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ANALYSIS OF DIETS USED BY MICHIGAN TROUT HATCHERIES WITH  
REFERENCE TO BLINDNESS AND PALE COLOR IN BROOK TROUT

By

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During the spring and early summer of 1946, yearling brook trout at the Baldwin Station began to become blind and turn a very pale color. All gradations in the change in color, from grayish to a paleness somewhat resembling albino trout, could be observed among the fish in the pond. The trout regained normal coloration after death, which made it difficult to determine that the slight increase in loss might be due to the pale, blind fish unless the eyes were closely examined. The crystalline lens of the eyes in blind fish was opaque, milky in color, and very soft. Dissection of the lens failed to reveal any parasites present. The occurrence of the unusual pale color of the blind trout (trout normally become dark in color when blind), and the large number of trout affected led us to believe that a disease of some kind was present. Since the pale color of the fish was due to constant contraction of the melanophores, it was suspected that the nervous system was involved and the diet was changed to include 5 percent brewers yeast. Several months on this diet had no apparent effect on the affected fish.

The same malady again appeared at Baldwin Station in yearling brook trout the spring of 1947 and 1948. In the beginning it was thought that some peculiarity of the water supply had developed at the Baldwin Station

that might have been responsible. However, in the spring of 1948 brook trout at other stations were checked and the same affliction was found in varying degrees at Grayling, Harrietta, Thompson, Watersmeet and Wolf Lake. Since the stations mentioned are located at various locations throughout the entire state, the theory that water supply might be the cause was discarded.

Hess (1937) produced dietary blindness in rainbow trout by feeding an exclusive diet of pig spleen. However, the fish in his experiment changed to a darker color as they became blind.

Diet as a cause was suspected but analysis of the previous diet at Baldwin did not show an excess of pig products. However, since the malady was not present at several stations (Oden, Cocks Run, Marquette), and since large amounts of horse products were being fed due to the prohibitive costs of the customary beef and pork meats, an analysis of the diets of all stations was made. Supervisors of the stations submitted monthly totals of foods used from September, 1947, to May, 1948. This period was chosen because the trout first became noticeably affected during the spring of the year.

The following tables were compiled from reports submitted by the various stations.

Table 1  
 GRAYLING HATCHERY  
 (5 percent blindness)

Month	Horse Liver	Horse Heart	Pork Melts	Beef Liver	Herring
September 1947	6175 (45.2%)	4950 (36.3%)	2511 (18.5%)		
October	11370 (36.9%)	9310 (30.2%)	7782 (25.2%)	2328 (7.5%)	
November	6928 (48.7%)	2861 (20.0%)	3784 (26.6%)	639 (4.5%)	
December	5500 (34.3%)	5508 (34.3%)	5032 (31.3%)		
January 1948	2750 (34.6%)	2760 (34.8%)	2421 (30.5%)		
February	5520 (34.6%)	5430 (34.0%)	5000 (31.3%)		
March	5557 (34.6%)	5476 (34.1%)	5000 (31.1%)		
April	4032 (25.0%)	3880 (24.7%)	6500 (40.4%)		1570 (9.8%)
May	3000 (18.7%)	4997 (31.1%)	6000 (37.3%)		2058 (12.8%)
TOTALS	50832 (34.7%)	45172 (30.8%)	44030 (30.0%)	2967 (2.0%)	3628 (2.5%)

Table 2  
HARRIETTA HATCHERY  
(10 percent blindness)

