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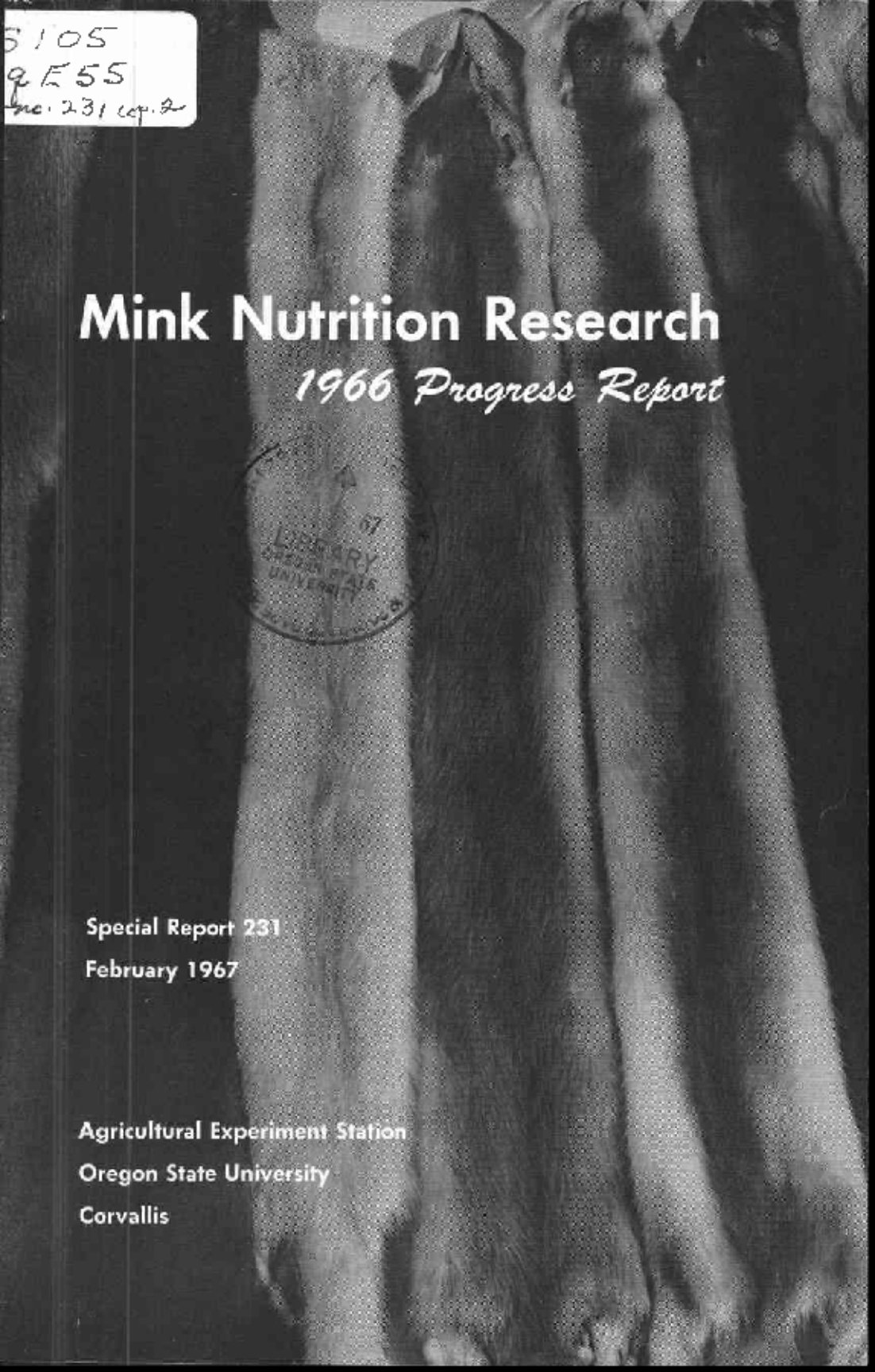

Mink Nutrition Research

1966 Progress Report

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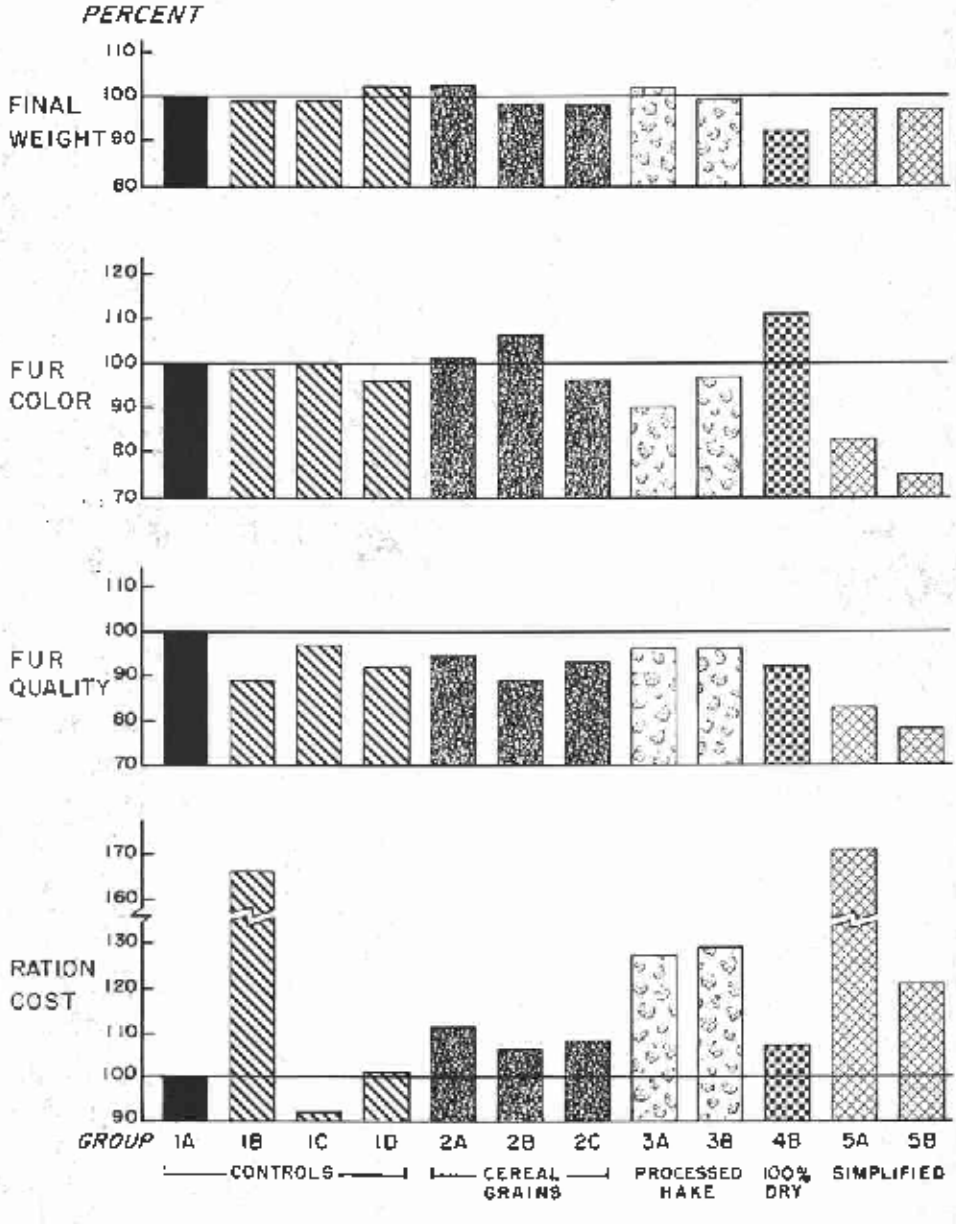
Special Report 231
February 1967

Agricultural Experiment Station
Oregon State University
Corvallis

COMPARATIVE GROUP PERFORMANCE

(% of control)



Test Results at a Glance

Group

1A A practical-type control diet for comparison of other groups, based on fish and high cereal grains, economically produced fairly large mink of good fur quality.

1B Original standard reference diet produced mink equivalent to the controls in all respects except fur quality, but feed costs were 66% higher.

1C Feeding a modified control ration based on equal parts of poultry offal, fish carcass, and high cereal grains resulted in mink generally equivalent to controls at a feed savings of 8%.

1D Supplementation of the control ration with neomycin and terramycin resulted in mink equivalent to controls in growth and fur characteristics.

2A A diet containing 30% oat groats produced large mink with good fur color but lower quality than controls at slightly increased ration cost.

2B Substitution of cooked wheat at 25% in the control diet produced slightly smaller animals with good fur color but reduced quality. Higher ration costs were due to poorer feed utilization.

2C Inclusion of 25% cooked corn for oat groats and wheat bran of the control reduced growth rate, fur color, and quality. Higher ration cost reflects greater feed consumption.

3A Cooked Pacific hake, substituted at 30% for other fish species, raised large mink with lower fur color and quality than controls at increased ration cost.

3B A similar hake product with phosphoric acid added to pH 4.5 resulted in mink equal in size but slightly lower in fur color and quality than controls.

4B A completely dry ration based on hake meal produced small animals with improved fur color, but lower in quality at higher cost because of excessive feed wastage.

5A Mink fed this simplified ration based on cooked hake were slightly smaller and had poor fur color and matted pelts because of the liquid nature of the feed.

5B A simplified diet based on turkey offal produced mink with poor growth, showing turkey-waste greying and matted furs. The product used was extremely variable and not representative of turkey offal generally.

6 Mink fed the control diet with lighting adjusted to shorten day length showed retarded fur priming, better color, less wet belly, and large size as compared to mink raised conventionally.

