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Research and Planning Division

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## Introduction

Phillips and co-workers reported in 1959 that brown trout could be maintained on a pelleted dry feed mixture without meat supplement over a 3-year period but that the condition of the fish was unsatisfactory at the conclusion of the feeding trials. Also, eggs taken from trout fed dry feed for 3 years did not develop. However, in recently completed experiments at Cortland, New York, brown trout raised on dry rations were in satisfactory condition and produced viable eggs at the end of 3 years. The eggs taken from brown trout fed a dry diet were equal in quality to those from fish fed a meat-meal mixture (Phillips, et al., 1964a). A similar test at the Westfield Research Station, Westfield, Wisconsin, with fall-hatched rainbow trout and brook trout demonstrated that these species can also be raised to maturity entirely on dry diets with no apparent adverse effects on production of eggs and fry.

## Methods

Wisconsin Conservation Department C series dry diets shown in Table 1 are the most satisfactory rations for brook, brown, rainbow, and lake trout reared in Wisconsin hatcheries (Mason et al., 1965). These diets were fed to a group of fall-hatched rainbow and brook trout until they were mature. Initially the trout were reared in shallow tanks inside the hatchery building, but throughout most of the test period they were held in a deep outside raceway where the water temperature reached a maximum of 55°F. in the summer and a minimum of 45°F. in the winter.

Eggs were taken from 56 fall-hatched rainbow trout and 7 brook trout reared on dry diets, and eggs from 12 brook trout reared on dry diets plus fresh meat supplements. The eggs from each female were collected separately, measured, and placed on individual trays in the hatchery trough. They were incubated in water with a constant temperature of 50°F. Malachite green was used for fungus control. Dead eggs were hand-picked and counted. All other quantity measurements were made by the Von Bayer method.

The trout hatched from the eggs of the rainbow trout were reared on a complete dry diet. On September 24, 1964, 900 of these trout were released into Trout Creek, Iowa County. During April 12-19, 1965, an estimate of their over-winter survival in Trout Creek was made by electro-fishing a 5.2-mile section containing the stocking sites. The Peterson-type mark and recapture method was employed for the estimate.

All trout captured on the first and second run during the estimate were measured to the nearest 0.1-inch. All trout captured on the first run were weighed, and on the second run trout not captured on the first run were weighed.

## Results

The statistics on the egg and fry production of the various groups of trout are presented in Table 2.

Survival and growth of the fry and fingerlings in the hatchery was similar to survival and growth of the progeny of fall-hatched rainbow and brook trout brood stock reared on dry diets plus fresh meat supplements (Mason et al., 1965).

Over-winter survival of the trout released in Trout Creek was 60 percent of the original stock.

Length, weight and coefficient of condition of the trout before release into Trout Creek September 24, 1964, and when collected April 12-19, 1965 were as follows:

| Date | Number Measured and Weighed | Total Length Range (Inches) | Average Length | Average Weight (Grams) | Average Coefficient of Conditions (R) |
|---|---|---|---|---|---|
| Sept. 24, 1964 | 100 | 6.7 - 10.4 | 8.8 | 125 | 1.81 |
| Apr. 12-19, 1965 | 530 | 6.7 - 11.4 | 9.5 | 133 | 1.52 |

The trout grew some in length while in Trout Creek but very little in weight with an attendant decrease in the condition factor (R).

## Discussion

The production and quality of eggs from the fall-hatched rainbow trout reared on dry diets at the Westfield Research Hatchery compared favorably with production and quality of eggs from this strain of trout reared on dry diets supplemented with fresh meat at Nevin State Trout Hatchery, Madison, Wisconsin. At Nevin Hatchery, the average hatch of fall-hatched rainbow trout eggs ranges from 75 to 80 percent. The 81 percent hatch of fall-hatched rainbow trout obtained at the Westfield Research Hatchery also compares favorably with results reported by Phillips et al. (1964b) when brown trout reared on dry diets produced eggs which had a combined total hatch of 86 percent.

