

1960 Progress Report . . .

Improving Mink Nutrition

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Drawing Mink Blood by Heart Puncture



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Agricultural Experiment Station
Oregon State College
Corvallis

Foreword

Research, according to Webster is "careful search; studious inquiry; usually critical and exhaustive investigation or experimentation having for its aim the revision of accepted conclusions, in the light of newly discovered facts". Mr. Webster might have added that for research to be productive the researcher must be patient, methodical, deliberate, unbiased, painstaking, observing, well informed, optimistic, must understand experimental procedures and possess the ability to report clearly his observations and conclusions.

Mink feeding research is beset with many complexities. The researcher must first determine the most pressing problems. Next comes selection of the specific problem whose solution can probably be determined within the available resources. The third phase is planning the experimental procedure, to eliminate all confounding variables, with enough animals to make results reliable, followed by regular observations, measurements and record keeping. Finally, if the planning was sound, the trial properly conducted and with a bit of luck, the researcher is able to interpret his findings and report them. His report may make a substantial contribution to the knowledge of the subject and, ideally, practical applications may follow.

Mink, like other animals are biological entities and seldom do we get clear-cut and precise measurements of results. There are always gradations and gray areas, "neither white nor black". And sometimes different results are obtained when the experiment is repeated, under slightly different conditions. Such are the trials and tribulations of the research worker.

We are fortunate in having the support of the Oregon State Fur Breeders Association and the guidance of its Research Committee. We are further grateful to the Advisory Committee from the Association for suggestions and counsel. We hope that our research efforts will merit the continued cooperation from the industry we serve.

J. C. Miller, Head
Dairy and Animal Husbandry

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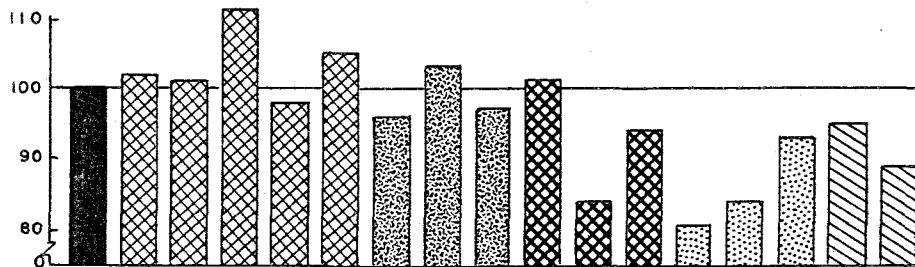
TEST RESULTS AT A GLANCE
Test Group No.

Summary

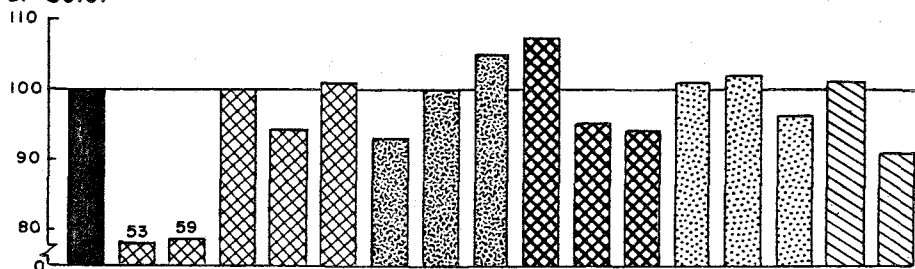
- 1 A basal control ration was fed to provide a standard for comparison. Growth was excellent--males averaged $4\frac{1}{2}$ lb., but incidence of wet bellies was high.
- 2A A ration containing 70% of turkey waste containing heads, viscera and feet, produced good growth, but was associated with an abnormal gray underfur coloration which lowered pelt values for dark mink. Sapphire fur color was not adversely affected.
- 2B A ration containing 50% of turkey waste as described above also produced off-colored underfur in standard dark mink, but was apparently satisfactory for lighter mutation mink.
- 2C A special low-protein cereal was included in a ration containing 50% turkey waste without feet, with good results in terms of growth and fur quality--especially for sapphire mink.
- 2D A ration containing 50% turkey waste without feet fed with basal cereal produced satisfactory growth and fur quality. Results from 2C and 2D suggest turkey feet may be involved in abnormal underfur coloration caused in dark mink by high levels of turkey waste.
- 2E Chicken waste without feet fed as 50% of the diet produced satisfactory results, little different from those produced by a similar level of turkey waste without feet.
- 3A Whale meat substituted for horsemeat at an 8% level in the basal diet lowered ration costs, but dark male size was smaller and pelt color was generally poorer.
- 3B Substitution of a processed meat product (Drum-Pak) at an 8% level for horsemeat resulted in good animal performance and slightly lowered ration costs.
- 3C Chicken waste replacing horsemeat at an 8% level in the basal diet produced generally satisfactory results at lowered ration costs.
- 4A A diet containing 30% of heated, acid-treated hake produced excellent results with generally outstanding fur color and quality. This experiment confirmed good results with processed hake fed at a 20% level last year.
- 4B Feeding of processed hake at a 40% dietary level produced inferior results to use of the same product at the 30% level. Growth and fur quality were both lowered.
- 4C Thirty per cent of heat and acid-treated, unselected fish in the diet gave poorer results than the basal ration or the ration (4A) containing 30% of similarly-processed hake.
- 5A A ration containing 47% dry ingredients, including 35% herring meal produced mink of slightly smaller size, but equal value to the basal ration, at 28% less feed cost.
- 5B Substitution of Viobin fish flour for herring meal in a 47% dry material diet gave similar performance to diet 5A.
- 5C A specially-formulated diet containing 70% dry ingredients produced mink of essentially equal quality and size to the basal ration at 32% lower feed cost.
- 6A Replacing some dietary protein after major mink growth had been attained, with fat and carbohydrate resulted in satisfactory growth and pelt quality at a feed cost 15% below the basal diet.
- 6B Replacing dietary protein as in 6A with carbohydrate alone gave inferior performance in terms of growth and fur color than when fat was added.

COMPARATIVE GROUP PERFORMANCE (% of control)

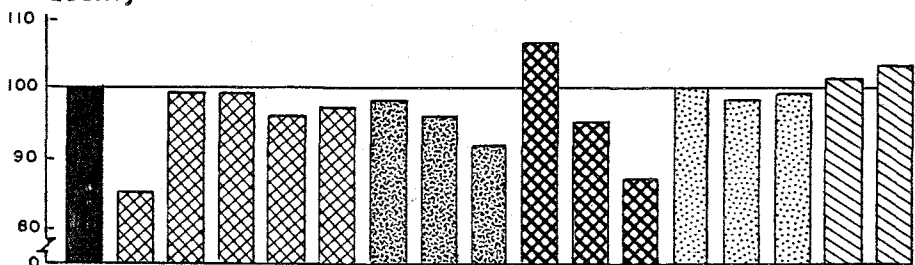
Final Weight



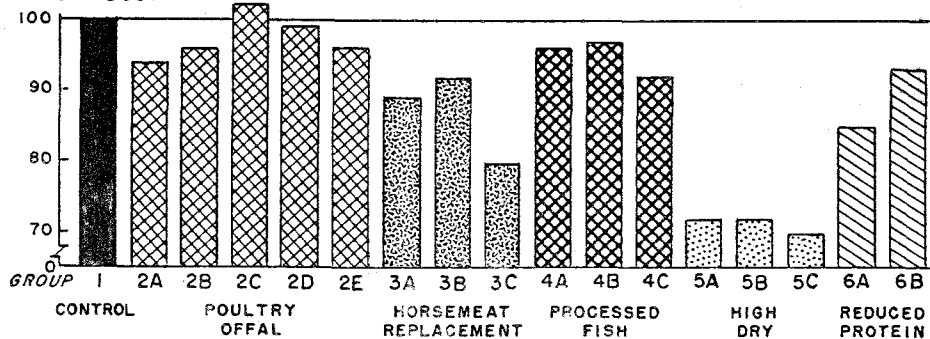
Fur Color



Fur Quality



Ration Cost



Introduction

The feeding trial plan this year involved investigation of 5 main items: (1) Poultry waste, (2) Replacements for horse meat in the basal ration, (3) Processed fish, (4) Increased use of dry ingredients and (5) Altered protein : energy ratios. Several sub-groups of animals were devoted to investigation of modifications of each of these main themes, thus for example, in this report all diets numbered 4 dealt with processed fish. Diet 4A included processed hake as 30% of the diet; 4B the same product at 40% of the diet and 4C involved a "boat-run" mixture of fish processed similarly and fed at a 30% dietary level. The same type of arrangement will be noted for other main and sub-groups, making an integrated program.

It may be of interest to describe some of the reasoning behind selection of these particular items for study. Poultry waste was studied intensively because of its important potential as a feed source, both in this area and elsewhere. The effects of high levels (70%) of turkey waste on fur color and quality needed further investigation, as did methods of preparation of the material (removal of feet) and supplementation practices.

The basal diet in any feeding trial is of great importance, because it is the standard against which all modifications are compared. It is desirable, therefore, that the basal diet contain ingredients that have been thoroughly investigated and evaluated. It is most useful however, if the basal diet may be composed of ingredients in popular use, so that ranchers may readily use it or compare it to their own formulas. To this end several replacers for horse meat (now practically eliminated as a major mink feed in this area) have been tested. These include whale meat, a processed meat product ("Drum-Pak") and poultry waste.

Fish, usually preserved by freezing, have in recent years been processed by heating and acid treatment. Such a procedure has the dual advantage of lowering storage costs and inactivating inhibitors (such as thiaminase) found in some fish, thus allowing them to be fed safely. Data are presented on the effects of various levels and types of such fish products on mink growth and fur quality.

In this period of increased production and consequent increased competition, efficiency of production becomes of primary importance. Results from an experimental ration utilized last year demonstrated that feed costs could be substantially reduced by providing a major source of the mink's nutrient requirement in the dry form. In this case there was some sacrifice in size but none in color or in quality of fur. This year, experimentation along this line has been repeated to verify previous results and to test dry ingredients in new combinations and at higher levels. In one case the bulk of the ration (70%) consists of dry materials.

Nutritional requirements of mink change as they reach their peak body size and begin to fur out, and studies are reported on possible ways of altering the diet appropriately. Two ways in which the high protein (needed for early rapid growth) may be lowered are through substitution of fat and carbohydrate. These are covered in the summaries on diet groups 6A and 6B.

