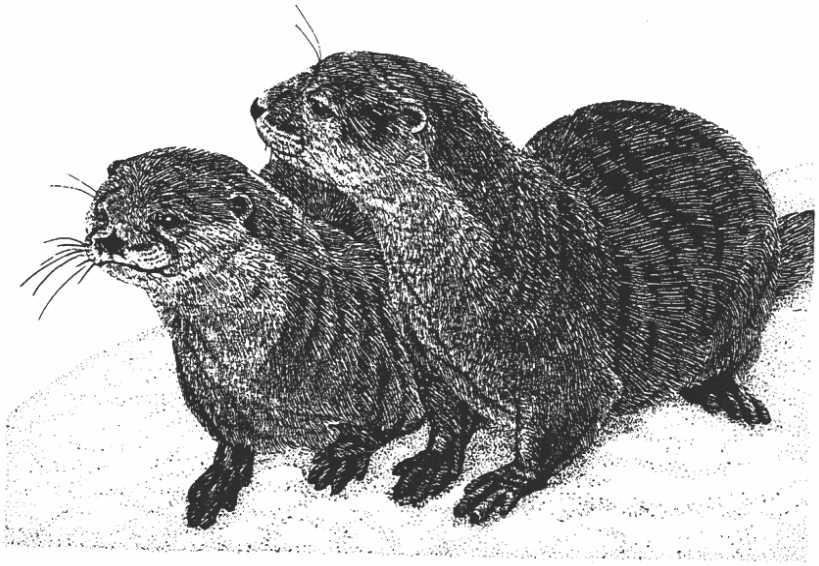
Asian Small Clawed Otter
(Aonyx cinerea)



Husbandry Manual
1998

Prepared By:
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Columbus Zoological Gardens
and the
Asian Small-Clawed Otter Species Survival Plan®

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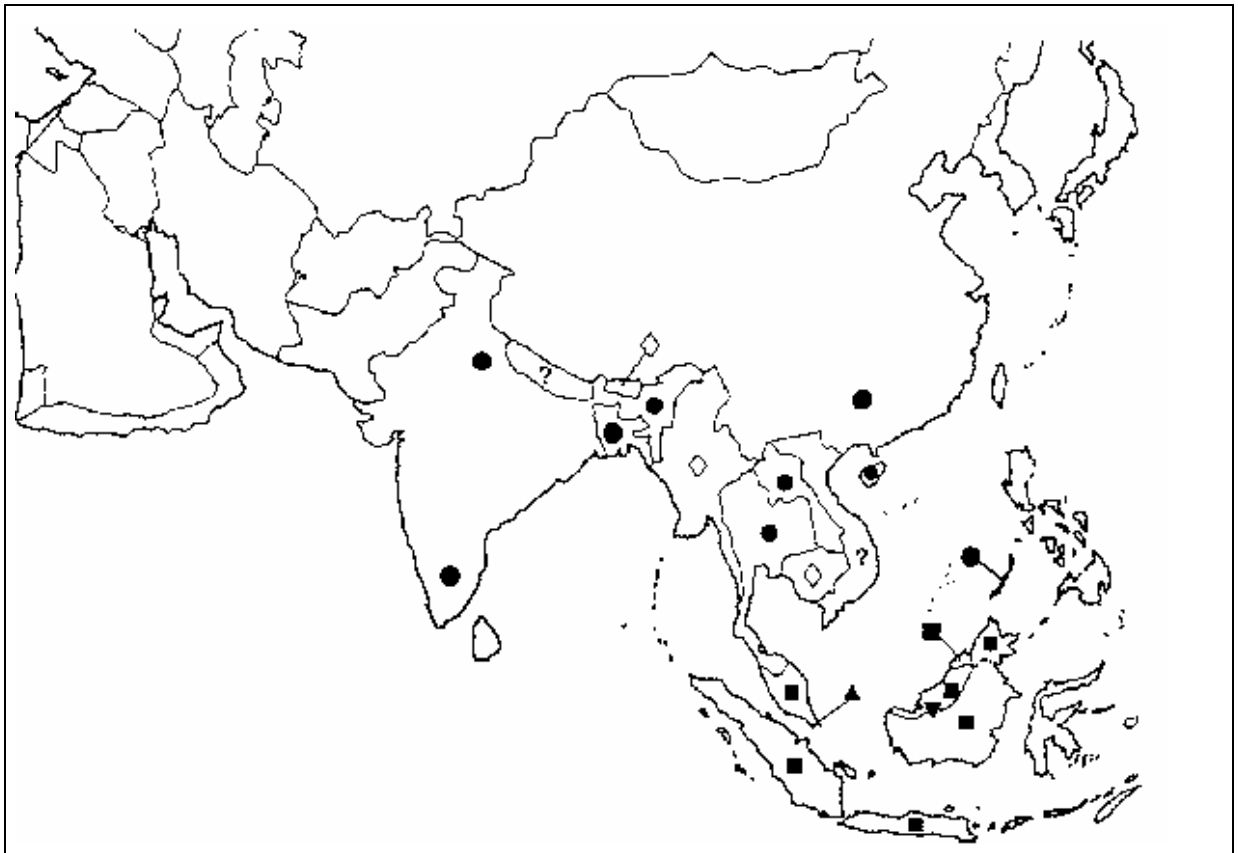
INTRODUCTION

The Asian small-clawed otter *(Aonyx cinerea)* is one of the five species of otters from Asia. It is the smallest of the world's otters, rarely weighing more than 5kg. A gregarious species, it is often seen in large groups of up to 15 animals and captive studies suggest that these groups are composed of an alpha breeding pair and their offspring from successive litters. Asian small-clawed otters have unusual hand-like front paws with increased tactile sensitivity and reduced webbing, which they use to forage for their prey of crustaceans, mollusks, and small fish. Asian small-clawed otters are found from Palawan (Philippines) through Indonesia, Southeast Asia, southern China, and westwards through the Himalayan foothills of Bangladesh, Bhutan, and Nepal. A disjunct population occurs in southern India (Foster-Turley P., Santiapillai C., Action Plan for Asian Otters).

Distribution of the Asian small-clawed otter (*Aonyx cinerea*)



Status of Asian Otters
The Red List is issued every two years and the 1996 version is the first to make use of the new IUCN categories and criteria, officially adopted in November 1994.

List 3: Lower Risk: Near Threatened--*Amblonyx cinereus* (listed as Aonyx cinerea); Bangladesh, Brunei, Cambodia, China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Philippines, Singapore, Thailand, Vietnam. (IUCN, 1996)

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Asian Small-Clawed Otter Species Survival Plan® (SSP)
The Asian Small-Clawed Otter SSP was established as a model for other endangered social otter species in 1981. It was felt that social otters would be difficult to breed reliably in captivity, and that appropriate husbandry should be established using a non-endangered otter species before captive breeding programs were initiated for endangered species. Consistent breeding of this species continues to have limited success. The SSP continues to explore and implement alternative strategies to enhance the breeding success.

In 1995 at the Master Plan Meeting it was decided that a Husbandry Manual, incorporated into a Resource Manual for Asian small-clawed otters, would be beneficial in making the decision as to whether to continue as an SSP or as a PMP.

There are many different ways to maintain small-clawed otters in captivity, it should be noted that this document is just a guideline to be used for reference. Flexibility and new ideas of management are always encouraged. This document is a compilation of comprehensive surveys that were sent to each holding institution in 1997. Member institutions and their representatives are:

Institution	**Representative**
Audubon Park & Zoological Gardens	Rhonda Votino
Bermuda Aquarium, Museum & Zoo	Jack Ward
Birmingham Zoo	Marcia Reidmiller
Bronx Zoo/Wildlife Conservation Park	James Doherty
Brookfield Zoo	Melinda Pruett-Jones
Cheyenne Mountain Zoological Park	Susan Engfer
Cleveland Metroparks Zoo	Donald J. Kuenzer
Columbus Zoological Gardens	Dusty Lombardi
Disney's Animal Kingdom	Sue Maher
Indianapolis Zoo	Lynne Villers
Kansas City Zoological Gardens	Conrad E. Schmitt
Lincoln Park Zoological Gardens	John Gramieri
Miami Metrozoo	Alice Gilley
Milwaukee County Zoological Gardens	Jan Rafert
Minnesota Zoological Garden	James H. Streater
National Zoological Park	Belinda Reser
Omaha's Henry Doorly Zoo	Liz Harmon
Reid Park Zoo	Mike Flint
Santa Barbara Zoological Gardens	Nancy Hollenbeck

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AMERICAN ZOO AND AQUARIUM ASSOCIATION®

CHAPTER 1

NUTRITION AND DIET

Mike Maslanka and Sue Crissey
Brookfield Zoo

To sustain a captive population of Asian small-clawed otters, the nutritional needs of the species must be met. Developing appropriate dietary guidelines requires consideration of: (1) feeding ecology, (2) target dietary nutrient values, (3) food items available to zoos, and (4) information collected from diets offered by institutions successfully maintaining/breeding Asian small-clawed otters. This chapter will address these nutritional issues in order to develop dietary guidelines for captive Asian small-clawed otters. It also provides an overview of the information that was gathered from the survey conducted during the fall of 1997 and spring of 1998.

FEEDING ECOLOGY

The Asian small-clawed otter (*Aonyx cinerea*, hereafter **ASC otter**) is a member of the Mustelidae family. The otter is a carnivore in dietary habits because the diet of free-ranging Asian small-clawed otters includes: crabs, crustaceans, snails, mollusks, frogs, and fish (Table 1.1; Duplaix-Hall 1975; Foster-Turley 1985; Foster –Turley 1992; Engfer, 1986). Partridge and Jordan (1995) also indicated that octopus was consumed by free-ranging ASC otters.

Nutrient Content of Diet

Although many of the items in the diet of free-ranging otters are established, the nutrient content of those items remains unknown. Descriptions of the nutrient content of food items similar to those described in the diet of free-ranging otters (although sometimes in distinctly different forms) can be found in several sources (NRC 1982, 1986; Pennington 1989). However complete nutrient information remains limited and should be used for estimations only.

TARGET DIETARY NUTRIENT VALUES

Target dietary nutrient values for ASC otters are based on several sources. The cat is typically the model species used to establish nutrient guidelines for carnivorous animals. The NRC (1986), AAFCO (1994), and Waltham Center for Pet Nutrition (Earle and Smith 1993) have provided recommendations for cats. A limited amount of information is provided by the NRC publication for mink and foxes (1982), which represents requirements of another mustelid species. The target nutrient values presented herein (Table 1.4) are a range of values nutrient derived from these sources. In most cases, they reflect the highest values reported from the various references. As new information becomes available, these ranges will change to reflect knowledge gained.

FOOD ITEMS AVAILABLE TO ZOOS

Historically, diets for captive ASC otters have revolved around meat products with additional supplements to compensate for any perceived nutrient shortfalls (Baer, et al 1994). Minced beef, fish, hard boiled eggs, locally available shellfish, crabs, etc. have all been included in diets reported for ASC otters (Timmins 1971; Lancaster 1975). To more closely match the apparent diet of free-ranging otters, locally obtained shellfish (crabs, clams, crayfish, etc.) and fish have increased in prevalence as part of the diet for captive ASC otters (See attached diet summary; Appendix 1.1).

ZOO DIET SUMMARY

Information collected from diets offered by institutions holding ASC otters can be a useful tool in proposing dietary guidelines. Because of this, a nutrition section was included in the recent ASC otter survey. The resulting information showed that a number of different diets were fed to otters. Food items included can be categorized into: manufactured feeds, meat products, fish/seafood, insects, vegetables, and supplements. Manufactured feeds included: ZuPreem Canned Feline diet, Purina dog food, Nebraska Brand Feline diet, Purina Fit'n'Trim dog food, Nutrena dog food, Iams Less Active dog food, Cycle Lite, Wisconsin Meat Mix, and Nebraska Brand Bird of Prey (Manufacturer contact information provided in Appendix 1.2). Meat products included horse liver and ribs. Seafood items

included a wide variety of fish (capelin, smelt, mackerel, herring, goldfish, minnows, trout, cichlids), shellfish (clams), and other crustaceans (crayfish). Invertebrates included mealworms, crickets, and earthworms. A variety of vegetables have been offered as well (carrots, lettuce, green beans, lettuce, cucumber, collard greens, kale, and other assorted greens). Supplements included: Vitamin E, Corn Oil, Children's Vitamins, Thiamin, Vitamin E / Thiamin (in combination), Linatone, B complex, Vitasol (with vitamin E), Potassium Citrate Granules, and Chitin. In many cases, food items offered in the diet were measured either by weight or volume. Consumption also was measured institutions however this was by general visual appraisal.

While all food items offered are considered a part of a complete and balanced diet, several institutions noted that some food items were used as enrichment. It was noted that some of these items were used by other institutions as part of the "base diet" as well. Live food items used as enrichment included crayfish, crabs, fish, crickets, mealworms, etc. Mussels, clams, hard-boiled eggs, peanuts, etc. are also occasionally offered as well as various items frozen into ice cubes (crickets, fish, etc.).

Most seasonal variation in the diet offered occurs due to availability of food items. Institutions where otters are housed outdoors (or in areas with little temperature regulation) report experiencing an increase in consumption as temperatures decrease during the winter.

Feeding Schedule/Interval

Most institutions represented in this survey offer food twice daily (morning and evening). Several institutions offer food more often (3 to 15 times) per day. Food items are offered on and off exhibit depending on the item(s) and the desired presentation.

Water Presentation

Most exhibits have potable water provided via running water and/or pools. Some institutions offer water in separate tubs for drinking. Most of the institutions reported that pool water was not heated and was maintained at a temperature of between 65º F and 80º F.

Determination of Nutrient Content of Total Diets

Several institutions have had their diets analyzed via lab assays and/or computer programs. The ingredients of these diets are listed in Table 1.2 and the nutrient content information is listed in Table 1.3. Two of the diets are fish based diets, and appear comparable in many nutrients.

Behavior Related to Feeding

Most institutions have experienced some type of competition for food items offered. In some cases, this competition has manifested itself in the form of aggression for food. This has led to physically separating individuals for feeding or offering food items in separate areas of the exhibit. It has been reported that ASC otters adapt well to routines, learn the precise time of feeding on a daily basis, and, in many cases, will vocalize at feeding time. Several institutions have observed a begging behavior for food. Once fed, otters have been observed to wash their food. In mixed species exhibits, other animals have been observed stealing the otter's food and vice versa, but little interspecies aggression has been observed.

Alternative Diets

Several institutions have employed alternative diets for special circumstances - lactating female diet (KMR and calcium carbonate added), weight loss diet, growing juvenile diet (Science Diet Growth Formula), maintenance diet (Science Diet Maintenance), possible calculi reduction, etc. Few details were provided regarding the specific situations when each diet was used.

RECOMMENDATIONS FOR FEEDING

Diet formulation should account for animal preferences, body weight, exercise, physical condition, environmental/seasonal changes, behavioral considerations, diet item availability, gastrointestinal tract morphology, and actual nutrient requirements. Thus, providing guidelines for nutrient content rather than specific food items in set quantities is appropriate (Table 1.4). This allows for flexibility in diet formulation while assuring that nutrient needs are met. Feeding mustelids at least 2 times/day is recommended due to a high metabolic rate and rapid digestion (Partridge and Jordan 1995).

Diets

As mentioned previously, several basic diets (including fish and commercially available dry, canned, and frozen diets) have been used to maintain ASC otters in captivity (Baer, et al 1994). Meat based diets have been used in most institutions for growth, maintenance, and breeding of ASC otters. There are a variety of meat products upon which to base the diet. Table 1.5 briefly describes the nutrient content of some commonly used manufactured products/nutritionally complete items. Although no definitive cause-effect relationship has been established, many otters offered meat-based diets have developed renal calculi (see Reported Health Problems Associated with Diet and/or Health Chapter). It must be noted however, that most otters receive this type of diet and most have this problem, so the involvement of the diet remains unclear at this point.

With the observation that renal calculi are observed almost solely in captive ASC otters, a diet which more closely resembles the diet reported for free-ranging ASC otters has been developed as an attempt to reduce the incidence of renal calculi in captive otters. This fish based diet has been evaluated for 2-3 years at the Minnesota Zoo, and appears to offer some promise in reducing incidence and/or development of renal calculi (Petrini, et al 1996). Alternatively, some institutions have historically offered ASC otters all fish diets with little, if any, reduction in the incidence of renal calculi (Petrini, pers. comm.). Common fish species and marine products, and their nutrient contents that could be included in an "all fish diet" are listed in Table 1.6. It should be noted that supplementation of vitamin E, thiamin, and possibly multivitamin are especially important when offering a diet comprised of mostly fish (see Nutrient Supplementation section).

Also, offering bones or some hard diet item, regardless of the rest of the diet, is recommended to maintain dental health.

