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FOREWORD

This report is one of a series issued under the direction of the Committee on Animal Nutrition, Agricultural Board, Division of Biology and Agriculture, National Research Council. It was prepared by the Subcommittee on Furbearer Nutrition, and it replaces Publication 296, *Nutrient Requirements of Foxes and Minks,* issued in 1953.

The earlier report represented the first attempt to develop nutrient standards for mink and foxes. The new report reflects changes that have since occurred in husbandry practices and in the choice of diet ingredients.

The metric system is used throughout this report. Feeds are named in accordance with nomenclature adopted by the Committee on Animal Nutrition (U.S.) and the National Committee on Animal Nutrition (Canada).

The Committee of Animal Nutrition acknowledges the substantial contribution by the former Subcommittee on Furbearer Nutrition: L. E. Harris (Chairman), C. A. Cabel, P. E. Kifer, J. K. Loosli, and J. E. Oldfield. The Committee also thanks Alice Denny, Utah State University, Logan, for assistance in the preparation of the report.

CONTENTS

INTRODUCTION

Among semidomesticated animals raised for production of fur, mink (*Mustela vison*) are of first importance. In 1965, kits produced in the United States totaled 8,225,000—about 2½ times the number produced a decade earlier.

The number of foxes raised in the United States has declined greatly since about 1948. The species utilized are the silver fox (*Vulpes fulva*) and the blue fox (*Alopex lagopus*). Information in this publication refers to the silver species unless the blue species is named.

Efficient production of fur is contingent on economical maintenance of breeding animals; large litters; rapid growth of the young; and desirable qualities in the fur, especially density and subtle differences in color. The relation between nutrition and the first three of these factors is evident. Desirable qualities in the fur result from careful selection and exploitation of mutant genes, but the extent of their development depends on nutrition.

DETERMINING NUTRIENT REQUIREMENTS

Nutrient requirements given here are based on the results of experimental work. In general, the investigators followed customary procedures:

Conclusions were based on the performance of groups of animals.

When performance was determined on the basis of gains in weight or on feed-conversion efficiency, averaged values were used in interpreting results.

When deficiency symptoms were the criteria of nutrient adequacy, conclusions were based on absence of the deficiency syndrome in all animals in the experimental group.

Calculations and interpolations are incorporated in some of the requirements stated here.

The Subcommittee believes the values stated here permit the maintenance of normal health and productivity of animals. The values have not been increased by any arbitrarily added amounts. However, feed manufacturers and fur-animal feeders may find it desirable to increase the concentration of certain unstable nutrients that might deteriorate while in storage or in shipment.

Requirements are expressed on two bases: percentage of dietary dry matter or amount per kilogram of dry matter fed (Tables 1 and 2); and daily nutrient requirements per animal (Tables 3 and 4).

Growth curves of standard dark and mutation (sapphire) mink are shown in Figure 1. The period of gestation for dark and mutation mink averages about 50 days and ranges from 38 to 76 days.

Growth curves of silver and blue foxes are shown in Figure 2. Blue foxes grow faster than silver foxes at early stages of growth; however, silver foxes are larger at maturity.

J. E. Oldfield, F. M. Stout, and J. Adair, Oregon State University, Corvallis

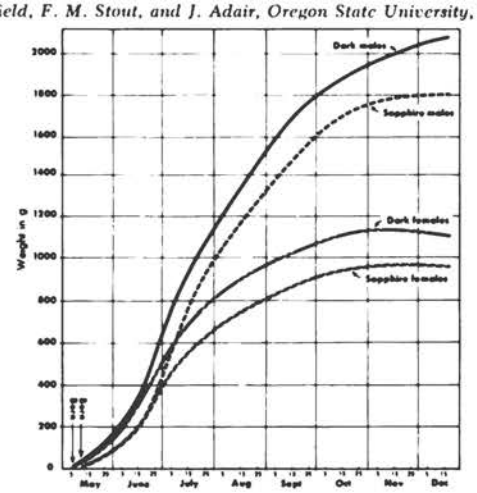


Figure 1
Growth curves of standard dark and sapphire mink.

F. C. Aitken, Rowett Research Institute, Aberdeen, Scotland

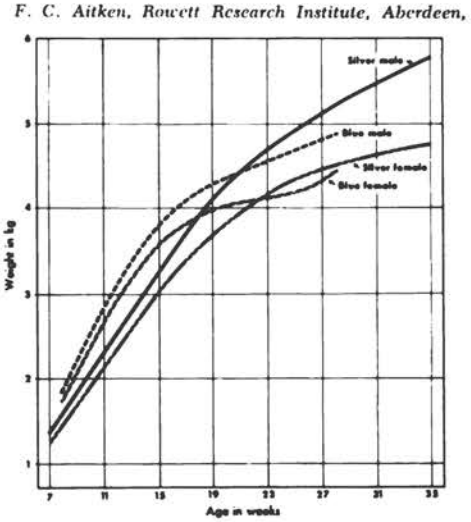


Figure 2
Growth curves of silver and blue foxes.

FORMULATING DIETS OR FEED MIXTURES

Adequate diets for mink and foxes should supply sufficient nutrients in the correct amounts and ratios to meet the physiological requirements of maintenance, or maintenance plus production, including reproduction, lactation, growth, and fur production. There is a rather wide normal range in the amounts of nutrients that can be used to satisfy these needs. If ingredients are cheap and abundant, it may be advisable to feed diets that provide nutrients in excess of those actually required. At times, however, it may pay to have fur animals grow at rates below the maximum. This fact has been demonstrated in studies of the protein requirements of foxes (Harris *et al.*, 1951). Foxes fed on a fresh-meat diet gained faster than those fed meat meal, but there is no difference in the ultimate size of the animals or in the size or quality of the pelts (Bassett, 1951).

Cereal grains, corn, potatoes, and soybeans should be cooked, because cooking improves digestibility.

Unidentified required nutrients can be provided by including the following feeds in mink and fox diets: liver, yeast, alfalfa meal, skimmed milk, wheat germ, whey distillers dried solubles, fish solubles, and fish meal. If combinations of these feeds are used, other vitamin supplements are usually unnecessary.

Since diets of mink and foxes contain varying amounts of moisture or other added liquids, it is desirable to calculate the diets on a "dry" feed basis (moisture-free) and then convert them to an "as-fed" basis. To adjust diets or feed mixtures to contain varying amounts of dry matter, use the formulas given in Table 5.

Examples of basic formulas are given for mink diets in Table 6 and for fox diets in Table 7.

Diets or feed mixtures may be calculated by using the data for nutrient requirements (Tables 1 to 4) and the data for composition of feeds (Table 8). Table 9 gives a list of abbreviations used in the NRC feed names that are listed in Table 8. Under some conditions, it may pay to have the feed ingredient analyzed for critical nutrients.

NUTRIENT REQUIREMENTS AND SYMPTOMS OF DEFICIENCY

MINK

Energy

For maintenance, mink require about 273 kcal per kg of body weight daily (Hodson and Smith, 1945). With a daily dry-feed intake of 73 g and a mean body weight of 1,550 g, this is equivalent to 4,250 kcal of gross energy per kg of feed dry matter.

There is some controversy regarding optimum energy concentration for growth and furring, and rations with widely different caloric densities have been fed. Evans (1964) and Wood and Farrell (1965) state that there is good evidence to suggest a gross caloric content of 5,300 kcal per kg of diet for young, rapidly growing mink. This figure is offered as a mean, and it is suggested that levels of protein and other essential nutrients be adjusted upward if higher energy rations are fed.

NRC (1966) recommends that mink requirements be expressed as a nutrient-to-calorie ratio in future research reports.

Symptoms of Deficiency Energy deficiencies may develop from a shortage of available food or from dietary imbalance or nutrient deficiency.

Shortage of available food may take either of two forms: the quantity of food may be insufficient, or major ingredients may have low digestibility. Either way, the appetite is unaffected.

Dietary imbalance or nutrient deficiency may limit voluntary food consumption or the efficiency with which the animals use the food.

Depending on the degree of energy deficiency, retardation or cessation of growth is accompanied by varying stages of emaciation; the fur may be dull and lack sheen, and milk yield may be reduced in lactating females.

Carbohydrates

No critical studies have been made on the carbohydrate requirements of mink. Purified diets with a composition of 60 percent sucrose have been fed (Tove *et al.*, 1949). Wide differences of opinion exist concerning the digestibility of various carbohydrate sources (Bernard *et al.*, 1942). The digestibility of carbohydrates in grains can be significantly increased by cooking (Ahman, 1959; Leoschke, 1965).

Fats

Fresh fat may be used in mink diets to the extent of 6 to 46 percent (Bassett, 1949). High fat in the ration has been thought to result in poor color in the fur of dark pelts (Stout *et al.*, 1963). However, extensive data from a study of some 1,500 mink indicated no direct causal relationship between diet fat level and fur color (Stout *et al.*, 1965).

Some evidence suggests that over 20 percent fat during the furring-out period influences wet belly incidence (Leoschke, 1959; Evans *et al.*, 1961). Discrepancies in the response to dietary fat may be caused by different genetic susceptibilities of the mink. (See the discussion of wet belly disease on page 10.)

Recent data (1965) suggest that diet fat level has a strong influence on final body weight at pelting. Oregon experiments showed that an increase of 1 percent fat in the diet (dry basis) increased final male mink weights by 25 g (Stout *et al.*, 1965).

The use of rancid fat or fat that has been stored for long periods should be avoided. (See the discussion of vitamin E, page 5.)

Protein

Although the previous edition of this publication suggests minimum requirements of 22 to 26 percent protein for mink kits from 7 to 16 weeks of age and 16 to 22 percent protein on a dry basis from 16 weeks to maturity (Bassett *et al.*, 1951*a*), others have considered 32 percent protein in the dry matter to be efficient for maximum growth in mink (Howell and Gunn, 1955). Stout *et al.* (1963) found that a level of 25 percent protein in the dry matter during the growth period is necessary for maximum growth of body and fur. This level (25 percent) is tentatively recommended as a minimum for growth, to allow for some variation in protein quality.

Peterson (1957) fed diets containing 40, 45, and 50 percent digestible protein and made observations to determine whether the changes in percentage affected the reproductive performance of the mink. He concluded that they did not.

Allen *et al.* (1964) and Sinclair *et al.* (1962) studied the protein and energy requirements in terms of calorie-to-protein ratios (kilocalories per percent protein) and caloric density (kilocalories per hundred g of moisture-free feed). They found that the optimum for growth of male kits up to 16 weeks of age was a calorie-to-protein ratio of 12.5 to 13.0 and a caloric density of 540 to 550 kcal per 100 g of feed. After 16 weeks, the calorie-to-protein ratio can increase to 17 and possibly to 21. A diet with a calorie-to-protein ratio of 13 and a caloric density of 540 contains 42 percent protein and 21 percent fat if the ash content is 10 percent. [See Aitken (1963) for additional discussion of protein requirements.]

Symptoms of Deficiency A deficiency of protein in mink diets results in retarded growth rate, poor general condition, and lack of normal development of the fur (Bassett *et al.*, 1951*a*). Because diets rich in meat, meat and poultry by-products, and fish are customary on fur farms, a deficiency of protein is rarely encountered.

Fat-Soluble Vitamins

VITAMIN A

A growing mink needs between 100 and 400 IU of vitamin A per kg of liveweight daily. At the 100-IU level, the amount stored in the liver is slight; at the 400-IU level, the amount stored is significantly larger (Abernathy, 1960). The amount suggested to meet the requirement is about 200 IU per kg of liveweight.

Experiments conducted by Warner *et al.* (1963*a*), in which plasma and liver vitamin A levels were measured after feeding carotene or alfalfa meal, showed that mink are inefficient in converting carotene to vitamin A. This work demonstrates that alfalfa meal and probably other plant sources of carotene are poorly utilized by mink.

In the absence of evidence to the contrary, the carotene content of the diet should be disregarded in computing the vitamin A requirement for mink.

Symptoms of Deficiency Vitamin A deficiency has been produced and described for mink (Abernathy, 1960; Stowe *et al.*, 1959; Helgebostad, 1955). When a purified diet devoid of vitamin A is fed, animals fail to grow normally. They develop night blindness and lack coordination, particularly in the rear quarters. Their eyes are affected, with the lenses becoming opaque and the conjunctivas encrusted. Metaplasia of epithelial tissues and fatty infiltration of the liver occur. The skull does not enlarge normally; as a result, the cerebellum is compressed and herniates into the foramen magnum. Damage to the cerebellum results in muscular incoordination.

Friend and Crampton (1961) observed that reproductive performance in mink was reduced when whale liver in breeder rations was increased from 5 to 10 percent. They postulated a hypervitaminosis A toxicity. Whale liver contains 4,400 IU of vitamin A per g, as compared with 150 IU in beef liver.

VITAMIN D

A diet of natural feedstuffs without a vitamin D supplement is probably adequate for growing mink (Bassett *et al.*, 1951*b*). A daily supplement of 200 IU of vitamin D per kg of body weight does not prevent rachitic changes when calcium or phosphorus is deficient nor does it improve physiological responses on adequate mineral levels.

Symptoms of Deficiency When mink are fed a diet that is low in vitamin D and abnormally low in calcium-to-phosphorus ratio, they develop rickets (Smith and Barnes, 1941; Bassett, 1951). When the diet is deficient in calcium or phosphorus, bone development is abnormal.

VITAMIN E

When mink diets contain rancid fats or are high in unsaturated fatty acids, the animals are subject to yellow fat disease.* Mink receiving such diets require

* This disease has been given various names, including nonsuppurative penniculitis (Quortrup *et al.*, 1948), Weber Christian disease (Quortrup *et al.*, 1948), fatty degeneration of the liver (Chaddock, 1948), and steatitis (Hartsough and Gorham, 1949).

an adequate supply of vitamin E or α-tocopherol, especially during growth (Lalor *et al.*, 1951; Gorham, 1951; Mason and Hartsough, 1951).

Yellow fat disease is likely to appear after feeding large amounts of stored fish scrap, horse meat, or poultry offal. It is also caused by diets high in tuna scrap (Adair *et al.*, 1959).

Vitamin E requirements are about 25 mg per kg of diet (Stowe and Whitehair, 1963). Studies conducted in Alaska indicate that the synthetic antioxidants butylated hydroxytoluene (BHT) and santoquin are effective in protecting mink against yellow fat disease when added at a level of 122 mg per kg of wet diet (Leckley and Cabell, 1961).

Michigan workers (Stowe and Travis, 1960) studied an uncomplicated vitamin E deficiency, using a purified diet containing 24 percent lard. The most frequent symptom was sudden death due to minor stress. Intercostal and myocardial muscles showed dystrophic lesions. Selenium had some but not a complete vitamin E-sparing effect.

Symptoms of Deficiency Kits are first affected with yellow fat disease shortly after weaning, and losses may continue until pelting time. The disease usually appears suddenly. The kits may refuse the night feeding and be dead in the morning. Other affected kits may leave their feed and show a peculiar, unsteady hop. The impaired gait may become gradually worse until the animals are unable to move. They become comatose and remain so until they die. In a typical outbreak, half of the kits may die.

At pelting time, nearly all the kits that survive show yellow discoloration of the fat. Blood appears in their urine. Presence of the blood suggests that a general normocytic, normochromic anemia, which does not respond to administration of iron, is a further symptom of yellow fat disease (Gorham, 1963).

"Cotton fur" may accompany this condition if rancid fat is fed during the period of active fur formation, and the number of animals affected reflects the extent of rancidity of the diet fat (Oregon State University Experimental Fur Farm, 1963).

VITAMIN K

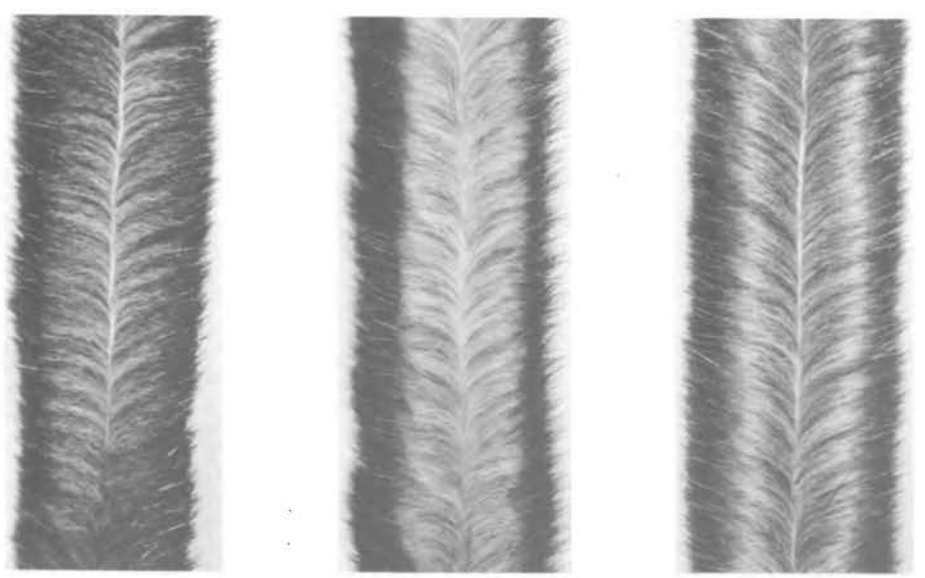
Little work has been done on vitamin K levels in mink diets, and a deficiency of vitamin K in practical rations appears unlikely. Travis *et al.* (1961) found that adding vitamin K to a semipurified diet low in the vitamin produced no change in blood prothrombin time.

Water-Soluble Vitamins

BIOTIN

Stout *et al.* (1966) showed that biotin deficiency can result from feeding practical mink diets composed of high levels (40 percent or more of ration dry matter) of offal from breeder hen turkeys. Presence of raw eggs in the offal is presumed responsible for the deficiency, because raw eggs contain avidin, a protein that binds dietary biotin in an unavailable form. The deficiency can be prevented by feeding the offal at subcausative levels, by heating it (to denature the avidin), by excluding it from the diet, and by supplementing the diet with biotin.

Symptoms of Deficiency The biotin deficiency that results from feeding breeder-turkey offal is marginal. Symptoms are gray or banded underfur in dark mink (Figure 3) and, in extreme cases, hair loss.



F. M. Stout, Oregon State University, Corvallis

Figure 3
Marginal biotin deficiency in dark mink. Pelts are parted to show underfur. *Left to right:* Normal, gray, and gray-banded underfur.

Biotin deficiency has been experimentally produced in mink by feeding raw egg white as 30 percent of the protein level (Helgebostad *et al.*, 1959). Symptoms noted were pronounced achromotrichia, reduced fur quality, hair loss, degenerative changes in the hair follicles, thickened and scaling skin, conjunctivitis, and fatty infiltration of the liver. The deficiency eventually causes death.

FOLIC ACID

Leoschke (1960), who made purified-diet studies, indicated that the folic acid requirement of the mink is 0.5 mg per kg of dry feed. Given at this level, folic acid caused remission of deficiency symptoms; however, daily levels below this were not fed.

NIACIN

The mink, like the cat, requires niacin in the ration, because it is unable to convert sufficient tryptophan to meet its niacin requirement (Warner *et al.*, 1962). When fed a purified ration supplemented with 20 mg of niacin per kg, it gains weight. This amount is tentatively stated as the requirement.

PANTOTHENIC ACID

Studies by Warner *et al.* (1963) placed the requirement for pantothenic acid at between 4 and 8 mg per kg of dry feed.

Symptoms of Deficiency When, in experiments, mink were fed purified diets deficient in pantothenic acid, blood appeared in the feces. It appeared 8 or 9 days prior to death and continued to death. In autopsy, the stomachs and intestines were found to be filled with dark porphyrinlike fluid, and severe stomach hemorrhages were observed (Warner *et al.*, 1963). Other symptoms included muscular incoordination, anorexia, emaciation, enlarged adrenal glands, and large, yellow livers.

PYRIDOXINE

No definite work has been done with pyridoxine. The requirement is tentatively stated as 1.1 mg per kg of dry diet (Leoschke, 1960). Daily doses of 0.6 to 1.2 mg of vitamin B_6 prevented the syndrome described under Symptoms of Deficiency.

Symptoms of Deficiency After mink were fed a diet containing added deoxypyridoxine, and low in vitamin B_6, the testes of males became atrophic, and histological examination showed aspermia and degeneration. Absorption sterility occurred in females (Helgebostad *et al.*, 1963).

RIBOFLAVIN

Riboflavin requirements for growth and fur production are about 1.5 mg per kg of dry feed (Leoschke, 1960).

THIAMINE

Young mink fed a purified diet require 1.2 mg of thiamine hydrochloride per kg of dry feed for growth and fur production (Leoschke and Elvehjem, 1959).

If animals are fed raw fish containing the enzyme thiaminase, the enzyme destroys the thiamine in a mixed ration. Since thiaminase is heat-labile, the problem can be avoided by cooking the fish before adding the other diet ingredients.

Whether a given species of fish contains thiaminase can be determined by consulting Table 10. Oregon studies showed that the diet consumed by the fish has an important bearing on whether they will contain thiaminase (Stout *et al.*, 1963*b*).

Symptoms of Deficiency In experiments, mink have been started on a thiamine-deficient purified diet at about 8 weeks of age. It was found that the animals begin to show thiamine deficiency (Chastek paralysis) in 3 weeks (Leoschke and Elvehjem, 1959). Symptoms are anorexia, loss of weight, lack of muscle coordination, extreme weakness, and, finally, paralysis; death soon follows. (See Figure 4.)

Thiamine deficiency has been produced in adult mink by feeding Columbia River smelt (Long and Shaw, 1943). It was found that the first obvious symptom is failure to eat. Emaciation and weakness rapidly follow. In 6 or 7 days, affected animals may experience convulsions, which lead to a state of collapse, and become unable to move. This final stage lasts only a few hours, after which death occurs. Diarrhea usually accompanies the last stage of the disease, and the fur on the posterior parts becomes coated with thick, black fecal excretions.

