STATION BULLETIN 322 MAY 1934

Some Diseases of Oregon Fish and Game AND Identification of Parts of Game Animals

Agricultural Experiment Station
Oregon State Agricultural College
CORVALLIS

SUMMARY

1. Parasites have been found in every important species of game fish which occurs in Oregon.
2. In most instances these parasites do no serious damage if they are present in only small numbers.
3. Some of the fish-eating birds are carriers of parasites which live a part of their lives in fish. Such birds may severely contaminate lakes and streams.
4. Since the life cycles of many of the parasites of fish are unknown, further studies are necessary if methods of control are to be worked out.
5. Parasites may become so numerous as to cause poor condition and losses among deer.
6. While other diseases of deer are known to exist in Oregon, they are seldom found.

Sportsmen finding diseased or parasitized fish or game are requested to forward specimens for examination and study. Such specimens should be either packed in ice or preserved in 5 per cent formaldehyde solution and shipped to the Department of Veterinary Medicine, Oregon Agricultural Experiment Station, Corvallis, Oregon. A letter should be sent to the same address, giving information as to the origin and type of material.

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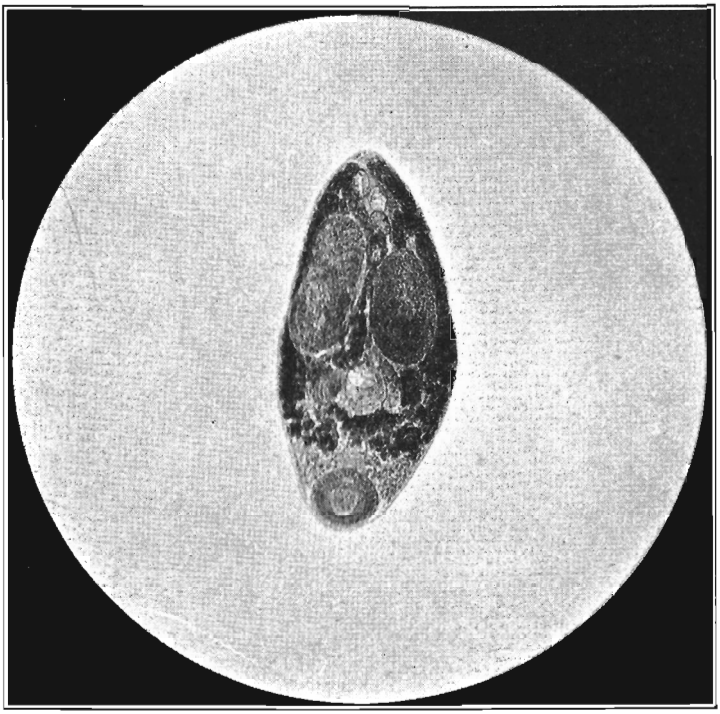

Figure 1. So-called salmon-poisoning fluke. *(Mag. 100x.)*

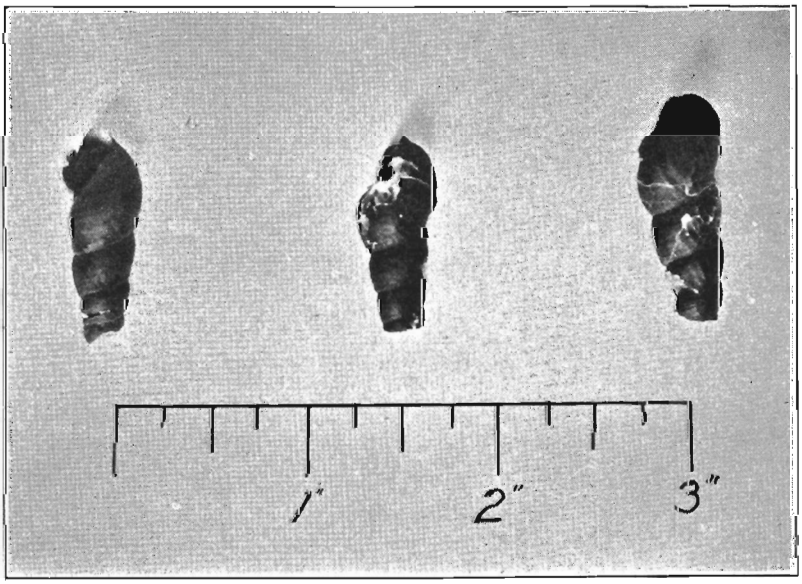

Figure 2. Snail used by salmon-poisoning fluke in its life cycle.

Some Diseases of Oregon Fish and Game AND Identification of Parts of Game Animals*

By

J. N. SHAW, B. T. SIMMS, and O. H. MUTH

INTRODUCTION

THIS bulletin reports results of studies of problems concerned with diseases of Oregon fish and game which have been conducted by the Department of Veterinary Medicine of the Oregon Agricultural Experiment Station in cooperation with the Oregon State Game Commission. Some of this work was undertaken as early as 1925.

Beginning in June 1932 the Oregon State Game Commission has budgeted $300 per annum to be used by the department in studying parasites of fish and other disease problems.

The mere finding of parasites in fish and game should not be reason for condemnation for food. All of our meat-producing animals serve as hosts for parasites.

PARASITES OF FISH

The salmon poisoning fluke (*Nanophyetus salmincola* Chapin). This is the parasite which occurs most frequently in game fish of Western Oregon. The mature worm (Figure 1) has been found in the intestines of dogs, foxes, coyotes, bear, mink, hogs, house cats, and bobcats. In dogs, foxes, and coyotes it burrows into the wall of the intestine and transmits the disease known as salmon poisoning.† This malady is known to attack only animals belonging to the dog family. The mature worm living in the intestine is about 1/30 to 1/50 inch long. It lays eggs which pass out with the droppings.

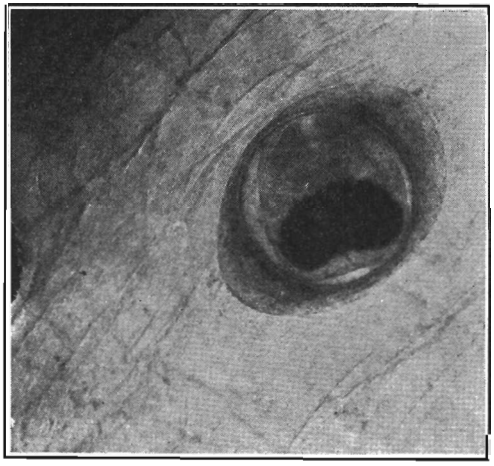

Figure 3. Salmon-poisoning fluke cyst in fish muscle. *(Mag. 90x.)*

If such eggs are kept in water they hatch in from 60 to 130 days, depending upon the temperature. The newly hatched worm lives only a day or two unless it can at-

*Acknowledgements: Thanks are due Mr. M. F. Ryckman and many other employees of the Oregon State Game Commission for assistance rendered in these studies.