Additional thoughts for experimental diets/items have been discussed in the Future Research Section. Use of potassium citrate has offered some promise in minimizing the incidence of renal

Calculi composed of calcium and oxalate in dogs and cats via alkalization of the urine, however its benefit to ASC otters has not been proven. Additionally, chitin, which potentially may bind dietary calcium, has been used as a possible way to minimize the incidence and/or development of renal calculi, but results have been disappointing.

Nutrient Supplementation

Vitamin E, Thiamin. Diets which contain high levels of marine products may predispose individuals to vitamin E deficiency if not adequately supplemented (Engberg, et al 1993). Marine products contain high levels of poly-and mono-unsaturated fatty acids. Because vitamin E functions as an antioxidant, the breakdown of these oils during storage causes vitamin E destruction. Thiamin deficiency may arise from feeding fish-based diets due to thiaminases present in some types of fish. If fish is offered as a major component of the total diet, supplementation with thiamin and vitamin E is recommended due to degradation of the two vitamins during the storage period (see Target Nutrient Values). These considerations should be addressed during the diet formulation process.

Multivitamin. In many cases, if a fish based diet is used, supplementation with a multivitamin is recommended. Nutritional deficiencies have been reported in commercially farmed mustelids (NRC, 1982). Fish composition can change based on species, season of harvest, duration of storage, etc. and addition of a multivitamin may provide some consistency in the nutrients contained in the diet. However, the diet should be analyzed to determine nutrient levels prior to supplementation in order to minimize the chance of over-supplementation and toxicity's particularly of fat-soluble vitamins.

HAND-REARING / INFANT DIET

The AZA Infant Diet Notebook provides some insight into hand-rearing mustelid species (Burnette 1994). Table 1.7 describes the milk composition of several mustelid species. According to Burnette (1994) the formula of choice appears to be Esbilac Dog Milk Replacer. This notebook is in the process of revision by the AZA Nutrition Advisory Group and should provide updated guidelines.

If hand rearing is necessary, and formula is offered via a bottle, a transition from 100% water to 100% formula should be gradual over a period of several feedings. This will allow for the infant to become used to the nipple or other feeding implement, thus minimizing the risk of fluid aspiration. It also will minimize the potential for diarrhea caused by a sudden dietary change.

Newborn and/or weakened cubs should be fed every 2-3 hours around the clock. After 10 days, feedings can be reduced to every 3-4 hours, and overnight feeding may still be necessary. As the animals grow, frequency of feedings can be continually reduced to 3-4 feedings per day until weaning (Burnette 1994).

Amounts to offer depend on size, age, and health. The recommended amount to offer as noted in the infant diet care notebook is described: "feed until the stomach is full but not taut or over-extended." It should be noted that the concept that an infant will correctly control its own intake if milk is offered ad lib has been proven incorrect by numerous reports of diarrhea, vomiting, listlessness, potbellies, labored breathing, anorexia, and death (Robbins 1993). Thus, ad libitum feeding is discouraged. It is best to establish moderate guidelines at the start of the hand-rearing period and adjust them based on consumption and observed growth.

ALTERNATIVE DIETS

Lactation Diet

There is an increased need for energy during lactation. Tumarov and Sorina (1997) have supported the use of high-energy diets for lactating female mustelids. Fat is the most concentrated source of energy in the diet. For lactating females, fat levels in the diet may be increased to support lactation and also to provide increased energy to minimize mobilization of body stores and metabolic stress associated with milk production. Diet increases for lactating otters should be based on past experiences with the individual otters and/or observed body weight loss (mobilization of tissue to support lactation).

Weight Loss Diet

There are several ways to approach formulating a weight loss diet for otters. Depending on the food items available, the feeding situation (fed alone or in a group), and the amount of weight loss desired, one or more approaches may be appropriate.

1. Feed less total food. By simply reducing the amount of total food offered, weight loss may occur. This practice is confounded by the aggression observed in group fed ASC otters around feeding time and the potential that this may be increased when less total food is offered.
2. Add more water to the diet. By providing a diet that contains more moisture, the total calories in the diet are diluted and this may allow weight loss. The otter can consume the same amount of total diet, but will actually be consuming fewer calories.
3. Increase the "bulk" of the diet. By adding indigestible or lower calorie items to the diet, the total "bulk" of the diet can be increased, effectively diluting the calories in the diet. The otter can consume the same amount of total diet, but will actually be consuming fewer calories.
4. Offer lower calorie items. Lower calorie items can be substituted in the diet. For example, fish varies in energy content from species to species. If weight loss is desired, a leaner fish could be substituted for a fattier fish to reduce total calories in the diet.

REPORTED HEALTH PROBLEMS ASSOCIATED WITH THE DIET

In 1985, the single major husbandry problem as reported in the regional studbook was urinary stones (calculi; Foster-Turley 1985). At the time, calculi appeared to exist regardless of the diet offered (meat mixes, commercial diets for cats or dogs, thawed fish, table scraps, etc.). In 1988, when the ASC otter SSP program was detailed, calculi were reported as the primary cause of death in the North American population (Foster-Turley and Engfer 1988). That same year, calculi were observed in over 75% of the captive population (Calle 1988) and are still apparently prevalent today (current survey). Eight out of nineteen survey institutions reported no nutritionally related disorders with their otters. Of the institutions that reported nutritional disorders, they all reported renal calculi (or "renal problems"). To this end, work has been

performed to determine the cause of renal calculi in ASC otters and possible management techniques to minimize incidence and/or development of calculi (Petrini 1996). This research has led to the philosophy that calculi formation in these otters is caused by a multitude of complex and inter-related factors. Several dietary adjustments have been attempted (all fish diets, potassium citrate addition,

chitin addition, special prescription diets), however few have been examined within the parameters of a defined study lasting for a period of time necessary to strongly conclude their efficacy or lack thereof.

FUTURE RESEARCH NEEDS

Studies examining the efficacy of all fish diets in reducing incidence/growth of renal calculi have been ongoing for several years with mixed results. Work performed at the Minnesota Zoo (Petrini, et al 1996) has shown some promise, however otters there have been on an all fish diet for slightly over 3 years and it will be important to observe those otters over the next few years as well. With this in mind, we have several considerations to direct our future efforts:

(1) Between 70-80% of ASC otters offered a variety of diets have developed renal calculi.

(2) Although some otters offered an all fish diet have developed calculi, the young otters at Minnesota have not exhibited calculi after being on the diet for 3 years or more.

(3) Several "new" diet items have been introduced that may assist in reducing incidence of renal calculi, but have yet to be adequately tested - potassium citrate, chitin, Hill's Feline c/d^{o}, etc. Collaborative efforts among holding institutions may allow for systematic evaluation of the abilities of these items to reduce incidence/development of calculi.

(4) Several young otters (assumed calculi free at this point) in the North American population may allow for the evaluation of a selected diet throughout their lives.

Due to the limitations of the current research on renal calculi and the association, if any, with the diet in Asian small-clawed otters, it is recommended that all young otters be thoroughly evaluated initially and periodically. This evaluation should include radiographs. Since the number of animals is relatively small, collaborative investigation is a necessity. This collaboration should involve standardized protocols and management guidelines, and should test a uniform diet (such as fish and specific supplements) among all participating institutions.

Table 1.1 . Prey items listed in order of frequency of occurrence in the scat of ASC otters.*

Prey Item*
Invertebrates (general)

Crab
Fish (general)
Gobiodei (mudskippers)
Anabantidae (specific fish family)
Snakes (general)
Trichogaster spp. (fish spp.)
Anabis testudineus
Amphibians (general)
Rattus spp.
Snail
Clarias spp. (fish spp.)

* From Foster-Turley, 1992.

Table 1.2. Percent distribution of food items included in the representative diets of captive ASC otters (as fed: 1997/98 survey results).

Audubon Zoo	Brookfield Zoo	WCS (Bronx)	Minnesota - Fish*	Minnesota - Meat*
53% Capelin	58% Otter Mix[2]	50% FelineDiet[4]	28.6% Capelin	100%FelineDiet[4]
33% Smelt	30% Fish[3]	18% Capelin	28.6% Mackerel	
7.1% Mackerel	8% Ribs	18%Carrot/Yam	28.6% Herring	
6.4% Herring	2% Dog food	14% Greens	14.3% Smelt	
0.2% Corn Oil	2%Invertebrates	Thiamin/E	1.9% Corn Oil	
0.1%Multivitamin[1]			0.2% Thiamin/E	
0.1% Vitamin E			Multivitamin[1]	
0.1% Thiamin				

* Two experimental diets have been used at the Minnesota Zoo: a fish based diet and meat based diet. These diets have been used to examine the incidence of renal calculi (Petrini, et al. 1996).

[1] Multivitamin was a Children's Multivitamin (Audubon) and A-Z Multivitamin (Minnesota).

[2] Otter mix contains 30% low calorie dog food, 27.6% Nebraska ground horsemeat, 14.9% ground beef heart, 12.3% water, 9.1% ground cat food, 2.7% poultry fat, 2.1% beet pulp, 0.58% CaCO3, 0.44% oil, 0.3% theralin substitute, 0.0001% Rovimix-E.

[3] Fish includes capelin, smelt, and herring.

[4] Feline diet is the Nebraska Brand Feline Diet (see manufacturer contacts, Appendix 2).

Table 1.3.Analyzed nutrient content of representative diets offered to captive ASC otters (dry matter basis).*

Nutrient	Audubon Zoo Diet	Brookfield Zoo Diet	WCS (Bronx) Diet	Minnesota Fish Diet	Minnesota Meat Diet
Dry Matter, %	25.3	56.0	60.6	24.8	39.3
CrudeProtein%	66.6	42.9	53.7	68.1	47.8
Fat, %	24.1	18.4	36.6	18.95	37.9
Fiber, %	1.02	4.5	-	1.2	2.8
Ash, %	9.56	6.2	-	10.4	6.5
Na, %	0.43	0.27	-	0.79	0.32
Ca, %	3.26	0.82	1.3	1.56	0.96
P, %	1.14	0.55	1.1	1.67	0.78
K, %	1.44	0.90	-	1.5	0.88
Mg, %	0.18	0.12	-	0.16	0.1
Zn, mg/kg	57.3	54.7	-	78.8	73.5
Cu, mg/kg	2.18	7.36	-	3.34	7.9
Mn, mg/kg	-	6.8	-	4.69	18.6
Fe, mg/kg	70.8	154.1	-	103.5	483

*Diets were analyzed at multiple sites (based on institution affiliation and/or preference).
- Indicates unknown value.

Table 1.4. Target nutrient ranges on a dry matter basis for Asian Small-Clawed Otters (dry matter basis).

Item	Target Nutrient Range*
Energy, kcal/g	3.6-4.0

Crude Protein, %	24-32.5
Fat, %	15-30**
Vitamin A, IU/g	3.3-10***
Vitamin D, IU/g	0.5-1.0
Vitamin E, mg/kg	30-120(α)
Thiamin, mg/kg	1-5(α)
Riboflavin, mg/kg	3.7-4.0
Pantothenic Acid, mg/kg	5-7.4
Niacin, mg/kg	9.6-40
Pyridoxine, mg/kg	1.8-4
Folic Acid, mg/kg	0.2-1.3
Biotin, mg/kg	0.07-0.08
Vitamin B12, mg/kg	0.02-0.025
Choline, mg/kg	1000-3000
Calcium, %	0.6-0.8(β)
Phosphorus, %	0.6(β)
Potassium, %	0.2-0.4
Sodium, %	0.04-0.6
Magnesium, %	0.04-0.07
Zinc, mg/kg	50-94
Copper, mg/kg	5.0-6.25
Manganese, mg/kg	5-9
Iron, mg/kg	80 -114
Iodine, mg/kg	1.4-4.0

* Target nutrient ranges on a dry matter basis derived from requirements for domestic cats (NRC 1986), AAFCO recommendations (1994), Waltham Center for Pet Nutrition recommendations (Earle and Smith 1993), requirements for mink and foxes (NRC 1982), and literature describing the foraging behavior of ASC otters.

** The fat content of fish commercially available in North America typically ranges from 5-40%, and ASC otters have been maintained on diets containing between 15-40% fat (see table 2), thus an appropriate range for fat appears to fall between 15-30%.

*** The vitamin A requirement for cats is 10 IU/g (dry matter basis; NRC 1985), which represents the upper bound of the range. However, free-ranging ASC otters may consume a diet of mostly fish (Foster-Turley 1992), thus may have a higher tolerance for vitamin A due to the high levels which may occur in their natural diet.

(α)When mostly fish diets are offered, the presence of unsaturated fatty acids and thiaminases causes the breakdown of these vitamins. Thus, dietary levels of 400 IU vitamin E / kg of dry diet and 100-120 mg thiamin / kg of dry diet are recommended (Engelhardt and Geraci 1978).

(β) The recommended Ca:P ratio is between 1:1 and 2:1.

Table 1.5. Nutrient content of several commonly used meat/nutritionally complete food items (dry matter basis).*

Nutrient	Ground Horsemeat	Nebraska Feline®	Nutrena River Run Dog Food®	Purina Fit 'n' Trim Dog Food®
CrudeProtein, %	51.7	50.0	23.9	18.2
Fat, %	19.7	31.6	9.1	5.7
Vitamin A, IU/g	-	97.1	5.7	20.1
Vitamin D, IU/g	-	1.2	5.7	2.0
VitaminE,mg/kg	-	42.4	56.8	12.5
Ca, %	-	1.6	1.7	1.1
P, %	-	1.3	1.1	0.9
Mg, %	-	0.05	0.05	0.2

* Values from manufacturer guaranteed analysis and analyses performed at or for Brookfield Zoo. See manufacturer contacts in Appendix 2.

Table 1.6. Nutrient content of several commercially available fish species and marine products (dry matter basis).*

Nutrient	Capelin	Herring	Oystershell	Shrimp***	Smelt	Trout
Dry Matter, %	18.8	27.7	100	24.1	22.7	23.7
Energy, kcal/g	5.5	6.3	-	2.3	7.0	6.5
CrudeProtein,%	59.8	45.3	0	20.5-44.2	70.4	55.8
Fat, %	14.8	34.0	0	1.8-4.3	16.6	34.5
VitaminA, IU/g	44	56	0	-	-	58
Vitamin E, IU/g	0.024	0.034	0	-	-	0.32
Ca, %	1.7	1.7	38.0	10.8	1.4	2.1
P, %	0.37(1.2-1.4**)	0.39	0.07	2.1	1.6	1.5

* Analyses from Bernard and Ullrey (1989), Minnesota Zoo, Brookfield Zoo unless otherwise noted.
** Unpublished data from the Brookfield Zoo and Minnesota Zoo indicates value may be closer to 1.2-1.4.
*** From NRC (1982), shrimp meal process residue, and Pennington (1989), whole raw shrimp.

Table 1.7. Milk composition of several mustelid species.*

			% of Solids		
Species	% Water	% Solids	Fat	Protein	Carbohydrate
N.A. River Otter	62.0	38.0	63.0	28.9	0.3
Sea Otter	69.9	30.1	65.0	31.2	2.6
Mink	78.3	21.7	33.0	26.0	21.0
	68.9	31.1	30.1	29.6	-
Badger	81.4	18.6	33.9	38.7	18.8
Ferret	76.5	23.5	34.0	25.5	16.2
Hog-nose Skunk	65.4	34.6	31.2	31.2	7.8
Striped Skunk	69.4	30.6	45.0	32.0	10.0

* From Burnette (1994); Robbins (1993).

Appendix 1.1. ASC Otter Diets
1997-98 SSP Survey Results
Reported Diet per Otter

Abbreviations:
ALT - alternating
App - approximately
BE - behavioral enrichment
eod - every other day
ex - on exhibit
0.1 - female
1.0 - male
occ - occasionally
pcs - pieces
SMTWHFS - days of the week
X - quantity not listed
x/w - times per week
w/a - when available

Footnotes to Appendix 1.1:
* 1 can Iams Less Active for Cats (Fish and Rice), ½ tbsp MirraCoat Daily Care, 1/8 cup Bran. Makes 5 ½ meatballs.

** 1 ½ cans ZuPreem Feline, ½ tbsp MirraCoat, 1/8 cup Bran. Makes 6 ½ meatballs.

*** 30.0 % Purina Fit'n'Trim, 27.6% Ground Nebraska Horse Meat, 14.9% Ground Beef Heart, 12.3% water, 9.08% Ground Nutrena Cat Chow, 2.66% poultry fat, 2.06% Beet Pulp, 0.58% CaCO3, 0.44% Nutriderm Oil, 0.3% Theralin Substitute, 0.0001% Rovimix E-125.

Appendix 1.2. Manufacturer Contacts.

