not drain or fill lakes or ponds that harbour wild geese while their attitude to duck ponds is considerably less favorable. In any case, the geese are popular and some are re-

W. WISHART

Figure 5. Captive Canada geese at the Brooks Research Centre.

latively easy species to propagate and manage, particularly the Canada goose. The Brooks Research Centre has successfully hatched and reared Canada goose goslings for transplanting into the wild and has considerable potential in this regard (Figure 4).

Canada goose studies in Alberta have shown that production is adversely affected by both drought and floods. Drought allows easy access by predators to nesting sites on islands. On the other hand, spring floods inundate islands.

The best all weather goose nesting sites are those that are well elevated above the ground or water; for example, old haystacks, cliffs, and unoccupied hawk or heron nests. Sportsmen and naturalists have sometimes assisted Canada geese by placing washtubs in trees, building elevated platforms or floating rafts with a few straw bales for nesting material.

The reaction of Canada geese to artificial nest structures has varied considerably throughout the continent. In some cases, nesting structures were not used and in other cases all structures were used. It seems that once geese start to use artificial nest structures and reproduce successfully for a few years, the nesting density for that particular area can be increased by building more nest sites. The question has arisen as to whether the geese become imprinted to the artificial structure when they fall from the nest shortly after hatching or if they learn as subadults by observing adults use the structures the following year. Goose studies in Alberta indicate that the latter learning process may be the answer. With this in mind a small flock of Canada geese are being retained at the Brooks Research Centre (Figure 5). These geese will be trained to use platform nesting sites and hopefully their behaviour pattern will be passed on to their progeny and consequently to other subadult birds in the wild. Marshes or farm ponds as small as one-quarter acre are suitable for "trained" geese if artificial nest sites are available.

W. WISHART

Figure 6. Clipping wing feathers of a black duck for Canadian Wildlife Service trace element studies.

Another waterfowl project includes the work of the Canadian Wildlife Service which is presently using some of the Brooks facilities for trace element studies on the wing feathers of ducks. Trace elements in the feathers of birds have recently been found to be useful in determining the place of origin of migratory species (Figure 6).

BIGHORN SHEEP

A small herd of bighorn sheep has been started at the Brooks Research Centre primarily to test two theories on horn growth (Figure 7). Following the experiment it is proposed to release the bighorns into some of Alberta's badlands.

In a recent issue of Lands-Forests-Parks-Wildlife the influence of climate, soil and vegetation on the horn growth of Alberta bighorns was discussed. If we look beyond Alberta's borders we find what appears to be another factor affecting horn growth of wild sheep. When one examines the ram horns of thinhorns, Rocky Mountain bighorns and desert bighorns a typical relationship is found, that is, maximum size horns are found in the centre of the range

Figure 7. Superintendent J. Pelchat "weighing in" a young bighorn.

and they taper off to smaller sizes at the extremes of the range. However, the horn size in relation to body size shows a different trend. As one proceeds from north to south the horn weight to body weight ratio in rams increases. In general, northern thinhorn rams have medium weight bodies with small horns, central Rocky Mountain rams have heavyweight bodies with large horns and southern desert rams have lightweight bodies with large horns. Although horns are generally considered as weapons, shields and display organs, a fourth function may be for body temperature regulation. It seems reasonable that large bare vascular extremities such as horns would be a disadvantage in cold climates and more advantageous in warm climates. It is not likely that arctic sheep would survive comfortably in the desert nor would desert sheep survive well in the arctic; it appears then that there have been genetic adaptations in body size and horn size to accommodate nearly opposite environments. Latitudinal and altitudinal differences in horn growth over fairly large regions imply that bighorns are forced by circumstance to grow horns to fit their environment. In other words, if a bighorn is raised in a cold environment on a low plane diet, his horn growth will be minimal and heat loss will not be excessive. Conversely, a bighorn that is raised in a warm environment on a readily available diet will maximize horn growth which can serve as a cooling mechanism.