Month	Cereal	Telang Liver	Horse Heart	Horse Liver	Canned C Cooked Horse	Horse Meat	Ocean Herring
September 1947	2371 (62%)	709 (18.5%)	747 (19.5%)				
October	2198 (72.4%)	839 (27.6%)					
November	1365 (59.3%)			712 (30.9%)	225 (9.8%)		
December			781 (39.1%)	281 (14.1%)	933 (46.7%)		
January 1948			334 (15.4%)	1380 (63.7%)	385 (17.8%)	67 (3.1%)	
February			58 (2.5%)	2067 (87.5%)		238 (10.0%)	
March			855 (30.5%)	1808 (64.5%)		140 (5.0%)	
April			311 (11.2%)	2080 (75.0%)	75 (2.7%)	216 (7.8%)	91 (3.3%)
May			1116 (40.0%)	1669 (60.0%)			
<b>TOTALS</b>	5934 (24.7%)	1548 (6.4%)	4202 (17.5%)	9997 (41.5%)	1618 (6.7%)	661 (2.7%)	91 (0.4%)

Table 3

## WATERSMEET HATCHERY

(Approximately 10 percent blindness, June, 1948)

Month	Horse Liver	Pork Liver	Pork Melts	Beef Melts	Dry Meals	Horse Heart
October 1947	250 (50%)		250 (50%)			
November	150 (60.5%)		98 (39.5%)			
December	260 (45.6%)	70 (12.3%)	240 (42.1%)			
January 1948	250 (46.7%)	95 (17.7%)	105 (19.6%)	85 (15.9%)		
February		200 (40.0%)	75 (15.0%)	175 (35.0%)	50 (10.0%)	
March		300 (52.1%)	200 (34.7%)	75 (13.0%)		
April	50 (8.4%)	200 (33.6%)	250 (42.0%)		45 (7.5%)	50 (8.4%)
TOTALS	960 (27.2%)	865 (24.5%)	1218 (34.6%)	335 (13.3%)	95 (2.3%)	50 (1.4%)

Table 4

WOLF LAKE HATCHERY  
(30 percent blindness)

Month	Horse Liver	Cooked Horse
September 1947	2160 (100%)	
October	2160 (100%)	
November	2160 (100%)	
December	2400 (100%)	
January 1948	2400 (100%)	
February	500 (23.9%)	1585 (76.1%)
March	1800 (100%)	
April	1500 (100%)	
TOTALS	15080 (90.5%)	1585 (9.5%)

Table 5

## THOMPSON HATCHERY

(5 percent blindness, June, 1948)

Month	Horse Livers	Horse Hearts	Pork Melts	Dried Food
October 1947	700 (70.3%)		250 (25.1%)	45 (4.5%)
November	600 (55.8%)	100 (9.3%)	300 (27.9%)	75 (6.9%)
December	400 (49.1%)	350 (42.9%)	50 (6.2%)	15 (1.8%)
January 1948	500 (40.8%)	400 (32.6%)	250 (20.4%)	75 (6.1%)
February	500 (39.5%)	425 (33.6%)	300 (23.7%)	40 (3.1%)
March	800 (42.5%)	600 (31.9%)	400 (21.2%)	80 (4.2%)
April	900 (36.0%)	600 (24.0%)	800 (32.0%)	200 (8.0%)
May	1100 (45.8%)	300 (12.5%)	800 (33.3%)	200 (8.3%)
TOTALS	5500 (45.2%)	2775 (22.8%)	3150 (25.9%)	730 (6.0%)

Table 6

## ODEN HATCHERY

(Percent blindness very low, June, 1948)

Month	Horse Liver	Inedible Liver	Pork Melts	Cooked Horse	Dry Meals
September 1947			10831 (38.8%)		17088 (61.2%)
October			15630 (54.9%)		12816 (45.0%)
November		7000 (19.4%)	16300 (45.1%)		12800 (35.4%)
December	2100 (8.1%)	8100 (31.3%)	8700 (33.7%)		6825 (26.1%)
January 1948	6850 (44.5%)	800 (5.2%)	5200 (33.8%)	2525 (16.4%)	
February	3055 (32.8%)	2900 (31.1%)	1600 (17.2%)		1750 (18.8%)
March	765 (6.0%)	6400 (50.5%)	1620 (12.8%)		3875 (30.6%)
April	1955 (15.7%)	2550 (20.5%)	1700 (13.6%)	4921 (39.5%)	1325 (10.6%)
TOTALS	14725 (8.7%)	27750 (16.5%)	61581 (36.6%)	7446 (4.4%)	56479 (33.6%)