ABDEC Baby Vitamin Drops (liquid baby vitamins)
Parke-Davis
Division of Warner-Lambert Company
201 Tabor Road
Morris Plains, NJ

Animal Spectrum, Inc. (Nebraska Brand Feline, Canine, and Bird of Prey diets, horsemeat).
P.O. Box 721
North Platte, Nebraska 69103-0721

Hill's Pet Products (Prescription diets, ZuPreem Canned and Dry Foods)
P.O. Box 148
Topeka, KS 66601

Iams Co. (Iams Less Active Dog Food)
7250 Poe Ave
Dayton, OH 45414
800-525-4267

Nutrena Feeds (River Run Dog Food)
2101 Terminal Road
Fort Worth, TX 76106

Lambert Kay, Inc. (Linatone)
Division of Carter-Wallace, Inc.
Cranbury, NJ 08512-0187

Landco, Division of Golden Crown Corp. (Potassium Citrate Crystals)
Post Falls, ID 83854

Pet Ag, Inc. (Mirracoat)
261 Keyes Ave.
Hampshire, IL 60140
800-323-6878

Ralston Purina Co. (Fit'n'Trim Dog Food)
St. Louis, MO 63164
317-962-8547

Roche, Inc. (Rovimix-E)

Animal Feed Division
Nutley, NJ 07110-1199

SmithKline-Beecham Animal Health (Nutriderm)
West Chester, PA 19380
800-733-5500

Stuart Products, Inc. (Thiamin-E Paste)
Bedford, TX 76021

Sundown Vitamins (Multivitamins)
Boca Raton, FL 33487
800-327-0908

	Audubon	Bermuda Aquarium	Birmingham Zoo	Bronx Zoo	Brookfield	Cleveland Metroparks	Columbus Zoo	Cheyenne Mt. Zoo	Henry Doorly Zoo	Kansas City
Manufactured Feeds										
Commercial Cat Food	-	-	-	-	-	50g IAMS Less Active	-	-	-	-
Commercial Dog Food	-	-	Purina 1cup	-	-	-	-	-	-	-
Hills ZuPreem Canned Feline	-	85g	-	-	-	-	-	-	-	-
Nebraska Canine	-	-	-	-	-	-	-	-	100g	-
Nebraska Feline	-	-	1cup	225g	-	-	-	57g	30g	-
Nebraska Bird of Prey	-	-	-	-	-	-	-	-	-	100g
Purina Fit'n'Trim	-	-	-	-	10 g	-	2/3 cup	-	-	-
Otter Mix	-	-	-	-	-	-	-	-	-	-
Science Diet	-	-	-	-	-	-	-	-	-	T/D 2cups
Other	-	110g Buckeye Dog Kibble	-	-	99g/f-162g/m Otter Mix***	-	4pcs Cycle Lite	-	-	-
	-	-	-	-	-	-	-	-	-	
Meats										
Horsemeat	-	-	1"x2"slice-1x/w Liver	-	Rib 120-140g 1x/w	-	-	-	-	-
Hard Boiled Egg	-	1/2	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	227g Wisconsin	-	-	-
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Fish/Seafood										
Capelin	370g/d	-	-	60g	65g,1x/w	30-60g	114g STHS	9-12g/d or	60g	2-3x/w
Crayfish	-	12g-2x/w	-	-	rarely - Tropic group	-	BE	-	BE	daily-BE
Smelt	230g/d	95g	4	-	100g,1x/w	30-60g	114g Lake MWF	12-18g/d or	-	-
Trout	-	-	-	-	50g,1x/w	-	295g	-	BE	-
Mackerel	50g/d	-	-	-	-	-	-	-	-	-
Herring	45g/d	92g	-	-	68g,1x/w	-	-	12-18g/d	-	daily
Goldfish	-	16g-w/a BE	-	-	-	-	-	-	-	-
Minnows (Golden roaches)	-	-	-	-	App 25g/w	-	-	-	-	eod-BE
Other	-	-	-	-	-	-	Clams-BE	-	-	-
Insects										
Crickets	-	-	2-3x/w BE	App 10-20	20g/w	-	occasionally	-	-	-
Mealworms	-	handful w/a	2-3x/w BE	App 10-20	-	-	occasionally	-	-	-
Other	-	Earthworms wild-in ex.	-	-	-	-	-	-	-	-
Vegetables										
Apple	-	-	-	-	-	-	-	-	-	-
Carrot	-	20g	1/2	50g	-	-	-	1/8	30g	-
Lettuce	-	20g	-	-	200 g/w - Tropic group	-	-	-	-	-
Sweet Potato	-	-	-	-	-	-	114g	-	-	-
Green Beans	-	-	2 1/2 beans	-	-	-	6	-	-	-
Assorted Greens	-	-	-	50g	-	-	-	1 leaf	kale 70g	-
Other	-	-	-	-	App 100 g/w cucumber	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Supplements										
Vitamin E Supplement	65 IU	-	-	-	-	-	-	-	-	4 (E-400IU)
Corn Oil	2cc	-	-	-	-	-	-	-	-	-
Children's Vitamin	1/3 tablet	-	-	-	-	-	-	-	-	-
Stuart Thiamin-E	-	1g/kg fish	-	-	-	-	-	-	-	-
Linatone	-	1/2 tbsp	-	-	-	-	-	-	-	-
Vionate	-	-	-	-	-	-	-	1/4 tsp	-	-
B1	-	-	-	-	-	-	-	25mg	-	4(100mg)
Chitin	-	-	-	-	-	-	Chitin	-	Chitin 15g	-
Cod Liver Oil	-	-	-	-	-	-	-	-	-	-
Other	25mg Thiamin	-	1/2 tab B-Complex	X Vit-a-sol with Vit E	-	300 mg K Citrate Granules	-	-	Polyvisol 3dps	-

Abbreviations: x/w-Times per week; w/a-When available; BE-Behavioral Enrichment; ex-Exhibit; tab-Tablet; App-Approximately; X-Quantity unknown; 0.1-Female; 1.0-Male; occ-Occasionally; pcs-Pieces; eod-every other day; ALT- Alternating; SMTWHFS-Days.

*1 can IAMS-Less Active for Cats: Fish & Rice; 1/2 tbsp Mirra-Coat Daily Care; 1/8 cup Bran. Makes 5 1/2 meatballs.

**1 1/2 cans Zu-Preem Feline; 1/2 tbsp Mirra-Coar Daily Care; 1/8 cup Bran. Makes 6 1/2 meatballs.

***27.6%Ground Nebraska Horse Meat; 14.9% Ground Beef Heart; 9.08%Ground Nutrena Cat Chow; 30% Ground Purina Fit n'Trim; 2.06% Beef Pulp; 0.58% CaCO3; 0.3% Theralin Substitute; 0.0001% Rovimix E-125; 2.66% Poultry Fat; 0.44% Nutriderm oil; 12.3% water.

	Miami Metrozoo	Minnesota Zoo	National Zoo (group1)	National Zoo (group2)	Reid Park	Santa Fe	Sea World-Ohio	Sea World-Texas	Topeka	Zoo Atlanta
ufactured Feeds										
Commercial Cat Food	-	-	-	-	-	-	-	-	-	-
Commercial Dog Food	75g Wayne Bites	-	-	-	20 Parner	FRM chunks 30g	-	-	-	-
Hills ZuPreem Canned Feline	-	-	-	1/3 can	-	-	-	-	-	-
Nebraska Canine	-	-	-	-	-	112.5g	-	-	-	-
Nebraska Feline	150g		-	-	454g	-	-	-	-	113g
Nebraska Bird of Prey	-	-	-	-	-	-	-	-	-	-
Purina Fit'n'Trim	-	-	-	-	-	-	-	-	-	-
Otter Mix	-	-	-	-	-	-	-	-	-	-
Science Diet	-	-	-	-	-	-	85g	112-148g	-	-
Other	-	-	1IAMS-Meatball*	1tbsp Bran	8 Zu-Preem Monkey Chow	-	-	-	-	-
		-	1Zu-Preem Feline-Meatball**	-	-	-	-	-	-	-
ts										
Horsemeat	-	-	2 Tail Bones S	-	-	-	-	-	-	-
Hard Boiled Egg	60g	-	-	-	-	1/w	X - BE	-	-	-
Other	-	-	-	2 Chicks TH	-	Yogurt 6 tbsp	Tadpoles-BE	-	-	Bouillon cubes-BE
	-	-	-	5 Mice WS	-	-	-	-	-	-
	-	-	-	1 joint Ox tail S	-	-	-	-	-	-
/Seafood										
Capelin	-	60g	-	-	-	-	400g	420-644g	-	-
Crayfish	-	-	1 HF	-	-	every other month	BE	-	-	-
Smelt	-	30g	-	10-15 MF	-	1	285g	-	-	-
Trout	-	-	-	-	-	-	varies - BE	-	-	occ treat
Mackerel	-	60g	-	-	-	-	-	-	-	-
Herring	-	60g	-	-	-	-	-	-	-	-
Goldfish	-	-	-	-	-	-	BE	-	-	-
Minnows (Golden roaches)	-	App 20/w	-	-	-	-	-	-	-	-
Other	Cichlids 4/d	-	1 Fishpop MWS	-	5 Silversides MWF	crabs-eod	-	-	-	silversides 75.7g
cts										
Crickets	20/d	-	1 T	-	-	-	-	wild	-	10g STHS + Cricket cubes-BE
Mealworms	25/d	-	-	-	-	-	-	-	-	6.7g MWF
Other	-	-	-	-	-	-	-	-	-	-
etables										
Apple	-	-	-	-	-	127.5g eod-ALT	-	-	-	-
Carrot	30g	-	-	1tbsp-grated	-	120g eod-ALT	-	-	-	-
Lettuce	-	-	-	-	-	-	-	-	-	-
Sweet Potato	-	-	-	-	-	-	-	-	-	-
Green Beans	-	-	-	-	-	-	-	-	-	-
Assorted Greens	-	-	-	-	-	1.4 cup	-	-	-	-
Other	-	-	-	-	-	WhPotato 127.5g	-	-	-	91g corn+celery+turnip root (MTH)
	-	-	-	-	-	-	-	-	-	91g whpotato+swpotato+carrot (SWFS)
	-	-	-	-	-	-	-	-	-	Celery
plements										
Vitamin E Supplement	-	-	-	-	0.2cc	-	-	-	-	0.12cc Emcelle
Corn Oil	-	4ml	-	-	-	-	-	-	-	-
Children's Vitamin	-	1/10 tablet	-	-	-	-	-	-	-	-
Stuart Thiamin-E	-	0.5ml	-	-	-	-	-	-	-	-
Linatone	3/4 tsp	-	-	-	-	1/4 tsp	-	-	-	-
Vionate	3/4 tsp	-	-	-	-	-	-	-	-	-
B1	-	-	-	-	-	-	-	-	-	-
Chitin	-	-	-	-	-	-	-	-	-	-
Cod Liver Oil	3/4 tsp	-	-	-	-	Cod liver oil 1/4 tsp	-	-	-	-
Other	-	-	-	-	-	-	-	Hi Vits	-	-

eviations: x/w-Times per week; w/a-When available; BE-Behavioral Enrichment; ex-Exhibit; tab-Tablet; App-Approximately; X-Quantity unknown; 0.1-Female; 1.0-Male; occ-Occasionally; pcs-Pieces; eod-every other day; ALT- Alternating;
WHFS-Days.
n IAMS-Less Active for Cats: Fish & Rice; 1/2 tbsp Mirra-Coat Daily Care; 1/8 cup Bran. Makes 5 1/2 meatballs.
1/2 cans Zu-Preem Feline; 1/2 tbsp Mirra-Coar Daily Care; 1/8 cup Bran. Makes 6 1/2 meatballs.
7.6%Ground Nebraska Horse Meat; 14.9% Ground Beef Heart; 9.08%Ground Nutrena Cat Chow; 30% Ground Purina Fit n'Trim; 2.06% Beef Pulp; 0.58% CaCO3; 0.3% Theralin Substitute; 0.0001% Rovimix E-125; 2.66% Poultry Fat; 0.44% Nutriderm oil;
% water.

Prescription Diet®
Feline c/d®

Product Characteristics

(Compared to average multipurpose cat foods)
Sodium - reduced
Magnesium – reduced
Phosphorus – reduced
Protein - reduced
Potassium Citrate - added
Vitamin B6 - added
Calcium - reduced

Target urinary pH - more alkaline (6.6 – 6.8)

Indications

One or several of the above characteristics make Hill's® Prescription Diet® Feline c/d® brand dietary pet food useful as a nutritional aid for cats with:

FELINE LOWER URINARY TRACT DISEASE (FLUTD) (Management of Oxalate)
Feline c/d® contains added potassium citrate and allows production of a more alkaline urinary pH. These nutritional attributes are relevant in the prevention of oxalate crystal formation which appears to be an important contributor to FLUTD.

Contraindications

Struvite uroliths or crystalluria
Growth and reproduction

Daily Feeding Guide

Feline c/d® is formulated to meet the nutritional levels established by the AAFCO Cat Food Nutrient Profiles for maintenance of adult cats. The analogous canned or dry formula may be used as a supplement. In most cases other supplementation, including concurrent use of urine acidifiers, is contraindicated.

The following daily intakes are intended as a starting point only and should be adjusted as needed to maintain optimum body weight. Individual requirements will vary depending upon environment, season, exercise, temperament and stress factors, including disease. Feeding transitions should be made over a period of seven to ten days.

	Amount of Feline c/d®		
BODY WEIGHT (LB.)	**CANNED (5½ OZ.)**	**DRY (CUPS)**	**CANNED + DRY (5½ OZ.)**
5	1	½	½ + ¼
10	1¾	¾	¾ + ½
15	2½	1¼	1¼ + ¾

One 5½oz. can = ¾ cup dry

One cup dry = one and three fourths 5½ oz. cans

Metabolizable Energy* (Caloric Content)

CANNED 1040 kcal/kg (162 kcal/5½ oz. can) (calculated)
DRY 3776 kcal/kg (256 kcal/cup**) (calculated)

*Measurement of the useable energy in a food, which differs substantially from gross caloric content.
**An eight fluid oz. measuring cup of Feline d/d contains 2.7 oz. by weight.

Average Nutrient Contents

	As Fed*		Dry Matter*		As Fed, Caloric Basis***	
	%		%		g/100 kcal	
	CANNED	**DRY**	**CANNED**	**DRY**	**CANNED**	**DRY**
Protein	9.9	31.5	41.7	34.3	9.6	8.4
Fat	4.7	15.4	19.7	16.8	4.6	4.1
Carbohydrate (NFE)	7.4	38.9	31.2	42.3	7.1	10.3
Fiber	0.44	1.0	1.87	1.1	0.43	0.3
Calcium	0.16	0.74	0.67	0.80	0.15	0.20
Phosphorus	0.13	0.61	0.55	0.66	0.13	0.16
Sodium	0.07	0.37	0.30	0.40	0.07	0.10
Potassium	0.21	0.74	0.87	0.80	0.20	0.20
Magnesium	0.02	0.07	0.09	0.08	20.2 mg	19.6 mg
Chloride	0.12	0.92	0.50	1.0	0.11	0.24
Taurine	0.12	0.13	0.52	0.15	112.0 mg	35.5 mg

*Differs from label guarantees which are either maximums or minimums.
**The nutrient in the product after moisture is removed. It is used to make direct comparisons of nutrient profiles of products with differing moisture contents.
***Nutrient intake for every 100 kilocalories consumed.

Ingredients

CANNED Water, Meat By-Products, Liver, Brewers Rice, Rice Flour, Corn Gluten Meal, Soy Fiber, Vegetable Oil, Brewers Dried Yeast, Xanthan Gum, Locust Bean Gum, Potassium Citrate, Choline Chloride, Calcium Carbonate, Dicalcium Phosphate, Taurine, DL-Methionine, Calcium Sulfate, Iron Oxide, Magnesium Oxide, Iodized Salt, Zinc Oxide, Ferrous Sulfate, Copper Sulfate, Manganous Oxide, Calcium Iodate, Sodium Selenite, Vitamin E Supplement, D-activated Animal Sterol, Thiamine, Pyridoxine Hydrochloride, Niacin, Calcium Pantothenate, Riboflavin, Folic Acid, Biotin, Vitamin B12 Supplement.

DRY Brewers Rice, Poultry By-Product Meal, Corn Gluten Meal, Animal Fat (preserved with BHA, Propyl Gallate and Citric Acid), Soy Fiber, Natural Flavor, Choline Chloride, Potassium Chloride, Calcium Sulfate, Iodized Salt, DL-Methionine, Potassium Citrate, Taurine, Magnesium Oxide, Zinc Oxide, Ferrous Sulfate, Copper Sulfate, Manganous Oxide, Calcium Iodate, Sodium Selenite, Vitamin A Supplement, D-activated Animal Sterol, Vitamin E Supplement, Niacin, Thiamine, Pyridoxine Hydrochloride, Calcium Pantothenate, Riboflavin, preserved with BHT, BHA and Ethoxyquin, Folic Acid, Biotin, Vitamin B12 Supplement.