All groups involved in this study consisted of 17 standard dark (9 males

and 8 females) and 8 sapphire (4 males and 4 females) mink. Experimental diets were begun on July 20, 1960 and were continued until pelting in December. Weights were recorded for all animals at monthly intervals. Fur color and quality grades were placed on the pelt by an experienced, commercial fur grader and are used in evaluating the various diets. Live fur grades were used for breeder animals selected from experimental groups. Cost data are listed on a comparative basis, using the control (No. 1) diet as a standard, rather than in actual dollars and cents figures. The reason for this is that actual costs vary so greatly in different management situations that a comparison to a standard may be of greater value.

In the following pages descriptions of experimental conditions and results from the various diet groups are listed. These include a description of each ration, both in terms of percentage composition by ingredients and chemical nutrient content. Data on the response to each ration include growth and fur quality evaluations as well as indications of any defects ("wet bellys", etc.). In addition, some composite tables are included (Page 3) which show the performance by various groups side by side for easier comparison.

Acknowledgements

The research reported herein has been very much a team effort in which many individuals and organizations have participated. Special appreciation for contributions of advice, money or materials to the Experimental Fur Farm is due the following:

Mink Farmers Research Foundation, Milwaukee, Wisconsin
Oregon State Fur Breeders Association
The Seattle Fur Exchange, Seattle, Washington
Bioproducts Incorporated, Warrenton, Oregon
Great Western Malting Company, Vancouver, Washington
Olympia Brewing Company, Olympia, Washington
Stein-Hall & Company, Inc., New York, N.Y.
Viobin Corporation, Monticello, Illinois

Control

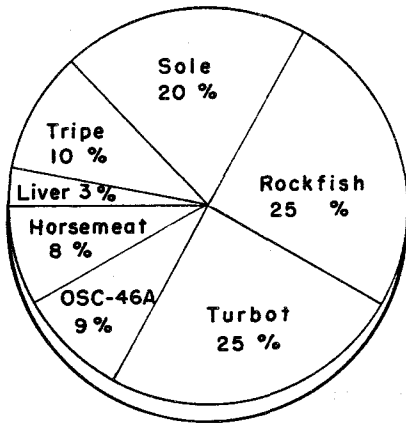
Test Group 1

Objective

To provide a standard CONTROL RATION compounded of ingredients which have consistently resulted in satisfactory growth and fur production. Mink performance on this ration serves as a basis for comparison with other groups.

Methods

Ration: Fed July 20 to pelting
Percentage Composition



Proximate Analysis

Dry Matter.....	28.4
Crude Protein*.....	51.7
Crude Fat*.....	19.5
Crude Fiber*.....	2.9
Ash*.....	10.0
Nitrogen-free Extract*.	15.9

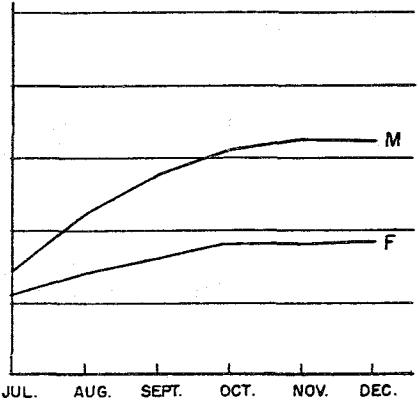
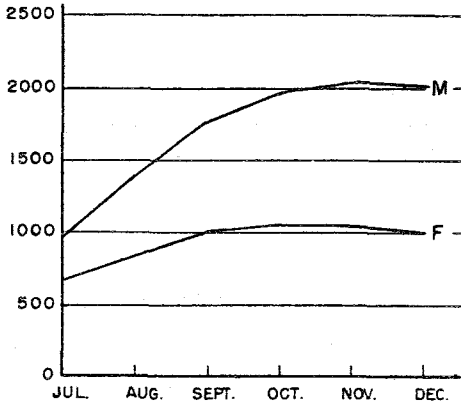
*Expressed as a percentage of the dry matter.

O.S.C. 46A Cereal Mix

Wheat germ.....	25.0%
Alfalfa meal.....	12.5
Skim milk powder.....	8.3
Meat meal.....	16.6
Soybean oil meal.....	16.6
Ground oat groats.....	16.7
Brewer's yeast.....	4.2
Fortafeed 2-4-9-c.....	0.4
Terramycin (TM-10).....	0.25
Methionine.....	0.05

Results

GRAMS



MONTHS

STANDARD DARK

SAPPHIRE

Males Females

2030	1008	..... Final weight (gm.).....
1062	348	..... Weight gain (gm.).....
45.0	37.5	..... Animal length (cm.).....
220	180	..... Fur color*.....
160	130	..... Quality of fur*.....
119	64	..... Weight of dried skin (gm.).....
70.5	55.5	..... Length of dried skin (cm.).....
67	0	..... Wet belly incidence (%).....
\$14.00	\$10.00	..... Estimated pelt value.....
100		..... Ration cost per mink (% of control)....

Males Females

1603	908
890	365
42.5	36.0
150	100
100	100
92	51
66.5	51.0
0	0
\$23.50	\$12.00
100	

*Fur color and quality, taken from dried skins, is rated from 100 (best) to 400 (poorest).

Conclusions

Animal performance on this control group provides a basis to which performance of other groups can be compared. Growth generally was good; dark males averaged 4-1/2 pounds, the highest value that has been recorded for this ration. Low pelt price estimates for dark males reflect the high percentage afflicted with the wet belly condition. Diets high in fat have been implicated as causative of wet belly; nevertheless, fat content of this ration is even below recommended levels for the furring period. Data collected here show a positive correlation between numbers of wet bellies and weights of animals. It is entirely possible that increased size of the dark males this year contributed to the higher wet belly incidence observed.

Poultry Offal

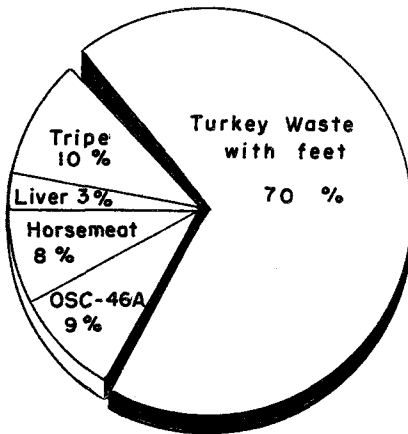
Test Group 2A

Objective

To verify results obtained in 1959 where mink fed this ration containing 70% TURKEY WASTE WITH FEET developed an abnormal white banding on the underfur.

Methods

Ration: Fed July 20 to pelting
Percentage Composition



Proximate Analysis

Dry Matter.....	34.1
Crude Protein*.....	49.1
Crude Fat*.....	25.3
Crude Fiber*.....	3.6
Ash*.....	10.6
Nitrogen-free Extract*.	11.4

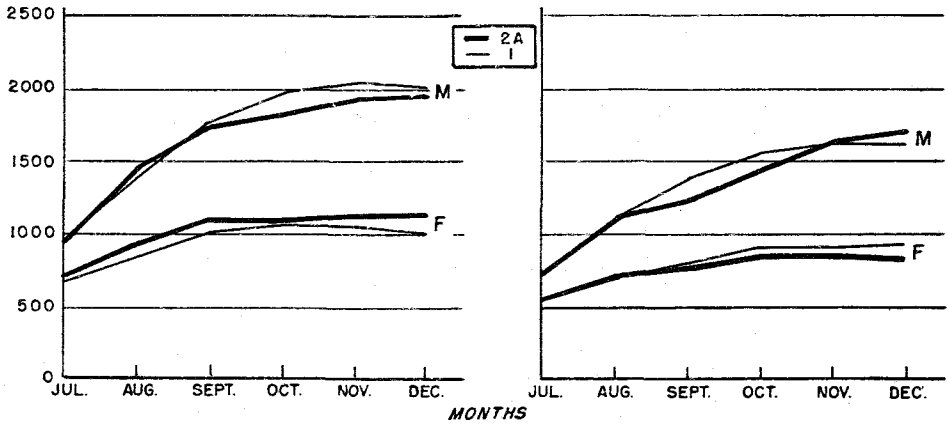
*Expressed as a percentage of the dry matter.

O.S.C. 46A Cereal Mix

Wheat germ.....	25.0%
Alfalfa meal.....	12.5
Skim milk powder.....	8.3
Meat meal.....	16.6
Soybean oil meal.....	16.6
Ground oat groats.....	16.7
Brewer's yeast.....	4.2
Fortafeed 2-4-9-c.....	0.4
Terramycin (TM-10).....	0.25
Methionine.....	0.05

Results

GRAMS



STANDARD DARK

SAPPHIRE

Males Females

1957	1150	.....Final weight (gm.).....
1009	445	.....Weight gain (gm.).....
45.5	37.5	.....Animal length (cm.).....
400	400	.....Fur color*.....
180	190	.....Quality of fur*.....
112	65	.....Weight of dried skin (gm.).....
70.0	59.0	.....Length of dried skin (cm.).....
89	0	.....Wet belly incidence (%).....
\$6.50	\$3.50	.....Estimated pelt value
94		.....Ration cost per mink (% of control)....

Males Females

1723	858
978	290
43.5	37.5
200	150
200	180
86	52
66.0	54.0
0	0
\$18.00	\$9.50
94	

*Fur color and quality, taken from dried skins, is rated from 100 (best) to 400 (poorest).

Conclusions

Again a ration containing this high level of turkey waste containing heads, viscera, and feet produced standard dark mink showing a definite abnormal fur coloration. Underfur color in all dark animals exhibited a white to greyish cast. Sapphire animals as before showed no evidence of this fur condition; however, pelt color was somewhat darker than observed in control sapphires. Final weight of mink was not adversely affected; in fact, dark females averaged 97 grams heavier than controls--a difference which approaches statistical significance. Fur on the live animal had a greasy feel which largely disappeared after the fleshing operation. Pelt quality was slightly reduced in all animals.

Rations containing this level of turkey waste with feet should not be fed to pelt dark mink, and pelt quality may be lowered if fed to mutation mink.

Poultry Offal

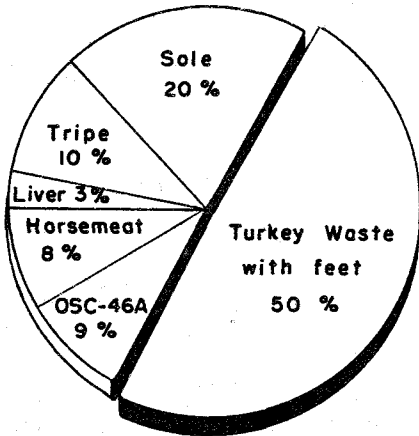
Test Group 2B

Objective

To evaluate TURKEY WASTE WITH FEET (50%) as a major ration ingredient replacing a like percentage of ocean fish.

