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Lectures at Flathead Lake

A Series of Lectures delivered at the University of Montana Biological Station at Flathead Lake, by the Staff of Instructors, Session of 1902.

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Montana Shells.

NATURE STUDY LESSON.

Morton John Elrod.

The state of Montana is not very productive of conchological specimens. The conditions are all against shell growth. The rivers are rapid, the water quite soft, and food in the rivers scarce. The large lakes, as Flathead lake, contain clear, cold water. They are usually deep, with rock bottoms, and surrounded by mountains with steep slopes. The marshy, stagnant parts of the lakes are usually small. The mountain sides in summer become dry and parched, except in protected portions and along streams. Great stretches of plain are without moisture for a portion of the summer, drying up almost every living thing that cannot move to the water-courses. The days are hot, the nights cool. In this mountainous state, where very little soil is lower than 3,000 feet above the sea, the air is dry and evaporation rapid. A passing rain cloud may leave considerable moisture, but it is soon taken up by the parched earth or evaporated if left on the surface. Stagnant ponds with decaying vegetation are few and confined to the vicinity of a few rivers. Even such ponds usually become dry each summer.

Most of the valleys were former lake beds of greater or less extent. As these lakes have been drained, they left swamps in which rhinoceroses, camels, three-toed horses, elephants, titanotheriums and other beasts became mired, their remains being buried for long ages. These swamps have dried up, and the waters have become more widely separated, now occurring as deep mountain lakes, or larger lakes, which are mere expansions of rivers. Such isolation must have caused the separation of shells of a species which naturally would take different lines of development. Accompanying this gradual separation of waters we might expect a region of moisture on the land adjacent to the lakes, giving suitable environment to the land snails.

As a result of the above conditions, we may expect great variations in adjacent regions, where the barriers may be sufficient to cut off all communication. There is very little doubt but that the isolated lakes in Montana and the northwest will produce interesting variations. But the sparsely settled country and the small number of collectors make the work of collecting and studying very slow.

The lack of lime in the waters of the state in considerable quantity is another element contributing to the paucity of shell life. Specimens taken from water invariably have thin or frail shells. Some are exceedingly delicate. The land forms, although not numerous in species, have thicker and heavier shells, affording much better protection. One species of slug, without a shell has been taken, but in small numbers.

In considering the above conditons it is apparent that collecting living shells is confined largely to the rainy season, i. e., the spring and early

summer. While this is particularly true of the land species, it applies also to water forms. The pond inhabiting animals in spring are given more extensive territory, thus increasing the food supply and furnishing better opportunity for the development of the young. The rushing waters of the rivers, except in shallow and swampy areas along shore, are almost destitute of shells. In the western part but one bivalve is found in the

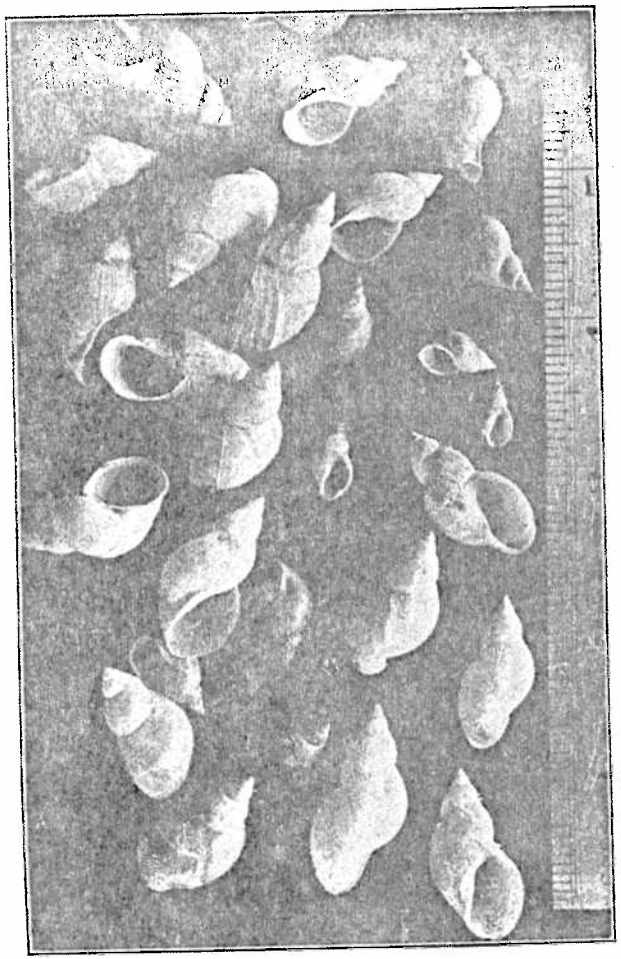

FIG. 22. *Limnaea palustris*, the commonest fresh water shell.

sand bars of the rivers, the common black clam, **Margaritana margaritifera** L. In the eastern part, tributary to the Atlantic, two Unionidae are recorded, **Anodonta plana** L., and **Anodonta ovata** L. In each case only the young were taken. Three other small bivalves, to be found among the vegetation of ponds, have been collected, one from the western and two from the eastern part of the state. It is thus seen that the total list

of bivalves inhabiting the waters of the state at present numbers but five species.

