Gevaert D7 film, values of 30–40 kv and 100–200 mas give good results. Infrequently, we use Kodak Type M film. Our exposures are then 40–50 kv and 200–400 mas.

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Journal Account of Trout Angling in Michigan, 1903–05

I discovered recently in the fish and fishery library of the Museum of Zoology, University of Michigan, four volumes of an angling journal kept by Mr. E. W. Wait, Traverse City, Michigan, relating in detail his trout fishing experiences during the period 1903–07: (1) 1903. Fishing reminiscences. vol. 2: 1–152 p. (2) 1904. Some fishing experiences. vol. 3: 1–152 p. (3) 1905. Some fishing excursions. vol. 4: 1–25 p. (4) 1905–07. Trout fishing experiences that are worth remembering. 1–115 p.

Data included in the 1903 and 1904 journals are: stream, day, date, wind direction, air temperature, cloud cover, hours fished, names of companions and their catches, and Wait's catch broken down by species, number of legals (7 inches), number 9 inches and over, and measurements to the nearest 0.5 inch of his largest specimens. Data for 1905 are complete only for nine trips made between 1 May and 4 June. The 1905–07 journal is a descriptive narrative, providing few quantitative data.

Wait fished in a five-county area near Grand Traverse Bay which is located in the northwestern portion of Michigan's lower peninsula (Figure 1). Table 1 lists the 11 trout streams fished during 1903–05. Except for Finch, Fouch, and Mabel (Battle) Creeks, all of the streams had a history of hatchery trout stocking by the time Wait opened the 1903 trout season 3 May.

Wait was a bait fisherman. He used worms almost exclusively, fishing with minnows preserved in formalin only briefly on a couple of occasions. His friends used worms predominantly but also used artificial flies, grasshoppers, and both preserved and live minnows.

The brook trout, *Salvelinus fontinalis* (Mitchill), was the only species caught except in the Boardman River where rainbow trout, *Salmo gairdneri* Richardson, were common and a single brown trout, *Salmo trutta* Linnaeus, was taken on 19 July 1903. The ratio of brook to rainbow trout varied from year to year, being 1903, 52%; 1904, 74%; and 1905, 67%. For the period 1903–05, 62% of a 476-fish sample were brook trout.

Total number of trips to four streams, Acme, Boardman, Mitchell, and Platte, was 56, or 83.5% of the 67 trips reported. One-day trips were the rule. A single journey by "gasoline launch" to the Clam Lake–Grass River region 23 miles northeast of Traverse City lasted several days during late July 1904. During this "trip" two trips each were made to Finch and Shanty Creeks. Platte River trips lasted 3 days—2 traveling, 1 fishing.

Proximity to Traverse City appears to explain why some streams were fished more than others. The approximate straight-line distance between Traverse City and the fishing site on each stream was measured and found to range between 3 miles (mid-Mitchell Creek) and 33 miles (Bear Creek). Although the Boardman River flows through Traverse City, Wait fished upstream some 8 miles straight-line distance above town. Acme Creek lies about 6 miles northeast of Wait's home and the Platte River lies about 17.5 miles to the southwest.

Mode of transportation available to Wait may have affected the number of trips made to each stream. He bicycled to Acme, Mitchell,