†Studies of salmon poisoning conducted by the Department of Veterinary Medicine of the Oregon Agricultural Experiment Station have resulted in the development of a method of immunizing dogs against this disease.

tack the snail, *Gonisbasis plicifera var. silicula* (Gould) (Figure 2), which is prevalent in most of the clear rapid streams of Western Oregon. This snail is known locally by the name of "periwinkle."

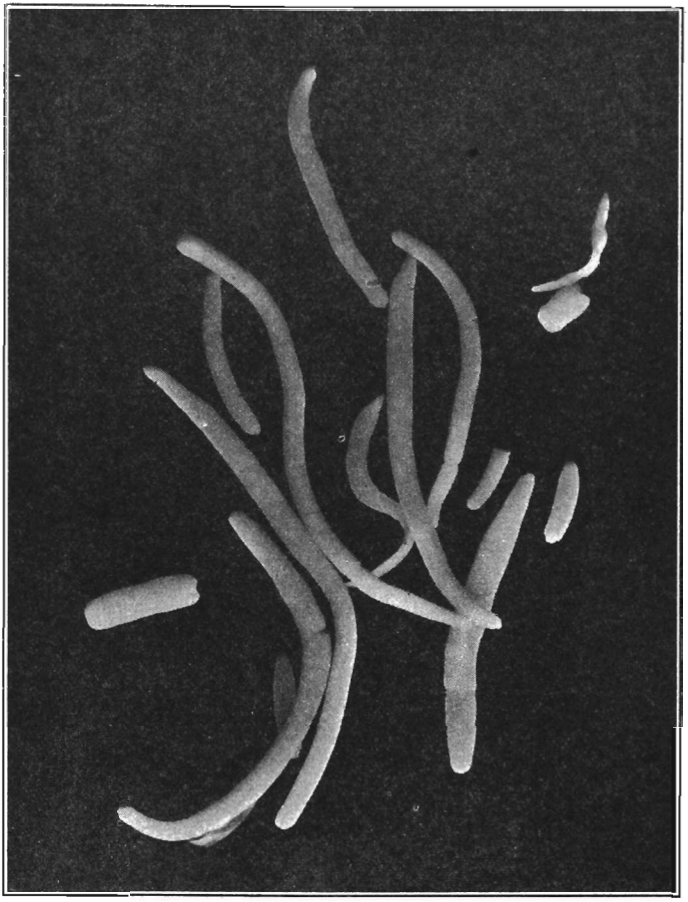

Figure 4. Larval tapeworms from Elk Lake fish. (*Mag. 3x.*)

Within the snail host the young worm changes its form and develops a large number of parasites. Some individual snails have been found to contain more than 80,000 of these new forms. When these forms escape from the snail, they may attack any Oregon fish of the salmon or trout family.

The organisms burrow through the skin of the fish and coil up as small cysts (Figure 3). These cysts are a little less than 1/100 inch in diameter. They are found in practically every part of the fish. In young

fry they are most numerous in the muscles or flesh, their favorite sites being the muscles of the eyeballs, the jaws, and the tail. In larger fish they are most plentiful in the kidneys.

Complete counts of these parasites in individual fish have revealed almost unbelievable numbers. More than 14,000 were found in a cutthroat trout, less than five inches long, caught in Oak Creek near Corvallis. There

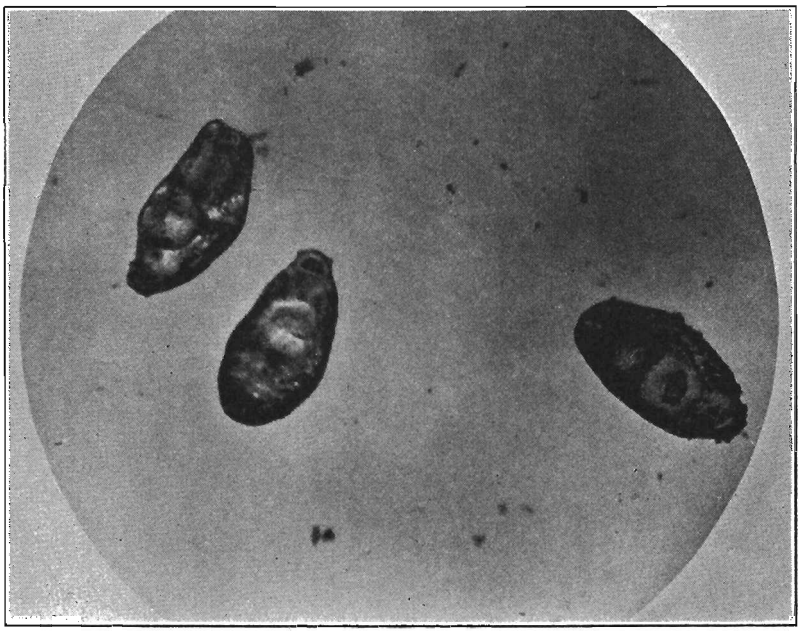

Figure 5. Fluke from rainbow trout of Diamond Lake. *(Mag. 25x.)*

were 386 cysts in the muscles of the two eyeballs and 1,739 in the kidney tissue. This fish was apparently healthy. In another instance 2,676 cysts were counted in about 1/500 ounce of kidney tissue from a fourteen-inch cutthroat trout caught from the Big Elk River. This fish was fat and appeared normal.

It seems probable that such large numbers of parasites would injure the infested fish. Studies of this possibility have been conducted both through examining sick and dying fish from hatcheries and through infesting fish with these parasites under experimental conditions in the laboratory.

At one hatchery where severe losses had occurred for several years, both eastern brook and rainbow trout had died. This hatchery was kept under observation for several years. On the first visit to this hatchery it was found that both eastern brook and rainbow trout were dying in fairly large numbers. The fish that were not visibly sick were inactive and the hatchery superintendent said they were not eating well. Examination

showed large numbers of encysted parasites in these fish but actual counts were not made. During later seasons more complete studies were possible. At one time when rainbow were dying in sufficient numbers to cause alarm, counts of parasites in two fish, each of which was approximately two inches long, revealed 67 and 87 parasites respectively.

