THE FEEDING HABITS OF THE MONTANA GRAYLING (*THYMALLUS MONTANUS*)[1]

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An investigation basic to a management program for the grayling in Montana was begun in the autumn of 1935 and extended intermittently through the next two years. Certain aspects of this study were carried out with the aid of a grant from the National Research Council. Due to a change in residence, it was not possible to complete the proposed program, but some of the data seem to have sufficient merit for publication. The food habits study is the first to be presented. Acknowledgments are due Elmer G. Phillips, former superintendent of fisheries in Montana, and the late Harry L. Johnston, superintendent of the Bozeman Station, for their fine cooperation in this study. I am indebted to Professor M. H. Spaulding, who shared in the collection of material, and to the U. S. Bureau of Fisheries for furnishing most of the equipment and the hatchery facilities.

Artificial Feeding

The difficulties involved in the artificial propagation of grayling have in practically all instances been those of feeding. Certain fish culturists have contended that grayling fry differed from the other coldwater game fish in that they required living food, such as the plankton of streams or lakes. According to this notion, the ordinary meats and meals used in the culture of trout were entirely unsatisfactory. Laird (1928) and Lord (1932), as well as several other fish culturists, have demonstrated that the problem is concerned more with the size of the food particles and the frequency of feeding than with the kind of food itself. Certain recommendations call for the use of beef liver or heart to be ground as many as 10–20 times through a plate with 1/64-inch openings. The feeding process consists of forcing the finely ground meat through a fine mesh screen into the water of the holding troughs. The interval of feeding recommended varies from 1–3 hours throughout the working day. By this method it has been possible to carry grayling past the difficult fry stage with no more than the expected loss. The fingerling and adult grayling are as easily cultured as trout by using the more or less standard hatchery methods and diets.

Experimental Feeding with Natural and Artificial Food

Henshall (1899, 1907) was able to rear grayling past the fry stage only when he supplied them with creek water containing natural food. He described this as consisting of *Daphnia*, *Cyclops*, shrimps, and snails. It is hardly probable that these organisms actually were the important foods since the water used (Bridger Creek) contains little or no plankton Entomostraca and since it would be utterly impossible for the fry to feed upon any

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of the ordinary shrimps or snails because of their size. Elmer G. Phillips had less than a five per cent mortality during the first $2\frac{1}{2}$ months in grayling fed on a diet of total net plankton from Albert Lake, near Libby, Montana. An examination of the plankton from this lake showed it to consist almost exclusively of *Daphnia* and *Diaptomus*.

An experiment was undertaken to determine whether or not grayling fry would exercise selection when offered the total plankton of lakes. About 5,000 fry held at the Meadow Creek station (water temperature 45–48°F.) were presented total net plankton from Meadow Lake at three hour intervals, starting the third day after the peak of hatching. Each day following, at 20–30 minutes after the first feeding, the stomach contents of 25 fish were subjected to microscopical examination. The first finding of food in the stomachs was in nine day old individuals and only a small number were found taking food before the thirteenth day. These results are surprising, considering the early attempts at feeding made by most of the fry. After the fifth day there was marked activity each time plankton was introduced. Time after time the tiny fish would try to take adult Entomostraca but without success, as shown by subsequent examination of their digestive tracts. Apparently the small size of the mouth at this stage prevents the taking of food organisms. Trout fry, on the contrary, were able to eat even the largest plankters on their first day of feeding. Between the time food was first taken and the fourth to fifth weeks, the food eaten was confined to the nauplii of Cladocera and Copepoda with an occasional filament of algae. After the fifth week practically all of the fry stomachs examined contained both nauplii and adults of Entomostraca as well as small numbers of rotifers, protozoans, and algae. The absence of algae was so conspicuous in view of their relative abundance that it is safe to conclude a degree of preference was shown for the Entomostraca. In all of the fish (1–5 weeks old) examined, which amounted to several hundred, the maximum number of organisms taken by a single fish during the 30 minute interval following the introduction of food, was 22, and the average eight.

In a later experiment conducted at the Bozeman station (water temperature 49–52°F.) in which artificial food was used, the first evidence of feeding occurred in five-day old fish. By the seventh day more than 90% of the fry in these troughs had food in their stomachs. It is obvious that both the temperature of the water and the size of the food particles affect the time when fry will begin feeding.

A few grayling fry placed in a pond at the Bozeman station were observed to live almost entirely on midge larvae. Of 12 fish examined, all had these larvae in their stomachs. The only other food items taken consisted of a few blue-green algae, one *Cyclops*, and 11 immature Copepoda. Forty-seven tiny midge larvae were found in one 20 mm. fish.