Alternative Formula

Call Hill's Consultation Service (1-800-548-VETS [8387]) for assistance in planning an alternative dietary strategy using Hill's® Prescription Diet® pet food products.

Packaging

CANNED Cases of 24 – 5½ oz. cans (4625)
DRY Bags – 4 lb. (4626)

CHAPTER 2

Health Care

Kristine R. Petrini, DVM

Veterinary Advisor, Asian Small-Clawed Otter SSP

Minnesota Zoological Garden

Introduction

The importance of a strong preventative health care program for Asian small-clawed otters cannot be over emphasized. Components of such a plan include proper housing, quarantine, nutrition, parasite control, vaccinations, regular physical examinations, dental care, and pathological surveillance. This manual includes protocols and suggestions for a successful medical management program for the Asian small-clawed otter. Diseases that are common in small-clawed otters and other mustelids are discussed in this section. Otters, like most wild animals, often do not show clinical signs of illness until a disease is quite advanced. Clinical signs such as vomiting, diarrhea, coughing, or anorexia should be investigated promptly. Please contact the small-clawed otter veterinary advisor for further information or to report unusual medical cases. Sharing medical information between institutions via the SSP makes it possible to continue to improve our knowledge and care of otters in captivity.

Physiological norms: (approximate values in anesthetized animals)

Adult weight: 2.0-4.8 kg
Body temperature: 99.5º-103º (37.2º-39.4º C)
Heart rate: 80-300 beats per min
Respiratory rate: 16-60 respirations per min
EKG (Samuels and Cooke, 1991):

QRS (mV)	0.99 ± 0.53
P (mV)	0.18 ± 0.12
T (mV)	0.20 ± 0.14
R (mV)	0.58 ± 0.28
P (s)	0.04 ± 0.02
PR (s)	0.06 ± 0.02
QRS (s)	0.04 ± 0.01
T (s)	0.06 ± 0.03
QT (s)	0.13 ± 0.02
MEA (frontal)	12.5 ± 52.8

Dental formula: (I 3/3, C 1/1, PM 3/3, M 1/2) X 2=34

Blood baseline values

Blood samples for diagnostic testing can be collected easily from the jugular vein while the animal is in dorsal recumbency. Collecting 12-15 ml of blood for analysis is well within tolerable limits for adult

small-clawed otters.

ISIS normal reference values for ***Aonyx cinerea:*** (International Species Information System, 1998).

		Mean	S.D.	(N)
WBC	*10^3/UL	6.427 ±	2.953	(262)
RBC	*10^6/UL	6.45 ±	1.04	(111)
HGB	GM/DL	13.9 ±	2.2	(199)
HCT	%	45.2 ±	5.8	(278)
MCH	MG/DL	23.0 ±	2.1	(111)
MCHC	uug	31.5 ±	3.3	(197)
MCV	FL	69.2 ±	7.4	(110)
SEGS	*10^3/UL	4.531 ±	2.643	(256)
BANDS	*10^3/UL	0.073 ±	0.075	(84)
LYMPHOCYTES	*10^3/UL	1.316 ±	0.759	(256)
MONOCYTES	*10^3/UL	0.209 ±	0.161	(224)
EOSINOPHILS	*10^3/UL	0.462 ±	0.464	(218)
BASOPHILS	*10^3/UL	0.017 ±	0.047	(31)
NRBC	/100 WBC	0 ±	1	(42)
PLATE. CNT.	*10^3/UL	396 ±	111	(44)
RETICS	%	1.5 ±	1.1	(9)
GLUCOSE	MG/DL	106 ±	28	(237)
BUN	MG/DL	23 ±	9	(241)
CREAT.	MG/DL	0.8 ±	0.3	(212)
URIC ACID	MG/DL	1.5 ±	0.7	(184)
CA	MG/DL	9.6 ±	0.6	(222)
PHOS	MG/DL	5.4 ±	1.4	(212)
NA	MEQ/L	151 ±	4	(210)
K	MEQ/L	4.2 ±	0.5	(207)
CL	MEQ/L	118 ±	4	(207)
FE	MCG/DL	119 ±	48	(119)
MG	MG/DL	1.99 ±	0.16	(61)
HCO3	MMOL/L	19.9 ±	2.3	(22)
CHOL	MG/DL	183 ±	56	(206)
TRIG	MG/DL	46 ±	29	(186)
T. PROT. (C)	GM/DL	6.6 ±	0.7	(231)
T. PROT. (R)	GM/DL	7.3 ±	0.5	(16)
ALBUMIN (C)	GM/DL	3.2 ±	0.3	(192)
GLOBULIN (C)	GM/DL	3.5 ±	0.6	(191)
AST (SGOT)	IU/L	91 ±	58	(227)
ALT (SGPT)	IU/L	53 ±	24	(233)
T. BILI.	MG/DL	0.3 ±	0.2	(227)
D. BILI.	MG/DL	0.1 ±	0.1	(23)
I. BILI.	MG/DL	0.1 ±	0.1	(23)
AMYLASE	U/L	13 ±	12	(30)
ALK. PHOS.	IU/L	153 ±	96	(219)
LDH	IU/L	488 ±	436	(172)
CPK	IU/L	1031 ±	1102	(106)
GGT	IU/L	11 ±	7	(167)
LIPASE	U/L	28 ±	8	(7)

Medical records

Thorough and accurate medical records are essential to learn and understand more about the medical problems of any of our captive species. Medical records should be systematic and entries should identify the history, physical findings, procedures performed, treatments administered, differential diagnosis, assessment, and future plans for treatment.

A computerized medical record system, which can help tract problems and can be easily transmitted from one institution to the next are extremely beneficial. The small-clawed otter SSP encourages the use of MedARKS (Medical Animal Records Keeping System, International Species Information System, 12101 Johnny Cake Ridge Rd., Apple Valley, MN 55124-8151) as a universal medical record program. Many institutions already use this program making it easy to transfer information between them.

Identification:

Transponder Chips:

The small-clawed otter SSP recommends that all otters be identified as soon as possible after birth with a Trovan® (InfoPet Inc, 415 W. Travelers Trial, Burnsville, MN 55337-2548) transponder chip placed subcutaneously above the bridge of the nose over the forehead. This location makes the chip easy to read when the animal comes to the front of the cage. Transponders placed in the shoulder or back can migrate and may be broken or lost during fighting and breeding attempts.

Tattoos:

Small-clawed otters should have their studbook number tattooed on the medial thigh as soon as they reach adult size. This should be applied to the left medial thigh for females and the right medial thigh for males.

Preventative Health Care

All small-clawed otters should have an annual examination during which the following is done:

- Transponder and tattoos should be checked and reapplied if they are not readable.
- Baseline physiological parameters, such as weight, body temperature, heart rate, and respiratory rate should be obtained and recorded.
- The oral cavity and all dentition should be examined. Teeth should be cleaned and polished if necessary. Any tooth that is fractured or in need of repair should be noted in the medical record and the condition corrected as soon as possible.
- The reproductive tract should be evaluated. Care should be taken to record any changes in the external genitalia, such as vulvar swelling or discharge, and testicular enlargement, and mammary gland changes. Contraceptive hormone implants should also to be checked to make sure they are in place and not causing any local irritation.
- Radiographs should be taken to check for renal and cystic calculi, as well to detect any subclinical problems, such as pulmonary masses, etc. The size, approximate number, and location of any urolith should be noted in the medical record.
- Blood collection should be done and a complete blood count and chemistry profile performed. Animals that are housed outside in heartworm endemic areas should be checked for heartworm disease by performing a heartworm elisa antigen test.

- Serum should be banked.

- Urine should be collected whenever possible by cystocentesis for a complete urinalysis. Animals with urinary calculi or with an abnormal urinalysis should have an aerobic and anerobic urinary culture performed.
- An annual fecal examination should be performed to check for internal parasites. Anthelmintics should be administered if necessary.
- Vaccines should be updated.

Immunizations

Vaccination products:

- Distemper vaccine—Galaxy D® (Schering-Plough Animal Health Corporation, PO Box 3113, Omaha, NE 68103). This is a modified-live canine distemper vaccine of primate kidney tissue cell origin, Onderstepoort type.
- ***Caution****: Safety and efficacy of canine distemper vaccinations in exotic species of carnivores have been problematic. Killed distemper vaccines have not provided long-lived protection in most species and often are not commercially available. Vaccine-induced distemper has occurred in the domestic ferret using modified-live vaccine of both canine and mink origin. The Galaxy product has proven safe and immunogenic in many mustelids and to date we are not aware of any cases of vaccine-induced distemper in small-clawed otters using this product. However,* ***recently several weasels died of vaccine-induced distemper following vaccinations of Galaxy-D.*** *Therefore, veterinarians should continue to be* ***cautious*** *when using any modified-live canine distemper vaccine in exotic species,* ***especially with young animals and those that have not be vaccinated previously.*** *New and safer distemper vaccines may be available in the future for use in otters. The SSP will update institutions with this information, as it becomes available. Any adverse reactions to vaccinations should be immediately reported to the small-clawed otter veterinary advisor.*
- Canine or feline killed parvovirus (Parvocine®, Pharmacia and Upjohn, 7000 Portage Road , Kalamazoo, MI 49001).
- Killed rabies
  Use only in animals that are at risk of contracting rabies. One commonly used product is RM Imrab 3® (Rhone Merieux Inc., 115 Transtech Dr., Athens, GA 30601).
  Note: The efficacy of killed rabies and parvovirus vaccines has not been proven in exotic mustelids.

Vaccination schedule:

- Subadults should be vaccinated at 8, 12, and 16 weeks. Vaccination should begin earlier in kits from unvaccinated dams.
- Veterinarians should **consider** vaccinating subadults at 8, 12, and 16 weeks for distemper. **The risk of contracting the disease must be weighed against the risk of vaccine-induced distemper at each institution.** Animals that are sick or immunologically compromised should not be vaccinated with a modified-live product. **See caution**

regarding distemper vaccines listed above.

- Rabies should be given at 16 weeks for animals at risk of contracting rabies.
- Adults should be vaccinated annually.

Parasites

Incidence:

Internal and external parasites have not been commonly reported in small-clawed otters. One institution reported having seen Giardia in their animals; the other institutions did not identify any parasites on fecal examination. A list of some of the parasites that have been identified in other mustelid species is included in the disease section of this chapter for reference.

Recommendations for control of parasites:

Internal:

- Annual fecal examination should include both a direct smear and a float.
- Preshipment fecal examinations, direct smear and float.
- Quarantine fecal examination, 3 direct smears and 3 fecal floats.
- Heartworm elisa antigen tests should be conducted annually in animals exposed to mosquitoes in heartworm endemic areas. Heartworm disease has never been reported in Asian small-clawed otters, although it has been found in a few other species of mustelids. See section under mustelid disease for more information. Until further information is known regarding the susceptibility of individual species to infection with *Dirofilaria*, it would seem prudent to treat otters housed outside in heartworm endemic area with heartworm preventative.

External:

- Animals should be inspected for external parasites, including ear mites, during any physical examination.

Anthelmintics:

The following is a list of products that have been used safely in other species of mustelids and some suggested doses. These products have not necessarily been evaluated in Asian small-clawed otters for safety and efficacy.

Fenbendazole:
50 mg/kg po for 3-5 days
Pyrantel pamoate:
10 mg/kg po
Ivermectin:
For heartworm prevention:
0.006 mg/kg po once monthly
For treatment of intestinal nematodiasis:
0.2 to 0.4 mg/kg SC or PO
Praziquantel:

5 mg/kg SC or PO

Preshipment examination recommendations

All otters should receive a thorough preshipment physical examination as outlined above in the preventative health care section. Ideally, a copy of the preshipment physical exam findings and laboratory work should be sent to the veterinarian at the receiving institution before the animal is transferred. If an otter has a current medical condition requiring ongoing treatment, the case should be discussed between the shipping and receiving institutions' veterinarians **before** the animal is moved. All animal shipments should be accompanied by a hard copy of the medical history, as well as a health certificate and the USDA acquisition, disposition, or transport form (APHIS form #7020). Institutions using MedARKS should provide the receiving institution with the medical records on a floppy disc or send them via E-mail.

Quarantine

All small-clawed otters should undergo a 30-day quarantine stay at the receiving institution before being added to the rest of the collection. This allows time for the development of clinical signs of disease that may have been incubating before the animal was shipped. During the quarantine period the animal should be observed for signs that may be associated with disease, such as sneezing, coughing, vomiting, diarrhea, ocular or nasal discharge, etc. Three fecal examinations for parasites should be performed. The diet should be slowly adjusted over several weeks if there is to be a diet change.

Quarantine examinations:

Initial exam:

Veterinarians should visually inspect otters as soon as possible after they have arrived in quarantine. If a preshipment physical examination has not been done before the animal was transferred it would be prudent to perform a complete examination during the first week of quarantine.

Final exam:

During the last week of quarantine, a thorough physical examination should be conducted as outlined in the preventative health care section above. **It is extremely important to take radiographs of the animal during this time even if they were done at the previous institution.** This gives the new institution its own baseline film from which to compare future radiographs. This is especially important since radiographic techniques vary somewhat from facility to facility.

Control of Reproduction

Melengesterol acetate hormone implants have been used to successfully contracept female small-clawed otters. These implants are surgically implanted subcutaneously and slowly release a progesterone compound. The duration of activity is about two years. Problems associated with these implants

include endometrial hyperplasia, mammary and endometrial cancer, and diabetes mellitus. For this reason they are recommended only for temporary control of reproduction. If longer-term contraception is necessary, permanent sterilization procedures such as ovariohysterectomy or castration should be considered. Several institutions have reported unexpected pregnancies when hormone implants were unknowingly lost during breeding and fighting episodes. Implants can be obtained by contacting Dr. Edward Plotka, 11713 West Lane, Marshfield, WI 54449, Phone: 715-387-2793; Fax: 715-384-9910; E-mail: plotka@usa.net.

If small-clawed otters are housed in a family group, only the original breeding pair will be reproductively active. Breeding activity in any offspring that result from the pairing will usually be suppressed. By vasectomizing the dominant-breeding male a stable non-reproductive group can be maintained. Obviously changes in the social structure of a group sometimes occur. However, with diligent observation of social behavior, this reproductive control strategy can be successful.

Immobilization/anesthesia

A variety of agents have been used to successfully immobilize small-clawed otters. Ketamine hydrochloride can be used alone or in combination with midazolam hydrochloride (Versad®, Roche Labs, 340 Kingsland St., Nutley, NJ 07110-1199) or diazepam to improve muscle relaxation. Telazol® (Fort Dodge, 9401 Indian Creek Parkway, Ste. 1500, Overland Park, KS 66210) is another good immobilizing agent for this species. Generally, it provides smooth, rapid induction and recovery along with good muscle relaxation. Doses of telazol required for adequate immobilization vary considerably between individuals. Ranges for some injectable drug combinations are listed below:

- Telazol 5.5 to 9.0 mg/kg IM
- Ketamine 12-15 mg/kg with midazolam 0.5-0.75 mg/kg IM (Spelman)
- Ketamine 9-12 mg/kg with diazepam 0.5-0.6 mg/kg IM

Muscle rigidity is common with these injectable drug combinations at the lower end of the dosages. Initial apnea and low oxygen saturation readings as measured by pulse oximetry often accompany higher doses. All three combinations produce a relatively short duration of anesthesia time, approximately 15-30 minutes. Administering an additional 5 mg/kg ketamine IM when needed can prolong anesthesia time. Alternatively the animal can be entubated and maintained on gas anesthesia.

Combining ketamine with medetomidine hydrochloride (Lewis, 1991 and Spelman) (Domitor®, Pfizer Animal Health, 812 Springdale Dr., Exton, PA 19341) may provide a slightly longer duration of anesthesia and may give better myorelaxation, plus it has the added advantage of being reversible with atipamezole hydrochloride (Antisedan, Pfizer Animal Health, 812 Springdale Dr., Exton, PA 19341). Vomiting may occur during induction and initial apnea and low oxygen saturation readings are common. Supplemental oxygen should be available for administration if necessary. Dosages that have been used successfully are described below:

- Ketamine 4-5.5 mg/kg with medetomidine 0.040-0.055 mg/kg IM (Spelman)
- Reverse with atipamezole 0.200-0.275 mg/kg IM (Spelman)

Injectable anesthetic agents can be delivered via a blowdart or hand injected with the animal in a squeeze cage. Since small-clawed otters will use and often sleep in a nest box, converting the box into a squeeze cage can allow drugs to be delivered more quickly and accurately than using a blowdart system. A design for creating a squeeze cage/nest box is included at the end of this chapter.