It is possible that Alberta bighorns are not separated far enough latitudinally to show major genetic differences in horn growth. However, it still remains to be proven whether the differences in horn size in Alberta bighorns are genetic or nutritional. The present plan is to rear bighorns from the north and from the south at the Brooks Research Station to determine if differences in growth occur when the two groups are raised on the same food in the same environment. If each group grows at a different rate and is different in size, a genetic difference will be implied. Under these circumstances quality of bighorns in Alberta may be improved by introducing the southern strain into the north. On the other hand, if there are no growth rate differences between the two groups, this will imply an equal response to the same forage and environment. In this case, every effort should be made to improve and enlarge our present and potential high quality bighorn ranges south of the Bow River.

SOILS

The Dynamic Portion of Our Earth's Surface

BY C. D. SAWYER

Many of the items which assist in the satisfaction of human wants and needs originate in soils. Soil is the medium in which plant life grows, which in turn is the food for our domestic livestock, our wildlife, our waterfowl, and directly or indirectly, man himself. Soil forms the basis of recreation in its many and varied forms, in parks, in golf courses, in playgrounds, viewpoints; in fact anywhere it serves as the base to grow the necessary grasses, trees, and shrubs. Soil is an important component of land. The sands are soils which form the beaches of our lakes and oceans. In the ultimate, soils sustain human life and welfare.

Being so vital to all life, we should further understand some of the aspects of this component. It is the purpose of this article to introduce some aspects of soils thought to be of interest and of importance.

Soil has been defined as: "A natural body of mineral and organic constituents, differentiated into horizons of variable depth which differs from the material below in morphology, physical makeup, chemical properties, composition and biological characteristics." Soil may be considered to be a three dimensional piece of landscape, having slope, area and depth. It is the outer layer of the earth's surface, ranging in thickness from a mere film, such as on some of our mountain slopes, to a depth of ten feet or greater in other areas. It is in some way altered from the underlying geologic material. It is the moving, massive, dynamic portion of the uppermost portions of the earth's surface.

Dokuchaev, who studied and worked in Russia almost 100 years ago, was one of the first to recognize soils as a unique "body", separate and independent from the earth beneath. This is called the soil solum as we know it today. Although a geologist by training, his primary interest was soils. He was ideally located to conceive the new concepts with opportunities to observe a variety of soils from the black Chernozems of the Ukrainian Steppes through leached Podzols of Siberia to the frozen soils of the northern tundra. Previous to Dokuchaev, some Danish geologists viewed the ashy, white leached horizon of Podzolic soils as a geologic stratum and formed in situ as part of the earth's crust. Dokuchaev and his pupils in Russia did not promote this concept but spearheaded the science of soils as separate from the science of geology. Many soil terms used today are recognized as being of Russian origin. Examples: Podzol has its root in the Russian word

"zola", meaning ash, a reminder of the ashy-grey color of the A horizon of our Gray Wooded Soils. Solonchak (very salty), solonetz (salty or less salty), are of Russian origin. Chernozem in Russian means "black earth", referring to the black characteristics of deep Chernozemic soils of the Ukraine, quite similar to those found in central Alberta.

Western countries were initially interested primarily in soil-plant relationships. They were interested in identifying the factors important to plant growth. An indication of this were the classic experiments and reports of Liebig in 1840, asserting that carbon for plant growth was derived from the atmosphere and not from the soil. Near this time Lawes and Gilbert initiated experiments with plant growth on the famous Rothamsted plots of England. These plots have been under test continuously since about 1843 with only minor adjustments in cropping sequences. Experiments in all phases of soil science have been conducted on these experimental fields and enormous quantities of data have been obtained. Similarly, early American soil scientists turned their attention to plant-soil relationships. Out of this grew the science known as Agronomy.

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Eluviated Black

Recognition of soils as a separate body was slow to be appreciated in the West. Soils as a three dimensional independent dynamic body was the Russian concept. Language barriers and internal strife prevented the Russian knowledge from reaching the western countries. It was not until 1912 and later that the relationships, climate, vegetation and soils were recognized. This recognition was imperative for scientific progress in understanding plant-soil relationships. Thus was born modern Pedology, the study of soils as an independent body.

