This work was supported by a Faculty grant awarded by the Southeastern Massachusetts Technological Institute.

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Occurrence of *Liparis atlanticus* in *Aequipecten irradians* in Buzzards Bay, Massachusetts

A sea snail, *Liparis atlanticus*, was collected from a bay scallop, *Aequipecten irradians* in Pine Island Cove, Buzzards Bay, Plymouth County, Massachusetts, on 7 October 1966.

The 35 mm fish (total length) was found inside a bay scallop shell (70 × 66 mm). The scallop was raked from one foot of water in an area densely covered with eel grass, *Zostera marina*. The water temperature was 17 C.

Young sea snails have been found living within the shells of the giant offshore scallop, *Pecten magellanicus*, a curious habit they share with the striped snail, *Liparis liparis*, and with the hakes of the genus *Urophycis* (Bigelow and Schroeder, 1953). Leim and Scott (1966) report that liparids are found inside "scallop shells." There seems to be no previous published record of a symbiotic relationship between *Liparis atlanticus* and *Aequipecten*.

Bigelow and Schroeder (1953) record the occurrence of *Liparis atlanticus* west and south of Cape Cod as rare but note that it has been taken off Woods Hole and off the New Jersey coast. Leim and Scott (1966) comment it occurs south to Virginia. More recently, unpublished records know this fish off Maryland and Virginia.

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Documentation of a Mass Emergence of *Hexagenia* Mayflies from the Upper Mississippi River

This report documents a mass *Hexagenia* mayfly emergence from the Upper Mississippi River, so that others may know of the magnitude of the phenomenon if *Hexagenia* populations are further reduced by pollution along the Upper Mississippi River. Man has already virtually eliminated *Hexagenia* mayflies from portions of Lake Michigan's Green Bay, western Lake Erie, most of the Illinois River, and from segments of the Mississippi River.

Mayflies are primitive insects which belong to the order Ephemeroptera. The adults, which have vestigial mouth parts, usually mate and die within 30 hours after they emerge from the fresh water in which they have lived as aquatic nymphs. The genera *Hexagenia, Pentagenia*, and *Ephemera* are of special interest to vacationers, tow boat captains, motorists, and others who spend much time along the water's edge. The biology of these insects has been reviewed by Needham *et al.* (1935), Hunt (1953), Fremling (1960), Britt (1962), and Swanson (1967).

The name "Green Bay fly" is often used for the mayfly because people still recall the hordes of *Hexagenia* mayflies which formerly arose from Green Bay of Lake Michigan and literally covered portions of the city of Green Bay, Wisconsin. Because of pollution, Green Bay flies are now rare on the lower reaches of the bay near the mouth of the Fox River (Lee, 1962). Pollution has decimated the *Hexagenia* mayfly population in the western end of Lake Erie (Britt, 1955; Beeton, 1961;