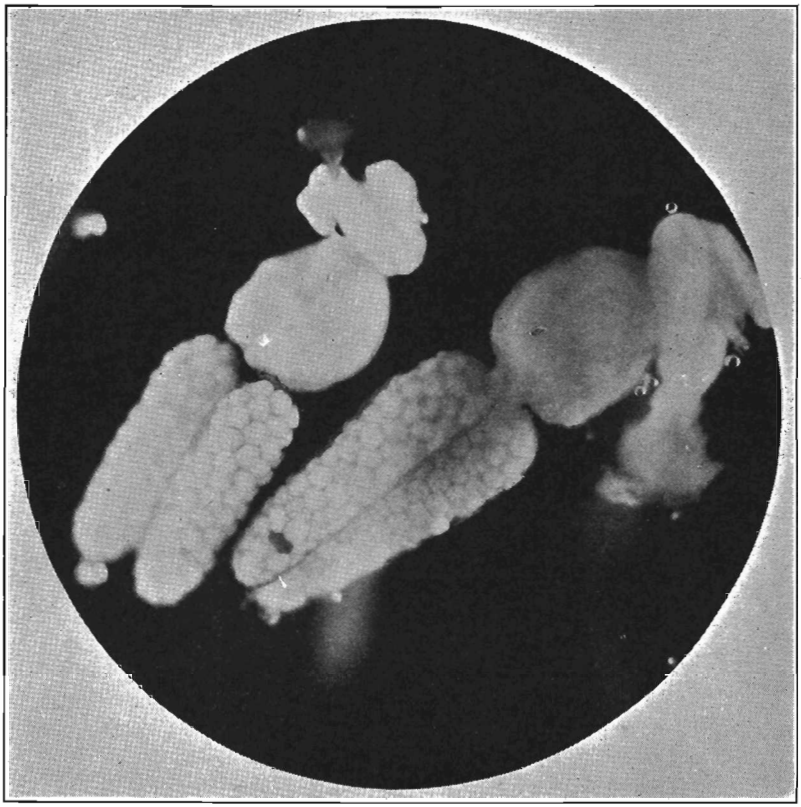

Figure 6. Parasitic Copepoda from rainbow trout. *(Mag. 10x.)*

Another year the fish in the ponds at this hatchery were observed several times. Brook trout which had been placed in the ponds in April were quite active and normal in appearance in June. At this time four fish, with an average length of about 1¼ inches, were examined. Cysts were found in the following numbers: 55, 70, 77, and 106. About a month later these fish began dying, while the rainbow at the same hatchery remained in good condition. Many of the affected fish were either "popeyed," "sway backed" or "pot-bellied." Microscopic examinations for parasites showed an average of about 420 each in sick brook trout about 1⅝ inches long and about 270 each in healthy rainbow trout which were a little less than 1½ inches long.

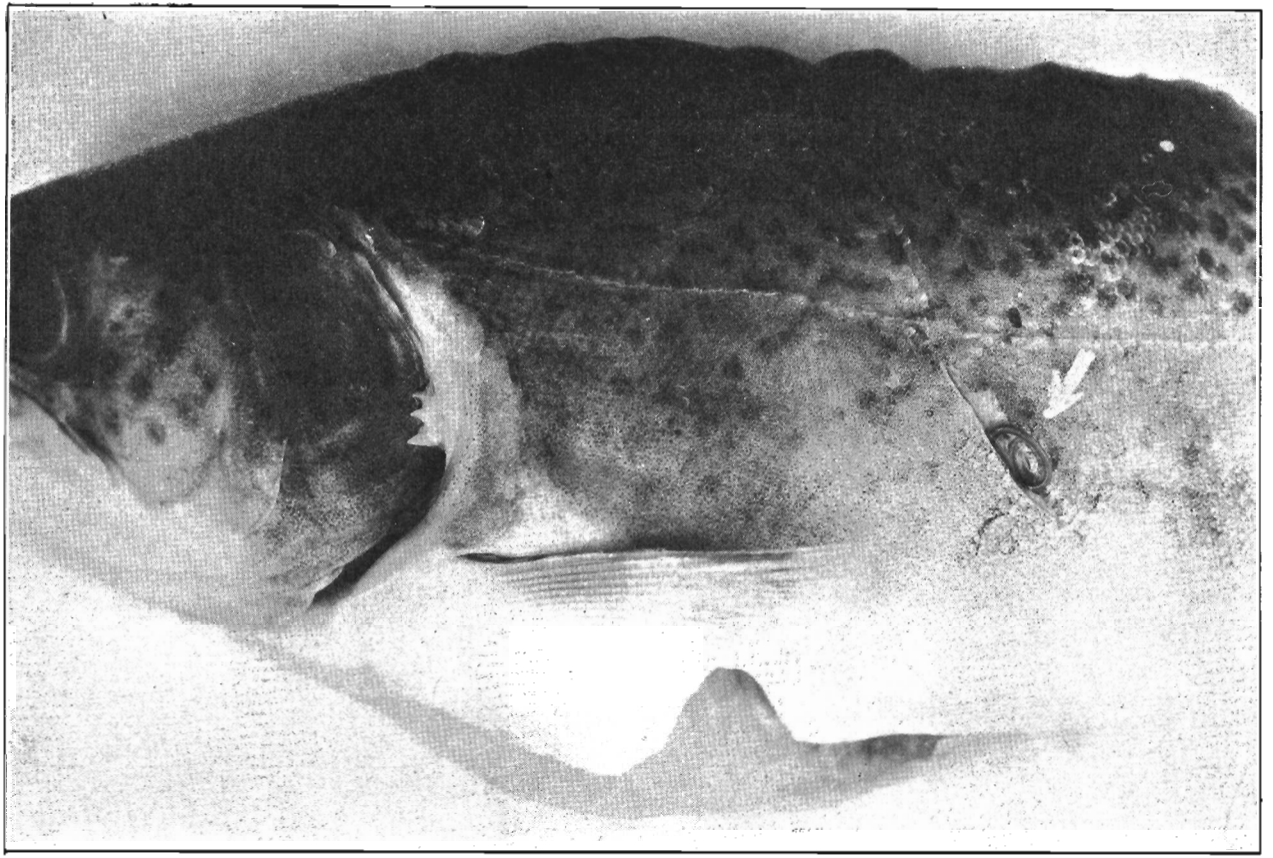

Figure 7. Parasites in muscles of cutthroat trout.

Laboratory studies were made by placing young fish and infested snails in small tanks and observing the results. In one experiment young rainbow were exposed to very severe infestation. On the eighteenth day following exposure examination of three fish, all of which were slightly under two inches in length, showed an average of 1,427 parasites per fish. The remaining fry in the tank were held for 90 days with no deaths and no indications of any disturbance.

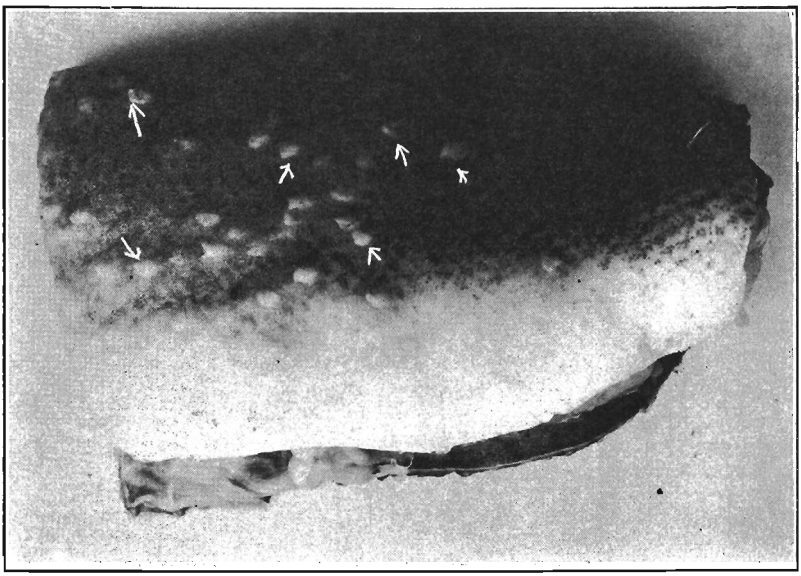

Figure 8. Parasites in skin of silverside salmon.