VITAMIN B_{12}

The vitamin B_{12} requirement is about 30 μg per kg of dry diet (Leoschke *et al.*, 1953; Leoschke, 1960). This requirement is usually met by ranch mink diets containing large quantities of animal protein.

Symptoms of Deficiency Mink affected by experimental vitamin B_{12} deficiency show anorexia, loss of weight, and severe fatty degeneration of the liver (Leoschke *et al.*, 1953).

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Figure 4
Thiamine deficiency in mink.

OTHER B VITAMINS

Although no definite work has been done on the other vitamins of the B group, the following levels are apparently adequate for mink that are fed purified diets (Leoschke, 1960): choline, 1,000 mg per kg; para-aminobenzoic acid, 550 mg per kg; and inositol, 250 mg per kg (dry feed).

Minerals

CALCIUM AND PHOSPHORUS

For growing mink, the ratio of calcium to phosphorus should be maintained between 1.0:1.0 and 1.2:1.0 (Bassett *et al.*, 1951*b*). The minimum calcium and phosphorus requirement is below 0.3 percent in the dry diet if there is an adequate supply of vitamin D and the stated ratio is maintained. In practice, however, it appears that growing mink require 0.4 to 1.0 percent calcium and 0.4 to 0.8 percent phosphorus.

Symptoms of Deficiency Within 10 days after they are placed on a rachitogenic diet high in calcium and low in vitamin D and phosphorus, mink kits experience difficulty in walking (Smith and Barnes, 1941). They tend to crawl, and the condition becomes more severe until they are unable to stand. Enlargements of the ribs at the costochondral junctions are evident. The spinal column in the thoracic region becomes concave (lordosis). The leg bones bend and enlarge at the ends. The ash contents of the dry fat-free femurs are 22 to 30 percent, compared with 60 to 64 percent for normal animals.

IRON

We do not know the exact amount of iron required by mink, but the occurrence of the cotton-fur syndrome, described under Symptoms of Deficiency, is evidence that availability of iron may be interfered with under certain dietary conditions (Stout *et al.*, 1960*a*, 1960*b*). The ration that produced the normal pelt on the right in Figure 5 contained 114 mg of iron per kg. This amount, therefore, may be considered satisfactory if there are no interfering factors.

Presence in the mink ration of large amounts of certain species of ocean fish induces the iron deficiency responsible for cotton fur. Among these are Atlantic whiting and Pacific hake. Heating these fish to 200°F destroys the causative factor, which has not been identified. The difficulty can also be overcome by supplying iron parenterally (Stout *et al.*, 1960*b*).

Supplemental iron does not prevent cotton fur that results from feeding rancid fats (Oregon State University Experimental Fur Farm, 1963).

Uncooked fish of certain types produce anemia in mink (Helgebostad and Ender, 1961). (See Figure 6.)

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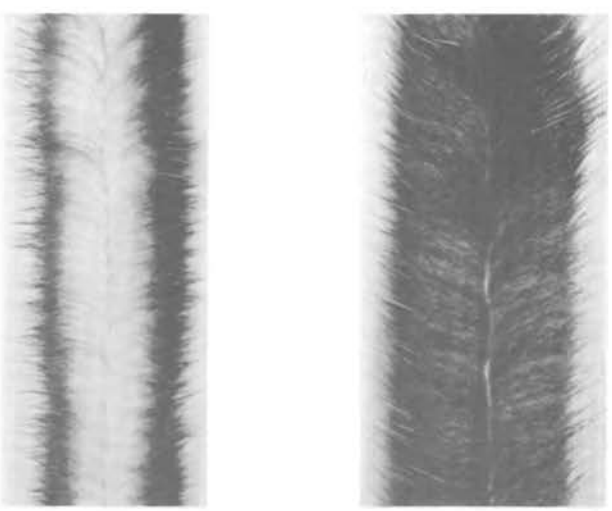

Figure 5
Cotton fur in mink. Pelts are parted to show underfur. *Left:* Cotton fur. *Right:* Normal fur.

A. Helgebostad, Veterinary College of Norway, Heggedal

Figure 6
Anemia in mink kits. *Left:* Litter from a female fed raw gutted coalfish, carbohydrate, vitamins, and iron. The kits were anemic; they weighed 73 g at 27 days. *Right:* Litter from a female fed boiled gutted coalfish and iron. These kits were not anemic; they weighed 170 g at 31 days.

Symptoms of Deficiency A fur abnormality that occurs on mink ranches from time to time, known as cotton fur, has been linked to a deficiency of iron. Symptoms usually include severe emaciation, growth retardation, microcytic–hypochromic anemia, roughened fur, and lack of underfur pigmentation (achromotrichia) (Stout *et al.*, 1960*a*). (See Figures 5 and 7.)

SODIUM AND CHLORINE (SALT)

There are no data on the requirements of mink for sodium and chlorine. However, the requirements are met by fortifying the dry diet with 0.5 percent salt.

Additives

Neither antibiotics nor hormones are commonly considered as nutrient materials, and no requirements are listed for them. Both classes of compounds may, however, exert some influence on mink growth and reproductive performance. Moreover, the nature of some of the by-products used as basic feeds for mink introduces the possibility of contamination with hormonal materials; mention of their effects is therefore pertinent. Parts of animal carcasses that contain endocrine glands (e.g., the neck) and parts containing undissolved residues from estrogen implantation (diethylstilbestrol in cattle ears) are examples of these by-products.

In experiments, 10 μg daily of diethylstilbestrol (DES) administered to female mink resulted in significantly lowered reproduction, although mating appeared normal (Warner *et al.*, 1958). Females thus fed reproduced normally the following year when the DES was removed. Travis and Schaible (1962) showed that residues of DES implants from ears of cattle could result in significant estrogenic contamination of the mink diet.

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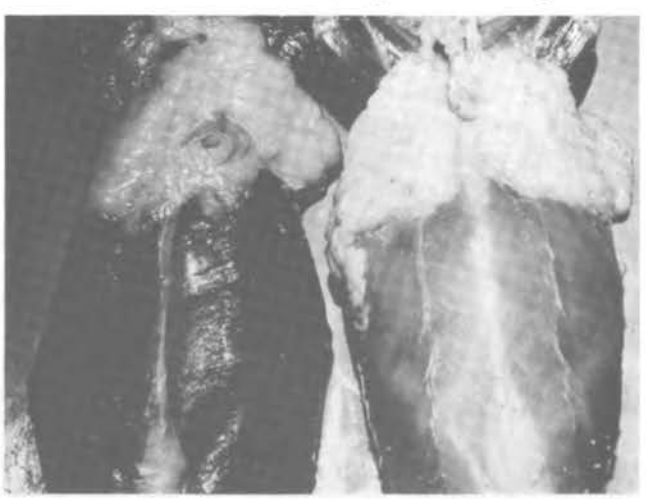

Figure 7
Left: Carcass of normal mink. *Right:* Carcass of cotton fur mink. Note the anemic condition of the carcass on the right.

Travis *et al.* (1963) investigated thyroactivity of "gullet trimmings" from calves by feeding this material to laboratory rats. They showed that additions of 0.3- and 1.5-percent levels of dried thyroid and parathyroid glands to rat diets (approximately equal to 10- and 50-percent additions to wet diets) caused almost complete losses of litters by 14 days after birth.

A number of experiments have been conducted in which antibiotics were included in the diets. Bassett and Warner (1962) showed that significant acceleration of growth resulted from including aureomycin and zinc bacitracin in mink diets. Wood (1963) reported an extensive experiment in which no significant improvement of growth or fur production followed inclusion of four different antibiotics to mink feed at levels varying from 0.5 to 100.0 g per ton. It would appear that response to antibiotics is variable and is probably influenced by environment.

Preventing Disease

Feeding practices may be important in disease prevention in mink. In general, to help prevent disease:

- Keep feed and water containers clean
- Provide fresh water at all times
- Ensure that meat and fish, or their by-products, are fed fresh, or are kept frozen if stored for some time prior to feeding
- Do not use diseased animals, or animals that have died of disease, as feed

Discussions follow on two specific disease situations not presented previously, which have nutritional implications for mink.

NURSING SICKNESS

Nursing sickness becomes apparent during the fifth or sixth week of lactation. Affected females are usually noticed in late June, about the time the young are weaned, but symptoms may appear after the kits have been taken away. Signs of nursing sickness include lack of appetite, loss of flesh, weakness, and incoordination. Death follows a period of coma. Some females, although apparently starving, fill their mouths with feed but do not swallow it. The carcass is extremely thin. The liver is often yellow and friable. The stomach is empty, and the gall bladder is distended with bile (evidence that the animal has not been eating).

Prevention is primarily a management problem. Nursing females that become thin and dehydrated should be removed from their kits if the latter are old enough to wean. Both feed and water must be readily available to the female and her young.

Nursing sickness may result from insufficient salt in the ration. Diets on a dry basis should contain 0.4 to 0.5 percent salt. Most commercial mink "cereals" contain added salt for this purpose.

WET BELLY DISEASE

A major problem in the mink industry is wet belly disease (see Figure 8). This condition occurs primarily in the male and is characterized in the live animal by an intermittent soaking with urine of the fur adjacent to the urinary orifice. It causes local irritation and interruption of fur growth and results in a blackened, melanin-containing area on the leather side of the pelt.

Considerable research has been conducted on this anomaly, and evidence indicates that wet belly probably has genetic, nutritional, bacterial, and other causes. Leoschke (1959) pointed out the positive relation of wet belly to the level of dietary fat. Aulerich *et al.* (1963) suggested that increased calcium

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Figure 8
Typical symptoms of wet belly disease of mink.

levels in the diet (1.5 percent $CaCO_3$ Ca:P ratio 2:1) are conducive to the disease.

Gunn's (1962) research indicates that the disease results from a monovalent or polyvalent infection caused by *Proteus* organisms or other potential pathogens present in certain feedstuffs, such as chicken waste, whole fish, or tripe.

Data assembled at the Oregon Agricultural Experiment Station (Stout *et al.*, 1964 and 1965) show that wet belly disease is a complex problem and that susceptibility is controlled by genetic factors and is aggravated by nutritional factors. They also show that wet belly incidence in two strains of dark mink fed identical rations was 60 percent in one strain and 5 percent in the other and that crossing these strains caused incidence in the offspring to be intermediate between incidences in the parental strains.

Nutritional factors that dispose susceptible animals to wet belly disease are, primarily: increased caloric density (i.e., high fat and low fiber levels) and increased mineral content (i.e., high phosphorus, high calcium, and wide calcium-to-phosphorus ratios).

FOXES

Energy

Two estimates of the daily energy requirement of a mature fox follow:

121 kcal per kg of body weight or 2,102 kcal per square meter of body surface (Hodson and Smith, 1942).

111 to 121 kcal per kg of body weight (Palmer, 1928).

Mamaeva (1958) conducted experiments involving energy intake of two groups of young foxes. Energy intake per animal (kcal) was as follows:

Month of Life	*Control Group*	*Experimental Group*
Third	470	650
Fourth	570	640
Fifth	680	620
Sixth	600	540
Seventh	550	420
Eighth	500	400

The animals in the experimental group gained most of their weight in the first 3 months, but weights were similar at the end of the eighth month of life. Animals in the experimental group were longer and taller and had greater chest girth. The control animals had the most body fat.

Using the figure 121 kcal per kg of body weight, an average animal weight of 4.8 kg and daily feed intake of 180 g of dry matter, a ration concentration of 3,227 kcal per kg of dry matter is obtained. This is suggested as a maintenance requirement for foxes (Table 2). Data are not available for calculation of growth requirements.

Symptoms of Deficiency Energy deficiency in foxes may develop from shortage of feed, in which case the appetite is not impaired, or from dietary imbalance (i.e., nutrient deficiency), which may limit voluntary food consumption. A serious deficiency causes retardation or cessation of growth, together with varying stages of emaciation. The fur may be dull. Milk yield may be reduced in lactating animals.

Carbohydrates

No critical studies of the carbohydrate requirements of foxes have been made. However, a purified basal diet containing 66 percent sucrose has been fed (Schaefer *et al.*, 1947*a*; Tove *et al.*, 1949). Apparently this diet was adequate.

Fats

Up to 44 percent fresh fat may be used in fox diets without causing any detrimental effects (Bassett, 1951). Rancid fat should not be used. It has been estimated that a minimum of 2 to 3 g of essential fatty acids should be fed to foxes daily to prevent hyperkeratosis and dandruff (Ender and Helgebostad, 1951). (See Figure 9.)

Oxidation and storage may interfere with availability of essential fatty acids.

Protein

When blue foxes are fed diets containing various levels of proteins, fats, and carbohydrates, the diets compounded with low levels of protein are less efficient than those with high levels (Høie and Rimeslatten, 1950).

More than 40.7 percent protein in the dry diet is needed to ensure maximum storage of nitrogen in a fox pup between 7 and 23 weeks of age (Harris *et al.*, 1951*a*). There is some question about the advisability of feeding enough protein to cause maximum retention at this age, because animals on less protein continue to retain nitrogen. Foxes receiving as little as 24.5 percent protein are as large at pelting time as

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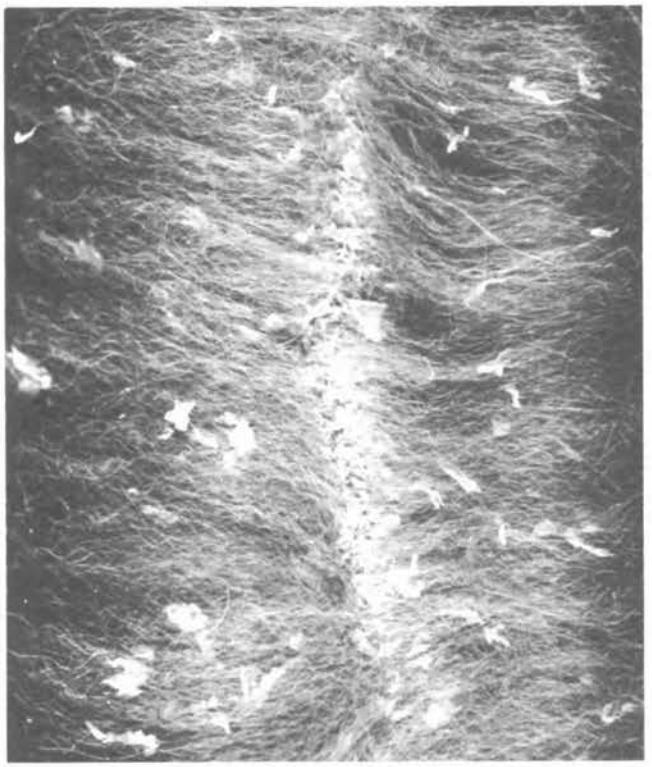

Figure 9
Effect of deficiency of available essential fatty acids is shown in this fur of a silver fox. The fox was fed whole coalfish containing 5 percent fat supplemented with brewers yeast.

those receiving larger amounts. Those receiving at least 19 percent protein while 23 to 37 weeks of age make satisfactory growth; however, it takes at least 22.9 percent protein to effect maximum storage of nitrogen. Foxes between 7 and 23 weeks of age require 25 to 34 percent protein in their diets on a dry basis; afterward they require 19 to 25 percent.

Symptoms of Deficiency A deficiency of protein in foxes results in retarded growth rate, poor general condition, and lack of normal development of fur (Harris *et al.*, 1951*a*). (See Figure 10.) The extent of retardation depends on the severity and duration of the deficiency. Since diets on fur farms are rich in meat, meat by-products, and fish, a deficiency of protein is rarely encountered. No reports on symptoms of individual amino acid deficiencies in foxes have been made.

In an experiment, protein was reduced in a diet fed to fox pups. The diet contained 600 kcal daily. Reduction of protein from 50 to 35 percent of the diet had no ill effects on growth, health, or fur (Firstov *et al.*, 1950). Reduction to 20 percent, however, delayed growth and lowered the quality of the fur.

Fat-Soluble Vitamins

VITAMIN A

The minimum amount of vitamin A necessary to prevent nervous symptoms in young foxes lies between 15 and 25 IU per kg of body weight per day (Smith, 1942). This vitamin is not stored in the liver until 50 to 100 IU per kg of body weight per day are fed.

Although a fox can apparently utilize carotene as a source of vitamin A, the carotene is poorly assimilated (Bassett *et al.*, 1946; Coombes *et al.*, 1940).

The international standards for vitamin A activity as related to vitamin A and β-carotene are as follows:

1 IU of vitamin A = one USP unit
= vitamin A activity of 0.300 μg of crystalline vitamin A alcohol, which corresponds to 0.344 μg of vitamin A acetate or 0.550 μg of vitamin A palmitate.

Beta-carotene is the standard for provitamin A.

1 IU of vitamin A = 0.6 μg of β-carotene.

1 mg of β-carotene = 1,667 IU of vitamin A.

International standards for vitamin A are based on the utilization of vitamin A and β-carotene by the rat. When carotene is being used to satisfy vitamin A requirements of foxes, a conversion factor of 6.0* should be applied, since foxes do not convert carotene to vitamin A as efficiently as do rats.

Until further data are available, it is recommended that growing foxes be supplied at least 100 IU of vitamin A, or 600 IU (360 μg) of β-carotene, per kg of body weight per day. If the vitamin A requirement is calculated on the basis of a body weight of 4.7 kg, with a feed intake of 195 g (Table 4), it would be 2,410 IU per kg of dry feed.

A fox can tolerate large doses of vitamin A (Helgebostad, 1955). A dosage of 40 IU of this vitamin per g of body weight, administered daily over a period of 3 to 4 months, produced no toxic symptoms; 200 IU per g of body weight, administered daily over a period of 1 to 2 months, produced symptoms of hypervitaminosis A in pups.

Symptoms of Deficiency Foxes on a diet deficient in vitamin A develop a series of nervous derangements, usually manifested in this order: first, trembling or

* 1,667 IU of vitamin A equivalent per mg of carotene ÷ 272 IU of vitamin A equivalent per mg of carotene for foxes.

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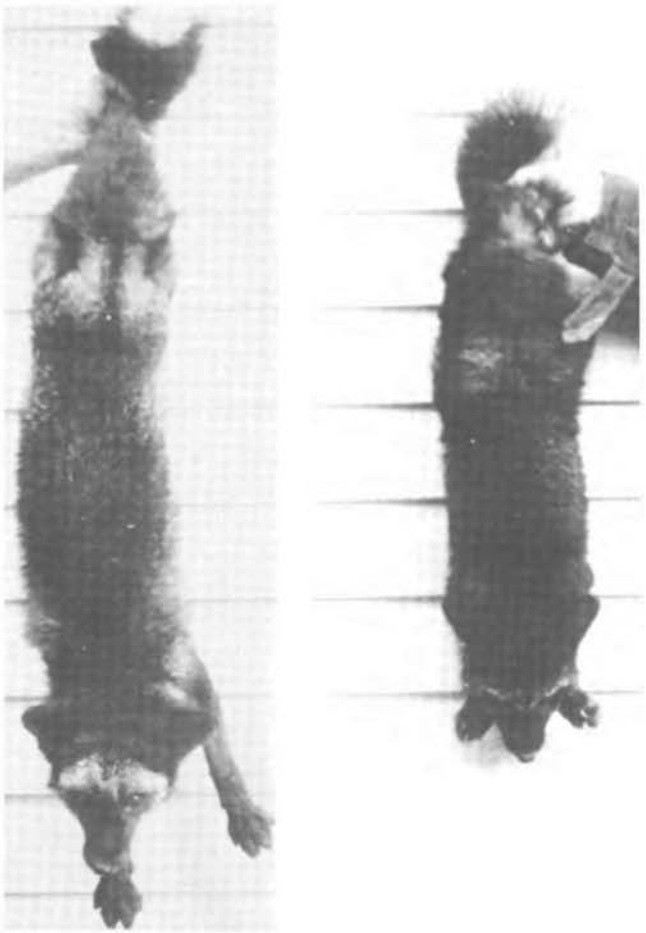

Figure 10
The fox pup on the left was fed a 25-percent protein diet (dry basis). The one on the right was fed an 18-percent protein diet. It was retarded in growth rate, and its general condition was poor; development of fur was not normal.

cocking of the head (similar to the action of a chicken looking at a hawk flying overhead); next, unsteadiness (resulting from a disturbed sense of balance); next, a tendency to run in circles (Smith, 1942). (See Figure 11.)

Often, in attempting to observe an object behind them, deficient animals, instead of turning around in the normal fashion, jerk their heads over their shoulders, lose their balance, and fall over.

These symptoms usually begin 1 to 5 months after the animals are placed on a diet deficient in vitamin A. Later, certain animals, after being excited, exhibit increased nervousness until they pass into coma or tetany, which lasts 5 to 15 minutes. Typical xerophthalmia occurs after 4 to 6 months.

The nervous symptoms are not eliminated by feeding or injecting vitamin A.

The milk and adult teeth of foxes deficient in vitamin A are present in the same socket, and in many instances the adult incisors are small, discolored, and chipped or broken on the corners (Bassett *et al.*, 1946). Another symptom is a high incidence of urinary calculi.

VITAMIN D

Harris *et al.* (1951*b*) found that a diet of natural feedstuffs that assayed 0.82 IU of vitamin D per g was adequate for growing foxes; the diet was fed without a vitamin D supplement. A daily supplement of 200 IU of vitamin D per kg of body weight with this diet did not prevent rachitic changes when calcium or phosphorus was deficient, and it did not improve physiological responses at adequate mineral levels. Vitamin D supplementation of practical fox diets, therefore, does not appear necessary.

Symptoms of Deficiency Rickets can be produced in foxes by feeding diets having low vitamin D content and abnormal calcium-to-phosphorus ratios (Hanson, 1935; Ott and Coombes, 1941; Smith and Barnes, 1941; Harris *et al.*, 1945; 1951*b*).

VITAMIN E

Vitamin E requirements of foxes have not been determined. However, it appears that when good-quality feedstuffs are given, supplemental sources of vitamin E are unnecessary for growth or reproduction.

