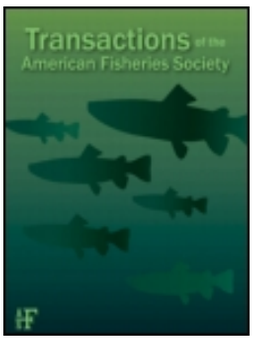

Transactions of the American Fisheries Society

ISSN: 0002-8487 (Print) 1548-8659 (Online) Journal homepage: http://www.tandfonline.com/loi/utaf20

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To cite this article: Dr. James A. Henshall (1899) Some Notes on the Montana Grayling, Transactions of the American Fisheries Society, 28:1, 80-85, DOI: 10.1577/1548-8659(1899)29[80:SNOTMG]2.0.CO;2

To link to this article: http://dx.doi.org/10.1577/1548-8659(1899)29[80:SNOTMG]2.0.CO;2

SOME NOTES ON THE MONTANA GRAYLING.

BY DR. JAMES A. HENSHALL.

My paper on the Montana grayling, read at the last meeting of the Society, contains some statements obtained at second hand which I wish to modify. My assistant engaged in collecting grayling eggs at Red Rock Lake, Montana, reported to me last season that the eggs when first extruded were quite adhesive, causing them to form in bunches, soon followed by a rapid development of fungus, which caused the death of the egg. When the eggs were received at Bozeman station they were clear, crystal white in color, which I gave as the characteristic hue.

I found this season, from personal observation, that the eggs when first extruded were of a rich yellow color, owing to the large oil drop, which renders them almost semi-buoyant; but after a few days of incubation they became quite pale. I also discovered that when first extruded the eggs were not at all adhesive, but if not exposed to a pretty strong pressure or current of water after fertilization (instead of being placed in the ordinary manner on flat trays), fungus soon formed, with the consequent adhesiveness and bunching of the eggs. This season we employed the hatching jar and the Stone-Williamson basket trays, instead of the flat tray, and had no trouble with fungus or bunching of the eggs, although we had but two feet fall of water from the reservoir trough. This proved the prediction made in my paper last year, that the eggs should be subjected to a strong current or pressure of water to obtain the best results; and this can be accomplished by the use of the hatching jar or the Stone-Williamson basket tray.

The grayling embryo is so active and lively, and the egg so buoyant, that there is a constant tendency to its floating off from the ordinary flat tray. This method is, however, still employed in England. In a letter recently received from Mr. Andrews, of the Surrey Trout Farm, Haslemere, England, he says:

"We find it an advantage when spawning the fish (grayling)

to avoid shaking the eggs in the pan more than we can possibly help—we usually spawn the fish direct into the perforated zinc trays (standing in the pans), in which they are to be hatched, and then after milting them and adding water we let them stand until they are ready to go into the hatching boxes.

"The tray with the eggs in it is then lifted out of the pan and placed in the hatching box. If very much fluid comes away from the female with the eggs, we drain this off before we add the milt from the male, and the water.

"Our hatching water is about 49° F. in temperature, and does not vary more than ½°. In this temperature the average time of hatching is about 22 days after being laid down, or half the time of trout ova. The alevins lose the sac very quickly, and at the first signs of feeding we sprinkle dry floating food, which we obtain from the dog biscuit manufacturers, on the water in the hatching trays, and they take this readily.

"After feeding for two or three days, and when they are taking the food well, we remove the fry from the hatching trays to a rearing box, where they are fed for about ten days in a similar manner, but they have in addition about two feeds a day of very finely chopped meat. We then turn the fry out into shallow ponds with a good stream of water running through them, or shallow streams; in all of these we have an abundance of natural food: shrimps, snails and minute crustaceans, water fleas, cyclops, etc. After turning out into these ponds and streams we do not feed more than twice a day with artificial food.

"We find grayling *much* more difficult to rear than trout; and in this country waters which suit trout do not always suit grayling."

The eggs of the Montana grayling hatch in from 10 to 15 days in water of about 50° F.; and in shipping the eggs after the eye-spots appear, some will hatch en route if the temperature rises above 40°. For shipping long distances they should be placed in refrigerator cars or a specially devised shipping case prepared, whereby the temperature can be kept at 40° or a few degrees below. I shall endeavor to design such a case for future shipments to long distances.

All of our grayling eggs are subjected to a wagon haul of fifty miles over rough spring roads before reaching the express office—an untoward circumstance that can not be avoided at present.

We find that the liver or meat diet, in a fluid state, as used for trout fry, is the best also for grayling fry. Our newly hatched fry will not take dry floating food, as recommended by Mr. Andrews. We have tried baker liver ground very fine

and the fine fish cake, but they refuse to notice either, though they will take it after being taught to feed on liver emulsion.

The proper systematic place for the Montana grayling has not yet been definitely settled. During the past year the name *ontariensis* has been relegated and the former name *tricolor* has been restored, so that the present name of the Montana grayling is *Thymallus tricolor montanus* (Milner). Jordan & Evermann say it is: "Entirely similar to the Michigan grayling, but the dorsal a little smaller." This I can not subscribe to, as from examination of a large series of specimens this spring I find the Montana grayling to be as closely allied to the description of the Arctic grayling (*T. signifer*) as to the Michigan form (*T. tricolor*), as the annexed table may show:

SPECIFIC CHARACTERIZATIONS OF THE AMERICAN GRAYLINGS.