Methods

Ration: Fed July 20 to pelting
Percentage Composition



Proximate Analysis

Dry Matter.....	30.0
Crude Protein*.....	48.1
Crude Fat*.....	20.4
Crude Fiber*.....	3.3
Ash*.....	14.1
Nitrogen-free Extract*.	14.1

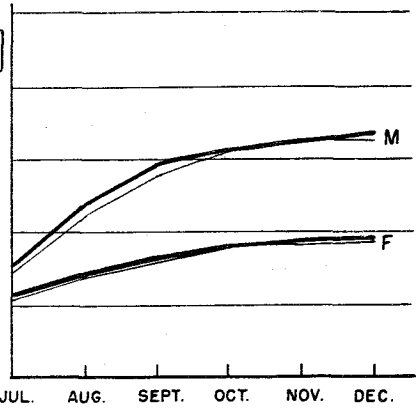
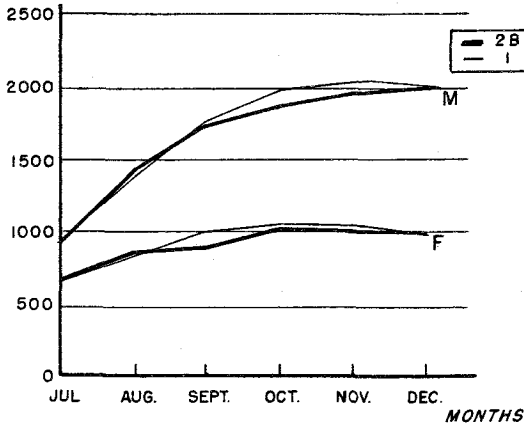
*Expressed as a percentage of the dry matter.

O.S.C. 46A Cereal Mix

Wheat germ.....	25.0%
Alfalfa meal.....	12.5
Skim milk powder.....	8.3
Meat meal.....	16.6
Soybean oil meal.....	16.6
Ground oat groats.....	16.7
Brewer's yeast.....	4.2
Fortafeed 2-4-9-c.....	0.4
Terramycin (TM-10).....	0.25
Methionine.....	0.05

Results

GRAMS



STANDARD DARK

SAPPHIRE

Males Females

2000	994	..... Final weight (gm.).....
1152	309	..... Weight gain (gm.).....
45.0	37.5	..... Animal length (cm.).....
400	380	..... Fur color*.....
130	110	..... Quality of fur*.....
116	59	..... Weight of dried skin (gm.).....
69.5	56.0	..... Length of dried skin (cm.).....
44	0	..... Wet belly incidence (%).....
\$8.50	\$5.00	..... Estimated pelt value.....
96		..... Ration cost per mink (% of control)....

Males Females

1700	963
933	408
43.0	37.5
130	150
130	180
96	53
65.5	54.5
0	0
\$23.50	\$9.50
96	

*Fur color and quality, taken from dried skins, is rated from 100 (best) to 400 (poorest).

Conclusions

Dark mink fed this ration, containing 50 per cent of turkey offal with heads, viscera, and feet, exhibited an off-colored underfur similar to mink fed 70 per cent of this product. Greying in this case was not so extensive and formed more of a banded appearance on the fur. Two dark females did not show greying, which may indicate closeness to the critical level. In previous years, levels as high as 50 per cent of a similar product did not produce off-colored mink. Color of sapphire mink was comparable to sapphires fed the control ration. Size, as measured by weight and animal length, equalled that of control mink. In contrast to the poorer quality of fur seen when mink were fed 70 per cent of turkey waste, fur quality in general was similar to the control group.

This level of turkey waste with feet is too high for normal pelt production of dark mink, but appears to be satisfactory for lighter mutation types.

Poultry Offal

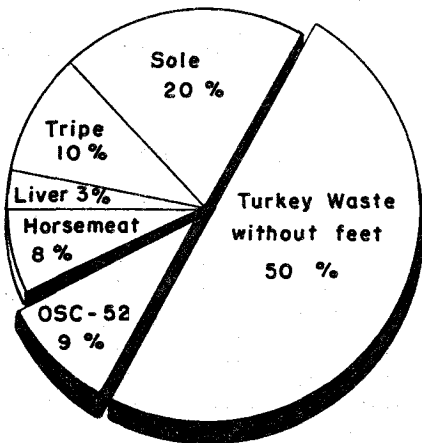
Test Group 2C

Objective

To test a new, LOW PROTEIN SUPPLEMENT compounded of plant materials for more effective supplementation of a ration containing 50% of TURKEY WASTE WITHOUT FEET.

Methods

Ration: Fed July 20 to pelting
Percentage Composition



Proximate Analysis

Dry Matter.....	32.7
Crude Protein*.....	51.5
Crude Fat*.....	22.9
Crude Fiber*.....	2.1
Ash*.....	9.0
Nitrogen-free Extract*.....	14.5

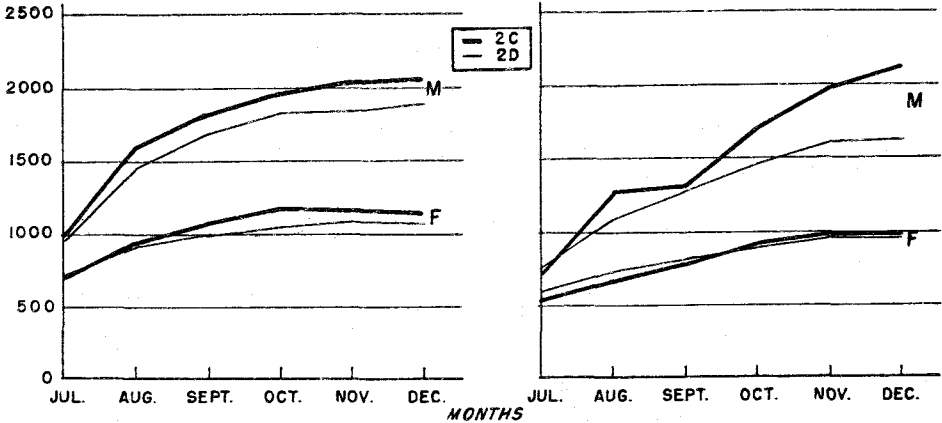
*Expressed as a percentage of the dry matter.

O.S.C. 52 Cereal Mix

Ground oat groats.....	65.0%
Alfalfa meal.....	10.0
Wheat germ meal.....	10.0
Soybean oil meal.....	10.0
Brewer's yeast.....	4.3
Fortafeed 2-4-9-c.....	0.4
Terramycin TM-10.....	0.25
Methionine.....	0.05

Results

GRAMS



STANDARD DARK

Males Females

2067	1150	.....Final weight (gm.).....
1096	468	..... Weight gain (gm.).....
45.5	37.5	.....Animal length (cm.).....
200	210	.....Fur color*.....
140	100	.....Quality of fur*.....
122	60	..... Weight of dried skin (gm.).....
70.5	55.5	..... Length of dried skin (cm.).....
78	0	..... Wet belly incidence (%).....
\$14.00	\$10.00	..... Estimated pelt value.....
102		.....Ration cost per mink (% of control).....

SAPPHIRE

Males Females

2128	995
1423	473
45.5	36.0
100	130
150	150
100	47
69.5	51.0
25	0
\$19.50	\$10.50
102	

*Fur color and quality, taken from dried skins, is rated from 100 (best) to 400 (poorest).

Conclusions

Performance of mink in this group (2c) is best compared to that of animals in group 2D. Both these groups were fed rations containing 50% turkey waste without feet, but this group received a special low protein cereal, while group 2D received the basal cereal. This group was superior in three ways: the animals were generally heavier (sapphire males significantly so), and longer, and fur color was better. This group produced the largest mink on the ranch, averaging 11% over the controls. This ration appeared particularly suitable for sapphire mink. Ration cost was slightly increased, due to greater feed consumption.

The ration described in this experiment, featuring a low protein cereal, was extremely palatable, and on the basis of the performance data listed above, it may be recommended - especially for sapphire mink.

Poultry Offal

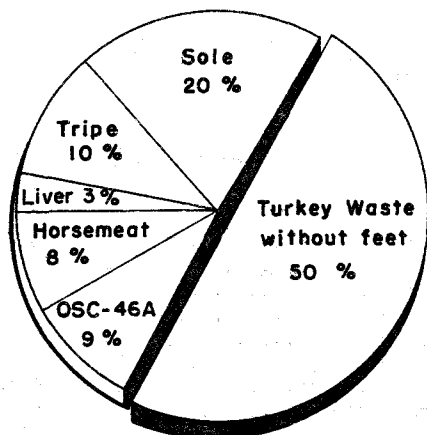
Test Group 2D

Objective

To compare the effect of feeding TURKEY WASTE WITHOUT FEET (50%) versus feeding turkey waste with feet (Ration 2B) and to provide a comparison for the supplement used in ration 2C.

Methods

Ration: Fed July 20 to pelting
Percentage Composition



Proximate Analysis

Dry Matter.....	28.3
Crude Protein*.....	51.9
Crude Fat*.....	16.0
Crude Fiber*.....	3.8
Ash*.....	8.2
Nitrogen-free Extract*,	20.1

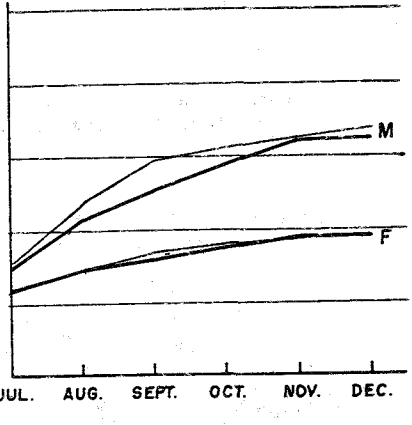
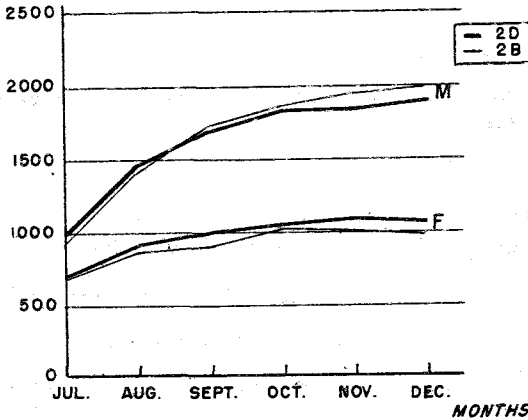
*Expressed as a percentage of the dry matter.