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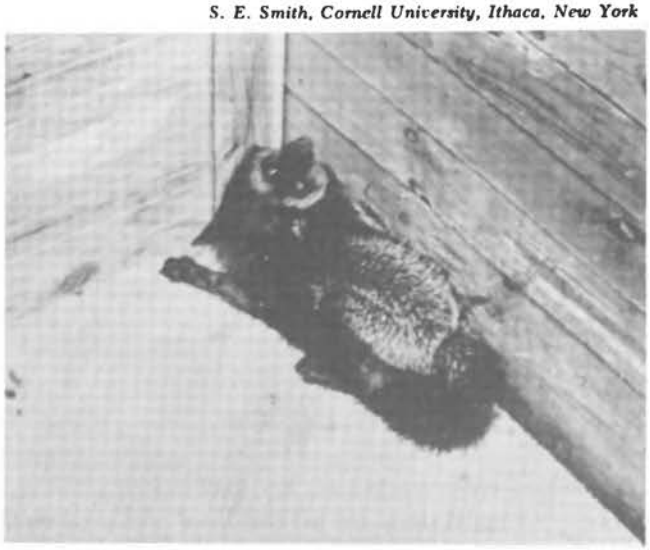

Figure 11
Cocking of the head is one of the symptoms exhibited by foxes on a diet deficient in vitamin A.

Symptoms of Deficiency Experimental production of yellow fat disease in foxes has been described (Ender and Helgebostad, 1953). The disease is often characterized by hemorrhagic diathesis and red, swollen, hemorrhagic gastrointestinal mucosa with or without ulcers. Calcium incrustations are found in the endothelium of the large vessels and in the muscles and kidneys.

Water-Soluble Vitamins

ASCORBIC ACID

Lack of vitamin C has no visible effect on the health of growing foxes or on the quality of their fur (Mathiesen, 1939 and 1942). However, there is a relation between vitamin A and ascorbic acid in the nutrition of foxes (Bassett *et al.*, 1948), which suggests that a deficiency of vitamin A in the diet will reduce tissue synthesis of vitamin C below physiological requirements.

BIOTIN

In a study of biotin deficiency of foxes, Helgebostad *et al.* (1959) used a diet that supplied a total of 30 percent of protein as raw egg white. This diet was fed to pregnant foxes, with the result that some of the young were born with changes in hair color. Some of those born with normal hair developed the changes in color after receiving the egg-white diet themselves (Figure 12). In trials, the condition rapidly improved in all deficient animals that were given 1 mg of biotin twice a week. At autopsy, the liver showed extensive fat infiltration in deprived animals. There were also large amounts of sudanophilic substances in the kidneys and myocardium. This confirmed earlier work (Gunn, 1948) in which 25 percent of raw egg powder was used in the diet of fox pups as the source of animal protein. Gunn found that deficiency symptoms developed after 12 to 15 weeks. The pups showed graying and loss of fur over the body and tail, eye infections, and gray muzzles. Finally, the legs became weak. Adding 5 percent of yeast to the diet or cooking the egg powder by autoclave greatly reduced the symptoms.

FOLIC ACID

Folic acid seems to be important in the fox diet. It is suggested that 0.2 mg per kg of dry diet be accepted as the tentative requirement (Schaefer *et al.*, 1947*a*). Folic acid conjugates are incapable of replacing folic acid in the fox diet (Tove *et al.*, 1949).

Symptoms of Deficiency Foxes fed a purified diet deficient in folic acid develop anorexia, loss of body weight, and a decrease in hemoglobin and in red and white blood cells (Schaefer *et al.*, 1947*a*). This condition causes death if it is not treated.

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Figure 12
Biotin deficiency. The newborn fox pup on the left is from a biotin-deficient dam that received a diet containing raw egg white. Thin, gray pelt and deformed legs are apparent. A control diet containing cooked egg white was fed to the dam of the pup on the right, which is also newborn.

NIACIN

Schaefer *et al.* (1947*b*) have suggested that foxes be fed 0.39 to 2.0 mg of niacin (as calculated from dose feedings) per kg of body weight per day. It is suggested that 10 mg per kg of dry diet be accepted as the tentative requirement.

Symptoms of Deficiency Foxes on a purified diet deficient in niacin show anorexia, loss of body weight, and typical black-tongue, which is characterized by severe inflammation of the gums and fiery redness of the lips, tongue, and gums. If the animals are not

treated with niacin, they develop severe diarrhea, pass into a coma, and die (Hodson and Loosli, 1942; Schaefer *et al.*, 1947*b*).

PANTOTHENIC ACID

Schaefer *et al.* (1947*b*) have suggested that a fox requires between 2.5 and 15.0 mg of pantothenic acid per kg of diet. Until further information is available, it is suggested that the tentative requirement be 8.0 mg per kg of dry diet.

Symptoms of Deficiency Symptoms of deficiency include cessation of growth, and coma (Schaefer *et al.*, 1947*b*). Death is sudden. Necropsies reveal gross fatty degeneration of the liver, catarrhal enteritis, and cloudy swelling and congestion of the kidneys.

PYRIDOXINE

A level of 2.0 mg of pyridoxine per kg of diet will prevent symptoms of deficiency in foxes (Schaefer *et al.*, 1947*b*). In the absence of more critical information, it is suggested that 2.0 mg per kg of dry diet be accepted as the tentative requirement.

Symptoms of Deficiency A pyridoxine deficiency results in anorexia, cessation of growth, and a decrease in hemoglobin (Schaefer *et al.*, 1947*b*).

RIBOFLAVIN

Experiments designed to show the importance of some of the B-complex vitamins in nutrition of foxes indicate that the minimum and maximum levels of riboflavin for pups are greater than 1.25 and less than 4.0 mg per kg of diet (Schaefer *et al.*, 1947*b*). In other experiments, a basal ration calculated to contain 1.3 to 1.6 mg per kg produced riboflavin deficiency in the blue fox (Rimeslatten, 1958).

The latter experiments are the basis for concluding that the riboflavin requirement of the blue fox is related to the energy content of the diet. The requirement per 100 kcal of metabolizable energy is at least 0.1 mg for larger pups and 0.15 mg during pregnancy and lactation. On this basis, a diet with 2,645 kcal of metabolizable energy per kg should contain 2.6 mg per kg for growth and 4.0 mg per kg of dry feed for pregnancy and lactation.

Symptoms of Deficiency Riboflavin deficiency in foxes results in a decreased rate of growth within 2 weeks after the animals are placed on a deficient diet (Schaefer *et al.*, 1947*b*). After 3 or 4 weeks, symptoms of muscular weakness, chronic spasms, and coma occur. When riboflavin is administered, animals will recover within a few hours. If foxes are further maintained on the deficient diet, opacity of the cornea and a decrease in pigment production in the fur are noted.

As shown by more-recent experiments (Rimeslatten, 1958), riboflavin deficiency will develop in litters of blue foxes fed a fish-meal diet. Additions of B-complex vitamins to the diet relieve the deficiency symptoms. When riboflavin is omitted, pups on the diet develop fatty dermatitis and become much paler (sometimes nearly white) in 5 to 7 weeks (Figure 13). Part or all of the hair falls out, the eye lenses become opaque, and muscular weaknesses develop. When a B-complex vitamin supplement containing riboflavin is fed, both dermatitis and muscular control improve in a few days. In 1 to 2 weeks, a new pigmented pelt begins to develop. The omission of B-complex vitamins other than riboflavin from the supplement produces no harmful effects.

THIAMINE

The minimum requirement of mature foxes for thiamine hydrochloride is 800 μg per kg of dry feed

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Figure 13
Riboflavin deficiency. *Right:* after 7 weeks on a diet deficient in riboflavin, 12-week-old blue fox showed depigmentation, shedding of fur, and dermatitis. *Left:* littermate was fed the same diet supplemented with riboflavin.

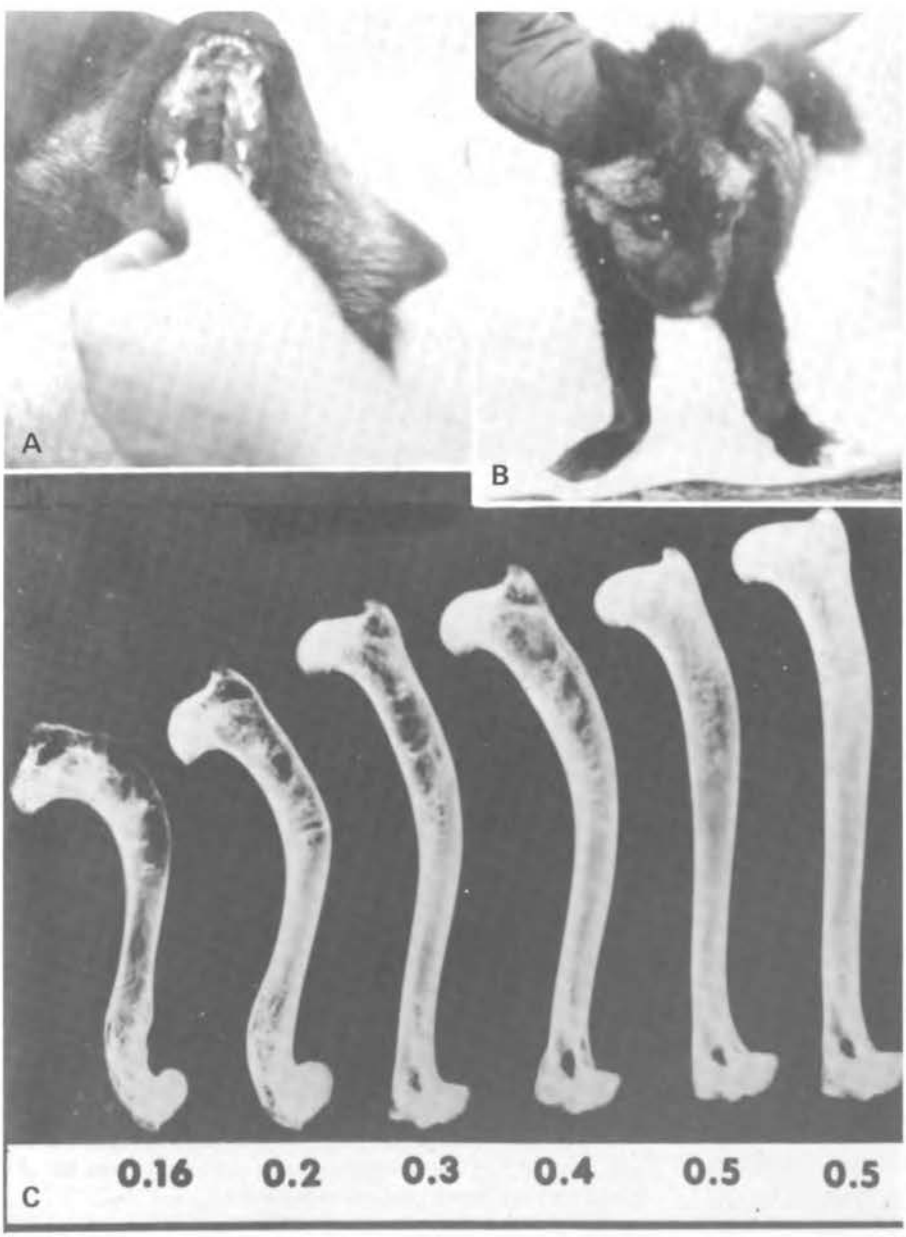
when the fat content is about 10 percent or 1,000 μg per kg of carbohydrate plus protein (Harris and Loosli, 1949). Kringstad and Lunde (1940) found that 0.2 mg of thiamine per animal per day is sufficient to prevent deficiency symptoms.

When whole carp is fed to foxes at a level of 20 percent of the wet diet, 5 to 10 mg of thiamine hydrochloride per animal per day are required to prevent Chastek paralysis (Green *et al.*, 1941).

The minimum level of thiamine suggested for practical feeding of foxes is 1.0 mg per kg of dry feed or 1.25 mg per kg of carbohydrate plus protein.

It is suggested that 0.5 to 0.75 mg of thiamine hydrochloride in sterile distilled water be injected subcutaneously into each fox to cure thiamine deficiency and that subsequently the animals be given a diet containing the recommended amounts of thiamine (Harris and Loosli, 1949).

Symptoms of Deficiency Thiamine deficiency in foxes results in anorexia, weakness, convulsions, and paralysis (Ender and Helgebostad, 1939; Kringstad and Lunde, 1940). Convulsions may occur just before death, which usually comes 48 to 72 hours after the onset of neurological symptoms. In advanced stages of the disease, foxes moan as if in great pain. At autopsy, the liver usually exhibits severe degeneration. Bilateral vascular lesions (apparently identical with



L. E. Harris, Utah Univ.; B and C, C. F. Bassett, Cornell Univ.

Figure 14
Calcium deficiency. *A:* large upper jaw and loose teeth resulting from a diet containing 0.16 percent calcium on a dry basis. *B:* swelling of maxilla and palatine bones and malformed leg bones resulting from a diet containing 0.16 percent calcium on a dry basis. *C:* each of these bones is a right humerus taken from a female fox. The bone on the right was taken from a fox that received 0.5 percent calcium in its diet, plus sunshine. The others are from foxes kept in the shade and fed (left to right) 0.16, 0.2, 0.3, 0.4, and 0.5 percent calcium in the dry diet.

those of Wernicke's disease in man), found principally in the paraventricular gray matter of the brain, are useful in diagnosing the disease.

Chastek paralysis is a deficiency disease of foxes. It occurs when certain types of raw fish (see Table 10) are included in the diet (Green *et al.*, 1941). These fish contain the enzyme thiaminase. When they are included in a mixed ration, the enzyme destroys the thiamine in the ration. The disease can be prevented or cured by feeding or injecting thiamine. Cooking the fish destroys the thiaminase and renders them safe.

VITAMIN B_{12}

No experiments to estimate vitamin B_{12} requirements of foxes have been reported. Practical diets for foxes usually contain sufficient amounts of animal protein. Such diets and additional vitamin B_{12} from intestinal synthesis should provide an adequate supply of this vitamin.

Minerals

CALCIUM AND PHOSPHORUS

The calcium requirement of the growing fox 7 to 37 weeks of age is between 0.5 and 0.6 percent in the dry diet (Harris *et al.*, 1945; Harris *et al.*, 1951*b*).

The ratio between calcium and phosphorus is important in the nutrition of foxes (Harris *et al.*, 1951*b*). A calcium-to-phosphorus ratio ranging from 1.0:1.0 to 1.7:1.0 appears to be satisfactory. Ratios outside this range may result in improper growth of bone, even when the ration contains large amounts of vitamin D.

Symptoms of Deficiency Fox pups on a rachitogenic diet develop a stiffness of the rear legs and begin walking on their pasterns rather than on their toes (Smith and Barnes, 1941). Their leg joints swell, and the leg bones become bent and crooked. The ash content of the dry, fat-free ulnas decreases from a normal of 62 to 67 percent to 36 to 47 percent. The long bones become soft and vascular. Serum calcium falls from 10.8 to 11.8 mg per 100 ml to 7.1 to 9.0 mg after 8 weeks on the rachitogenic diet.

Later work (Harris *et al.*, 1945) supplies evidence that calcium-deficient foxes show, progressively, lameness, recurrent spasms, crooked legs, and enlargement of the cranial bones, especially the maxillae and palatines (Figure 14). The muzzle becomes enlarged; the gums become swollen, and the teeth become loose.

Foxes on low phosphorus diets reveal symptoms of lameness, crooked legs, enlarged joints, and a mineral poverty of the bones, shown by X ray (Harris *et al.*, 1951*b*). Occasionally, an animal develops an undershot jaw.

SODIUM AND CHLORINE (SALT)

There are no data on the requirements of foxes for sodium and chlorine. However, the requirements are met by fortifying the dry diet with 0.5 percent salt.

COMPOSITION OF FEEDS

Table 8 shows the composition of feeds commonly used in mink and fox diets.* It also shows values for gross energy (GE), mineral, vitamin, and amino acid content of feeds.

More comprehensive feed-composition tables may be consulted in *United States–Canadian Tables of Feed Composition.*†

In Table 8 and in Publication 1684, names of the feeds are based on a scheme proposed by Harris (1963). The names, called NRC names, are designed to give, to the extent that the information is available and pertinent, a qualitative description of each product. A complete NRC name consists of as many as eight components, written in linear form, with the components separated by commas. The components are:

- Origin (or parent material)
- Species, variety, or kind
- Part eaten
- Process(es) and treatment(s) to which product has been subjected
- Stage of maturity
- Cutting or crop
- Grade or quality designations
- Classification

Feeds of the same origin (and of the same species, variety, or kind, if one of these is stated) have been grouped into eight classes, each of which is designated by a number in parentheses. The numbers and the classes they designate are as follows:

(1) Dry forages or dry roughages
(2) Pasture, range plants, and green soiling crops
(3) Silages
(4) Energy feeds
(5) Protein supplements
(6) Minerals
(7) Vitamins
(8) Additives

In the NRC nomenclature, feeds that in the dry state contain on the average more than 18 percent of crude fiber are classified as forages and roughages. Products that contain 20 percent or more of protein are classified as protein supplements. Products with less than 20 percent of protein are classified as energy feeds. (These guidelines are approximate, and there is some overlapping.) The feeds are classified in this way because each class has certain properties that are considered in balancing a ration. Fruits, nuts, and roots are classified as energy feeds because most of the by-product feeds from these subclasses furnish, primarily, energy to the animal.

The scientific name precedes each group of feeds with the same scientific name. The use of the scientific name makes it possible to recognize the feeds on an international basis.

Abbreviations have been devised for many of the

* This table was prepared by E. W. Crampton and L. E. Harris, Subcommittee on Feed Composition, Committee on Animal Nutrition, National Research Council.

† *United States–Canadian Tables of Feed Composition,* NAS Publication 1684, National Academy of Sciences–National Research Council, Washington, D.C. This is a supplement to the NAS-NRC series of reports on nutrient requirements of domestic animals. For each class of animals (e.g., mink or foxes), it lists more feeds than are listed in the individual report for that class. It includes data on proximate composition of feeds; values for gross energy, apparent digestible energy, metabolizable energy, and total digestible nutrients; and data on mineral, vitamin, and amino acid content.

terms in the NRC system (Table 9). This was done to make the names fit printing and punch-card space requirements.

Three feeds—dehydrated alfalfa meal, whole raw rockfish, and ground oat groats—are shown in the following listings by way of illustration.

Components of Name	*Feed No. 1*	*Feed No. 2*	*Feed No. 3*
Origin (or parent material)	Alfalfa	Fish	Oats
Species, variety, or kind	Ranger	rockfish	—
Part eaten	aerial pt	whole	groats
Process(es) and treatment(s) to which product has been subjected	dehy	raw	grnd cooked
Stage of maturity	early blm	—	—
Cutting or crop	cut 1	—	—
Grade or quality designations	mn 17 prot mx 17 fbr	—	—
Classification	(1) (dry forages)	(5) (protein supplements)	(4) (energy feeds)

Thus, the NRC names of the three feeds are written as follows:

No. 1: Alfalfa, Ranger, aerial pt, dehy, early blm, cut 1, mn 17 prot mx 27 fbr, (1)
No. 2: Fish, rockfish, whole, raw, (5)
No. 3: Oats, groats, grnd cooked, (4)

The preceding examples illustrate the principle that an NRC feed name consists of components that are applicable to the feed; inapplicable components are omitted.

To locate the NRC name of a feed, its origin (the name of the parent material), and usually the variety or kind must be known. The first word of each NRC name is the name of the parent material. For feeds of vegetable origin, the origin term is the name of the plant (e.g., alfalfa, barley, oats), not the word "plant."

For feeds of animal or bird origin, the origin term is the name of the animal or bird (e.g., cattle, horse, whale, crab, chicken, turkey). For feeds of fish origin, "Fish" is the origin term, and the species or variety follows (e.g., Fish, cod; Fish, salmon).

When the specific origin of a nonvegetable feed is not known, the origin is stated as "animal," "poultry," or "fish."

A reader who is uncertain about the origin term that introduces an NRC name in Table 8 may find the term by referring to the common name of the feed in which he is interested. Common names appear in the table in their alphabetical place. Thus, in the "H" listings, one finds "Hominy feed—see Corn, grits by-prod"; in the "M" listings, "Molasses—see Beet, sugar, molasses; see Sugarcane, molasses"; and in the "T" listings, "Tankage—see Animal, carcass res w blood; see Animal-Poultry carcass res mx 35 blood."

How names that have the same origin term are alphabetized depends on whether the names include references to species, variety, or kind. Names that lack such references are arranged as follows: (1) by origin; (2) within origin, by classes; (3) within a class, by parts eaten. Those that include such references are alphabetized as follows: (1) by origin and species; (2) within origin and species, by classes; (3) within a class, by parts eaten. Names that lack references to species, variety, or kind are listed before names that include them.

Many feeds have names that were given to them by the Association of American Feed Control Officials (AAFCO), the Canada Feed Act (CFA), or the Canada Grain Act (CGA). In addition, some feeds have regional or local names. These names are in alphabetical order and are cross-referenced to the NRC names; they are also listed under the NRC names. Thus, one may wish to know the composition of "Oat middlings." The "Oat middlings" entry will direct him to the NRC name, where he will find that "Oat middlings" is a CFA name and that the product also has an AAFCO name, "Feeding oat meal."

A 6-digit reference number is listed after the NRC name and other names. The number may be used as the "numerical name" of a feed when performing linear programming with electronic computers.

Analytical data are expressed in metric units and are on an "as-fed" as well as a "dry" basis. (See Table 11 for weight-unit conversion factors).

The coefficient of variation is shown where enough analyses are available to make the value meaningful. This value is useful in setting tolerance limits.

International standards for vitamin A and carotene are stated on page 12.

The vitamin A equivalent for carotene was calculated by assuming that 0.6 μg of β-carotene = 1 IU of vitamin A.

