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cc : Education -- Game
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ANN ARBOR, MICHIGAN

November 13, 1951

Report No. 1305

A SURVEY OF THE TRICHOPTERA OF DOUGLAS LAKE AND VICINITY, CHEBOYGAN COUNTY, MICHIGAN

By

Neil A. Walker

Abstract

Adult and larval caddis flies (Trichoptera) were collected in and around Douglas Lake, Cheboygan County, Michigan and from other lakes in the vicinity as a part of a state-wide inventory of aquatic insects. Descriptions of the collecting sites are given in the body of the report. Collection of larval or pupal stages of caddis flies was rather disappointing considering the numbers collected and the time spent. Adults were taken in quantity by the use of a standard New Jersey style mosquito light trap. An experimental subaquatic light trap was constructed but was placed in use too late in the season to attract many large Trichoptera larvae. A description of this light trap is given along with a list of the orders and groups of organisms attracted by it.

The biology of the early instars of Triaenodes sp. (Leptoceridae: Trichoptera) is discussed. From this study, it seems apparent that Triaenodes larvae have stadia of about 3 weeks between first and second instars, and that they are phytophagous.

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Introduction

A survey of the caddis fly fauna of Douglas Lake, Michigan, and vicinity, was undertaken as part of a state-wide inventory of the aquatic insects to be found in lakes. Insects of other orders are not considered in this particular report. The period of study extended from June 21 to August 17, 1951. The University of Michigan Biological Station was the base of operations for all field work.

Acknowledgments

The problem was under the general supervision of Dr. Justin W. Leonard while the taxonomic work was supervised by Fannie A. Leonard. The actual field work and biological aspects of the problem were directed by Dr. H. B. Hungerford of the University of Michigan Biological Station, and much help and advice was received from him. Other members of the Biological Station staff were equally free with suggestions and equipment. The Institute for Fisheries Research, Michigan Department of Conservation, supplied much of the equipment used. The subaquatic light trap described in this report was fabricated by the working crew

of the Biological Station from both their material and supplies from the Institute for Fisheries Research.

Equipment

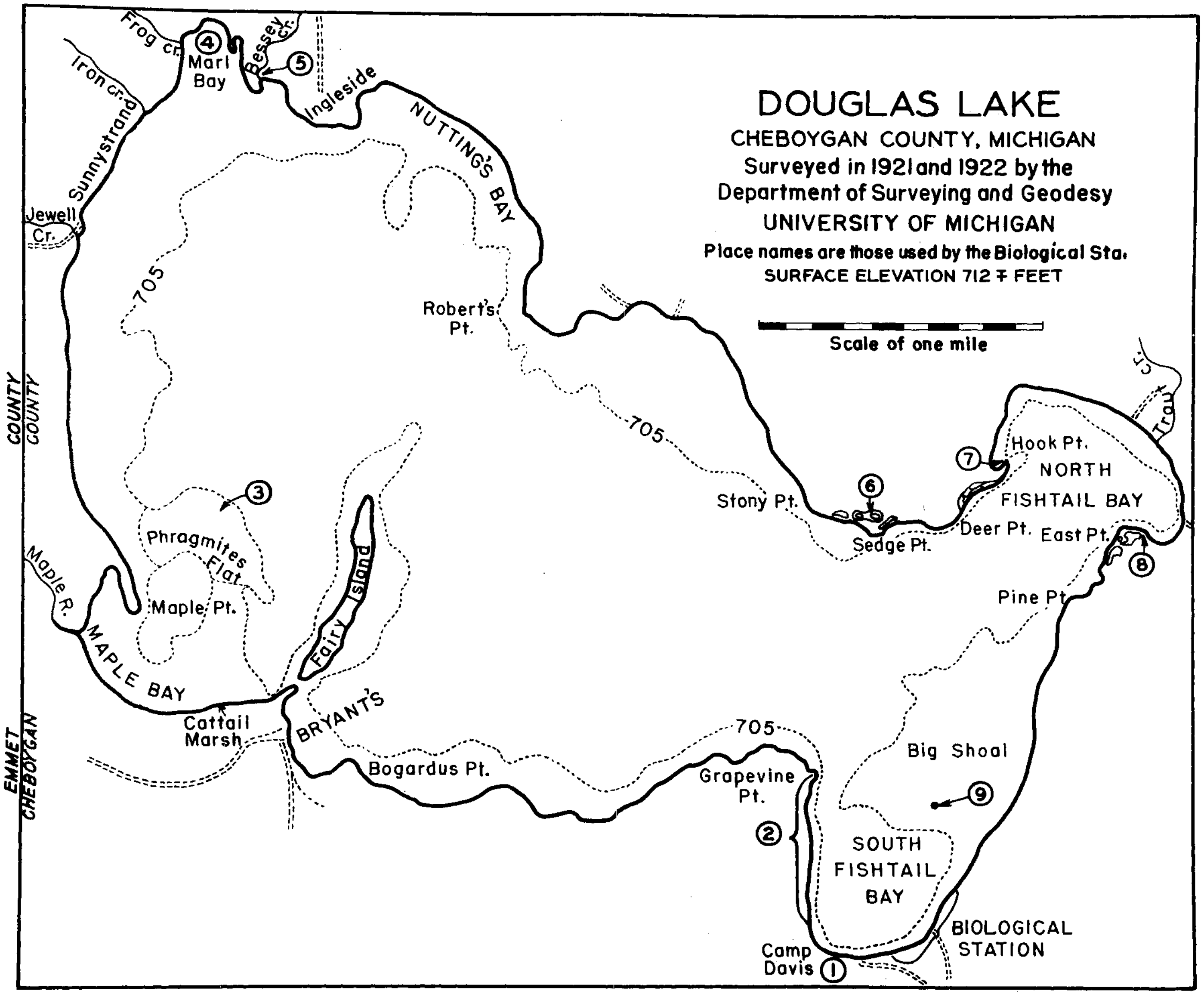
Collecting equipment used included a boat and outboard motor, a long handled aquatic net with a cloth bag about 12 inches deep, a fine-mesh wire screen scap net, plankton net, plant hook, Ekman dredge and two light traps. The first of these to be used was a standard automatic mosquito light trap. The second was a light trap for underwater use designed by the author from suggestions by Dr. Hungerford and modified from one previously used in stream work.