O.S.C. 46A Cereal Mix

Wheat germ.....	25.0%
Alfalfa meal.....	12.5
Skim milk powder.....	8.3
Meat meal.....	16.6
Soybean oil meal.....	16.6
Ground oat groats.....	16.7
Brewer's yeast.....	4.2
Fortafeed 2-49c.....	0.4
Terramycin (TM-10).....	0.25
Methionine.....	0.05

Results

GRAMS



STANDARD DARK

SAPPHIRE

Males Females

Males Females

1883	1058	.....	Final weight (gm.).....	1618	960
942	370	.....	Weight gain (gm.).....	870	340
44.0	37.5	.....	Animal length (cm.).....	43.5	37.0
200	230	.....	Fur color*	180	150
130	140	.....	Quality of fur*.....	130	200
110	59	.....	Weight of dried skin (gm.).....	84	48
69.0	56.5	.....	Length of dried skin (cm.).....	64.5	51.0
67	0	.....	Wet belly incidence (%).....	25	0
\$16.00	\$9.00	.....	Estimated pelt value.....	\$21.00	\$9.00
99		.....	Ration cost per mink (% of control)....	99	

*Fur color and quality, taken from dried skins, is rated from 100 (best) to 400 (poorest).

Conclusions

Unlike similar rations (2A and 2B) compounded of turkey offal containing feet, this ration, with no turkey feet included, produced dark mink with a normally dark underfur. This would indicate that turkey feet are acting in some manner to interfere with the usual pigmentation process in dark mink. Both growth and fur production of mink fed this ration compared well with mink fed the control ration with the exception that sapphire females showed a lowered quality of fur, a difference which was not significant. Cost of raising a mink on this ration was similar to producing one on the control ration.

When turkey waste not containing the feet is included at levels of 50 per cent of the ration, mink with good growth and fur production are produced.

Poultry Offal

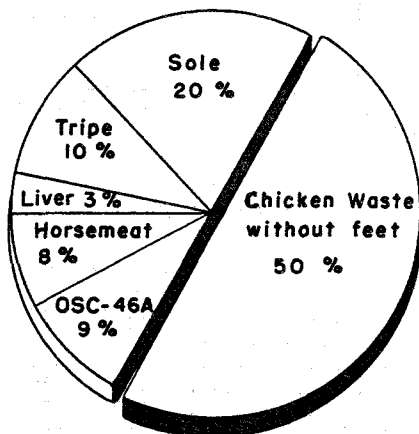
Test Group 2E

Objective

To compare the use of CHICKEN WASTE WITHOUT FEET (50%) with use of turkey waste without feet at a similar level (2D).

Methods

Ration: Fed July 20 to pelting
Percentage Composition



Proximate Analysis

Dry Matter.....	33.1
Crude Protein*.....	43.7
Crude Fat*.....	28.4
Crude Fiber*.....	3.9
Ash*.....	7.0
Nitrogen-free Extract*.	17.0

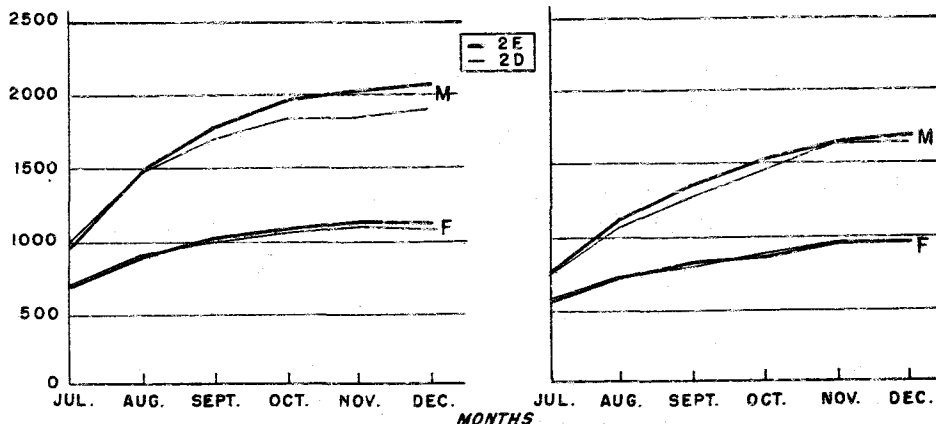
*Expressed as a percentage of the dry matter.

O.S.C. 46A Cereal Mix

Wheat germ.....	25.0%
Alfalfa meal.....	12.5
Skim milk powder.....	8.3
Meat meal.....	16.6
Soybean oil meal.....	16.6
Ground oat groats.....	16.7
Brewer's yeast.....	4.2
Fortafeed 2-4-9-c.....	0.4
Terramycin (TM-10).....	0.25
Methionine.....	0.05

Results

GRAMS



STANDARD DARK

Males Females

2072 1129
1130 450
45.5 37.0
210 150
170 130
126 61
72.0 57.0
89 0
\$12.50 \$10.50
96

.....Final weight (gm.).....
..... Weight gain (gm.).....
.....Animal length (cm.).....
.....Fur color*.....
.....Quality of fur*.....
..... Weight of dried skin (gm.).....
..... Length of dried skin (cm.).....
..... Wet belly incidence (%).....
..... Estimated pelt value.....
.....Ration cost per mink (% of control).....

SAPPHIRE

Males Females

1678 965
938 430
43.0 36.5
130 180
100 150
89 49
66.0 54.5
25 0
\$22.00 \$9.50
96

*Fur color and quality, taken from dried skins, is rated from 100 (best) to 400 (poorest).

Conclusions

There was no evidence of abnormal coloration in dark mink fed this ration employing 50 per cent of chicken waste without feet. Growth and fur production generally equalled that of the control group. Dark females showed some advantage in final weight; sapphire females were somewhat, but not significantly, darker in color. The high wet belly incidence probably reflects the high fat content of this ration. A comparison of mink fed chicken and a similar level of turkey waste shows no outstanding differences, however the trend was for chicken-fed mink to be heavier.

Chicken offal without feet included as 50 per cent of the ration provided a ration high in fat which produced large mink with good color and quality fur.

Horse Meat Replacement

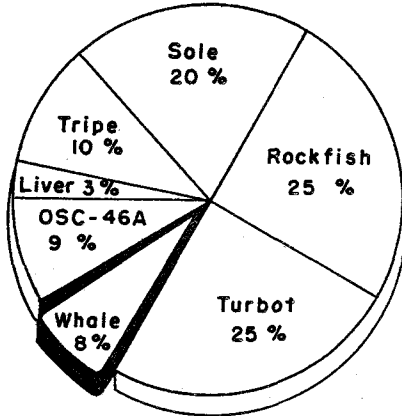
Test Group 3A

Objective

To evaluate the replacement of WHALE MEAT (8%) for a similar level of horse meat in mink production.

Methods

Ration: Fed July 20 to pelting
Percentage Composition



Proximate Analysis

Dry Matter.....	31.0
Crude Protein*.....	49.8
Crude Fat*.....	19.4
Crude Fiber*.....	2.7
Ash*.....	11.3
Nitrogen-free Extract*.	16.8

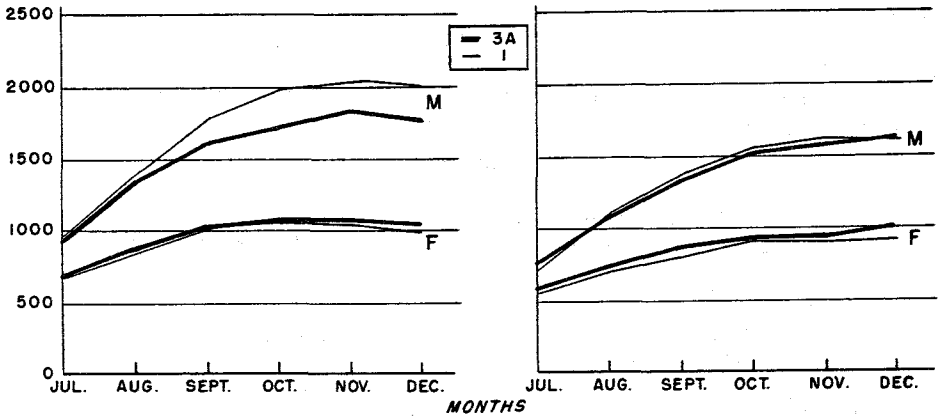
*Expressed as a percentage of the dry matter.

O.S.C. 46A Cereal Mix

Wheat germ.....	25.0%
Alfalfa meal.....	12.5
Skim milk powder.....	8.3
Meat meal.....	16.6
Soybean oil meal.....	16.6
Ground oat groats.....	16.7
Brewer's yeast.....	4.2
Fortafeed 2-4-9-c.....	0.4
Terramycin (TM-10).....	0.25
Methionine.....	0.05

Results

GRAMS



STANDARD DARK

Males Females

1776	1055	.....Final weight (gm.).....
851	361	.....Weight gain (gm.).....
44.0	37.0	.....Animal length (cm.).....
210	200	.....Fur color*.....
140	110	.....Quality of fur*.....
101	58	.....Weight of dried skin (gm.).....
65.5	55.0	.....Length of dried skin (cm.).....
50	0	.....Wet belly incidence (%).....
\$14.00	\$9.50	.....Estimated pelt value.....
89		.....Ration cost per mink (% of control).....

SAPPHIRE

Males Females

1620	1003	.....Final weight (gm.).....
875	423	.....Weight gain (gm.).....
43.5	38.0	.....Animal length (cm.).....
200	170	.....Fur color*.....
100	200	.....Quality of fur*.....
86	50	.....Weight of dried skin (gm.).....
64.5	54.5	.....Length of dried skin (cm.).....
0	33	.....Wet belly incidence (%).....
\$23.00	\$7.00	.....Estimated pelt value.....
89		.....Ration cost per mink (% of control).....

*Fur color and quality, taken from dried skins, is rated from 100 (best) to 400 (poorest).

