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THE BEAVER OF THE RIDING MOUNTAIN, MANITOBA

AN ECOLOGICAL STUDY AND COMMENTARY

By H. U. GREEN

To
Grey Owl,
In Admiration,
I Dedicate the Labour
of this Study.

FOREWORD

THE PURPOSE of a field study is usually twofold:—to increase one's knowledge, and to augment, if possible, the work of other naturalists. There appears at this time, however, when many species of game and fur-bearing animals are fast approaching extinction, the need of including a further design:—to create in the mind of every nature lover a greater aesthetic and economic appreciation of their value to the nation and the necessity for their preservation in reasonable numbers as our heritage to future generations.

"The Beaver of the Riding Mountain, Manitoba", the second of a proposed series of ecological studies covering the larger forms of mammalian life indigenous to the Riding Mountain National Park, could, apart from local comment, well apply to the beaver throughout its North American range, were it not for the fact that certain of its habits deviate in relation to the many diverse environments in which it exists. Therefore, every isolated range differing from another in ecological association presents individual problems which may necessarily change or modify characteristic behaviour in accordance with the demands of the local surroundings. In consequence, the accumulated data must be considered as referring to the beaver of the Riding Mountain, although much, if not all, may be applicable where similar conditions prevail. It is not suggested, though, that extreme deviations from accepted beliefs

Grey Owl

are disclosed, but rather that variations of certain conduct may be evident to investigators whose knowledge has been gained in other parts of Canada and the United States. This I infer from my own experience.

From the spring of 1930 until the autumn of 1932 the work proceeded in conjunction with a study of the Riding Mountain wapiti*. It was pursued during 1933 to the late summer of 1934 as a specific investigation, covering broadly the entire Riding Mountain range. Most of the data, however, were acquired from three beaver families and the locations providing their habitat requirements.

Although every observation was recorded with strict regard to scientific accuracy, many of my deductions from circumstantial facts may be capable of other interpretation. To believe otherwise, in the case of the beaver, would indeed savour of extreme presumption, especially as the study is entirely original and presented without reference to the findings of other authors. I have merely written of what I learnt of this intensely interesting mammal during many delightful months' residence in the wilderness at all seasons of the year, including in the text a brief history and description of the beaver of the Riding Mountain, together with some constructive comment and a series of original photographs from the Riding Mountain range. If the reader derives pleasure and understanding from my efforts, the field work incidental to the study, often performed under adverse conditions, will acquire an added value.

I wish gratefully to acknowledge the financial assistance tendered by the T. Eaton Co. Ltd., Winnipeg, Manitoba, who generously contributed towards the expense of the work performed in 1933 and 1934. I also greatly appreciate the courtesy extended by The Commissioner, National Parks of Canada, for permission to pursue the study, and the interest and kindness of Mr. James Smart, Superintendent, Riding Mountain National Park, and W. A. Scott, Chief Warden. I am further indebted to my good friends, Grey Owl, ex-Constable Mark Goldie, Royal Canadian Mounted Police, and A. Burton Gresham, for their helpful aid.

H. U. GREEN.

Mistamick Lodge,
Dauphin, Manitoba,
December, 1934.

INTRODUCTION

The Riding Mountain may be described as an elevated plateau consisting of some 600,000 acres of forest and bushland rising above the semi open prairies of central Manitoba.

Terminating in steep escarpments cut by deep ravines, and with successive benches indicating the receding shore lines of ancient Lake Agasiz, the northern and eastern boundaries of the "mountain" attain an elevation of 2200 feet above sea level and 900 feet above the plains below. The southern and western borders, however, merge imperceptibly into the surrounding terrain with a gradual loss of altitude. Near the northwest extremity of the plateau a valley, several miles wide at its greatest breadth, separates the Riding Mountain from the Duck Mountain, a range of high hills extending northward for many miles with similar escarpments to the north and east and benches of equal elevation.

Evidence of glaciation is abundant throughout the Riding Mountain area in the form of huge boulders of striated Devonian limestone and other rocks of Cambrian and Precambrian origin from the Canadian shield, besides many lateral and terminal moraines.