There is some evidence that grayling fry are mainly day feeders. Those placed in dark troughs remained comparatively inactive even when concentrated plankton was introduced. Electric lighting immediately above the troughs greatly increased feeding activity.

NATURAL FEEDING

The fact that grayling are so easily caught at times indicates their voracity. Parker (1888) observed the Michigan species during its natural feeding activity and records 50 rises in 15 minutes for one fish. They feed both deep and at the surface and seem to take food species except fish as they are available. In all of the specimens collected for study, not a single one was without food in its stomach. Grayling are almost invariably found in schools and it is not at all unusual to see three or four individuals rise for the same fly. In one instance, a specimen was taken a second time on an artificial fly within three hours after being jaw-tagged. In coming to the surface for food these fish often swim with enough force to emerge almost completely from the water. Montana grayling fry exhibit many of the qualities of the adult. They feed vigorously and almost without caution.

STOMACH EXAMINATIONS OF WILD FISH

The stomachs of approximately 125 fish were examined. The larger specimens were collected by fly casting, with the exception of about 10 individuals taken from state and federal traps during the spawning season. The fry and fingerlings were captured with small-mesh nets. Collections were made in the artificially stocked waters of Rogers Lake, Flathead County; Agnes Lake, Beaverhead County, Montana; and from Grebe Lake in Yellowstone National Park. A fair number also were secured from the mouth of Meadow Creek, Madison County, Montana, one of the grayling's native habitats. All fish were measured and weighed at the time of capture and their stomachs removed and preserved in seven per cent formalin for later study. Examinations of stomach contents were made in the laboratory with the aid of a dissecting microscope. The organisms found were counted and identified to the larger taxonomic groups, then spread on blotting paper for 1–2 minutes to remove excess moisture and weighed on a torsion balance to the nearest .05 gram. The cc. volume by water displacement was also taken but was found to be practically identical with the weight in grams so is not given in the following tables. The results are tabulated according to localities and sizes of fish; in most cases, the size groups represent age classes. All weight percentages are given in terms of total weight of the stomach contents minus debris. This last-named material, which obviously had no food value, contained such items as sticks, stones, caddis cases and mud.

Very little published information concerning the food of the Montana grayling has come to the writer's attention. A note on stomach examinations of Michigan grayling is given by Milner (1874) in which he lists Coleoptera, Neuroptera, and the larvae of dragonflies as food items. He also found the leaves of the white cedar which he credits to accidental food. Norris (1883) speaking of the Michigan grayling says, "The various orders of flies which lay their eggs in running water, and the larvae of such flies, appear to be their only food." This is especially interesting because in the present study midges (chironomid flies) have been found to be the most commonly occurring items in the stomachs of all sizes of Montana