Conclusions

This test provides a direct comparison of the value of whale meat versus horse meat in a ration for peltier mink. Use of whale lowered the ration cost by about 10%. Final weights were comparable to mink fed the control ration containing horsemeat with the exception of the dark males which were smaller (not significantly). Average pelt length and pelt weight for dark males, however, were significantly reduced. Fur color for the group as a whole was not quite as good as that of control animals. Fur quality of the two groups compared well.

Although use of whale in place of horse meat lowered ration costs, resulting pelt color was generally poorer, fur quality was about equal and dark male size smaller.

Horse Meat Replacement

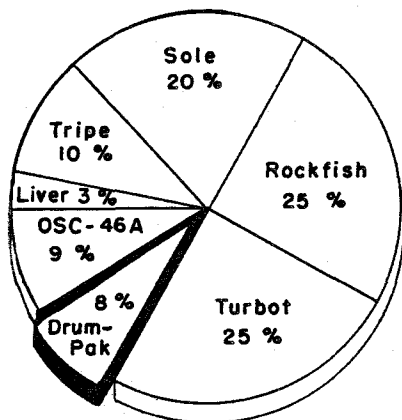
Test Group 3B

Objective

To evaluate the replacement of PROCESSED MEAT PRODUCT (DRUM-PAK) (8%) for a similar level of horse meat in mink production.

Methods

Rations: Fed July 20 to pelting
Percentage Composition



Proximate Analysis

Dry Matter.....	30.5
Crude Protein*.....	50.1
Crude Fat*.....	22.3
Crude Fiber*.....	2.7
Ash*.....	10.5
Nitrogen-free Extract*,	14.4

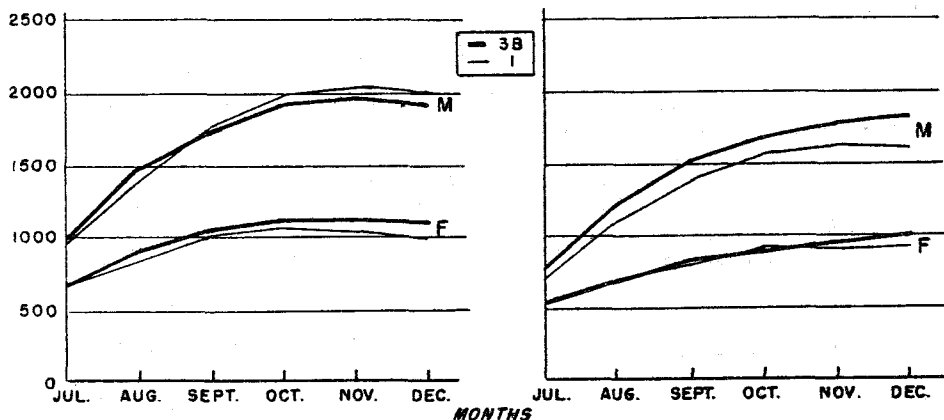
*Expressed as a percentage of the dry matter.

O.S.C. 46A Cereal Mix

Wheat germ.....	25.0%
Alfalfa meal.....	12.5
Skim milk powder.....	8.3
Meat meal.....	16.6
Soybean oil meal.....	16.6
Ground oat groats.....	16.7
Brewer's yeast.....	4.2
Fortafeed 2-4-9-c.....	0.4
Terramycin (TM-10).....	0.25
Methionine.....	0.05

Results

GRAMS



STANDARD DARK

Males Females

1933	1114	.....Final weight (gm.).....
934	423	..... Weight gain (gm.).....
46.0	37.5	.....Animal length (cm.).....
200	180	.....Fur color*.....
140	150	..... Quality of fur*.....
116	61	.....Weight of dried skin (gm.).....
70.5	55.5	.....Length of dried skin (cm.).....
73	0	..... Wet belly incidence (%).....
\$15.00	\$9.50	..... Estimated pelt value.....
92		.....Ration cost per mink (% of control).....

SAPPHIRE

Males Females

1820	1003
1025	468
44.5	37.0
180	130
150	130
100	55
68.0	56.0
0	0
\$22.50	\$11.00
92	

*Fur color and quality, taken from dried skins, is rated from 100 (best) to 400 (poorest).

Conclusions

There has been a noticeable trend in the mink industry in recent years toward use of processed meat by-products to replace horsemeat. The ration containing processed meat fed in this experiment supported equivalent overall performance to the control ration, but use of this product cheapened the ration 8% below the control. In general size of the animals was slightly greater, both in weight and pelt length, than the controls, but these differences were not statistically significant. Pelt color of sapphires was somewhat darker in this group than in the controls.

Use of the processed meat product at an 8% dietary level in place of horsemeat can be recommended on the basis of animal performance and ration cost demonstrated in this experiment.

Horse Meat Replacement

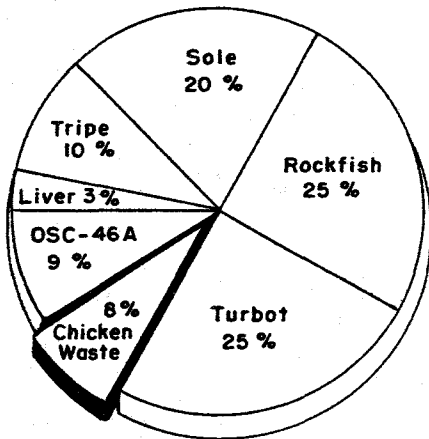
Test Group 3C

Objective

To evaluate the replacement of CHICKEN WASTE WITHOUT FEET (8%) for a similar level of horse meat in mink production.

Methods

Ration: Fed July 20 to pelting
Percentage Composition



Proximate Analysis

Dry Matter.....	29.1
Crude Protein*.....	49.0
Crude Fat*.....	20.1
Crude Fiber*.....	2.4
Ash*.....	11.7
Nitrogen-free Extract*.....	16.8

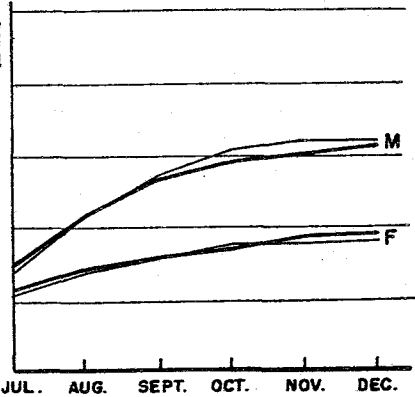
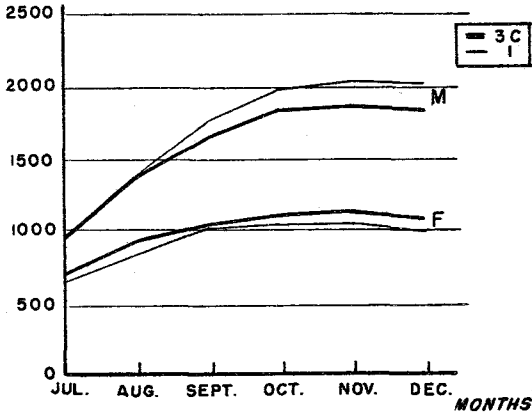
*Expressed as a percentage of the dry matter.

O.S.C. 46A Cereal Mix

Wheat germ.....	25.0%
Alfalfa meal.....	12.5
Skin milk powder.....	8.3
Meat meal.....	16.6
Soybean oil meal.....	16.6
Ground oat groats.....	16.7
Brewer's yeast.....	4.2
Fortafeed 2-4-9-c.....	0.4
Terramycin (TM-10).....	0.25
Methionine.....	0.05

Results

GRAMS



STANDARD DARK

SAPPHIRE

Males Females

1831	1084	.....Final Weight (gm.).....
883	379	..... Weight gain (gm.).....
44.0	37.0	.....Animal length (cm.).....
180	180	.....Fur color*.....
160	140	..... Quality of fur*.....
113	61	.....Weight of dried skin (gm.).....
68.5	56.0	.....Length of dried skin (cm.).....
67	0	..... Wet belly incidence (%).....
\$14.00	\$10.00	..... Estimated pelt value.....
80		.....Ration cost per mink (% of control).....

Males Females

1560	958
833	395
43.0	36.5
130	130
180	150
81	50
63.0	53.5
50	25
\$18.50	\$9.50
80	

*Fur color and quality, taken from dried skins, is rated from 100 (best) to 400 (poorest).

Conclusions

Another alternative feed source that may be used in place of horsemeat is the ground offal from poultry packing plants. In this experiment chicken waste was fed at an 8% dietary level, replacing the horsemeat in the control ration. Results were generally good and little different from the controls. Animal size was similar although there was a trend towards smaller males and larger females. Dark males showed significantly shorter pelts than the controls. Fur color and quality were equal to controls except that sapphires showed somewhat reduced quality. Inclusion of the chicken waste reduced ration costs 20% below the control.

Chicken waste fed at an 8% dietary level will replace a like amount of horsemeat reasonably well and will lower ration costs considerably.

Processed Fish

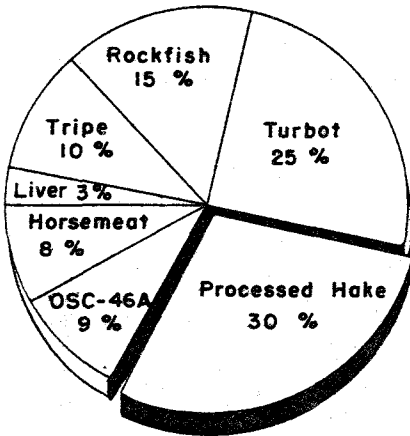
Test Group 4A

Objective

To replace ocean fish normally stored by freezing with PROCESSED HAKE (30%), an abundant species, prepared by a promising method involving heat and acid treatment.

Methods

Ration: Fed July 20 to pelting
Percentage Composition



Proximate Analysis

Dry Matter.....	33.3
Crude Protein*.....	50.2
Crude Fat*.....	17.8
Crude Fiber*.....	1.9
Ash*.....	13.2
Nitrogen-free Extract*.	16.9

*Expressed as a percentage of the dry matter.

