

## RESEARCH OUTLINE--Summer, 1947 (Revised)

- I. Taxonomy--Check on variation of Hvalella knickerbockeri by observation and breeding
- II. Distribution--Continuation of observation of general distribution and habitat selection
- III. Population Census--for Gammarus and Hvalella
  1. Sex ratio
  2. Age ratio
- IV. Breeding Habits
  1. Relation of number of copulations to number of broods
  2. Relation of number of eggs in marsupium to size of female
  3. Number of broods
  4. Duration of breeding
    - A. Length of interval between copulations
    - B. Length of interval between broods (appearance in marsupium)
    - C. Length of period during which eggs-embryos are retained in marsupium--length of period of gravidity
  5. Number of live young emerging from marsupium
- V. General observations of food, enemies, etc.

OUTLINE OF RESEARCH PROGRESS--SUMMER, 1947

I. Taxonomy of Hvalella strains

A. Pigmented form definitely larger, even in comparisons between both adults and emergent young.  
(Populations preserved, awaiting measurement in Ann Arbor.)

B. Pigmentation

1. Young unpigmented at birth, but begin to show pigmentation in the form of striped transverse areas of little speckles after several weeks.  
(Young raised in population kept in lab preserved for meas.)
2. Young collected in field showed similarly a noticeable streaking in older young, but no pigmentation in the smaller specimens.  
(Collection awaiting measurement in Ann Arbor.)
3. Further studies awaiting development of young to show adult features for comparison.

II. Distribution

A. New localities and records for Hvalella

1. "Brewery Pond"--beside M131 at Bay View  
Small form of Hvalella -- rather scarce  
Found chiefly in Chara  
Bottom mucky, with marl, fallen logs, etc.  
Abundant snail population  
Water temperature--24.6 C.
2. "Brewery Pond" creek--at railroad crossing on road perpendicular to M131, just behind brewery  
Small form of Hvalella--fairly abundant  
Mucky bottom with fallen logs, debris  
Heavy vegetation with cover of Nymphaea  
Water temperature 24.6
3. Mouth of Nigger Creek at U.S. 27  
Small and large forms of Hvalella  
Bottom sandy with thin layer of muck covering  
Debris, Mvriophyllum, Nuphar, Potamogeton  
Rich fauna, particularly crayfish.

B. Survey of Carp Creek from Gorge to Iron Bridge on Hogback Road  
August 1, 1947

1. Spring bed in Gorge  
Depth--1 inch                      Water temp. 11.0 C.  
Fallen leaves and timber, mainly of Acer sp.  
Soft muck bottom
2. Stream near picnic point--swift current, riffles  
Depth--4 inches                      Water temp. 11.6 C.  
Moss, fallen twigs, a few leaves
3. Edge of stream beyond picnic point  
Depth--5 inches                      Water temp. 11.8 C.  
Sand bottom  
Moss covering at shore line

4. In algae mound and moss beds at side of stream  
Depth--3-4 inches                      Water temp. 11.2 C.  
Sand bottom
5. First Fontanalis bed along stream--on log, near Algae (#4)  
Depth--1-2 inches                      Water temp. 11.6 C.
- 6.-7. Chara bed near first very large fallen tree  
Depth--1-8 inches                      Water temp. 11.6 C.  
Sand bottom covered with organic ooze at base of Chara
8. Algae on log and bottom  
Depth--2 inches                      Water temp. 11.8 C.
9. First spring entering from NE (on left going down stream)  
Depth--3 inches                      Water temp. 11.2 C.  
Sand bed with underground passage just before entering main  
stream flowing under tree rooted soil.  
Mosses
10. Carex bed just below first sharp right angle bend  
Layer of silt over sand.  
Collected at roots  
Depth--2-3 inches                      Water temp. 12 C.
11. Mouth of spring entering from NE near second sharp right angle  
bend  
Depth--3-4 inches                      Water temp. 11.2 C.  
Fallen timber, Carex
12. Thick Chara bed at mouth of very large tributary  
Depth--3 inches                      Water temp. 11.8 C.

From this point to the bridge repeated samples were taken, but none collected for preservation, hence there is no series of other bottle numbers.

Although a complete study waits measuring, all specimens identified were Gammarus limnaeus, of varying ages and sizes. The Hvalella type previously collected from the Gorge seemingly were not present.

Specimens were collected in all points tried except one log bearing dead Fontanalis. The Chara beds were especially good sources for collecting, but even the semi-aquatic plants submerged by the unusually high water, such as Ranunculus spp., Carex, etc. had some animals at their roots.

All collections were from relatively shallow water, since the deeper portions were points at which the current was more swift and there was no vegetation rooted there for the animals to cling to or feed from.

