

*New Developments in . . .*

# MINK NUTRITION

*1958 Progress Report*

John Adair, F. M. Stout, J. E. Oldfield



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NEW DEVELOPMENTS IN MINK NUTRITION  
(Progress Report, 1958)

John Adair, F. M. Stout, J. E. Oldfield\*

INTRODUCTION:

Practices and procedures are rapidly changing in modern agriculture. The mink industry has experienced such changes, particularly in the area of nutrition, where cost and availability of materials suitable for mink feeds have often made drastic diet changes necessary. Fur farmers, dealing largely with perishable feed products, have faced problems uncommon to those using more stable feeds. Consequently, they have appreciated the need for quick and reliable information on use of alternative dietary sources.

The O.S.C. Experimental Fur Farm, a division of the Department of Dairy and Animal Husbandry, has had as its major objective investigation of nutritional problems with mink. The program followed has involved a two-pronged approach: one dealing with evaluation of alternate feed sources in comparison with a proven standard basal diet; the other with more fundamental problems of mink metabolism and fur growth, and specifically, nature and prevention of abnormal fur development.

This combination of basic and applied research is thought productive and sound, uniting as it does a continuing study of processes by which mink are nourished and grow with diet trials from which results can be applied directly by the industry. Neither basic nor applied research can exist for long without the other.

Experiments reported in this publication have been grouped according to their nature as applied or basic research. Applied studies are discussed individually under "Alternate Feed Sources," while basic experiments are grouped under "Fur Abnormality Studies." In each case an attempt has been made to describe the experimental diet accurately both in terms of gross composition and nutrient content. Animal performance has been evaluated in terms of growth, measured as weight increases and also as pelt length and fur quality, as determined by experienced graders, pelt evaluation and feed cost.

During 1958, 156 breeder female mink were maintained at the Fur Farm. Overall ranch average litter size was 4.5 young, and total production of kits counted was 705. As in previous years, as large a portion as possible of young mink have been included in some phase of experimental work. Six hundred ninety-eight mink, including 559 standard darks and 139 sapphires, were used in 1958. Experimental groups included 77 standard dark animals each. Where sapphire mink were studied, the groups comprised 38 animals each.

All mink were similarly housed in standard wire cages and were managed identically with exception of different experimental diets. Feeding of experimental diets commenced shortly after weaning, on July 7, 1958, and

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continued until mink were pelted in early December. Weights were taken on all animals at monthly intervals, and weights of feed given were recorded daily by groups. In some cases, notably the basal group, breeders were selected from among test animals, hence values were computed from live animal-pelt correlations to determine pelt values for animals thus retained. Pelts taken from experimental animals were sold at auction through normal commercial channels. Since such sales included auctions held at different times, evaluation of pelts was taken from fur grade estimates which were made at once at conclusion of the tests.

Two cereal mixes were used in experimental diets during 1958. These were composed as follows:

	O.S.C. 46*	O.S.C. 49
Wheat germ meal	25	25
Brewers yeast	4.2	--
Alfalfa meal	12.5	13
Dried skim milk	8.3	8
Meat meal	16.7	18
Soybean oil meal	16.7	18
Flaked corn	16.6	18
	<u>100.0</u>	<u>100.0</u>

\*O.S.C. 46 had added Fortafeed 2-49C at a level of 8 pounds per ton, TM-10 (Terramycin) 5 pounds per ton and Methionine 1 pound per ton.

#### ACKNOWLEDGMENTS

The work of the Experimental Fur Farm has been accomplished largely through a team approach in which many individuals and organizations have participated. Donations of funds, materials, advice and services are gratefully acknowledged from the Mink Farmers' Research Foundation, the American Cyanamid Company, the Burroughs-Wellcome Laboratories, the Oregon State Fur Breeders' Association, and the Seattle Fur Exchange.