In another test brook trout about two and one-half inches long were exposed in the laboratory by placing infested snails in the tank with them. Twenty-five days later 246 parasites were found in one fish and 316 in another. No further counts were made but the snails remained in the tank with the fish for another thirty days. The remaining fish of this group were held for four months after the examinations showed they were heavily parasitized. They remained healthy and grew as rapidly as another group not exposed to these flukes.

While these observations and experiments do not prove that the salmon poisoning parasite is never injurious to fish, they do show that all three species of trout which are being reared and planted by the Oregon State Game Commission can remain in good health when they are harboring large numbers of the salmon-poisoning fluke. It is, of course, quite possible that severe infestation with the parasite in question may result in a slower rate of growth than normal. Further studies of this problem are under way.

Parasites of fish in Elk Lake. During the summer of 1929 the department was requested to help in the solution of a disease problem causing

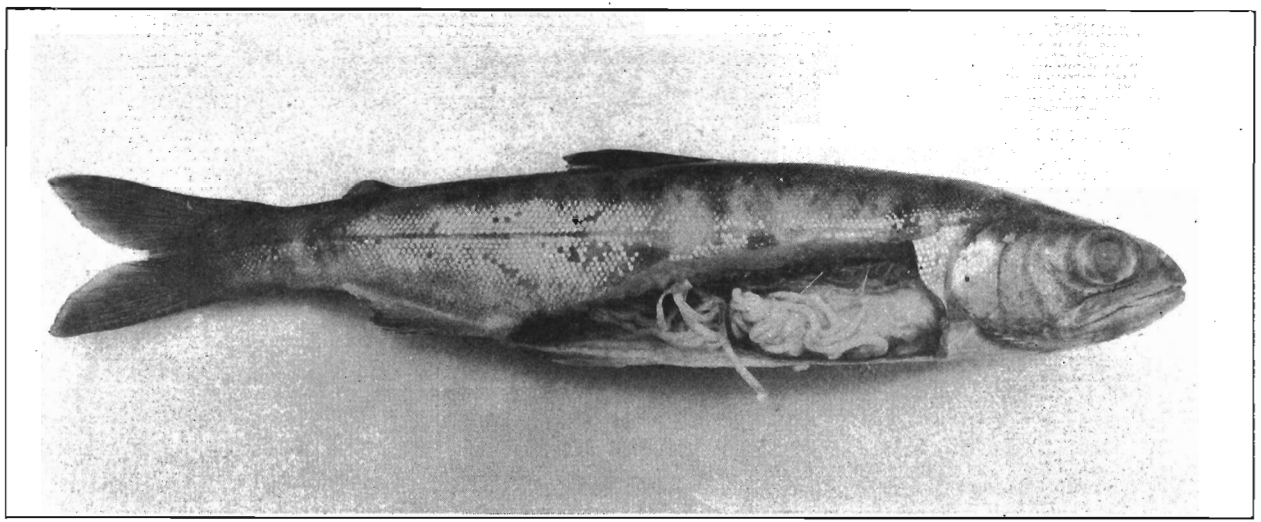

Figure 9. Parasites in abdomen of silverside salmon.

heavy losses in the eastern brook trout *Salvelinus fontinalis* (Mitchell) in Elk Lake. Investigations proved the losses to be due to a larval tapeworm (Figure 4) and further studies incriminated a new bird host and three new fish hosts. Parasitized fish were found in other lakes of the same region and the game commission was advised of the possibilities of new outbreaks. Methods of control seemed to be successful in reducing losses although last summer two lots of fish examined proved to be quite

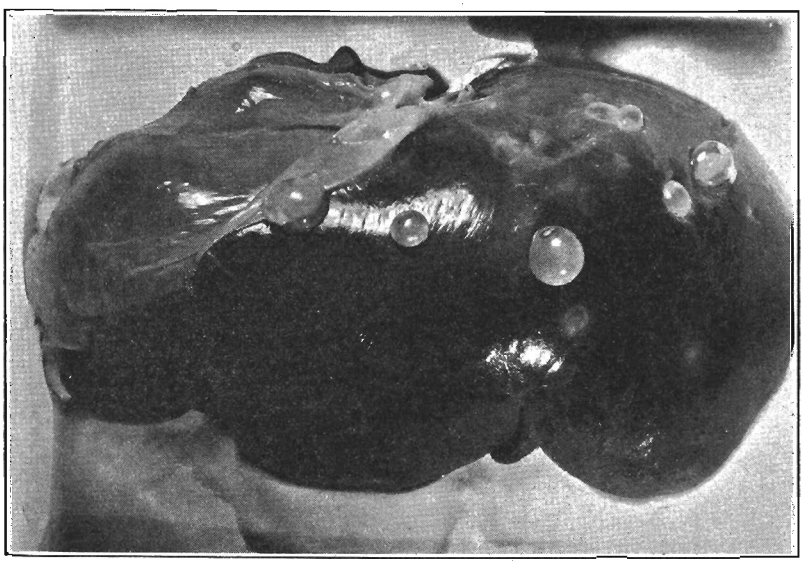

Figure 10. Tapeworm cysts in liver of deer.

thoroughly infested. On a visit to the lake at that time several dead fish were found in the water close to the shore. The life cycle of the parasite responsible for these losses had been previously quite thoroughly worked out. It was named *Dibothrium cordiceps* (Leidy) 1871 and was found in cutthroat trout *Salmo clarkii clarkii* (Richardson) in Yellowstone Lake as early as 1871. In the case of the Yellowstone Lake studies the Pelican, *Pelecanus erythrorynchas*, was proved as a bird host. In the studies of the Elk Lake losses the gull, *Larus californicus*, was proved as a carrier of the mature tapeworm. Larval forms were found in the eastern brook trout in Elk Lake and in eastern brook trout, rainbow trout, and silverside salmon in some of the other lakes. Work should be done to determine just how the parasite gets from the tapeworm egg, discharged from the gull, to the fish—probably through some lower form of animal life such as a copepod crustacean being used for food by the fish. Young fry planted in the lake one month previously were found quite thoroughly infested. Other possible bird hosts should be investigated and if found kept from spreading the eggs in the lakes. During the year one of the Bureau of Animal Industry workers expressed the opinion that little or no difference existed between the Elk Lake tapeworm and the broad tapeworm *Diphyllobothrium latum* (Cob-