C. No chemical analyses were made this year.

D. Habitat preferences

1. Large form Hyaella were found burrowed in mud, similarly to the habits of Gammarus.

This is contrary to the habits of the smaller type; they customarily frequent branched vegetation such as Chara, Myriophyllum, Ceratophyllum, Hippurus, etc., clinging to the upper parts of the plant.

2. In collection August 12 around stump on east shore of Nigger Creek just to left of Iron Bridge, very few adult large form Hyaella or Gammarus were found, but the young Hyaella were super-abundant.

Water was approximately 3-4 inches deep, and the water level was considerably lower than that recorded from previous collections, leaving many shallow, isolated, relatively open sections of water between logs, stumps, etc.

In collection August 13 just some 20-30 feet from the collecting site August 12, a locality was chosen a little farther out from shore, with a depth of 4-6 inches. Vegetation and covering was more abundant. Here adults were found more frequently at the base of plants, with the young more abundant on the vegetation itself. This determination was made by screening at various depths.

3. Earlier collections in Nigger Creek during high water showed Gammarus at surface of muck, in fairly open water around the stumps and logs near the shore.

III. Population Census

Material collected from

Carp Creek--at Iron Bridge on Hogback Road

Nigger Creek--at Iron Bridge (2)

Bessey Creek--at source in Lancaster Lake

Ocqueoc River--near highway bridge

Ocqueoc Lake--east shore

Survey material from 12 points along Carp Creek (small samples)

All measurements to be determined in Ann Arbor.

IV. Breeding Habits

Study of large form Hyaella collected from Nigger Creek, June 30  
at which time all couples were copulating

	A	B	C	D	E	F	G	H	I	J
7/7&	37	12 cop/	12 ♀ gr.	11 ♀ gr.	19 ♀ gr.	29 ♀ gr.	20 cop/	22 cop.		
7/9	3 cop/	♂ dead	♂ dead molting	cop.	cop.	♂ dead				
7/11	15			7 & 5 dead cop.	13 cop.		♂ dead		17	6
7/15	♂ dead 13		17	9 ♀ gr.	♀ gr.	(1) ♀ gr.	(1) ♀ gr.		♀ gr.	
7/20				(2)	(1)		(2)		3	
7/24				12						
7/27								dead ♀ + ♂		
7/31				♀ dead						

Other observations were made, but nothing found to report.  
Subsequent to July 31 observations were continued, but owing to the male mortality, breeding had ceased among the adults, and no special behavior was noted among the young, except for growth and the disastrous effect of extreme weather conditions until August 7.

On August 7, one couple from the first brood collected from couple C were found copulating. At present writing there are no evidences to report of gravidity of female or the production of young.

1. Relation of copulation to brood incidence
  - A. No brood was produced without previous copulation.
  - B. In C, the female was apparently fertilized before death of male.
  - C. In F and G, female became gravid after death of male, but the eggs did not develop.
  - D. Numbers in parentheses represent young of previous brood (judged by relative sizes), not removed from dish containing parents up to that date.
  - E. Number of copulations observed in field very numerous in early collections; almost none in period of August 4-13.
  
2. Number of young in brood in relation to size of female
 

Number of young varied from 11-37 -- no measurements made, but female A was apparently somewhat larger than female D.  
Others didn't vary enough to notice with naked eye.

3. Intervals between broods

- A. Data from A, D, and E show an interval of only 4-5 days between 1st and 2nd broods.
- B. Data from A and D show an interval of 4-5 days also between brood 2 and 3 (those collected in laboratory, not those produced in nature)
- C. In D 4th brood followed in 9-10 days after 3rd.
- D. Environmental conditions undoubtedly affect period of time between broods and made observations questionable.
- E. Rapid temperature changes and perhaps incorrect feeding caused death of males and prevented further observation.

4. Intervals of time between formation of eggs in ovary and gravidity of female.

Owing to the pigmented nature of this form of Hvalella, this type of observation could not be made without damage to the specimen, and hence was not recorded at this time.

5. Number of young produced per brood

- A. This strain produced larger broods than those typically reported from the smaller strain.
- B. Average number of 1st broods collected--19.5
- C. Average number of 2nd brood collected--14.5 (from only 4 broods)  
The reduction in number is probably due to environmental effects, as is indicated by the fact that in D, 5 of the brood of 14 were found "still-born". Perhaps other such incompletely developed or weak young were emitted from marsupium, but not found in culture dishes.
- D. Third and fourth broods were slightly reduced in number from second broods.

V. Observations of feeding, predators, etc.

1. Feeding

- A. Used organic ooze with algae or moss in culture dishes with fair success
- B. Suggestion (from D. DeGiusti) to use willow roots on Hvalella
- C. Small number of Gammarus maintained in flat enamel pan with Chara, despite radical changes in temperature. (from 11.2 at source in Carp Creek--aver. temp. in dish about 21 C.)

2. Predators

Caddis larva seen feeding on dead Hvalella--might be scavenger or predator.