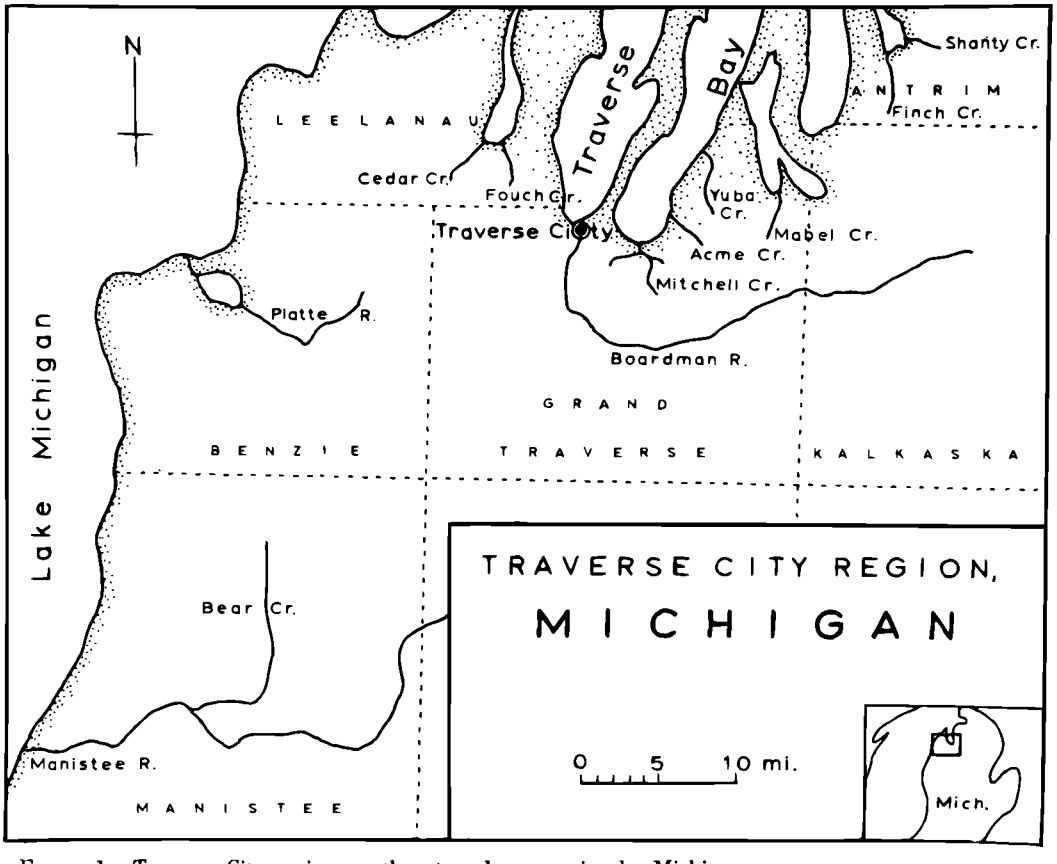

FIGURE 1.—Traverse City region, northwestern lower peninsula, Michigan.

and Yuba Creeks. Streams more than about 5 miles away were reached by horse-and-rig, or by train when convenient. The Boardman River was commonly fished between two train stations. Wait would arrive at Cobb's Junction in the morning and fish downstream to Sleight's Station where he boarded the evening train back to Traverse City.

Most streams were fished in the company of another angler. The most conspicuous exception to this was Mitchell Creek; only four times in 25 trips was this creek fished with a

TABLE 1.—*Trout angling summary, 1903–05, all anglers*

Stream	Year first stocked[1] (brook trout)	Total trips	Angler days	Total hours	Total catch	Catch per hour	Average total length (inches)
Acme Cr.	1903	7	13	69	130	1.89	7.0
Bear Cr.	1897	2	4	40	81	1.00	6.2
Boardman R.	1883[2]	20	47	381	737	1.93	8.0
Cedar Cr.	1891	2	4	33	52	1.58	6.8
Finch Cr.		2	4	5	16	3.20	6.9
Fouch Cr.		1	1	1.5	8	5.33	7.3
Mabel Cr.		1	3	24	97	4.05	5.7
Mitchell Cr.	1888	25	29	136	339	2.49	7.3
Platte R.	1892	4	8	86	253	2.94	8.7
Shanty Cr.	1891	2	7	17.5	23	1.33	8.2
Yuba Cr.	1903	1	2	20	26	1.30	7.8
Total or average		67	122	813	1,762	2.17	7.7

[1] Source: Mich. State Fish. Comm. Bien. Repts. 1–16 (1873–1904); Repts. 14 and 15 (1899–1902) never published.
[2] Brook trout were first introduced into the Boardman River in Kalkaska County (1883) and were not stocked in Grand Traverse County until 1903. Brown trout were first introduced in 1895, and rainbow trout first in 1898, both in Grand Traverse County.

TABLE 2.—*Size distribution of trout caught by E. W. Wait during 1903–05*

Stream	Total length (inches)							
	Total	<7	8	10	12	14	16	18
Acme Cr.	94	47	35	12	—	—	—	—
Bear Cr.	40	13	17	8	2	—	—	—
Boardman R.	504	90	324	82	6	1	—	1
Cedar Cr.	37	20	14	3	—	—	—	—
Finch Cr.	14	6	8	—	—	—	—	—
Fouch Cr.	8	3	4	1	—	—	—	—
Mabel Cr.	33	30	3	—	—	—	—	—
Mitchell Cr.	322	133	139	44	5	1	—	—
Platte R.	157	2	102	48	3	2	—	—
Shanty Cr.	17	2	11	4	—	—	—	—
Yuba Cr.	24	6	13	5	—	—	—	—
Total	1,250	352	670	207	16	4	0	1
Percentage		28.1	53.6	16.6	1.3	0.3		0.1
Catch per hour	3	0.84	1.60	0.50	0.04	0.01		0.002

companion. Short trips with another angler were made to Acme Creek. Other fishermen, totaling 22 individuals, fished with Wait. These fishermen contributed 55 angling days to the total 122 days reported. One individual fished eight times and five anglers fished as many as five times.

The all-angler average number of hours fished per angler day was 6.7 hours and Wait's average was 6.25 hours. Among those factors that might have affected length of the angler day are (1) weather, (2) stream, (3) distance of stream from Wait's home, (4) number and compatibility of fishermen, (5) catch-rate, and (6) fish-size.

Weather, whether rainy, dry, sunny, or cloudy, appeared to affect Wait's disposition and physical comfort, but like mosquitoes and blackflies, was taken in stride. Wait's shortest trip, 0.25 hour, 27 May 1904 to Mitchell Creek was made on a bright day when the creek was flooded. Wait himself eventually came to believe that weather had no direct effect on the quality of his fishing on any particular day.