In most sections of the state rains are more or less constant in the state from early spring until the last of June. In May, June and sometimes early July, land forms may be hunted successfully. After this it is rare to find living animals except in very limited areas around lakes, ponds, or water courses. It is not uncommon to find bleached shells lying out in open and exposed places, but they are usually of one species, **Pyramidula strigosa** Gld., or some of its numerous subspecies or varieties.

To secure shells for the sanilery for class use is not exceedingly difficult, although they are not to be picked up at random. The water inhabiting species may be sought in shallow ponds, among the decaying or living vegetation. To secure them requires a pair of rubber boots, if one does not wish to have wet feet, and some form of a net for dipping them out of the water. The species in greatest abundance which is most likely to be taken is a small gastropod, with tapering spire, **Limnaea palustris** Muell. (Fig. 22). It is found throughout the state, may usually be had in abundance, and is not difficult to keep in the school room or laboratory. With it is likely to be had the smaller and more delicate **Physa**, with left handed turns in the shell. With these specimens in a vessel of water with suitable food a fund of information relative to their habits, movements and life may be secured. They will prove easy subjects for genuine work in nature study, and a large number of persons may carry on original observations. Other smaller species may be had possibly by sifting fine sand and separating the few shells to be had. I have kept many of these minute animals in vessels for months, and they have multiplied and done well. Those I have had were the diminutive **Pyramidula striatella** Anth., **Physa ampullacea** Gld., and **Limnaea palustris** Muell.

The land species must be sought in damp places. My most successful hunts have been in June on rainy days, although they may be had earler than this. It is usually necessary to search among the weeds and underbrush of the timber along the water courses or ponds, or in the damp canyons and gulches on the mountain sides. I distinctly remember several days in the Mission mountains where specimens were gathered. It necessitated crawling around on hands and knees among rank and dense vegetation, while rain was falling in torrents. While this was very disagreeable, it was the time when snails were active. Even when abundant they are difficult to find, owing to their color. They very much resemble the leaves and dead wood over which they crawl in search of food.

The snailery must be kept neat and clean, for snails are dainty creatures, and will not thrive in dirty cages. The water species will need occasional fresh water. The water of Montana's lakes and streams is so free from mud and silt, as a general rule, and so full of oxygen, that changes need not be made often. Once in two or three weeks will probably suffice if the vessel be large enough to hold a gallon or more. Water vegetation should be supplied, which will not only furnish food for the