Collection Areas

Collections of caddis flies (Trichoptera) were chiefly made in and on the shores of Douglas Lake in Munro Township, T. 37 N., R. 3 W., Sec. 17, 18, 19, 20, 21, 22, 27, 28, 29, 30, 33, 34, Cheboygan County, Michigan. Some collections were also made from the east shore of Burt Lake, T. 36 N., R. 3 W., Sec. 11; Lancaster Lake, T. 37 N., R. 3 W., Sec. 5, 8; Vincent Lake, T. 37 N., R. 3 W., Sec. 16, 17; Black Lake beach pool, T. 36 N., R. 1 E., Sec. 21; and Nelson (Nolton) Lake, T. 38 N., R. 3 W., Sec. 15, 22. Other collection areas included the mouth of Nigger Creek at Mullett Lake, T. 36 N., R. 2 W., Sec. 16, all in Cheboygan County, and in "Pellston Pools," T. 37 N., R. 4 W., Sec. 22, Emmet County, Michigan.

Douglas Lake

The shore line of Douglas Lake was examined for possible collecting areas. The ones chosen reflect the various types of habitat found in and around the lake, with the exception of deep water (over 10 feet). (See Map I.) Adults were taken by a standard New Jersey style mosquito light


DOUGLAS LAKE
CHEBOYGAN COUNTY, MICHIGAN
Surveyed in 1921 and 1922 by the
Department of Surveying and Geodesy
UNIVERSITY OF MICHIGAN
Place names are those used by the Biological Sta.
SURFACE ELEVATION 712 ∓ FEET
Scale of one mile
Frog cr.
Marl Bay
Bessey Cr.
Ingleside
Iron cr.
Sunnystrand
NUTTING'S BAY
Jewell Cr.
705
Robert's Pt.
COUNTY
COUNTY
Trout cr.
Hook Pt.
NORTH FISHTAIL BAY
Stony Pt.
Sedge Pt.
Deer Pt.
East Pt.
Phragmites Flat
Maple R.
Maple Pt.
Fairy Island
Pine Pt.
MAPLE BAY
Cattail Marsh
BRYANT'S
Bogardus Pt.
Grapevine Pt.
Big Shoal
EMMET
CHEBOYGAN
SOUTH FISHTAIL BAY
BIOLOGICAL STATION
Camp Davis
1
2
3
4
5
6
7
8
9

Map I.

trap on the shore of South Fishtail Bay, by sweeping over the water in various areas of the lake, and a few by sweeping vegetation along the shore. The majority of adults were taken by the mosquito light trap. Larvae and pupae were collected in various areas of the lake and its beach pools.