Next, we might have a closer look at soils, to determine just what it is. Soil is a fascinating mixture of sand, silt, clay, humus, decaying plant and animal matter, and countless numbers of plants and animals. Water and air should also be considered as important constituents. While the proportions of sand, silt and clay in soils are important for plant and animal growth, the most dynamic part of the soil is organic matter. Soil organic matter consists of a series of break down products of plant and animal material, of which the more stable and product is humus. Humus gives soil the blacklish colours which we are familiar with. It is also important in giving good soil tilth, and in supplying a source of nutrients for plant growth.

Soils are biologically tremendously active. Macroorganisms found in soils include gophers, mice, moles, insects, millipedes, slugs, snails and earthworms. Among the microorganisms can be found protozoa, fungi, molds, yeasts, actinomycetes, bacteria, and others. An indication of the numbers and weights of microorganisms in the soil is that a 6 inch slice of the top of an acre of reasonable fertile soil may contain 400-500 pounds of bacteria, and 500 to 600 pounds of actinomycetes. Like all of nature's organisms, they have tremendous abilities to multiply their numbers under favourable conditions. Similarly, they are very susceptible to environmental changes. An environmental change will result in the invasion of another organism. An example may be a change of drainage, where increased soil moisture will inhibit aerobic (oxygen demanding bacteria) and favour anaerobic, (bacteria not needing oxygen). Another example of environmental factors and microorganisms is that under acidic conditions, such as common in the upper horizons of forest soils, soil fungi are the most active. Actinomycetes and bacteria are very susceptible to acid changes and are prevelant under neutral to slightly basic conditions. You may be familiar with the aroma of active actinomycetes in newly spring cultivated soil, either in the garden or on the farm.

Also combined in the soil interlocked system of dynamic microorganisms equilibrium are killing agents such as bacteriophages, antibiotics, etc. Penicillium, streptomycin, aureomycin were first isolated from soils. In 1929, Fleming announced the antibiotic effects of Penicillium notatum, a bacteria common to soils.

The above discussions indicate that soils are separate three dimensional bodies, easily identifiable from the undifferentiated materials below, that they are made up of sand, silt, clay, humus and organic matter, and are the basis of all plant and animal life. Other important aspects of soils are that when viewed horizontally, such as from a road cut, we see easily recognizable layers called horizons. These horizons constitute the soil profile. In a soil profile, four main horizons are observed. These are the L-H A, B, and C horizons, surface downwards. The L-H horizon, when present, is made up of loose organic material, undecomposed, or slightly decomposed. The A is the top mineral horizon, underlying the organic L-H when present. Since it is the surface mineral horizon, it is the most important, particularly in chernozemic soils. The B horizon underlies the A, and is some way changed chemically or physically, from the A above and the C below. The C horizon occupies the lower portion of the soil profile and generally represents the parent material, theoretically the same material from which the horizons above were developed. Since it is the parent material from which the above horizons were formed, it is geologic in origin, unchanged by the soil forming processes. The above major horizons are subdivided to lesser horizons, which may or may not be present.

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Brown Solonetz

Soils of vastly different characteristics exist throughout the world. From the tropics, through the savannas, the deserts, the steppes or grasslands, the forests, the taiga, and the tundras, we observed vastly different soils. Examples perhaps unfamiliar to some of us include the Desert Gray Soils, Red Soils of the Desert, the Sierozems of the Desert, Lateritic Soils of the Tropics, the Grumisols, or self mulching soils, Red and Yellow Podzolics, Arctic Polygonal Soils, etc. The Chestnuts or Brown Soils of Southern Alberta, Chernozems of the Parkland, Gray Woodeds of the forested areas are more familiar. A zonation of Alberta soils may be as follows: Brown, Dark Brown, Thin Black, Black, Dark Gray and Gray Wooded.

The Brown and Dark Brown soil zones consist of the prairie grassland areas. They are brown in colour, formed under annual rainfalls of less than 15 inches and fairly high summer temperatures. The Brown soil zone contains our natural grazing lands of the prairies. Experience has shown they are best kept under a grassland vegetation to prevent soil drifting. The Dark Brown soil zone is also partially grassland with some areas being used extensively for cereal crops. Land his been developed for irrigation in these regions.

The Thin Black soil zone is transitional to the Black zone. It consists of the Parkland areas, frequented by poplar bluffs. The Black soil zone of Alberta is the most productive, both for agriculture, wildlife, and forestry. The deep black soils of this area are well supplied with plant nutrients, have optimum physical characteristics, are easy to cultivate and generally receive a favourable supply of rainfall for plant growth. They have formed under a grassland vegetation.