Table 7

## COOKS RUN

(No blindness present, June, 1948)

Month	Horse Liver	Pork Liver	Pork Melts	Beef Melts	Dry Meals	Horse Heart
October 1947	2556 (35.9%)	503 (7.0%)	3748 (52.7%)	296 (4.1%)		
November	1039 (28.2%)	1400 (38.0%)	2347 (63.8%)			
December	1148 (18.4%)	2812 (45.2%)	2258 (36.3%)			
January 1948	900 (25.0%)	670 (18.6%)	982 (27.3%)	502 (13.9%)	540 (15.0%)	
February		1568 (38.3%)	1274 (31.1%)	576 (14.0%)	670 (16.4%)	
March		1787 (39.4%)	1781 (39.2%)	246 (5.4%)	720 (15.9%)	
April	1045 (16.5%)	2205 (34.8%)	2150 (34.0%)		675 (10.7%)	250 (3.9%)
TOTALS	6688 (18.2%)	10945 (30.0%)	14540 (39.7%)	1620 (4.4%)	2605 (7.1%)	250 (0.68%)

Marquette Hatchery was omitted from the analysis because, according to the Supervisor, Mr. Russell Robertson, very little horse products were fed and the diet was changed very frequently so that the fish were never on a steady diet of any product.

Since dietary blindness had been produced in rainbow trout by Hess, who fed pig spleen, both pig and horse products were included in the following analysis of the diet (Table 8).

In comparing the stations where blindness is present with those not having blindness, the combined total percent of both horse and pig products is not significant because the figure is high where no blindness is reported. The same is true in considering only pig products. Neither can any correlation be found between blindness and any of the horse or pig products considered individually, with the exception of Wolf Lake where 90.5 percent of horse products fed was horse liver.

If, however, the total percent of all horse products (liver, heart, canned meat, and raw meat) is considered, it will be noted that all stations feeding more than 18.2 percent (Cook's Run) have blindness. Those stations feeding from 27.2 percent to 100 percent horse products are affected with blindness in brook trout. If the cause of blindness is horse products, as the above data indicate is a strong possibility, the critical percent appears to be somewhere between 18.2 percent and 27.2 percent. Accordingly, it is suggested that, in an effort to prevent blindness in brook trout, the diet fed brook trout should not contain more than 18 percent of horse products.

Although the percentage of blindness is not high (estimated 10 percent - 30 percent) this type of blindness in brook trout, is, nevertheless, important because tests have shown that affected trout cannot be cured and the stocking of such fish is wasted effort because the benefits to the angler are small since blind trout are difficult to catch with hook and line.

INSTITUTE FOR FISHERIES RESEARCH

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Table 8  
Diet Analysis

	★ Watersmeet	★ Thompson	★ Harrietta	★ Wolf Lake	★ Grayling	Cooks Run	Oden
Horse Liver	27.2%	45.2%	41.5%	90.5%	34.7%	18.2%	8.7%
Horse Heart		22.8%	17.5%		30.8%		
Canned, Cooked Horse Meat			6.7%	9.5%			4.4%
Horse Meat			2.7%				
Pork Melts	34.6%	25.9%			30.0%	39.7%	36.6%
Pork Liver	24.5%					30.0%	
Beef Melts	13.3%					4.4%	
Beef Liver					2.0%		
Telang Liver			6.4%				
Cereal	2.3%	6.0%	24.7%			7.1%	33.6%
Ocean Herring			0.4%		2.5%		
Inedible Liver							16.5%
Total percent Horse Meat	27.2%	68.0%	68.4%	100%	65.5%	18.2%	13.1%
Total percent Pork	59.1%	25.9%			30.0%	69.7%	36.6%
Total percent Horse and Pork	86.3%	93.9%			95.5%	87.9%	49.7%

★ Blindness present.