Mink Nutrition Research

1966 Progress Report

JOHN ADAIR, F. M. STOUT, and J. E. OLDFIELD[1]

Objectives

This publication reports on several series of nutritional experiments conducted during 1966 at the Experimental Fur Farm of the Oregon Agricultural Experiment Station. The first series (test groups numbered 1A-D) deals with various modifications of the control diet (1A) against which performance on other diets is compared. Such work is necessary to insure that the control ration is constantly improved both nutritionally and economically. Test groups 2A-C illustrate performance obtained when high levels of various cereal grains were substituted in the control ration. Groups 3A and B extend previous investigations on Pacific hake processed by cooking and acid treatment. Group 4B was fed a ration composed completely of dry materials, while the two groups, 5A and B, illustrate attempts to reduce the number of ingredients in the diet without lowering nutritive value. Group 6 represents a different type of experiment in which the control diet was fed but in which the hours of daylight to which the animals were exposed were controlled.

Procedures

Mink were randomly allotted to test groups after first balancing for sex, weaning weight, and litter size, so that any inherent differences in the animals were minimized as far as possible. Mink were weaned and accustomed to individual cages for two weeks prior to starting the various test rations on July 20, 1966. Weights were taken on all animals at the start of the test and at four-week intervals thereafter, terminating at pelting. All weights are given in grams. Conversions may be made on the basis of 454 grams=1 pound.

Pelt valuation

Since the pelt is the prime product of the mink, extensive pelt data have been assembled. Length and weight have been recorded for dried skins. Numerical expressions for color and quality have been calculated from grades assigned by an experienced commercial grader. Pelt values were estimated by the grader with respect to color and quality and adjusted for changes in pelt length and wet-belly incidence. Male pelts were increased $1.00 per inch for lengths over 26 inches and decreased similarly for shorter lengths, while female

[1]AUTHORS: John Adair is Superintendent, Experimental Fur Farm; F. M. Stout is Assistant Professor; and J. E. Oldfield is Professor; Department of Animal Science, Oregon State University. The assistance of Ivan Scott and Clifford Thomson, Department of Animal Science, in conducting the experiments is gratefully acknowledged.

pelts were increased or decreased $.50 an inch above or below 21 inches, respectively. Estimated pelt values were reduced 20, 30, or 40% according to increasing severity of wet belly.

Interpretation

Data for each test group of mink are assembled in a two-page format. Objectives and methods are described on the left-hand page, and the results and discussion on the right-hand page. Ration composition is given "as fed" and on a "dry basis." The former shows the amounts of each ingredient the mink rancher will assemble to make a comparable diet; the latter is a valuable indication of the actual nutrient contribution of each ingredient. "Proximate analysis" tables, listing certain chemical data for each diet, were derived from calculations based on analytical data given for the individual diet ingredients in the appendix table on the back cover. Ration costs listed in the production data tables indicate the cost of ingredients only and are compared with the control diet. For example, rations showing a cost per mink of greater than 100% were more expensive to feed than the control group, and those showing a figure less than 100% were less expensive.

Fur farm production

It is not possible to make direct comparisons between production on the Experimental Fur Farm and commercial ranches because mink saved for breeders possibly have been exposed to an experimental diet which has adversely affected their reproductive capability. In addition, reproductive capacity has been sacrificed in specific strains propagated by inbreeding in order to study particular abnormalities. During 1966, as in past years, all mink on the Experimental Fur Farm have been devoted to some experimental purpose. All mink kits were counted as of May 23, 1966; and the total number at that time was 696. These included 488 normal standard darks and 47 darks from a special "fur-chewer" group; 62 pastels and 99 sapphires. In addition, 40 mink were born to a cotton fur-susceptible group kept for intensive study of the physiology of this problem.

Ranch average production figured on the basis of all females (except cottons) retained on the ranch as breeders was 3.46 overall, including 3.64 for normal standard darks, 3.92 for the fur-chewer group, 3.20 for the pastels, and 2.83 for sapphires. Litter averages figured on the basis of those females producing kits (excluding those with no kits at the time of counting) were as follows: 4.61 total, including 4.69 for normal standard darks, 5.22 for fur-chewers, 3.88 for pastels, and 4.50 for sapphires. A total of 134 breeder female kits were kept over for use in 1967, including 79 standard darks, 24 pastels, and 31 sapphires. Data for these mink were taken from the live animals and assembled with the data of pelted mink in the appropriate test groups. The total number of females retained for breeding in 1967 was 254. As in 1966, ten standard dark male kits were purchased as a continuation of a planned program to improve fur characteristics by introducing outside blood lines and to reduce wet belly.

Diet Studies

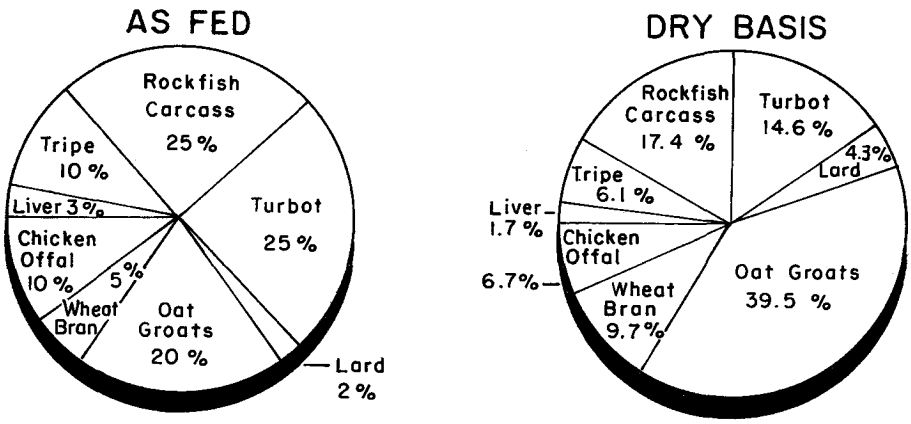
CONTROL RATION

Test Group 1A

Objective: To provide a practical control ration of readily available feed ingredients against which performance on other experimental groups can be compared. This is a new formula featuring high levels of cereal grains and reduced quantities of fish.

Methods: Twenty-four standard dark mink kits (12 males and 12 females) were fed the ration shown from August 9 to pelting on November 29 and 30. Initially, from July 20 to August 8, oat groats comprised 25% of the ration, as fed, and wheat bran was absent.

RATION COMPOSITION



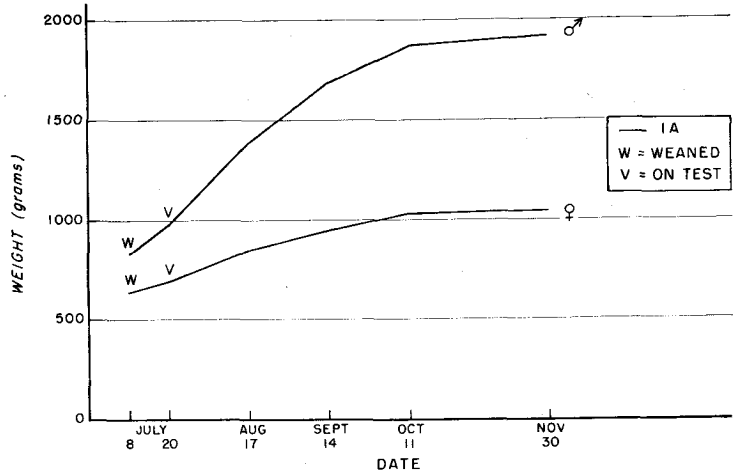
Note: Vitamin E (d-alpha tocopheryl acetate) comprised .01% of the ration, as fed.

PROXIMATE ANALYSIS

	As fed	Dry basis
	%	%
Dry matter	36.1	100.0
Crude protein	12.0	33.1
Crude fat	8.0	22.1
Crude fiber	0.8	2.3
Ash	2.7	7.5
Nitrogen-free extract	12.6	35.0

Results:

GROWTH CURVES



PRODUCTION DATA

	Males	Females
Final weight (gm.)	1,925	1,043
Weight gain (gm.)	946	348
Animal length (cm.)	44.8	36.8
Fur color*	233	167
Fur quality*	167	200
Weight of dried skin (gm.)	115	59
Length of dried skin (cm.)	70.8	56.4
Wet-belly incidence (%)	67	.....
Estimated pelt values ($)	17.90	12.88
Ration cost per mink (% of control)	100	

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

Discussion:

The control ration, as fed test group 1A, is the diet treatment against which others are compared. It is important that the control ration be good since comparing treatments against an inferior control gives an inflated idea of their value. Several changes, designed as improvements, have been made in the control diet this year: sole has been eliminated, due to difficulties in obtaining it, and the cereal level has been increased from 9 to 25%, in the interests of economy. Ration economy was also improved by using carcass in place of whole rockfish. Lard at 2% was added to bring protein and fat to a ratio of 1.5:1. Since loose droppings were observed initially when the cereal was composed entirely of oat groats, it was changed to 20% oat groats and 5% wheat bran, which eliminated the problem. This change was also made in the cereal components of diets fed groups 1D, 3A, 3B, and 6. Overall performance shows that this is a satisfactory control ration. Growth was below that of mink on the previous year's control diet, but this is primarily attributed to one very small male. Fur color and quality ratings are equal to or better than those of other test groups, and ration cost was lower than all except 1C. The high wet-belly incidence is typical of our standard dark strain.

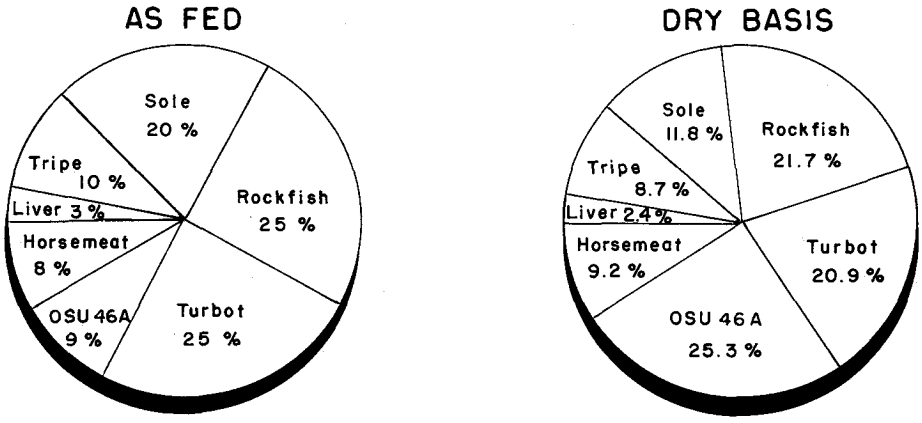
ORIGINAL STANDARD CONTROL

Test Group 1B

Objective: To provide a standard reference ration (unchanged in formulation for the past eight years) which serves as a basis by which to check improvement in the control ration and also to evaluate changes in genetic composition of the experimental mink herd.