TABLE 1

SUMMARY OF FOOD ORGANISMS IDENTIFIED FROM THE STOMACHS OF MEADOW CREEK GRAYLING

Kind of Organism		Dates: June 14, 27 and July 10, 1936. Size of fish: 190–250 mm. standard length. Number of fish: 20.						Dates: June 14, 27 and July 10, 12, 1936. Size of fish: 250–335 mm. standard length. Number of fish: 20.					
		Greatest No. in Any Fish	Average No. Per Fish	Per Cent of Fish With Organism	Total Wt. of Organism For All Fish	Greatest* Per Cent of Total Wt. in Any Fish	Per Cent* of Total Wt. of All Food Taken	Greatest No. in Any Fish	Average No. Per Fish	Per Cent of Fish With Organism	Total Wt. of Organism For All Fish	Greatest* Per Cent Of Total Wt. in Any Fish	Per Cent* of Total Wt. of All Food Taken
Aquatic Insects: Mayflies (Ephemeroptera)	Nymph	62	6.2	40	2.4	94	21.9	42	6.0	40	1.7	64	6.1
	Adult	6	0.6	25	0.2	20	1.8	19	1.0	15	0.15	21	0.5
Damselflies (Odonata)	Nymph	8	1.6	40	1.5	81	13.7	20	2.8	45	3.0	44	10.8
	Adult	5	7.5	20	1.0	46	9.1	41	4.1	45	6.2	82	22.4
Stoneflies (Plecoptera)	Nymph	4	2.5	10	0.5	16	4.6						
	Adult												
Caddisflies (Trichoptera)	Larva	1	0.15	15	0.5	22	4.6	2	0.35	20	0.85	70	3.1
	Adult	3	0.2	10	0.15	35	1.4	1	0.05	5	0.1	3	0.4
Bugs (Hemiptera)	Larva												
	Adult	2	0.2	15	0.1	13	0.9	6	1.2	45	0.45	9	1.6
Beetles (Coleoptera)	Larva												
	Adult	1	1.5	15				29	5.2	65	2.05	52	7.4
Midges (Diptera)	Larva and pupa	56	11.4	95	0.95	92	8.7	46	7.35	85	0.75	9	2.7
	Adult	2	0.15	10				1	0.1	10			
Terrestrial Insects: Grasshoppers (Orthoptera)		2	0.1	5	0.4	29	3.7	8	1.6	50	8.2	70	29.6
Leafhoppers (Homoptera)								6	0.3	5			
Beetles (Coleoptera)		1	0.05	5				1	0.05	5			
Flies (Diptera)		10	1.8	35	0.75	62	6.8	2	0.04	25	0.25	11	0.9
Bees (Hymenoptera)		5	0.35	20	0.20	14	1.8	4	0.04	15	0.35	19	1.3
Other Aquatics: Waterfleas (Cladocera)		937	191	45	2.15	90	19.6	64	4.0	10	0.05	6	0.2
Shrimp (Amphipoda)								2	0.25	15	0.15	9	0.5
Sow Bugs (Isopoda)		4	0.2	10	0.15	66	1.4	19	2.4	25	1.0	29	4.0
Fish (Salmo trutta)								5	0.25	5	2.35	75	8.5

* Debris not included.

grayling. Parker (1888) considered the Michigan grayling as a vegetable feeder and accounts for the flavor of the fish by this assumption.

Meadow Creek foods

The mouth of Meadow Creek constitutes about 150 yards of stream, most of which is directly influenced by the fluctuations of Meadow Lake reservoir. During the periods of high lake level this portion of the stream becomes sluggish but remains considerably colder than the lake. Grayling congregated here during the early summer and were the predominant species, their associates being brown, rainbow, and brook trouts. This is one of the few known ancestral waters still occupied by grayling and the data secured from stomach examinations of the fish should reflect, at least in part, original feeding conditions.

Stomach examinations indicate that large quantities of non-nutritive materials are regularly ingested by the grayling. The item of debris, in the group of smaller fish from Meadow Creek, made up 70.1% of the total weight of stomach contents and in the larger fish constituted 58.8%. The aquatic insects accounted for 66.5% by weight of the food organisms present in the smaller fish and 55% in the larger. Predominant foods were mayflies, 23.7% of the total food in the first group, and damselfly nymphs, 33.2% in the second. The aquatic Coleoptera formed 7.4% of the diet of the larger fish. All of the beetles were adults and more than one-half were *Donacia*, with Dytiscidae, Hydrophilidae, Haliplidae, and Parnidae following in order of abundance.

Terrestrial insects contributed more to diet of the larger fish, 31.8% of the total weight as compared to 12.3% for the smaller. A few large grasshoppers were mainly responsible for this difference, making up 29.6% of the total food for the 250–335 mm. specimens. Other aquatic organisms were chiefly Crustacea, with Cladocera accounting for 19.6% of the total food weight in the first size group and the isopod, *Asellus*, amounting to 4% in the second. Five brown trout fingerlings were found in the stomach of one large female grayling. This was unusual but not surprising, since this fish was caught within 200 feet of the hatchery outlet, where trout fingerlings were concentrated in great abundance. This was the only instance observed where fish of any kind were used as food. According to Svetvidov (1931), the white grayling from Lake Baikal in Russia, feeds chiefly on fish and amphipods. Heckel and Kner (1858) and Siebold (1863) list fish brood and minnows as regular items of food for the European grayling. There are no records, except that here given of fish in the stomachs of the Montana or Michigan species.

Rogers Lake foods

Rogers Lake has proved to be an excellent grayling water. It is free from other species of fish except the cutthroat trout which occurs in very limited numbers. The lake has a maximum depth of about 25 feet and supports an enormous amount of vegetation. The maximum summer temperature is near the upper limit of toleration for trout and grayling (about 80°F.). The fish in this lake were in excellent condition and showed rapid growth.

