NOTES ON NIDIFICATION IN GILLIA AND AMNICOLA.

BY FRANK COLLINS BAKER.

Observations on the nidification and embryology of our American fresh-water mollusks are rare; and contributions to our knowledge of this subject, though they may not be extensive, are of value. With this need for additional knowledge in mind, the writer ventures to present the following fragmentary notes on the nidification of two common genera of American Amnicolidæ, two species of which have but recently been described.

The observations were made while conducting quantitative studies of the animal life of Oneida Lake, New York State's largest inland body of water. The eggs of four genera of mollusks were observed at this time (the latter part of July and the first part of August), *Gillia, Amnicola, Galba,* and *Physa.* Only the first two genera are considered in this paper. It was hoped that time would permit a more extensive study of these embryos, but the quantitative studies extended to such a late date that there was no opportunity to carry on the very interesting studies on the development of these snails, which would have been of great interest and some value. The information gathered, however, may be considered a contribution to our knowledge of the embryology of these mollusks and may stimulate other students to a study of our fresh-water gastropods.

Gillia altilis (Lea). Pl. 2, figs. 1-8.

Gillia altilis is a very common species in Oneida Lake in the quiet bays, among vegetation. Egg-laying apparently takes place late in June or early in July. In eggs examined July 31st, the embryos were nearly ready to be hatched, the embryonic shell being fully formed. Eggs were observed on six species of plants; *Vallisneria spiralis* (abundant near base), *Pomatogeton robbinsii* (on lower three or four leaves), *Potamogeton perfoliatus, Scirpus smithii, Scirpus americanus,* and *Sagittaria latifolia.*

The eggs are laid singly (never in a capsule as in the

fresh-water pulmonates), either alone or in groups of one, two, or more, but never exceeding six in any one group (as far as observed). As a rule, many eggs were crowded in a small space on the plant surface (see figures 1-3). On some plants but one side of a leaf contained eggs while other leaves contained eggs on both sides of the leaf. Several areas of the leaves of different plants were measured and the number of eggs in this area were counted, with the result shown in table No. 1. These figures indicate the great abundance of the eggs of this mollusk. The leaf used for attachment was generally of a living plant, but in many cases the dead and partly decayed leaves and pieces of plants were utilized for this purpose. In the table all leaves were about 6 mm. wide.

TABLE No. 1. Number of Eggs of *Gillia altilis* on Plants.

Plant.	Length of Leaf.	No. of Eggs.
Vallisneria spiralis	50 mm.	70
" "	60 mm.	160
" "	50 mm.	22
" "	100 mm.	69
" "	75 mm.	132
" "	75 mm.	73
" "	90 mm.	68
" "	45 mm.	33

The eggs are somewhat hemispherical in form, 1.25 mm. in diameter, the thickness being about a third of the diameter. Upwards of 80 per cent of the eggs contained living embryos, the balance being dead; a number of these were filled with protozoa. The envelope of the egg is very transparent and the embryo is transparent enough to permit some of the organs of the body to be seen through the mantle and transparent shell. The heart, placed near the aperture of the shell, was observed to pulsate very rapidly in all the embryos, in one individual 87 pulsations per minute.

Nearly all of the embryos were in an advanced stage of development, the embryonic shell as well as the external organs of the body—rostrum, tentacles, eyes, operculum, etc.—being fully formed (fig. 4). The embryos moved about in the egg

in the same manner that adult *Gillia* and other Amnicolidæ browse over vegetation, the proboscis moving slowly about and the radula being protruded as in the adult animal. There appeared to be a regular circular movement of the embryo around the area of the egg capsule. A favorite position of the young animal when at rest is shown in figure 5. The rostrum appears to be cleft at the extremity in some individuals and the anterior part of the foot varies greatly in form when the young animal is active (fig. 6).

The embryonic shell is transparent, spermaceti-white in color and about 1.25 mm. in diameter. It consists of rather more than one whorl which enlarges rapidly (fig. 7). The nucleus and a large part of the shell is covered with very fine spiral lines, the lines of growth beginning abruptly near the aperture. The umbilicus is of medium size and rather deep (fig. 8).

Amnicola oneida or *bakeriana* Pilsbry. Pl. 2, figs. 9, 10.

The lenticular eggs of *Amnicola* (figs. 9, 10) were notably abundant in many localities covering all objects on the bottom, including living and dead vegetation, dead and living shells, and bottom debris. Two species, recently described,[1] are represented. It is impossible to differentiate the eggs of the two species, as both occurred with the eggs, but it is suspected that the narrower form of egg (fig. 9) is from *oneida* and the wider form from *bakeriana* (fig. 10). It will be noted that the form of these eggs differs from the figure given by Stimpson [2] for *Amnicola limosa* in which the egg is much attenuated at both ends. The eggs of the new *Amnicola* were especially abundant in filamentous algæ (*Cladophora fracta* and *Œdogonium* species), the long filaments often being covered with the lens-shaped eggs. *Scirpus, Vallisneria,* and other plants were also used for attachment. An effort was made to ascertain the number of eggs on certain species of plants in a measured area, with the result shown in table No. 2. In *Vallisneria,* eggs occurred on both sides of the leaf.

