3. The Reproduction of the Lobster.

By Francis H. Herrick, Adelbert College, Cleveland, Ohio, U.S.A.

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The breeding habits of the lobster (*Homarus americanus*) is a subject about which many conflicting statements have been made. These have resulted from insufficient observation, while much has also been written in ignorance of ascertained facts.

The questions of most immediate interest are; 1) When are the eggs laid; 2) what is the length of the reproductive period, or how often are the eggs produced; 3) what is the law of production, or the relation between the number of eggs and the size of the animal producing them; 4) how are the ova fertilized; 5) when do the young hatch; 6) what is the law of survival of the larvae?

I have recently gathered some new facts which bear particularly upon the first of these questions, and clear away much obscurity which has surrounded it. Before giving these I will first point out the condition in which this subject has remained up to a very recent date[1].

It at first seemed probable that the breeding season of the lobster was not limited to a definite season of the year, but further study convinced me that this conclusion was erroneous, and in a paper published in 1891 the following statement was made »The spawning season is confined to the summer months, and the eggs which are then laid, are carried by the female throughout the fall, winter and spring, and are not hatched under natural conditions until the following summer« (Notes on the Habits and Larval Stages of the American Lobster, Johns Hopkins University Circulars, Vol. 10. No. 88. May, 1891).

Bumpus (Journal of Morphology, Vol. 2. Sept. 1891) tells us in his careful paper on the embryology of the lobster, that »the eggs are normally deposited during the months of July and August«. Eggs collected in winter at Nahant »were almost invariably in the same advanced stage of development — the eyes large and bright, the appendages well outlined, and the yolk occupying but a fraction, perhaps one third of the surface exposed«. Of hundreds of lobsters examined in May 1890 at Woods Holl, Mass., »not a single one had eggs in early stages of development«. Verrill (Report upon the Invertebrate Animals of Vineyard Sound etc. p. 745) affirmed that he had examined lobsters with freshly laid eggs in December, and that the breeding season extended over a large part of the year.

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[1] See »The Habits of the Lobster, and their Bearing on its Artificial Propogation«. (Bull. U. S. Fish Commission, Vol. 13. 1893.)

The true answer to the first question propounded above seems to be as follows: The majority of adult lobsters extrude their eggs during the months of June, July, and August, but a considerable number, probably as great as ten per cent of the entire number which breed in the year, lay eggs during the fall, winter, and spring months. Careful systematic data have been collected by the U. S. Fish Commission during the past winter at Woods Holl, bearing upon this and other questions relating to the lobster, and will be given in the detailed report now in the course of preparation.

Newly laid eggs have been collected in the fall and winter on the coasts of Maine and Massachusetts. Microscopical examination showed them to be undergoing perfectly normal development from yolk-segmentation onward. Mr. Vinal N. Edwards sent me a number of live lobsters from Woods Holl, Dec. 4th 1893. One of these had external eggs, which had probably been extruded less than three weeks. At Eastport, Me., a female lobster with partially discharged eggs was taken from a lobster-car April 30th., 1894 by Mr. W. J. Fisher. In this case the eggs were laid in less than ten hours from the time the lobster was placed in the car. About one eighth of the spawn was under the »tail«; the rest was found in the body.

This production of eggs outside of the summer months seems to be a perfectly normal process, although a somewhat unusual one, and it is possible that if the habits of many fish and other animals with a fairly definite breeding season, were minutely studied, a similar variability would be found.

How often does an adult female lobster breed? It had been supposed that the mature lobster laid eggs at least once a year. In the paper already referred to I pointed out the important economic fact that the adult lobster could not possibly breed oftener than once in two years, that annual breeding was out of the question, as was »abundantly proved by the slow growth of the ovarian eggs, by the immature condition of the ovaries at the time when the young are hatched, and by the large percentage of non egg-bearing females taken in the winter and spring«. This fact was further established upon the ground of anatomy by dissections and histological examinations of a large number of individuals, representing every important phase in the growth of the ovaries. This is confirmed by Garman (The Aquarium, Jan. 1894. p. 91) who reaches conclusions similar to those already expressed.