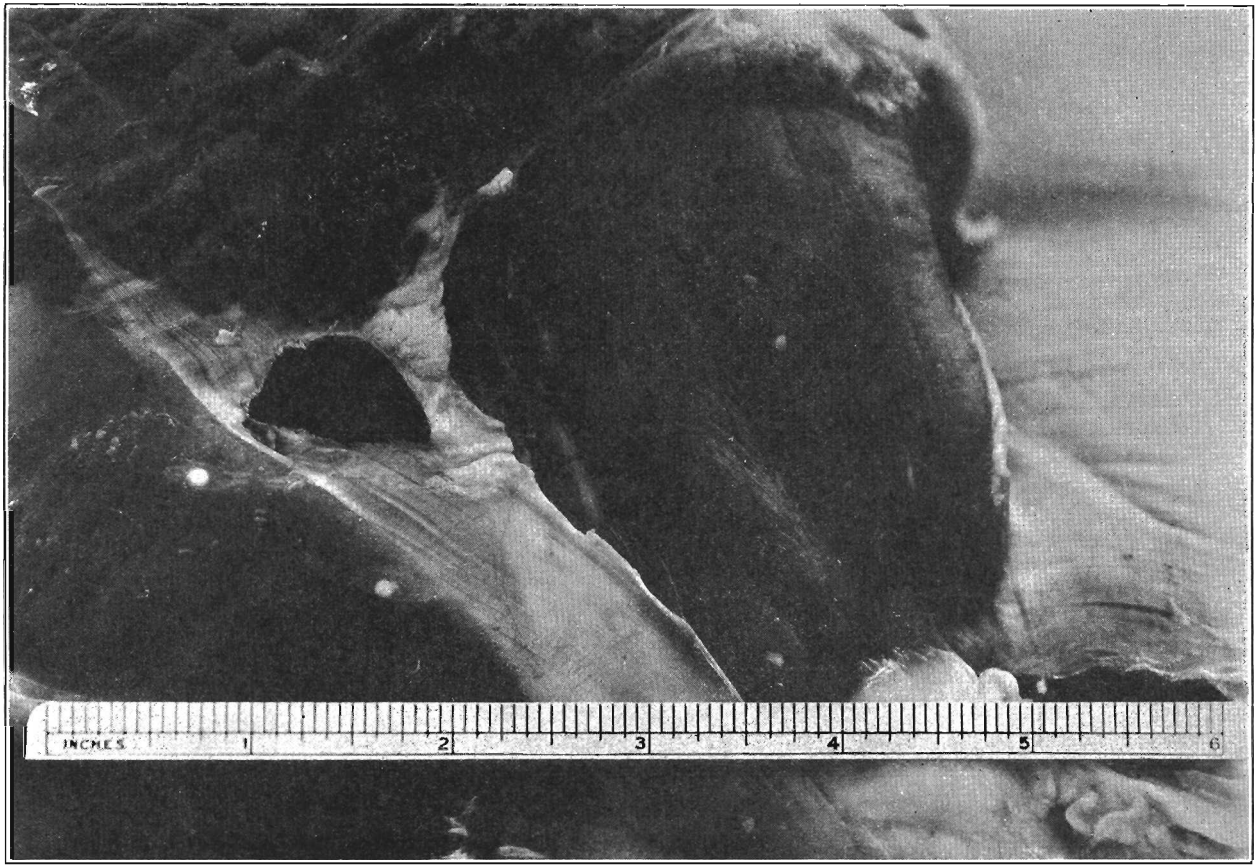

Figure 11. Tapeworm cysts in muscles of deer.

bald) 1858. This broad tapeworm infests man, dogs, and bear. It was with this in mind that one dog was fed 70 larval forms. At the end of one month no tapeworms could be found. Feeding a dog and a racoon at a previous time had given negative results.

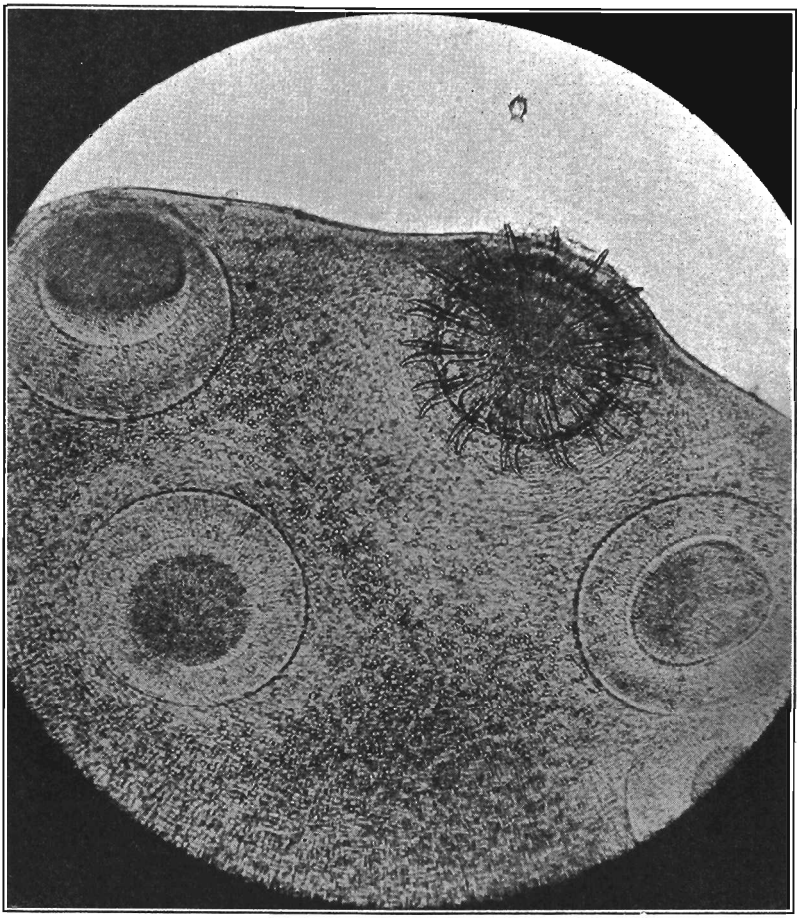

Figure 12. Tapeworm from dog fed tapeworm cysts from deer. *(Mag. 92x.)*

Rainbows (*Salmo irideus gairdneri* Gibbons). Rainbow trout sent in from Diamond Lake were in very poor condition. Upon examination it was found that the entire intestine was inflamed. This inflammation was evidently caused by a small fluke (Figure 5) which was present in large numbers in the fish that were in poor condition, but could not be found in a rainbow from the same source that was in good condition. The stomachs of most of the other fish contained specimens of fresh-water snails, which may be capable of acting as hosts for this fluke. It is possible and probable that

the flukes were obtained from the water in the vicinity where the snails were obtained for food. No examinations were made of the lake but if the condition continues some means of destroying the snails may have to be found.