Another method of anesthesia induction is to use isoflurane (AErrane®, Ohmeda Pharmaceutical Products Division Inc, Box 804 110 Allen Rd., Liberty Corner, NJ 07938) delivered via an anesthetic chamber. Small-clawed otters have a large respiratory reserve and can hold their breath for a relatively long period of time. Induction time may be as long as 10 minutes using this method.

Despite the method of induction, anesthesia can be maintained by entubating the animal and maintaining it on isoflurane or halothane (Fort Dodge, 9401 Indian Creek Parkway, Ste. 1500, Overland Park, KS 66210) anesthesia. Otters are relatively easy to entubate and this method is preferred when it is necessary for an animal to be immobilized for a lengthy procedure.

Careful monitoring of anesthetic depth and vital signs are imperative during any anesthesia attempt. Body temperature, respiratory rate and depth, heart rate and rhythm, and mucous membrane color should be assessed frequently during each anesthetic procedure. Pulse oximetry can be beneficial. The most accurate site for sensor placement is the tongue, however the animal must be quite relaxed for the sensor to stay in place and take a reliable reading. A clip sensor placed over the lip at the commissure of the mouth works well in some patients. Sensors placed on the digits or prepuce, or in the rectum or esophagus will sometimes give readings but are less reliable. Oxygen supplementation should be available and administered when indicated. Non-invasive blood pressure and electrocardiogram monitoring are also useful.

Necropsy Protocol

A thorough necropsy should be performed on all small-clawed otters that die. This examination should include the following:

BLOOD COLLECTION

Antemortem blood collection for serum banking is recommended on any animal that is being euthanized. Collect enough to obtain a minimum of 5 ml of serum. Post mortem blood collection may be possible on specimens that have recently died.

RADIOGRAPHS

Ventral-dorsal and lateral abdominal radiograph should be taken on all otters that die. This is necessary to document the degree (or lack thereof) of urolithiasis at the time of death. **This is particularly important in animals in which the disease is in the early stages, since it is very easy to miss small renal calculi on the necropsy examination.** An estimation of the number and size of the

calculi present in the left kidney, right kidney, and urinary bladder should be recorded on the post mortem report.

GROSS POST MORTEM EXAMINATION

A veterinarian should perform a thorough post mortem examination as soon as possible after death. Please use the standardized necropsy report included at the end of this section for recording the results. This form is also available in the pathology module of MedARKS.

LESIONS

- Cultures: Cultures (aerobic, anaerobic, and fungal) should be taken of any lesions before they are contaminated.
- Freeze tissues: Samples of lesions should be frozen at -20° or -70° C.
- Histopathology: Make sure all lesions are saved for histopathology (2 sets).

UROLITH ANALYSIS

Urinary calculi should be collected during the necropsy procedure and submitted to Dr. Carl Osborne for analysis. The appropriate submission form along with the address is included at the end of this chapter. Currently there is no charge for this service. **Uroliths from the kidney and urinary bladder should be kept separate and labeled appropriately.**

FORMALIN FIXED TISSUES

Two sets of tissues should be collected and placed in 10% buffered formalin. All tissues (except the uterus and ovaries) may be placed together in a single container as long as the volume of formalin is at least 10 times the total volume of the tissues collected. Tissues should be no thicker than 0.5 cm. A checklist of tissues that should be preserved in formalin is attached. In addition, include sections of all lesions in formalin. The entire uterus (with longitudinal cut into the lumen) and ovaries should be placed in a separate container for formalin for Dr. Linda Munson.

HISTOPATHOLOGY

One set of fixed tissues should be sent to a pathologist, preferably one that is familiar with exotic species. If you would like the names of qualified pathologists, please contact the veterinary advisor. The second set of fixed tissues should be mailed to the veterinary advisor. The uterus and ovaries should be submitted to Dr. Linda Munson as part of the AZA contraceptive pathology survey. A separate submission sheet is included at the end of this chapter for this submission. Dr. Munson's address is: Dept. VM-PM1, Haring Hall, School of Veterinary Medicine, University of California, Davis, CA 95616.

FROZEN TISSUES

Please store 3-5 cm sections of the following tissues in plastic bags at –20 to –70 °C.

- Liver
- Brain
- Kidney

- Serum, (antemortem or postmortem) if possible.
- Sections of any lesions.

NEONATES, STILLBIRTHS, ABORTIONS

In addition to the standard adult necropsy protocol, please include the following:

- Weight, crown-rump length, and sex.
- Estimate degree of maturity (1^{st}, 2^{nd}, or 3^{rd} trimester).
- Fix umbilical stump and surrounding tissues. Obtain bacterial cultures before fixing if there is evidence of infection.
- Check carefully for evidence of congenital deformities (cleft palate, deformed limbs, heart defects, anal atresia, etc).
- Assess hydration (tissue moistness) and evidence of nursing (milk in stomach).
- Determine if breathing occurred (do lungs float in formalin).
- Note whether there is meconium in the colon/rectum.
- Fix placenta if available. Culture first if indicated.

SUBMISSION OF RESULTS TO VETERINARY ADVISOR

A copy of the otter's medical report, gross postmortem report, pathology report, calculi analysis, cultures, and any related laboratory tests, as well as the extra set of fixed tissues should be submitted to the veterinary advisor once all the information is complete. The veterinary advisor will review this information in order to identify medical problems in the population. A yearly mortality report will be submitted to the Asian small-clawed otter SSP. If you would like to send the frozen tissues and/or serum to the veterinary advisor for long-term storage, please contact him/her in advance to make sure your request can be accommodated.

Tissues to be placed in 10 % formalin. Please save 2 sets of tissues.

- ❑ Skin: full thickness of abdominal skin.
- ❑ Skeletal muscle: medial thigh, with sciatic nerve.
- ❑ Tongue: Cross section near tip including both mucosal surfaces.
- ❑ Trachea
- ❑ Thyroid/parathyroid
- ❑ Thymus: representative section.
- ❑ Lungs: section from several lobes including a major bronchus.
- ❑ Heart: Longitudinal section including atrium, ventricle and valves form both right and left heart. Include large vessels.
- ❑ Aorta
- ❑ Salivary gland
- ❑ Gastrointestinal tract: 2-3 cm long section of esophagus, stomach (cardia, antrum, pylorus), duodenum, jejunum, ileum, colon, omentum. Open carefully along the long axis.
- ❑ Lymph nodes: Cervical, bronchial, and mesenteric with a transverse cut.
- ❑ Liver: Sections from several lobes with capsule and gall bladder.
- ❑ Adrenal: Incise transversely.
- ❑ Female reproductive tract: Entire uterus and ovaries with longitudinal cut into lumen. Entire testis with transverse cut, entire prostate with transverse cut. This should be sent to Dr. Linda Munson.
- ❑ Pancreas: Representative sections from 2 areas.
- ❑ Spleen: Cross sections including capsule.
- ❑ Kidneys: Section from both kidneys (cortex, medulla, and pelvis).
- ❑ Urinary bladder/ureter/urethra: Cross section of bladder, 2-cm sections of ureters, cross section of urethra.
- ❑ Eyes: leave intact.
- ❑ Brain, include cerebrum and cerebellum: Sliced longitudinally along the midline.
- ❑ Pituitary gland: Bisect gland including dura, if possible. Otherwise submit entire gland to local pathologist.
- ❑ Long bone: Submit ½ of femur.
- ❑ Mammary gland
- ❑ Diaphragm
- ❑ Spinal cord: 1-cm section from cervical cord.

Diseases of the Asian small-clawed otter

Uroliths and dental problems were the most commonly reported diseases of the Asian small-clawed otter in a survey conducted by the SSP in 1997-1998. Other problems frequently encountered included abscesses, (usually due to intraspecies aggression), lameness (often self-limiting), and occasional vomiting and diarrhea. A couple of institutions reported fur pulling, which appeared to be related to the environmental stress of overcrowding. Non-specific dermatitis was also reported from two institutions. Other health problems listed infrequently in the survey included spinal disease, intussusception, pyothorax, salmonellosis, corneal ulcer, ruptured cruciate ligament, and diabetes.

Urolithiasis:

Urolithiasis is a prevalent disease in the captive population of Asian small clawed otters with the incidence being as high as 66 % (Calle, 1988). The most common component of uroliths in this species is calcium oxalate, however urate calculi have also been reported. Most of these calculi are sterile however there are exceptions. Calculi are most frequently located in the kidneys; however, some animals develop cystic calculi as well. Rarely does an otter have cystic calculi without also having kidney stones. Many small-clawed otters will develop calculi by 2 years of age, and most are affected by 4 or 5 years Both males and females are affected. The calculi generally do not cause clinical signs of disease in the early stages and radiographs are required to diagnose the condition. **Small renal calculi can usually be seen on radiographs before they are visible by ultrasound**. In most cases the calculi get progressively larger as the animal matures. Larger renal calculi diminish urine flow and histopathologic changes occur in the renal parenchyma, getting more severe with age. Older animals with large renaliths **may** have elevated serum BUN and creatinine serum levels. Cystic calculi may cause hematuria and dysuria, but many animals with cystic calculi remain asymptomatic. Rarely do the calculi cause a complete blockage of the urinary tract.

Treatment:

No successful treatment for this disease has yet been identified. Lithotripsy has been attempted in one case with little success. Cystic calculi can be successfully removed by surgery, but often reoccur. A few veterinarians have removed some larger renaliths surgically from the renal pelvis. This may temporarily alleviate some of the symptoms, although, as with cystic calculi, the stones often reoccur.

Recommendations:

Radiograph all small-clawed otters beginning at six month of age to check for calculi. After that, annual examinations and radiographs should be performed. The number and size of the calculi present in the left kidney, the right kidney, and the urinary bladder should be recorded.

All otters with urolithiasis should have a complete medical work-up performed including CBC, chemistries, urinalysis, and an aerobic and anaerobic culture of the urine. Bacterial infections should be treated according to the results of cultures and sensitivities. Follow-up cultures should be performed periodically to assure infections have been eliminated. Cystic calculi should be removed surgically to

help alleviate discomfort that may be associated with their presence and for diagnostic purposes. The calculus and bladder wall should be cultured both aerobically and anaerobically at the time of surgery. The calculus should be sent to Dr. Carl Osborne at the University of Minnesota Urolith Laboratory for analysis of composition. At this time there is no charge for the test. A copy of the submission form is included at the end of this chapter for your convenience. A copy of the medical report, including laboratory work and calculi analysis should be sent to the small-clawed otter veterinary advisor.

Prevention:
There are several diets that are currently under investigation that **may** be useful in reducing the incidence of this disease in Asian small-clawed otters. One is an all-fish diet (Petrini, Treschsel, Wilson, and Bergert, 1996) with specific nutrient supplements and the other is a calcium oxalate prevention diet used in adult cats manufactured by Hill's (C/D^{o}, Hill's Pet Nutrition Inc, PO Box 148, Topeka, KS 66601-0148). These diets are discussed in the nutrition section of the manual. **Any institution wishing to try one of these two diets should contact the veterinary advisor for more details.**

Other strategies that may be useful:

- Increase fluid intake. Make sure fresh water is available at all times. Consider adding extra moisture to the food to increase water intake. When possible, provide warm water (85ºF) for swimming since these tropical animals will spend more time in the water if it is warm, which may encourage additional water intake.
- Minimize dietary intake of oxalate (found primarily in plants) and ascorbic acid.
- Provide adequate dietary intake of phosphorus, magnesium, and pyridoxine.
- Potassium citrate may be useful for treatment since it both inhibits crystallization and also forms complexes with calcium, thus reducing calcium oxalate saturation in the urine. Potassium citrate also increases urine pH, which in turn enhances the effect. Levels of 40-75 mg/kg body weight twice daily have been used in dogs. (Note: The Hill's diet already contains potassium citrate).
- Pyridoxine (10-800 mg per person per day) has been successful in treating some cases of calcium oxalate urolithiasis in humans. Levels of 2 mg/kg body with have been suggested for dogs. (Again the Hill's product contains a higher level of pyridoxine than other pet foods).

  Note: Any institution interested in using either potassium citrate and/or pyridoxine should contact the veterinary advisor.

Dental disease
Periodontal disease, fractured teeth, and abscesses are common problems in captive small-clawed otters. Prompt treatment of fractures and abscesses is extremely important. Dental radiographs can aid in diagnosis and help determine a course of action. Endodontic procedures such as root canals and pulpotomies can be performed on diseased teeth following appropriate antibiotic therapy. Alternatively, diseased teeth can be extracted.

Animals with periodontal disease should have their teeth regularly cleaned and polished. Antibiotic therapy initiated several days before a dental cleaning and extended for 1-2 weeks following a

procedure can help minimize bacterial embolism.

Providing bones, such as knucklebones or neck bones from sheep or other large animals **twice** weekly, along with regular cleaning and polishing will help reduce periodontal problems.

General Mustelid Diseases (Petrini, 1992)

Viral Disease

Aleutian disease (also called **plasmacytosis**) is typically a disease of farm-raised mink, but has been found in feral mink, the domestic ferret, and the striped skunk. Aleutian disease viral antibody has been found in skunks, fishers, and the American marten (*Martes americana*). A disease resembling Aleutian disease was recently described in a wild European Otter. Aleutian Disease is an immune-mediated disease caused by a parvovirus of which there are several strains of varying pathogenicity. In mink, infection can range from inapparent to fatal. Generally, the course of the disease is slowly progressive over months to years. It is characterized by weight loss, hypergammaglobulinemia (greater than 20% of total serum protein), reproductive failure, and an immune-mediated glomerulonephritis. Some animals have hemorrhagic enteritis. Neonates may develop a fatal interstitial pneumonia. Increased numbers of plasmacytes are found in the liver, kidney and other organs, hence the name plasmacytosis. Several methods of detecting the disease antemortem are used including the rapid iodine agglutination test (IAT) and the counter immuno-electrophoresis (CIEP) test.

Influenza--The domestic ferret is susceptible to certain strains of human influenza and is used as a research animal to study the disease. Symptoms in ferrets include sneezing, conjunctivitis, unilateral otitis, fever, and sometimes photophobia. The disease usually lasts 7-14 days. Avian influenza A virus was responsible for an outbreak of contagious interstitial pneumonia in mink in Sweden in 1984. Although it is not known whether other species of mustelids are susceptible to influenza, it would seem prudent for animal caretakers exhibiting signs of influenza to wear masks and disposable gloves when caring for mustelids. Infected ferrets can also transmit influenza to humans.

Rotavirus--A disease described in domestic ferrets as "ferret kit disease" is caused by a rotavirus. The disease usually affects kits from two to six weeks old causing diarrhea and resulting in high mortality. Histopathological lesions include villous atrophy and vacuolation of villar epithelial cells in the small intestine. Direct electronmicroscopy is used to identify the virus in the feces. Serological tests are unreliable. Since secondary bacterial invaders may increase mortality, it has been recommended that affected individuals be treated with oral gentomycin and parenteral ampicillin. A syndrome in farmed mink known as "**3-day disease**", "**Utah disease**", or "**Epizootic Catarrhal Gastroenteritis**" may also be caused by a rotavirus. The disease is characterized by a short course of diarrhea, anorexia, and lethargy. It is rarely fatal.

Transmissible Mink Encephalopathy (TME) is caused by a scrapie-like virus that occasionally causes disease in adult mink. Experimentally, striped skunks are also susceptible. It has a long incubation period lasting five to 12 months. Both morbidity and mortality are high. The main clinical signs can be attributed to lesions in the cerebrum and include behavioral changes, weakness, ataxia, and sometimes paralysis. Reproductive failure including stillbirths (often with anasarca) and congenital

defects is also a feature of the disease. Diagnosis is based on histopathological findings in the cerebrum.

Mink Enteritis Virus, Feline Panleukopenia, Canine Parvovirus--These closely related viruses have been shown to affect mink and the skunk. The domestic ferret is not susceptible to these viruses under natural circumstances. The disease in mustelids is similar to that in felids and includes diarrhea, vomiting, fever, and leukopenia.

Canine Distemper has been confirmed in multiple species of mustelids. The clinical presentation in mustelids is similar to that in dogs. In addition to mucopurulent oculonasal discharge, respiratory disease, diarrhea, hyperkeratosis of the footpads, and C.N.S. signs, ferrets and mink also frequently get a rash under the chin and in the inguinal area. In the black-footed ferret intense pruritis and cutaneous hyperemia is common. Vaccine-induced distemper may have a slightly different clinical presentation.

Feline Leukemia Virus--Healthy domestic ferrets have been positive to FeLV by ELISA, but the significance of this is unknown. It is possible that the test is cross-reacting with another retrovirus or that false positive results are occurring.

Powassan Virus--This arbovirus has been isolated from a healthy Eastern spotted skunk in California in 1969 and antibodies to the virus have been isolated from at least one other skunk. Powassan virus causes encephalitis in humans, but to date has not been associated with clinical disease in mustelids.