Because foxes do not convert carotene to vitamin A in the same ratio as rats, it is suggested that one of the following conversion rates be used:

1 mg of carotene = 278 IU vitamin A

or

1 IU of vitamin A = 6.0 IU carotene.

Mink do not utilize carotene.

Despite the care that has gone into the preparation of Table 8, it is realized that individual lots of feed may vary widely from indicated averages because of variations in animal and crop variety, storage conditions, nutritive level of the animals used in producing by-product feeds, and climate and soil in the locality where the feed was produced. Therefore, the values given are subject to interpretation and often should be considered along with more-specific information about the feed to be used. In some situations, it is desirable to have the feed analyzed for critical nutrients before mixing it in the diet.

CONCLUDING STATEMENTS

Data on the nutrient requirements of mink and foxes are limited. More research should be undertaken, particularly on the reproduction and lactation requirements.

Data are needed on food intake (on both a dry and a wet basis), on body weights at various stages of development, and on energy requirements based on kcal per kg of dry diet.

Because of the great difference in the growth rates of males and females, sex should be considered in working out nutrient requirements.

Mink and foxes are fed varying amounts of fat. The amount influences the energy concentration in the diet. When the energy concentration is increased, other nutrients should probably be increased also. It is suggested that research be initiated to determine requirements on the basis of nutrient-to-calorie ratio. Requirements could be expressed as amounts of nutrients (g of protein, mg of calcium, mg of riboflavin, and so on) per 1,000 kcal of metabolizable energy.

The supply of fresh meat, fresh-meat by-products, and fish commonly used in the diets of fur animals is becoming scarce and expensive. Fur farmers are, therefore, encouraged to use minimum amounts of fresh meat in animal diets.

Research to develop a dry diet for mink should be supported. Until such a diet is developed, use of by-products from fish, slaughterhouses, and poultry-processing plants is advised.

TABLE 1 Nutrient Requirements of Mink: Percentage of Dietary Dry Matter or Amount per Kilogram of Dry Matter Fed

Nutrient		Growth (weaning to pelting)	Maintenance (mature)	Pregnancy	Lactation
Energy	kcal GE	5,300.0	4,250.0	5,300.0	[a]
Protein	%	25.0	?	?	?
Fat-soluble vitamins					
Vitamin A	IU	3,500.0	?	?	?
Vitamin E	mg	25.0	?	?	?
Water-soluble vitamins					
Folic acid	mg	.5	?	?	?
Niacin	mg	20.0	?	?	?
Pantothenic acid	mg	6.0	?	?	?
Pyridoxine	mg	1.1	?	?	?
Riboflavin	mg	1.5	?	?	?
Thiamine	mg	1.2	1.1	?	?
Minerals					
Calcium	%	.4	.3	.4	.6
Phosphorus	%	.4	.3	.4	.6
Ca:P ratio		1:1 to 2:1	1:1 to 2:1	1:1 to 2:1	1:1 to 2:1
Salt	%	.5	.5	.5	.5

[a] Energy requirements for lactation increase sharply with number of young produced and growth of the young. The recommended level for growth may be taken as basal and increased according to the criteria stated here.

TABLE 2 Nutrient Requirements of Foxes: Percentage of Dietary Dry Matter or Amount per Kilogram of Dry Matter Fed

Nutrient		Growth		Maintenance	Pregnancy	Lactation
		7 to 23 Weeks	23 Weeks to Maturity			
Energy	kcal GE	?	?	3,227.0	?	?
Protein	%	25.0	19.0	?	?	?
Fat-soluble vitamins						
Vitamin A	IU	2,410.0	2,410.0	?	?	?
Water-soluble vitamins						
Folic acid	mg	.2	.2	?	?	?
Niacin	mg	10.0	10.0	?	?	?
Pantothenic acid	mg	8.0	8.0	?	?	?
Pyridoxine	mg	2.0	2.0	?	?	?
Riboflavin	mg	2.6	2.6	?	4.0	4.0
Thiamine	mg	1.0	1.0	1.0	.5	?
Minerals						
Calcium	%	.6	.6	.6	?	?
Phosphorus	%	.6	.6	.4	?	?
Ca:P ratio		1.0:1.0 to 1.7:1.0	1.0:1.0 to 1.7:1.0	1.0:1.0 to 1.7:1.0	?	?
Salt	%	.5	.5	.5	.5	.5

TABLE 3 Daily Nutrient Requirements for Growth of Mink

Nutrient		Age (weeks) 7	9	11	13	16	19	22	25	28	31
FOR ONE DARK MALE											
Body weight	g	690.0	940.0	1,150.0	1,320.0	1,570.0	1,760.0	1,880.0	1,960.0	2,020.0	2,070.0
Total daily dry feed	g	37.0	60.0	78.0	91.0	104.0	104.0	98.0	87.0	78.0	75.0
Total daily wet feed[a]	g	112.0	182.0	236.0	276.0	315.0	315.0	297.0	264.0	236.0	227.0
Protein	g	9.0	15.0	20.0	23.0	26.0	26.0	24.0	22.0	20.0	19.0
Fat-soluble vitamins											
Vitamin A	IU	130.0	210.0	273.0	318.0	364.0	364.0	343.0	304.0	273.0	262.0
Vitamin E	mg	.9	1.5	2.0	2.3	2.6	2.6	2.4	2.2	2.0	1.9
Water-soluble vitamins											
Folic acid	mg	.019	.030	.039	.046	.052	.052	0.049	.044	.039	.038
Riboflavin	mg	.06	.09	.12	.14	.16	.16	.15	.13	.12	.11
Thiamine	mg	.044	.072	.094	.109	.125	.125	.118	.104	.094	.090
Niacin	mg	.74	1.20	1.56	1.82	2.08	2.08	1.96	1.74	1.56	1.50
Pantothenic acid	mg	.22	.36	.47	.55	.62	.62	.59	.52	.47	.45
Pyridoxine	mg	.041	.066	.086	.100	.114	.114	.108	.096	.086	.082
Minerals											
Calcium	mg	148.0	240.0	312.0	364.0	416.0	416.0	392.0	348.0	312.0	300.0
Phosphorus	mg	148.0	240.0	312.0	364.0	416.0	416.0	392.0	348.0	312.0	300.0
FOR ONE DARK FEMALE											
Body weight	g	560.0	700.0	805.0	880.0	990.0	1,060.0	1,110.0	1,130.0	1,130.0	1,110.0
Total daily dry feed	g	32.0	52.0	68.0	79.0	86.0	84.0	78.0	71.0	64.0	60.0
Total daily wet feed[a]	g	97.0	158.0	206.0	239.0	261.0	255.0	236.0	215.0	194.0	182.0
Protein	g	8.0	13.0	17.0	20.0	22.0	21.0	20.0	18.0	16.0	15.0
Fat-soluble vitamins											
Vitamin A	IU	112.0	182.0	238.0	276.0	301.0	294.0	273.0	248.0	224.0	210.0
Vitamin E	mg	.8	1.3	1.7	2.0	2.2	2.1	2.0	1.8	1.6	1.5
Water-soluble vitamins											
Folic acid	mg	.016	.026	.034	.040	.043	.042	.039	.036	.032	.030
Riboflavin	mg	.05	.08	.10	.12	.13	.13	.12	.11	.10	.09
Thiamine	mg	.038	.062	.082	.095	.103	.101	.094	.085	.077	.072
Niacin	mg	.64	1.04	1.36	1.58	1.72	1.68	1.56	1.42	1.28	1.20
Pantothenic acid	mg	.19	.31	.41	.47	.52	.50	.47	.43	.38	.36
Pyridoxine	mg	.035	.057	.075	.087	.095	.092	.086	.078	.070	.066
Minerals											
Calcium	mg	128.0	208.0	272.0	316.0	344.0	336.0	312.0	284.0	256.0	240.0
Phosphorus	mg	128.0	208.0	272.0	316.0	344.0	336.0	312.0	284.0	256.0	240.0

[a] Calculated on the basis of 33% dry matter.

TABLE 4 Daily Nutrient Requirements for Growth of Foxes

Nutrient		Age (weeks) 7	11	15	19	23	27	31	35
FOR ONE MALE									
Body weight	kg	1.4	2.3	3.3	4.1	4.7	5.2	5.4	5.7
Total daily dry feed	g	59.0	168.0	195.0	213.0	195.0	172.0	159.0	150.0
Total daily wet feed	g	179.0	509.0	591.0	645.0	591.0	521.0	482.0	455.0
Protein	g	15.0	42.0	49.0	53.0	37.0	33.0	30.0	28.0
Fat-soluble vitamins									
Vitamin A	IU	142.0	405.0	470.0	513.0	470.0	415.0	383.0	362.0
Water-soluble vitamins									
Folic acid	mg	.012	.034	.039	.043	.039	.034	.032	0.30
Niacin	mg	.59	1.68	1.95	2.13	1.95	1.72	1.59	1.50
Pantothenic acid	mg	.47	1.34	1.56	1.70	1.56	1.38	1.27	1.20
Pyridoxine	mg	.11	.34	.39	.43	.39	.34	.32	.30
Riboflavin	mg	.15	.44	.51	.55	.51	.45	.41	.39
Thiamine	mg	.06	.17	.20	.21	.20	.17	.16	.15
Minerals									
Calcium	g	.35	1.01	1.17	1.28	1.17	1.03	.95	.90
Phosphorus	g	.35	1.01	1.17	1.28	1.17	1.03	.95	.90
FOR ONE FEMALE									
Body weight	kg	1.3	2.2	3.0	3.7	4.2	4.4	4.6	4.7
Total daily dry feed	g	36.0	136.0	163.0	168.0	154.0	136.0	127.0	118.0
Total daily wet feed	g	79.0	412.0	494.0	509.0	467.0	412.0	385.0	358.0
Protein	g	9.0	34.0	41.0	42.0	29.0	26.0	24.0	22.0
Fat-soluble vitamins									
Vitamin A	IU	87.0	328.0	393.0	405.0	371.0	328.0	306.0	284.0
Water-soluble vitamins									
Folic acid	mg	.007	.027	.033	.034	.031	.027	.025	.024
Niacin	mg	.36	1.36	1.63	1.68	1.54	1.36	1.27	1.18
Pantothenic acid	mg	.29	1.09	1.30	1.34	1.23	1.09	1.02	.94
Pyridoxine	mg	.07	.27	.33	.34	.31	.27	.25	.24
Riboflavin	mg	.09	.35	.42	.44	.40	.35	.33	.31
Thiamine	mg	.04	.14	.16	.17	.15	.14	.13	.12
Minerals									
Calcium	g	.22	.82	.98	1.01	.92	.82	.76	.71
Phosphorus	g	.22	.82	.98	1.01	.92	.82	.76	.71

TABLE 5 Formulas for Calculating Diets and Feed Mixtures and for Adjusting Moisture Content

FROM DRY TO AS-FED

To be used in converting the amounts of ingredients of a dry diet to a wet diet having a given percent of dry matter.[a]

Formula 1

$$\text{Parts of ingredient in wet diet} = \frac{\%\text{ ingredient in dry diet} \times \%\text{ dry matter wanted in diet}}{\%\text{ dry matter in ingredient}}$$

Total the parts and add enough water to make 100 parts (or 100%)

FROM WET TO DRY

To be used in calculating the amount of an ingredient that should be contained in a dry diet if the amount required in a wet diet having a given percent of dry matter is known.

Formula 2

$$\%\text{ of ingredient in wet diet} = \frac{\%\text{ ingredient in wet diet}}{\%\text{ dry matter wanted in diet}} \times \%\text{ dry matter in ingredient}$$

FROM WET TO DRY

To be used if the diet is on an as-fed basis and it is desired to change the amounts of the ingredients to a dry basis.

Formula 3

$$\text{Parts on wet basis} = \%\text{ ingredient in wet diet} \times \%\text{ dry matter of ingredient}$$

Perform this calculation for each ingredient; then add the products and divide each product by the sum of the products.

FROM WET TO DRY

To be used if the diet is on an as-fed basis and it is desired to compare the nutrient content of the diet with dry-basis requirements.

Formula 4

$$\%\text{ nutrient in dry diet (total)} = \frac{\%\text{ nutrient in wet diet (total)}}{\%\text{ dry matter in diet (total)}}$$

[a] The term "dry diet" means a diet calculated on a dry (moisture-free) basis; "as fed" means a diet calculated to contain the amount of dry matter as it is fed to the animal.

TABLE 6 Examples of Basic Formulas for Mink Diets, Weaning to Pelting[a]

Ingredient	Assumed Dry Matter (%)	Level of Ingredients in Diet (%)					
		Diet High in Fish		Diet High in Poultry		Diet High in Beef By-products	
		As Fed	Dry Basis	As Fed	Dry Basis	As Fed	Dry Basis
Fish (whole or cuttings)	31	50	34.6	10	7.3	10	7.1
Poultry offal	25	10	5.6	50	29.4	10	5.7
Cattle by-products (tripe, lips, lungs, udders, etc.)	28	10	6.2	10	6.6	50	32.1
Cattle liver	26	5	2.9	5	3.1	5	3.0
Cereal[b]	91	25	50.7	25	53.6	25	52.1
TOTAL		100	100.0	100	100.0	100	100.0

[a] Breeder rations are frequently modifications of those given here and are made by increasing the amount of beef liver, as fed, from 5 to 10% and by decreasing the amount of cereal from 10 to 5%.

[b] May consist of single, cooked, cereal-grain products, such as oat groats, or commercially prepared cereal mixtures.

TABLE 7 Examples of Basic Formulas for Fox Diets[a]

Feeds	Recommended Percentage of Feed in Diet, by Level of Protein Desired in Diet[b]			Recommended Maximum Percentage
	Level 1 (19% protein)	Level 2 (25% protein)	Level 3 (34% protein)	
ENERGY FEEDS				
Farm grains				
Rice, groats, polished, cooked, dehydrated	59.4		35.1	60.0
Wheat, grain, cooked, dehydrated		53.0		60.0
Oats, groats, cooked, dehydrated		21.5	22.0	50.0
Corn, grain, cooked, dehydrated				50.0
Potato tubers, cooked				50.0
By-products feeds				
Corn, cereal flakes				50.0
Rice, cereal flakes				50.0
Bakery refuse, dehydrated, ground	17.0			50.0
PROTEIN SUPPLEMENTS				
Animal proteins				
Horse meat, fresh	3.0	8.8	20.0	30.0
Cattle tripe, fresh		3.5		10.0
Animal carcass residue, dehydrated, ground (meat meal)	8.3		8.0	10.0
Cattle lungs, fresh	3.0			10.0
Cattle blood, fresh				5.0
Plant proteins				
Soybeans, solvent-extracted, ground			2.0	10.0
Peanuts, solvent-extracted, ground				10.0
Cottonseed, without hulls, solvent-extracted, ground				5.0
MINERAL SUPPLEMENTS				
Salt	.5	.5	.5	.8[c]
Animal bone, steamed, dehydrated, ground	.5			3.0
Animal bone, fresh				5.0
Limestone, ground		1.5	.5	1.5
VITAMIN SUPPLEMENTS				
Alfalfa leaves, sun-cured, ground	2.8	2.8	2.0	3.0
Animal liver, fresh	1.5	4.4	7.0	7.0[d]
Wheat germ, ground				2.0
Yeast, brewers, dehydrated, ground	2.0	2.0	1.0	3.0[e]
Cod liver oil	.6	.6	.6	.8[f]
Vegetables				
Tomato, fruit, fresh	.6	.6	.6	1.5
Carrot roots, fresh	.8	.8	.7	2.0
Lettuce, aerial part, fresh				2.0

[a] These formulas have been calculated to meet the basic requirements stated in Table 2. They may be suitable only where other factors, such as economy and availability of ingredients, are favorable. All figures are on a moisture-free basis.

[b] The significance of these levels is explained in the text (page 11).

[c] Recommended minimum: 0.3%.

[d] Recommended minimum: 1.5%.

[e] Recommended minimum: 0.5%.

[f] Recommended minimum: 0.3%.

TABLE 8 Composition of Feeds Commonly Used in Mink and Fox Rations[a]

ALFALFA. Medicago sativa

Alfalfa, aerial pt, dehy grnd, mn 17 prot, (1)

Ref no 1-00-023

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Dry matter	%	93.0	100.0	
Ash	%	9.0	9.7	
Crude fiber	%	24.3	26.1	
Ether extract	%	3.0	3.2	
N-free extract	%	38.9	41.8	
Protein (N x 6.25)	%	17.9	19.2	
Calcium	%	1.33	1.43	
Chlorine	%	.46	.49	
Iron	%	.046	.049	
Magnesium	%	.29	.31	
Phosphorus	%	.24	.26	
Potassium	%	2.49	2.68	
Sodium	%	.09	.10	
Cobalt	mg/kg	.360	.390	
Copper	mg/kg	9.9	10.6	
Iodine	mg/kg	.150	.161	
Manganese	mg/kg	29.0	31.2	
Selenium	mg/kg	.600	.645	
Zinc	mg/kg	16.0	17.2	
Carotene	mg/kg	161.2	173.3	
Choline	mg/kg	1518.	1632.	
Folic acid	mg/kg	2.10	2.26	
Niacin	mg/kg	45.8	49.2	
Pantothenic acid	mg/kg	30.0	32.2	
Riboflavin	mg/kg	12.3	13.2	
Thiamine	mg/kg	3.5	3.8	
α-tocopherol	mg/kg	128.0	137.6	
Vitamin B_6	mg/kg	6.30	6.77	
Vitamin K	mg/kg	8.70	9.35	
Vitamin A equiv	IU/g	268.7	288.9	
Alanine	%	.90	.97	
Arginine	%	.70	.75	
Aspartic acid	%	1.90	2.04	
Glutamic acid	%	1.70	1.83	
Glycine	%	.90	.97	
Histidine	%	.40	.43	
Isoleucine	%	.70	.75	
Leucine	%	1.30	1.40	
Lysine	%	.80	.86	
Methionine	%	.20	.22	
Phenylalanine	%	.80	.86	
Proline	%	.90	.97	
Serine	%	.70	.75	
Threonine	%	.80	.86	
Tryptophan	%	.40	.43	
Tyrosine	%	.50	.54	
Valine	%	.90	.97	

(1) dry forages and roughages
(2) pasture, range plants, and forages fed green

1

Alfalfa, aerial pt, dehy grnd, mn 20 prot, (1)

Ref no 1-00-024

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Dry matter	%	93.1	100.0	
Ash	%	10.3	11.1	
Crude fiber	%	20.2	21.7	
Ether extract	%	3.6	3.9	
N-free extract	%	38.4	41.2	
Protein (N x 6.25)	%	20.6	22.1	
Calcium	%	1.52	1.63	
Chlorine	%	.58	.62	
Iron	%	.040	.043	
Magnesium	%	.35	.38	
Phosphorus	%	.27	.29	
Potassium	%	2.52	2.71	
Sodium	%	.86	.92	
Cobalt	mg/kg	.320	.344	
Copper	mg/kg	10.6	11.4	
Iodine	mg/kg	.140	.150	
Manganese	mg/kg	34.0	36.5	
Selenium	mg/kg	.500	.537	
Zinc	mg/kg	18.0	19.3	
Carotene	mg/kg	216.4	232.4	
Choline	mg/kg	1618.	1738.	
Folic acid	mg/kg	2.67	2.87	
Niacin	mg/kg	54.7	58.7	
Pantothenic acid	mg/kg	32.8	35.2	
Riboflavin	mg/kg	15.5	16.6	
Thiamine	mg/kg	3.9	4.2	
α-tocopherol	mg/kg	147.0	157.9	
Vitamin B_6	mg/kg	7.90	8.48	
Vitamin K	mg/kg	14.70	15.79	
Vitamin A equiv	IU/g	360.7	387.4	
Alanine	%	1.10	1.18	
Arginine	%	.90	.97	
Aspartic acid	%	2.10	2.26	
Glutamic acid	%	2.10	2.26	
Glycine	%	1.00	1.07	
Histidine	%	.40	.43	
Isoleucine	%	.80	.86	
Leucine	%	1.50	1.61	
Lysine	%	.90	.97	
Methionine	%	.30	.32	
Phenylalanine	%	1.10	1.18	
Proline	%	1.00	1.07	
Serine	%	.90	.97	
Threonine	%	.90	.97	
Tryptophan	%	.50	.54	
Tyrosine	%	.70	.75	
Valine	%	.10	.11	

(3) silages
(4) energy feeds
(5) protein supplements

2

Alfalfa, hay, s-c grnd, (1)
Sun-cured alfalfa meal (AAFCO)
Ground alfalfa hay (AAFCO)

Ref no 1-00-111

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Dry matter	%	92.2	100.0	3
Ash	%	9.5	10.3	22
Crude fiber	%	25.8	28.0	15
Ether extract	%	2.3	2.5	31
N-free extract	%	37.8	41.0	
Protein (N x 6.25)	%	16.7	18.2	16
Cellulose	%	22.1	24.0	25
Lignin	%	9.8	10.7	
Energy	GE kcal/kg	4204.	4560.	
Swine	DE kcal/kg	1382.	1499.	
Swine	ME kcal/kg	1276.	1384.	
Swine	TDN %	31.	34.	
Calcium	%	1.24	1.35	42
Chlorine	%	.43	.47	33
Iron	%	.040	.050	56
Magnesium	%	.31	.34	68
Phosphorus	%	.28	.30	41
Potassium	%	2.27	2.46	8
Sodium	%	.18	.19	26
Cobalt	mg/kg	.220	.240	86
Copper	mg/kg	17.2	18.7	99
Manganese	mg/kg	42.9	46.5	99
Zinc	mg/kg	32.4	35.1	49
Carotene	mg/kg	96.3	104.5	92
Vitamin A equiv	IU/g	160.5	174.2	

ANIMAL. Scientific name not used

Animal, blood, spray dehy, (5)
Blood flour

Ref no 5-00-381

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Dry matter	%	91.0	100.0	2
Ash	%	4.8	5.3	43
Crude fiber	%	1.0	1.1	99
Ether extract	%	1.0	1.1	99
N-free extract	%	2.0	2.2	
Protein (N x 6.25)	%	82.2	90.3	5
Calcium	%	.45	.49	56
Iron	%	.300	.330	69
Magnesium	%	.04	.04	52
Phosphorus	%	.37	.41	39
Potassium	%	.41	.45	
Sodium	%	.33	.36	
Cobalt	mg/kg	.100	.100	99
Copper	mg/kg	8.1	8.9	52
Manganese	mg/kg	6.4	7.0	46
Choline	mg/kg	279.	307.	
Niacin	mg/kg	28.6	31.4	23
Pantothenic acid	mg/kg	5.3	5.8	58

Continued

(6) minerals
(7) vitamins
(8) additives

3

[a] For an explanation of this table, see page 18.