TABLE 2

SUMMARY OF FOOD ORGANISMS IDENTIFIED FROM THE STOMACHS OF ROGERS LAKE GRAYLING

Kind of Organism	Date: July 19, 1936. Size of fish: 22–50 mm. standard length. Number of specimens: 20.			Date: July 19, 1936. Size of fish: 150–250 mm. standard length. Number of specimens: 10.						Dates: May 24, 1936 and July 19, 1936. Size of fish: 250–338 mm. standard length. Number of specimens: 21.					
	Greatest No. in Any Fish	Average No. Per Fish	Per Cent of Fish With Organism	Greatest No. in Any Fish	Average No. Per Fish	Per Cent of Fish With Organism	Total Wt. of Organism For All Fish	Greatest Per Cent of Total Wt. in Any Fish	Per Cent of Total Wt. of All Food Taken	Greatest No. in Any Fish	Average No. Per Fish	Per Cent of Fish With Organism	Total Wt. of Organism For All Fish	Greatest Per Cent of Total Wt. in Any Fish	Per Cent of Total Wt. of All Food Taken
Aquatic Insects: Damselflies (Odonata) Nymph	One small dragonfly nymph			10	0.7	10	0.25	69	2.1	3	0.25	15			
Damselflies (Odonata) Adult										1	0.50	5			
Caddisflies (Trichoptera) Larva										4	0.25	10	0.4	10	3.8
Caddisflies (Trichoptera) Adult	1	0.05	5	3	0.3	5	0.10	35	0.8	1	0.10	10			
Bugs (Hemiptera)										1	0.10	9	0.15	52	1.4
Midges (Diptera) Larva and pupa	57	12	90	1,050	446	70	8.45	100	71.3	631	177.0	70		100	
Midges (Diptera) Adult	33	4.9	60							600	35.0	9	2.0	86	18.8
Other flies (Diptera) Larva				1,454*	146	10	1.15	98	9.7						
Other flies (Diptera) Adult															
Terrestrial Insects: Thrips (Thysanoptera)	3	0.25	15												
Leafhoppers (Homoptera)	1	0.1	10												
Beetles (Coleoptera)	1	0.05	5							2	0.4	30	0.65	38	6.1
Flies (Diptera)	10	0.25	25	1	0.05	5				1	0.05	5			
Bees (Hymenoptera)	3	0.30	15	1	0.10	10				1	0.30	15			
Other Aquatics: Water fleas (Cladocera)	926	187	85	688	112	30	0.2	25	1.7	3,150	176	20	1.5	67	14.1
Copepods (Copepoda)	47	6	15												
Shrimps (Amphipoda)	4	0.35	15	8	1.7	60	1.7	26	14.3	64	11.2	72	2.95	91	27.7
Snails (Gastropoda)										35	2.4	20	1.35	85	12.7
Water mites (Hydrachnida)	11	2.0	40												
Fish eggs										35	4	14	1.65	100	15.5
Algae											Several small bunches				

* *Corethra*.

Food organisms especially midges were abundant.

There was practically no debris in the stomachs of the 20 fingerlings seined from this lake (see Table 2). The 150–250 mm. specimens contained 25% debris, while the largest specimens had 72.6%. Aquatic organisms made up almost 100% of the total food contents in the 150–250 mm. fish and 74.7% in the 250–338 mm. specimens. Midges and water-fleas were the most important aquatic items of the fingerlings' diet. In the 150–250 mm. specimens, midges made up 71.3% of the total food weight, with amphipods contributing 14.3%. The stomachs of the larger fish contained 27.7% amphipods, 18.8% midges, and 14.1% Cladocera. The fish eggs taken included those of both grayling and cutthroat trout. All of the fish having eggs in their stomachs came from the Montana state fish traps during the spawning season.

The largest variety of terrestrial insects was found in the fingerlings' stomachs, but the only significant item so far as quantity is concerned was the 6.1% of Coleoptera found in the larger size fish. Traces of filamentous algae were rather common. Items not listed in Table 2 were: 10 leech egg cocoons, one terrestrial arachnid, one *Gordius*, and eight nematodes. The last two groups were probably parasites.

Grebe Lake foods

Grebe Lake is situated at an elevation of about 8,000 feet and is one of the more productive mountain lakes, with comparatively shallow water and abundant vegetation. A few rainbow and cutthroat trouts and rainbow-cutthroat hybrids were present along with an abundant population of grayling. The fish examined were in good condition. Food organisms were plentiful, especially the damselflies, *Argia* and *Ischnura*.

Twenty-five grayling fry (19–24 mm. standard length) taken from the east end of Grebe Lake had 53 midge larvae and pupae as well as 21 very small mayfly nymphs in their stomachs. Plankton samples from the same part of the lake showed *Daphnia*, *Diaptomus*, rotifers, and many algae to be present, but none of these had been used as food.