Methods: Twenty-four standard dark mink kits (12 males and 12 females) were fed this ration from July 20 to pelting on November 29.

RATION COMPOSITION



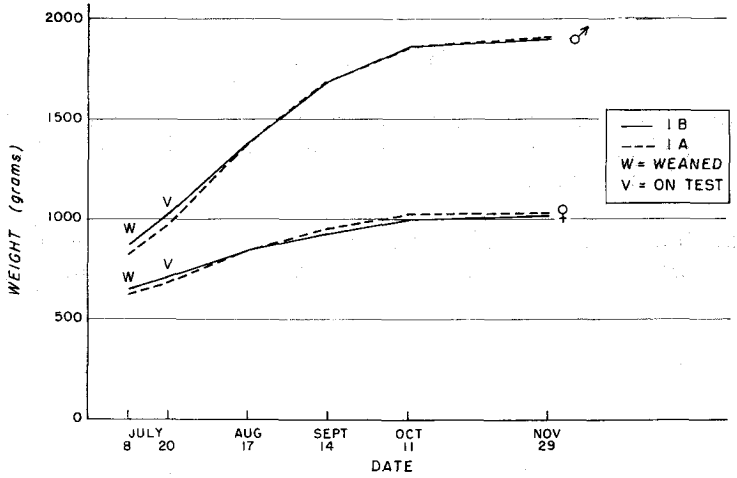
PROXIMATE ANALYSIS

	As fed	Dry basis
	%	%
Dry matter	26.6	100.0
Crude protein	14.1	52.9
Crude fat	5.9	22.0
Crude fiber	0.4	1.6
Ash	2.7	10.2
Nitrogen-free extract	3.5	13.3

Composition of cereal mix OSU 46A, parts as fed: wheat germ, 25; alfalfa meal, 12.5; skim milk powder, 8.3; meat meal, 16.6; soybean oil meal, 16.6; cooked, ground oat groats, 16.6; brewers' yeast, 4.2; 2-4-9-10, 0.4; Terramycin (TM-10), 0.25; and dl-methionine, 0.05.

Results:

GROWTH CURVES



PRODUCTION DATA

	Males	Females
Final weight (gm.)	1,909	1,028
Weight gain (gm.)	883	323
Animal length (cm.)	44.7	36.7
Fur color*	225	182
Fur quality*	217	218
Weight of dried skin (gm.)	110	58
Length of dried skin (cm.)	71.5	56.2
Wet-belly incidence (%)	42	-----
Estimated pelt value ($)	18.33	12.50
Ration cost per mink (% of control)	166	

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

Discussion:

In contrast to the control group, fed an improved ration, group 1B was fed a ration unchanged in composition for eight years. This ration serves to measure improvement in the control ration and provides a constant standard against which year-to-year changes in animal performance can be evaluated. Nutritionally, diet 1B has been satisfactory; however, the high costs of some of its ingredients make it uneconomical, as evidenced by the 66% higher cost than the control. Some of the changes that have taken place by which the improved control ration (1A) has evolved to considerably lower the price of this standard ration follow. Horsemeat, currently 20¢ per pound has been replaced by poultry offal at 4½¢; whole rockfish at 4.2¢ has been replaced by carcass at 3.4¢; and a simplified cereal has replaced the more expensive complex cereal mixture. Animal growth was similar in groups 1A and 1B, and fur color was almost identical; but fur quality was lower in 1B. Performance of mink on this ration as compared to those fed a similar ration last year indicates decreased final weights, equal fur color, and lower quality scores. An explanation for this may be the increased variability in animals due to genetic segregation resulting from crossing with new bloodlines.

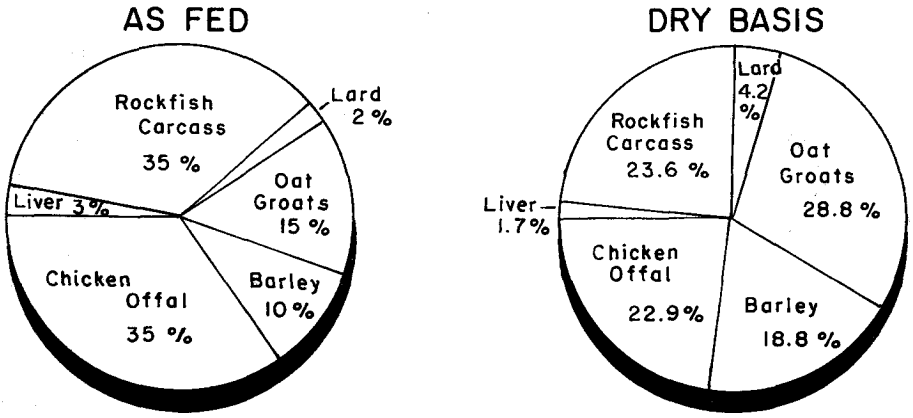
MODIFIED CONTROL

Test Group 1C

Objective: To evaluate, as a potential control, a ration based on chicken offal and rockfish carcass in combination with a high level of a mixture of cereal grains.

Methods: Twenty-four standard dark mink kits (12 males and 12 females) were fed this ration from July 20 to pelting on November 29.

RATION COMPOSITION



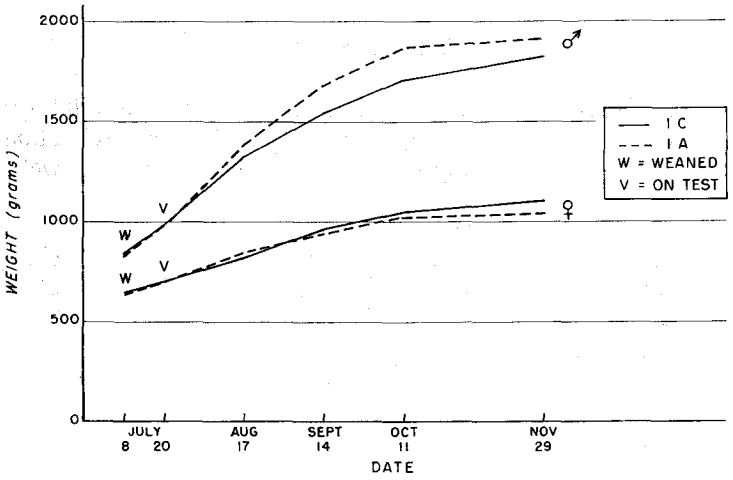
Note: Vitamin E (d-alpha tocopheryl acetate) comprised .01% of the ration, as fed.

PROXIMATE ANALYSIS

	As fed	Dry basis
	%	%
Dry matter	39.4	100.0
Crude protein	12.0	30.3
Crude fat	8.3	21.1
Crude fiber	2.2	5.6
Ash	3.5	9.0
Nitrogen-free extract	13.4	34.0

Results:

GROWTH CURVES



PRODUCTION DATA

	Males	Females
Final weight (gm.)	1,828	1,111
Weight gain (gm.)	843	404
Animal length (cm.)	43.8	36.8
Fur color*	183	217
Fur quality*	183	200
Weight of dried skin (gm.)	105	61
Length of dried skin (cm.)	67.9	58.8
Wet-belly incidence (%)	70	.....
Estimated pelt value ($)	19.80	12.17
Ration cost per mink (% of control)	92	

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

Discussion:

The diet fed test group 1C was formulated as a modified control ration from economical, readily available ingredients. Thus, use of fish carcass and chicken offal, coupled with a high level of a simple cereal (oat groats and barley) provided an economical mix from feeds readily available to northwest ranchers. It will be noted that this ration was 3% lower in crude protein, 3.3% higher in crude fiber, and 1.5% higher in ash than that fed group 1A. Ration economy was improved both by lowered cost of ingredients and by decreased feed consumption to the extent that mink on 1C were produced for 8% less than mink on the control diet. Males were somewhat smaller, but females equalled the controls in size, as indicated both by weights and pelt lengths. There were no great differences from the controls in fur quality; however, color tended to be better in males, poorer in females. Wet-belly incidence on diet 1C was similar to that on 1A. Estimated pelt prices were $1.90 higher for males and $.70 lower for females than pelt prices for the control mink, in line with color differences observed for these two groups.

ANTIBIOTIC SUPPLEMENT

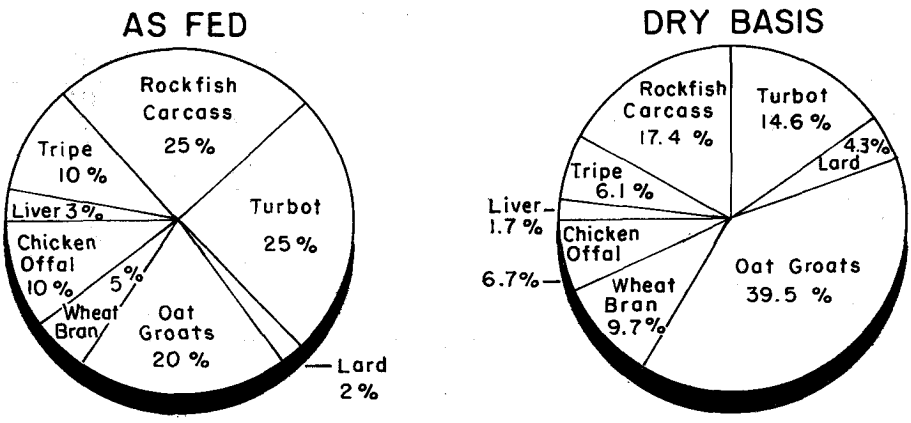
Test Group 1D

Objective: To determine whether or not advantages result in mink growth and fur production from supplementation of the control ration with 50 grams each of Neomycin[1] and Terramycin[1] per ton of wet feed.