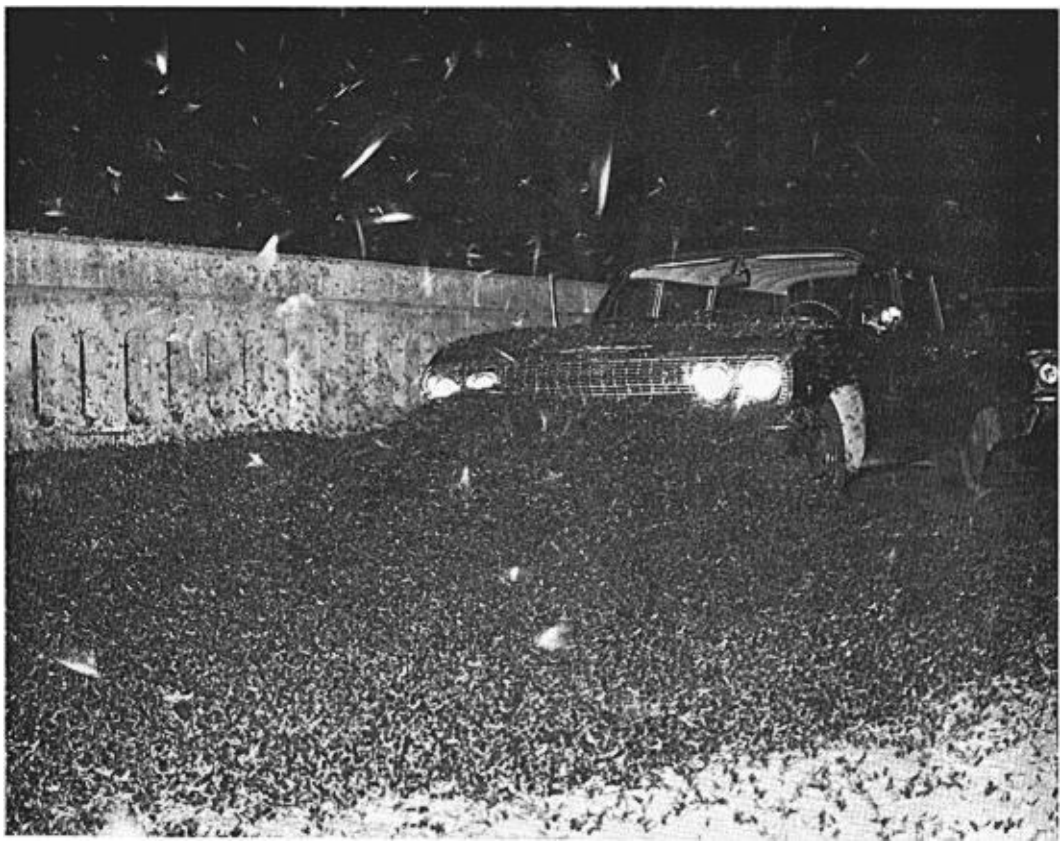

FIGURE 1.—*Hexagenia bilineata* mayflies attracted to automobile headlights on Mississippi River bridge at Winona, Minnesota, 8 July 1966.

Carr and Hiltunen, 1965). *Hexagenia* emergences were once common along the Illinois River, but pollution has virtually eliminated the insects from the upper 150 miles of the river (Richardson, 1921; Mills *et al.*, 1966). *Hexagenia* mayflies, which were once common along the entire Upper Mississippi River, are now rare for 30 miles below Minneapolis, Minnesota, and for almost 200 miles downstream from St. Louis, Missouri (Fremling, 1964). *Hexagenia* and *Pentagenia* mayflies still occur abundantly in the less polluted areas of the Upper Mississippi River. In Pool 19, for example, Carlander *et al.* (1967) estimated the June, 1962, nymphal *Hexagenia* population to be 23.6 billion.

On the afternoon of 8 July 1966, thousands of cast *Hexagenia* nymphal exuviae were observed floating on the surface of the Mississippi River at Winona, Minnesota. The trees on several near-by islands were examined and they were found to be laden with *Hexagenia bilineata* subimagoes. Being quite sure that the subimagoes would molt to the imago form late on the afternoon following emergence from the river and be wafted by the slight northerly breeze into Winona that evening, I planned to collect large numbers of eggs and adults for laboratory experiments.

The first adult insects were attracted to waterfront lights at 2130 hr Central Daylight Time, and by 2200 hr large swarms had formed around most lights. I drove to a little-used bridge which spans a side channel of the river and parked my car. A tub of water was placed beneath the headlights, and mayflies which were attracted fell into the water, where they released their eggs. As the layer of insects became too thick on the water's surface, the spent insects were scooped

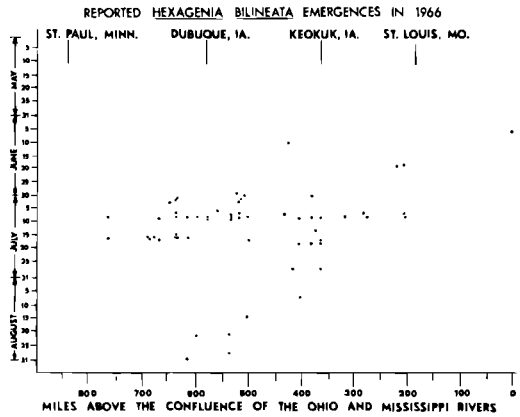

FIGURE 2.—Mass *Hexagenia bilineata* mayfly emergences observed by cooperators on the Upper Mississippi River during 1966. Each dot indicates one observation.

away by hand to make room for more. In less than two hours, 5.5 liters of eggs (*ca.* 345 million) were thus collected.

Female mayflies comprised all of those collected. They passed in steady flight over the bridge, 50 feet above the river surface, flying upstream. Those that passed through the beam of the headlights flew erratically toward them and milled around in the beam. As they landed on the bridge or on the car, they were quickly buried beneath other incoming insects. With each light gust of wind, high-flying insects suddenly descended to a lower level, thus increasing temporarily the hordes of insects in the area of the headlight beam.

