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D. A. MacKay.

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Atlantic Biological Station

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D. A. MACKAY, M. A., Ottawa.

During the months of July and August, 1921, an attempt was made to rear young lobsters at St. Andrews, N. B.

A box 14 feet long, 10 feet wide and 2 1/2 feet deep was constructed out of tongued and grooved spruce boards. One end of the box was pointed and the interior was divided into two compartments by a partition down the centre. Two openings covered with fine copper wire netting were made in each compartment, one at each end. This was to ensure proper circulation of water. Two doors closed in the top. Inner and outer surfaces were painted with copper oxide paint.

The box was anchored out a short distance from shore where the depth of the water was about fifteen feet at low, and about forty feet at high tide.

Berried Lobsters

Berried females, averaging 15 inches in length and 4 lbs. in weight were put into the rearing box on July 13th, two being put into each compartment. The eggs of at least two were mature and on July 15th, both compartments contained large numbers of larvae, all of which appeared to be healthy and active.

Food.

At first, plankton was used as food. This consisted mostly of small crustaceans (copepods) captured with a fine net. This material was placed in the rearing box, with the hope that the larvae would thrive upon it. However, after using it for two weeks, the larvae were not growing properly and a change was made. Clams (*Mya arenaria*) were removed from the shells and ground up as finely as possible and placed in the box. Many of these small particles were light in color and also in weight, and remained for a time floating. At first, the larvae appeared to take readily to the clams. In a few days, a considerable amount was found on the bottom of the box and there was some danger that it might foul the water. Small crustaceans, *Gammarus locusta* and *Michtheimysis stenolepis* were killed in boiling water and finely pulverized. These were used for a few days; also hens' eggs cooked and pulverized.

In addition to all these kinds of food, there was whatever the current flowing through the box might bring, but notwithstanding all

this, there was not satisfactory growth. One great difficulty was the fact that it seemed impossible to pulverize the material finely enough. A larva would not attack a large piece of food.

Temperature.

The water in Passamaquoddy bay was very cold. During July it would average about 51 degrees F. at the surface, and during August about three degrees higher. This felt almost like ice water, and I have no doubt was the chief factor in retarding the proper growth of the larvae.

Light.

For convenience I shall label the compartments "A" and "B". The doors on B were kept closed, while those of A were left open. The fry in A came to the surface in the daytime and continued to swim actively about, and for a time seemed to thrive. Parasitic plants and animals, however, began to develop on these larvae, while there was little evidence of such organisms in B. After this both compartments were kept closed.

Circulation.

There is no doubt that one of the important factors in lobster rearing in boxes is an optimum current. What that should be has

not been determined. If the current is too weak, there is not sufficient change of water for best results; if the current is too strong, then the helpless larvae are carried against the wire netting of the outlet and large numbers killed.

An attempt was made to regulate, to some extent, the current in one compartment, A, but results were not fully satisfactory.

Diatoms.

After the larvae were about two weeks old, diatoms were found on quite a number. This was more particularly true in the case of the larvae kept in compartment A, while the light was being admitted. When the light was shut out, a smaller percentage of fry was affected.

The principal diatom found belonged to the genus Licmophora. Each diatom was more or less cigar shaped, or wedge shaped, and they were usually joined together into fan-shaped fascicles. Eighty per cent. of the larvae were practically free from diatoms.

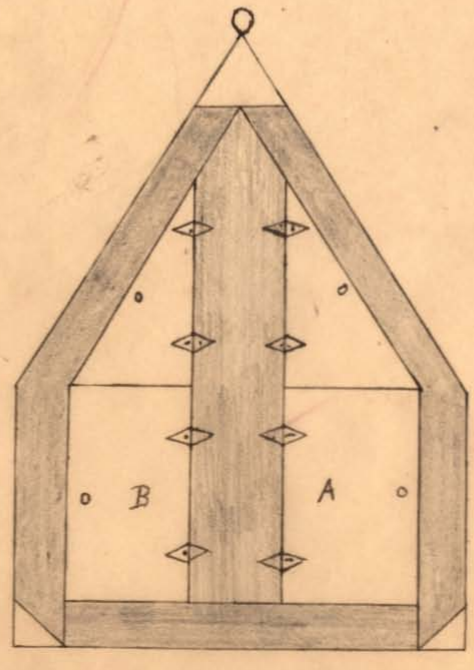
These observations corroborate those made at Long Beach pond in 1914-15.

Animal Parasites.