Herpes Necrotizing Encephalitis is caused by a herpes simplex virus and has been reported in skunks. The virus causes necrotizing meningoencephalitis with necrosis and hemorrhage in the liver and adrenal. Clinical signs include salivation, tremors, and head bobbing. Diagnosis can be made from serology.

Infectious Canine Hepatitis has been reported in the striped skunk and **Pseudorabies** has been reported in several species of mustelids. Signs are similar to those of other carnivores. **Rabies** has been documented in numerous species of mustelids. Some species may remain asymptomatic. Experimentally, domestic ferrets are susceptible to **Infectious Bovine Rhinotracheitis,** human **Respiratory Syncytial Virus** and a strain of **Measles** that causes human subacute sclerosing panencephalitis. Serum-virus neutralization antibody to **Feline Rhinotracheitis** and **Feline Calicivirus** has been reported in the North American otter, but the significance of this is unknown.

Bacterial Disease

Pseudomonas pneumonia--Several serotypes of *Pseudomonas aeruginosa* cause hemorrhagic pneumonia in mink. The disease usually occurs in the autumn and can quickly spread through a ranch. Mortality rates vary from 0.1% to 50%. Animals die quickly, often without showing clinical signs. Occasionally dyspnea, a bloody nasal discharge, or convulsions are seen. The main post mortem lesion is hemorrhagic pneumonia with or without hemorrhagic pleural exudate. There is evidence that bacterial toxins may play a role in the pathogenesis of the disease.

Concurrent infection with calicivirus or picornavirus, as well as poor air quality with high ammonia levels has been implicated as predisposing factors in the pathogenesis of the disease. Bacterins composed of all four stereotypes are available for use. (United Vaccines, Harlan Sprague Dawley Inc., Madison, WI 53711 and American Scientific Labs., Elkhorn, Nebraska).

Botulism--Most species of mustelids are susceptible to type C toxin (and to a lesser extent types A, B, and E) produced by *Clostridium botulinum*. Usually animals are found dead but some may exhibit paralysis and dyspnea before dying. There are no postmortem lesions. The disease is caused by eating uncooked or contaminated meat. Animals not on a commercially prepared diet should be vaccinated annually.

Tuberculosis--Many mustelids are susceptible to bovine, avian and human strains of tuberculosis. The disease has been reported in the domestic ferret, mink, otters, and the European badger. It is usually acquired by eating contaminated food, however in the European badger, transmission can occur from mother to cub, by aerosol, or through bite wounds. Clinical signs may include weight loss, enlarged lymph nodes, chronic respiratory disease, and mastitis. Tuberculin skin testing is unreliable. Serological tests used to identify European badgers with *Mycobacterium bovis* have also been unreliable. Mustelid caretakers should be tested annually for TB.

Anthrax has been reported in the European badger, the honey badger (*Mellivora capensis*), and mink. Clinical signs include acute death with blood draining from body cavities. Postmortem findings include subcutaneous and subserosal edema, hepatomegaly, and splenomegaly.

Campylobacteriosis--Diarrhea caused by *Campylobacter jejuni* and *C. coli* has been reported in domestic ferrets and mink. Fever and leucocytosis often accompany infections. Abortion and other reproductive problems occur in both mink and ferrets when they are inoculated with *C. jejuni* during pregnancy. Ferrets can be asymptomatic carriers. Clinical disease is most common in animals less than six months of age. Special techniques are required to culture the organism from the feces. Humans are also susceptible to infections with *C. jejuni*. Erythromycin, the drug of choice in humans, does not eliminate the carrier state in ferrets. Raw meat diets appear to predispose mink to *C. jejuni* infection.

Campylobacter-like organisms (C.L.O.) have been cultured from the gastric mucosa of both normal and diseased ferrets. The role they play in the pathogenesis of gastritis and gastric ulcer disease is unclear at this time.

Proliferative colitis is a syndrome described in young domestic ferrets characterized by mucohemorrhagic diarrhea, weight loss, and partial prolapse of the rectum. Occasionally it is accompanied by C.N.S. signs. The disease causes a profound thickening of the mucosa and muscular wall of the colon, which can be palpated per rectum. Pathological lesions are similar to those found in hamsters with "wet tail" and swine with proliferative ileitis, except lesions in the ferret are in the colon not the ileum. *Campylobacter jejuni* and *Campylobacter*-like organisms have frequently been isolated in the feces of affected animals, but their role in the disease is uncertain. Experimental inoculation of mink and ferret kits with *C. jejuni* causes enterocolitis but not proliferative colitis.

***E. coli* mastitis**--A rapidly progressive gangrenous mastitis caused by *E. coli* has been reported in the domestic ferret. Toxemia occurs, and mortality can be quite high. Early, aggressive therapy involving ampicillin, gentamicin, and surgical excision of the affected mammae has been successful. The disease has also been seen in mink. (Bill Wustenberg, pers. comm.)

Purulent pleuritis involving several different bacteria has been commonly reported in mustelids including the European badger, mink, and a North American otter. In mink, it is often seen in conjunction with dental disease and severe gingivitis.

Other bacterial diseases documented in mustelids include **listeriosis, tularemia, pasteurellosis, leptospirosis, salmonellosis, brucellosis**, and **actinomycosis**. The clinical manifestations of these diseases in mustelids do not vary appreciably from that seen in other carnivores.

Mycotic Disease

Fungal diseases have not been frequently reported in mustelids. **Dermatomycosis**, involving *Microsporum* and *Trichophyton*, has been reported in mink, domestic ferrets, and otters. **Histoplasmosis** has been seen in both domestic ferrets and striped skunks. There have been several cases of **cryptococosis** in the domestic ferret and one case of **blastomycosis**. **Coccidiomycosis** has been described in several North American otters from Arizona. **Mucormycosis** involving *Absidia corymbifera* has caused otitis media and meningoencephalitis in farmed ferrets. This infection is found in conjunction with *Otodectes cyanotes*. **Adiaspiromycosis** has been reported in striped skunks and European polecats (*Mustela putorius*). The disease caused by *Emmonsia* (formerly *Chrysosporium crescens)*, results in varying degrees of pulmonary granulomatous disease and can also involve regional lymph nodes.

Parasites

Numerous external and internal parasites have been identified in both wild and captive mustelids. Only a few will be discussed in this paper.

Heartworm disease caused by *Dirofilaria immitis* has been reported numerous times in the domestic ferret. Microfilaremia is an uncommon finding in this species, and antibody testing is unreliable. Most authors recommend heartworm preventative for ferrets in heartworm endemic areas. Heartworm disease has been reported only rarely in other species of mustelids. One adult *D. immitis* was found in a North American otter from Louisiana, which was not associated with clinical disease. *D. immitis* was also found in a Giant Brazilian otter (*Pteronura brasiliensis*) in Venezuela and twenty-five adult heartworms along with microfilaremia were found in an aged wolverine from Michigan in 1976. *Dirofilaria lutrae* has been found in the subcutis and pulmonary arteries of several North American otters. It is unclear whether this species of *Dirofilaria* causes clinical heartworm disease. Until further information is known regarding the susceptibility of individual species to infection with *Dirofilaria*, it would seem prudent to keep valuable mustelids that are housed outside in heartworm endemic areas on preventative.

Dracunculus insignis ("**Guinea worm**") is a nematode that has been found in the subcutaneous tissues of several species including fishers, skunks, and mink. A separate species has been identified in the North American otter. *Dracunculus* causes a varying degree of pruritis and local erythema. It is most commonly located on the legs. Removal of the adult parasite is curative.

The **kidney worm** (*Dioctophyma renale*) has been reported in the North American otter, ermine, the long-tailed weasel, mink, the American marten, fishers, and the little grison (*Galictis cuja*). Mink appear to be the primary host in North America. The parasite causes weight loss, abdominal pain, and hematuria. Infection almost always involves the right kidney where a plate of bone often forms which is visible on radiographs. Diagnosis can be made from finding the ova in the urine. Another species of kidney worm, *Gnathostoma miyazakii*, is commonly found in North American otters in Virginia.

Lungworms are another common parasite problem of captive and wild mustelids. Several species affect mustelids including *Crenosoma spp., Perostrongylus spp*., and *Filaroides spp*. Clinical signs vary from cachexia and anemia to coughing, dyspnea, and depression. Diagnosis is made by finding the first stage larvae in the feces. *Capillaria aerophilia* is another common nematode that causes respiratory disease in mustelids. It has been seen in fishers, pine martens, stone martens (*Martes foina*), and badgers. The ova, resembling *Trichuris vulpis,* are found in the feces or sputum.

Nematodes of the genus *Skrjabingylus* are located in the frontal sinus and cause progressive damage to the skull and nasal turbinates. Clinically, nasal discharge and neurological signs may be seen. *Skrjabingylus spp.* have been reported in mink, ermine, fishers, North American otters, striped skunks, and spotted-necked otters (*Lutra maculicollis*), as well as other mustelids.

Mustelids fed raw meat are susceptible to **trichinosis**. Typical clinical signs include eosinophilia, muscular pain, anorexia, and dyspnea. Heavy infestations are fatal.

Other nematodes that have been reported in mustelids include *Baylisascaris devosi, Molineus patens, Ascaris* spp., *Physaloptera* spp., and *Uncinaria stenoceophala* to mention a few.

Lung flukes (*Paragonimus kellicotti*), **intestinal flukes** (*Nanophyetus salmincola*), and several other species of trematodes (including *Alaria* and *Metorchis*) have been reported in mustelids. Multiple species of cestodes and several species of **acanthocephala** are also common parasites of mustelids.

Heavy infestations of **coccidia** can cause mortality in young ferret and mink kits. **Toxoplasmosis** can cause neonatal deaths and stunting in both ferrets and mink. Asymptomatic ferrets can shed *cryptosporidia* and pose a zoonotic hazard. *Giardia* spp. has been seen in the feces of various mustelids.

Pneumonia due to *Pneumocystis carinii* has been diagnosed in immunosuppressed ferrets *Hepatozoon* spp. have been reported in the blood of wild mink and *Sarcocystis* spp. have been found in fishers,

mink, wolverines, and badgers. Recently, a case of **Chagas' disease** caused by *Trypanosomiasis cruzi* was reported in a striped skunk from California. Histopathological findings included myocarditis and meningoencephalitis.

External parasites of mustelids include **fleas, ticks**, **lice,** and **mites**, including *Sarcoptes scabei*. **Ear mites** (*Otodectes cynotis)* have been reported in ferrets and wolverines. Infestation of young ferret and mink kits by the **flesh fly** (*Wohlfahrtia vigil*) causes pruritis and restlessness as the fly larvae penetrate the skin and cause abscessation. Mothers will often remove the kits from the nest resulting in death from exposure. Early identification and treatment of the disease using local and systemic therapy can improve survivability. *Cuterebra* and *Hypoderma bovis* larvae have also been reported in mustelids. *Filaria taxideae* causes an exudative dermatitis on the ventrum of badgers. Ova and larvae can be found in skin scrapings. Adults have been found in the heart, peritoneal cavity, and skeletal muscle fascia.

Miscellaneous Diseases

Neonatal mortality

Neonatal mortality in small-clawed otters is most commonly due to septicemia, buy starvation and hypothermia are also common in the first four weeks of life. Trauma and cannibalism also occur frequently and are more of a problem with large litters. Neonatal losses can be minimized by providing secluded nest boxes with sufficient bedding, insuring adequate nutrition for the dam, and providing food and water to the young beginning at two to three weeks of age. With large litters, cross fostering or hand rearing can improve survivability.

Energy demands during lactation are quite high in mustelids. Animals on a commercial dog or cat food diet may require additional protein supplementation during lactation.

Hypocalcemia may affect ferrets approximately 3-4 weeks postpartum and **pregnancy toxemia** has been described in domestic ferrets both pre- and postpartum. Poor nutrition has been implicated as a cause, but this is not proven. Post mortem findings usually include hepatic lipidosis.

Both mink and ferrets are afflicted with a syndrome known as **agalactia** or "**nursing sickness**". This generally occurs 5-6 weeks postpartum before the kits are completely weaned, but it can occur even after weaning. Clinical signs include lethargy, weight loss, ataxia, weakness, and coma. Occasionally hemolytic anemia can occur. The cause of the disease is unknown, but diets high in polyunsaturated fats may predispose animals to the condition. Some authors believe the condition is due to a sodium chloride deficiency. Hepatic lipidosis is often seen on post mortem examination. Offering food and water to kits beginning at 2-3 weeks of age will help prevent the disease.

Aplastic anemia due to the **hyperestrogenism** occurs in unbred domestic ferrets due to a prolonged estrus. This condition has not been reported in any other mustelid. It is believed that the domestic ferret is highly susceptible to the effects of estrogen.

It is not uncommon for both male and female mustelids to develop a partial **alopecia** during the

breeding season. The alopecia most commonly involves the tail and ventral abdomen and usually is bilaterally symmetrical. The cause is unknown but probably hormonal. It resolves spontaneously at the end of the breeding season. Weight fluctuations also occur during the breeding season.

Pyelonephritis (commonly due to hemolytic *E. coli*) has been seen in ferrets. **Cystic kidneys** have also been reported frequently in ferrets, and urethral cysts are common in older mink. **Chronic interstitial nephritis** has been reported in the ferret, striped skunk, the European badger, and other mustelids. The syndrome known as "**wet belly**" in mink is probably caused by a number of different urinary tract diseases, all of which cause urinary incontinence.

Numerous authors have described dilatative cardiomyopathy in the domestic ferret. It has also been seen in the European badger and in mink. **Cardiovascular calcification** secondary to nephritis has been described in the badger. **Cor pulmonale** and cardiac failure have been reported in an Eastern spotted skunk.

Idiopathic hypersplenism was diagnosed in a domestic ferret. The disease caused a pancytopenia, which reversed itself after splenectomy.

Gastric ulcers can cause vomiting, halitosis and acute death in mink and domestic ferrets. Although stress has usually been implicated as the etiology, recent evidence from human and ferret research suggests that a *Campylobacter*-like organism may play a role in the pathogenesis. Cimetidine, amoxicillin, and bismuth subsalicylate are suggested treatments. **Gastric dilatation** has also been reported in ferrets. It is often associated with dietary changes or overeating, especially after a prolonged fast. *Clostridium welchii* has sometimes been isolated from bloated ferrets.

Metabolic diseases including **hyperadrenocorticism** and **insulinoma have** been reported in the domestic ferret. **Diabetes mellitus** has been described in the ferret and there has been at least one case in an Asian small-clawed otter. **Fatty liver** is a common histopathological finding in sick mustelids and occurs secondarily to many disease states.

Intervertebral disc disease is another common entity reported in ferrets, otters, and other mustelids. Exhibit space, housing, handling procedures and activity can predispose animals to vertebral problems and should be carefully evaluated.

Numerous **neoplasias** have been reported in mustelids. Lymphosarcoma is the most commonly reported tumor type in the domestic ferret, followed by tumors of the reproductive tract and skin. In the mink, lymphoreticular tumors and anal sac carcinomas are commonly reported. Tumors resembling Hodgkin's Disease in humans have been reported from striped skunks.

Recently several Asian small-clawed otters died from cyanide toxicity. It is suspected that this resulted from the ingestion of large amounts of loquat seeds from a tree in their exhibit.

ASIAN SMALL-CLAWED OTTER NECROPSY REPORT
AONYX CINEREA

Institution:

Institution Acc #: _____ Necropsy #: _____ Studbook #:

Date of Birth: _____ Age: _____ Weight: _____ Kg Sex:

Date of Death: _____ Date of Necropsy: _____

Gross exam performed by:
Histopathology performed by: _____
Pathol. Acc. # _____

Tissue saved: Yes ? No ?
Formalin ?
Frozen ? _____
Other ?

Copy of report sent to SSP Veterinary advisor? Yes ? No ?

Tissues sent to SSP Veterinary advisor? Yes ? No ?

HISTORY (Include clinical signs, treatments, antemortem test results, diet, circumstances of death and quarantine status.)

Laboratory Studies: (List bacterial and viral cultures submitted. Attach results of any of the following:)

Hematology	?	Chemistry	?	Photography	?
Cytology	?	Fluid analysis	?	Bacteriology	?
Mycology	?	Virology	?	Urinalysis	?
Parasitology	?	Toxicology	?	Urolith analysis	?
Other	?				

Radiology:

Urinary calculi Yes ? No ?

Left kidney: Number _____ Size _____
Right kidney: Number _____ Size _____
Urinary bladder: Number _____ Size _____

Gross Diagnosis: (List each lesion separately. Include organ, lesion type, distribution, severity, etc.)

Histological Diagnosis: See attached report ? Not done ?