This fluke, *Crepedostomum cooperi*, was also found in Dolly Varden trout and rainbow from the McKenzie and from eastern brook trout from Elk Lake. The Dolly Varden, *Salvelinus malma spectabilis* (Girard), and the

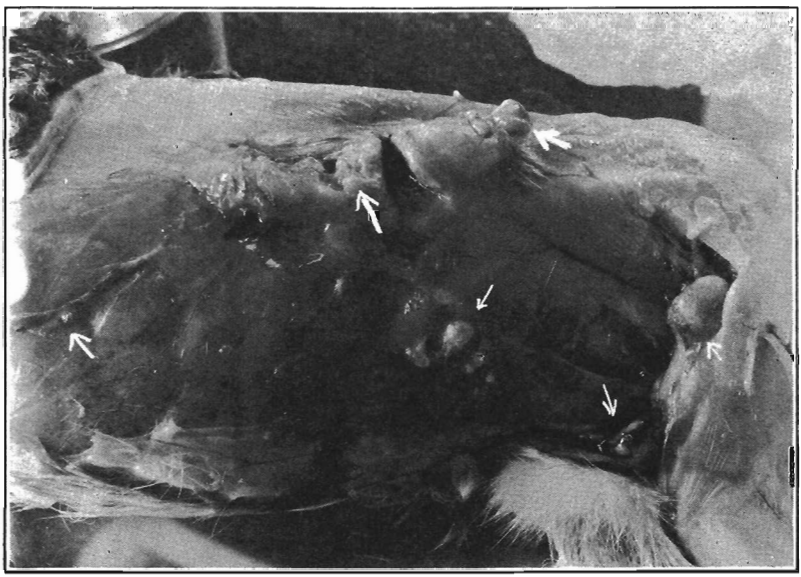

Fig 13. Abscesses in rabbit injected with pus from deer.

eastern brook trout were apparently in good condition, but the rainbow, a 14-inch fish, was so nearly dead that it was caught by hand. At the time it was thought that perhaps the salmon-poisoning fluke was responsible, but possibly this intestinal fluke is a serious parasite in this particular species of fish. Encysted forms of this fluke have been found in crawfish and immature forms have been reported as occurring in May flies, *Hexagenia*.

On April 28, 1933, this laboratory received fish parasites for identification from Dr. Hibbard of Harney county. These parasites (Figure 6) removed from the gills of trout caught in Kerger Creek proved to be parasitic copepoda, *Lernacopoda beani* (Wilson). The fish from which the parasites were removed were in good shape, as Dr. Hibbard reported, but it is known that members of this group of parasites are capable of causing heavy losses, especially in pond fish. This same parasite was found in rainbows from Umatilla county.

Cutthroat trout. Specimens of cutthroat trout were received from Squaw Lake in Jackson county that were infested with a larval form of a

round worm that grows to maturity in the intestine of some fish-eating birds such as the heron. These larval worms (Figure 7) are found in bleb-like cysts under the skin in the muscles of the fish. The worms are about one inch in length and dark red in color. The mature form reaches a length of two inches. Just how much damage to the health of the fish these parasites cause is not definitely known, but they certainly make the fish undesirable for human consumption. These same parasites have been very

Figure 14. Warts on deer.

common in cutthroats from the Alsea and have also been found in spawning silversides from the Wilson River in Tillamook county. The name of this parasite is *Eustrongylides* sp.

Steelhead trout (*Salmo gairdneri irideus* Gibbons). During the winter of 1932-33 a good many steelhead trout taken from the Alsea river in Lincoln county were found infested with thorn-headed worms. These parasites present in the digestive tract were next to flukes in numbers and frequency of infestation. They were also present in chinooks and steelheads taken from the mouth of the Rogue River, so are undoubtedly obtained by the fish while at sea. Just how serious this parasite is to the fish is not definitely known.

On April 26, 1933, young steelheads two inches long were received from the Roaring River Hatchery. These fish were infested with an external parasitic flat worm *Gyrodactylus* (Von Nordmann) 1912. The worms were found attached to the fins and succeeded in producing a ragged frayed appearance. The Hatchery foreman reported heavy losses during the winter months.

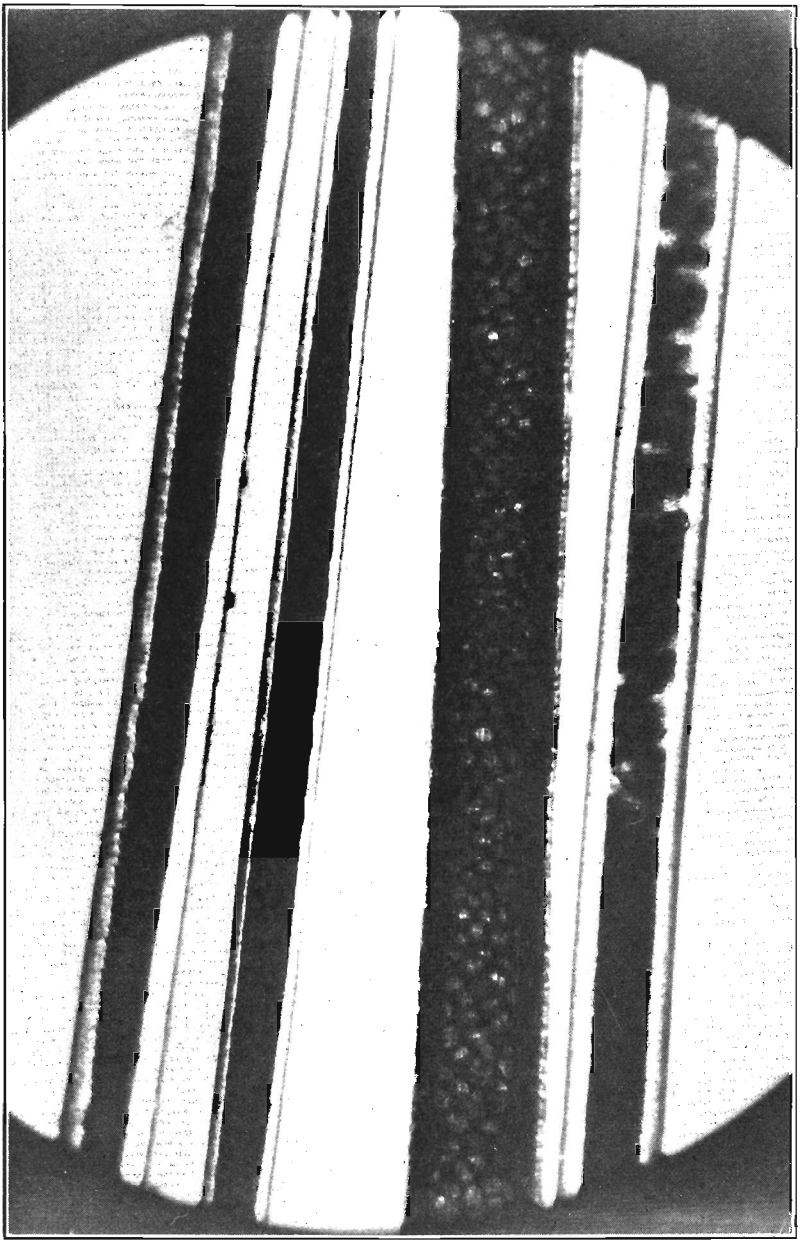

Figure 15. Deer hair compared with hair of dog, goat, and cow. The largest hair is that of deer.