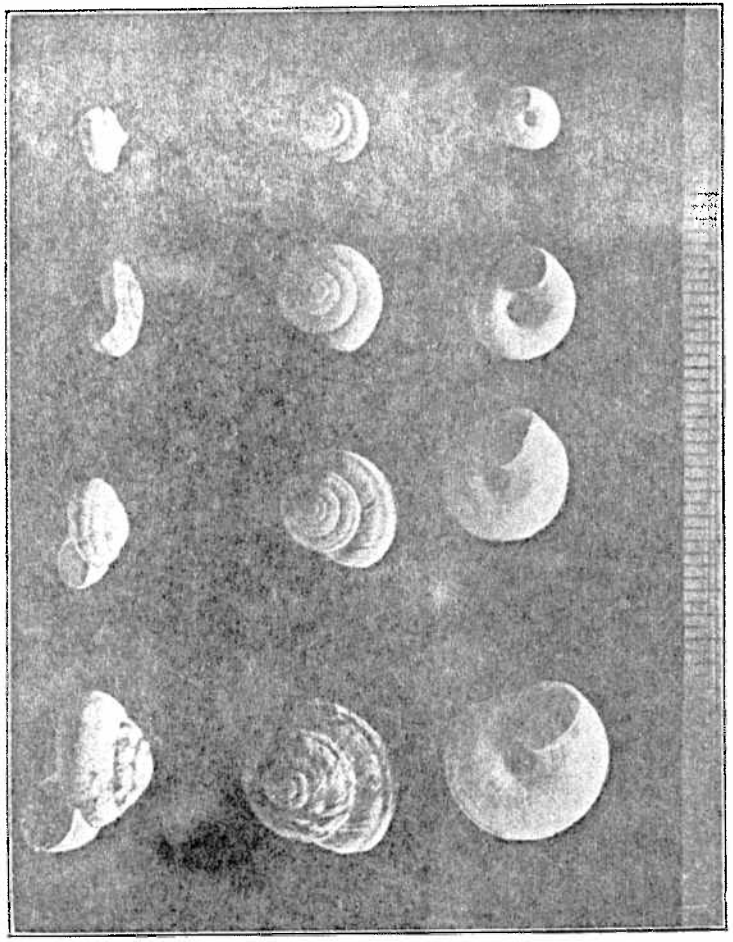

FIG. 23. A series of shells showing the varieties of Pyramidula strigosa due to high altitude. The largest, to the left, from McDonald Lake, altitude 3,300 feet. The next size, from Tobacco Root Mountains, east of the main range. The third, from the Bitter Root Mountains, altitude 5,000 feet. The smallest, from McDonald Peak, altitude 8,000 feet. Photo by M. J. E.

animals, but will also by its growth supply oxygen for their needs. I discover that pond scum may be kept growing all winter if placed in a south or west window for sunlight. Of course, water species may be kept in winter, when it will probably be found impossible to keep land species. In spring and summer the land snails may be kept in a suitable cage, and with a small amount of care and trouble in supplying food and in keeping the cage clean they will amply repay for the trouble. Pupils will find them interesting, and with a few suggestions will be able to make many valuable observations, and thus get true nature study lessons, a study of the living specimen whose habits and natural peculiarities may be known first hand.

The land snail most aboundant in the state is **Pyramidula strigosa** Gld. It is found abundantly west of the Rocky mountains at all altitudes from the lowest elevations to 9,000 feet. The shells found may easily be referred to several varieties. Figure 23 shows their general appearance. The shell is rather thick and heavy, recognized by two dark bands, one of which extends into the spire for several whorls. Closely related to it, and often associated with it, is **Pyramidula solitaria** Say, but the latter is more earthy, with darker color, a trifle flatter, and with broader bands, not extending into the spire. **Solitaria** is less common, and is not yet reported from east of the range.

Pyramidula strigosa has been taken by us abundantly in the western part of the state. It has been found on the slopes of many mountain ranges in the state. It has been taken as far east as Lewistown. It is a Rocky mountain species, and is so variable that conchologists despair of bringing the numerous subspecies and varieties into systematic relations which will be satisfactory. At two places in the Mission range, Sinyaleamin and McDonald mountains, it has been found at high altitudes, as explained in "A Biological Reconnoissance in the Vicinity of Flathead Lake." The lower snails are large and fine looking. The higher ones are very small, greatly reduced in size, and have very hard conditions to fight against in the struggle for a living. While the species is apparently of western origin, its presence at Lewistown shows that it has crossed the range, and is slowly making its way eastward. This is the second species, according to our studies, that has crossed the main Rockies, the other being a dragonfly. As there are seven species found in the state on both sides of the main range it is apparent that they have crossed the range in some way. As **P. strigosa** has been found at elevations up to 9,000 feet it seems reasonable to suppose that it was not carried over by some larger bird or animal, but crossed over by its own wanderings.

Several hundred duplicates have been collected, and two or three will be sent to any teacher of nature study, so long as they last, if postage accompanies the request for them.

It is needless, in this lecture, to atempt giving a list of the sixty species found in the state, twenty-five of which have been found west of the range, with forty-two from the east side. A list may be found in Bulletin University of Montana, Biological Series No. 3, pp. 170-174. Teachers who wish shells identified may send them to the writer, who will

name them without charge. For much work in nature study a name is unnecessary, but it is very desirable. There are no keys available for identification of western species.

It will be seen from the above that the molluscan fauna of the west end of the state is entirely different from that of the east end, but seven being found on both sides of the mountains. As very few collections have been made it is very desirable that material be secured from various sections, and correspondence is invited on the subject and specimens very much desired. If teachers will suggest to pupils the desirability of gathering a few specimens the boys will probably bring them if they are in the neighborhood.

If the animals die, or if it is desired that they be killed so the shells may be used, the process of cleaning the shells and removing the dead animals is very simple. The shells containing the animals are dropped in hot water, and left for a few minutes. This quickly kills the animals and loosens them from the shell. The soft parts may then be removed by a bent pin or a piece of small wire bent at an angle at the end. Perfect specimen may then be made by washing out the inside with a pipette or small syringe. By gently rubbing the outside with a tooth or nail brush and water the outside may be shown off to best advantage. Such shells will ornament any school room or cabinet of collections.