The law of the production of ova may be expressed as follows: the numbers of eggs produced by female lobsters at each reproductive period vary in a geometrical series, while the lengths of the lobsters

producing these eggs vary in an arithmetical series. According to this law we have the following:

Series of lengths: (in inches)	8	10	12	14	16
Series of eggs:	5,000	10,000	20,000	40,000	80,000

An examination of nearly a thousand cases shows that this law usually holds good.

The question of fertilization of the egg is a very difficult one, and nothing is yet known of how the spermatozoon is conveyed to the egg, and penetrates its membranes. We know, however that copulation takes place in the spring and summer months, and probably at other times of the year, that fertilization is effected outside of the body, that the semen is stored in a peculiar pouch or receptacle, where it may retain its vitality for months, at least.

The eggs are carried, attached to the body of the female for a period of from ten to eleven months, that is, on the coast of Massachusetts, from the middle of July or the first of August to the middle of the following June. The period of fosterage undoubtedly varies considerably in eggs not produced in summer, some of which may hatch in the fall and possibly in the winter months.

Some lobsters become sexually mature when they are 8 inches long, while a relatively small number do not produce eggs until they have attained a length of 12 inches. The majority are mature when $10^1/_2$ inches long.

The law of survival of the larvae I have discussed in a paper already referred to (Bulletin of the U. S. Fish Commission, Vol. 13. 1893). It is probable that the survival of 2 out of every 10,000 larvae hatched, is a high estimate, since the female of average size produces upward of 10,000 eggs at a single laying, and may have the opportunity of reproducing more than once in the course of her life. The number of survivals must be less than the number of adults caught and destroyed each year, since the fishery is declining, and in some places has been destroyed through the persistence with which it is carried on.

Shortly after hatching her brood the mother lobster molts, but does not produce eggs again until the following summer. Very rarely a female lobster molts just before extruding her eggs. In such cases probably two molts intervene between the time of hatching of one batch of eggs and the extrusion of another.

Considering the fact that the American lobster ranges through twenty degrees of latitude, from the southern coast of Labrador on the north, to Delaware on the south, there is perhaps less variation in the breeding habits than we should expect. In the north the eggs are

laid somewhat later in the summer, and the period of fosterage is undoubtedly longer.

It is probable that when the habits of the European lobster (*Homarus vulgaris*) are carefully studied, they will be found to conform in all essential respects with those of its American relative.

4. Contribution à l'anatomie des Glossiphonides (Clepsinides).

Le canal efférent du testicule.

Par H. Bolsius, S.J., Oudenbosch.

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I. Les testicules des Hirudinides et des Néphélides se déversent dans un canal efférent commun, auquel ils sont réunis par un faible canal de peu de longueur. C'est là un fait très connu. Il est encore de notoriété fort répendue, que ce canal commun, qui réunit le produit spermatique de tous les testicules du même côté de l'animal, circule du côté ventral.

Ce qui semble moins connu, est la disposition de ces mêmes parties chez les *Glossiphonides*.

Ici l'union du testicule a lieu par un conduit assez long, et cela pour une raison décisive: le canal efférent commun est placé à une grande distance du sommet du testicule.

La figure 1 est une coupe sagittale d'une *Haementeria officinalis*[1].

Nos coupes microtomiques ont une épaisseur de 15 μ. Dans une seule section nous avons les quatre testicules que contenait le tronçon. Tous sont rencontrés au point d'insertion du canal efférent, *CE*.

Mais ce canal efférent, *CE*, au lieu de rester au même niveau horizontal, comme chez les Hirudinides et les Néphélides, monte vers le dos de l'animal.

Les autres sections de notre série font voir l'anastomose de ces premiers canaux, *CE*, avec le canal efférent commun, *CC*. Celui-ci est placé, non pas près de la face ventrale, *FV*, mais près de la face dorsale, *FD*.

Cette disposition renversée nous ayant étonnée, nous avons tenu à contrôler sur nos espèces indigènes, si là aussi le même renversement avait lieu.

A cette fin nous avons examiné les espèces suivantes:

1) *Glossiphonia sexoculata*,
2) *Glossiphonia bioculata*,
3) *Glossiphonia* (*Hemiclepsis*) *marginata*.

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[1] Nous devons cet animalcule à M. le Dr. R. Blanchard, auquel nous présentons à cette occasion nos sincères remercîments.