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Brunisolic Gray Wooded

Dark Gray and Dark Gray Wooded soils are transitional, or between the Gray Wooded and Chernozemic in their developed characteristics. They are characterized by a moderately leached (Ae) horizon as a result of degradation of the original deeper black A horizon. The true or Orthic Gray Wooded, common to forested areas, is characterized by a severely leached Ae horizon where the fine textured clay particles have leached downward to the underlying B horizon. The black (Ah) horizon in these soils is either non-existent or very minimal. An organic L-H horizon, primarily from fallen leaves, lies on the surface.

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Orthic Podzol

In these soils the rains washing acidic leachate from the deciduous and coniferous tree cover has degraded the upper black Ah soil horizon to the leached gray Ae horizon and the underlying Bt horizon of illuviation (clay enrichment), in a process called Podzolization.

A description of Alberta soils would be incomplete without mention of the poorly structured Solonetz or hardpan soils. These soils are scattered over large areas of eastern and northern Alberta. They occur on all soil zones and are the result of high sodium or magnesium content in the subsoil or parent materials from which these soils were formed. As a result, an impermeable Bnt, hardpan horizon has formed. This horizon is very hard during dry spells, preventing root penetration, swells tremendously when wet, preventing water entry. These solonetz soils are troublesome and of low productivity regardless of location.

Interspersed in the soil zones may be found Gleysolic or Meadow soils. They are common in low, poorly drained areas. The soil profile is generally a drab, blue colour when moist, and when dry, is characterized by reddish blotches of iron oxides.

Organic (peat or moss) soils, as indicated by name, consist mainly of raw and decomposed mosses, sedges, shrubs, etc. The organic layer is generally greater than 12 inches. These soils are interspersed with mineral soils in central and northern Alberta.

The purpose of this article has been to point out some of the more interesting features of our soils, and provide some limited information. Some aspects of the early history of Soil Science have been reviewed. Soil ecology, micro and macro-organisms have been discussed. Soil horizons, soil zones have been noted, particularly those pertaining to Alberta. Naturally, much more could be said on all of these aspects of soils plus other soil features. It is hoped that the article has stimulated a further appreciation of soils by all readers.

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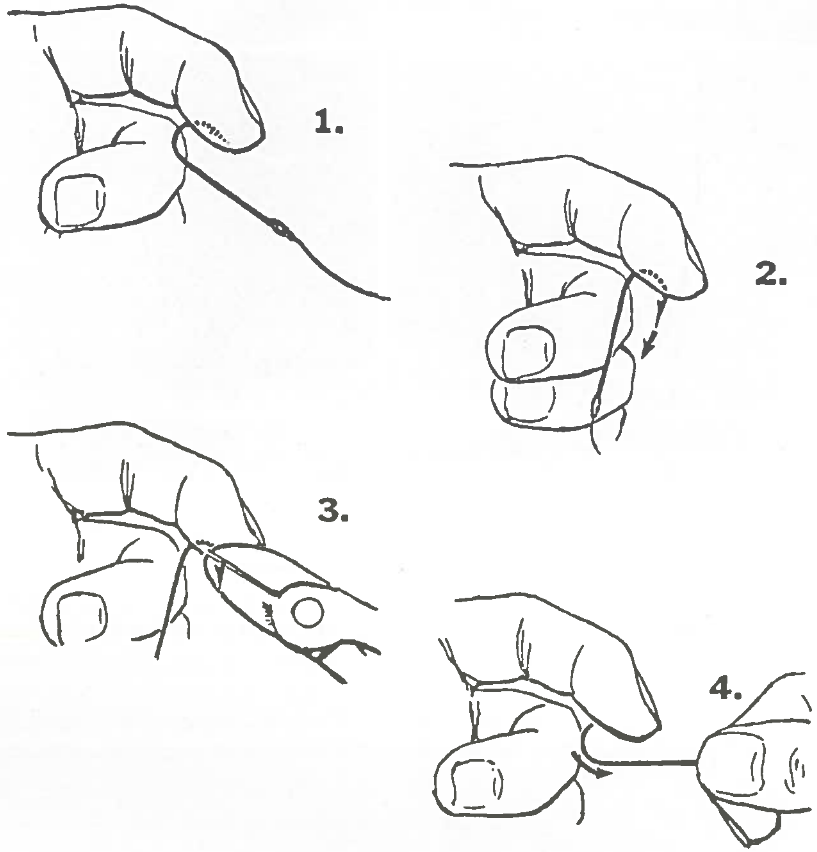
HOW TO