During the 34-month period before the fall-hatched rainbow trout spawned, they appeared to be healthy, vigorous fish. Pathological examination of the trout several days after spawning revealed that approximately 20 percent had pin-point hepatoma of the liver. Twenty percent incidence of hepatoma is slightly higher than is normally present in Wisconsin rainbow trout brood stock fed a fresh meat supplement with their dry diets.

The 60 percent survival of the stocked rainbow trout over the winter of 1964-65 in Trout Creek was nearly as high as the 62 percent survival of a group of dry-diet fall-hatched rainbow trout in Trout Creek during the winter of 1961-62 (Mason, 1963).

Average growth in length of the trout from September, 1964 to April, 1965, was 0.7 inches while the 1961-62 trout grew 1.7 inches. The 1964-65 trout condition factor (R) dropped 0.29 while (R) of the 1961-62 trout dropped 0.19 during the winter in Trout Creek. The 1961-62 trout gained an average of 46 grams over the winter while the 1964-65 trout gained only 8 grams. In April, 1962, the trout stock was 6 percent greater in weight than when stocked in September, 1964. In April, 1965, the trout stock was 37 percent less in weight than when stocked in September, 1965.

In the section of lower Trout Creek where the rainbow trout were released in September, 1961 and 1964, the stream is partly ice-covered in winter. The winter of 1964-65 was the coldest and one of the longest Wisconsin has experienced in decades. Lower Trout Creek had infrequent ice cover during the 1961-62 winter but was mainly ice-covered during the 1964-65 winter. Probably because of the colder environment during the 1964-65 winter the trout during that period grew relatively slower and could not maintain as high coefficients of condition as the trout could during the warmer winter of 1961-62.

## Literature Cited

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## Table 1

### Composition of Wisconsin Conservation Department Dry Trout Diets in Pounds per 1,000 Pounds of Feed

| | Diet C | Diet C-1 | Diet C-2 |
|---|---|---|---|
| Fish meal (white fish) | 325 | 250 | 200 |
| Fish solubles, condensed | 20 | 20 | 20 |
| Skim milk, dried, spray process | 200 | 100 | 50 |
| Yeast, primary, 50-B | 80 | -- | -- |
| Yeast, brewer's | -- | 80 | 80 |
| Distiller's solubles, dried[1] | 100 | 100 | 50 |
| Alfalfa meal | 50 | 50 | 50 |
| Blood flour | 50 | 25 | -- |
| Liver meal (beef liver nonextracted) | 125 | 75 | 50 |
| Wheat, red dog | -- | 100 | 200 |
| Cotton seed meal (degossypolized) | -- | 100 | 200 |
| Corn gluten meal | -- | 50 | 50 |
| Feeding oil, 300 D and 2,250 A | 40 | 40 | 40 |
| Salt, trace, mineralized | 10 | 10 | 10 |
| Vitamin mixture added in grams | | | |
| Riboflavin | 50 | 50 | 50 |
| Pantothenate | 60 | 60 | 60 |
| Niacin | 250 | 250 | 250 |
| Choline chloride | 250 | 250 | 0 |
| Thiamin | 40 | 40 | 40 |
| Ascorbic acid | 100 | 100 | 100 |
| Vitamin E | 0.8 | 0.8 | 0.8 |
| Vitamin $B_{12}$ | 0.04 | 0.04 | -- |

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[1] Commercial Solvents Co. Soluferm

# Table 2

## Egg and Fry Production of Trout on Dry Diets and Dry Diets Plus Fresh Meat Supplements

| | Fall-hatched rainbow trout (dry diet) | Brook trout (dry diet) | Brook trout (dry diet plus meat) |
|---|---|---|---|
| Age of trout (months) | 34 | 21 | 21 |
| Number of females | 56 | 7 | 12 |
| Ounces of eggs | 366 | 21 | 20 |
| Average egg size (No./oz.) | 467 | 489 | 539 |
| Number of eggs | 171,012 | 10,270 | 10,787 |
| Percentage eyed eggs | 86 | 86 | 83 |
| Percentage eggs hatched | 81 | 86 | 83 |

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