Methods: Twenty-four standard dark mink kits (12 males and 12 females) were fed the ration shown below from August 9 to pelting on November 29. Initially, from July 20 to August 8, oat groats comprised 25% of the ration, as fed, and wheat bran was absent.

[1] Supplied as "Neo-Terramycin" by the Chas. Pfizer Co., Terre Haute, Indiana.

RATION COMPOSITION



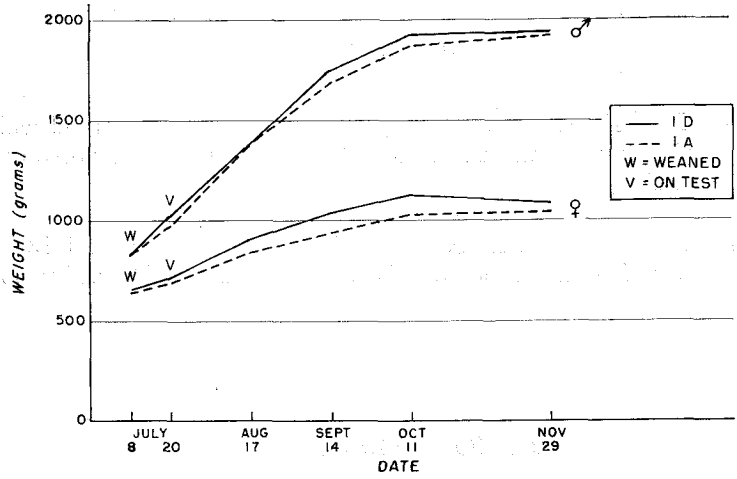
Note: Vitamin E (d-alpha tocopheryl acetate) comprised .01% and "Neo-Terramycin," including carrier, comprised .125% of the ration, as fed.

PROXIMATE ANALYSIS

	As fed	Dry basis
	%	%
Dry matter	36.9	100.0
Crude protein	12.2	33.1
Crude fat	8.2	22.1
Crude fiber	0.8	2.3
Ash	2.8	7.5
Nitrogen-free extract	12.9	35.0

Results:

GROWTH CURVES



PRODUCTION DATA

	Males	Females
Final weight (gm.)	1,940	1,086
Weight gain (gm.)	921	399
Animal length (cm.)	44.5	36.6
Fur color*	233	192
Fur quality*	200	217
Weight of dried skin (gm.)	109	61
Length of dried skin (cm.)	70.9	59.1
Wet-belly incidence (%)	50	-----
Estimated pelt value ($)	17.52	12.54
Ration cost per mink (% of control)	101	

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

Discussion:

For several years, the control ration has been simplified by removing all fortification and medication items. Such simplified feed provides a useful basis for evaluating the effectiveness of various additives. Test group 1D is an evaluation of the addition of the antibiotics, terramycin and neomycin. These two antibiotics have a complementary action: terramycin is freely absorbed from the digestive system and thus is active systemically, while neomycin is not absorbed and is active in the intestinal tract against organisms causing enteritis and diarrhea. Growth curves showed improvement by both males and females over the controls, although differences were narrowed at the final weighing. Pelt lengths were similar to controls for males but about an inch longer for females. Fur color was identical in males, but lower in females than controls, while fur quality was slightly lower for both sexes. Wet-belly incidence appeared slightly reduced. Both ration costs and estimated pelt values were equivalent to control figures. This limited experiment shows no great advantage for antibiotic supplementation; however, it must be emphasized that no evidence of bacterial enteritis occurred in controls.

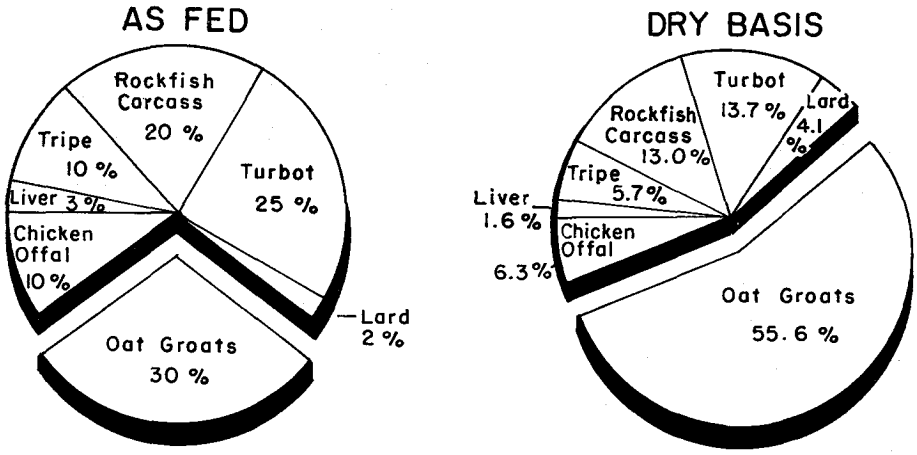
OAT GROATS

Test Group 2A

Objective: To evaluate finely ground, cooked oat groats at a level which provides more than half of the nutrients in a ration for growing-furring mink.

Methods: Twenty-four standard dark mink kits (12 males and 12 females) were fed this ration from July 20 to pelting on November 30.

RATION COMPOSITION



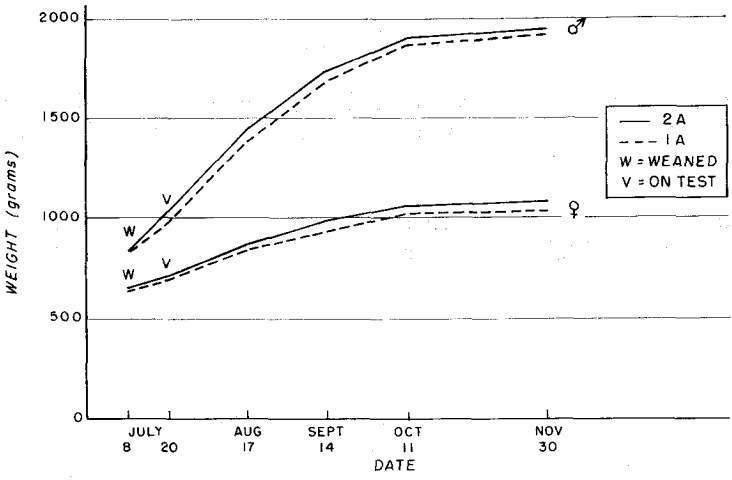
Note: Vitamin E (d-alpha tocopheryl acetate) comprised .01% of the ration, as fed.

PROXIMATE ANALYSIS

	As fed	Dry basis
	%	%
Dry matter	39.8	100.0
Crude protein	12.4	31.1
Crude fat	8.3	20.8
Crude fiber	0.7	1.8
Ash	2.5	6.2
Nitrogen-free extract	15.9	40.1

Results:

GROWTH CURVES



PRODUCTION DATA

	Males	Females
Final weight (gm.)	1,953	1,087
Weight gain (gm.)	922	377
Animal length (cm.)	45.1	36.6
Fur color*	200	192
Fur quality*	200	196
Weight of dried skin (gm.)	114	60
Length of dried skin (cm.)	71.7	57.5
Wet-belly incidence (%)	58	.....
Estimated pelt value ($)	19.37	12.83
Ration cost per mink (% of control)	111	

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

Discussion:

Test group 2A was the first of a trio devoted to continuing study of high levels of cereal grains in mink rations. Ration 2A actually contained 30% oat groats (the additional 5% oat groats replaced 5% of rock carcass), and this cereal supplied 56% of the total ration nutrients. Incidentally, this was the highest level of oat groats fed at this Station. This ration was slightly lower in protein than 1A and was very low in fiber, due to the high percentage of oat groats. Animals' droppings were loose on this diet; however, since production was good it appears that this looseness was physiological rather than pathological and reflected the low dietary fiber. Rations containing high levels of oat groats have consistently supported good growth in the past, and although this year's growth was not outstanding it exceeded that of the controls. Fur color in the males was very slightly improved over the controls, but fur quality was generally lower than in test group 1A. Estimated pelt values were similar to the controls for females and slightly higher for males largely due to lower wet-belly incidence. Ration cost was 11% higher than for controls because of increased ingredient costs and increased feed consumption.

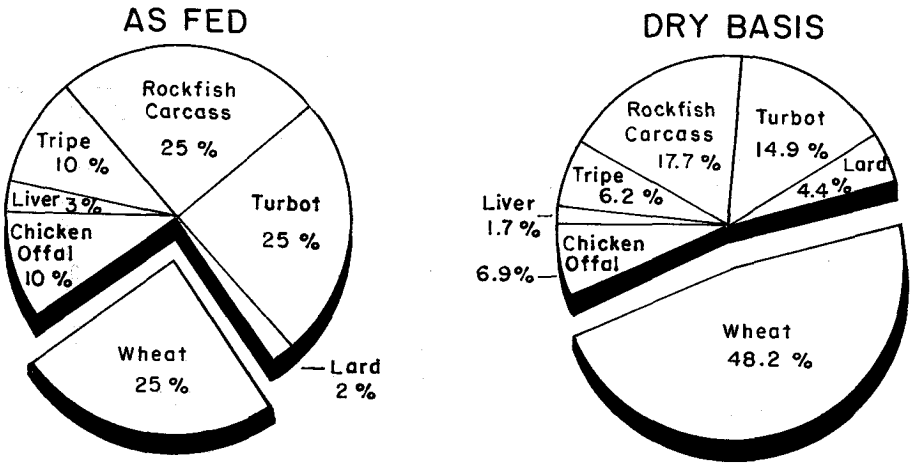
WHEAT

Test Group 2B

Objective: To determine the value of finely ground, cooked wheat as a major constituent in the ration of the mink during periods of late growth and furring.

Methods: Twenty-four standard dark mink kits (12 males and 12 females) were fed this ration from July 20 to pelting on November 30.