O.S.C. 46A Cereal Mix

Wheat germ.....	25.0%
Alfalfa meal.....	12.5
Skim milk powder.....	8.3
Meat meal.....	16.6
Soybean oil meal.....	16.6
Ground oat groats.....	16.7
Brewer's yeast.....	4.2
Fortafeed 2-4-9-c.....	0.4
Terramycin (TM-10).....	0.25
Methionine.....	0.05

Results

GRAMS

2500

2000

1500

1000

500

0

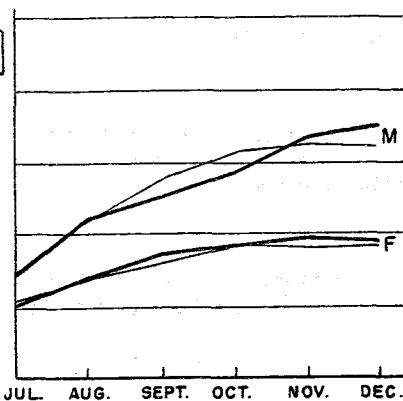
JUL. AUG. SEPT. OCT. NOV. DEC.

MONTHS

— 4A
— I

M

F



STANDARD DARK

Males Females

1850	1125	.....Final weight (gm.).....
208	433	..... Weight gain (gm.).....
43.0	37.5	.....Animal length (cm.).....
140	190	.....Fur color*.....
110	100	.....Quality of fur*.....
101	60	.....Weight of dried skin (gm.).....
67.5	57.0	.....Length of dried skin (cm.).....
67	0	..... Wet belly incidence (%).....
\$18.00	\$10.50	..... Estimated pelt value.....
96		.....Ration cost per mink (% of control).....

SAPPHIRE

Males Females

1750	957
1043	373
43.5	37.0
130	100
100	100
86	---
65.5	---
33	0
\$22.00	\$12.00
96	

*Fur color and quality, taken from dried skins, is rated from 100 (best) to 400 (poorest).

Conclusions

Processing of hake by heat and acid-treatment effectively overcomes the tendency to "cotton" fur production noticeable when the raw fish is fed. In this experiment processed hake made up 30% of the total ration. Fur color and quality were outstanding for the group as a whole, with the color of dark males especially good. Animal weights were larger throughout, with the exception of the dark males. All things considered, performance of this group was outstanding among those fed this year.

Inclusion of processed hake as 30% of the diet for peltier mink gave excellent performance in terms of both animal growth and fur production. These results extend last year's observations on the suitability of processed hake fed as 20% for the diet.

Processed Fish

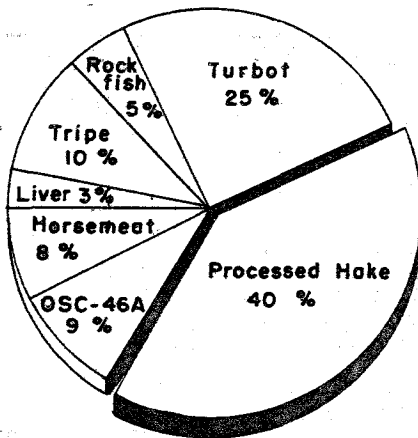
Test Group 4B

Objective

To replace ocean fish normally stored by freezing with PROCESSED HAKE (40%), an abundant species, prepared by a promising method involving heat and acid treatment.

Methods

Ration: Fed July 20 to pelting
Percentage Composition



Proximate Analysis

Dry Matter.....	33.6
Crude Protein*.....	50.8
Crude Fat*.....	16.7
Crude Fiber*.....	2.0
Ash*.....	13.9
Nitrogen-free Extract*.	16.6

*Expressed as a percentage of the dry matter.

O.S.C. 46A Cereal Mix

Wheat germ.....	25.0%
Alfalfa meal.....	12.5
Skim milk powder.....	8.3
Meat meal.....	16.6
Soybean oil meal.....	16.6
Ground oat groats.....	16.7
Brewer's yeast.....	4.2
Fortafeed 2-4-9-c.....	0.4
Terramycin (TM-10).....	0.25
Methionine.....	0.05

Results

GRAMS

2500

2000

1500

1000

500

0

JUL.

AUG.

SEPT.

OCT.

NOV.

DEC.

MONTHS

— 4B
— 4A

M

F

2500

2000

1500

1000

500

0

JUL.

AUG.

SEPT.

OCT.

NOV.

DEC.

M

F

STANDARD DARK

Males Females

1470	1074	.....Final weight (gm.).....
511	395	.....Weight gain (gm.).....
42.0	37.0	.....Animal length (cm.).....
220	230	.....Fur color*.....
160	160	.....Quality of fur*.....
90	57	.....Weight of dried skin (gm.).....
63.5	56.0	.....Length of dried skin (cm.).....
11	0	.....Wet belly incidence (%).....
\$15.00	\$8.50	.....Estimated pelt value.....
97		.....Ration cost per mink (% of control).....

SAPPHIRE

Males Females

1288	885
530	335
42.5	36.0
130	130
130	130
76	40
60.0	49.5
0	0
\$23.50	\$11.00
97	

*Fur color and quality, taken from dried skins, is rated from 100 (best) to 400 (poorest).

Conclusions

This experiment, involving processed hake as 40% of the diet, may be compared with the control (group 1) or group 4A where hake was fed at the 30% level. Performance of this group was generally poorer than either of the others named. Weight gains and pelt lengths were generally smaller, and significantly so in males. Fur color was poorer in the dark mink, and fur quality tended to be poorer, though not significantly so. An interesting point is that incidence of wet bellies on this diet was markedly less than among the controls. This item probably accounts for the fact that pelt prices are comparable to the control group. Feed consumption on this diet was reduced over either the control or group 4A. This indicates decreased palatability which may possibly be associated with the acid treatment rather than the fish itself.

Growth and fur quality in mink fed a diet containing 40% processed hake were inferior to those on the control diet, or a similar diet containing 30% processed hake.

Processed Fish

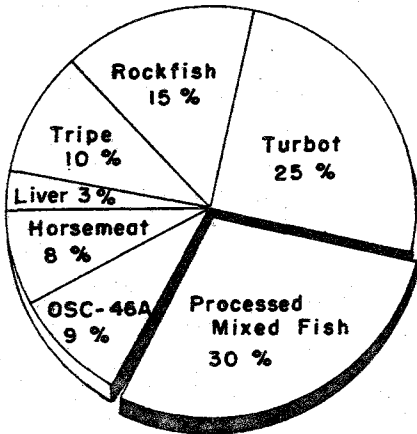
Test Group 4C

Objective

To test the replacement value of a PROCESSED FISH MIX (30%), prepared by heat and acid treatment, as a substitute for freezer-stored, marine fish.

Methods

Rations: Fed July 20 to pelting
Percentage Composition



Proximate Analysis

Dry Matter.....	33.9
Crude Protein*.....	51.5
Crude Fat*.....	17.2
Crude Fiber*.....	1.8
Ash*.....	14.9
Nitrogen-free Extract*.	14.6

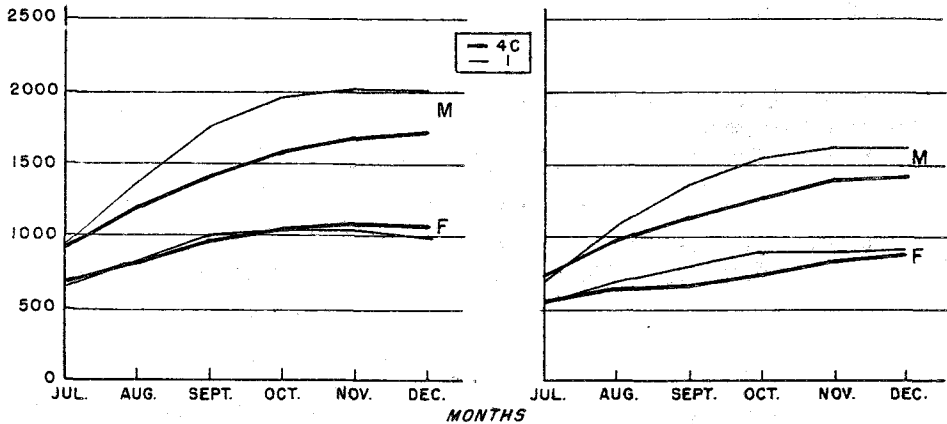
*Expressed as a percentage of the dry matter.

O.S.C. 46A Cereal Mix

Wheat germ.....	25.0%
Alfalfa meal.....	12.5
Skim milk powder.....	8.3
Meat meal.....	16.6
Soybean oil meal.....	16.6
Ground oat groats.....	16.7
Brewer's yeast.....	4.2
Fortafeed 2-4-9-c.....	0.4
Terramycin (TM-10).....	0.25
Methionine.....	0.05

Results

GRAMS



STANDARD DARK

Males Females

1718	1069	.....Final weight (gm.).....
783	391	.....Weight gain (gm.).....
43.0	37.0	.....Animal length (cm.).....
230	230	.....Fur color*.....
190	130	.....Quality of fur*.....
95	57	.....Weight of dried skin (gm.).....
66.5	56.0	.....Length of dried skin (cm.).....
33	0	.....Wet belly incidence (%).....
\$13.50	\$9.50	.....Estimated pelt value.....
92		.....Ration cost per mink (% of control).....

SAPPHIRE

Males Females

1423	888
710	353
42.0	36.5
130	130
180	250
71	46
62.0	52.0
0	0
\$20.50	\$6.50
92	

*Fur color and quality, taken from dried skins, is rated from 100 (best) to 400 (poorest).

Conclusions

This experiment evaluates unselected, mixed fish processed by heat and acid treatment and fed as 30% of the diet. The results were generally poorer than either the controls or group 4A where 30% processed hake was fed. Weight gains were lower, and pelt lengths shorter, significantly so in the case of dark males. Fur color was inferior, especially in the dark males, as compared with those fed 30% processed hake. Fur quality was substantially lower, particularly in the cases of dark males and sapphire females. Again, as in group 4B, wet belly incidence was low. These results suggest that some type of quality control may have to be devised for processed fish products.

Performance of mink fed heat and acid-treated, unselected fish as 30% of their diet was poorer than those fed the control ration or fed 30% of processed hake.

High-Dry Rations

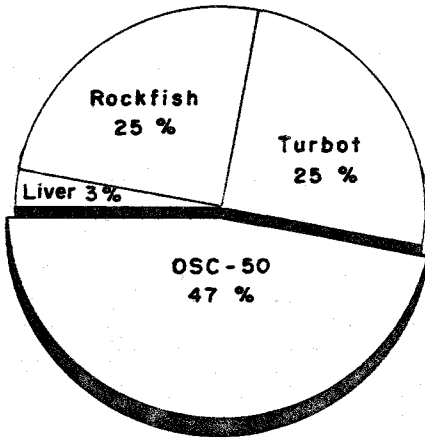
Test Group 5A

Objective

To re-evaluate a ration composed of 47% DRY INGREDIENTS. In 1959 a similar ration produced, at a 32% saving in feed costs, mink with fur color and quality comparable to controls, however smaller in size.