TABLE 8 Composition of Feeds Commonly Used in Mink and Fox Rations–Continued.

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Riboflavin	mg/kg	4.2	4.6	46
Thiamine	mg/kg	.4	.4	29
Arginine	%	3.30	3.63	8
Histidine	%	4.80	5.28	10
Isoleucine	%	1.10	1.21	19
Leucine	%	10.60	11.65	19
Lysine	%	8.20	9.01	11
Methionine	%	1.00	1.10	7
Phenylalanine	%	5.60	6.15	6
Threonine	%	3.60	3.96	7
Tryptophan	%	1.00	1.10	11
Tyrosine	%	2.00	2.20	15
Valine	%	7.20	7.91	7

Animal carcass res, dry-rend dehy grnd, mx 4.4 P, (5)
Meat meal (AAFCO)
Meat scrap

Ref no 5-00-385

Dry matter	%	93.5	100.0	2
Ash	%	25.2	27.0	22
Crude fiber	%	2.4	2.5	40
Ether extract	%	9.9	10.6	24
N-free extract	%	2.6	2.8	
Protein (N x 6.25)	%	53.4	57.1	6
Energy	GE kcal/kg	3181.	3402.	
Calcium	%	7.94	8.49	33
Chlorine	%	1.31	1.40	
Iron	%	.044	.047	43
Magnesium	%	.27	.29	
Phosphorus	%	4.03	4.31	43
Potassium	%	.55	.59	
Sodium	%	1.68	1.80	
Sulfur	%	.50	.53	
Cobalt	mg/kg	.128	.137	55
Copper	mg/kg	9.7	10.4	30
Manganese	mg/kg	9.5	10.2	51
Biotin	mg/kg	.09	.10	
Choline	mg/kg	1955.	2091.	33
Niacin	mg/kg	56.9	60.8	20
Pantothenic acid	mg/kg	4.8	5.1	41
Riboflavin	mg/kg	5.3	5.7	42
Thiamine	mg/kg	.2	.2	
Vitamin B_{12}	mcg/kg	51.1	54.6	
Arginine	%	3.70	3.96	27
Cystine	%	.60	.64	35
Cysteine	%	.80	.86	
Glutamic acid	%	8.10	8.66	23
Glycine	%	2.20	2.35	
Histidine	%	1.10	1.18	35
Isoleucine	%	1.90	2.03	22
Leucine	%	3.50	3.74	17
Lysine	%	3.80	4.06	39
Methionine	%	.80	.86	25
Phenylalanine	%	1.90	2.03	23
Serine	%	2.10	2.24	
Threonine	%	1.80	1.92	14

Continued

(1) dry forages and roughages
(2) pasture, range plants, and forages fed green

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Tryptophan	%	.30	.32	25
Tyrosine	%	.90	.96	20
Valine	%	2.60	2.78	17

Animal, carcass res w blood, dry- or wet-rend dehy grnd, mx 4.4 P, (5)
Meat meal tankage (AAFCO)
Digester tankage

Ref no 5-00-386

Dry matter	%	92.0	100.0	3
Ash	%	21.4	23.3	20
Crude fiber	%	2.0	2.2	63
Ether extract	%	8.1	8.8	29
N-free extract	%	.6	.7	
Protein (N x 6.25)	%	59.8	65.0	10
Lignin	%	3.0	3.3	
Calcium	%	5.94	6.46	36
Magnesium	%	.16	.17	
Phosphorus	%	3.17	3.45	24
Potassium	%	.56	.61	
Sodium	%	1.67	1.82	
Cobalt	mg/kg	.200	.200	53
Copper	mg/kg	38.7	42.1	33
Manganese	mg/kg	19.1	20.8	57
Choline	mg/kg	2169.	2358.	
Folic acid	mg/kg	1.50	1.60	
Niacin	mg/kg	39.2	42.6	20
Pantothenic acid	mg/kg	2.4	2.6	32
Riboflavin	mg/kg	2.4	2.6	61
Arginine	%	3.60	3.91	23
Histidine	%	1.90	2.07	42
Isoleucine	%	1.90	2.07	40
Leucine	%	5.10	5.54	25
Lysine	%	4.00	4.35	23
Methionine	%	.80	.87	11
Phenylalanine	%	2.70	2.93	37
Threonine	%	2.40	2.61	25
Tryptophan	%	.70	.76	34
Valine	%	4.20	4.57	29

Animal, carcass res w bone, dry-rend dehy grnd, mn 4.4 P, (5)
Meat and bone meal (AAFCO)
Meat and bone scrap

Ref no 5-00-388

Dry matter	%	94.0	100.0	2
Ash	%	29.1	31.0	15
Crude fiber	%	2.2	2.3	52
Ether extract	%	9.5	10.1	31
N-free extract	%	2.6	2.8	
Protein (N x 6.25)	%	50.6	53.8	6
Calcium	%	10.57	11.25	13
Chlorine	%	.35	.37	
Iron	%	.050	.053	

Continued

(3) silages
(4) energy feeds
(5) protein supplements

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Magnesium	%	1.13	1.20	
Phosphorus	%	5.07	5.39	20
Potassium	%	1.46	1.55	
Sodium	%	.73	.78	
Cobalt	mg/kg	.183	.195	
Copper	mg/kg	1.5	1.6	
Manganese	mg/kg	12.3	13.1	
Choline	mg/kg	2189.	2329.	30
Niacin	mg/kg	47.8	50.8	46
Pantothenic acid	mg/kg	3.7	3.9	30
Riboflavin	mg/kg	4.4	4.7	31
Thiamine	mg/kg	1.1	1.2	
Vitamin B_{12}	mcg/kg	44.8	47.7	
Arginine	%	4.00	4.26	18
Cystine	%	.60	.64	
Glutamic acid	%	11.00	11.70	
Glycine	%	6.60	7.02	
Histidine	%	.90	.96	36
Isoleucine	%	1.70	1.81	20
Leucine	%	3.10	3.30	6
Lysine	%	3.50	3.72	45
Methionine	%	.70	.74	11
Phenylalanine	%	1.80	1.92	19
Threonine	%	1.80	1.92	24
Tryptophan	%	.20	.21	25
Valine	%	2.40	2.55	30

Animal, bone, steamed dehy grnd, (6)
Bone meal, steamed (AAFCO)

Ref no 6-00-400

Dry matter	%	95.0	100.0	2
Ash	%	71.8	75.6	12
Crude fiber	%	2.0	2.1	58
Ether extract	%	3.2	3.4	94
Protein (N x 6.25)	%	12.1	12.7	53
Calcium	%	28.98	30.51	9
Iron	%	.084	.088	71
Magnesium	%	.64	.67	41
Phosphorus	%	13.59	14.31	14
Sodium	%	.46	.48	9
Cobalt	mg/kg	.100	.100	29
Copper	mg/kg	16.3	17.2	44
Manganese	mg/kg	30.4	32.0	66
Zinc	mg/kg	424.6	447.1	
Niacin	mg/kg	4.2	4.4	58
Pantothenic acid	mg/kg	2.4	2.5	53
Riboflavin	mg/kg	.9	.9	33
Thiamine	mg/kg	.4	.4	99

(6) minerals
(7) vitamins
(8) additives

TABLE 8 Composition of Feeds Commonly Used in Mink and Fox Rations—Continued.

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
ANIMAL—POULTRY. Scientific name not used				
Animal-poultry, fat, heat-rend, mn 90 fatty acids mx 2.5 unsaponifiable matter mx 1 insol matter, (4)				
Animal fat (AAFCO)				
Ref no 4-00-409				
Dry matter	%	99.5	100.0	
Ether extract	%	99.4	99.9	
Energy	GE kcal/kg	9450.	9497.	
Baking refuse - see Bread, dehy				
BARLEY. Hordeum vulgare				
Barley, grain, (4)				
Ref no 4-00-530				
Dry matter	%	89.0	100.0	3
Ash	%	2.4	2.7	60
Crude fiber	%	5.0	5.6	36
Ether extract	%	1.9	2.1	4
N-free extract	%	68.2	76.6	
Protein (N x 6.25)	%	11.6	13.0	15
Energy	GE kcal/kg	4084.	4589.	
Calcium	%	.08	.09	66
Iron	%	.005	.006	25
Magnesium	%	.12	.14	11
Phosphorus	%	.42	.47	13
Potassium	%	.56	.63	19
Sodium	%	.02	.02	
Cobalt	mg/kg	.100	.100	
Copper	mg/kg	7.6	8.6	62
Manganese	mg/kg	16.3	18.3	33
Zinc	mg/kg	15.3	17.2	
Biotin	mg/kg	.20	.20	99
Choline	mg/kg	1030.	1157.	
Folic acid	mg/kg	.50	.60	
Niacin	mg/kg	57.4	64.5	31
Pantothenic acid	mg/kg	6.5	7.3	26
Riboflavin	mg/kg	2.0	2.2	70
Thiamine	mg/kg	5.1	5.7	24
α-tocopherol	mg/kg	6.1	6.8	50
Vitamin B_6	mg/kg	2.90	3.30	99
Arginine	%	.53	.60	16
Cystine	%	.18	.20	20
Glycine	%	.36	.40	
Histidine	%	.27	.30	23
Isoleucine	%	.53	.60	22
Leucine	%	.80	.90	26
Lysine	%	.53	.60	45
Methionine	%	.18	.20	50
Phenylalanine	%	.62	.70	20

Continued

(1) dry forages and roughages
(2) pasture, range plants, and forages fed green

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Threonine	%	.36	.40	17
Tryptophan	%	.18	.20	35
Tyrosine	%	.36	.40	40
Valine	%	.62	.70	14
Barley, grain, Pacific coast, (4)				
Ref no 4-07-939				
Dry matter	%	89.0	100.0	
Ash	%	2.3	2.6	
Crude fiber	%	6.2	7.0	
Ether extract	%	2.2	2.5	
N-free extract	%	68.5	77.0	
Protein (N x 6.25)	%	9.7	10.9	
Calcium	%	.06	.07	
Phosphorus	%	.40	.45	
Choline	mg/kg	937.	1054.	
Niacin	mg/kg	44.1	49.6	
Pantothenic acid	mg/kg	7.3	8.2	
Riboflavin	mg/kg	1.3	1.5	
Thiamine	mg/kg	4.0	4.5	
Barley, malt sprouts w hulls, dehy, mn 24 prot, (5) Malt sprouts (AAFCO)				
Ref no 5-00-545				
Dry matter	%	93.0	100.0	2
Ash	%	6.4	6.9	8
Crude fiber	%	14.0	15.1	11
Ether extract	%	1.4	1.5	29
N-free extract	%	44.9	48.3	
Protein (N x 6.25)	%	26.2	28.2	7
Calcium	%	.22	.24	22
Magnesium	%	.18	.19	
Phosphorus	%	.73	.78	9
Potassium	%	.21	.23	
Manganese	mg/kg	31.7	34.1	34
Choline	mg/kg	1584.	1703.	
Folic acid	mg/kg	.20	.20	
Niacin	mg/kg	43.3	46.5	
Pantothenic acid	mg/kg	8.6	9.2	
Riboflavin	mg/kg	1.5	1.6	9
Thiamine	mg/kg	.7	.8	
Beef - see Cattle				

(3) silages
(4) energy feeds
(5) protein supplements

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
BEET, SUGAR. Beta saccharifera				
Beet, sugar, molasses, mn 48 invert sugar mn 79.5 degrees brix, (4)				
Beet molasses (AAFCO)				
Molasses (CFA)				
Ref no 4-00-668				
Dry matter	%	77.0	100.0	7
Ash	%	8.2	10.6	19
Ether extract	%	.2	.3	99
N-free extract	%	61.9	80.4	
Protein (N x 6.25)	%	6.7	8.7	35
Calcium	%	.16	.21	80
Iron	%	.010	.010	
Magnesium	%	.23	.30	
Phosphorus	%	.03	.04	89
Potassium	%	4.77	6.20	
Sodium	%	1.17	1.52	
Cobalt	mg/kg	.400	.500	
Copper	mg/kg	17.6	22.9	
Manganese	mg/kg	4.6	6.0	
Niacin	mg/kg	42.2	54.8	15
Pantothenic acid	mg/kg	4.6	6.0	
Riboflavin	mg/kg	2.4	3.1	
Beet, sugar, pulp, dehy, (4) Dried beet pulp (AAFCO)				
Dried beet pulp (CFA)				
Ref no 4-00-669				
Dry matter	%	91.0	100.0	4
Ash	%	3.6	3.9	28
Crude fiber	%	19.0	20.9	11
Ether extract	%	.6	.7	68
N-free extract	%	58.7	64.5	
Protein (N x 6.25)	%	9.1	10.0	10
Lignin	%	8.0	8.8	
Energy	GE kcal/kg	3837.	4217.	
Calcium	%	.68	.75	22
Iron	%	.030	.033	44
Magnesium	%	.27	.30	42
Phosphorus	%	.10	.11	27
Potassium	%	.21	.23	41
Cobalt	mg/kg	.100	.100	
Copper	mg/kg	12.5	13.7	29
Manganese	mg/kg	35.0	38.5	45
Zinc	mg/kg	.7	.8	
Choline	mg/kg	829.	912.	24
Niacin	mg/kg	16.3	17.9	55
Pantothenic acid	mg/kg	1.5	1.6	38
Riboflavin	mg/kg	.7	.8	51
Thiamine	mg/kg	.4	.4	38
Vitamin D_3	ICU/g	1.0	1.0	

Continued

(6) minerals
(7) vitamins
(8) additives

TABLE 8 Composition of Feeds Commonly Used in Mink and Fox Rations–Continued.

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Arginine	%	.30	.33	
Histidine	%	.20	.22	
Isoleucine	%	.30	.33	
Leucine	%	.60	.66	
Lysine	%	.60	.66	
Phenylalanine	%	.30	.33	
Threonine	%	.40	.44	
Tryptophan	%	.10	.11	
Tyrosine	%	.40	.44	
Valine	%	.40	.44	

Blood flour - see Animal blood, spray dehy

Bone - see Animal

Bran - see Wheat

BREAD. Scientific name not used

Bread, dehy, (4)

Ref no 4-07-944

Dry matter	%	95.0	100.0	
Ash	%	1.9	2.0	
Crude fiber	%	.5	.5	
Ether extract	%	1.0	1.1	
N-free extract	%	80.6	84.8	
Protein (N x 6.25)	%	11.0	11.6	
Calcium	%	.03	.03	
Phosphorus	%	.10	.10	

Brewers dried yeast - see Yeast, brewers

Buttermilk - see Cattle

CALCIUM PHOSPHATE, DIBASIC

Calcium phosphate, dibasic, comm, (6)
Dicalcium phosphate (AAFCO)

Ref no 6-01-080

Dry matter	%	96.0	100.0	
Calcium	%	22.20	23.13	
Phosphorus	%	17.90	18.65	
Fluorine	mg/kg	768.00	800.00	

Cane molasses - see Sugarcane

(1) dry forages and roughages
(2) pasture, range plants, and forages fed green

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %

Casein - see Cattle

CATTLE. Bos spp

Cattle, whey, dehy, mn 65 lactose, (4)
Dried whey (AAFCO)
Whey, dried

Ref no 4-01-182

Dry matter	%	94.0	100.0	3
Ash	%	9.7	10.3	16
Ether extract	%	.8	.9	84
N-free extract	%	69.6	74.1	
Protein (N x 6.25)	%	13.8	14.7	10
Calcium	%	.87	.93	31
Iron	%	.016	.017	5
Magnesium	%	.13	.14	
Phosphorus	%	.79	.84	19
Cobalt	mg/kg	.094	.100	51
Copper	mg/kg	43.1	45.9	44
Manganese	mg/kg	4.6	4.9	98
Biotin	mg/kg	.40	.40	41
Choline	mg/kg	20.	21.	25
Folic acid	mg/kg	.90	1.00	
Niacin	mg/kg	11.2	11.9	51
Pantothenic acid	mg/kg	47.7	50.8	29
Riboflavin	mg/kg	29.9	31.8	34
Thiamine	mg/kg	3.7	3.9	26
Arginine	%	.40	.43	18
Cystine	%	.30	.32	
Histidine	%	.20	.21	
Isoleucine	%	.90	.96	13
Leucine	%	1.40	1.49	29
Lysine	%	1.10	1.17	26
Methionine	%	.20	.21	34
Phenylalanine	%	.40	.43	10
Threonine	%	.80	.85	15
Tryptophan	%	.20	.21	36
Tyrosine	%	.30	.32	40
Valine	%	.70	.74	21

Cattle, buttermilk, dehy, feed gr mx 8 moisture mx 13 ash mn 5 fat, (5)
Dried buttermilk, feed grade (AAFCO)
Buttermilk, dried

Ref no 5-01-160

Dry matter	%	93.0	100.0	2
Ash	%	9.6	10.8	25
Ether extract	%	5.8	6.2	41
N-free extract	%	45.2	48.6	
Protein (N x 6.25)	%	32.0	34.4	7
Calcium	%	1.34	1.44	27
Magnesium	%	.48	.52	

Continued

(3) silages
(4) energy feeds
(5) protein supplements

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Phosphorus	%	.94	1.01	9
Potassium	%	.71	.76	
Sodium	%	.95	1.02	
Manganese	mg/kg	3.5	3.8	78
Biotin	mg/kg	.30	.30	26
Choline	mg/kg	1808.	1944.	35
Folic acid	mg/kg	.40	.40	
Niacin	mg/kg	8.6	9.2	57
Pantothenic acid	mg/kg	30.1	32.4	36
Riboflavin	mg/kg	31.0	33.3	31
Thiamine	mg/kg	3.5	3.8	18
Vitamin B_6	mg/kg	2.40	2.60	23
Arginine	%	1.10	1.18	
Histidine	%	.90	.97	
Isoleucine	%	2.70	2.90	
Leucine	%	3.40	3.66	
Lysine	%	2.40	2.58	
Methionine	%	.70	.75	
Phenylalanine	%	1.50	1.61	
Threonine	%	1.60	1.72	
Tryptophan	%	.50	.54	
Tyrosine	%	1.00	1.08	
Valine	%	2.80	3.01	

Cattle, casein, milk acid-precip dehy, mn 80 prot, (5)
Casein (AAFCO)
Casein, dried

Ref no 5-01-162

Dry matter	%	90.0	100.0	2
Ash	%	3.3	3.7	33
Ether extract	%	.5	.6	93
N-free extract	%	4.3	4.8	
Protein (N x 6.25)	%	81.8	90.9	5
Calcium	%	.61	.68	29
Phosphorus	%	.99	1.10	33
Manganese	mg/kg	4.4	4.9	12
Choline	mg/kg	209.	232.	
Folic acid	mg/kg	.40	.40	
Niacin	mg/kg	1.3	1.4	
Pantothenic acid	mg/kg	2.6	2.9	
Riboflavin	mg/kg	1.5	1.7	
Thiamine	mg/kg	.4	.4	
Vitamin B_6	mg/kg	.40	.50	
Arginine	%	3.40	3.78	8
Cystine	%	.30	.33	
Glycine	%	1.50	1.67	
Histidine	%	2.50	2.78	11
Isoleucine	%	5.70	6.33	15
Leucine	%	8.60	9.55	14
Lysine	%	7.00	7.78	11
Methionine	%	2.70	3.00	9
Phenylalanine	%	4.60	5.11	8
Threonine	%	3.80	4.22	11
Tryptophan	%	1.00	1.11	12
Tyrosine	%	4.70	5.22	16
Valine	%	6.80	7.55	9

(6) minerals
(7) vitamins
(8) additives

TABLE 8 Composition of Feeds Commonly Used in Mink and Fox Rations–Continued.