RATION COMPOSITION



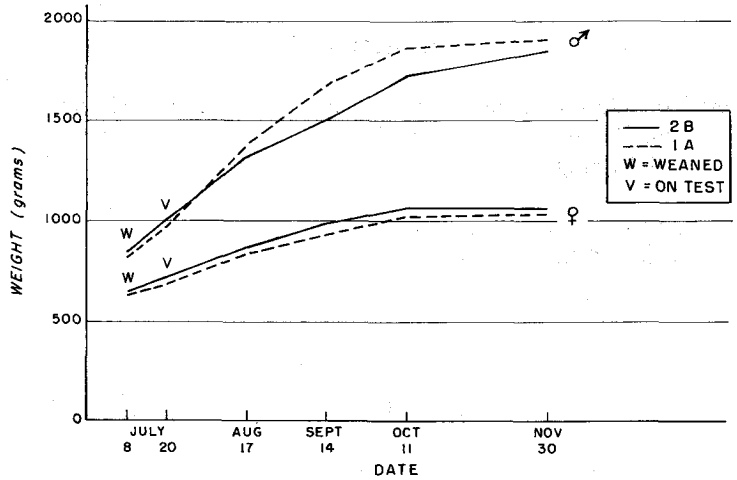
Note: Vitamin E (d-alpha tocopheryl acetate) comprised .01% of the ration, as fed.

PROXIMATE ANALYSIS

	As fed	Dry basis
	%	%
Dry matter	39.0	100.0
Crude protein	11.3	28.9
Crude fat	7.9	20.3
Crude fiber	0.6	1.5
Ash	2.7	6.8
Nitrogen-free extract	16.5	42.5

Results:

GROWTH CURVES



PRODUCTION DATA

	Males	Females
Final weight (gm.)	1,851	1,062
Weight gain (gm.)	816	342
Animal length (cm.)	44.1	36.4
Fur color*	200	167
Fur quality*	200	233
Weight of dried skin (gm.)	109	55
Length of dried skin (cm.)	70.1	55.3
Wet-belly incidence (%)	30	.....
Estimated pelt value ($)	20.76	12.58
Ration cost per mink (% of control)	106	

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

Discussion:

The cereal portion of ration 2B consisted of finely ground, dry-cooked wheat, as contrasted with the oat groats-wheat bran combination in the control diet. This substitution resulted in a 4% lower protein content, but the total protein level of 29% was still considered adequate for late growth and furring of mink. Previous trials with raw wheat as the dietary cereal resulted in extremely loose droppings. Cooking of this year's wheat, adopted in an effort to eliminate this problem, was ineffective and the animals again exhibited diarrhea. The low fiber level of wheat may contribute to this condition; however, the looseness produced by wheat has consistently been more severe than that produced by oat groats. Growth of males on ration 2B was poorer than that on the control diet, 1A, or the high oat groats diet, 2A; females, however, grew satisfactorily. Fur color was better in males and equal in females to the controls, but fur quality ratings were lower in both sexes and in fact were lowest among the grain-supplemented series. Wet-belly incidence and severity were both lowered, and this resulted in improved pelt price estimates. Ration ingredient costs were low, but this was still a more expensive diet to feed due to low conversion efficiency.

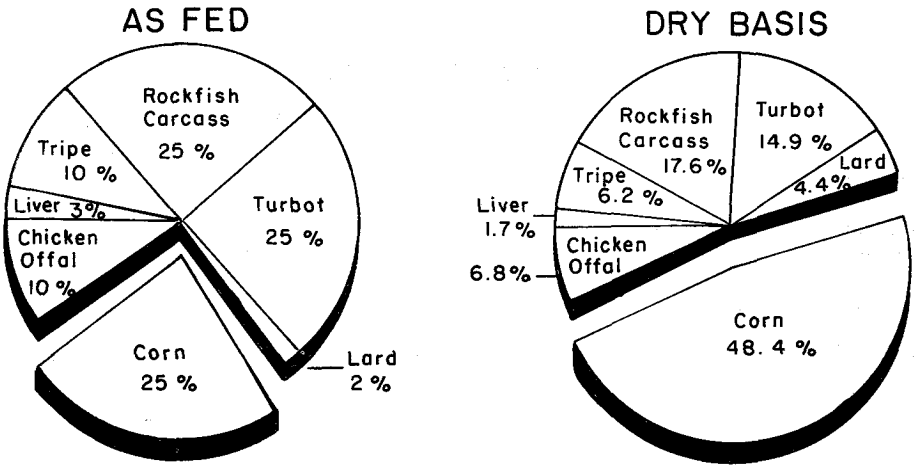
CORN

Test Group 2C

Objective: To determine the value of finely ground, cooked corn as a major constituent in the ration of the mink during periods of late growth and furring.

Methods: Twenty-four standard dark mink kits (12 males and 12 females) were fed this ration from July 20 to pelting on November 30.

RATION COMPOSITION



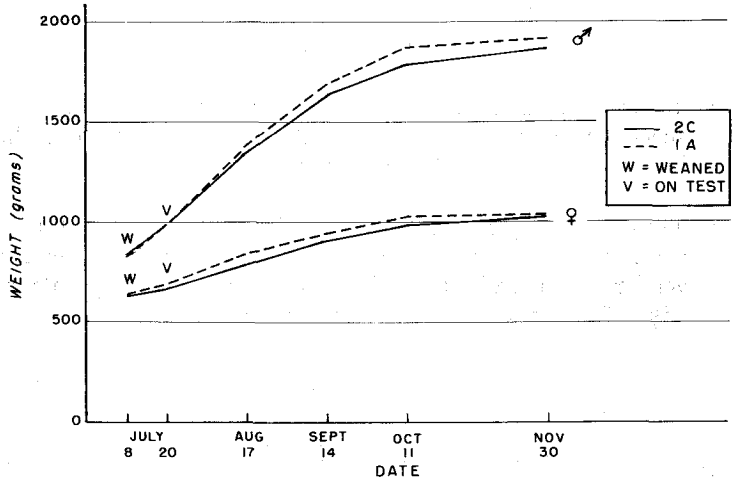
Note: Vitamin E (d-alpha tocopheryl acetate) comprised .01% of the ration, as fed.

PROXIMATE ANALYSIS

	As fed	Dry basis
	%	%
Dry matter	39.2	100.0
Crude protein	11.6	29.5
Crude fat	8.5	21.6
Crude fiber	0.5	1.2
Ash	2.6	6.7
Nitrogen-free extract	16.0	41.0

Results:

GROWTH CURVES



PRODUCTION DATA

	Males	Females
Final weight (gm.)	1,870	1,026
Weight gain (gm.)	879	376
Animal length (cm.)	44.3	36.8
Fur color*	208	217
Fur quality*	200	208
Weight of dried skin (gm.)	107	56
Length of dried skin (cm.)	70.1	57.1
Wet-belly incidence (%)	36	-----
Estimated pelt value ($)	20.60	11.92
Ration cost per mink (% of control)	108	

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

Discussion:

The diet fed this group of animals contained 25% finely ground, dry-cooked corn in place of the oat groats and wheat bran of the control diet. About half of the dietary nutrients came from the cereal. Both protein content (29.5%) and fiber content (1.2%) were lower than in the control diet. Droppings of mink on this diet were extremely loose, similar to those on the high-wheat diet (2B), and since both of these cereals were cooked, the factor responsible for the diarrhea cannot be heat-sensitive. Growth on this corn diet was slightly improved over the wheat diet but was somewhat less than that on the oat groats diet. Fur color, especially in females, was poorer than in the controls or in the other high grain-fed groups. Fur quality was poorer than on the control diet, but equivalent to that on the other grain diets. Since wet-belly incidence was reduced by half, estimated pelt prices for males were significantly increased. Pelt prices for females were estimated lower, however. Although the feed ingredients were less expensive than in the control, ration costs were higher, reflecting increased consumption. Poor feed efficiency possibly resulted from extreme diarrhea. Increased fiber might improve this diet.

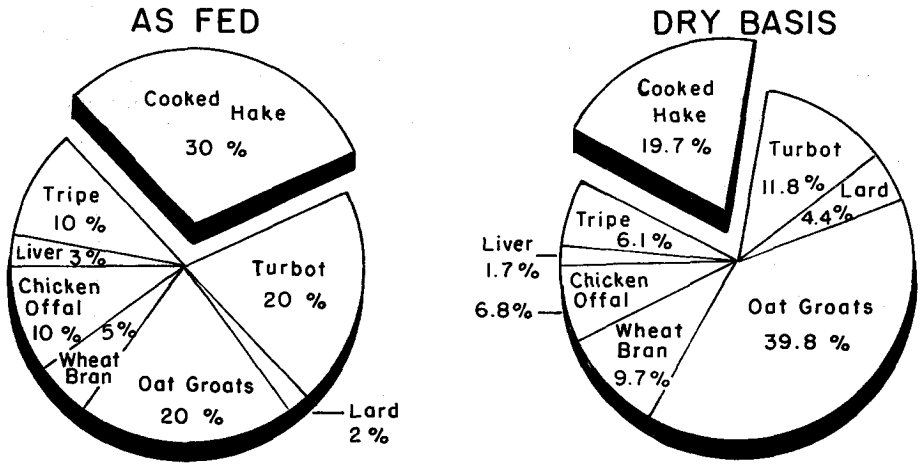
PROCESSED HAKE

Test Group 3A

Objective: To evaluate Pacific hake as a partial replacement for other fish species in the mink ration when it has been processed by heating to inactivate its iron-binding properties.

Methods: Twenty-four standard dark mink kits (12 males and 12 females) were fed the ration shown below from August 9 to pelting on November 30. Initially, from July 20 to August 8, oat groats comprised 25% of the ration, as fed, and wheat bran was absent.

RATION COMPOSITION



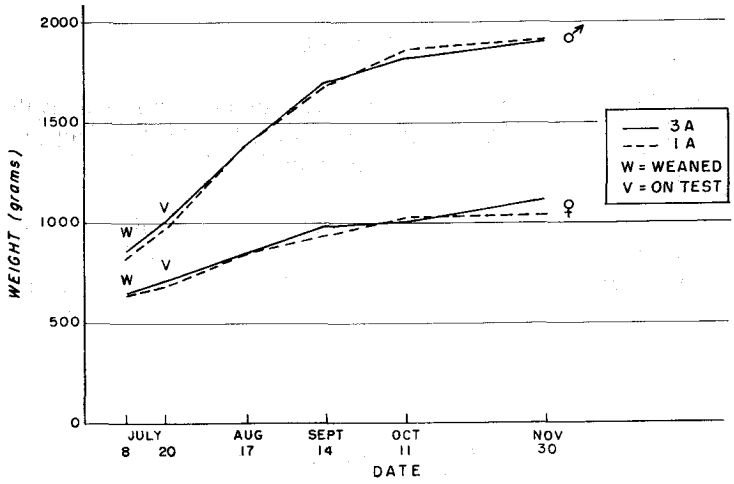
Note: Vitamin E (d-alpha tocopheryl acetate) comprised .01% of the ration, as fed.