Camera strobe unit flashes induced an immediate rustle of thousands of wings and an increased pelting of the observers. Insects which had previously landed were similarly affected.

The pile of insects was so deep by 0020 hr that they began to cover the headlights of the car (Figure 1). The height of the pile tapered off with increasing distance from the lights, but it was still an inch deep 30 feet away. The insects were still flying in undiminished numbers when the car was shoveled free of the wet, greasy mass at 0035 hr.

During the observation, the annual celebration "Steamboat Days" had been in progress at Levee Park along the Winona waterfront. The brightly-lighted carnival area attracted many insects and by 2300 hr the insects were over 6 inches deep on the floor of the carousel. The carnival was shut down completely after mayflies clogged the radiators of the diesel-powered generators at 2345 hr, causing them to overheat.

The Hannibal Courier-Post reported that on the night of 10 July, two motorcycles and four cars were involved in a series of accidents on the Mark Twain Bridge at Hannibal, Missouri. The vehicles, which had slid into each other on a 6-inch carpet of mayflies, were removed, and a snow plow was used to clear the slippery bridge. Cinders were then applied to insure traffic over the bridge.

Collections made by ship captains, lockmasters, and other cooperators revealed that the mass emergence encompassed the river from Wabasha, Minnesota, to Alton, Illinois, a distance of 550 river miles (Figure 2). Another emergence of almost the same magnitude occurred on the nights of 15–17 July over much of the Upper Mississippi River.

ACKNOWLEDGMENTS

Supported in part by Federal Water Pollution Control Administration Grant WP-009871. I wish to thank the ship captains, lockmasters, and other interested river residents who made this documentation possible.

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Latex Injection as a Method of Marking Large Catostomids for Long Term Study

A method of marking fishes that involves the injection of liquid latex under the scales has been described by Davis (1955), Gerking (1958), and Riley (1966). The results reported here indicate the usefulness of this technique for long term studies on some fish populations.

Latex marking was employed in 1956 during a study of fishes spawning in the inlet and outlet streams of Sixteenmile Lake near Quesnel, British Columbia. Adult longnose suckers, *Catostomus catostomus* Forster, white suckers, *Catostomus commersonni* (Lacépède), rainbow trout, *Salmo gairdnerii* (Richardson), squawfish, *Ptychocheilus oregonensis* (Richardson), and juveniles of both species of suckers (< 180 mm fork length) were marked.

The red and blue liquid marking latex was comparable to that available from biological supply houses. It hardens shortly after injection and remains visible as a small colored spot. In 1957 a yellow, commercial latex paint was used but this did not harden as rapidly and was not retained as well as the pure latex.

TABLE 1.—*The numbers of white and longnose sucker spawners latex marked in Sixteenmile Lake inlet stream in 1956 and recovered, in the stream, from 1957 through 1962*

	Number of Fish	
Number Marked 1956	Longnose Suckers 1316	White Suckers 362
Number of Marked Recoveries		
1957	501	132
1958	378	55
1959	76*	—
1960	102	24
1961	64	13
1962	17	2
1964**	2	1

* The fish spawning in 1959 were sampled on one occasion when only longnose suckers were present. The number of fish examined probably accounted for one third of the total spawning run.
** These fish were taken in Sixteenmile Lake with a gill net.

The latex mark was applied to unanaesthetized fish with a 1-ml tuberculin syringe equipped with a 38-mm long No. 20 hypodermic needle (0.91 mm outside diameter). The needle was inserted along the underside of a few scales into one or two scale pockets. As the hypodermic needle was being withdrawn the syringe plunger was depressed and two or three small drops of latex were expelled into the dermal layer immediately beneath the scales. In 1956, 17 different marks distinguished by color and position were applied to most spawning suckers. The position or color of the mark was changed every other day so that all fish entering a trap across the stream, in a 2-day period, received the same distinctive mark. Further information on trapping details are given by Geen *et al.* (1966). Fish were released into the stream immediately after marking.

The trout, squawfish, and juvenile suckers did not retain the mark well enough to permit more than short term recognition (less than one month). We achieved best results when we marked the larger fish (> 250 mm fork length), such as adult suckers, that had relatively large scales. The fork length of the trout, juvenile suckers, and most squawfish was between 150 and 240 mm. Scales were also smaller than in adult suckers. However, R. H. K. Mann (personal communication) reported best results when latex marking fish with no scales or very small scales.