Chinook salmon (*Oncorhynchus tschawytscha* Walbaum). Chinook salmon taken from the mouth of the Rogue River and from the Siletz River some three miles from the mouth were quite heavily parasitized. In the intestines of the Chinook from the Rogue River was found a nematode, *Contracaecum spiculigerum* (Raillet and Henry), which has also been found in a pelican from Crane Prairie dam. A closely related specimen was found in a silverside salmon, *Oncorhynchus kisutch* (Walbaum), taken from the Wilson River. This parasite lives in the stomach and intestines of fish-eating birds, fish-eating mammals, and fish. To what extent this parasite damages the salmon is not definitely known.

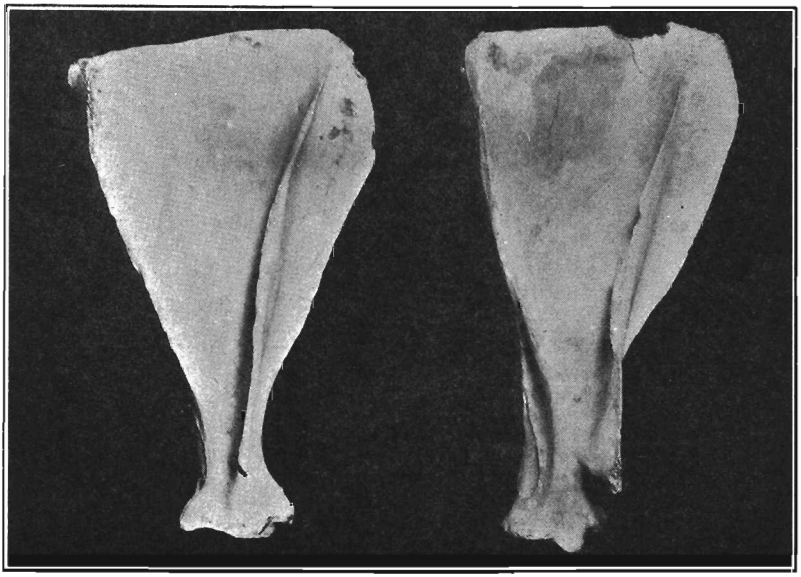

Figure 16. Scapula or shoulder blade of elk *(left)* compared with scapula of cow *(right)*.

Silverside salmon. In November 1932 a specimen of silverside salmon was brought in. This fish, weighing six pounds, was caught on hook and line and was apparently in good flesh. When taken into the boat it was found to be suffering with some disease of the skin. Examination of pimple-like growths on the skin (Figure 8) revealed a very small parasite, a protozoan. This parasite has been reported from pond fishes and fish from inland waters and it is said to be quite damaging to pond fishes. Just how common this parasite is or how serious a pest it is to the fish is not known. Here again the fish had become unfit for food because of the unsightly appearance. The name of this parasite is *Myxobolus squamae* (Keysselitz).

Silverside salmon, six inches long and cutthroat trout taken on fly in Mercer Lake in Lane county, March 24, 1933, were thoroughly infested with a round worm two inches in length. These worms were found in the abdomen (Figure 9) and they apparently were not causing any immediate

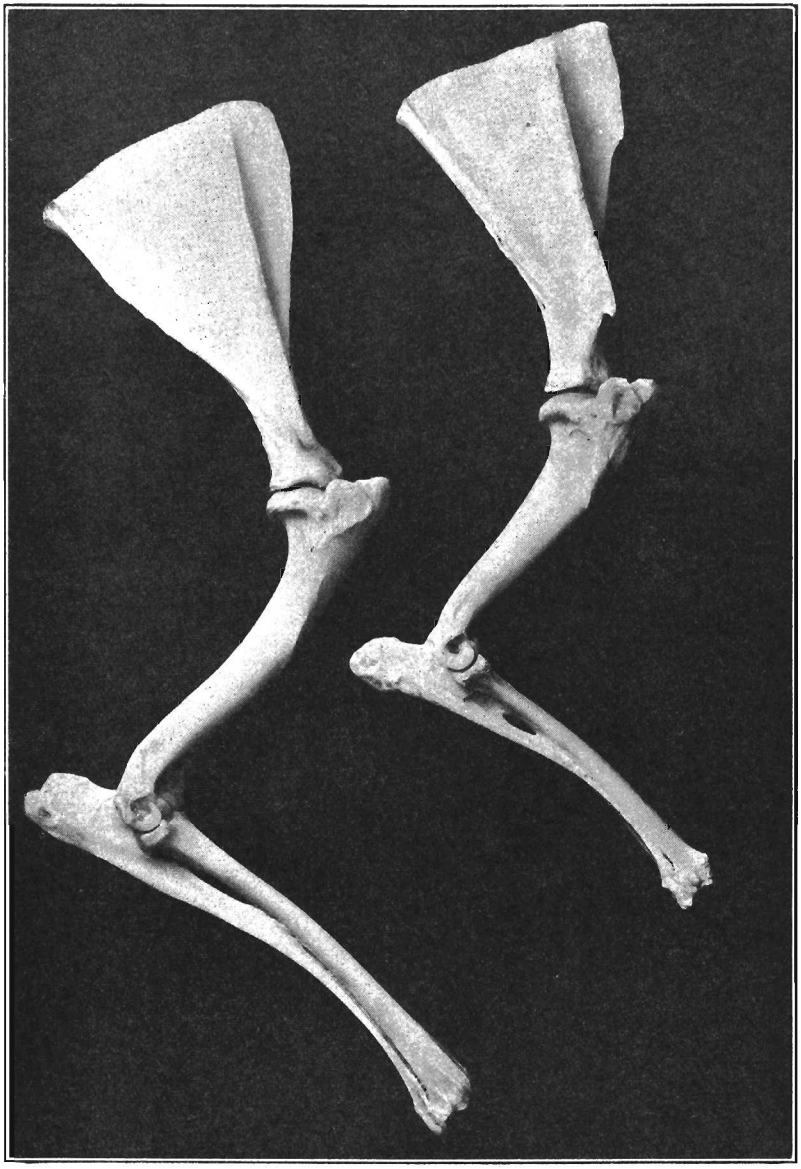

Figure 17. Bones of fore limb of deer compared with bones of fore limb of goat. The longer limb is that of deer.

damage. The salmon were the most thoroughly infested—7 out of 10 containing worms. The cutthroats were only slightly infested as only one worm was found in 17 fish. This same parasite was found in cutthroat and steelhead trout taken in the Alsea and Big Elk rivers in Benton county during the winter. The cutthroats from the Big Elk contained large numbers and were in poor condition. Other cutthroats taken at the same time were in good condition.

Trash fish. Only a few so-called trash fish have been examined. One squaw fish from the Willamette proved to be free from parasites and six suckers from Klamath Lake contained two different kinds of fluke. The Klamath Lake suckers were sent in for examination by a man wishing to know whether they contained parasites capable of being transmitted to foxes. An effort was made to locate salmon-poisoning flukes but none existed. Up to the present, this parasite has never been found in a so-called trash fish. Numerous leech were found attached to the larger suckers. All were filled with blood and no doubt were causing some damage.