	T. signifer.	* T. tricolor.	T. t. montanus.
Head in length	5½	5	5
Depth in length	4⅝	5½ to 6	4½
Eye in head	3		3½
Maxillary in head	6		3
Scales	8-88 to 90-11	93-98	8-82 to 85-10
Gill rakers	12 below angle		5+12
Dorsal rays	24	21-22	18-21
Height of dorsal	3½ in length	Moderate	4½ in length
Spots on body	Anterior	Posterior	Anterior

* Not having the full description of *T. tricolor* at hand will account for the omission of some points in above table.

The color of the Montana grayling is as follows: back, gray, with purplish reflections; sides, lighter, with purplish and silvery reflections; belly, pure white; a few V-shaped spots from middle of dorsal fin to gill cover, but none posteriorly; two oblong black blotches in cleft between opercle and branchiostegals, more pronounced in the male; a dark heavy line on upper edge of belly, running from ventrals to pectorals in male, very faint in female.

Dorsal fin edged with a red or rosy border; six or seven rows of red or rosy, roundish spots, ocellated with white; dark blotches forming lines between the rows of red spots; in upper, posterior angle there are several larger oblong rosy spots. Ventral fins with three rose-colored stripes along the rays. Pectoral and anal fins plain.

DISCUSSION OF DR. HENSHALL'S PAPER.

Mr. Clark: In reference to the work Dr. Henshall is doing there, I wish to state that a case of these eggs was forwarded

this year to the station of which I have charge. They were billed to me as fifty thousand eggs. They came the forepart of June, probably the 10th, a very warm time, and they were nicely packed with an ice tray. The loss on these eggs was quite considerable, I should presume ten per cent. Some of them had hatched and died, but after they were thoroughly sorted out they measured up about sixty-seven thousand. They were said to be fifty thousand when they were sent. That is something remarkable, because fish culturists sometimes ship less than they count out on arrival at destination. I feel well assured that this is going to be a valuable work of the United States Fish Commission. I immediately wrote Washington after carrying them along until the time of distribution, and praised the work highly, and recommended that next year at least five hundred thousand be forwarded to the Northville station. Mr. Ravenel informs me that if the money is available they will send us all we want. The Montana grayling fry are very much different from the fry hatched from the eggs of Michigan grayling. They do not act the same in the troughs at all. After hatching, they settle on the bottom of the trough the same as trout fry. The fry hatched from the Michigan grayling about fifteen years ago at our station are free swimmers, the same as a white fish; but in the case of the Montana grayling they lie on the bottom of the trough from twenty-four to forty-eight hours before they begin to swim. Then they begin to swim, and of course the sac is absorbed in a very few days, about six or eight days; between the sixth and eighth day they begin to take food. We have them there now, and if you could take a look at them you would see them under different conditions from what you did those at the Omaha Exposition last year. So far they are doing very finely, very nicely indeed; but whether we are to succeed in raising many of them or not I can not say as yet. They are taking food. We are feeding them finely chopped liver.

President Peabody: Would you advise putting grayling in a stream where there are brook trout?

Mr. Clark: Well, you cannot hurt the brook trout any, but it is a question, of course about the grayling.

President Peabody: Whether you would waste your grayling or not?

Mr. Clark: Yes, whether you would waste your grayling or not. I have planted half of these in the Au Sable River and half in the Pere Marquette River, two old grayling streams, both having brook and rainbow trout now.

President Peabody: In regard to the temperature, a stream that is too warm for brook trout is all right for rainbow trout. How is it about the grayling?

Mr. Clark: We can keep them in ponds in the warmer water, if we have plenty of it. Mr. Stone informed me that Dr. Henshall, when he sent these on, advised that we be sure and hatch them in creek water, and keep them in creek water. We did not hatch them in creek water and we are not keeping them in creek water, because our creek water is not so clear and nice as our spring water. His idea was that we could not hatch them in our spring water.

Mr. Titcomb: As I understood it, the question was whether the grayling would survive in warmer water than our brook trout?

President Peabody: That is it.

Mr. Titcomb: I understand they require cold water. The cold, swift mountain streams of Montana are their natural habitat, and also some of the cold water lakes. These eggs Mr. Clark received came from the station, I presume, from which I received some, and were taken in what is called Red Rock Lake.

Secretary Whitaker: In answer to a question put by the President to Mr. Clark, I want to say that in my opinion there is no difficulty about grayling and trout living in harmony, at least such is disclosed to be the fact by the literature in England upon the subject from Francis and Walton down to the present day. There they are found in the same stream. So far as the temperature of the water is concerned I know nothing about it further than the character of the streams where they are found in Michigan. They are cold spring streams, and some of the best results obtained in trout culture in the United States have been had in old grayling streams. They do not inhabit streams south of a belt stretched some twenty or thirty miles north of Grand Rapids, diagonally northwest and southeast across the state. They are not indigenous to the streams below that line, so far as my knowledge goes.

President Peabody: They practically require the same water as brook trout.

Secretary Whitaker: Oh, yes.

Mr. Titcomb: May I inquire how you account for the disappearance of the grayling in your trout waters?

Secretary Whitaker: I have had occasion to refer to that in our reports three of four times, and there is no question that it is due to the lumbering operations in our state.

President Peabody: Are the trout similarly affected?

Secretary Whitaker: No; the spawning season of the grayling is later. During the winter the streams are filled with logs, and when the ice passes out in the spring, which is before the grayling eggs have hatched, they destroy the beds and kill the ova.

Mr. Parker: The spawning habits are entirely different. The trout spawns on the gravel and the grayling on the sandy ridges.

Secretary Whitaker As it is getting late, I move that the paper of Mr. Meehan be read by title.

The motion was seconded and carried.