PROXIMATE ANALYSIS

	As fed	Dry basis
	%	%
Dry matter	39.8	100.0
Crude protein	13.6	34.2
Crude fat	8.3	20.9
Crude fiber	1.0	2.4
Ash	3.1	7.8
Nitrogen-free extract	13.8	34.7

Results:

GROWTH CURVES



PRODUCTION DATA

	Males	Females
Final weight (gm.)	1,906	1,117
Weight gain (gm.)	820	385
Animal length (cm.)	43.8	36.4
Fur color*	258	200
Fur quality*	183	208
Weight of dried skin (gm.)	116	64
Length of dried skin (cm.)	71.3	59.9
Wet-belly incidence (%)	92	.....
Estimated pelt value ($)	15.28	12.33
Ration cost per mink (% of control)	127	

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

Discussion:

This trial is a continuation of experiments utilizing a so-called "trash" fish, Pacific hake, to replace other fish species which are becoming difficult to obtain for mink feed. In accord with previous demonstrations at this Station that cooking hake will prevent it from causing cotton pelts in mink, the hake used in this diet was heated to 190° F for 5 minutes. The hake was processed on a pilot-plant basis, and ration costs have been estimated as accurately as possible, but they may not exactly reflect cost of commercial production. Nutrient composition of the diet was very similar to that of the control diet. Males grew equally as well as the control males, but females were somewhat heavier on the hake diet. Fur color ratings were definitely lower than those of the controls. This is inconsistent with past experiences where processed hake has supported good color. Fur quality was slightly poorer than that of the control animals. There was an extremely high incidence of wet belly, with 11 of the 12 males in the group affected. Because of this, male pelt value estimates were low but female pelts were valued about equal to the controls. Ration costs were increased over controls, partly because feed intake was 9 pounds higher.

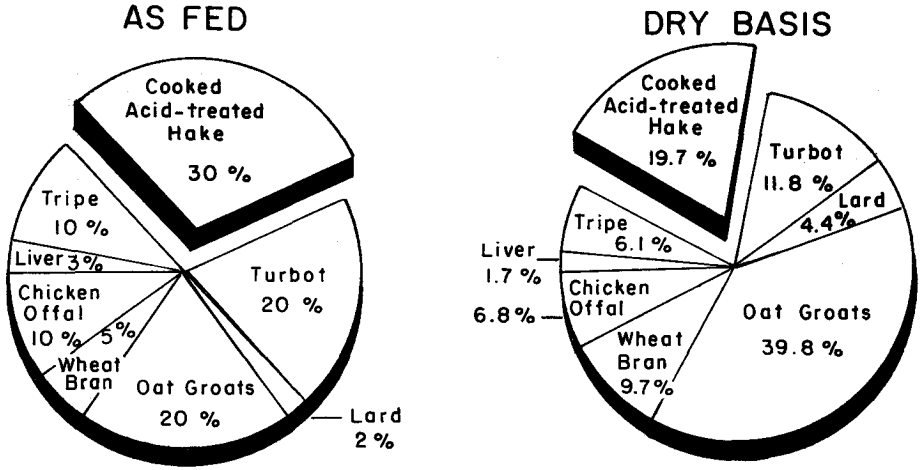
PROCESSED HAKE—ACID TREATED

Test Group 3B

Objective: To evaluate Pacific hake, processed by heating to inactivate its iron-binding properties and by acidification to retard spoilage, as a partial replacement of other fish species in the mink ration.

Methods: Twenty-four standard dark mink kits (12 males and 12 females) were fed the ration shown below from August 9 to pelting on November 30. Initially, from July 20 to August 8, oat groats comprised 25% of the ration, as fed, and wheat bran was absent.

RATION COMPOSITION



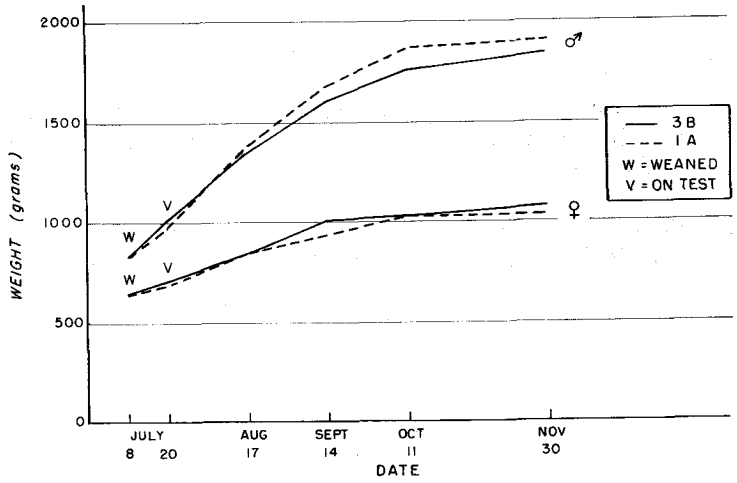
Note: Vitamin E (d-alpha tocopheryl acetate) comprised .01% of the ration, as fed.

PROXIMATE ANALYSIS

	As fed	Dry basis
	%	%
Dry matter	38.6	100.0
Crude protein	13.6	35.3
Crude fat	8.1	21.0
Crude fiber	0.9	2.3
Ash	2.5	6.4
Nitrogen-free extract	13.5	35.0

Results:

GROWTH CURVES



PRODUCTION DATA

	Males	Females
Final weight (gm.)	1,849	1,084
Weight gain (gm.)	835	378
Animal length (cm.)	44.6	37.1
Fur color*	233	183
Fur quality*	200	192
Weight of dried skin (gm.)	108	60
Length of dried skin (cm.)	69.5	58.3
Wet-belly incidence (%)	50	.....
Estimated pelt value ($)	17.74	12.96
Ration cost per mink (% of control)	129	

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

Discussion:

Besides heating hake to inactivate its iron-binding factor which causes cotton pelts, there is potential value in acidification to aid preservation. Accordingly, the hake used in the diet for group 3B was heated similarly to the 3A diet material and then acidified with phosphoric acid to a pH of 4.5. This processed hake was included in the diet at a 30% level. The hake product was prepared experimentally on a pilot-plant basis so that, again, the ration cost figures may not accurately indicate the ultimate commercial cost. Past experiments have usually shown acidified, processed hake to support better growth than similar amounts of unacidified product, when lower levels were fed. This year the reverse was true; animals on diet 3A gained more than those on diet 3B, suggesting that the optimum level for use of the acidified product may be between 25 and 30% of the diet. Growth was also less than on the control diet, males averaging 75 grams lighter. Fur color was equal to the controls for males, poorer in females, but generally improved over 3A. Fur quality was equal to 3A and slightly poorer in males than in the controls. Wet-belly incidence was reduced from 3A and estimated sale prices equalled those of controls.

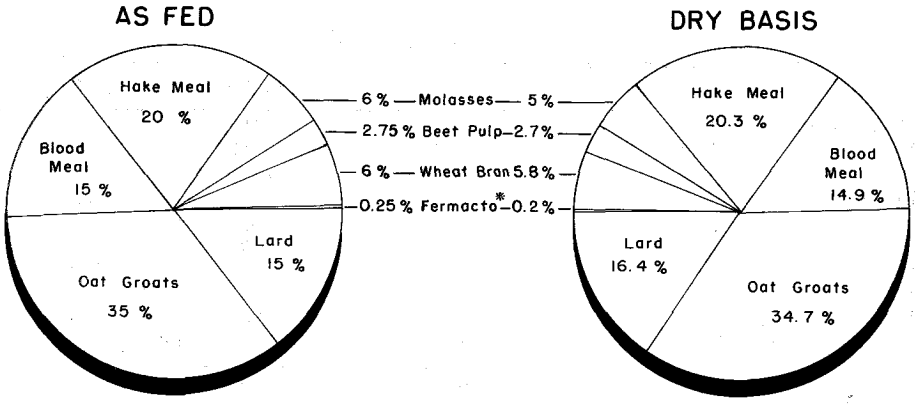
COMPLETELY DRY

Test Group 4B

Objective: To develop a ration composed completely of dry ingredients for growth and fur production of mink, utilizing Pacific hake and blood meals as protein sources.

Methods: Twenty-four standard dark mink kits (12 males and 12 females) were fed this ration from July 20 to pelting on December 1.

RATION COMPOSITION



* Supplied by the Borden Company, Elgin, Illinois.

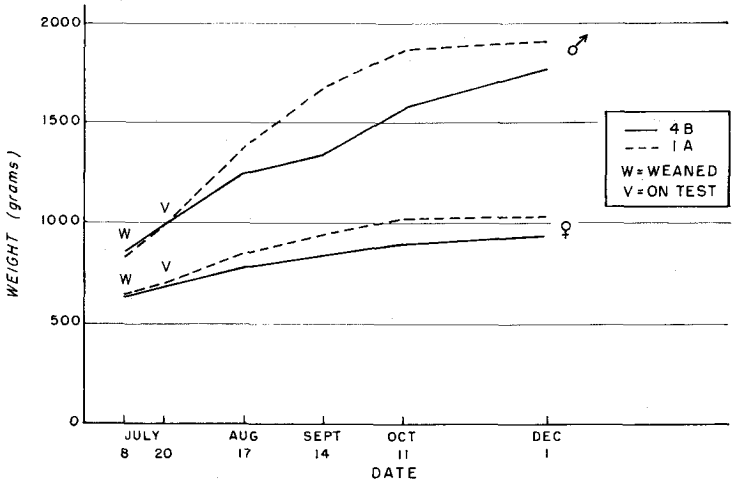
Note: Vitamin E (d-alpha tocopheryl acetate) comprised .01% of the ration, as fed.