## ALTERNATE FEED SOURCES

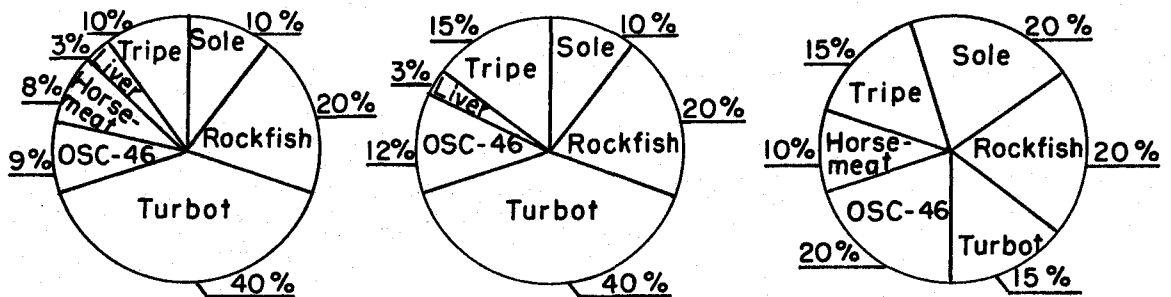
### TEST GROUP 1

**OBJECTIVE:** To feed a basic control ration to which other groups can be compared, similar to the control ration feed in previous years.

**METHOD:**

Number and Type of Mink - 77 standard dark (39 males and 38 females)

Ration -      July 7-Aug. 14                      Aug. 15-Sept. 14                      Sept. 15-Pelting

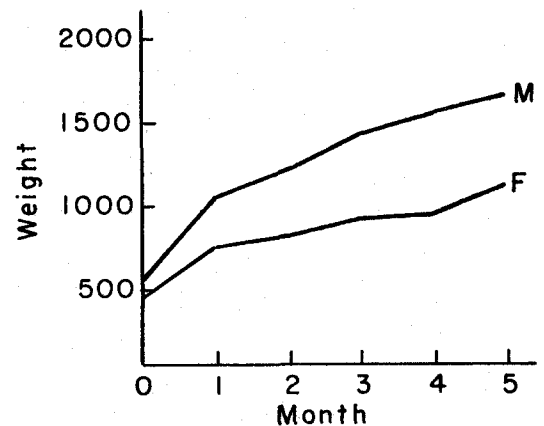


**Proximate Analysis (percentage of dry matter)**

Dry matter	33.75	35.10	39.33
Crude protein	52.92	52.17	54.67
Crude fat	27.62	26.74	19.75
Crude fiber	0.62	0.82	1.37
Ash	9.18	9.63	10.41
Nitrogen-Free Extract	9.66	10.64	13.80

**RESULTS:** (Note: 28 grams = 1 ounce, 454 grams = 1 pound)

Weight data (grams)	Males	Females
Final weight	1681	1006
Weight gain	1111	544
*Pelt data		
Length (inches)	24.22	20.44
Color	1.90	1.89
Depth & density	1.83	1.78
Coverage	1.67	1.81
Price data		
Ration cost	\$ 7.93	\$ 7.93
Estimated pelt value	31.18	19.65
Miscellaneous		
Wet belly	14	0
Matted	2	1
Stains, rubs	0	2
Losses	1	1



\*Pelt color, depth and density and coverage are rated from 1 to 5; 1 denoting best and 5 poorest. Thus, the lower the numerical rating, the better the pelt quality.

DISCUSSION: Performance of this group of mink is the standard against which other test groups may be compared. While diet ingredients remained the same, proportions were changed from time to time as shown. For comparison, 5-year averages on control group mink from this Station are as follows: final weights--male 1655 grams, female 964 grams; weight gains--male 1084 grams, female 503 grams; pelt price--male \$26.04, female \$16.56.

Since breeder animals (12 males and 20 females) were kept largely from this group, returns shown are slightly lower than they might have been if all mink were pelted. Generally speaking, performance on this basal control diet was satisfactory, and other diets which compare favorably with this may also be called satisfactory.

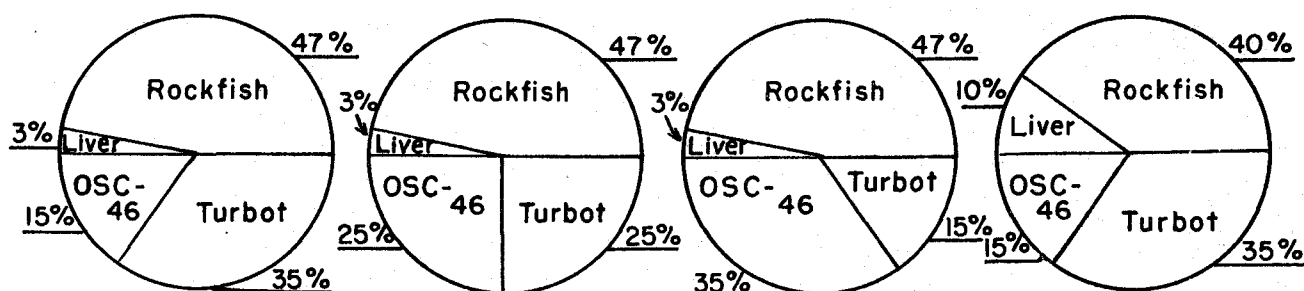
## TEST GROUP 2

OBJECTIVE: To test increasing levels of cereal throughout growth period.