The light trap was placed (Map I, Station 1) on the southwest shore of South Fishtail Bay, near the Biological Station boathouse, within 10 feet of the shore; the area near the trap was sandy, covered with some small trees, low willow bushes, weeds and poison ivy. During the first few collections, the automatic timer of the light trap was set to turn on at 10:00 P.M. and off at 4:00 A.M. The time was changed as the days became shorter until the trap was in operation from 8:30 P.M. until 4:00 A.M. On occasional dark evenings, the trap was turned on by 7:00 P.M. No systematic attempt was made to determine what particular period during the night was most productive, although casual observations indicate that the early evening was more productive, particularly if the night were cold.

Larvae were collected along the east shore of Grapevine Point (Map I, Station 2) by picking individual rocks, by "shoveling" the bottom with a fine mesh wire scap net and sorting the gravel, or by picking up individual specimens when they were noticed moving on the bottom.

Representative of the weedy shoals of Douglas Lake was the northeast portion of "Phragmites Flat," (Map I, Station 3) a collecting area varying from 3 to 10 feet deep with rather heavy growths of Scirpus, Potamogeton, Elodea, Myriophyllum, Ceratophyllum and other submergent plants. The bottom was sand to gravel. An Ekman dredge was used, both to get bottom samples and to obtain the roots of the plants for examination. Here, as elsewhere, larvae were infrequent in their distribution.

Marl Bay (Map I, Station 4), was investigated and collections attempted. The bottom was marl and the vegetation consisted almost entirely of Scirpus. No larvae were found in this area.

Larvae were collected at the mouth of Bessey Creek (Map I, Station 5), where it enters the northwest portion of Douglas Lake. Here, the larvae were collected by pulling up water plants with a plant hook. Those larvae found on Elodea were either near the roots, or in the bushy, bud-like tips. Few were found on other plants or in the more exposed mid-section of Elodea. While Balduf (1939) states that some larvae feed on algae, and personal observations lead to the same conclusion, none could be found in the long strands of filamentous algae examined from Bessey Creek.

Other larvae were collected in the Sedge Point beach pools (Map I, Station 6), which have muddy bottoms and a maximum depth of 3 feet, and are weedy with Elodea, Potamogeton, Nymphaea, Nuphar, cattails, various bulrushes and other vegetation. Caddis larvae were found on the vegetation, on the mud or barely in the mud, contrary to collections in gravel-bottomed sites where they were frequently found in the gravel. Both nets and the subaquatic light trap were used to collect in the pools. The shore of Douglas lake in this area, composed of sand and gravel, is exposed to considerable wave action and appeared to be practically sterile as far as Trichoptera larvae were concerned.

Hook Point (Map I, Station 7), partially encloses a forming beach pool which harbors the typical beach pool vegetation: cattails, Scirpus and other emergent and submergent plants, including Nymphaea and Nuphar. Off the end of the point are found beds of Scirpus in a marly to sandy bottom. The subaquatic light trap was used here, as well as off the north side of the point in a weed bed at the drop-off. Net collections were attempted in the pool area with little success.

Collections were also made in the beach pools on East Point (Map I, Station 8), but these pools dried up fairly early in the summer. Collections were attempted along the drop-off east of East Point by using a weighted circular plankton net 12 inches in diameter. This net was dragged behind the boat at various speeds but was an unsuccessful collecting device because the cloth was too fine-meshed to permit the free passage of water; a "low wave" was set up in front of the net which pushed the plants aside and defeated the purpose of the attempt. The idea might be usable with a much coarser-mesh net bag.

The Big Shoal (Map I, Station 9), was used as a collecting spot for the subaquatic light trap, which was placed in a bed of Scirpus in approximately 5 feet of water. However, a considerable portion of the catch consisted of a fish.

Other Areas

Adult caddis flies were collected on trees and in a field about 200 yards east of the shore of Burt Lake.