The flora and fauna of the Riding Mountain are typical of the border of the Transition and Canadian Life Zones. Dense forests of Black and White Spruce dominate the higher elevations, but here and there destruction by fire has created many extensive stands of Aspen Poplar which shelter solitary bluffs of coniferous survivors and a host of coniferous seedlings seeking an ultimate return to a natural climax.

At the lower elevations, to the south and west, the coniferous forest gives way to Aspen and Balsam Poplar, Box Elder, White Birch, Bur Oak, and Ash, interspersed with small belts of Spruce, Tamarac swamps, marshy meadows, and park-like regions of limited extent.

The original fauna, with the exception of the beaver and several predacious mammals that have become exterminated during recent years, is, generally, well represented.

Few lakes of any size exist, but many small streams rise about the divide at the height of land, creating an extensive watershed draining from the north slope into Lake Dauphin on the plains below the northern escarpment, and from the south into Lake Audy and Clear Lake.

After a winter of average snowfall the watercourses are miniature torrents for several weeks, but unless replenished by spring rains, soon dry up, except in the vicinity of springs and where potholes and beaver ponds exist. Throughout the summer and autumn the watercourses alternately rise and fall in accordance with the frequency and degree of precipitation.

* The Wapiti of the Riding Mountain, Manitoba, by H. U. Green. *Canadian Field-Naturalist*, 47: 105, 122, 150, 172, 1933.

The banks of the larger streams, situated in deep valleys the floors of which are from 100 to 300 yards in width, are, for the most part, heavily wooded with Aspen Poplar between stands of Spruce, offering an unlimited supply of food and building material for beavers.

Some thirty years ago, at the advent of the surrounding agricultural settlement, the Riding Mountain was set aside and administered as a Dominion Forest Reserve. The wild life resources during the major part of this regime were controlled by the government of the Province of Manitoba. In 1930, it was included in the chain of National Parks, under the complete jurisdiction of the federal government. Failing these commendable policies it is safe to say that the Riding Mountain with its forests, scenic beauty, and wild life, would long have ceased to exist as virgin terrain.

Of the three inhabited beaver locations especially under observation, two were situated in the valley of the Vermilion River near its source, approximately one mile east and one mile west respectively of Mile 32 Cabin on the Dauphin — Clear Lake road. The other was situated on a tributary of the Vermilion River known as Spruce Creek, about 200 yards to the west of the Dauphin—Clear Lake road at Mile 35. They are identified and referred to in the text as Sites Nos. 1, 2, and 3. Each location was inhabited by only one family of beavers; an adult male and female and the young of the year.

In referring to the Vermilion as a river, I have been guided by the local topographical terminology, for as such it appears on all maps of the district. However, to apply this designation to the locus of study without explanation would suggest a greater volume of water than actually flows at any season of the year and so create an erroneous impression of the work accomplished by beavers to stem the flow. The Vermilion River at, and near, its source is merely a creek which gains size from many tributaries as it wends a tortuous way from the hills. The width of the river bed above Site No. 1 is approximately 10 feet, and above Site No. 2 approximately 12 feet. Spruce Creek above Site No. 3 is approximately 5 feet wide.

The following air temperature extremes were recorded during the course of the study:—

Summer maximum:	July	102.F
Summer minimum:	July	43.F
Winter maximum:	January	38.F
Winter minimum:	"	minus 46.F

HISTORY

The history of the beaver of the Riding Mountain is the history of all fur-bearers with a price on their pelts existing near the haunts of Man,—a story of willful and illegal destruction bordering on extermination.

A few terse remarks of little value may be gathered from many old residents of the district who speak of previous abundance in the early days of settlement, and reminiscently relate their adventures in the Riding Mountain while poaching the beaver (and other fur) to supplement the meager reward for their initial agricultural activities.

Local Indians, generally a valuable source of information regarding wild life conditions of the past, have little to offer, mainly because of their reluctance in the old days to visit the Riding Mountain, believing it to be the abode of evil spirits. They do say, however, that many beavers once lived there "before the white man came to plough the land".