### METHOD:

Number and Type of Mink - 77 standard dark (39 males and 38 females)

Ration - July 7-Aug. 14 Aug. 15-Sept. 16 Sept. 17-Oct. 23 Oct. 24-Pelting



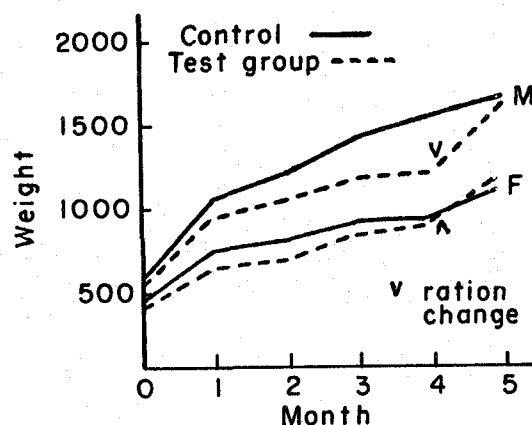
### Proximate Analysis (percentage of dry matter)

Dry Matter	38.69	45.09	51.50	38.89
Crude protein	50.17	49.08	47.98	50.46
Crude fat	24.74	20.90	17.06	24.18
Crude fiber	1.03	1.72	2.40	1.03
Ash	11.47	11.70	11.93	10.58
Nitrogen-Free Extract	12.59	16.60	20.63	13.75

RESULTS: (Note: 28 grams = 1 ounce; 454 grams = 1 pound)

Weight data (grams)	Males	Females
Final weight	1630	1042
Weight gain	1073	593
*Pelt data		
Length	23.78	20.53
Color	1.92	1.97
Depth & density	1.89	2.26
Coverage	1.84	1.97
Price data		
Ration cost	\$ 5.76	\$ 5.76
Estimated pelt value	31.76	19.37
Miscellaneous		
Wet belly	12	2
Matted	1	0
Red hip	0	1
Losses	0	0

\*Pelt color, depth and density and coverage are rated from 1 to 5; 1 denoting best and 5 poorest. Thus, the lower the numerical rating the better the pelt quality.



DISCUSSION: Growth on the higher levels of cereal was much below that of the control group. Readjustment of ration proportions (indicated by arrow on graph) resulted in greatly improved growth with final weights approaching those of the control. Under conditions of this experiment, feeding high levels of this cereal mixture during the growing season did not favor adequate performance of mink. Seven female animals were kept for breeders.

### TEST GROUP 3

OBJECTIVE: To test increasing levels of cereal throughout growth period.

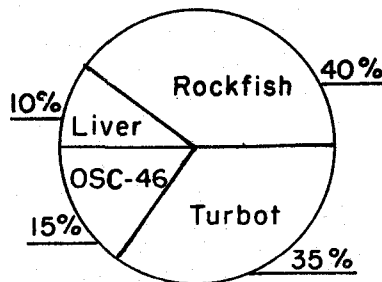
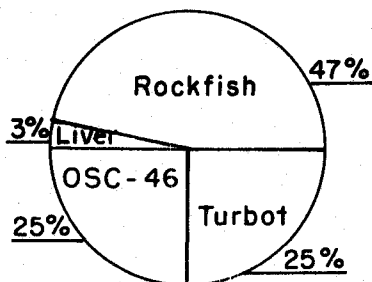
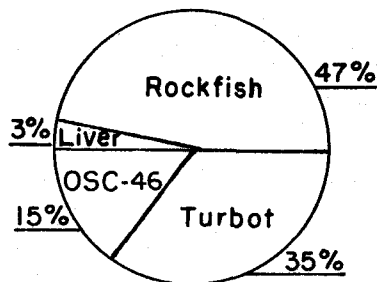
#### METHOD:

Number and Type of Mink - 38 sapphire (19 males and 19 females)