The west shore of Lancaster Lake, formed of gravel and rubble and subjected to considerable wave action, was searched for larvae. This lake is somewhat more acid (pH 7.2) than is Douglas (pH 8.2) according to Dr. F. F. Hooper (personal communication). Here were found mostly Molanna, with some other families represented by a few specimens. The weed beds of this lake were not examined thoroughly, but no Trichoptera were found in them.

Vincent Lake also yielded chiefly Molanna cases, which were empty when collected. The south shore of this lake was marshy while the east shore had a muck-clay bottom with some small areas of sand and gravel.

Collections at Black Lake beach pool were chiefly made to obtain egg masses of Triaenodes but some larvae also were taken. This beach pool is of varying depth, and apparently has a boggy bottom with numerous holes over 6 feet deep. The bottom near shore is muck. Vegetation consists of *Nymphaea*, *Nuphar*, *Ceratophyllum*, *Elodea*, *Myriophyllum*, *Scirpus* and cattails.

Nelson (Nolton) Lake was visited with considerable anticipation. It is a shallow lake that apparently dries up occasionally until the only remnants of water are in the ditches alongside the road. There is a solid bottom of grasses with some willow scattered about. The deeper portions, ditches, are 3 to 4 feet deep but most of the lake was only 1 to 2 feet deep when visited. Along the ditches are found numerous willow bushes and cattail clumps. This lake was very poor for collection of Trichoptera although other aquatic insects were present in fair numbers.

The mouth of Nigger Creek, emptying into Mullett Lake, was recommended as a location where caddis fly larvae might be found in freshwater sponges. None could be found however, even by the informant, on the afternoon spent there. This was a deep area characterized by rocks covered with algae and some freshwater sponges. At the extreme mouth, some 50 feet below, the bottom was a mixture of sand and gravel, also apparently sterile so far as Trichoptera were concerned.

"Pellston Pools" are small clay-pit pools, apparently filled by run-off water, they support rather heavy populations of aquatic Hemiptera, Coleoptera and Odonata. From collections made at high, moderate and low water levels however, there seem to be very few Trichoptera in them.

Collection Notes

The night of July 27, 1951, was very productive of adults collected by the standard light trap. There was a strong on-shore north wind with rain beginning late in the night. There seems to be no obvious reason for such a heavy collection in one night. The increase in numbers of adults collected was noticeable during any warm, rainy evening. This summer was cooler and had more precipitation than normal, as evidenced by the report for July at the Biological Station: the lowest maximum temperature (86° F.) in the station's history, and almost twice the normal precipitation. Many days were so windy, and the lake so rough, that it was not sensible to venture out in a boat.

Subaquatic light trap

The subaquatic light trap (Diagram I) comprised a wooden frame 12" x 12" x 24", made of 1" x 2" planed stock, covered on the inside by window screen and inside that by dark cloth. It was ballasted by 2 window sash weights, 21 3/4" long and 2" in diameter, weighing about 25 pounds each. It was originally made with a funnel constructed in the same manner with the only light shining out through the funnel opening from a 2-celled flashlight in a 2-quart jar. This was very evidently unsatisfactory and was modified by replacing the funnel with one made of fine-mesh (40/inch) wire screen. This funnel was entirely open to the transmission of light from a sealed-beam automobile headlight powered by a 6-volt battery. The headlight was set in a 9-inch-diameter common funnel which was held in place by two pieces of No. 9 wire running through the frame of the trap and through holes in the funnel. The battery was connected to the "bright beam" post of the headlight, and to the ground post, by 50 feet of rubber-covered No. 18 house (110 V.) extension wire. There was some resistance by this wire, but sufficient current reached the headlight to give a good beam of light. The headlight would burn satisfactorily for 12 to 14 hours but the battery then needed to be recharged.

It is suggested that any subaquatic light trap of this sort built in the future be modified as follows: it should be constructed from 1/2-inch angle iron for the frame with the wire screen, of 30 to 40 meshes per inch, soldered to the frame; the length would be reduced by removing the spout of the funnel holding the headlight; and a solid bottom of galvanized iron used in place of the screen to help keep the bottom ooze from seeping in and obscuring the catch. It is possible that less resistance would be offered to the electrical current by rather large, solid wires, which would probably be more difficult to coil and use. Such a modified subaquatic trap would require smaller weights, if any, and could be much more easily handled.