Average time Wait fished Platte River, Boardman River, Acme Creek, and Mitchell Creek, in order, was 10.7, 8.0, 5.3, and 4.7 hours per trip. Distance, in order, was 18, 8, 6, and 3 miles. Catch-per-hour, in order, was 3.65, 3.17, 2.54, and 2.76 fish. Average size of fish, in order, was 8.7, 8.0, 7.0, and 7.3 inches. Platte River and Boardman River rank one and two, respectively, for all four criteria. The indication is that fishing was better with distance from Traverse City and that the number of hours spent fishing per trip varied directly with both the number and size of the fish caught. Although both of the effort criteria appear related, the relationship between the two catch criteria and the two effort criteria is inverse for Acme and Mitchell Creeks. The reasons for this may be due to the fact that Mitchell Creek was fished alone usually and Acme Creek was fished with a partner.

Total catch reported was 1,762 trout (Table 1), of which Wait caught 1,250 or 71%, of the fish. Wait's fraction of the total catch by year was 1903, 545/740; 1904, 568/816; and 1905, 56/87. In all, he fished 418/813 or 52% of the fishing time reported. With few exceptions, he caught more fish per trip than anyone else who fished with him. He caught no fish once in 67 trips and two others caught nothing one time each.

Average size of trout taken by Wait (1,250 fish) was 7.7 inches total length (Table 1). Most trout were smaller than 9 inches (81.7%) and 98.3% were smaller than 11 inches (Table 2). In only four streams—Bear Creek, Boardman River, Mitchell Creek, and Platte River—were fish larger than 11 inches taken. Fish as small as 4 inches were creeled.

Wait's average catch-rate was 3 fish per hour (Table 2). Catch-rate of fish smaller than 7 inches was 0.84 fish per hour. This rate actually represents the catch-rate of illegal fish that were retained in the creel. No quantitative data are available on the number of sublegal fish that were returned to the stream, but Wait mentioned several instances when this was done. His legal catch-rate was 2.16 fish per hour.

All 11 streams fished by Wait at the turn of

the century still contain brook trout and continue to provide trout angling today. Although Wait caught rainbow trout only in the Boardman River, this species is now present in the lower portions of each stream. Bear Creek, Boardman River, and Platte River are stocked annually (Michigan Department of Conservation Fish Planting Record, 1954–64) and together with Mitchell Creek (Jack Hammond, District 6 Biologist; Orville Rettig, District 6 Law Supervisor and area resident for the last 25 years, telephone conversations) remain excellent Michigan trout angling streams. Hammond and Rettig report that Acme, Cedar (Cedar Run), Fouch, Mabel, and Yuba Creeks, though small, continue to support trout angling. According to James Skinner, Antrim County Conservation Officer (telephone conversation), both Finch and Shanty Creeks also support trout fishing today.

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An Adverse Effect of Coelomic Fluid on Unspawned Ova in Trout

INTRODUCTION

Land development in the Rotorua district of New Zealand has been encouraged over recent years and large acreages of native bush have been replaced by farmland. Such development within the catchment of the major lakes and rivers has had a detrimental effect on the previously excellent trout fishery (Allen, 1960). Nevertheless, the number of anglers increases each year and so public pressure is exerted to keep the lakes and rivers well stocked in spite of the decrease in quality of these waters. The managing authority for the trout fishery in the Rotorua district, the Department of Internal Affairs, responds by the artificial stocking of selected areas with hatchery-reared trout fingerlings. These are derived from ova obtained from the stripping of mature wild fish trapped in suitable streams in the district and elsewhere. The species conserved in this way is *Salmo gairdneri* Richardson.

The personnel engaged in these operations have reported an increasing incidence of abnormal ova from several sites and particularly from one of the inflows to Lake Rotorua, the Utuhina Stream. These abnormal ova are known as "spotted eggs" because of the presence of large oil globules, clearly visible through the outer membrane of the ovum. Such ova are usually discarded, but this is not always practicable when they appear to form only a relatively small proportion in a batch of otherwise good eggs.

Purely qualitative observations were made, since close observation of the millions of eggs handled hardly seemed warranted at the time. However, heavy demands on the hatchery for trout fingerlings recently caused an inquiry as to whether such discards were worthless. During the 1964 season, therefore, it was noted that out of 553 female fish examined at the Utuhina fish trap 57 were discarded as yielding spotted eggs. This incidence compared unfavorably with records from elsewhere (15 discarded out of 1,034 fish stripped at Tokaanu from inflows into Lake Taupo). In addition, although over a million eggs were obtained from the Utuhina Stream, over 40% mortality had occurred at the conclusion of "hatchery shocking" operations during incubation. Over the same period the losses were much fewer in ova collected from other streams (5.4% in 2,666,000 ova from the Lake Taupo inflows). These data prompted this investigation into the spotted-egg abnormality.

METHODS

Ripe female fish were brought alive into the laboratory from the fish traps. They were killed and immediately stripped of ova, which were drained from the accompanying coelomic fluid with a large Gooch filter funnel. The various tissues were prepared for amino acid