Ration - July 15-Aug. 14

Aug. 15-Sept. 14

Sept. 15-Pelting

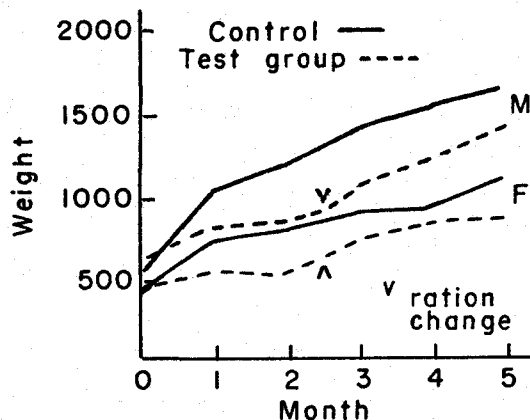


#### Proximate Analysis (percentage of dry matter)

Dry matter	38.69	45.09	38.89
Crude protein	50.17	49.08	50.86
Crude fat	24.74	20.90	24.18
Crude fiber	1.03	1.72	1.03
Ash	11.47	11.70	10.58
Nitrogen-Free Extract	12.53	16.60	13.35

RESULTS: (Note: 28 grams = 1 ounce; 454 grams = 1 pound)

Weight data (grams)	Males	Females
Final weight	1402	856
Weight gain	750	370
*Pelt data		
Length (inches)	22.20	19.13
Depth & density	1.81	2.05
Coverage	1.94	2.05
Price data		
Ration cost	\$ 5.39	\$ 5.39
Estimated pelt value	19.25	11.32
Miscellaneous		
Wet belly	4	0
Matted	2	0
Red hips, stains	2	4
Losses	3	0



\*Pelt depth and density and coverage are rated from 1 to 5; 1 denoting best and 5 poorest. Thus, the lower the numerical rating, the better the pelt quality.

DISCUSSION: Growth of sapphire mink on increasing levels of cereal during the growth period (similar to ration fed test group 2) was inferior to that of animals in the control group. Females especially showed poor weight gains during the first 2-1/2 months. The change in proportion of dietary ingredients resulted in rapid improvement in rate of gain. One male and seven females were kept as breeder replacements.

# TEST GROUP 4

OBJECTIVE: To test high level cereal throughout growth and furring period.

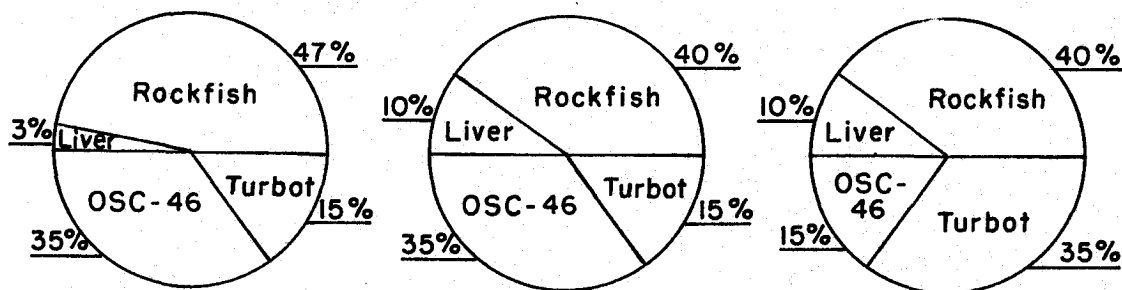
## METHOD:

Number and Type of Mink - 38 sapphire (19 males and 19 females)

Ration - July 15-Sept. 2

Sept. 3-Sept. 14

Sept. 15-Pelting



## Proximate Analysis (percentage of dry matter)

Dry matter	51.50	51.70	38.89
Crude protein	47.98	48.67	50.86
Crude fat	17.06	16.50	24.18
Crude fiber	2.40	2.40	1.03
Ash	11.93	11.04	10.58
Nitrogen-Free Extract	20.63	21.39	13.35

RESULTS: (Note: 28 grams = 1 ounce; 454 grams = 1 pound)