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Cattle, lips, raw, (5)				
Ref no 5-07-940				
Dry matter	%	30.0	100.0	
Ether extract	%	7.0	23.3	
Protein (N x 6.25)	%	18.0	60.0	
Cattle, liver, raw, (5) Beef liver				
Ref no 5-01-166				
Dry matter	%	26.0	100.0	
Crude fiber	%	.0	.0	
Ether extract	%	3.2	12.3	
Protein (N x 6.25)	%	17.3	66.7	
Calcium	%	.01	.04	
Phosphorus	%	.23	.88	
Cattle, lungs, raw, (5)				
Ref no 5-07-941				
Dry matter	%	20.0	100.0	
Ether extract	%	3.0	15.0	
Protein (N x 6.25)	%	16.0	80.0	
Cattle, milk, skim dehy, mx 8 moisture, (5) Dried skimmed milk, feed grade (AAFCO) Milk, skimmed, dried				
Ref no 5-01-175				
Dry matter	%	94.0	100.0	2
Ash	%	7.6	8.1	10
Crude fiber	%	.2	.2	90
Ether extract	%	.9	1.0	98
N-free extract	%	51.8	55.1	
Protein (N x 6.25)	%	33.5	35.6	5
Energy	GE kcal/kg	3456.	3677.	
Calcium	%	1.26	1.34	10
Iron	%	.005	.005	60
Magnesium	%	.11	.12	
Phosphorus	%	1.03	1.10	9
Potassium	%	1.67	1.78	
Cobalt	mg/kg	.110	.117	78
Copper	mg/kg	11.5	12.2	55
Manganese	mg/kg	2.2	2.3	58
Biotin	mg/kg	.33	.35	27
Choline	mg/kg	1426.	1517.	37
Folic acid	mg/kg	.62	.66	17
Niacin	mg/kg	11.5	12.2	26
Pantothenic acid	mg/kg	33.7	35.8	23
Riboflavin	mg/kg	20.1	21.4	28
Thiamine	mg/kg	3.5	3.7	50

Continued

(1) dry forages and roughages
(2) pasture, range plants, and forages fed green

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
α-tocopherol	mg/kg	9.2	9.8	
Vitamin B_6	mg/kg	3.97	4.22	14
Vitamin B_{12}	mcg/kg	41.9	44.6	
Vitamin D_2	IU/g	.4	.4	
Arginine	%	1.20	1.28	17
Cystine	%	.50	.53	
Glutamic acid	%	6.80	7.24	
Glycine	%	.20	.21	
Histidine	%	.90	.96	20
Isoleucine	%	2.30	2.45	19
Leucine	%	3.30	3.51	5
Lysine	%	2.80	2.98	5
Methionine	%	.80	.85	21
Phenylalanine	%	1.50	1.60	16
Threonine	%	1.40	1.49	8
Tryptophan	%	.40	.42	18
Tyrosine	%	1.30	1.38	31
Valine	%	2.20	2.34	4
Cattle, spleen, raw, (5) Cattle, melts, raw				
Ref no 5-07-942				
Dry matter	%	25.0	100.0	
Ether extract	%	4.0	16.0	
Protein (N x 6.25)	%	18.0	72.0	
Cattle, udders, raw, (5)				
Ref no 5-07-943				
Dry matter	%	25.0	100.0	
Ether extract	%	12.0	48.0	
Protein (N x 6.25)	%	12.0	48.0	
Chicken - see also Turkey				
CHICKEN. Gallus domesticus				
Chicken, broilers, whole, raw, (5)				
Ref no 5-07-945				
Dry matter	%	68.0	100.0	
Ether extract	%	7.8	11.5	
Protein (N x 6.25)	%	17.6	25.9	

(3) silages
(4) energy feeds
(5) protein supplements

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Chicken, cull hens, whole, raw, (5)				
Ref no 5-07-950				
Dry matter	%	70.0	100.0	
Ether extract	%	8.0	11.5	
Protein (N x 6.25)	%	18.1	25.9	
Chicken, day-old chicks, whole, raw, (5)				
Ref no 5-07-946				
Dry matter	%	24.4	100.0	
Crude fiber	%	.9	3.6	
Ether extract	%	5.7	23.5	
Protein (N x 6.25)	%	13.9	57.0	
Chicken, eggs w shells, raw, (5)				
Ref no 5-01-213				
Dry matter	%	34.1	100.0	
Ash	%	10.7	31.4	
Crude fiber	%	.0	.0	
Ether extract	%	10.6	31.1	
N-free extract	%	.0	.0	
Protein (N x 6.25)	%	12.8	37.5	
Calcium	%	1.50	4.40	
Chicken, feet, raw, (5)				
Ref no 5-07-947				
Dry matter	%	47.0	100.0	
Ether extract	%	11.0	23.4	
Protein (N x 6.25)	%	25.0	53.2	
Chicken, gizzards, raw, (5)				
Ref no 5-07-948				
Dry matter	%	69.0	100.0	
Ether extract	%	6.2	9.0	
Protein (N x 6.25)	%	20.3	29.4	
Chicken, heads, raw, (5)				
Ref no 5-07-949				
Dry matter	%	33.0	100.0	
Ether extract	%	6.0	18.2	
Protein (N x 6.25)	%	19.0	57.6	

(6) minerals
(7) vitamins
(8) additives

TABLE 8 Composition of Feeds Commonly Used in Mink and Fox Rations–Continued.

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Chicken, offal w feet, raw, (5)				
Ref no 5-07-951				
Dry matter	%	31.0	100.0	
Ether extract	%	12.9	41.6	
Protein (N x 6.25)	%	13.1	42.3	
Calcium	%	.82	2.64	
Phosphorus	%	.42	1.35	
Chicken, offal wo feet, raw, (5)				
Ref no 5-07-952				
Dry matter	%	27.0	100.0	
Crude fiber	%	.2	.7	
Ether extract	%	11.4	42.2	
Protein (N x 6.25)	%	11.8	43.7	
Calcium	%	.27	1.00	
Phosphorus	%	.19	.70	
CORN. Zea mays				
Corn, grain, flaked, (4)				
Flaked corn (AAFCO)				
Corn grain, flaked				
Ref no 4-02-859				
Dry matter	%	97.0	100.0	
Crude fiber	%	.4	.4	
Ether extract	%	.3	.3	
Protein (N x 6.25)	%	7.8	8.0	
Calcium	%	.01	.01	
Phosphorus	%	.04	.04	
Niacin	mg/kg	21.0	21.6	
Riboflavin	mg/kg	1.3	1.3	
Thiamine	mg/kg	4.1	4.2	
Corn grain- see Corn, dent yellow; see Corn, white				
Corn, distil grains w sol, dehy, mn 75 orig solids, (5)				
Corn distillers dried grains with solubles (AAFCO)				
Ref no 5-02-843				
Dry matter	%	92.0	100.0	2
Ash	%	2.6	2.8	24
Crude fiber	%	9.0	9.8	19
Ether extract	%	9.3	10.1	21
N-free extract	%	43.7	47.5	

Continued

(1) dry forages and roughages
(2) pasture, range plants, and forages fed green

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Protein (N x 6.25)	%	27.4	29.8	12
Lignin	%	6.0	6.5	
Energy	GE kcal/kg	4528.	4922.	
Calcium	%	.09	.10	27
Iron	%	.020	.020	47
Magnesium	%	.06	.07	36
Phosphorus	%	.37	.40	24
Potassium	%	.09	.10	49
Sodium	%	.90	.98	
Cobalt	mg/kg	.100	.100	
Copper	mg/kg	44.7	48.6	
Manganese	mg/kg	18.9	20.5	61
Biotin	mg/kg	.70	.80	60
Carotene	mg/kg	3.7	4.0	82
Choline	mg/kg	2471.	2686.	49
Niacin	mg/kg	66.9	72.7	21
Pantothenic acid	mg/kg	11.0	11.9	57
Riboflavin	mg/kg	8.6	9.3	39
Thiamine	mg/kg	2.9	3.2	52
Vitamin A equiv	IU/g	6.2	6.7	
Vitamin D_3	ICU/g	1.0	1.0	
Glycine	%	.50	.54	
Leucine	%	2.20	2.39	15
Lysine	%	.70	.76	14
Methionine	%	.50	.54	22
Phenylalanine	%	1.70	1.85	16
Threonine	%	1.00	1.09	
Tryptophan	%	.10	.11	36
Tyrosine	%	.60	.65	11
Valine	%	1.60	1.74	6
Corn, distil sol, dehy, (5)				
Corn distillers dried solubles (AAFCO)				
Ref no 5-02-844				
Dry matter	%	93.0	100.0	2
Ash	%	8.0	8.6	18
Crude fiber	%	4.0	4.3	74
Ether extract	%	9.1	9.8	68
N-free extract	%	45.0	48.4	
Protein (N x 6.25)	%	26.9	28.9	28
Lignin	%	2.0	2.2	
Calcium	%	.35	.38	34
Iron	%	.055	.059	30
Magnesium	%	.64	.69	19
Phosphorus	%	1.37	1.47	28
Potassium	%	1.74	1.87	5
Copper	mg/kg	82.7	88.9	4
Manganese	mg/kg	73.5	79.0	27
Biotin	mg/kg	1.50	1.60	56
Carotene	mg/kg	.7	.8	
Choline	mg/kg	4818.	5179.	28
Folic acid	mg/kg	1.10	1.20	
Niacin	mg/kg	115.3	123.9	20
Pantothenic acid	mg/kg	20.9	22.5	32
Riboflavin	mg/kg	16.9	18.2	41
Thiamine	mg/kg	6.8	7.3	53
Vitamin A equiv	IU/g	1.2	1.3	

Continued

(3) silages
(4) energy feeds
(5) protein supplements

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Cystine	%	.60	.65	
Glycine	%	1.10	1.18	
Leucine	%	2.10	2.26	46
Lysine	%	.90	.97	49
Methionine	%	.60	.65	
Phenylalanine	%	1.50	1.61	10
Threonine	%	1.00	1.07	20
Tryptophan	%	.20	.22	40
Tyrosine	%	.70	.75	34
Valine	%	1.50	1.61	11
Corn, germ wo sol, wet-mil solv-extd dehy grnd, (5)				
Corn germ meal, solvent extracted, (wet-milled) (AAFCO)				
Ref no 5-02-898				
Dry matter	%	93.0	100.0	
Crude fiber	%	12.0	12.9	
Ether extract	%	2.0	2.2	
Protein (N x 6.25)	%	18.0	19.4	
Calcium	%	.10	.11	
Phosphorus	%	.40	.43	
Choline	mg/kg	1800.	1936.	
Folic acid	mg/kg	.20	.21	
Niacin	mg/kg	35.1	37.7	
Pantothenic acid	mg/kg	4.1	4.4	
Riboflavin	mg/kg	4.1	4.4	
Thiamine	mg/kg	1.0	1.1	
Corn, gluten, wet-mil dehy, (5)				
Corn gluten meal (AAFCO)				
Corn gluten meal (CFA)				
Ref no 5-02-900				
Dry matter	%	91.0	100.0	2
Ash	%	2.4	2.6	34
Crude fiber	%	4.0	4.4	31
Ether extract	%	2.3	2.5	28
N-free extract	%	39.5	43.4	
Protein (N x 6.25)	%	42.9	47.1	7
Calcium	%	.16	.18	69
Iron	%	.040	.040	40
Magnesium	%	.05	.05	98
Phosphorus	%	.40	.44	33
Potassium	%	.03	.03	87
Sodium	%	.10	.10	
Cobalt	mg/kg	.100	.100	50
Copper	mg/kg	28.2	31.0	40
Manganese	mg/kg	7.3	8.0	52
Choline	mg/kg	330.	363.	23
Folic acid	mg/kg	.20	.20	
Niacin	mg/kg	49.9	54.8	21
Pantothenic acid	mg/kg	10.3	11.3	39
Riboflavin	mg/kg	1.5	1.6	53
Thiamine	mg/kg	.2	.2	97
Arginine	%	1.40	1.54	20

Continued

(6) minerals
(7) vitamins
(8) additives

TABLE 8 Composition of Feeds Commonly Used in Mink and Fox Rations–Continued.

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Cystine	%	.60	.66	
Glycine	%	1.50	1.65	
Histidine	%	1.00	1.10	
Isoleucine	%	2.30	2.53	
Leucine	%	7.60	8.35	
Lysine	%	.80	.88	10
Methionine	%	1.00	1.10	32
Phenylalanine	%	2.90	3.19	
Threonine	%	1.40	1.54	
Tryptophan	%	.20	.22	
Tyrosine	%	1.00	1.10	
Valine	%	2.20	2.42	

Corn, dent yellow, grain, grnd cooked, (4)

Ref no 4-07-953

Dry matter	%	88.0	100.0	
Crude fiber	%	2.1	2.4	
Ether extract	%	4.0	4.5	
Protein (N x 6.25)	%	9.2	10.5	
Calcium	%	.02	.02	
Phosphorus	%	.26	.30	

Corn, dent yellow, grain, (4)

Ref no 4-02-935

Dry matter	%	86.0	100.0	3
Ash	%	1.1	1.3	45
Crude fiber	%	2.0	2.3	23
Ether extract	%	3.8	4.4	99
N-free extract	%	70.3	81.8	
Protein (N x 6.25)	%	8.8	10.2	9
Energy	GE kcal/kg	3786.	4402.	
Calcium	%	.03	.03	65
Chlorine	%	.03	.04	25
Iron	%	.003	.003	67
Magnesium	%	.15	.17	99
Phosphorus	%	.27	.31	27
Potassium	%	.33	.38	29
Sodium	%	.01	.01	99
Sulfur	%	.12	.14	14
Cobalt	mg/kg	.100	.100	60
Copper	mg/kg	3.4	4.0	48
Manganese	mg/kg	4.1	4.8	99
Zinc	mg/kg	10.4	12.1	
Biotin	mg/kg	.06	.07	21
Carotene	mg/kg	4.1	4.8	52
Choline	mg/kg	537.	625.	48
Folic acid	mg/kg	.20	.20	99
Niacin	mg/kg	22.9	26.6	41
Pantothenic acid	mg/kg	5.0	5.9	32
Riboflavin	mg/kg	1.1	1.3	69
Thiamine	mg/kg	4.0	4.6	16
Vitamin B_6	mg/kg	7.20	8.40	
Vitamin A equiv	IU/g	6.8	8.0	

Continued

(1) dry forages and roughages
(2) pasture, range plants, and forages fed green

Feed name or analyses		Mean As fed	Mean Dry	C.V ± %
Cystine	%	.09	.10	42
Glycine	%	.43	.50	
Methionine	%	.17	.20	50

CORN, WHITE. Zea mays

Corn, white, grits by-prod, mn 5 fat, (4)
White hominy feed (AAFCO)
White hominy feed (CFA)
Hominy, white corn, feed
Corn, white, hominy feed

Ref no 4-02-990

Dry matter	%	89.9	100.0	
Crude fiber	%	4.7	5.2	
Ether extract	%	5.7	6.3	
Protein (N x 6.25)	%	10.8	12.0	
Calcium	%	.05	.06	
Phosphorus	%	1.00	1.10	
Niacin	mg/kg	55.3	61.5	
Pantothenic acid	mg/kg	6.7	7.5	
Riboflavin	mg/kg	2.2	2.4	
Thiamine	mg/kg	13.1	14.6	

COTTON. Gossypium spp

Cotton, seed w some hulls, solv-extd grnd, mn 41 prot mx 14 fbr mn 0.6 fat, (5)
Cottonseed meal, solvent extracted, 41% protein

Ref no 5-01-621

Dry matter	%	91.5	100.0	
Ash	%	6.2	6.8	
Crude fiber	%	12.0	13.1	
Ether extract	%	2.0	2.2	
N-free extract	%	30.3	33.1	
Protein (N x 6.25)	%	41.0	44.8	
Energy	GE kcal/kg	4300.	4700.	
Calcium	%	.16	.17	
Iron	%	.030	.033	
Magnesium	%	.56	.61	
Phosphorus	%	1.20	1.31	
Potassium	%	1.40	1.53	
Sodium	%	.04	.04	
Cobalt	mg/kg	.150	.164	
Copper	mg/kg	19.5	21.3	
Manganese	mg/kg	21.5	23.5	
Choline	mg/kg	2860.	3126.	
Folic acid	mg/kg	2.30	2.51	
Niacin	mg/kg	39.5	43.2	
Pantothenic acid	mg/kg	14.0	15.3	
Riboflavin	mg/kg	5.0	5.5	
Thiamine	mg/kg	6.5	7.1	

Continued

(3) silages
(4) energy feeds
(5) protein supplements

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Arginine	%	4.25	4.64	
Cystine	%	.85	.93	
Glycine	%	2.05	2.24	
Histidine	%	1.10	1.20	
Isoleucine	%	1.60	1.75	
Leucine	%	2.50	2.73	
Lysine	%	1.70	1.86	
Methionine	%	.65	.71	
Phenylalanine	%	2.35	2.57	
Threonine	%	1.45	1.58	
Tryptophan	%	.65	.71	
Valine	%	2.05	2.24	

CRAB. Callinectes sapidus, Cancer spp, Paralithodes camachatica

Crab, proc res, dehy grnd, mn 25 prot salt declared above 3 mx 7, (5)
Crab meal (AAFCO)

Ref no 5-01-663

Dry matter	%	93.0	100.0	3
Ash	%	40.7	43.8	15
Crude fiber	%	11.0	11.8	12
Ether extract	%	1.8	1.9	57
N-free extract	%	8.4	9.1	
Protein (N x 6.25)	%	31.1	33.4	10
Calcium	%	15.32	16.47	18
Iron	%	.44	.47	
Magnesium	%	.88	.95	
Phosphorus	%	1.59	1.71	9
Potassium	%	.45	.48	
Sodium	%	.85	.91	
Copper	mg/kg	32.8	35.3	
Manganese	mg/kg	133.8	143.8	41
Pantothenic acid	mg/kg	6.6	7.1	
Riboflavin	mg/kg	5.9	6.3	48
Arginine	%	1.70	1.83	
Histidine	%	.50	.54	17
Isoleucine	%	1.20	1.29	17
Leucine	%	1.60	1.72	13
Lysine	%	1.40	1.51	3
Methionine	%	.50	.54	17
Phenylalanine	%	1.20	1.29	23
Threonine	%	1.00	1.08	4
Tryptophan	%	.30	.32	
Tyrosine	%	1.20	1.29	
Valine	%	1.50	1.61	8

Dicalcium - see Calcium phosphate, dibasic, comm

Digester tankage - see Animal, carcass res w blood

Distillers grains with solubles - see Corn

(6) minerals
(7) vitamins
(8) additives

TABLE 8 Composition of Feeds Commonly Used in Mink and Fox Rations–Continued.

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Distillers solubles - see Corn				
Fat - see Animal-Poultry; see Swine, lard				
FISH. Scientific name not used				
Fish meal, drum - see Fish, redfish				
Fish, sol, cond, mn 30 prot, (5) Condensed fish solubles (AAFCO)				
Ref no 5-01-969				
Dry matter	%	51.0	100.0	13
Ash	%	10.0	19.6	58
Crude fiber	%	1.0	2.0	93
Ether extract	%	6.5	12.7	99
N-free extract	%	2.1	4.1	
Protein (N x 6.25)	%	31.4	61.6	21
Calcium	%	.61	1.20	99
Iron	%	.03	.06	99
Magnesium	%	.02	.04	
Phosphorus	%	.70	1.37	
Potassium	%	1.75	3.43	
Sodium	%	3.06	6.00	99
Copper	mg/kg	48.2	94.5	99
Manganese	mg/kg	11.9	23.3	99
Zinc	mg/kg	38.3	75.1	
Biotin	mg/kg	.2	.4	
Choline	mg/kg	4028.	7899.	
Niacin	mg/kg	168.7	330.8	99
Pantothenic acid	mg/kg	35.4	69.4	
Riboflavin	mg/kg	14.5	28.4	99
Thiamine	mg/kg	5.5	10.8	97
Arginine	%	2.40	4.71	60
Cystine	%	1.70	3.33	
Glycine	%	4.90	9.61	48
Histidine	%	2.50	4.90	78
Isoleucine	%	1.60	3.14	65
Leucine	%	2.50	4.90	48
Lysine	%	2.70	5.29	66
Methionine	%	1.00	1.96	52
Phenylalanine	%	1.40	2.75	46
Threonine	%	1.20	2.35	53
Tryptophan	%	.80	1.57	
Tyrosine	%	.50	.98	92
Valine	%	1.60	3.14	45

(1) dry forages and roughages
(2) pasture, range plants, and forages fed green

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
FISH, ALEWIFE. Pomolobus pseudoharengus				
Fish, alewife, whole, raw, (5)				
Ref no 5-07-964				
Dry matter	%	26.0	100.0	
Ether extract	%	5.0	19.2	
Protein (N x 6.25)	%	19.5	75.0	
FISH, CARP. Cyprinus carpio				
Fish, carp, whole, raw, (5)				
Ref no 5-01-986				
Dry matter	%	22.0	100.0	
Ether extract	%	2.3	10.4	
Protein (N x 6.25)	%	18.5	84.1	
FISH, CATFISH. Ictalurus spp				
Fish, catfish, whole, raw, (5)				
Ref no 5-07-965				
Dry matter	%	17.5	100.0	
Ether extract	%	.4	2.3	
Protein (N x 6.25)	%	16.5	94.3	
FISH, FLOUNDER. Bothidae (family), Pleuronectidae (family)				
Fish, flounder, whole, raw, (5)				
Ref no 5-01-996				
Dry matter	%	17.0	100.0	
Ether extract	%	.5	2.9	
Protein (N x 6.25)	%	15.0	88.2	
FISH, HADDOCK. Melanogrammus aeglefinus				
Fish, haddock, whole, raw, (5)				
Ref no 5-07-966				
Dry matter	%	18.0	100.0	
Ether extract	%	.3	1.7	
Protein (N x 6.25)	%	17.0	94.4	

(3) silages
(4) energy feeds
(5) protein supplements

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
FISH, HAKE. Merluccius spp, Urophycis spp				
Fish, hake, whole, cooked, (5)				
Ref no 5-07-967				
Dry matter	%	30.0	100.0	
Ether extract	%	5.6	18.8	
Protein (N x 6.25)	%	17.2	57.4	
Fish, hake, whole, cooked acidified, (5)				
Ref no 5-07-968				
Dry matter	%	25.0	100.0	
Crude fiber	%	.3	1.1	
Ether extract	%	5.3	21.2	
Fish, hake, whole, raw, (5)				
Ref no 5-07-969				
Dry matter	%	19.0	100.0	
Ether extract	%	1.1	5.8	
Protein (N x 6.25)	%	17.0	89.5	
FISH, HERRING. Clupea harengus harengus, Clupea harengus pallasi				
Fish, herring, whole, raw, (5)				
Ref no 5-01-999				
Dry matter	%	26.0	100.0	
Ether extract	%	5.5	21.1	
Protein (N x 6.25)	%	18.0	69.2	
Fish, herring, whole or cuttings, cooked mech-extd dehy grnd, (5) Fish meal, herring				
Ref no 5-02-000				
Dry matter	%	92.0	100.0	2
Ash	%	10.8	11.7	12
Ether extract	%	7.5	8.2	26
N-free extract	%	3.1	3.4	
Protein (N x 6.25)	%	70.6	76.7	6
Calcium	%	2.94	3.20	32
Phosphorus	%	2.20	2.39	13
Manganese	mg/kg	9.9	10.8	
Choline	mg/kg	4004.	4352.	27
Folic acid	mg/kg	2.40	2.60	

Continued

(6) minerals
(7) vitamins
(8) additives

TABLE 8 Composition of Feeds Commonly Used in Mink and Fox Rations—Continued.