SUBAQUATIC LIGHT TRAP

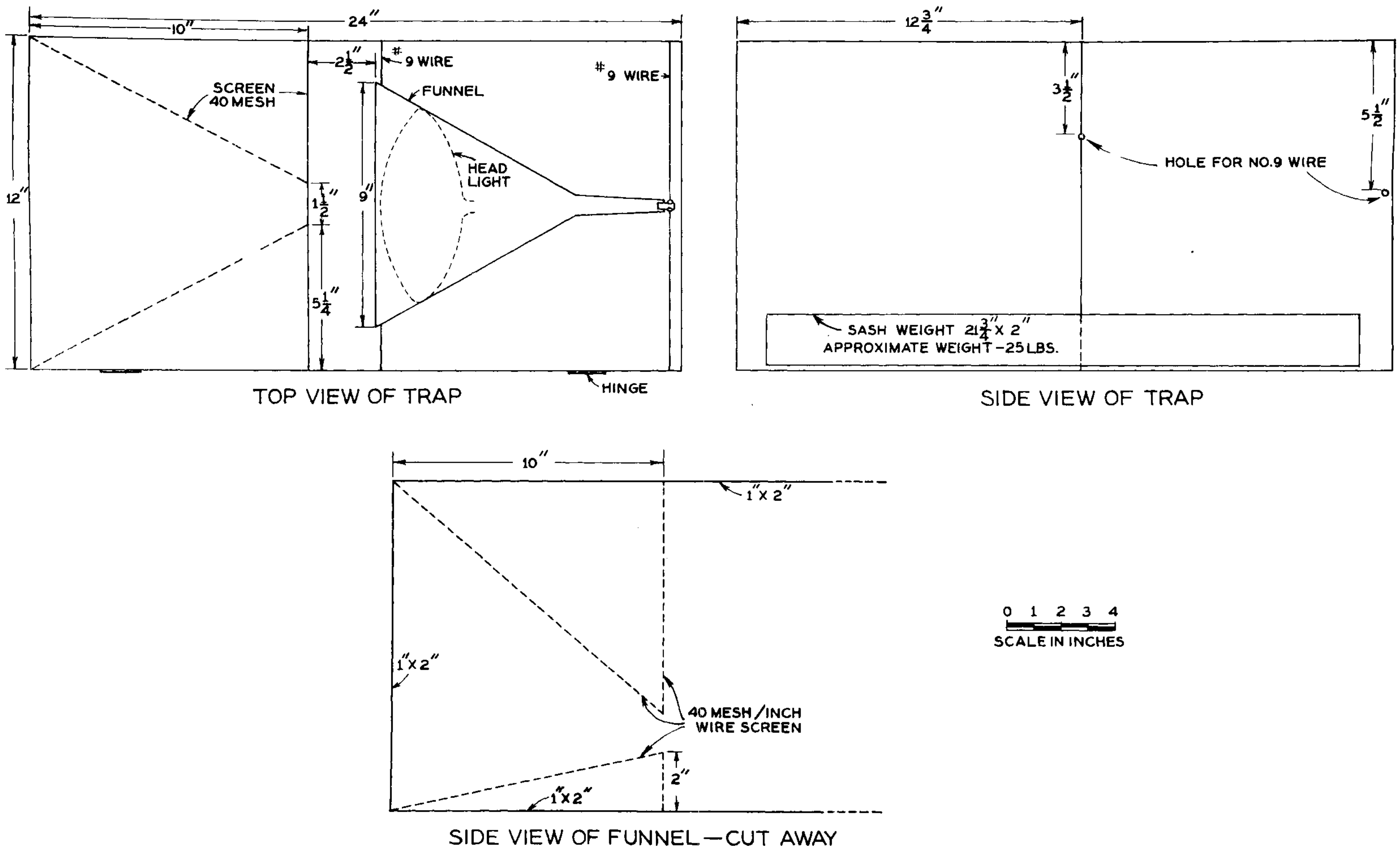


Diagram I.