Weight data (grams)	Males	Females
Final weight	1452	879
Weight gain	810	394

## \*Pelt data

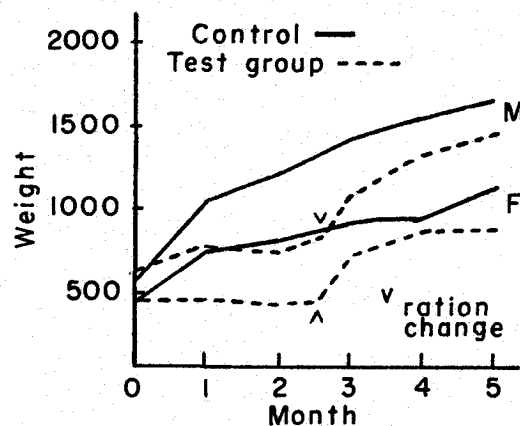
Length (inches)	22.43	19.45
Depth & density	2.11	1.47
Coverage	2.26	1.82

## Price data

Ration cost	\$ 5.42	\$ 5.42
Estimated pelt value	17.16	11.65

## Miscellaneous

Wet belly	0	0
Matted	2	0
Red hips, stains	5	3
Losses	0	2



\*Pelt depth and density and coverage are rated from 1 to 5; 1 denoting best and 5 poorest. Thus, the lower the numerical rating, the better the pelt quality.

DISCUSSION: Poor growth occurred on this initially high level of cereal. Females just maintained their weight for the first 2-1/2 months and males made only slight gains. When cereal was reduced to 15 per cent growth improved. Feeding a high level (35 per cent) of this cereal early in the growing period did not support adequate growth of sapphire mink. Three males and nine females were retained as breeder replacements.



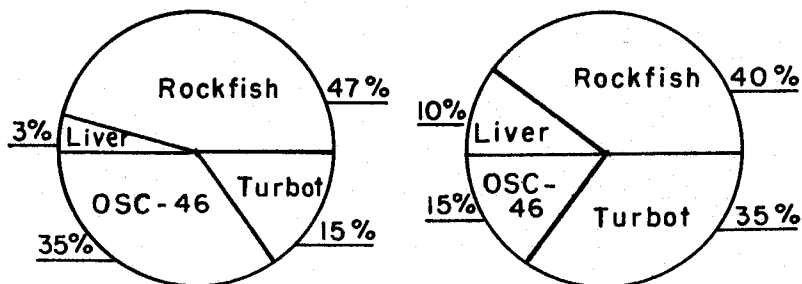
## TEST GROUP 5

OBJECTIVE: To test high level cereal throughout growth and furring period.

### METHOD:

Number and Type of Mink - 77 standard dark (39 males and 38 females)

Ration - July 7-Sept. 25 Sept. 26-Pelting

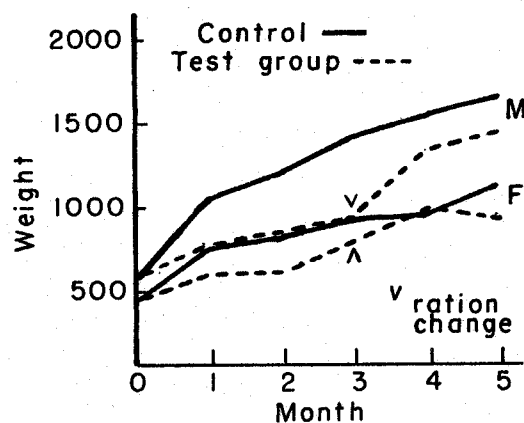


### Proximate Analysis (percentage of dry matter)

Dry matter	51.50	38.89
Crude protein	47.98	50.86
Crude fat	17.06	24.18
Crude fiber	2.40	1.03
Ash	11.93	10.58
Nitrogen-Free Extract	20.63	13.35

RESULTS: (Note: 28 grams = 1 ounce; 454 grams = 1 pound)

Weight data (grams)	Males	Females
Final weight	1473	985
Weight gains	922	530
*Pelt data		
Length (inches)	23.18	20.32
Color	2.47	2.49
Depth & density	2.97	2.49
Coverage	2.17	2.14
Price data		
Ration cost	\$ 5.71	\$ 5.71
Estimated pelt value	28.75	18.03
Miscellaneous		
Wet belly	6	0
Matted	1	1
Low grades	3	2
Losses	0	0



\*Pelt color, depth and density and coverage are rated from 1 to 5; 1 denoting best and 5 poorest. Thus the lower the numerical rating, the better the pelt quality.