Methods

Ration: Fed July 20 to pelting
Percentage Composition



Proximate Analysis

Dry Matter.....	31.3
Crude Protein*.....	46.8
Crude Fat*.....	9.1
Crude Fiber*.....	3.7
Ash*.....	8.7
Nitrogen-free Extract*.	31.7

*Expressed as a percentage of the dry matter.

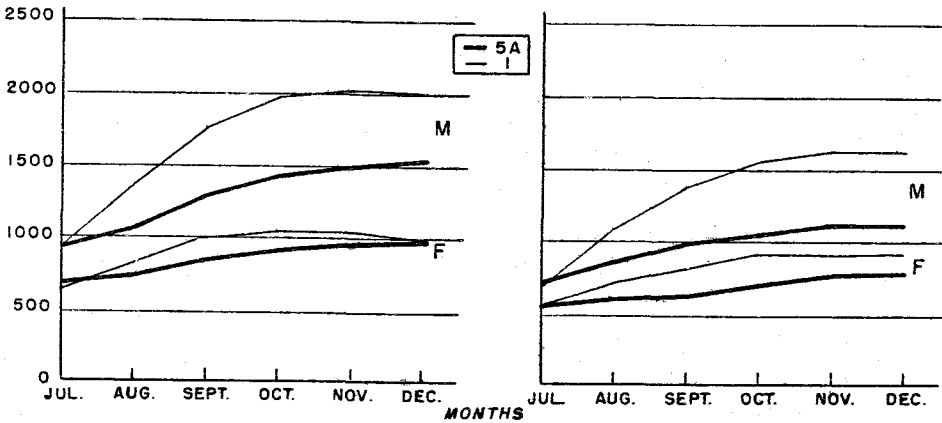
O.S.C. 50 Cereal Mix**

Wheat germ.....	15%
Alfalfa meal.....	5
Skim milk powder.....	5
Soybean oil meal.....	15
Ground oat groats.....	20
Herring meal.....	35
Malt sprouts.....	5

**To each ton of the above mixture 100 lbs. of beet pulp and 14 lbs. of gum guar were added for binding purposes.

Results

GRAMS



STANDARD DARK

SAPPHIRE

Males Females

1559	986	.....Final weight (gm.).....
643	298	.....Weight gain (gm.).....
42.5	37.0	.....Animal length (cm.).....
220	150	.....Fur color*.....
130	110	.....Quality of fur*.....
90	57	.....Weight of dried skin (gm.).....
64.0	54.5	.....Length of dried skin (cm.).....
33	0	.....Wet belly incidence (%).....
\$15.00	\$11.00	.....Estimated pelt value.....
72		.....Ration cost per mink (% of control).....

Males Females

1130	778
430	258
41.0	36.0
130	150
130	150
69	43
57.5	49.0
0	0
\$23.50	\$10.00
72	

*Fur color and quality, taken from dried skins, is rated from 100 (best) to 400 (poorest).

Conclusions

Two items are of special interest in evaluating this ration, composed of 47% dry ingredients. First, feed cost per mink was 28% less than on the control ration. Second, incidence of the troublesome wet belly condition was greatly reduced. Although weight and pelt length was sacrificed generally, and especially in the males, fur color and quality were practically identical to the control group. This area of research needs further work, but the lowered costs involved in this type of feeding are of immediate interest. Results of this experiment confirm similar data obtained last year.

Feeding of a ration formulated around 47% dry ingredients resulted in mink of equal value (notwithstanding their smaller size) at a reduction of 28% in feed cost.

High-Dry Rations

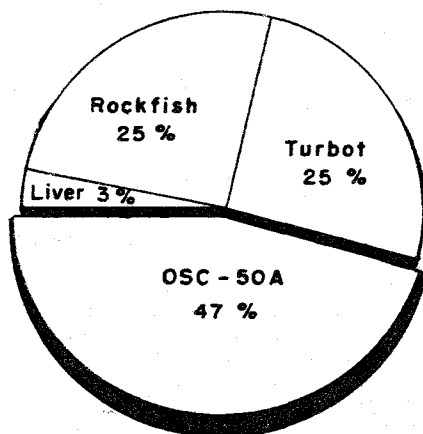
Test Group 5B

Objective

To test the feeding value of a ration containing 47% of DRY INGREDIENTS. This ration is similar to 5A except that herring meal has been replaced by VIOBIN FISH FLOUR.

Methods

Ration: Fed July 20 to pelting
Percentage Composition



Proximate Analysis

Dry Matter.....	33.0
Crude Protein*.....	46.8
Crude Fat*.....	8.9
Crude Fiber*.....	4.0
Ash*.....	9.8
Nitrogen-free Extract*.	30.5

*Expressed as a percentage of the dry matter.

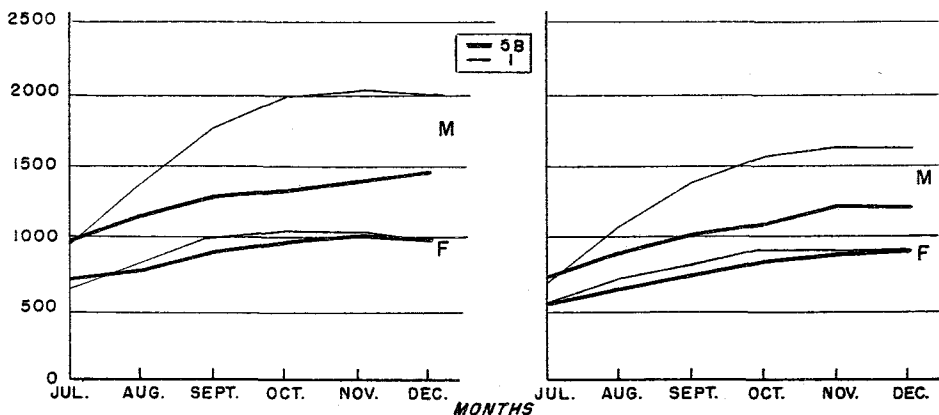
O.S.C. 50A Cereal Mix**

Wheat germ.....	15%
Alfalfa meal.....	5
Skim milk powder.....	5
Soybean oil meal.....	15
Ground oat groats.....	20
Viobin Fish Flour.....	35
Malt sprouts.....	5

**To each ton of the above mixture 100 lbs. of beet pulp and 14 lbs. of gum guar were added for binding purposes.

Results

GRAMS



STANDARD DARK

Males Females

1466	994	.....Final weight (gm.).....
501	291	.....Weight gain (gm.).....
42.5	37.0	.....Animal length (cm.).....
200	160	.....Fur color*.....
160	130	.....Quality of fur*.....
89	56	.....Weight of dried skin (gm.).....
62.0	53.0	.....Length of dried skin (cm.).....
22	0	.....Wet belly incidence (%).....
\$15.00	\$10.00	.....Estimated pelt value.....
72		.....Ration cost per mink (% of control).....

SAPPHIRE

Males Females

1215	918
490	353
41.5	37.0
150	130
130	130
69	50
58.5	53.0
0	0
\$23.00	\$11.00
72	

*Fur color and quality, taken from dried skins, is rated from 100 (best) to 400 (poorest).

Conclusions

Performance of this group may be compared with that of group 5A which was fed a similar diet containing herring meal instead of the Viobin fish flour fed here, or with that of the control group. Fur color and quality were good, equalling the controls. Animal size was below the controls, although somewhat greater than in group 5A. Size reduction was reflected in both weights and pelt lengths, and was most marked in the males. There was a low wet belly incidence on this diet, and ration cost was only 73% of that of the controls.

This ration containing 47% dry ingredients (which include 35% Viobin fish flour) gave pelt values similar to the controls at a lower feed cost. Animal size was reduced below controls.

High-Dry Rations

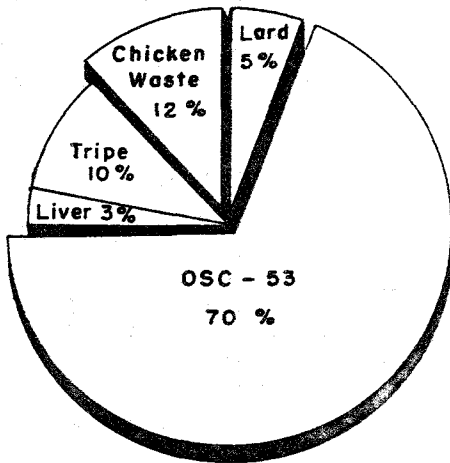
Test Group 5C

Objective

To evaluate further the concept of feeding mink rations high in dry materials. This ration containing 70% of the **INGREDIENTS** in the **DRY FORM** was developed to increase efficiency of mink production by lowering feed costs while maintaining or improving pelt quality.

Methods

Ration: Fed July 20 to pelting
Percentage Composition



Proximate Analysis

Dry Matter.....	36.6
Crude Protein*.....	40.4
Crude Fat*.....	14.8
Crude Fiber*.....	2.5
Ash*.....	10.3
Nitrogen-free Extract*.	32.0

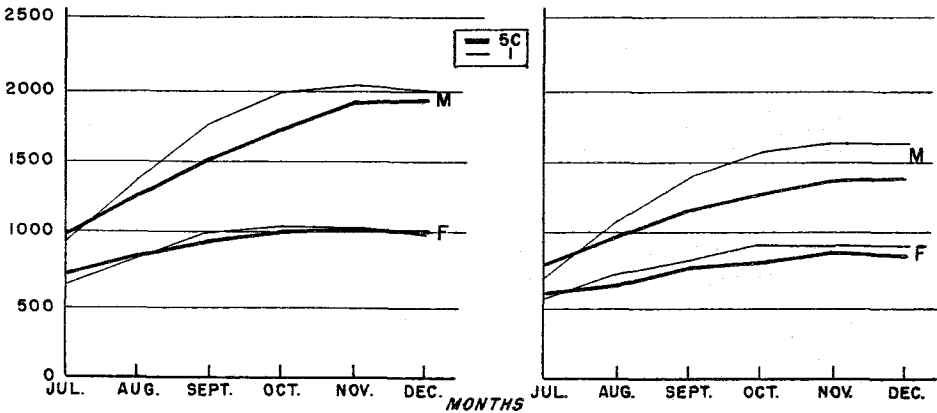
*Expressed as a percentage of the dry matter.