In themselves such data, although undoubtedly authentic, lack sufficient detail to be of much value. Fortunately, though, the beaver of the Riding Mountain has written its own history; for remains of their work undeniably tell of once wide distribution and probable population, dating back many years before the tide of civilization surrounded the Riding Mountain range, sweeping them almost to oblivion.

Exploring the streams in search of evidence one cannot fail to be impressed by the number and extent of old beaver signs. Innumerable lodges ravished by the flight of time, overgrown with willows and grass, stand tomb-like in the valleys as if sheltering the spirits of the vanished occupants; brush dams broken and bleached by the sun of years streak the now arid flats and meadows where once dense lush grass grew, and countless ranks of beheaded aspens in various stages of decay, but bearing the marks of chiselling teeth, relate a saga of the beaver's passing better than mere words can describe. In a few years little will remain to remind us of the folly of human greed, except a few heaps of crumbling debris. It is well, perhaps, that the sun, wind, and rain, will eradicate an uncherished memory of an inglorious period in the local history of a wonderful animal whose one appreciated value is a coat of glossy fur.

There is indisputable evidence to support the fact that up to forty years ago the beaver population of the Riding Mountain within the area of what now is the National Park exceeded two hundred families, maintained from year

to year through economic trapping by persons from the neighbourhood of old Fort Elphinstone, who, with an eye to the future, practiced methods of conservation disdained to-day wherever beavers exist. Ten years ago a liberal estimate would not account for more than thirty families. During the period of my investigation only eight families could be located, although, without doubt, a few more may have been hidden away in the deep forest. Of this remnant five or six families would appear to be the limit of beaver population in the Riding Mountain National Park, and even they are ever in danger of being destroyed.

It is not strange that persons whose attitude towards furbearing animals is tinged with commercialism should seek to attribute some reason for the decimation of the beaver of the Riding Mountain, other than destruction for monetary gain. Failure of food supply, drought, and disease, are among the suggestions advanced. All are insufficient and merely remote possibilities offered without consideration. My investigation, I believe, proves conclusively that there is not even one circumstantial fact to support these assertions. However, why consider an apologetic explanation when there is sufficient proof to the contrary? The hill billy type of settler with no ideas of conservation or of the æsthetic value of wild life is still responsible for the beaver's destruction as in the early days of settlement. In less degree to be sure, but more devastating in view of ever-decreasing numbers.

CLASSIFICATION AND DESCRIPTION

Common Name:	Beaver; American Beaver.
Local Indian Name:	Ah-meek (Salteaux)
Order:	Rodentia.
Family:	Castoridae.
Genus:	Castor.
Type Species:	*Castor c. canadensis* Kuhl.
Type locality:	Hudson's Bay.

The beaver of the Riding Mountain is *Castor canadensis canadensis* Kuhl.

The genus Castor is represented in North America by several species and sub-species whose habitats extend from Newfoundland to Vancouver Island and from the Rio Grande to the Arctic Circle. They differ slightly in size, colour, or cranial characteristics.

The following description, weights and measurements of the beaver of the Riding Mountain were made from three dead adult specimens, two males and one female, three years or more of age, and one male juvenile, also dead, about five months old. Two two-year-old specimens, male and female, collected alive for restocking purposes while supplying descriptive information regarding sex, colour, etc., could not be weighed or accurately measured under field conditions. The weights and measurements of several small "kittens" were also neglected as I was reluctant to handle them very much. The dead specimens, although not from the locations especially under observation, came from the same region.

Colour of Adults

Upper-parts: Under-fur, rich medium brown, dense, and curly; surface pelage, rich chestnut with dark guard hairs; head and shoulders, slightly brighter than body.

Under-parts: Under-fur, dull medium brown; surface pelage, dull brownish chestnut.

No perceptible difference between male and female.

Colour of Juvenile

The same as the adults only more subdued.

Colour of "Kittens"

Slightly duller than juvenile.

Weight of Adults

Males:	(1)	35.2 lbs.
	(2)	33.6 lbs.
Female:		38.5 lbs

Weight of Juvenile

8.3 lbs.