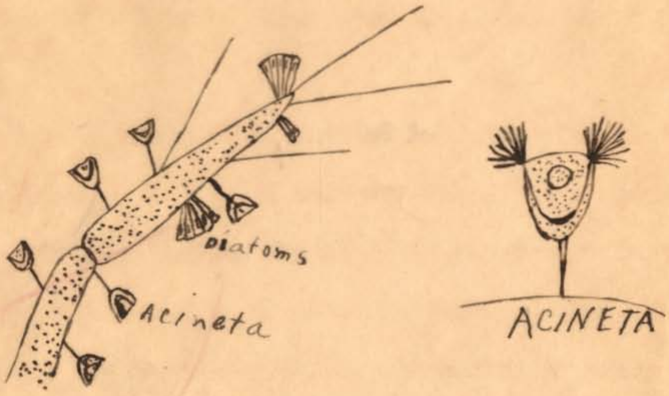
The principal parasitic animal preying upon the larvae was a small protozoan - Acineta mystacina. These minute animals have knobbed tentacles which serve as sucking discs. They are sedentary

in habit and are either free or attached. In the young state they are ciliated. When attached, they may be sessile or stalked. They exist upon the living tissues of other organisms, which are absorbed by means of tentacles, of which there are two kinds:- (a) suctorial, (b) prehensile. The body is surrounded by a covering which sometimes becomes thickened to form a sort of shell. When the stalk of attachment is present, it is not contractile.

A number of larvae were examined every day and several were found fairly well covered with both classes of parasites mentioned. One of the appendages was removed from one of the worst specimens and a photomicrograph made. This shows both organisms and will furnish some idea of the number on the whole body.



PLAN OF HATCHING AND REARING BOX.
10' WIDE, 14' LONG, 2½' DEEP.



Part of a leg of a larval lobster covered with parasites.

Cannibalism.

The tendency to devour one another is a well-known fact in the rearing of lobster fry, and was frequently observed in our experiments.

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On July 28th, the two female lobsters in compartment B no longer carried eggs and were removed. The fry continued active and mostly free from parasites. When last examined by me on August 25th, there would be at least 500 larvae alive, and they would be at least four weeks old.

In compartment A four more berried lobsters were placed, and each one removed when it ceased to carry eggs. In this compartment, hatching was continued during the whole course of the experiment. For this reason there was no check on the ages of the larvae. Many were found dead, but there were always thousands swimming around actively. On August 25th there would be at least 5000 alive.

At the end of August, just a week after my last examination, Dr. Huntsman examined both compartments and did not find one living larva. He found a number of eggs lying on the bottom of each compartment, and tried to hatch some of them in the laboratory, but was unsuccessful. These eggs no doubt had dropped off the mother during storms when the water was agitated, or when the lobsters were being dipped up for examination.

My examination of the larvae from day to day revealed the fact that in A the larvae for some reason or reasons did not develop properly. They were first stage fry, but as hatching was going on

continuously, one could never be sure of the ages of those examined.

In compartment B, however, there was no hatching after July 28th, unless a small percentage of the eggs that had fallen to the bottom hatched. The fry were, therefore, four weeks old, but for all that they were little larger than when first hatched. They should have moulted twice and passed into the third stage. Retarding influences had delayed development. However, while the larvae did not properly exuviate, there was good evidence of some development. The swimmerets were developed and could be seen moving underneath the epidermis; the claws were prominent and decidedly larger than the legs; the rostrum also was more prominent than at first. Now these are not characteristics of the first stage but rather of the second and third stages, except for the fact that the swimmerets were not free.

Small Lobsters.

Five small wire traps were put out in various places around St. Andrews in order to find out if any small lobsters live in this locality. None were captured. The traps were found to be filled up with starfish, sea urchins, snails, etc., but no crabs or lobsters. For example, when the five traps were hauled on July 25th, the yield was:

43 sea urchins

Strongylocentrotus drobachiensis.

12 starfish

Asterias vulgaris.

A large number of Gastropods,

Littorina litorea

Purpura lapillus

Buccinum undatum

Chrysodomus decemcostatus

A few hours were spent examining the Maine shore above St. Andrews, and about a mile of the shore of Campobello island, but no small lobsters were discovered.

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Before closing this report, I wish to thank Dr. Huntsman, Director of the biological laboratory, for his assistance and advice, which were freely given at all times.

In addition, I wish to thank the other members of the biological staff who helped to further my work.