O.S.C. 53 Cereal Mix

Wheat germ.....	5%
Alfalfa meal.....	2
Skim milk powder.....	5
Soybean oil meal.....	10
Ground oat groats.....	20
Herring meal.....	40
Meat meal.....	15
Brewer's yeast.....	1
Beet pulp.....	2
Guar gum.....	0.7
Fortafeed 2-4-9-c.....	0.09
Terramycin (TM-10).....	0.05
Methionine.....	0.01

Results

GRAMS



STANDARD DARK

Males Females

1949	1020	.....Final weight (gm.).....
931	301	.....Weight gain (gm.).....
44.0	37.0	.....Animal length (cm.).....
230	200	.....Fur color*.....
130	130	.....Quality of fur*.....
102	60	.....Weight of dried skin (gm.).....
68.5	55.0	.....Length of dried skin (cm.).....
88	0	.....Wet belly incidence (%).....
\$14.00	\$9.50	.....Estimated pelt value.....
69		.....Ration cost per mink (% of control).....

SAPPHIRE

Males Females

1493	856
710	292
42.5	36.5
170	120
100	180
77	47
61.0	51.0
0	0
\$23.50	\$9.50
69	

*Fur color and quality, taken from dried skins, is rated from 100 (best) to 400 (poorest).

Conclusions

The ration fed this group was designed to extend further the use of dry ingredients to 70% of the diet. A different combination of dry ingredients was used from that listed for group 5A. This formula apparently overcame much of the growth deficiency noted for 5A, since animal size in this group nearly equalled the controls. Fur quality was similar to the controls, however color was slightly, although not significantly, lower. This ration showed the lowest feed costs of any tested this year.

This specially-formulated diet, containing 70% dry ingredients, produced mink of essentially equal quality and size to the control ration, at 68% of the feed cost.

Reduced Protein

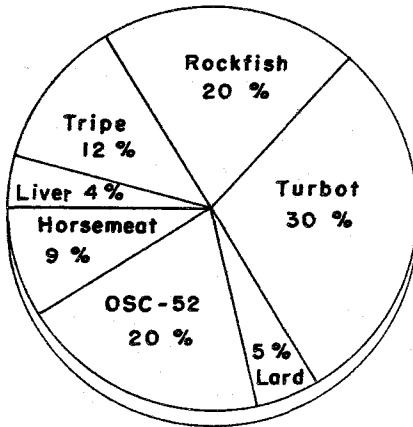
Test Group 6A

Objective

To assess the effects on mink growth and fur production of altering ration composition after the attainment of body growth by LOWERING PROTEIN and INCREASING FAT and CARBOHYDRATE content of the ration.

Methods

Ration:¹ Fed September 28 to pelting
Percentage Composition



Proximate Analysis

Dry Matter.....	32.5
Crude Protein*.....	38.0
Crude Fat*.....	21.4
Crude Fiber*.....	2.6
Ash*.....	7.3
Nitrogen-free Extract*.	30.7

*Expressed as a percentage of the dry matter.

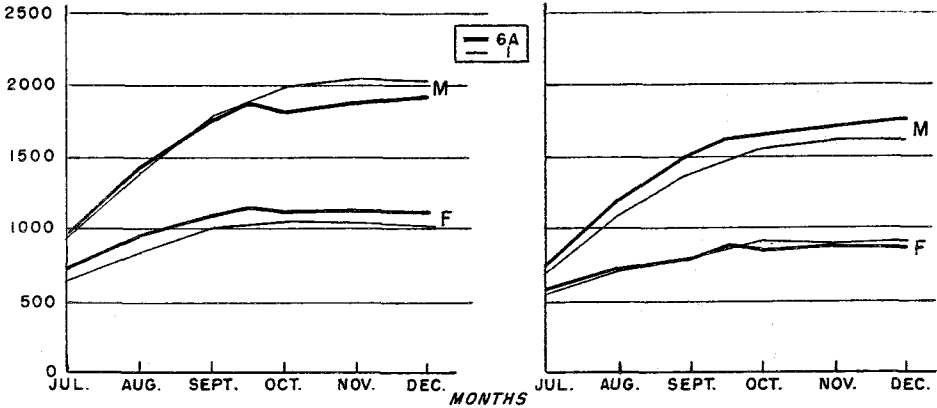
O.S.C. 52 Cereal Mix

Ground oat groats	65.0%
Alfalfa meal	10.0
Wheat germ meal	10.0
Soybean oil meal	10.0
Brewer's yeast	4.3
Fortafeed 2-4-9-c	0.4
Terramycin (TM-10)	0.25
Methionine	0.05

¹The control ration (as shown on Page 6) was fed throughout the growth period. From September 28 to pelting the above ration was fed.

Results

GRAMS



STANDARD DARK

SAPPHIRE

Males Females

1924	1123	.....Final weight (gm.).....	1770	870
940	403	.....Weight gain (gm.).....	1028	300
44.5	38.0	.....Animal length (cm.).....	44.5	37.5
170	180	.....Fur color*.....	180	180
100	130	.....Quality of fur*.....	150	150
111	62	.....Weight of dried skin (gm.).....	90	51
69.0	56.5	.....Length of dried skin (cm.).....	67.0	53.0
57	0	.....Wet belly incidence (%).....	25	0
\$18.00	\$10.00	.....Estimated pelt value.....	\$20.50	\$9.50
85		.....Ration cost per mink (% of control).....	85	

Males Females

*Fur color and quality, taken from dried skins, is rated from 100 (best) to 400 (poorest).

Conclusions

Replacing dietary protein with fat and carbohydrate after major growth has been attained can apparently be done without affecting the size of mink at pelting adversely. In this experiment, final weights were not significantly different from the controls, but dark males tended to be smaller; dark females and sapphire males larger. The diet change was made rather abruptly, and this may be the reason for the dip in growth curves noticeable on the graphs. Fur color and quality were both improved in dark males, however quality was somewhat reduced in sapphires and color was noticeably darker in the sapphire females. Wet belly incidence was not increased by the addition of fat.

Protein reduction by fat and carbohydrate addition as shown in this experiment supported approximately equal mink performance to the control ration at 15% less feed cost.

Reduced Protein

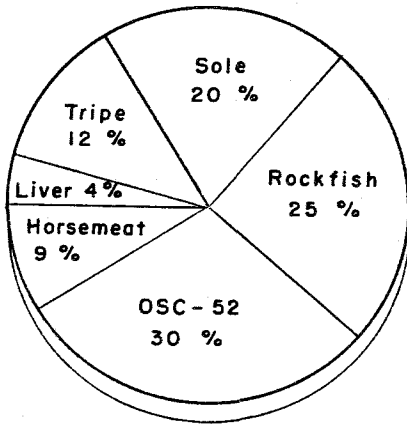
Test Group 6B

Objective

To assess the effects on mink growth and fur production of altering ration composition after the attainment of body growth by LOWERING PROTEIN and INCREASING CARBOHYDRATE content of the ration.

Methods

Ration:¹ Fed September 28 to pelting
Percentage Composition



Proximate Analysis

Dry Matter.....	32.4
Crude Protein*.....	38.5
Crude Fat*.....	10.1
Crude Fiber*.....	3.5
Ash*.....	6.3
Nitrogen-free Extract*.	41.6

*Expressed as a percentage of the dry matter.

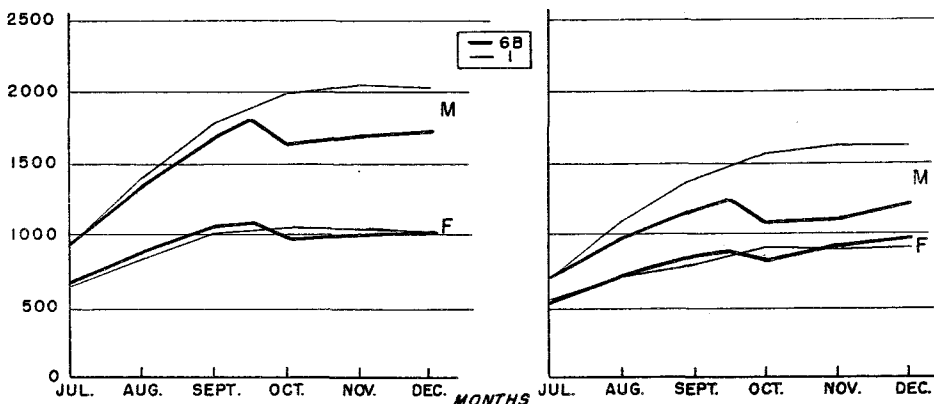
O.S.C. 52 Cereal Mix

Ground oat groats	65.0%
Alfalfa meal	10.0
Wheat germ meal	10.0
Soybean oil meal	10.0
Brewer's yeast	4.3
Fortafeed 2-4-9-c	0.4
Terramycin (TM-10)	0.25
Methionine	0.05

¹The control ration (as shown on Page 6) was fed throughout the growth period. From September 28 to pelting the above ration was fed.

Results

GRAMS



STANDARD DARK

Males Females

1701	1005	.....Final weight (gm.).....
744	319	..... Weight gain (gm.).....
44.0	37.5	.....Animal length (cm.).....
230	190	.....Fur color*.....
120	130	.....Quality of fur*.....
104	57	.....Weight of dried skin (gm.).....
68.0	54.0	.....Length of dried skin (cm.).....
67	0	.....Wet belly incidence (%).....
\$15.00	\$9.50	.....Estimated pelt value.....
93		.....Ration cost per mink (% of control).....

SAPPHIRE

Males Females

1230	995
530	463
41.5	37.0
200	130
100	100
79	53
59.0	54.5
0	0
\$23.00	\$11.50
93	

*Fur color and quality, taken from dried skins, is rated from 100 (best) to 400 (poorest).

Conclusions

Comparison of this group's performance with that of the previous one shows replacement of protein with carbohydrate to be less satisfactory than its replacement with fat plus carbohydrate. The growth charts show a sharp decline following the change in diet, part of which may be attributed to abruptness of the change. The growth decline was more severe, and recovery was less complete in this group than in the previous one. Males were most severely affected. Color was generally poorer, but fur quality was about equal to the controls. Although fat content of this diet was lower than in 6A, wet belly incidence was not reduced.

Replacement of dietary protein with carbohydrate, after major growth has been attained, was apparently less satisfactory than its replacement with fat plus carbohydrate.