Debris made up 38.3% of the total weight of stomach contents in the larger fish (Table 3). The food organisms consisted of 76.9% aquatic, and about two per cent terrestrial, insects. All of the latter were Coleoptera. About 40% of the aquatic species were midges and 20% damselflies. The aquatic Coleoptera, *Donacia* and Hydrophilidae, constituted 9.3%, amphipods 10.2% and *Asellus* one per cent, of the total food weight. Algae were fairly numerous in many stomachs and accounted for 10.2%. Two 265 mm. fish not listed in Table 3, taken from the traps at Grebe Lake during the spawning season, contained 137 grayling eggs besides one damselfly nymph and two adult Dolichopodidae.

Agnes Lake foods

Agnes Lake is a small mountain lake with barren rocky shoals, situated at an altitude of about 9,000 feet. No fish were present in this lake until about 1930, when grayling were stocked by the Montana State Fish and Game Commission. During the next five years heavy plants were made and there was

TABLE 3

SUMMARY OF FOOD ORGANISMS IDENTIFIED FROM THE STOMACHS OF AGNES AND GREBE LAKES GRAYLING

Kind of Organism		GREBE LAKE Date: July 6, 1936. Size of fish: 125–162 mm. standard length. Number of specimens: 14.						AGNES LAKE Date: June 6, 1936. Size of fish: 250–325 mm. standard length. Number of specimens: 6.					
		Greatest No. in Any Fish	Average No. Per Fish	Per Cent of Fish With Organism	Total Wt. of Organism For All Fish	Greatest Per Cent of Total Wt. in Any Fish	Per Cent of Total Wt. of All Food Taken	Greatest No. in Any Fish	Average No. Per Fish	Per Cent of Fish With Organism	Total Wt. of Organism For All Fish	Greatest Per Cent of Total Wt. in Any Fish	Per Cent of Total Wt. of All Food Taken
Aquatic Insects: Mayflies (Ephemeroptera)	Nymph	2	0.6	40									
	Adult	7	1.1	30	0.2	33	3.7	6	1.0	17.0	0.2	25	10.5
Damselflies (Zygoptera)	Nymph	9	1.0	21	0.8	87	14.8						
	Adult	3	0.4	14	0.3	30	5.6	One adult specimen					
Caddisflies (Trichoptera)	Larva												
	Adult	4	0.6	21	0.2	20	3.7						
Beetles (Coleoptera)	Larva												
	Adult	1	0.4	14	0.5	16	9.3	One Dytiscidae					
Midges (Diptera)	Larva and pupa	137	43	100	2.15	80	39.8	228	56	100	0.75	69	39.4
	Adult	3	0.15	14				One adult specimen					
Terrestrial Insects: Leafhopper (Homoptera)		One small specimen											
Beetle (Coleoptera)		2	0.14	7	0.1	20	1.9	2	1	66	0.25	12	13.1
Flies (Diptera)		2	0.4	7				One Rhagionidae					
Other Aquatics: Shrimp (Amphipoda)		26	3.3	38	0.55	45	10.2	2	0.7	33	0.1	8	5.3
Sow bugs (Isoptera)		2	0.2	14	0.05	14	0.9						
Fish eggs (Grayling)								30	5.7	33	0.6	33	31.6
Algae				36	0.55	58	10.2						

no open season. In the spring of 1935, when the writer visited the lake, the fish were in poor condition and obviously hungry. Very few food organisms of any kind were observed and there was an almost complete lack of vegetation.

The stomachs of six grayling from this lake contained 52.5% debris. The aquatic insects were represented by only two groups: midges which accounted for 39.4% and mayflies which made up 10.5% of the total weight of food organisms taken (see Table 2). Terrestrial insects (all Coleoptera) constituted 13.1% of the total food, while amphipods were present to the extent of 5.3%. The item of grayling eggs (31.6%) seems large, but is entirely the result of conditions at the time of capture. With the very limited area for spawning, there is great wastage of eggs in this lake. Many are eaten by the fish that spawn them.