REMOVE FISH HOOKS



With hook's point just under skin, push point and barb the rest of the way through, snip off hook behind the barb, and pull hook out. Allow wound to bleed freely, then disinfect.

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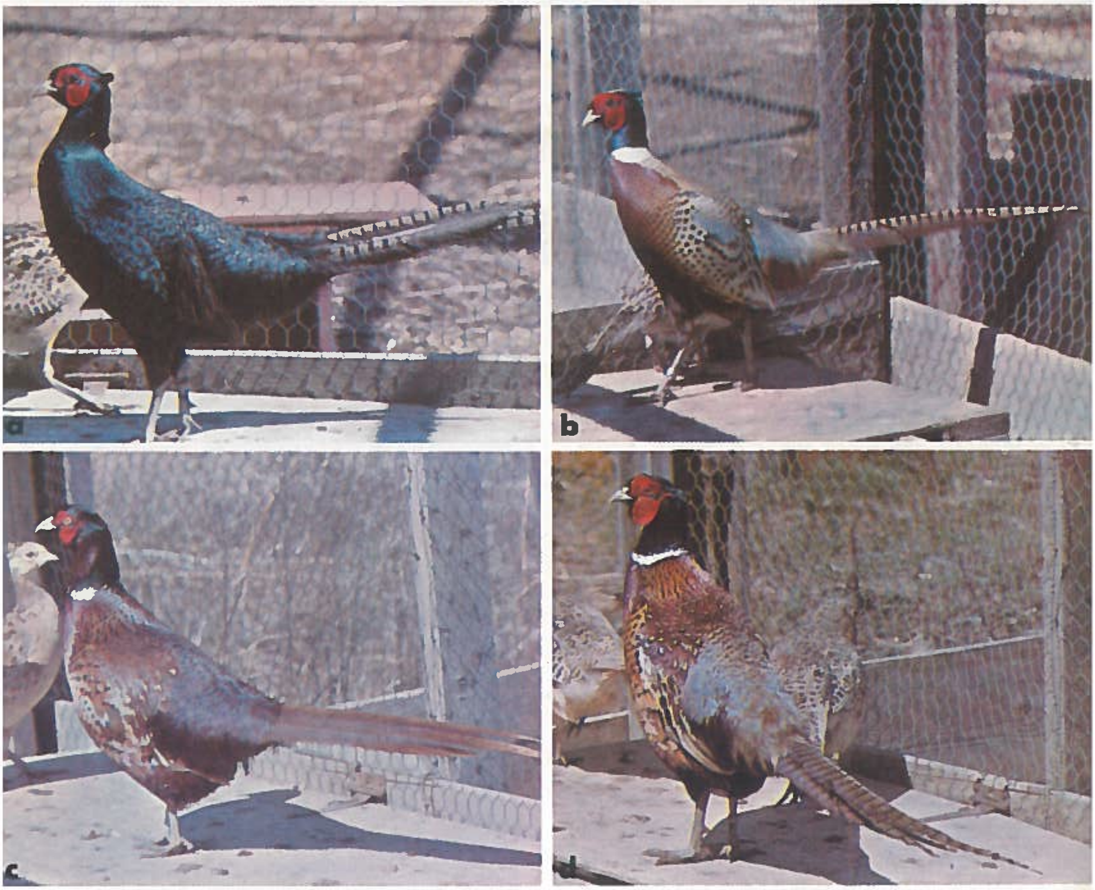

W. Wishart

Color phases of pheasants that are used for "genetic marks" at the Brooks Research Centre

(a) black phase or "Melanistic"
(b) yellow phase or "Formosan"
(c) red phase or "Mongolian"
(d) Alberta ring-neck or "Chinese"

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