DISCUSSION: Males on this diet weighed approximately the same as females fed the control ration over a three-month period. Females performed equally poorly. Lowering cereal level to 15 per cent and increasing levels of liver and turbot improved growth. Final weights did not approach those of control animals. The early detrimental effect was also apparent on pelt length of males and color and quality of pelts of both sexes. These dark mink reacted similarly to sapphire mink (Test Group 4) on the same ration. One female animal was kept as a breeder.

## TEST GROUP 6

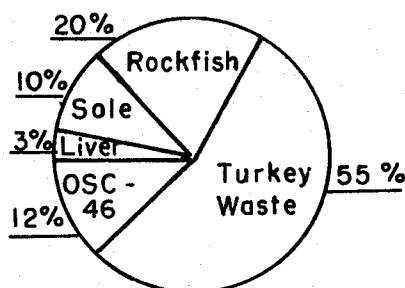
**OBJECTIVE:** To test replacement of horsemeat, tripe and turbot with turkey waste throughout growth and furring period.

### **METHOD:**

Number and Type of Mink - 77 standard dark (39 males and 38 females)

Ration -

July 7 - Pelting

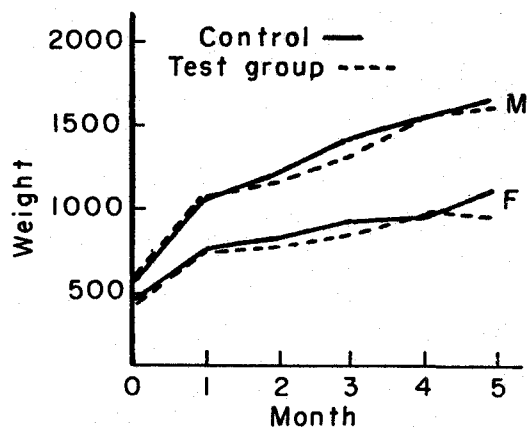


### **Proximate Analysis (percentage of dry matter)**

Dry matter	35.66
Crude protein	55.62
Crude fat	18.30
Crude fiber	0.82
Ash	19.82
Nitrogen-Free Extract	5.44

**RESULTS:** (Note: 28 grams = 1 ounce; 454 grams = 1 pound)

Weight data (grams)	Males	Females
Final weight	1602	964
Weight gains	1021	505
*Pelt data		
Length (inches)	24.01	20.26
Color	2.03	1.88
Depth & density	1.97	1.80
Coverage	1.77	1.78
Price data		
Ration cost	\$ 5.67	\$ 5.67
Estimated pelt value	26.10	18.30
Miscellaneous		
Wet belly	9	0
Matted	22	8
Losses	0	0



\*Pelt color, depth and density, and coverage are rated from 1 to 5; 1 denoting best, 5 poorest. Thus the lower the numerical rating, the better the pelt quality.

**DISCUSSION:** Mink on this ration were comparable to the control group in growth and pelt quality, however their color was somewhat less desirable. Due to high incidence of matting (39%) in this group, pelt values were depressed. Matting in this group alone constituted 68 per cent of the total matting noted in all experimental groups. Fine grinding and thorough mixing of turkey waste rations are recommended to avoid excessive dripping on the mink and subsequent matting. Two males and nineteen females were retained as breeders.

## TEST GROUP 7

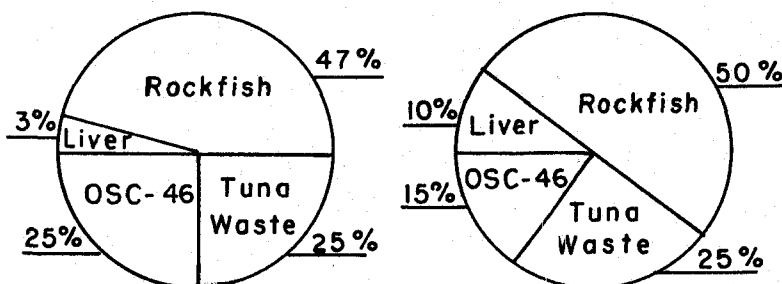
**OBJECTIVE:** To test utilization of tuna waste and high level cereal throughout growth and furring periods.