Measurements

Males:	(1)	T.L. 39"	T.V. 12.8"	H.F. 5.9"
	(2)	T.L. 36"	T.V. 12.6"	H.F. 5.8"
Female:		T.L. 38"	T.V. 12.5"	H.F. 6"
Juvenile:		T.L. 19"	T.V. 6.3"	H.F. 3.8"

Although the beaver, by virtue of dental characteristics is essentially a rodent, it differs sufficiently from other members of the order Rodentia to warrant a detailed description of certain parts of its anatomy to understand better their use in adaption to a specialized existence.

TEETH.—Twenty in number, equally arranged in both upper and lower jaws. The incisors, four in number, long and scalpriform, grow from persistent pulps. Sixteen molar teeth serve to complete the dental arangement. The enamel of the incisors is reddish brown or orange in colour. It is thicker and harder on the anterior

surface so that a sharp edge is preserved by the wearing away of the softer posterior portion, thus producing a constant chisel-shaped crown. The continual growth of the incisors must be compensated by wear to prevent abnormal development. The molars are strong, rough, with the tissues arranged like the molars of the Ungulates for the purpose of reducing vegetable fibre for food. They have no other use. It is the incisor teeth which serve to cut down trees, etc.

The largest incisors taken from the specimens examined measured, along the anterior curves, as follows:

Lower Pair: 91 mm. Exposed portion: 22 mm.
Upper Pair: 67 mm. Exposed portion: 18 mm.

DENTAL FORMULA

I.	C.	P.M.	M.
1-1 / 1-1	0-0 / 0-0	0-0 / 0-0	4-4 / 4-4

LIPS—The lips are well haired and meet behind the incisor teeth, a wise provision of nature to enable the beaver to work under water without inconvenience.

NOSE—Small, but with relatively large nasal cavities equipped with valves which are closed by voluntary muscular action when the animal is submerged.

EYES—Deep brown in colour, and small in comparison with size of body. Iris black or blackish brown. The eyes of very young beavers are much larger in proportion to their size.

EARS—Comparatively small but very conspicuous when the animal is swimming or resting on the water. Internal orifices closed by voluntary muscular action while submerged.

FRONT FEET—The front feet or "hands" are relatively small. They have five digits terminating in claws of medium length, are sparingly haired and devoid of connective tissue. The "hands" are used in typical rodent fashion for digging, etc., and for holding food when eating.

HIND FEET—The hind feet with five digits are webbed and terminate in long nails rather than claws. A peculiarity is the construction of the two inner nails of each foot which, generally speaking, are double and, to a certain extent, opposable. The supernumary to the inner nail is much shorter than the nail proper, and not as hard. The supernumary to the second nail is of almost equal length, but somewhat blunter. Their purpose is undoubtedly to act as implements for combing the fur and, perhaps, to remove parasites from the skin.

TAIL—Horizontally flat and paddle-shaped and composed for the most part of gelatinous tissue rich in fat. The thickest part is close to the body and along the median line, from which it thins out to the extreme end and sides. Both upper and lower surfaces are naked, except near the junction of the body which is densely haired, and covered with transverse rows of small scales, between which grow a few widely separated minute hairs. The colour of the tail is murky grey.

Tail measurements (naked parts only) of specimens examined and approximate number of scale rows is as follows:

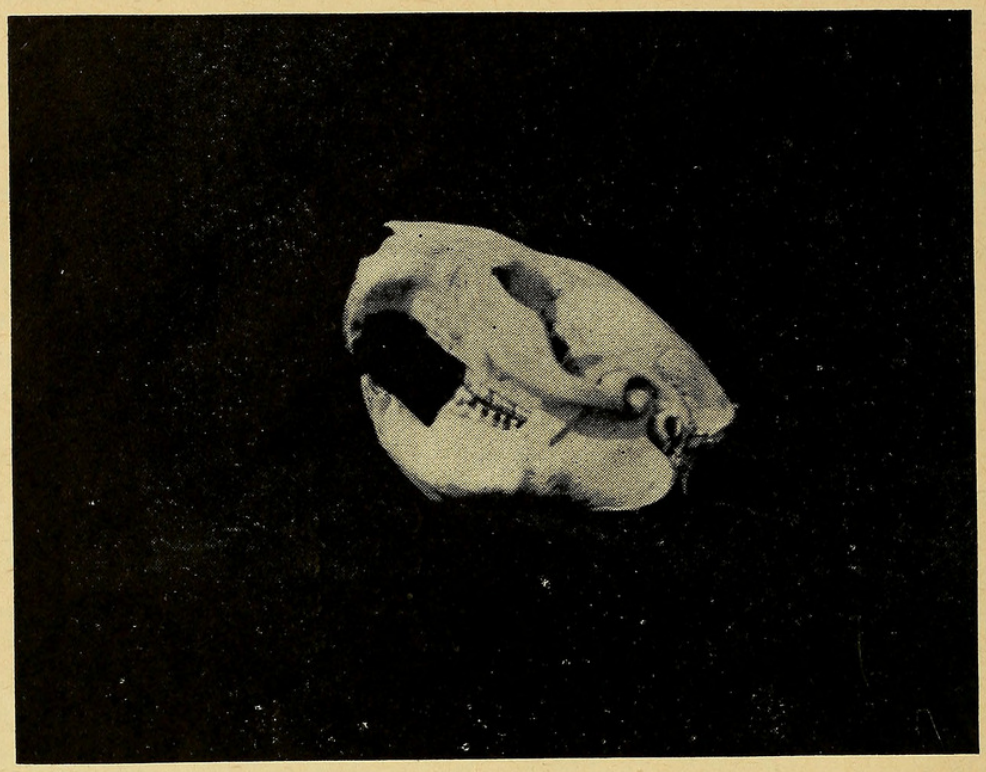
	Length	*Ex.Width*	*Ex.Thickness*	*Scale Rows.*
Males				
(1)	9.1"	4.5"	1.4"	78
(2)	8.9"	4.2"	1.2"	75
Female	8.5"	4.6"	1.7"	81
Juvenile	4.2"	2.8"	.8"	76

GENITALS—The copulatory and urinary organs of both male and female beavers are not visible externally. Their openings are situated within the anal orifice, which thus becomes a general purpose outlet or cloaca. It is, therefore, difficult upon cursory examination to distinguish one sex from another. However, manual manipulation will cause the penis of the male to protrude, and failing this the testes may be felt by pressure. Determination of sex in the female is without difficulty after the first parturition, for loose mammary glands and elongated teats afford positive evidence.

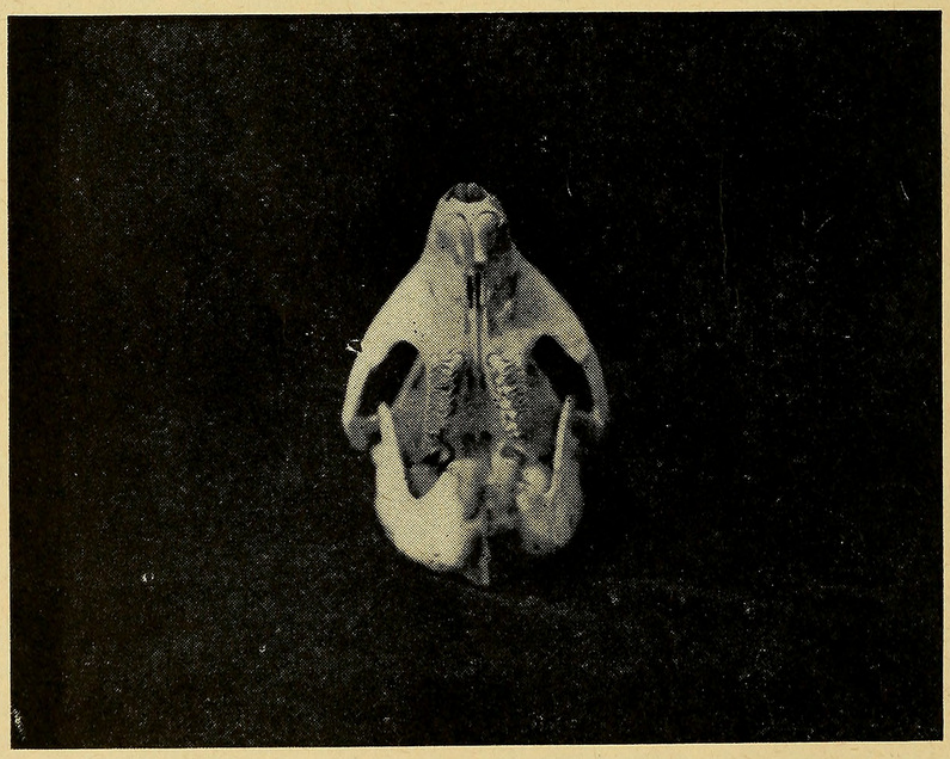
MAMMARY GLANDS—The female mammary glands with four teats are in the pectoral region, one pair between the fore legs and the other pair a few inches toward the abdomen. The male is endowed with four rudimentary teats or nipples. The teats of virgin females are only slightly larger than those of the male.