PROXIMATE ANALYSIS

	As fed	Dry basis
	%	%
Dry matter	53.6	100.0
Crude protein	18.5	34.5
Crude fat	10.7	20.0
Crude fiber	1.6	2.9
Ash	3.4	6.3
Nitrogen-free extract	19.4	36.3

Results:

GROWTH CURVES



PRODUCTION DATA

	Males	Females
Final weight (gm.)	1,781	947
Weight gain (gm.)	802	266
Animal length (cm.)	43.9	36.3
Fur color*	191	142
Fur quality*	218	200
Weight of dried skin (gm.)	102	54
Length of dried skin (cm.)	68.0	55.0
Wet-belly incidence (%)	50	-----
Estimated pelt value ($)	18.66	12.96
Ration cost per mink (% of control)	107	

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

Discussion:

This test group is devoted to investigating diets composed of dry materials. Ration 4B in 1966 was completely formulated from dry feeds and was quite similar to ration 4 as fed in 1965. Two variations from the earlier formula were the use of hake meal in place of herring meal and the addition of a source of unidentified growth factors in the form of a fermentation product (Fermacto). The dry ration was mixed with water before feeding and fed on the cage wire in the conventional manner. The growth curves show an interruption in males' growth during September, and they averaged 150 grams less than control males at the end of the test. Growth was generally poorer than on the all dry ration fed in 1965, suggesting that the hake meal was lower in quality than the herring meal previously used. The hake meal was made in a pilot plant, without addition of stickwater, and future products may be improved. Interestingly, fur color was the best of any experimental group this year, and rated 11% above the controls. Fur quality was below that of the controls, generally reflecting low scores on male pelts. Although feed ingredient costs were low, wastage was excessive; consequently, ration costs were higher than those of the control group.

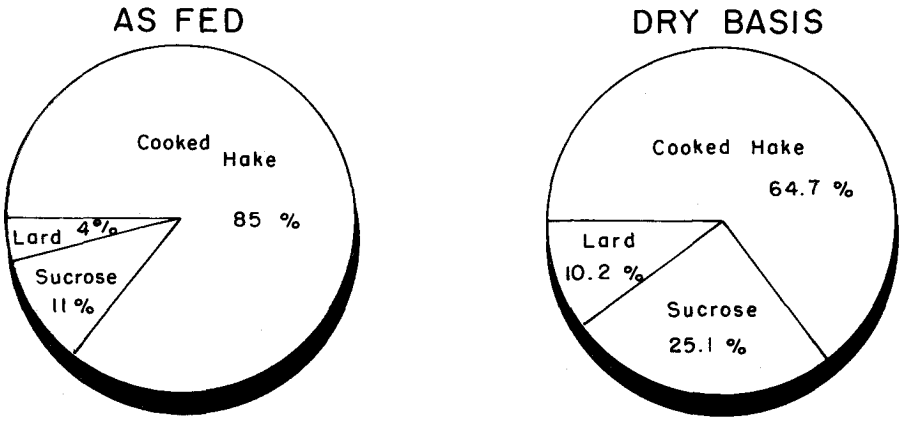
SIMPLIFIED—HAKE

Test Group 5A

Objective: To test the concept of simplification of the mink ration by supplying basic nutritional requirements from one fish source (processed Pacific hake) and balancing only with pure sources of carbohydrate and fat.

Methods: Twenty-four standard dark mink kits (12 males and 12 females) were fed this ration from July 20 to pelting on November 30.

RATION COMPOSITION



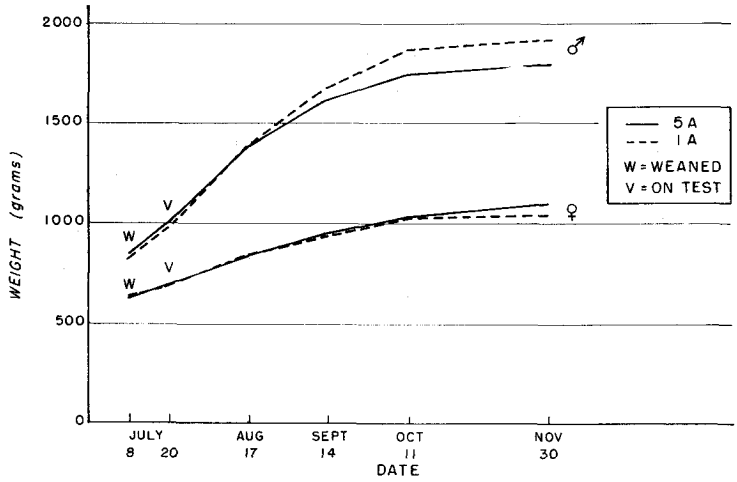
Note: Vitamin E (d-alpha tocopheryl acetate) comprised .01% of the ration, as fed. To improve feed consistency, guar gum was added at .5% and wheat bran at 4%, as fed, after July 27.

PROXIMATE ANALYSIS

	As fed	Dry basis
	%	%
Dry matter	38.2	100.0
Crude protein	13.6	35.6
Crude fat	8.0	20.9
Crude fiber	0.3	0.9
Ash	4.7	12.3
Nitrogen-free extract	11.6	30.3

Results:

GROWTH CURVES



PRODUCTION DATA

	Males	Females
Final weight (gm.)	1,793	1,091
Weight gain (gm.)	783	404
Animal length (cm.)	45.0	37.1
Fur color*	275	225
Fur quality*	200	275
Weight of dried skin (gm.)	115	63
Length of dried skin (cm.)	69.6	57.4
Wet-belly incidence (%)	58	.....
Estimated pelt value ($)	14.93	9.63
Ration cost per mink (% of control)	171	

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

Discussion:

This ration, simplified in composition so that one ingredient supplied the bulk of required nutrients, was based on Pacific hake. The hake was processed by heating as previously described for ration 3A. The product was almost liquid, and since the other ingredients, sugar and lard, had little absorptive action, wheat bran and guar gum were added in an attempt to solidify the mixture, but it still was necessary to feed it in a bowl. All mink showed extreme diarrhea from start to finish of the trial which was attributed to the physical nature of the diet. Weights of males were below those for control males although carcass lengths were slightly longer. Females were larger than control females. Fur color was poor as was fur quality largely due to matting because animals could lie in the semi-liquid food. Although less severe, incidence of wet belly was similar to controls. Sale price estimates were depressed because of matted furs. High cost of ingredients and wastage incurred by difficulty in feeding made ration costs soar. Although this ration is not practical, it does serve to demonstrate that mink rations can be simplified and the number of ingredients reduced. It further illustrates the definite potential of hake as a protein source in diets for mink.

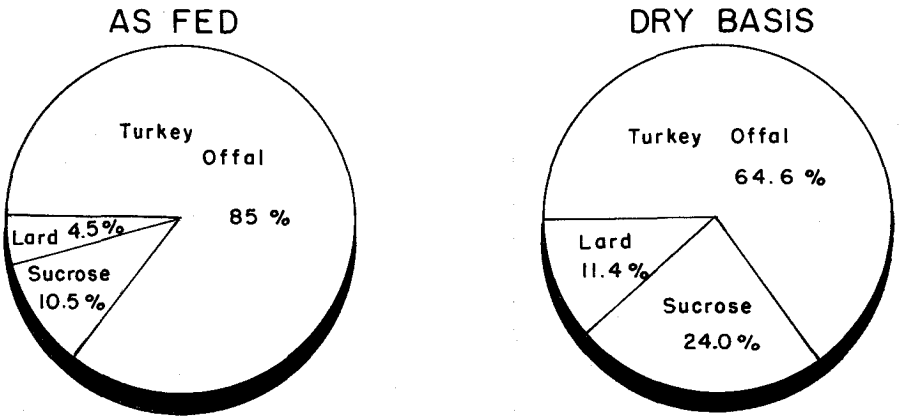
SIMPLIFIED—TURKEY OFFAL

Test Group 5B

Objective: To test the concept of simplification of the mink ration by supplying basic nutritional requirements from one source (turkey offal) and balancing only with pure sources of carbohydrate and fat.

Methods: Twenty-four standard dark mink kits (12 males and 12 females) were fed this ration from July 20 to pelting on November 30.

RATION COMPOSITION



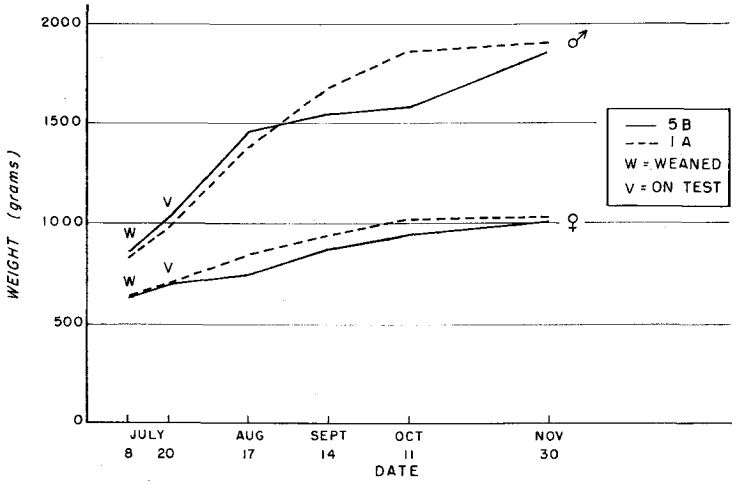
Note: Vitamin E (d-alpha tocopheryl acetate) comprised .01% of the ration, as fed.