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Niacin	mg/kg	88.9	96.6	46
Pantothenic acid	mg/kg	11.4	12.4	53
Riboflavin	mg/kg	9.0	9.8	19
Vitamin B_{12}	mcg/kg	218.7	237.7	69
Arginine	%	4.00	4.35	25
Cystine	%	1.60	1.74	
Glycine	%	5.00	5.44	
Histidine	%	1.30	1.41	40
Isoleucine	%	3.20	3.48	8
Leucine	%	5.10	5.54	18
Lysine	%	7.30	7.94	18
Methionine	%	2.00	2.17	29
Phenylalanine	%	2.60	2.83	11
Threonine	%	2.60	2.83	26
Tryptophan	%	.90	.98	42
Tyrosine	%	2.10	2.28	17
Valine	%	3.20	3.48	19

FISH, MACKEREL ATLANTIC. Scomber scombrus

Fish, mackeral Atlantic, whole, raw, (5)

Ref no 5-07-971

Dry matter	%	32.0	100.0
Ether extract	%	12.0	37.5
Protein (N x 6.25)	%	18.5	57.8

FISH, MACKEREL PACIFIC. Scomber japonicus

Fish, mackeral Pacific, whole, raw, (5)

Ref no 5-07-972

Dry matter	%	31.0	100.0
Ether extract	%	7.6	24.5
Protein (N x 6.25)	%	22.0	71.0

FISH, MENHADEN. Brevoortia tyrannus

Fish, menhaden, whole or cuttings, cooked mech-extd dehy grnd, (5)
Fish meal, menhaden

Ref no 5-02-009

Dry matter	%	92.0	100.0	2
Ash	%	19.6	21.3	17
Crude fiber	%	1.0	1.1	90
Ether extract	%	7.7	8.4	41
N-free extract	%	2.4	2.6	
Protein (N x 6.25)	%	61.3	66.6	5
Calcium	%	5.49	5.97	16
Iron	%	.056	.061	37
Phosphorus	%	2.81	3.05	31

Continued

(1) dry forages and roughages
(2) pasture, range plants, and forages fed green

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Copper	mg/kg	8.4	9.1	23
Manganese	mg/kg	25.7	27.9	40
Choline	mg/kg	3080.	3348.	
Niacin	mg/kg	55.9	60.8	13
Pantothenic acid	mg/kg	8.8	9.6	
Riboflavin	mg/kg	4.8	5.2	32
Thiamine	mg/kg	.7	.8	69
Arginine	%	4.00	4.35	
Histidine	%	1.60	1.74	
Isoleucine	%	4.10	4.46	
Leucine	%	5.00	5.44	
Lysine	%	5.30	5.76	6
Methionine	%	1.80	1.96	5
Phenylalanine	%	2.70	2.93	
Threonine	%	2.90	3.15	
Tryptophan	%	.60	.65	
Tyrosine	%	1.60	1.74	
Valine	%	3.60	3.91	

FISH, REDFISH. Sciaenops ocellata

Fish, redfish, whole, raw, (5)
Drumfish, whole, raw
Ocean perch, whole, raw

Ref no 5-08-113

Dry matter	%	19.8	100.0
Ash	%	1.3	6.5
Ether extract	%	.4	2.0
N-free extract	%	.1	.6
Protein (N x 6.25)	%	18.0	90.9
Energy	GE kcal/kg	800.	4040.
Potassium	%	.27	1.36
Sodium	%	.06	.30
Niacin	mg/kg	35.0	176.8
Riboflavin	mg/kg	.5	2.5
Thiamine	mg/kg	1.5	7.6

Fish, redfish, whole or cuttings, cooked mech-extd dehy grnd, (5)
Fish meal, drum
Fish meal, redfish

Ref no 5-07-973

Dry matter	%	94.2	100.0
Crude fiber	%	1.0	1.1
Ether extract	%	8.0	8.5
Protein (N x 6.25)	%	55.0	58.4
Calcium	%	4.00	4.20
Phosphorus	%	2.20	2.40
Choline	mg/kg	1400.	1486.
Niacin	mg/kg	27.0	28.7
Pantothenic acid	mg/kg	2.4	2.6
Riboflavin	mg/kg	2.9	3.1

(3) silages
(4) energy feeds
(5) protein supplements

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %

FISH, ROCKFISH. Sebastodes spp

Fish, rockfish, whole, raw, (5)

Ref no 5-07-974

Dry matter	%	32.0	100.0
Ether extract	%	7.2	22.6
Protein (N x 6.25)	%	16.2	50.7

FISH, SALMON. Oncorhynchus spp, Salmo spp

Fish, salmon, whole, raw, (5)

Ref no 5-02-011

Dry matter	%	35.0	100.0
Ether extract	%	13.0	37.1
Protein (N x 6.25)	%	22.0	62.8

FISH, SARDINE. Clupea spp, Sardinops spp

Fish, sardine, whole or cuttings, cooked mech-extd dehy grnd, (5)
Fish meal, sardine

Ref no 5-02-015

Dry matter	%	93.0	100.0	1
Ash	%	15.7	16.9	17
Crude fiber	%	1.0	1.1	70
Ether extract	%	4.3	4.6	37
N-free extract	%	6.5	7.0	
Protein (N x 6.25)	%	65.5	70.4	7
Calcium	%	4.90	5.27	13
Iron	%	.03	.03	
Magnesium	%	.10	.11	
Phosphorus	%	2.77	2.98	14
Potassium	%	.33	.35	
Sodium	%	.18	.19	
Copper	mg/kg	20.2	21.7	1
Manganese	mg/kg	22.2	23.9	1
Choline	mg/kg	2959.	3181.	10
Niacin	mg/kg	62.0	66.7	
Pantothenic acid	mg/kg	9.2	9.9	
Riboflavin	mg/kg	5.9	6.3	23
Thiamine	mg/kg	.4	.4	
Arginine	%	2.70	2.90	42
Cystine	%	.80	.86	
Glycine	%	4.50	4.84	
Histidine	%	1.80	1.94	29
Isoleucine	%	3.30	3.55	
Leucine	%	4.70	5.05	
Lysine	%	5.90	6.34	38

Continued

(6) minerals
(7) vitamins
(8) additives

TABLE 8 Composition of Feeds Commonly Used in Mink and Fox Rations–Continued.

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Methionine	%	2.00	2.15	2
Phenylalanine	%	2.60	2.80	
Threonine	%	2.60	2.80	
Tryptophan	%	.50	.54	
Tyrosine	%	3.00	3.23	
Valine	%	4.10	4.41	

FISH, SMELT. Asmerus spp

Fish, smelt, whole, raw, (5)

Ref no 5-07-975

Dry matter	%	21.0	100.0	
Ether extract	%	1.8	8.6	
Protein (N x 6.25)	%	18.0	85.7	

FISH, SOLE. Soleidae (family)

Fish, sole, whole, raw, (5)

Ref no 5-07-976

Dry matter	%	19.0	100.0	
Ether extract	%	1.7	9.1	
Protein (N x 6.25)	%	13.7	72.3	
Calcium	%	.63	3.32	
Phosphorus	%	.44	2.30	

FISH, TUNA. Thunnus thynnus, Thunnus albacares

Fish, tuna, proc res, (5)

Ref no 5-07-977

Dry matter	%	44.0	100.0	
Ether extract	%	9.6	21.8	
Protein (N x 6.25)	%	24.1	54.8	

FISH, TURBOT. Psetta maxima

Fish, turbot, whole, raw, (5)

Ref no 5-07-978

Dry matter	%	27.0	100.0	
Ether extract	%	10.4	38.7	
Protein (N x 6.25)	%	14.4	53.2	
Calcium	%	.39	1.46	
Phosphorus	%	.32	1.17	

(1) dry forages and roughages
(2) pasture, range plants, and forages fed green

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %

FISH, WHITE. Gadidae (family), Lophiidae (family), Rajidae (family)

Fish, white, whole or cuttings, cooked mech-extd dehy grnd, mx 4 oil, (5)
White fish meal (CFA)
Fish, cod, meal
Fish, cusk, meal
Fish, haddock, meal
Fish, hake, meal
Fish, pollock, meal
Fish, monkfish, meal
Fish, skate, meal

Ref no 5-02-025

Dry matter	%	92.0	100.0	3
Ash	%	21.7	23.6	13
Crude fiber	%	1.0	1.1	98
Ether extract	%	4.4	4.8	59
N-free extract	%	1.6	1.8	
Protein (N x 6.25)	%	63.2	68.7	7
Calcium	%	7.87	8.55	16
Phosphorus	%	3.61	3.92	20
Manganese	mg/kg	14.3	15.5	
Choline	mg/kg	8917.	9692.	
Niacin	mg/kg	69.7	75.8	26
Pantothenic acid	mg/kg	8.8	9.6	
Riboflavin	mg/kg	9.0	9.8	39
Thiamine	mg/kg	1.8	2.0	83

FISH, WHITING. Gadus merlangus

Fish, whiting, whole, raw, (5)

Ref no 5-07-979

Dry matter	%	23.0	100.0	
Ether extract	%	2.0	8.7	
Protein (N x 6.25)	%	16.0	69.6	

FLAX. Linum usitatissimum

Flax, seed, solv-extd grnd, mx 0.5 acid insol ash, (5)
Solvent extracted linseed meal (AAFCO)
Solvent extracted linseed meal (CFA)
Linseed oil meal, solvent extracted

Ref no 5-02-048

Dry matter	%	91.0	100.0	2
Ash	%	5.8	6.4	12
Crude fiber	%	9.0	9.9	11
Ether extract	%	1.7	1.9	51

Continued

(3) silages
(4) energy feeds
(5) protein supplements

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
N-free extract	%	39.3	43.2	
Protein (N x 6.25)	%	35.1	38.6	8
Calcium	%	.40	.44	20
Iron	%	.033	.036	
Magnesium	%	.60	.66	
Phosphorus	%	.83	.91	21
Potassium	%	1.38	1.52	
Sodium	%	.14	.15	
Cobalt	mg/kg	.20	.20	
Copper	mg/kg	25.7	28.2	
Manganese	mg/kg	37.6	41.3	36
Choline	mg/kg	1225.	1347.	
Niacin	mg/kg	30.1	33.1	
Riboflavin	mg/kg	2.9	3.2	
Thiamine	mg/kg	9.5	10.4	28

Flax, seed screenings, mech-extd grnd, (5)
Flaxseed screenings meal (AAFCO)

Ref no 5-02-054

Dry matter	%	91.0	100.0	1
Ash	%	6.7	7.4	18
Crude fiber	%	12.0	13.2	20
Ether extract	%	9.4	10.3	18
N-free extract	%	47.0	51.7	
Protein (N x 6.25)	%	15.8	17.4	11
Energy	GE kcal/kg	4316.	4743.	
Calcium	%	.37	.41	
Phosphorus	%	.43	.47	

HORSE. Equus caballus

Horse, meat, raw, (5)

Ref no 5-07-980

Dry matter	%	24.0	100.0	
Ether extract	%	4.0	16.7	
Protein (N x 6.25)	%	18.0	75.0	
Calcium	%	.05	.13	
Phosphorus	%	.62	1.69	

Horse, meat w bone, raw grnd, (5)

Ref no 5-07-981

Dry matter	%	36.0	100.0	
Ether extract	%	7.0	19.4	
Protein (N x 6.25)	%	18.5	51.4	

Lard - see Swine, lard

(6) minerals
(7) vitamins
(8) additives

TABLE 8 Composition of Feeds Commonly Used in Mink and Fox Rations—Continued.

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
LIMESTONE. Scientific name not applicable				
Limestone, grnd, mn 33 Ca, (6)				
Limestone, ground (AAFCO)				
Ref no 6-02-632				
Dry matter	%	100.0	100.0	
Ash	%	95.8	95.8	
Calcium	%	33.84	33.84	10
Iron	%	.330	.330	
Phosphorus	%	.02	.02	
Sodium	%	.06	.06	
Manganese	mg/kg	279.6	279.6	99
Linseed meal - see Flax				
Maize - see Corn				
Malt sprouts - see Barley, malt sprouts w hulls				
Meat meal - see Animal, carcass res				
Meat meal tankage - see Animal, carcass res w blood				
Meat and bone meal - see Animal, carcass res w bone				
Meat and bone scrap - see Animal, carcass res w bone				
Meat scrap - see Animal, carcass res				
Middlings - see Wheat, flour by-prod, f-sift, mx 4 fbr				
Melts - see Cattle, spleen				
Milk - see Cattle, milk				
Milo - see Sorghum, milo				
Molasses - see Beet, sugar, molasses; see Sugarcane, molasses				

(1) dry forages and roughages
(2) pasture, range plants, and forages fed green

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Monosodium phosphate - see Sodium phosphate, monobasic				
OATS. Avena sativa				
Oats, grain, (4)				
Ref no 4-03-309				
Dry matter	%	89.0	100.0	3
Ash	%	3.2	3.6	28
Crude fiber	%	11.0	12.4	33
Ether extract	%	4.5	5.1	24
N-free extract	%	58.5	65.7	
Protein (N x 6.25)	%	11.8	13.2	17
Cellulose	%	16.0	18.0	
Lignin	%	8.9	10.0	
Energy	GE kcal/kg	4187.	4704.	
Calcium	%	.10	.11	70
Iron	%	.007	.008	75
Magnesium	%	.17	.19	28
Phosphorus	%	.35	.39	43
Potassium	%	.37	.42	33
Sodium	%	.06	.07	59
Cobalt	mg/kg	.060	.070	99
Copper	mg/kg	5.9	6.6	74
Manganese	mg/kg	38.2	42.9	8
Biotin	mg/kg	.30	.30	99
Choline	mg/kg	1073.	1206.	17
Folic acid	mg/kg	.40	.40	57
Niacin	mg/kg	15.8	17.8	41
Pantothenic acid	mg/kg	12.9	14.5	33
Riboflavin	mg/kg	1.6	1.8	99
Thiamine	mg/kg	6.2	7.0	26
α-tocopherol	mg/kg	5.9	6.6	28
Vitamin B_6	mg/kg	1.2	1.3	42
Arginine	%	.71	.80	29
Cystine	%	.18	.20	54
Histidine	%	.18	.20	58
Isoleucine	%	.53	.60	21
Leucine	%	.89	1.00	21
Lysine	%	.36	.40	28
Methionine	%	.18	.20	35
Phenylalanine	%	.62	.70	22
Threonine	%	.36	.40	24
Tryptophan	%	.18	.20	35
Tyrosine	%	.53	.60	5
Valine	%	.62	.70	26
Oats, groats, grnd cooked, (4)				
Ref no 4-07-982				
Dry matter	%	91.0	100.0	
Crude fiber	%	3.0	3.3	
Ether extract	%	5.8	6.4	

Continued

(3) silages
(4) energy feeds
(5) protein supplements

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Protein (N x 6.25)	%	16.7	18.4	
Calcium	%	.07	.08	
Phosphorus	%	.43	.47	
Skimmed milk - see Cattle, milk, skim				
SODIUM PHOSPHATE, MONOBASIC				
Sodium, phosphate, monobasic, $NaH_2PO_4 \cdot H_2O$, tech, (6)				
Monosodium phosphate (AAFCO)				
Ref no 6-04-288				
Dry matter	%	96.7	100.0	
Ash	%	96.7	100.0	
Phosphorus	%	21.80	22.46	
Sodium	%	32.3	33.4	
		120.00	124.10	
SORGHUM, MILO. Sorghum vulgare				
Sorghum, milo, grain, (4)				
Ref no 4-04-444				
Dry matter	%	89.0	100.0	2
Ash	%	1.7	1.9	44
Crude fiber	%	2.0	2.2	38
Ether extract	%	2.8	3.1	18
N-free extract	%	71.6	80.4	
Protein (N x 6.25)	%	11.0	12.4	8
Energy	GE kcal/kg	3906.	4389.	
Calcium	%	.04	.04	99
Magnesium	%	.20	.22	26
Phosphorus	%	.29	.33	19
Potassium	%	.35	.39	7
Sodium	%	.01	.01	
Cobalt	mg/kg	.100	.100	62
Copper	mg/kg	14.1	15.8	33
Manganese	mg/kg	12.9	14.5	49
Choline	mg/kg	678.	761.	17
Niacin	mg/kg	42.7	48.0	35
Pantothenic acid	mg/kg	11.4	12.8	42
Riboflavin	mg/kg	1.2	1.3	23
Thiamine	mg/kg	3.9	4.4	14

Continued

(6) minerals
(7) vitamins
(8) additives

TABLE 8 Composition of Feeds Commonly Used in Mink and Fox Rations–Continued.

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Vitamin B_6	mg/kg	4.10	4.60	
Arginine	%	.36	.40	14
Cystine	%	.18	.20	95
Histidine	%	.27	.30	18
Isoleucine	%	.53	.60	11
Leucine	%	1.42	1.60	12
Lysine	%	.27	.30	27
Methionine	%	.09	.10	61
Phenylalanine	%	.45	.51	26
Threonine	%	.27	.30	
Tryptophan	%	.09	.10	31
Tyrosine	%	.36	.40	27
Valine	%	.53	.60	5

Soy - see Soybean

SOYBEAN. Glycine max

Soybean, oil, (4)

Ref no 4-07-983

Dry matter	%	100.0	100.0	
Ether extract	%	100.0	100.0	

Soybean, seed, solv-extd grnd, mx 7 fbr, (5)
Solvent extracted soybean meal (AAFCO)
Soybean meal, solvent extracted
Soybean oil meal, solvent extracted

Ref no 5-04-604

Dry matter	%	89.0	100.0	2
Ash	%	5.8	6.5	10
Crude fiber	%	6.0	6.7	20
Ether extract	%	.9	1.0	70
N-free extract	%	30.5	34.3	
Protein (N x 6.25)	%	45.8	51.5	7
Energy	GE kcal/kg	4198.	4719.	
Calcium	%	.32	.36	56
Iron	%	.012	.013	34
Magnesium	%	.27	.30	60
Phosphorus	%	.67	.75	21
Potassium	%	1.97	2.21	6
Sodium	%	.34	.38	68
Cobalt	mg/kg	.100	.100	63
Copper	mg/kg	36.3	40.8	12
Manganese	mg/kg	27.5	30.9	12
Choline	mg/kg	2743.	3083.	9
Folic acid	mg/kg	.70	.80	
Niacin	mg/kg	26.8	30.1	21
Pantothenic acid	mg/kg	14.5	16.3	28
Riboflavin	mg/kg	3.3	3.7	23
Thiamine	mg/kg	6.6	7.4	57
Arginine	%	3.20	3.60	14
Histidine	%	1.10	1.24	14

Continued

(1) dry forages and roughages
(2) pasture, range plants, and forages fed green

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Isoleucine	%	2.50	2.81	18
Leucine	%	3.40	3.82	14
Lysine	%	2.90	3.26	13
Methionine	%	.60	.67	43
Phenylalanine	%	2.20	2.47	7
Threonine	%	1.70	1.91	5
Tryptophan	%	.60	.67	9
Tyrosine	%	1.40	1.57	14
Valine	%	2.40	2.70	7

Soybean, seed wo hulls, solv-extd grnd, mx 3 fbr, (5)
Soybean meal, dehulled, solvent extracted (AAFCO)
Soybean oil meal, dehulled, solvent extracted

Ref no 5-04-612

Dry matter	%	89.8	100.0	1
Ash	%	5.6	6.2	8
Crude fiber	%	2.8	3.1	16
Ether extract	%	.8	.9	51
N-free extract	%	29.7	33.1	
Protein (N x 6.25)	%	50.9	56.7	1
Calcium	%	.26	.29	38
Phosphorus	%	.62	.69	9
Potassium	%	2.02	2.24	
Manganese	mg/kg	45.5	50.6	62
Choline	mg/kg	2761.	3068.	
Niacin	mg/kg	21.6	24.0	
Riboflavin	mg/kg	3.1	3.4	
Thiamine	mg/kg	2.4	2.7	

SUGARCANE. Saccharum officinarum

Sugarcane, molasses, mn 48 invert sugar mn 79.5 degrees brix, (4)
Cane molasses (AAFCO)
Molasses, cane

Ref no 4-04-696

Dry matter	%	75.0	100.0	7
Ash	%	8.1	10.8	34
Ether extract	%	.1	.1	99
N-free extract	%	63.6	84.8	
Protein (N x 6.25)	%	3.2	4.3	87
Energy	GE kcal/kg	3086.	4114.	
Calcium	%	.89	1.19	51
Iron	%	.019	.025	9
Magnesium	%	.35	.47	56
Phosphorus	%	.08	.11	75
Potassium	%	2.38	3.17	21
Copper	mg/kg	59.6	79.4	62
Manganese	mg/kg	42.2	56.3	58
Choline	mg/kg	876.	1167.	87
Niacin	mg/kg	34.3	45.7	44

Continued

(3) silages
(4) energy feeds
(5) protein supplements

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Pantothenic acid	mg/kg	38.3	51.1	34
Riboflavin	mg/kg	3.3	4.4	99
Thiamine	mg/kg	.9	1.2	63

SWINE. Sus scrofa

Swine, lard, (4)

Ref no 4-04-790

Dry matter	%	100.0	100.0	
Ether extract	%	100.0	100.0	
Protein (N x 6.25)	%	.0	.0	
Energy	GE kcal/kg	9020.	9020.	