Final Diagnosis:

Summary / Comments:

GROSS EXAMINATION
General Condition: (External appearance, physical and nutritional condition, pelage, subQ fat stores, body orifices, superficial lymph nodes.)
Musculoskeletal System: (Bone, joints, muscles)
Body Cavities: (Fat stores, abnormal fluids)
Hemolymphatic: (Spleen, lymph nodes, thymus, Bursa of Fabricius)
Respiratory System: (Nasal cavity, larynx, trachea, bronchi, lungs, regional lymph nodes, air sacs, gills)
Cardiovascular System: (Heart, pericardium, great vessels)

Digestive System: (Mouth, teeth, esophagus, stomach(s), intestines, liver and gall bladder, pancreas, mesenteric lymph nodes)
Urinary System: (Kidneys, ureters, urinary bladder, urethra)
Reproductive System: (Testis / ovary, uterus, oviduct, vagina, cloaca, penis, prepuce, accessory glands, mammary glands, placenta)
Endocrine System: (Adrenals, thyroid, parathyroids, pituitary)

Nervous and Sensory Systems: (Brain, spinal cord, peripheral nerves, eyes, ears)

CHAPTER 3

REPRODUCTION

Jan Reed Smith
John Ball Zoo

Reproductive biology: Sobel (1996) and Gross from the University of Florida have developed a noninvasive technique for monitoring fecal steroid levels in *A. cinerea*. The purpose of their studies was to further the understanding of "...ovarian endocrine events desirable for determining fertility, estrus cycles, pregnancy, seasonality, and monitoring treatment therapies." (Gross, 1996) Their results validated previous observations that this species is a "...nonseasonal, induced ovulator". (Gross, 1996)

Estrous: The estrous cycle has a duration of anywhere from 30 to 37 days, with breeding occurring year around. Some facilities report this cycle extending to "every few months" with older animals. Estrus lasts from one to thirteen days. Behavioral signs of the onset of estrus may include increased rubbing and marking.

Age at first breeding: Sexual behavior has been observed in pups as young as 6 months with breeding behavior having been noted in animals (males and females) as young as 1 ½ years. Successful breeding has been reported for 2.1-year-old females and 2.8-year-old males.

Factors affecting breeding behavior: There do not appear to be any significant environmental cues that are involved with the onset of estrus. Breeding pairs have been introduced at various ages and have been together for varying lengths of time before successful breeding occurs. It has been reported that pups from previous litters have interfered with copulation but their presence had no bearing in any other way. There have been no management practices reported that significantly increased the likelihood of a successful breeding. It should be noted however, that the male is generally left with the female throughout the pregnancy, birth and rearing of the pups.

Courtship Behavior: See Chapter 5, Behavior and Social Organization.

Copulation: Copulation is initiated by both the male and the female. It appears that any given pair will show a repeated pattern with copulatory bouts being initiated by the male predominantly, female predominantly, or by both animals. Copulation is initiated by gentle rubbing, following or chasing. Copulatory bouts have been reported to last 30 seconds to 30 minutes and occur several times throughout the day.

The dorsal/ventral position is most frequently observed but ventral/ventral copulation is seen in some pairings. Males have been known to lay on their side and use a hind leg to lift the female's tail while she stands on all four legs.

Copulatory bouts occur on land and in the water. The presence of the public does not seem to interfere with breeding activity.

Interference with copulation by other group members has occurred. It was reported that two year old animals (males and females) housed with the adult pair repeatedly interfered with copulation.

Management for breeding and/or parturition: Pair manipulation, i.e. separating pairs before estrus to stimulate breeding is not advised for this species. The general practice is to introduce and leave the pair together because the male is believed to play an important role in the successful rearing of the pups.

The only environmental manipulation indicated by any of the facilities responding to the survey was the addition of (more) hay and/or nest boxes when a female was due to give birth. Females have used tunnels in hay, burlap bags, hollow logs, hollows under logs, and wooden boxes for puping. Some of the more successful nest boxes incorporate an antechamber, which allows the female to stay in the box but not necessarily with the pups.

Manipulating light or temperature cycles is not required. However, due to the more tropical nature of their native habitat, many Asian small-clawed otters are housed inside under temperature/light controlled conditions. Whether this has any bearing on the success, or failure of pairs to breed is unclear at this time.

Pregnant females are not separated from the group. As mentioned, the male plays an important role in pup rearing which includes bringing food to the females, patrolling the area and teaching pups to swim. Some competition for the female when the males reached three years of age has occurred. If there is prolonged conflict of this kind, or any other, separation of the rest of the group from the pair may need to be considered.

Gestation: Gestations of 62 to 86 days have been recorded in North American Zoos. Sobel (1996) recorded a gestation length between 60 and 74 days from his study.

Litter size and pup sex ratios: Litter size (mean, range, mode, median and sample size) was 3.5, 1 - 7, 3, 3, n=28. The observed pup sex ratio was not statistically ($p = 0.05$ level) different from an expected 1:1 ratio.

Inter-birth intervals: An inter-birth interval as short as eight months was observed by Gross and Sobel during their study. (Gross, 1996)

Diet: A pregnant female's diet may be increased, a lactating female's diet should be increased 10 to 20% (see Chapter 1, Nutrition and Diet).

Parturition: Some females show a nest box or puping location preference and this possibility should be taken into account. If a female's preference is unknown, nest box and nesting location choices should be offered. Even with familiar females, choices should be available (nest box, hollow log, holding den, etc.)

unless this is proven to present some kind of problem. Some females became agitated by the presence of alternate nest boxes and carried the pups back and forth excessively. In cases like, this alternate boxes should be removed. Signs of imminent parturition include some weight gain, and more time spent in the nest box.

Pup Development

Eyes open (start to finish)	28 - 47 days
Crawling to walking	15 - 43 days
Moving on their own	39 - 50 days
Teeth coming in	27 days (lower canines)
	39 days (molars)
Swimming lessons start	52 - 56 days
Playing together	49 - 53 days
Follow parents to latrine	55 days
First solids	49 - 58 days
Playing in the water	61 days
Eating adult diet	60 days
Weaned	82 - 120 days (210 days reported by one facility)

Behavior of group members towards pups: In general the other group members are not aggressive towards the pups. Problems with the cannibalization of the second litter by the dam when the pups were two days old have been reported. Whether or not this was due to the presence of the previous litter's offspring is not possible to determine. All facilities should monitor the situation and remove animals that show a tendency towards aggression.

Age pups separated: The age at which pups are separated from the natal group varies greatly and to a large extent is a management decision. The 1997/98 SSP survey showed pups were separated as young as five months to as old as six years.

Pup diet: As would be expected, pups' diets should be increased as they mature (see Chapter 1, Nutrition and Diet).

Asian Small Clawed Otter *(Aonyx cinerea)*
Pup Weight Ranges
A.Z.A. SSP 1998 Survey

Day	Weight	Day	Weight
Birth	45.60 - 62.50 g.	36	243 - 638 g.
1	62 g. - 74 g.	37	243.2 - 659 g.
2	70 g. - 86 g.	38	262.8 - 688 g.
3		39	267.2 - 701 g.
4	86 g. - 100 g.	40	276.8 - 719 g.
5	45.12 - 90.79 g.	41	283.6 - 731 g.
6	106 - 148 g.	42	297.2 - 756 g.
7		43	309.5 - 765 g.
8		44	305 - 785 g.
9	109.2 - 168 g.	45	346.6 - 800 g.
10	111.8 - 167.2 g.	46	357.9 - 809 g.
11	126.1 - 190 g.	47	365.9 - 825 g.
12	128.6 - 191.3 g.	48	417.2 - 835 g.
13	137.1 - 252 g.	49	452.9 - 835 g.
14	149.9 - 213.1 g.	50	469 - 900 g.
15	158 - 252 g.	51	475.2 - 880 g.
16	174.6 - 298 g.	52	474 - 890 g.
17	188.3 - 250 g.	53	310 - 900 g.
18	203.1 - 266 g.	54	475.4 - 786 g.
19	212.5 - 252.4 g.	55	480 - 830 g.
20	218 - 358 g.	56	476 - 692 g.
21	224.3 - 377 g.	57	470 - 880 g.
22	232.4 - 377 g.	58	480 - 775 g.
23	203.1 - 400 g.	59	634 - 690 g.
24	207.1 - 435 g.	60	315 - 650 g.
25	197.8 - 450 g.	61	330 - 795 g.
26	203.6 - 466 g.	62	878 - 889 g.
27	203.7 - 479 g.	63	355 g.
28	210.4 - 355.8 g.	64	360 g.
29	220.5 - 521 g.	65	365 g.
30	235.8 - 546 g.	66	370 - 720 g.
31	239.4 - 557 g.	67	385 g.
32	250.5 - 570 g.	68	
33	266.3 - 585 g.	69	410 - 988 g.
34	276.5 - 608 g.	70	
35	252.6 - 429.8 g.	71	

Weights taken from a sample of 18.10 captive born pups. High/low weights should be regarded as exceptions with the mid-range being the norm.

CHAPTER 4

Captive Management

Dusty Lombardi, Columbus Zoological Garden

Mike Coker, Topeka Zoological Park

Daniel J. Morris, Omaha's Henry Doorly Zoo

Exhibit size, water quality, temperature, and enrichment are important components for maintaining otters in captivity. The most important points to remember are land vs. water, turf vs. shrub, the extent of areas for grooming and the smooth overhang. This data was collected from an Asian small-clawed otter SSP survey conducted during the Fall of 1997 and Spring of 1998.

Housing and Enclosure Recommendations

The AZA Minimum Husbandry Guidelines state that for a single individual, the largest enclosure dimension should be at least four times the average adult head-body length, while the shortest dimension should be at least two times the adult head-body length. Enclosures should be at least 50 percent larger per additional animal, and may need to be even larger for breeding pairs. The quality of space is very important for these animals (Wallach and Boever, 1983). Hollow logs, digging sites, natural trees and vines, water features, rawhide chews, and other "toys" contribute to the quality of the space. If enclosure sides are shared, a mesh small enough to prevent intra-specific aggression and physical injuries must be used (AZA Minimum Husbandry Guidelines for Mammals).

Table 4.1: Minimum accommodation requirements for one pair of otters in captivity
(Duplaix-Hall, 1975)

	Size of enclosure (m)	Land/water ratio	Number of hollow logs	Turf/shrubs ratio	Fence (height) +80cm smooth overhang
Amblonyx	10x6	5or6: 1 +shallow pools	1	3:2	1•50
Lutrogale	15x10	4:1	2	3:1	1•80
L. lutra	15x10	4:1	2	1:3	1•80
L. canadensis	15x10	4:1	2	2:3	1•80

However, the SSP suggests that the exhibits be constructed taking the collected survey information into consideration and not built for minimum standards.

Housing

Otters are land animals that swim. Although captive otters are good swimmers, they must be maintained in an environment that provides adequate dry land for resting, grooming, exploring, and eating large prey items. The biggest mistake many new otter keepers make is in designing displays and holding compounds with large swimming pools but not enough land area for these activities. In addition to the pool, the otters should be provided with a separate source of drinking water that is replenished daily (Foster-Turely 1990).

Land Area

The land area of the exhibits in the survey range in size from 160 square feet to 43,244 square feet. Exhibits were constructed from a variety of different substrates. These include concrete, soil, rock, sand, clay, gunnite, natural soil with vegetation, and mulch or any combination of the above is acceptable. Land area for exhibits should measure approximately twice the size of the pool area, since these animals spend a considerable amount of time on land (Wilson, Tropea and Calle).

Sanitation

Enclosures should be raked and spot-cleaned daily, with appropriate disinfecting as necessary. Indoor or hard-surface enclosure floors should be cleaned daily with detergent and disinfectant. Enclosure "furniture", including perches and nest boxes, should not be included in this frequent regime because this species scent marks their territory and a thorough cleaning of their home space may increase stress. One quarter of the enclosure "furniture" may be disinfected at a time, leaving scent marks on the rest. Old, soiled furnishings may be replaced 25 percent at a time rather than total replacement as is commonly done for species which do not scent mark heavily. Substrates from large "naturalistic" enclosures should be removed and replaced as necessary. The larger the enclosure, the less frequently this activity will need to be performed.

Food containers must be cleaned daily with detergent and disinfectant.

Footbaths, filled with disinfectant, should be used prior to entering mustelid enclosures to prevent disease and parasite transmission.

A safe and effective control program for insects, ectoparasites, and bird and mammal pests should be maintained.

Containment Barriers

Otters can dig and climb proficiently. When designing exhibits perimeter walls and fences should be buried or mesh linked for digging. Walls should be non-climbable. If the containment barrier is chain-link fencing, it should be topped with an unclimbable overhang (Foster-Turely, 1990 & Duplaix-Hall 1975). Hot wire can also be effective but it must be placed far enough away from the animal so there is no contact from the water.

The material used for barriers can consist of glass viewing windows, Plexiglas, gunnite rockwork, stainless steel woven netting, 1inch X 1 inch plastic coated wire, and wet moats.

Height of the barriers from the water ranged from 3 1/2 feet (glass) to 15 feet. Height of the barriers from land ranged from 3 1/2 feet to 20 feet. The SSP recommends a 5 feet smooth non-climbable surface as a safe minimum.

Water Quality

Pools

It is recommended that filtration be used in otter pools. Sand filters, pool pumps, charcoal filters, and pressure sand filters have all been used effectively.

If filtration is not used, pools need to be changed often. Institutions participating in the survey that did not use filtration changed their pools from daily to every two to three weeks. However, fresh drinking water must be offered at all times when filtration is not used.

Pool Temperatures

Pool temperatures reported in the survey ranged from 65º-85º F. It is recommended that warm water (85ºF) be provided for swimming since these tropical animals will spend more time in the water since if it is warm (Petrini, 1998).

Size and Shape

The depth and volume of pools in exhibits ranged from moats of 2-3 feet deep to pools 4 1/2 feet deep and over 7500 gallons of water. It is recommended by the SSP that a pool have a shallow area of 8-10 inches for teaching pups to swim. Pools can grade to any depth. Some pools were graduated from 2 inches to 6 inches, while some had no grade or were flat. Otters have been reported to spend more time in shallow water.

Pools can be constructed of several materials but commonly concrete was used. Gunnite is another substrate that has been used successfully.

Live Plants

Live plants that have been used successfully in otter exhibits are: bamboo; grasses; ficus pandanus (screw pine); iris; elephant ear; cast iron; ginger; nandina; cheery laurel; sweet olive; oak trees; cat whisker; quilfoylei; panniculala; banana plants; wax myrtle; mimosa trees; vitex; osmanthus; alocasia; ficus benjamina; palm grass; agleonema; dogwood; and rice paper plants.

Holding Area

A holding area connected to the exhibit is recommended. This area should comfortably house the animals when they are not on exhibit. A well-designed holding area facilitates close observations of the animals, introductions, medical treatments, and provides a quiet place for birthing and cub rearing. A total area of at least 100 square feet per family group (12 otters or 8.3 feet per otter) is recommended (Wilson, Tropea and Calle). The smallest that was reported in the survey, was 4 feet X 6 feet while the largest was 12 feet X 14 feet.

The holding area should include:

A pool or tub with clean fresh running water is recommended (Wilson, Tropea and Calle). The smallest reported off exhibit pool was a 6 gallon tub while the largest reported was a 150 gallon tub.

A nest box large enough to comfortably accommodate all the animals in the group should be provided. If located outdoors, the nest box must be heated during cool weather. Hot spots appear to be the best method of heating so that the otters can chose the temperature ranges they prefer (Wilson, Tropea and Calle).

Bedding or nesting material (hay, straw or burlap) should be available at all times. Otters will use a surprisingly large volume of nesting material to pack a nest box, making a series of tunnels within the box (Wilson, Tropea and Calle).

A "drying" area between the pool and the nest box that is bedded heavily with hay is necessary for proper hygiene. This area allows animals to both remove excess moisture from their coats and maintain a dry nest box (Wilson, Tropea and Calle).

It is also recommended that holding areas have a concrete floor with a drain, for proper daily disinfecting. Containment recommendations for on exhibit areas apply to off exhibit as well.

Lighting

If housed indoors, otters should be kept on a 12-hour light cycle (Wilson, Tropea, and Calle). Fluorescent, metal halide, mercury vapor and natural are all types of lighting used in off exhibit areas. If animals are held in holding areas for any length of time, some natural light is recommended.

Air Temperatures

A recommended air temperature for otters is 72°-76° F or 22.2°-24.4° C (Wilson, Tropea and Calle).

Sanitation

Daily maintenance should include disinfecting of feeding and toilet areas, pools and replacement of soiled bedding (Wilson, Tropea and Calle).

Den Boxes

Den boxes should be provided at all times, not just for maternal care of young. Often otters will share the same den box, but it is safest to provide one per otter in the same enclosure (Foster-Turely 1990). They can be constructed of wood, Plexiglas, PVC tubing, plastic barrels, sky kennels, and burlap bags. They have been reported to range in size from 12 inch X 30 inch tubing to as large as 6 feet X 6 feet.

Table 4.2:Minimum den accommodation requirements for one pair of otters (Duplaix-Hall, 1975).