### **METHOD:**

Number and Type of Mink - 77 standard dark (39 males and 38 females)

Ration - July 7-Oct. 23

Oct. 24- Pelting

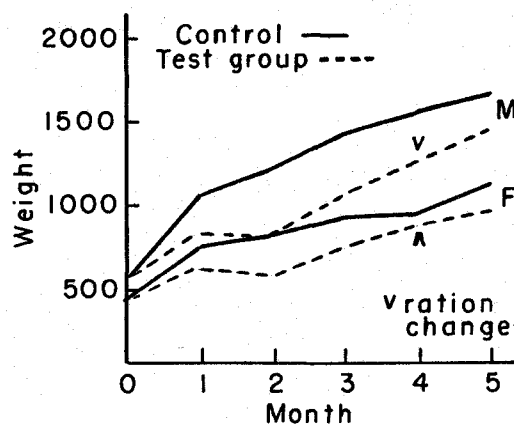


### Proximate Analysis (percentage of dry matter)

Dry matter	48.47	42.04
Crude protein	51.27	54.07
Crude fat	15.60	15.39
Crude fiber	1.72	1.03
Ash	14.33	14.31
Nitrogen-Free Extract	17.08	15.20

**RESULTS:** (Note: 28 grams = 1 ounce; 454 grams = 1 pound)

Weight data (grams)	Males	Females
Final weight	1483	940
Weight gain	897	479
*Pelt data		
Length (inches)	23.11	20.00
Color	2.49	2.29
Depth & density	2.31	2.38
Coverage	2.11	2.24
Price data		
Ration cost	\$ 6.15	\$ 6.15
Estimated pelt value	26.71	17.85
Miscellaneous		
Wet belly	12	0
Matted	2	1
Cotton & low grade	4	3
Losses	4	4



\*Pelt color, depth and density and coverage are rated from 1 to 5; 1 denoting the best and 5 poorest. Thus the lower the numerical rating, the better the pelt quality.

DISCUSSION: Mink on this ration showed poor growth, fur quality and color. Pelt length of males averaged 1 inch less than control males; females 1/2 inch less. Pelt price figures were similarly lowered. Seven losses due to yellow fat disease occurred after three weeks on this ration. A dry water-soluble form of vitamin E was added to supply 100 I.U. of vitamin E per animal per day for two days and 20 I.U. subsequently for the remainder of the experiment. No further losses occurred which could be attributed to yellow fat disease. Lowering of the cereal level to 15 per cent and increasing the liver to 10 per cent during the furring-out period did not improve growth. Four cotton mink appeared on this ration. Two female animals were kept as breeders.

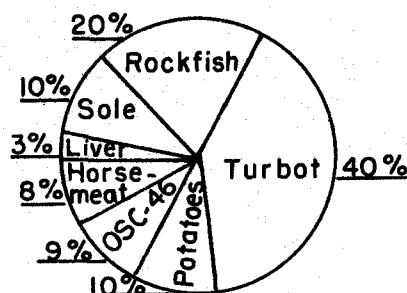
## TEST GROUP 8

OBJECTIVE: Replacement of tripe with cooked potatoes throughout growth and furring period as a wet belly preventative.

### METHOD:

Number and Type of Mink - 38 sapphire (19 males, 19 females)

Ration - July 15 - Pelting

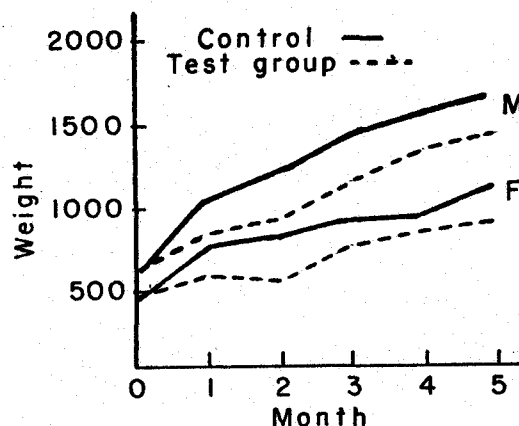


### Proximate Analysis (percentage of dry matter)

Dry matter	33.34
Crude protein	47.95
Crude fat	24.84
Crude fiber	0.95
Ash	8.69
Nitrogen-Free Extract	17.57

RESULTS: (Note: 28 grams = 1 ounce; 454 grams = 1 pound)

Weight data (grams)	Males	Females
Final weight	1444	916
Weight gain	842	422
*Pelt data		
Length (inches)	22.56	19.55
Depth & density	1.58	2.00
Coverage	1.79	1.84
Price data		
Ration cost	\$ 5.28	\$ 5.28
Estimated pelt value	22.84	10.53
Miscellaneous		
Wet belly	1	0
Matted	1	0
Red hips & stains	0	6
Losses	1	0



\*Pelt depth and density and coverage are rated from 1 to 5; 1 denoting best and 5 poorest. Thus, the lower the numerical rating, the better the pelt quality.