PROXIMATE ANALYSIS

	As fed	Dry basis
	%	%
Dry matter	43.1	100.0
Crude protein	14.2	32.9
Crude fat	9.6	22.2
Crude fiber	0	0
Ash	4.8	11.1
Nitrogen-free extract	14.5	33.8

Results:

GROWTH CURVES



PRODUCTION DATA

	Males	Females
Final weight (gm.)	1,863	1,018
Weight gain (gm.)	842	319
Animal length (cm.)	44.6	37.0
Fur color*	300	258
Fur quality*	273	250
Weight of dried skin (gm.)	104	55
Length of dried skin (cm.)	70.1	55.9
Wet-belly incidence (%)	82	.....
Estimated pelt value ($)	10.36	9.00
Ration cost per mink (% of control)	121	

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

Discussion:

This ration was based on turkey offal, intended to be from young birds. Ration specifications similar to 1A were met by adding beet sugar and lard. The erratic responses of mink to this ration as evidenced by growth curves and fur color and quality scores indicate an extremely variable product, partly from breeder birds. Final weights approached those of control mink but reflected compensatory growth after a period of high stress between late August and early October. Fur color was poorer than for any other group this year. Several males showed greying typical of biotin deficiency caused by inclusion of breeder turkey offal including eggs. Fur quality was poorest of all groups from matting caused by a dripping feed. Males had an extremely high occurrence of severe wet belly. All of these undesirable characteristics are reflected in the very low estimated pelt prices. Feed utilization was poor, evidenced by a high consumption rate which increased ration costs above controls, even though prices per pound were comparable. Performance on this diet is not typical of many earlier experiments with turkey offal at high levels. Trials last year showed chicken offal in a similar formula to be an excellent feed.

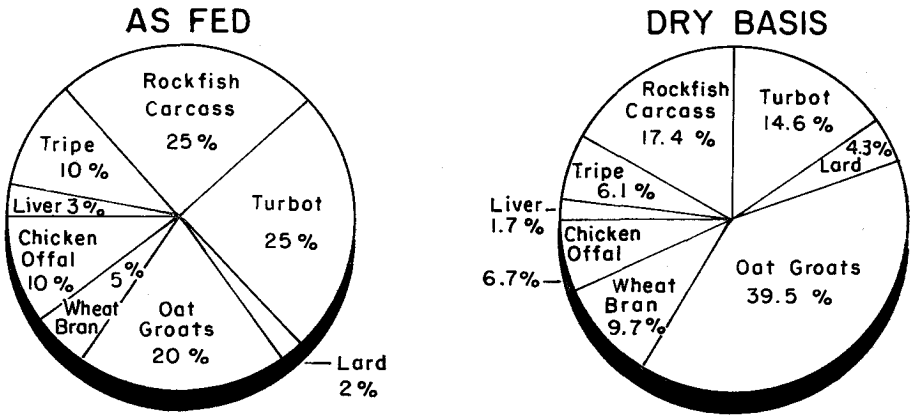
CONTROLLED LIGHT

Test Group 6

Objective: To determine the effect of more rapid shortening of day length and rearing in a semi-controlled environment on fur and body growth in the mink.

Methods: Twenty-four standard dark mink kits (12 males and 12 females) were fed the ration shown from August 9 to pelting on December 14. Initially, from July 20 to August 8, oat groats comprised 25% of the ration, as fed, and wheat bran was absent.

RATION COMPOSITION



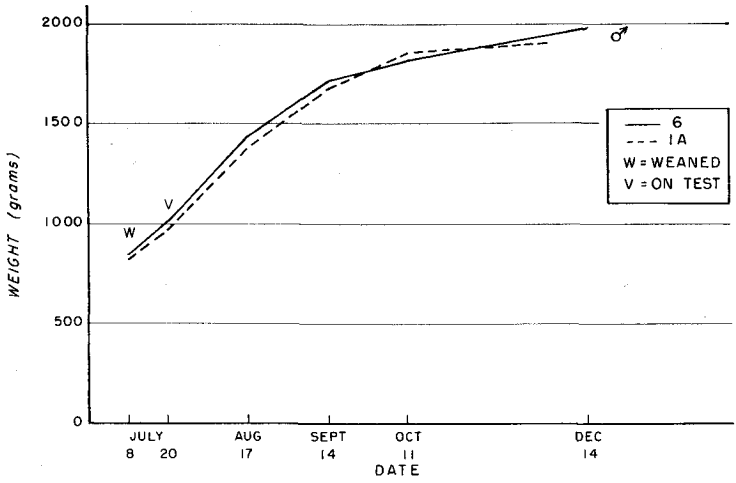
Note: Vitamin E (d-alpha tocopheryl acetate) comprised .01% of the ration, as fed.

PROXIMATE ANALYSIS

	As fed	Dry basis
	%	%
Dry matter	36.1	100.0
Crude protein	12.0	33.1
Crude fat	8.0	22.1
Crude fiber	0.8	2.3
Ash	2.7	7.5
Nitrogen-free extract	12.6	35.0

Results:

GROWTH CURVES



PRODUCTION DATA

	Males
Final weight (gm.)	1,989
Weight gain (gm.)	973
Animal length (cm.)	43.3
Fur color*	180
Fur quality*	170
Weight of dried skin (gm.)	113
Length of dried skin (cm.)	69.7
Wet-belly incidence (%)	50
Estimated pelt value ($)	21.56

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

Discussion:

The variable under test is the effect of more rapid shortening of the natural day length by imposing an artificial environment with the objective of early fur priming. Ten dark male mink fed the control ration (1A) were caged inside a light-proof building with light provided by four 150 watt, incandescent bulbs activated by a time clock. Day lengths were shortened proportionally each day so that the length on October 1 coincided with actual length on December 1. Reduction of the artificial day continued to October 31, and it was kept constant thereafter until pelting. A lagoon beneath the pens was provided for waste material and an exhaust fan operated continuously. The objective of hastening winter fur growth was not achieved; in fact, pelting had to be postponed for two weeks, and a few individuals were not entirely prime then. Males raised inside were slightly heavier but shorter than controls. Fur color was darker than that of males raised conventionally. and average fur quality was almost identical. Wet-belly stains were evident in 50% of the animals but were very mild. Estimated sale price was improved by about $3.50 because of improved color and less wet belly. Factors other than shortening light exposure apparently influence fur growth in young mink.

APPENDIX

Proximate Analysis of Feedstuffs Used in 1966 Feeding Trials

(Percent of dry matter)

Item	Dry matter	Crude protein	Crude fat	Crude fiber	Ash	NFE	Calcium	Phosphorus	References
	%	%	%	%	%	%	%	%	
MEATS:									
Chicken offal with feet	35	43.4	38.3	0 *	12.3	6.0	4.04	2.22	OSU analyses
Horsemeat	37	47.6	42.8	0 *	13.7	5.9	0.13	1.69	OSU analyses
Lard, stabilized	100	0	100.0	0	0	0	0	0	OSU analyses
Liver, beef	26	66.5	12.4	0 *	7.0	14.1	0.04	0.87	OSU analyses
Tripe, beef	28	53.8	36.9	0 *	6.3	3.0	1.05	0.57	OSU analyses
Turkey offal with feet (young)	25	54.5	15.6	0 *	18.4	11.5	6.39	3.26	OSU analyses
FISH:									
Hake, processed	30	57.4	18.8	0 *	19.8	5.0	.....	.....	OSU analyses
Rockfish (mixed species)	28	61.3	20.1	0 *	16.1	2.5	4.36	2.50	OSU analyses
Rockfish, carcass	32	50.7	22.6	0 *	19.4	7.3	5.38	3.13	OSU analyses
Sole (mixed species)	19	72.3	9.1	0 *	13.8	4.8	3.32	2.30	OSU analyses
Turbot	27	53.2	38.7	0 *	7.8	0.3	1.46	1.17	OSU analyses
DRIED ANIMAL PRODUCTS:									
Blood meal, spray-dried	91	88.1	0	2.1	2.5	7.3	0.06	1.78	OSU analyses
Hake meal	90	67.0	5.0	0 *	20.0	8.0	3.38	0.84	OSU analyses
Meat and bone meal	94	54.0	10.7	2.1	33.2	0	10.40	4.50	NRC 296 & OSU analyses
Skim milk powder	94	36.8	1.3	0.2	8.2	53.5	1.40	1.20	NRC 296, 659 & OSU analyses
DRIED PLANT PRODUCTS:									
Alfalfa meal, suncured	91	19.1	2.2	25.8	9.8	43.1	1.50	0.20	NRC 296 & 659
Barley, whole ground	89	10.9	2.5	7.0	3.0	76.6	0.07	0.47	NRC 296 & 659
Beet pulp	91	8.9	1.1	25.5	4.0	60.5	0.70	0.09	NRC 296 & 659
Brewers' yeast	93	49.9	1.3	3.0	6.9	38.9	0.10	1.60	NRC 296 & 659
Corn, whole ground, cooked	88	10.5	4.6	2.4	1.5	81.0	0.02	0.30	NRC 296 & 659
Oat groats, ground, cooked	91	18.4	6.4	3.3	2.4	69.5	0.07	0.43	NRC 659
Molasses, cane	76	4.2	0	0 *	10.5	85.3	0.58	0.08	OSU analyses
Soybean oil meal	89	50.9	1.1	6.5	6.5	35.0	0.30	0.70	NRC 296 & 659
Sucrose (beet sugar)	90	0	0	0	0	100.0	0	0	Merck Index
Wheat bran	89	18.3	4.8	11.0	6.9	59.0	0.20	1.40	NRC 296 & 659
Wheat germ meal	90	27.5	7.7	3.3	5.3	56.2	0.08	1.20	NRC 296 & 659
Wheat, whole ground, cooked	87	9.1	1.7	3.1	1.6	84.5	0.09	0.34	OSU analyses & NRC 659
OTHER:									
Fermacto	90	24.0	3.0	8.0	15.0	50.0	.....	.....	The Borden Co.

2-4-9-10 (vitamin supplement: riboflavin—2 mg., calcium d-pantothenate—4 mg., niacin—9 mg., and choline chloride—10 mg. per pound)
Methionine, dl
d-alpha tocopheryl acetate (50,000 International Units of vitamin E per pound)
Neo-Terramycin (20 grams of neomycin sulphate and 20 grams of oxytetracycline per pound)
Terramycin (10 grams of oxytetracycline per pound)

These data have been compiled from analyses of feedstuffs made at Oregon State University or have been taken from National Research Council publication numbers 296 and 659, or the Merck Index. * Estimated.