1 Pilsbry, NAUTILUS, XXX, pp. 44-46, 1917.

2 Researches upon the Hydrobiinae, etc., Smith, Miss. Coll., fig. 7, 1865.

TABLE No. 2. Number of Eggs of *Amnicola* on Plants.

Plant.	Size.	No. of Eggs.
Vallisneria spiralis	70 x 5 mm.	44
" "	70 x 5 mm.	27
" "	153 x 5 mm.	257
" "	140 x 5 mm.	58
" "	140 x 5 mm.	222
" "	89 x 5 mm.	23
" "	53 x 5 mm.	93
Potamogeton perfoliatus, leaf ..	64 x 10 mm.	16
" "	165 x 28 mm.	150
" "	25 x 5 mm.	21
Potamogeton perfoliatus, stem ..	72 x 2 mm.	42
Potamogeton robbinsii, leaf	19 x 10 mm.	55
" "	38 x 10 mm.	42
Scirpus occidentalis	95 x 12 mm.	33
" "	111 x 12 mm.	54
" "	77 x 6 mm.	76
" "	77 x 8 mm.	141
Scirpus americanus	111 x 3 mm.	200
" "	111 x 3 mm.	36
" "	165 x 3 mm.	150

Quantitative studies show that *Amnicola* is the dominant genus of mollusks in the part of Oneida Lake examined, and the vast number of the eggs of this snail indicates that the group is fully maintaining itself. This fact is of importance economically, as several fish of food value—perch, pumpkinseed, bluegill, sunfish, catfish, sucker—as well as a few smaller fish preyed upon by larger and valuable food fish, use these snails as food. The eggs of *Amnicola* were observed in midsummer (July 25 to Aug. 4), and the condition of the embryos (in the trochosphere stage) indicate that they would be hatched from the middle to the latter part of August.

EXPLANATION OF FIGURES, PLATE 2.

1. Eggs of *Gillia altilis* on leaf of *Scirpus smithii.*
2. Eggs of *Gillia altilis* on leaf of *Vallisneria spiralis.*
3. A single egg of *Gillia* on leaf of *Vallisneria.*
4. Embryo of *Gillia* about ready to hatch.
5. Embryo of *Gillia* in resting position.

6. Embryo of *Gillia;* forms assumed by fore part of foot.
7. Shell of *Gillia altilis,* top view showing rapid enlargement of whorl.
8. Shell of *Gillia* viewed from the front.
9. Egg of Amnicola (*? oneida*) on leaf of *Vallisneria.*
10. Egg of *Amnicola* (*? bakeriana*).

PLEISTOCENE FOSSILS OF MAGDALENA BAY, LOWER CALIFORNIA, COLLECTED BY CHARLES RUSSELL ORCUTT.

BY WILLIAM HEALEY DALL.

In a recent visit to Magdalena Bay, Mr. Orcutt obtained a series of Pleistocene fossils from a deposit on Magdalena Island which prove very interesting. A number of the species average larger than the recent forms of the same name, others, like *Strombus granulatus,* are uniformly smaller. Many of the species have not been reported from so far north in the recent state, and on the whole the assembly has a more topical aspect than that of the recent fauna. One or two of the largest forms appear to be new. The list follows:

Bullaria aspersa A. Adams.
Terebra armillata Hinds.
Conus fergusoni Sowerby.
Conus vittatus Hwass.
Conus, *cf.* ximenes Gray.
Conus purpurascens Broderip.
Conus lucidus Mawe.
Conus tornatus Broderip.
Surcula maculosa Sowerby.
Crassispira nigerrima Sowerby.
Cancellaria obesa Sowerby.
Cancellaria candida Sowerby.
Cancellaria cassidiformis Sowerby.
Lyria (Enaeta) cumingi Broderip.
Vasum caestus Broderip.
Oliva incrassata Solander.
Olivella dama Mawe.
Phyllonotus stearnsii Dall, n. sp.
Phyllonotus bicolor Valenciennes.
Phyllonotus princeps Broderip.
Solenosteira anomala Reeve.
Patellipurpura patula Lamarck.
Thais biserialis Blainville.
Thais kiosquiformis Duclos.
Macron aethiops Reeve.
Arcularia tegula Reeve.
Strombina dorsata Sowerby.