ANAL GLANDS—Two pairs of large internal glands are present in the region below the cloacal orifice, one behind the other. The anterior pair, which are the largest, secrete castoreum, and the posterior pair, an unctuous fluid apparently used for oiling and water-proofing the fur. The secretion of the latter oozes through the skin when pressure is applied, and seemingly the only outlet for the fluid is by percolation. On the other hand, castoreum is, I believe, voided per cloaca by voluntary muscular action.

Castoreum has a somewhat musky smell not at all unpleasant to a nose familiar with animal odours. It is oily and, apparently, slightly volatile. The secreting glands are known commercially as beaver castors.



Teeth and skull of beaver. Side view.



Teeth and skull of beaver. Front view.

Photographs by H. U. Green.

Teeth of beaver. Occlusal view, showing condyles and glenoid fossa.
Photograph by H. U. Green.

WALKING; SWIMMING; DIVING

An aquatic mammal in every sense of the word, the beaver is literally out of its element when on land. Progress is slow and cautious, a few ambling steps at a time with body close to the ground, punctuated with a moment's survey of the immediate surroundings before proceeding on its way. The gait is simple, that is the fore legs are followed by the hind legs on opposite sides.

The attitude of the beaver on land is similar to that of all wild things finding themselves for the time being at a disadvantage and helpless to frustrate an attack by prowling enemies. When suddenly disturbed the beavers under observation invariably turned towards the water and, with a galloping gait, ran as fast as their short legs could carry them, reminding one of a lusty woodchuck seeking the sanctuary of its den. This does not mean that walking is a tiresome means of progression, for, as a matter of fact, migration and casual jaunts take them far afield on land.

The beaver's lack of terrestial agility, however, is compensated for by many masterful accomplishments in water, for swimming on the surface or submerged they move with ease and grace at a moderate speed which does not exceed two or three miles per hour. From observation, I should say that the beaver's submerged speed is about equal to progress on the surface.

While swimming, the fore legs are not used, and hug tight to the body out of the way. It is difficult to ascertain positively in what manner the hind legs are utilized, but the evidence is in favour of alternate strokes rather than both legs struck out together.

Change of direction when swimming slowly is, I believe, accomplished by single strokes of either leg applied like the oar of a rowboat according to the direction desired. Turning when swimming in a direct line at top or moderate speeds appears to be performed by rudder-like movements of the tail slightly inclined towards the vertical, the feet being used as an auxiliary. I have never seen the tail employed as a means of propulsion, or any movement which would suggest that it is so used.

The difficulty of making positive assertions in regard to the swimming habits of the beaver is obvious, and it would be interesting to observe the animal in a glass tank of clear water and learn without question how the various movements are performed and the action of the tail as a horizontal plane for controlling ascent, descent, and submerged swimming depth.

Excessive speed is seldom, if ever, necessary in water. Hiding with body submerged and nose above the surface, or seeking the protection of a well concealed den, is more to be desired and infinitely more practical than speeding away in full view of a possible enemy.