Tankage - see Animal, carcass res w blood; see Animal-Poultry, carcass rex mx 35 blood

TOMATO. Lycopersicon esculentum

Tomato, pulp, dehy, (5)
Dried tomato pomace (AAFCO)

Ref no 5-05-041

Dry matter	%	92.0	100.0	
Crude fiber	%	29.0	31.5	
Ether extract	%	13.0	14.1	
Protein (N x 6.25)	%	21.7	23.6	
Calcium	%	.28	.30	
Phosphorus	%	.57	.62	
Riboflavin	mg/kg	6.2	6.6	
Thiamine	mg/kg	11.9	12.6	

TURKEY. Meleagris gallapavo

Turkey, offal mature birds, raw, (5)

Ref no 5-07-984

Dry matter	%	28.0	100.0	
Crude fiber	%	.4	1.4	
Ether extract	%	12.3	43.9	

Turkey, offal young birds, raw, (5)

Ref no 5-07-985

Dry matter	%	35.0	100.0	
Crude fiber	%	.3	.9	
Ether extract	%	14.9	42.6	

(6) minerals
(7) vitamins
(8) additives

TABLE 8 Composition of Feeds Commonly Used in Mink and Fox Rations–Continued.

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
WHALE. Balaena glacialis, Balaenoptera spp, Physeter catadon				
Whale, meat, raw, (5)				
Ref no 5-07-986				
Dry matter	%	26.0	100.0	
Crude fiber	%	.0	.0	
Ether extract	%	2.1	8.1	
Protein (N x 6.25)	%	21.3	81.9	
WHEAT. Triticum spp				
Wheat, bran, dry-mil, (4) Wheat bran (AAFCO) Bran (CFA)				
Ref no 4-05-190				
Dry matter	%	89.0	100.0	3
Ash	%	6.1	6.9	17
Crude fiber	%	10.0	11.2	22
Ether extract	%	4.1	4.6	19
N-free extract	%	52.8	59.3	
Protein (N x 6.25)	%	16.0	18.0	14
Energy	GE kcal/kg	4052.	4554.	
Calcium	%	.14	.16	71
Iron	%	.017	.019	27
Magnesium	%	.55	.62	18
Phosphorus	%	1.17	1.32	32
Potassium	%	1.24	1.39	22
Sodium	%	.06	.07	57
Cobalt	mg/kg	1.000	1.100	40
Copper	mg/kg	12.3	13.8	52
Manganese	mg/kg	115.7	130.0	15
Choline	mg/kg	988.	1110.	
Folic acid	mg/kg	1.80	2.00	92
Niacin	mg/kg	209.2	235.1	44
Pantothenic acid	mg/kg	29.0	32.6	25
Riboflavin	mg/kg	3.1	3.5	37
Thiamine	mg/kg	7.9	8.9	43
α-tocopherol	mg/kg	10.8	12.1	36
Arginine	%	1.00	1.12	13
Cystine	%	.30	.34	
Glycine	%	.90	1.01	
Histidine	%	.30	.34	24
Isoleucine	%	.60	.67	24
Leucine	%	.90	1.01	8
Lysine	%	.60	.67	22
Methionine	%	.10	.11	63
Phenylalanine	%	.50	.56	15
Threonine	%	.40	.45	18
Tryptophan	%	.30	.34	11
Tyrosine	%	.40	.45	40
Valine	%	.70	.79	16

(1) dry forages and roughages
(2) pasture, range plants, and forages fed green

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Wheat, flour by-prod, f-sift, mx 4 fbr, (4) Wheat red dog, mx 4.0 fbr (AAFCO) Middlings, mx 4.5 fbr (CFA)				
Ref no 4-05-203				
Dry matter	%	89.0	100.0	2
Ash	%	2.5	2.8	30
Crude fiber	%	2.0	2.2	47
Ether extract	%	3.6	4.0	24
N-free extract	%	63.0	70.8	
Protein (N x 6.25)	%	18.0	20.2	11
Calcium	%	.08	.09	33
Iron	%	.006	.007	48
Magnesium	%	.29	.33	
Phosphorus	%	.52	.58	28
Potassium	%	.60	.67	
Sodium	%	.66	.74	
Copper	mg/kg	4.4	4.9	25
Manganese	mg/kg	37.6	42.3	60
Niacin	mg/kg	52.6	59.1	37
Pantothenic acid	mg/kg	13.6	15.3	16
Riboflavin	mg/kg	1.5	1.7	76
Thiamine	mg/kg	18.9	21.2	24
α-tocopherol	mg/kg	57.6	64.7	
Arginine	%	1.00	1.12	20
Histidine	%	.40	.45	20
Isoleucine	%	.70	.79	26
Leucine	%	1.20	1.35	17
Lysine	%	.60	.67	27
Methionine	%	.10	.11	40
Phenylalanine	%	.50	.56	40
Threonine	%	.50	.56	8
Tryptophan	%	.20	.22	20
Tyrosine	%	.50	.56	40
Valine	%	.80	.90	23
Wheat, grain, Pacific coast, (4)				
Ref no 4-08-142				
Dry matter	%	89.2	100.0	
Ash	%	1.9	2.1	
Crude fiber	%	2.7	3.0	
Ether extract	%	2.0	2.2	
N-free extract	%	72.8	81.6	
Protein (N x 6.25)	%	9.9	11.1	
Calcium	%	.12	.14	
Phosphorus	%	.30	.34	
Niacin	mg/kg	59.1	66.3	
Pantothenic acid	mg/kg	11.5	12.9	
Riboflavin	mg/kg	1.1	1.2	
Thiamine	mg/kg	4.9	5.5	

(3) silages
(4) energy feeds
(5) protein supplements

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Wheat grain- see also Wheat, hard red spring; see Wheat, hard red winter				
Wheat, germ, grnd, mn 25 prot 7 fat, (5) Wheat germ meal (AAFCO)				
Ref no 5-05-218				
Dry matter	%	90.0	100.0	2
Ash	%	4.3	4.8	8
Crude fiber	%	3.0	3.3	18
Ether extract	%	10.9	12.1	15
N-free extract	%	45.6	50.7	
Protein (N x 6.25)	%	26.2	29.1	14
Energy	GE kcal/kg	4206.	4673.	
Calcium	%	.07	.08	9
Iron	%	.011	.012	
Phosphorus	%	1.04	1.16	5
Copper	mg/kg	8.8	9.8	
Manganese	mg/kg	134.9	149.9	
Choline	mg/kg	3010.	3344.	19
Folic acid	mg/kg	2.00	2.20	
Niacin	mg/kg	47.3	52.6	50
Pantothenic acid	mg/kg	11.2	12.4	59
Riboflavin	mg/kg	5.1	5.7	25
Thiamine	mg/kg	27.9	31.0	42
α-tocopherol	mg/kg	132.7	147.4	9
Arginine	%	1.60	1.78	
Cystine	%	.50	.56	
Histidine	%	.50	.56	
Isoleucine	%	1.20	1.33	
Leucine	%	1.10	1.22	
Lysine	%	1.60	1.78	
Methionine	%	.30	.33	
Phenylalanine	%	.80	.89	
Threonine	%	.80	.89	
Tryptophan	%	.30	.33	14
Valine	%	1.10	1.22	32
WHEAT, HARD RED SPRING. Triticum aestivum				
Wheat, hard red spring, grain, (4)				
Ref no 4-05-258				
Dry matter	%	86.5	100.0	
Ash	%	1.7	2.0	27
Crude fiber	%	3.0	3.4	99
Ether extract	%	1.9	2.2	44
N-free extract	%	66.0	76.3	
Protein (N x 6.25)	%	13.9	16.1	14
Calcium	%	.05	.06	22
Iron	%	.005	.006	35
Phosphorus	%	.41	.47	18

Continued

(6) minerals
(7) vitamins
(8) additives

TABLE 8 Composition of Feeds Commonly Used in Mink and Fox Rations–Continued.

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
Copper	mg/kg	10.6	12.3	20
Manganese	mg/kg	62.2	71.9	21
Choline	mg/kg	778.	899.	13
Folic acid	mg/kg	.42	.48	25
Niacin	mg/kg	57.8	66.8	32
Pantothenic acid	mg/kg	13.5	15.6	12
Riboflavin	mg/kg	1.1	1.3	20
Thiamine	mg/kg	5.2	6.0	13
Arginine	%	.60	.70	21
Cystine	%	.17	.20	24
Histidine	%	.17	.20	24
Isoleucine	%	.69	.80	
Leucine	%	.95	1.10	
Lysine	%	.35	.40	24
Methionine	%	.17	.20	
Phenylalanine	%	.78	.90	
Threonine	%	.35	.40	
Tryptophan	%	.17	.20	24
Tyrosine	%	.78	.90	
Valine	%	.69	.80	

WHEAT, HARD RED WINTER. Triticum aestivum

Wheat, hard red winter, grain, (4)

Ref no 4-05-268

Dry matter	%	89.1	100.0	1
Ash	%	1.8	2.0	18
Crude fiber	%	2.7	3.0	23
Ether extract	%	1.6	1.8	16
N-free extract	%	70.0	78.6	
Protein (N x 6.25)	%	13.0	14.6	15
Energy	GE kcal/kg	3552.	3991.	
Calcium	%	.05	.06	25
Magnesium	%	.10	.11	
Phosphorus	%	.40	.45	20
Potassium	%	.51	.57	
Cobalt	mg/kg	.100	.100	15
Copper	mg/kg	4.5	5.1	34
Manganese	mg/kg	38.8	43.6	32
Choline	mg/kg	734.	825.	23
Folic acid	mg/kg	.40	.40	37
Niacin	mg/kg	50.9	57.2	27
Pantothenic acid	mg/kg	12.5	14.1	15
Riboflavin	mg/kg	1.0	1.1	54
Thiamine	mg/kg	6.2	7.0	18
Vitamin B_6	mg/kg	4.10	4.60	18

Wheat red dog - see Wheat, flour by-prod, f-sift, mx 4 fbr

Whey - see Cattle, whey

Feed name or analyses		Mean As fed	Mean Dry	C.V. ± %
YEAST. Saccharomyces cerevisiae				
Yeast, brewers saccharomyces, dehy grnd, mn 40 prot, (7)				
Brewers dried yeast (AAFCO)				
Ref no 7-05-527				
Dry matter	%	93.0	100.0	2
Ash	%	6.4	6.9	13
Crude fiber	%	3.0	3.2	86
Ether extract	%	1.1	1.2	36
N-free extract	%	37.9	40.8	
Protein (N x 6.25)	%	44.6	47.9	4
Energy	GE kcal/kg	3958.	4255.	
Calcium	%	.13	.14	42
Iron	%	.010	.010	99
Magnesium	%	.23	.25	43
Phosphorus	%	1.43	1.54	15
Potassium	%	1.72	1.85	19
Sodium	%	.07	.08	57
Cobalt	mg/kg	.200	.200	32
Copper	mg/kg	33.0	35.5	45
Manganese	mg/kg	5.7	6.1	35
Zinc	mg/kg	38.7	41.6	64
Choline	mg/kg	3885.	4177.	32
Folic acid	mg/kg	9.70	10.40	
Niacin	mg/kg	447.5	481.1	19
Pantothenic acid	mg/kg	109.8	118.0	36
Riboflavin	mg/kg	35.0	37.6	65
Thiamine	mg/kg	91.7	98.6	31
Vitamin B_6	mg/kg	43.30	46.60	46
Arginine	%	2.20	2.36	12
Cystine	%	.50	.54	44
Glycine	%	1.70	1.83	11
Histidine	%	1.10	1.18	20
Isoleucine	%	2.10	2.26	31
Leucine	%	3.20	3.44	44
Lysine	%	3.00	3.22	19
Methionine	%	.70	.75	31
Phenylalanine	%	1.80	1.93	13
Threonine	%	2.10	2.26	13
Tryptophan	%	.50	.54	99
Tyrosine	%	1.50	1.61	31
Valine	%	2.30	2.47	13

(1) dry forages and roughages
(2) pasture, range plants, and forages fed green

(3) silages
(4) energy feeds
(5) protein supplements

(6) minerals
(7) vitamins
(8) additives

TABLE 9 Abbreviations Used in NRC Feed Nomenclature and the Terms For Which They Stand

AAFCO	Association of American Feed Control Officials	insol	insoluble
		IU	International Units
blm	bloom	kcal	kilocalorie
by-prod	by-product	kg	kilogram
Ca	calcium	mech-extd	mechanically extracted, expeller-extracted, hydraulic-extracted, or old process
Can	Canadian		
c-bolt	coarse-bolted		
CFA	Canada Feeds Act		
chop	chopped	μg	microgram
c-sift	coarse-sifted	mg	milligram
comm	commerical	mil-rn	mill-run
cond	condensed	mn	minimum
CW	Canadian Western	mx	maximum
dehy	dehydrated	N	nitrogen
dig	digestibility, digestible	No	Northern
distil	distillation, distillers		
dry-mil	dry-milled	P	phosphorus
dry-rend	dry-rendered	precip	precipitated
equiv	equivalent	proc	processed, processing
		prot	protein
F	fluorine	pt	part(s)
fbr	fiber	res	residue
f-grnd	fine-ground		
fm	foreign material (including seeds other than the principal product or grain)	s-c	sun-cured
		shred	shredded
		skim	skimmed
f-scr	fine-screened	sol	solubles
f-sift	fine-sifted	solv-extd	solvent-extracted
g	gram	US	United States
gr	grade		
grnd	ground	w	with
hydro	hydrolyzed	wet-rend	wet-rendered
		wo	without
ICU	international chick units	wt	weight

TABLE 10 Occurrence of Thiaminase in Fish

Species	Habitat	References
SPECIES THAT CONTAIN THIAMINASE		
Alewife (*Pomolobus pseudoharengus*)	Freshwater	Gnaedinger (1964)
Anchovies (*Anchoa hepsetus*)	Gulf of Mexico	Jones (1960)
Anchovies (*Engraulis mordax*)	Salt water	Stout *et al.* (1963)
Bass (white) (*Lepibema chrysops*)	Freshwater	Deutsch and Hasler (1943)
Black quahog (*Artica islandica*)	Atlantic	Lee (1948)
Bowfin (dogfish) (*Amia calva*)	Freshwater (Arkansas)	Gnaedinger (1964)
Bream (*Abramis brama*)	Freshwater	Kuusi (1963)
Buckeye shiner (*Notropus atherionoides*)	Salt water	Lee (1948)
Bull head (*Ameirurus m. melas*)	Freshwater	Deutsch and Hasler (1943)
Burbot (*Lota lota maculosa*)	Freshwater Lake Erie	Deutsch and Hasler (1943); Gnaedinger (1964)
Butterfish (*Poronotus triacanthus*)	Gulf of Mexico	Lee *et al.* (1955)
Carp (*Cyprinus carpio*)	Freshwater	Gnaedinger (1964); Deutsch and Hasler (1943)
Catfish (channel) (*Ictalurus lacustris punctatus*)	Freshwater	Deutsch and Hasler (1943)
Clams (chowder, steamer, cherrystone)	Freshwater	Melnick *et al.* (1945)
Fathead minnow (*Primephales p. promelas*)	Freshwater	Deutsch and Hasler (1943)
Garfish (gar pike)	Salt water	Borgstrom (1961)
Goldfish (*Carassius auratus*)	Freshwater	Gnaedinger (1964); Deutsch and Hasler (1943)
Herring (Baltic) (*Clupea harengus* var. *membranus*)	Baltic	Kuusi (1963)
Herring (*Clupea harengus*)	Atlantic	Deutsch and Hasler (1943)
Mackerel (*Scomber japonicus*) (Pacific)	Salt water	Borgstrom (1961)
Menhaden (large scale) (*Brevoortia patronus*)	Gulf of Mexico	Jones (1960)
Moray eel (*Gymnothorax ocellatus*)	Gulf of Mexico	Lee *et al.* (1955)
Mussell (bigtoe) (*Pluerobema cordatum*)	Tennessee River	Gnaedinger (1964)
Razor belly (scaled sardine) (*Harengula pensacolae*)	Gulf of Mexico	Lee *et al.* (1955)
Redfish (*Sebastes marinus*)	Salt water	Deutsch and Hasler (1943)
Sauger (*Stizostedion c. canadense*)	Freshwater	Deutsch and Hasler (1943)
Sculpin (*Myoxocephalus quadricornis thompsonii*)	Lake Michigan	Gnaedinger (1964)
Shad (gizzard) (*Dorosoma cepedianum*)	Freshwater	Gnaedinger (1964)
Shiner (spottail) (*Notropis hudsonius*)	Lake Michigan	Gnaedinger (1964)
Smelt (freshwater) (*Osmerus mordax*)	Freshwater	Gnaedinger (1964); Deutsch and Hasler (1943)
Starfish (*Asterias forbesi*)	Atlantic	Lee (1948)
Stoneroller (central) (*Campostoma anomalum pullum*)	Lake Michigan	Gnaedinger (1964)
Sucker (common white) (*Catostomus c. commersonnii*)	Freshwater	Deutsch and Hasler (1943); Gnaedinger (1964)
Whitefish (*Prosopium cylindraceum quadrilaterale*)	Freshwater	Deutsch and Hasler (1943)
Whitefish (*Coregonus clupeaformis*)	Freshwater	Deutsch and Hasler (1943)
SPECIES THAT DO NOT CONTAIN THIAMINASE		
Ayu (*Plecoglossus altivelis*)	Freshwater	Borgstrom (1961)
Bass (largemouth) (*Huro salmoides*)	Freshwater	Deutsch and Hasler (1943)
Bass (rock) (*Ambloplites r. rupestris*)	Freshwater	Deutsch and Hasler (1943)
Bass (smallmouth) (*Micropterus d. dolomieu*)	Freshwater	Deutsch and Hasler (1943)
Bluegill (*Lepomis m. macrochirus*)	Freshwater	Deutsch and Hasler (1943)
Chub (bloater) (*Coregonus hoyi*)	Lake Michigan	Gnaedinger (1964); Deutsch and Hasler (1943)
Cod (*Gadus morrhua*)	Salt water	Deutsch and Hasler (1943)
Crappie (*Pomoxis nigro-maculatus*)	Freshwater	Deutsch and Hasler (1943)
Croaker (*Micropogon undulatus*)	Gulf of Mexico	Gnaedinger (1964); Lee *et al.* (1955)
Cunner (*Tautogolabrus adsperus*)	Long Island Sound	Lee (1948)
Cutlassfish (silver eel) (*Trichiurus lepturus*)	Gulf of Mexico	Gnaedinger (1964); Lee *et al.* (1955)
Gar (northern longnose) (*Lepisostous osseus oxyusus*)	Freshwater	Deutsch and Hasler (1943)
Haddock (*Melanogrammus aeglefinus*)	Salt water	Deutsch and Hasler (1943)
Hake (*Merluccius productus*)	Pacific	Stout *et al.* (1963)

TABLE 10 Occurrence of Thiaminase in Fish—Continued.

Species	Habitat	References
Hake (*Urophcis* spp.)	Gulf of Mexico	Lee *et al.* (1955)
Herring (*Leuciohthys artedi arcturus*)	Lake Superior	Deutsch and Hasler (1943)
King whiting (ground mullet) (*Menticirrhus americanus*)	Gulf of Mexico	Gnaedinger (1964)
Lemon sole (*Pseudophleuronectes americanus dignabilis*)	Salt water	Deutsch and Hasler (1943)
Lizard fish (*Shyodus foetens*)	Gulf of Mexico	Lee *et al.* (1955)
Mackerel (*Scomber scombrus*) (Atlantic)	Salt water	Deutsch and Hasler (1943)
Mullet (*Mugil* spp.)	Gulf of Mexico	Gnaedinger (1964)
Perch (yellow) (*Perca flavescens*)	Freshwater	Deutsch and Hasler (1943)
Pike (northern) (*Esox lucius*)	Freshwater	Deutsch and Hasler (1943)
Pike (wall-eyed) (viscera) (*Stizostedion v. vitreum*)	Freshwater	Deutsch and Hasler (1943)
Porgy (Scup) (*Stenotomus aculeatus*)	Gulf of Mexico	Lee *et al.* (1955)
Pumpkinseed (*Lepomis Gibbosus*)	Freshwater	Deutsch and Hasler (1943)
Sea catfish (*Galeichthya felis*)	Gulf of Mexico	Lee *et al.* (1955)
Sea robin (*Prionotus* spp.)	Gulf of Mexico	Gnaedinger (1964); Lee *et al.* (1955)
Smelt (pond) (*Hypomesus olidus*)	Freshwater	Borgstrom (1961)
Spot (*Leiostomus xanthurus*)	Gulf of Mexico	Gnaedinger (1964); Lee *et al.* (1955)
Squid (*Loligo brevis*)	Gulf of Mexico	Lee *et al.* (1955)
Tautog (blackfish) (*Tautoga onita*)	Long Island Sound	Lee (1948)
Trout (brown) (*Salmo trutta fario*)	Freshwater	Deutsch and Hasler (1943)
Trout (lake) (*Cristivomer n. namayoush*)	Freshwater	Deutsch and Hasler (1943)
Trout (rainbow) (*Salmo gairdnerii irideus*)	Freshwater	Deutsch and Hasler (1943)
Walleye (yellow) (*Stizostedion v. vitreum*)	Freshwater	Deutsch and Hasler (1943)
White trout (*Cynoscion nothus*)	Gulf of Mexico	Gnaedinger (1964)
White trout (*Cynoscion avenarius*)	Gulf of Mexico	Lee *et al.* (1955)
Whiting (*Merluccius bilinearis*)	Salt water	Deutsch and Hasler (1943)
Yellow tails (*Limanda ferruginea*)	Salt water	Deutsch and Hasler (1943)

TABLE 11 Weight-Unit Conversion Factors

Units Given	Units Wanted	For Conversion Multiply by	Units Given	Units Wanted	For Conversion Multiply by
lb	g	453.6	μg/kg	μg/lb	0.4536
lb	kg	0.4536	kcal/kg	kcal/lb	0.4536
oz	g	28.35	kcal/lb	kcal/kg	2.2046
kg	lb	2.2046	ppm	μg/g	1.
kg	mg	1,000,000.	ppm	mg/kg	1.
kg	g	1,000.	ppm	mg/lb	0.4536
g	mg	1,000.	mg/kg	%	0.0001
g	μg	1,000,000.	ppm	%	0.0001
mg	μg	1,000.	mg/g	%	0.1
mg/g	mg/lb	453.6	g/kg	%	0.1
mg/kg	mg/lb	0.4536			

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