DISCUSSION: Incidence of wet bellies on this ration was 2.6% as compared with 10.5% wet bellies on group 3 and none on group 4 (all sapphire groups). Two male and eight female animals were retained as breeder replacements.

## FUR ABNORMALITY STUDIES

### Cotton Mink

Occurrence of "cotton" mink, which are characterized most strikingly by absence of underfur pigmentation, accounts for considerable economic loss annually by the fur industry. This project was designed to study the nature of the cotton pelt, to determine its cause and to develop means for its prevention.\*

Methods and Materials. One hundred and ninety-nine mink, randomly chosen with the exception of 58 on genetic studies (groups 10 and 11), were divided into 8 groups as listed below, which were designed to determine: (1) which portion of the implicated fish contains the cotton-causing factor, (2) the effect of cooking this fish on the cotton-causing factor, (3) the role of folic acid (a B vitamin) on the formation of cotton pelts and (4) the effect of genetic background on the incidence of "cotton" mink.

#### Experimental Treatments

<u>Group No.</u>	<u>No. of Mink</u>	<u>Ration treatment</u>
9	26	Control ration plus "anti-folic acid factor"
10	26	High hake ration fed to mink from families which had previously produced "cotton" mink.
11	26	High hake ration fed to mink from families which had not previously produced "cotton" mink.
12	26	High hake ration plus weekly folic acid injections.
13	20	High cooked-hake ration
14	25	High eviscerated hake ration
15	25	Hake-viscera containing ration
16	25	High whiting ration (sapphire mink)

Comparison of fur color, growth and blood data were made with mink in group No. 1, which were fed the normal control ration. The basic ration fed to all groups except 9 (fed the control ration) was as follows: horse-meat, 7%; mixed rockfish, 10%; turbot, 15%; cereal mix, 18% (composed of wheat germ meal - 25%; alfalfa meal - 13%, skim milk - 8%, meat meal - 18%, soybean oil meal - 18% and flaked corn - 18%). To this, 50% of hake or whiting in various forms was added.

Results and Discussion. Work here and elsewhere indicates that occurrence of "cotton" mink can largely be attributed to feeding of certain fishes. Norwegian investigators have implicated "coalfish" and "stockfish" as causative fish, and experiments at O.S.C. clearly show that the cotton condition follows the feeding of hake and to a lesser extent whiting, with the incidence of cottons closely paralleling the percentage of these fishes included in the ration.

\*This project has been supported by an annual grant from the Mink Farmers' Research Foundation, Milwaukee, Wisconsin.

When mink were fed hake that had been heated to 200° F in open steam cookers, the cotton condition did not develop, revealing that the cotton-causing factor is destroyed by heat. This knowledge provides a practical means of prevention if the implicated fish species are to be fed.

Both hake carcass and hake viscera contain the cotton-causing factor, but it appears to be more concentrated in the viscera fraction as 28 per cent more "cottons" were produced on a ration containing whole hake than on a ration containing an equal amount of eviscerated hake.

Supplementation of mink fed a 50 per cent raw, uneviscerated hake-containing ration by injection of various levels of folic acid had no effect on incidence of "cottons" produced nor upon blood pictures of these animals. Likewise addition of an anti-folic agent (which would interfere with normal use of this vitamin by the animals) to the control ration fed to animals in group 9 did not produce any cotton mink. These observations indicate that a lack of folic acid per se is not the specific cause of "cotton" mink.

A susceptibility to the cotton condition which is apparently under genetic control has been demonstrated by putting entire litters on test from mink known to have produced cottons prior to this time. Incidence of "cotton" mink produced by these animals was 40 per cent higher than the incidence from animals showing no record of cottons in their previous offspring.

Evidence suggesting that only young mink develop the cotton condition was obtained when adult mink which were previously cottons and therefore known to be susceptible were placed on the high hake ration and did not develop the depigmented condition.

Work is continuing on the identification of the factor involved and on the role of certain B vitamins, copper and iron upon the occurrence of the cotton pelt condition.

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