PARASITES OF FISH-EATING BIRDS

Fish-eating birds. On June 10, 1932, a Blue heron that had been killed in one of the ponds at the Roaring River Hatchery was brought to the laboratory. This bird was killed at 4:30 in the morning. In its stomach were found 8 eastern brook trout varying in size from 2 to 8 inches. Three of the eight fish were 8 inches long. No parasites could be found.

On August 31, 1932, Sergeant Hearing of the Oregon State Police of Coos county sent a heron to the laboratory for examination. This bird had a stomach well filled with catfish fry. Some 109 two-inch catfish could be counted and possibly that many more had undergone digestion to such an extent that counting was impossible. This bird had been destroyed while feeding in a private lake where catfish had been recently planted. No parasites were found in this bird.

At various times during the past several years other fish-eating birds have been examined. Some parasites were present but none of any considerable importance were found. Birds examined included Mergansers, pelicans, king fishers, cormorants, grebes, and gulls.

PARASITES OF DEER

(Odocoileus columbianus)

During the spring of 1928 the State Veterinarian brought in the carcass of a deer found in Douglas county. This deer was very thoroughly parasitized. Some six internal parasites were found and two external. No doubt the parasites were responsible for the poor condition of the animal. Of the internal parasites found, two were common parasites of sheep, goats, and cattle. The small stomach worm, *Ostertagia circumcincta,* is especially bad in Oregon sheep and goats. The liver tapeworm, *Thysanosoma actinoides,* is not uncommon in our sheep. In considering parasites of deer it must be remembered that deer, sheep, and goats use the same ranges. The other parasites found were a tapeworm cyst, *Cysticercus tenuicollis*; a whip worm,

Trichuris ovis; an intestinal worm, *Chabertia ovina*; a lung worm, *Dictyocaulus hadweni;* a grub from the head, *Cephenomyia;* a louse fly, *Lipoptena depressa;* and a louse, *Trichodectes parallela.*

A deer from a park near Alsea brought in for diagnosis was found to have died from a broken neck, probably obtained while playing in a pen. The liver contained larval forms of a tapeworm called *Taenia marginata.* The cysts

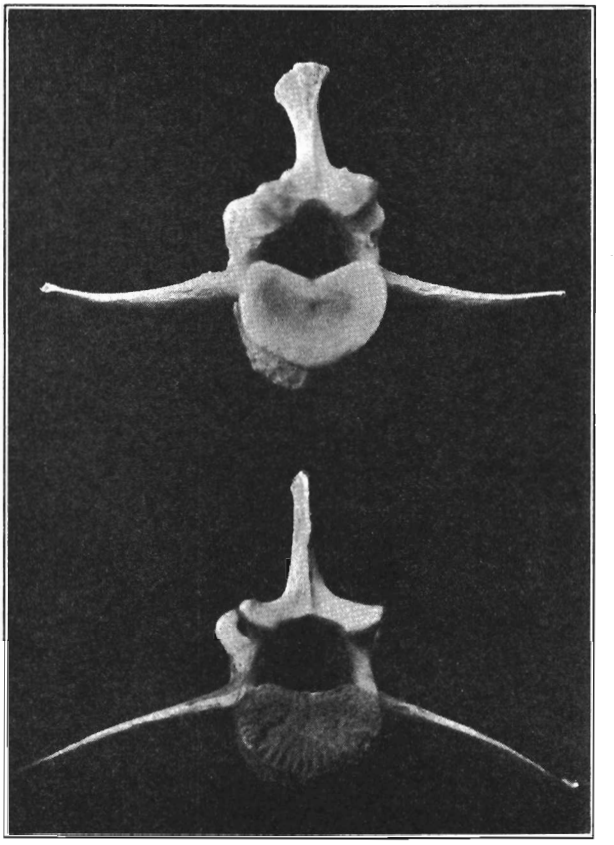

Figure 18. Lumbar vertebrae of goat *(upper)* and deer *(lower).*

of the liver (Figure 10) are named *Cysticerci tenuicollis.* The mature form of this parasite is found in the intestine of the dog. This same parasite has been found in deer and sheep from Douglas county.

Another tapeworm cyst from deer was examined on September 28, 1933. This deer, killed on the north fork of the Santiam River, was apparently in excellent condition. When the hide was removed the cysticercoids were found everywhere in the muscles (Figure 11). Sixty of these cysts were fed to a dog and fifteen were fed to a cat. On January 5 when the

dog was killed 55 mature tapeworms were recovered from its intestines. The hooks and suckers of the mature worm (Figure 12) compared very well with the hooks and suckers of the immature parasites. Autopsy of the cat failed to reveal any tapeworms. Specimens of those taken from the dog were forwarded to Washington where they were identified as *Taenia krabbei*, a tapeworm also found in the muscles of reindeer. This trouble in reindeer is controlled by having the Eskimos keep their dogs tied up. This parasite was first found in deer in 1924 in a deer from Douglas county.

OTHER DISEASES OF DEER

Abscesses. Hunters have reported the finding of subcutaneous abscesses in the deer killed in Eastern Oregon. Material of this kind was received at this laboratory. Rabbits were injected and abscesses (Figure 13) were produced resembling in all respects those found in the deer. Attempts to isolate a causative organism were unsuccessful. This disease is similar to a disease of the lymph glands in sheep called Lymphadenitis. This disease produced in rabbits did follow the lymph channels and affect lymph glands but seemed to develop too quickly to be Lymphadenitis. The pus present in the abscesses did not have the greenish appearance as it does in sheep, nor was it arranged in concentric layers as is characteristic of Lymphadenitis. More work should be done with this disease as the abscesses when found cause a hunter to question the worth of the deer for food purposes.

Warts. During the summer of 1933 the local warden brought in the carcass of a deer having on its skin many large warts (Figure 14). This condition had been seen in deer before but had not been so extensive. A similar type of wart is infectious in cattle and is spread from one animal to another. The warts were so numerous and large as to have possibly caused the animal's death. A similar condition has been reported from Eastern Oregon deer, but so far as known no serious outbreaks have occurred.

IDENTIFICATION OF PARTS OF GAME ANIMALS

From time to time the Oregon State Game Commission has asked for help in identifying parts of carcasses of game animals which have been found in possession of game law violators. While it is relatively easy to identify such material it is sometimes rather difficult to produce proof of such identity that will satisfy a trial jury.

It is well known that the hairs of the members of the deer and elk family are very different in miscroscopic appearance from those of the domestic animals (Figure 15). For this reason game law enforcement officers have been advised to try to find hair on any part of a carcass which is confiscated. Collections of hairs from all the common domestic animals and from deer, elk, and antelope have been made. These have been used with success in jury trials in connection with the identification of both elk and deer hair found on confiscated meat.

The bones of the domestic animals are different from those of the game animals (Figures 16, 17, 18). Game law violators have usually claimed that deer meat is either sheep or goat meat and that elk is beef. Enforcement officers have usually been successful in obtaining parts of carcasses containing bones which could be used for positive identification. Collections of bones from mule deer, blacktailed deer, elk, goats, sheep, and cattle have been made. These have been used successfully in court cases.

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