Collections

The subaquatic light trap was placed in the west pool at Sedge Point, in two areas at Hook Point and on Big Shoal in the lake proper. It was used with the light on and off in order to be fairly certain of the attraction by the light. In various of the collections were found:

- Turbellaria (Planariidae), unidentified
- Hirudinea, unidentified
- Gastropoda, unidentified
- Entomostraca, unidentified
- Copepoda, unidentified
- Arachnida (Hydrachnidae) unidentified
- Insecta
  - Ephemeroptera nymphs
  - Odonata nymphs
  - Hemiptera
  - Corixidae
  - Notonectidae (Buenoa)
  - Pleaidae
  - Nepidae (Ranatra)
  - Belostomatidae
- Coleoptera
  - Haliplidae
  - Dytiscidae
  - Unidentified larvae
- Trichoptera
  - unidentified small larvae
- Diptera
  - Chironomidae (Tendipedidae)
  - Culicidae (Chaoborinae)

Two fish were taken in the trap. These were a pumpkinseed (*Lepomis gibbosus*), 2 7/8 inches long, and a smallmouth bass (*Micropterus dolomieu*), 2 3/4 inches in length.

Biology of *Triaenodes*

The information given here on the biology of *Triaenodes* (Leptoceridae: Trichoptera) was obtained in the course of a problem directed by Dr. H. B. Hungerford at the University of Michigan Biological Station. This problem was concerned with the rearing and biology of the early instars of *Triaenodes* sp.? larvae.

The egg mass of the species of *Triaenodes* studied is a circle 4 to 6 mm. in diameter and about 2 mm. high in the center, sloping to about 0.8 mm. at the outer edge. These masses are deposited on the underside of the leaves of *Nymphaea odorata* (white water lily), and more rarely on *Nuphar advena* (yellow pond lily), within 2 to 4 mm. of the edge of a hole, or of the leaf. The females seem to prefer the medium-sized (6-inch-diameter) *Nymphaea* leaves that have holes in them. The largest number of egg masses found on one leaf was 58, on a small *Nymphaea* leaf. An average-sized egg mass contained 171 eggs arranged in a flat spiral from the center outward. Some spirals seem to have rows of eggs two deep vertically, but the more usual mass has only 1 row in the spiral. The viable eggs are yellow-white ovate spheroids averaging 0.25 mm. by 0.30 mm. in size and are imbedded in a water-green to clear gelatinous matrix. This matrix forms a tough outer membrane that serves as a protective device against entomophagous larvae and desiccation and the matrix also protects against shocks and jars since eggs are so imbedded as to be surrounded by a wall of the gelatin. When viable, the eggs are translucent but become opaque cream-white when dead.

No definite information is available concerning the incubation period since there was no definite date known for the oviposition. However, from circumstantial evidence, the incubation period appears to be about three weeks. The newly hatched larvae remain in the gelatinous mass for two or more days usually hatching and leaving the mass together. Occasionally there are masses in which some eggs will hatch and the larvae will leave the mass before the remaining eggs hatch. The larvae feed on the gelatin while they remain in the mass, but no molt was noted during that period.

The egg masses were placed in petri dishes, still attached to the portion of leaf on which they were found. By the time the eggs hatched and the larvae were ready to leave the gelatin mass, the leaf epidermis had begun to decay and slough off. The larvae fed on this decayed material and built their cases from it. At no time were they seen to eat the firm, green tissue of the leaf, nor were they observed to eat the other larvae, living or dead. Cases of dead larvae were eaten if the amount of leaf was small and a short supply of food existed. No oxygen was supplied other than that originally in the water and that added by the leaf before it decayed.

Because of the variation in size of the head capsule, difference in distance between the eyes and in total lengths (See Table I), in addition to the variation in types of cases, it is considered probable that these larvae developed through 2 instars and some reached the third instar. The approximate interval between molts was 3 weeks in the laboratory.

Table 1

Comparative measurements of Triaenodes larvae in millimeters

	Length		
	Total	Head capsule	Width between eyes
first instar larva from gelatinous mass	0.64	not sclerotized	0.10
first instar larva from case	0.80	0.10	0.10
second instar larva from case	1.28	0.16	0.12
third instar larva from case	1.58	0.21-	0.13+

These measurements are necessarily approximate since the ocular screen was calibrated against a ruler and no allowance was made for stretching during removal from the cases or for shrinkage in alcohol.

The first major activity of the newly-free first instar larva is the construction of a bushy, loose case, from the decaying epidermis of the leaf. The second instar larval case was much more compactly constructed but was not built in the tapered cylindrical shape typical of the genus, as was the third instar larval case.