Unless otherwise desired, diving is an almost noiseless action, a few bubbles and the concentric circles of small ripples are often the first intimation one has that a beaver has submerged. They seem to slide into the water whether from land, the eaves of their lodges, or some floating log upon which they have been dozing in the sun.

How long can a beaver remain under water without coming to the surface for air? is a question often asked. Two out of many unsuccessful attempts to gain this knowledge throw some light on the subject, but whether or not the beavers were forced to the surface to breath, it is impossible to say. One dived and swam submerged in a direct line towards its lodge breaking surface 58 seconds later. Another, probably the same beaver, as both observations were made at Site No. 1, remained beneath the water for 1 minute and 4 seconds. The indications of each observation were such that there was no doubt the individuals who dived were the same who later re-appeared. It was for want of sufficient evidence to establish identity that many other observations were without value. Sometimes, too, beavers after diving did not re-appear within one's range of vision. They either swam direct to their lodges or dens, or hid among cover about the edge of the ponds. Questionable observations, however, would indicate that beavers may remain under water for from two to four minutes.

A discussion of the swimming and diving ability of beaver "kittens", is reserved for a later chapter.

(*To be continued*)

NOTES ON THE GENUS CYSTIDICOLA IN CANADIAN FISHES

By ELLA EKBAUM

THE MATERIAL upon which the present study is based was obtained from the examination of 170 specimens of different species of Pacific salmon during the months of July and August in 1934. The coho, *Oncorhynchus kisutch* (Walbaum), alone was found to harbour nematodes of the genus *Cystidicola* in the swim-bladder. Out of 63 specimens of coho five were found to be infested with *Cystidicola walkeri* Ekbaum. The degree of infestation was very slight at that time of the year, the highest number of nematodes in one host being four, the lowest two. The fish examined were in their third year.

Specimens of *Cystidicola stigmatura* (Leidy) were collected from whitefish, *Coregonus clupeaformis* Mitch., Lake Winnipeg, Manitoba, in August, 1933, and from ciscoes, *Leucichthys artedi* LeS., Bay of Quinte, Ontario, in December, 1934.

Acknowledgments are due to Dr. W. A. Clemens, the Director of the Pacific Biological Station, and to Dr. G. V. Wilby for much assistance in obtaining the material from Pacific salmon; to Mr. F. J. Fry for the specimens from ciscoes, and to Dr. E. M. Walker for his valuable advice and assistance in preparing the manuscript.

Cystidicola walkeri Ekbaum*

A short note on this new species was published by the writer (1935).

Specific diagnosis.—Body comparatively stout, transparent with a smooth unstriated cuticle, tapering slightly towards the anterior end, while the posterior end is more or less sharply pointed. Mouth with two blunt teeth, buccal cavity followed by a cylindrical vestibulum 0.115 mm. to 0.125 mm. in length, 0.013 mm. in width; oesophagus 0 70 mm. in length, 0.09 mm. in minimum width, indistinctly divided into two portions, an anterior muscular part 0.36 mm. long and a posterior glandular part 0.39 mm. long. Nerve ring 0.38 mm. from the anterior end.

Female.—The specimens measured up to 44 mm. in length, 0.82 mm. in maximum diameter; caudal extremity straight and pointed, vulva on the ventral surface, approximately in the middle of the body; eggs oblong with rounded ends and a shell 0.004 mm. in thickness. A cuticular knob at one pole bears two long filaments, about 20 times the length of the egg, which are comparatively thick at the base, but taper gradually to very fine distal ends. Occasionally two very thin and short accessory filaments are present at the same pole. The eggs, 0.046 to 0.052 mm. long, 0.018 to 0.020 mm. wide, resemble those of *Ascarophis morrhuae* v. Beneden, 1870 (in Yorke and Maplestone, 1926), which are also described as having filaments at one pole only.

Male.—The single specimen obtained was 12 mm. long and 0.22 mm. wide; anterior end tapering slightly, posterior end pointed and spirally coiled with narrow caudal alæ; cloaca 0.28

* This species was named in honour of Dr. E. M. Walker, University of Toronto.