Some of the suggestive points to which attention should be called may now be given.

Habitat. This includes the natural home, whether in water or on land, in the open or among dense vegetation. If among rocks the nature of the rocks should be determined. Shells found in water will suggest running water, sand banks, rocky bottom, shallow ponds, lake swamps, cold springs, or some other varying condition. Every phase of the environment should be noted, and suggestions thrown out for the purpose of having the pupils secure the information individually.

Movements. These may easily be watched, if specimens are kept in the snailery. It is very essential that the conditions in which the snail is placed should be as lifelike as possible, so as to be able to study movements that are natural and not forced. The animal may be watched while crawling around over the vegetation or along the sides of the aquarium. The use of the tenacles, the protrusion of the body from the shell, the withdrawal into the shell in times of danger, the action of the creeping foot during progression, and the movements of the mouth in feeding, all should be noted if possible.

Color and markings. Dead and bleached shells are not of much value, but are better than none. From them few conclusions may be drawn except as to size and shape. Teachers who understand the theory of protective resemblance will find shells suggestive of many things to which reference may be made. Those who do not understand it should make haste to consult some good zoology and discover its meaning. Shells generally resemble the surroundings so closely that they must be sought closely. I have frequently tried the experiment of searching a given spot carefully, to be followed by a second person who will see how many I have missed. A new spot is chosen and the order is reversed. Rarely

will the second person fail to find some overlooked specimens, so closely do they harmonize with their surroundings. This blending of colors applies with almost equal force to the species living in water. Markings may refer to spots or bands on the shell, or to the indentations on the surface. This latter may be coarse or fine, deep or shallow, numerous or few. It may be possible to count the number per inch or millmeter, and thus determine points of variation.

The Spiral. This may be right or left handed, dextrose or levulose. Most shells are dextrose. If shells are in quantity each should be examined carefully to see if perchance an accidental specimen may be found the reverse of the ordinary. Such cases occur. Some species have the shells left handed, turning opposite to the hands of a watch. Each should be examined. The number of turns in the spiral should be counted. A means should be devised for determining the fractional turn at the last, as it is very likely to result in a fraction. By making count of a series variations will be found and a mean established.

Diameter and Depth. Adult specimens should be used. Three straight edges are necessary, one of which should be a finely graduated ruler. Place the shell against the ruler, and put the two remaining straight edges on either side, also against the ruler. The reading may be taken from the ruler directly. With a ruler and two square blocks any number of shells may be quickly measured. By turning the specimen measurements may be made in different ways, and variations noted. It is understood that the value of such work to the pupil depends largely on whether it is done for him or by him.

Variations. In a mountainous region shells of a given species from different localities or altitudes will show many variations. In fact, not two shells from any place are exactly alike. By noting the above points many lines of variation may be noted. It is possible to determine the direction toward which the species is tending; i. e., it is becoming thicker shelled, with deeper markings, broader bands, fewer turns to the spire, less width and depth, smaller in body, or the reverse. All such observations afford food for reflection, and are excellent mental stimuli. As this is the main thing sought in nature study work the observations should be encouraged by each individual, and not by the class as a whole.

Food. Few suggestions need be given on this. In the snailery different things must be tried. Daily observations may show whether land forms eat living or dead leaves, decaying wood, wet or dry leaves; whether water snails eat living plants or decaying material in the water, or living animals. All observations should be carefully recorded, and at stated times notes may be compared.

Enemies and Unfavorable Conditions. Drouth kills most land snails. Those living in water have no doubt many enemies about which little can be determined. Permit some shells to become quite dry and watch their actions. Notice the film across the shell to prevent evaporation. Other enemies to land snails are rodents, including mice and squirrels. If broken shells are found, examine carefully to see if the break is by accident after death, as by washing among rocks, or by an enemy before death. This must be determined by the position and character of the

opening, as also by its recurring in a given manner. Observe whether the break is haphazard or shows evidence of careful selection as to place.

Geographical Distribution. Having found the name of the specimen in the snailery, it may be possible to find how extensively it is distributed over the state, over the United States, or over the world. This information may be had by consulting a library with conchological literature, or by inquiry of friends versed in knowledge of shells. In any event, whether the information is found or not, suggestions may be thrown out as to ways by which the species may be scattered, reasons for dispersal, and barriers which may prevent it.