COMPARISON BETWEEN THE FEEDING HABITS OF GRAYLING AND TROUT

There is great similarity between the feeding habits of grayling and cutthroat trout. Specimens of both these species taken from Grebe Lake on the same date had the same kinds of organisms in their stomachs. The percentages of the food items in the two species were somewhat different but not more so than between any two grayling or any two trout. Damselflies made up 60% of the stomach contents of the cutthroat trout and about 20% of those of the grayling, while midges amounted to 6% of the cutthroat's diet and 40% of the grayling's. Hazzard and Madsen (1933) list the aquatic food of 40 cutthroat trout from Glacier National Park lakes as 92.4% and the terrestrial as 7.6%. In Rogers Lake, which is near and similar to the above lakes, 21 of the larger grayling contained 93.9% aquatic organisms and 6.1% terrestrial. Mayflies and shrimps were the most important items in the cutthroat trout diet, while shrimps and midges were the major items in that of grayling. The ratio of aquatic to terrestrial foods for 40 Meadow Creek grayling was about 78%:22% and for the 36 cutthroat trout from Teton Park streams (Hazzard and Madsen, 1933), 75%:25%. Most of the food items, exclusive of fish and other vertebrates, recorded as staple for cutthroat trout are also important in the grayling diet.

A comparison was made between the feeding habits of grayling and the trout (rainbow, brown, brook) in Meadow Creek. Stomachs of all these species taken on the same day showed a complete replication of items. The proportions of the various organisms varied between species and among individuals within the species but not in such a way as to indicate a difference in selection. Coston, Pentelow and Butcher (1936) point out that the European grayling has exactly the same food requirements as trout. They list insect larvae, shrimps, snails, ephemerids, caddisflies, and smuts as characteristic food items.

None of the specimens studied had fish in their stomachs, although several hundred trout and sucker fingerlings were seined from some of the same pools in which certain of the larger grayling were caught. Most of the organisms found in the trout stomachs were aquatic. *Daphnia* was the largest single item in the two brook trout,

damselflies in the three rainbow trout, and the isopod, *Asellus*, in the five brown trout examined. Three of the brown trout also contained snails (*Physa*), an item which was not found in any of the other fish.

Two doubles, each consisting of a grayling and a brown trout were taken on two "Cahill" flies and their stomachs saved for separate study. The organisms found in the stomachs of these four fish (see Table 4) are almost equivalent to a random sample of the most available food species taken from Meadow Creek on the same date. While Cladocera were not present in these particular brown trout, they were found in other specimens of this species taken about the same time. The other differences in the stomach contents are certainly not significant when individual variation is considered.

TABLE 4

A COMPARISON BETWEEN THE STOMACH CONTENTS OF TWO DOUBLES, EACH OF A GRAYLING AND A BROWN TROUT, CAUGHT BY FLY-CASTING IN THE MOUTH OF MEADOW CREEK—JULY 10, 1936

Kind of Organism	Double		Double	
	Grayling 335 mm. Standard L.	Brown Trout 300 mm. Standard L.	Grayling 310 mm. Standard L.	Brown Trout 386 mm. Standard L.
Snails (Physa)				7
Waterfleas (Cladocera)	15			
Shrimps (Amphipoda)			1	1
Sow Bugs (Isopoda)	1	5		
Mayflies (Ephemeroptera)	1	1		
Damselflies (Zygoptera)			1	
Caddisflies (Trichoptera)			2	
Bugs (Corixidae)	1	1		
Beetles (Dytiscidae)	2	5	9	1
Midges (Chironomidae)	3		1	2
Fly (Anthomyiidae)			1	
Plant roots				2

It is quite evident from the records of Metzelaar (1929) and others that the larger trout and grayling are not very selective in their feeding habits. The kinds and abundance of different organisms in the diets of these fish are determined by the size of the fish taking the food and the availability of the food species. The availability of food species is determined by the habitat and season of the year. Because a certain organism is consistently found to make up a part of a fish's food does not necessarily mean that the fish selected it in preference to something else. In order to test selection, all items must be present in equal numbers.

Bottom and plankton samples taken on the grayling waters mentioned above indicate that the invertebrate food items of grayling are roughly proportional to their relative abundance. The season of the year and the habitat of the fish almost certainly have greater influence on what is eaten than any selection these fish have demonstrated by their stomach contents.

There can be little doubt but what trout and grayling are natural competitors. The introduction of non-endemic trout into grayling waters certainly has contributed to the decrease of the grayling. A list of our present successful grayling waters includes only those which are free or nearly free from such trout. On the other hand, the grayling and cutthroat trout, which together originally occupied certain Montana waters, are compatible today in the successfully stocked Georgetown, Rogers, and Grebe lakes. Under present conditions in many places where rainbow, brown, and brook trouts have been introduced, the cutthroat as well as the grayling has almost completely disappeared.

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