Triaenodes larvae swim in a rapid, jerky manner by the oar-like manipulation of the elongate hind legs. Walking is done by the short fore legs and the moderately long mid legs, with the third pair acting as balancers. The prothoracic legs are also used to aid the maxillary palpi in sweeping food toward the mandibles, while the meso- and metathoracic legs act as holdfasts. Actual feeding is done while at rest, although the feeding animal does 'graze'.

Some of the possible reasons for the failure of certain of the cultures were: infertility of eggs, desiccation, shortage of food due either to lack of leaf decay or an insufficient amount of leaf present, competition for limited food supplies by other phytophagous larvae, the growth of mold, or excessive heat.

It was impossible to determine the one or more species of Triaenodes used in the study since the available larval key (Ross, 1944) does not identify all species reported for Michigan by Leonard and Leonard (1949).

The following list of 39 species of Trichoptera from Douglas Lake was prepared by Fannie A. Leonard, who verified Mr. Walker's identifications of his earlier collections, and who determined all the adult material in the collections made later in the season which he was unable to study before returning to his classes at Kansas University.

Almost all of these specimens were taken by the New Jersey style light trap, and hence represent only the phototropic elements of the Douglas Lake caddis fly fauna. It should be noted also that collections were not inititated until June 21. It is safe to assume that a considerable number of species had completed their emergence and adult life prior to this date, and that certain other species may have appeared after August 17, the terminal date of the project.

NAME	NUMBER OF MALES	NUMBER OF FEMALES	DATES OF COLLECTIONS
PSYCHOMYIIDAE			
Polycentropus aureolus	1		August 1
Polycentropus cinereus	305	34	July 3 - August 17
Polycentropus interruptus	9	29	July 5 - August 6
Nyctiophylax vestitus	156	612	July 2 - August 16
Lype diversa		2	July 8 & 16
Psychomyia flavida		12	July 15 - August 3
HYDROPSYCHIDAE			
Hydropsyche sp.		36	July 27 - August 2
Cheumatopsyche analis	2		July 30
Cheumatopsyche campyla	1		August 6
HYDROPTILIDAE			
Oxyethira grisea	1		July 22 & 23
Oxyethira serrata	1	26	August 14 & 15
Orthotrichia cristata	3	33	July 27 & 30
PHRYGANEIDAE			
Banksiola smithi	1		August 7
LIMNEPHILIDAE			
Limnephilus consocius	1		July 31
Limnephilus moestus	5	2	July 6-9 & 26, August 8
MOLANNIDAE			
Molanna flavicornis	4		July 15 & August 3
Molanna uniophila	1,485	166	July 3 - August 17

NAME	NUMBER OF MALES	NUMBER OF FEMALES	DATES OF COLLECTIONS
LEPTOCERIDAE			
Leptocella exquisita		5	July 30 - August 9
Leptocella pavida	14	67	July 26 - August 13
Athripsodes alagmus	5	1	July 26 - August 7
Athripsodes annulicornis	1		July 6
Athripsodes dilutus	31	56	July 21 - 31
Athripsodes tarsi-punctatus	436	69	July 16 - August 9
Oecetis avara	15	29	July 24-30
Oecetis cinerascens	41	30	July 3 - August 9
Oecetis immobilis	16	2	July 21-29, August 14
Oecetis inconspicua	230	72	July 3 - August 13
Oecetis osteni	73	6	July 22 - August 9
Triaenodes aba		1	August 5
Triaenodes injusta	1		August 9
Triaenodes marginata		11	July 7-29
Mystacides longicornis	44	22	July 3 - August 15
Mystacides sepulchralis	62	18	June 21 - August 16
Setodes oligia	17	29	July 9 - August 15
LEPIDOSTOMATIDAE			
Lepidostoma sp.		12	July 27 - August 2
BRACHYCENTRIDAE			
Micrasema rusticum	1		July 8
Brachycentrus americanus	1		August 3

NAME	NUMBER OF MALES	NUMBER OF FEMALES	DATES OF COLLECTIONS
SERICOSTOMATIDAE			
Sericostoma distinctum	2	7	July 10-31
HELICOPSYCHIDAE			
Helicopsyche borealis	978	222	July 3 - August 16

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INSTITUTE FOR FISHERIES RESEARCH

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