	Size (cm)	Heating (22ºC) thermostat	Access diameter (cm)	Bedding (dry)	Mats
Amblonyx cinerea	60x60x50	Autumn-Spring	15	+	+
Lutrogale perspicillata	75x75x50	Autumn-Spring	Tunnel 20	+	+
Lutra lutra	75x75x50	Winter+Cubs	Tunnel 18	+	+
Lutra canadensis	75x75x50	Winter+Cubs	22	+	+

Capture and Restraint

Capture

The best methods for capture are: nets, blow darts, burlap bag, squeeze cage built into holding, squeeze box, and crate training. Crate training is always the preferred method.

Restraint

For chemical restraining please refer to the recommendations in Chapter 2, Health Section.

For non-chemical restraining, gloves and rubber boots should be worn to net the animal. As previously stated, crate training is preferred.

Successful Introductions

Introductions have occurred between all ages and both sexes. Auditory, visual, and olfactory introduction must be successfully completed before attempting physical introduction. Successful introductions have been reported as early as one day and have taken as long as three weeks.

Shipping

The International Air Transport Association has published the Live Animal Regulations, 24th Edition, effective October 1, 1997 (see containment requirements, page 56 & 57). Note that animals under 56 pounds can be carried in a vari-kennel. It is recommended that a privacy cloth be attached to the outside door (IATA, 1997).

Enrichment

Cage Furniture

Artificial mangrove trees	Bamboo
Garbage cans	Hammock
Hollow logs	Logs
Plexiglas transport cages	Pipe tunnels
Rocks	Rock ledges
Ropes	Stone benches
Substrate pans	Trees
Tree roots	Vines
Wooden barrels	Wooden platforms

Food Items

Crayfish	Crickets
Ice blocks	Minnows
Trout	

Nonfood Items

Balls	Boomer ball
Clay	Dirt
Feeder tubes for crayfish	Grass
Hay	Hollow rings
PVC pipe for feeding live fish	Plant pockets in pool
Running water	Sand
Straw	Underwater branches
Waterfall	Woodwool

Mixed Species

The following animals have been successfully housed with Asian small clawed otters:

Baribusa	Binturong
Black Hornbills	Butterflies
Free-range PeaFowl	Giant Asian Squirrels
Grey Gibbon	Giant Hornbill
Muntjac	Prevost's Squirrels
Proboscis Monkeys	Rodriguez Fruit Bats
White-handed Gibbon	

*Water monitor's were tried but were not successful.

CONTAINER REQUIREMENT 82

Applicable to:

Aardwolf	Hyena species
Asiatic wild dog	Jackal
Badger species	Jaguarundi
Bobcat	Lynx
Bush dog	Maned wolf
Caracal	Ocelot
Coyote	Otter species
Dhole	Panda (lesser or red)
Dog, bush wild	Tasmanian tiger
Dog, hunting wild	Wild cat species (small)
Dog, fighting	Wolf
Fox species	Wolverine

See Exceptions GBG-05, HKG-01, SAG-02, USG-08 and other USG Exceptions in Chapter 2 and Exceptions AF-01, BA-04, IB-01 and SV-01 in Chapter 3.

△ 1. CONTAINER CONSTRUCTION

(see Exception QF-01 in Chapter 3)

Materials

Wood, metal, weld mesh and wire mesh.

Principles of Design

The following principles of design must be met in addition to the General Container Requirements outlined at the beginning of this chapter.

Dimension

The height of the container must allow the animal to stand in a natural position with its head extended and the width must permit it to turn around and lie down comfortably. The actual measurements will vary with the species involved.

Frame

The frame must be made from solid wood or metal parts bolted or screwed together. It must be constructed so that it cannot be damaged from continual biting or scratching at the corners. If the total weight of the container plus animal exceeds 60 kg (132 lb) metal bracing must be added to the frame.

Sides

The sides and door must be made metal or solid wood. The front of the container must be constructed of weld mesh. The mesh must have a diameter that will prevent the animal protruding its nose or paws to the outside. The whole front must be covered by a sliding shutter which can be raised and lowered to permit feeding and watering. It must have two observation holes of at least 10 cm (4 in) in the upper part and ventilation holes, with a minimum diameter of 2.5 cm (1 in), spread over the remainder of the surface in order to give good ventilation but at the same time leave the animal in semi-darkness.

Floor

The floor must be solid and leak-proof, there must be a droppings tray with a layer of absorbent material for bedding.

Roof

Must be solid wood or metal with ventilation openings over its surface.

Doors

A sliding door must be provided, it can be made from the weld meshed ventilation front if required. It must have a secure means of fastening so that it cannot be opened.

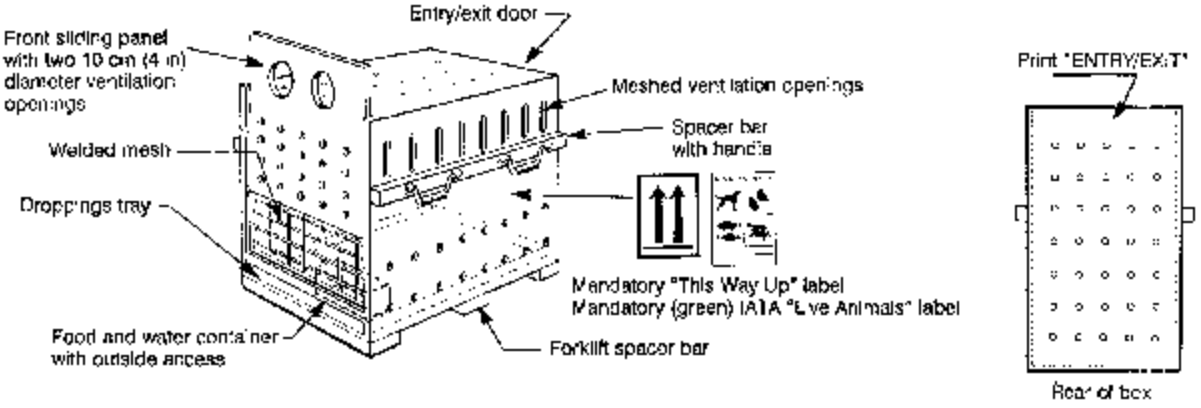
Ventilation

The main ventilation front must be supplemented by meshed openings along the upper part of the container walls and/or holes with a minimum diameter of 2.5 cm (1 in) spread over the top third of the sides and the whole of the back and top. These holes must be spaced both horizontally and vertically at intervals of approximately 10 cm (4 in) centre to centre. It is essential that there is some ventilation is provided in the lower third of the sides for the removal of harmful waste gases.

The total ventilated area must be at least 20% of the total area of the surface of all four sides. More ventilation and the use of larger meshed openings is permitted but the animal must not be able to protrude its nose or paws to the outside from any opening.

If the mesh is fixed to the interior of the container all sharp edges must be protected.

EXAMPLE:



CONTAINER REQUIREMENT 82 *(cont'd)*

Spacer Bars/Handles

Must be made to a depth of 2.5 cm (1 in), must be present on the sides of the container as shown in the illustration.

Feed and Water Containers

Food and water containers must be provided with a means of access from the outside.

Special Requirements

Hyena, wolves, badger, otter wolverine and wild dogs must have the container completely lined with sheet iron or other hard metal sheeting with through ventilation holes cut into it.

Palletised shipments must have the containers made entirely of weld mesh of a suitable dimension that no part of the animal can protrude in order to ensure good ventilation.

Forklift Spacers

Must be provided if the total weight of the container plus the animal exceeds 60 kg (132 lb).

Rigid Plastic Pet Containers
(see Container Requirement 1)

Some of the less destructive of these species can be transported individually in modified rigid plastic pet containers.

Animals over 25 kg (56 lb) are carried at the discretion of the carrier.

The following modifications must be made:

the grill door must be covered with securely fixed weld mesh and all ventilation openings covered with wire mesh;

the door of the larger containers must have secure fastenings at the top and the bottom;

a curtain, that can be raised and lowered and does not impede ventilation, must be fixed over the door to reduce light inside the container;

a dropping tray must be fixed to the floor and filled with absorbent material;

there must be ventilation openings on the rear of the container, extra ventilation openings may have to be made in order that the total ventilation area is at least 20% of the four sides;

food and water containers must be fixed inside with access from the outside;

the container must be correctly labelled.

2. PREPARATIONS BEFORE DISPATCH
(see Chapter 5 and Chapters 5 and 10)

No special requirements.

3. FEEDING AND WATERING GUIDE
(for emergency use only)

Animals do not normally require additional feeding or watering during 24 hours following the time of dispatch.

If feeding is required due to an unforeseen delay, canned dog or cat food must be provided but care must be taken not to overfeed.

4. GENERAL CARE AND LOADING
(see Chapters 5 and 10)

Animals in quarantine must be segregated from those which are not.

Hand-reared young may be loaded in the same container as long as they are used to cohabiting.

CHAPTER 5

Behavior and Social Organization

Don Kuenzer, Cleveland Metroparks Zoo

Dusty Lombardi, Columbus Zoological Gardens

The following information was gathered in 1998 through a survey produced by the Asian Small-Clawed Otter SSP for a husbandry manual. This portion of the survey deals with "social groupings" both successful and unsuccessful attempts of introduction for two or more otters.

A standard rule for introducing two or more animals does not exist. If the survey showed one thing it was that each animal is different. Institutions have mixed various aged animals of both sexes or as single groups with as little an introduction period as one day with success. We DO NOT recommend this technique.

Our recommendation is to place animals together at the earliest possible age. Pairs, scheduled for reproduction, require establishing of a pair bond. An olfactory and visual, but separate, area for introduction is suggested. The period before actual contact may be as little as 24 hours or extend beyond three weeks. Keepers should watch for "playful" interaction before introductions are attempted. Pairs do not bond for life. Breeding pairs may be split for re-pairing. These are social animals and should not be held singly.

Multiple specimen group introductions vary. The consensus is most groupings tried, work over time. However, after a group is established, problems have occurred (i.e. aggression towards least dominant, over aggressiveness by older sibling). These groupings have varied in sex ratios, number of individuals, and ages. No institutions replying mentioned being able to hold multiple breeding pairs together. Most institutions keep single sex groups, although Bronx and Minnesota zoos have kept adult pairs with up to three litters together. Minnesota noted removal of older siblings from their group at approximately 6 years of age. Even in either single sex groupings, problems can occur over time (i.e. weight loss or aggression).

Breeding Behavior

Asian small-clawed otters (*Aonyx cinerea)* in captivity are monogamous, with both members of the pair helping to raise the offspring. Unlike *Lutra* species the otter parents and offspring must be housed together. One breeding pair can produce two litters a year, with up to seven pups in each litter. Older siblings help raise the younger ones and a family group of these otters can build up to 15 or more in a year. Similar sized groups are sometimes found in the wild (Turely 1990).

Breeding pairs must establish a bond for successful reproduction. The male pursues the female in courtship and most breeding occurs in shallow water. A single copulation can last from five to twenty-five minutes. Courtship behavior has been recorded from one to three days, at one-month intervals. Gestation is sixty to sixty-four days and litter sizes range from one to seven young. Females become very aggressive prior to parturition, and remain so post parturition. The sire

plays a very active role in rearing the cubs, and should not be removed prior to their birth. Male behaviors include nest building, carrying cubs, and bringing food to the cubs during weaning.

Cubs are carried by the nape of the neck, and are frequently moved between nest sites. The adults may construct several nests.

Social Groupings
It is recommended that otters be held in adult pairs, adult pairs with offspring, or in single sex groups.

Successful Groupings
It has been noted that male groupings tend to show aggression with age. It is recommended that single sex groups be introduced as early as possible. Full siblings or siblings seem to be the most compatible.

Successful Introductions
Introductions have occurred between all ages and both sexes. Auditory, visual, and olfactory introductions must be successfully completed before attempting physical introduction.

Courtship Behavior
Courtship behavior has been observed in many institutions and in many different ways. Some examples are: female mounting male; increase scent marking; longer stay time; oral and genital stimulation by both sexes; nest building by male; tail movement; increased vocalization; climbing on each other; backing into each other; and clasping ventral/ventral. This usually lasts through estrus.

Sexual maturity has been documented as early as 13 months for a female. Usually the male pursues the female although females have been noted to mount males as well.

Observed Copulation
Breeding occurs dorsal/ventral or ventral/ventral. Breeding occurs usually on land, nest boxes, shallow or slow moving water (i.e. waterfall with both animals lying on their sides, her back to his belly). The male will mount the female from behind or female will back into male.

Nest Boxes-Birthing Area
Most institutions are successfully using nest boxes. Cleveland has had multiple birth and rearing successes using a single, large, course weave burlap bag placed directly on the floor of the holding area. Bags are interchanged regularly for sanitation and to keep nest areas dry. Bags can be washed, dried, and reused. A single bag has held up to twelve otters. In use of either method, dry off areas need to be provided. Access to water (pools, water bowls) should be strictly monitored to prevent newborns from drowning. Monitoring of young, with care, can be accomplished from day one. Parents and older siblings are separated using a non-stressful method from the nest area. Young can be weighed and measured without interference. This is usually a procedure that does stress the adults but if done quickly and with a minimum of extra staff, it is usually not fatal.

Parental Care

It has been noted that males play an important role in parental care. Males carry food to female in the nest box. Both parents carry and groom cubs. The males seem too responsible for gathering food items for cubs after weaning. Both parents teach young to swim.

Young Removed

Age will vary depending on compatibility of group. Some cubs are removed as young as 5 months and as old as 6 years. It is recommended that one set of siblings assist in care of second set if possible.

Inter-Birth Interval

Established breeding pairs confined with previous offspring have been known to reproduce and deliver within the group after a 9.5-month period with previous litters assisting the pair. Adult and sub-adult males should remain with females before and after delivery unless extreme aggression is observed. It is normal for dams to carry young to a new location and have the sire return them to the old. This exchange has been observed to continue for sometime. During this period some sires have been observed to lose weight. Seasonality or breeding does not appear to change the group's social behavior except that the adults may become more aggressive towards older youngsters.

Behavior Indicators for Social Stress

Otters will show certain behavior indicators such as: defined pecking order; fur plucking; spinning; ostracizing; fighting; pacing; submission; and avoidance. If any behaviors are seen, social structure should be changed or evaluated.

CHAPTER 6

Action Plan for Asian Otters

Pat Foster-Turley and Charles Santiapillai

Introduction

Five species of otter are known from Asia. They are Eurasian otter *(Lutra lutra);* smooth otter *(Lutra perspicillata);* hairy-nosed otter (Lutra *sunwtrana);* Asian small-clawed otter *(Aonyx cinerea)* and the sea otter *(Enhydra lutris).*

Throughout their distribution in Asia, otters are being threatened by a combination of habitat destruction, hunting, and environmental pollution, especially from the organochlorines. The demand for natural resources in the Asian region is bound to increase sharply. The human population is predicted to reach 3.4 billion by the year 2000 and is not expected to stabilize below 6 billion in the latter part of the twenty-first century. This growth rate alone indicates a doubling in the demand on the natural resources every 30 years or less. In reality, the situation is likely to be worse than this, since most Asian economies are booming, and the resource use per person can be expected to increase drastically over the next 20 years. One of the consequences of the burgeoning human population across Asia is the rapid conversion of forests to other land uses. The conversion of forests in general and the riparian vegetation in particular is a serious conservation problem in Asia. Otters are among the animals that suffer.

Direct threats to the otters in Asia include killing them for their pelts, or for their organs, which are thought to have medicinal value in some regions. Otters are also sometimes killed because they are thought to compete with fishermen, or because of their depredations upon fish-farming operations. The indirect threats such as pollution of the environment with industrial and agricultural wastes are even more serious. Of particular concern are the organochlorines, especially PCBs (polychlorinated biphenyls), which are bio-magnified at the top of the food chain. As the level of PCBs in the wetlands increases, there is usually a general decline in aquatic mammals, such as otters. It is therefore quite alarming to note that large quantities of PCBs are still in use in Asian countries. Unless these are collected and destroyed, they will remain a potent threat to the survival of the otters and other wildlife in the wetlands. Evidence suggests that the accumulation of PCBs has been largely responsible for the widespread decline of populations of the Eurasian otter in Western Europe (Mason and Macdonald 1986a). A similar problem could be developing in Asia. In many countries in Asia where otters were once common, they have disappeared due to a combination of the direct and indirect threats. In Hong Kong, Japan, and Singapore, otters are believed to be extirpated, and otters of all species are rare in much of the rest of Asia.

Despite the overall pessimistic condition facing otters in Asia, there are some causes for guarded optimism as well. In Peninsular Malaysia, for instance, otters are still widespread in many areas, even beyond the boundaries of protected areas. In other countries, healthy populations of otters remain in

national parks and preserves. Indonesia in particular has an excellent system of protected areas that covers all the major habitat types and ecosystems. However, the main problem is in protecting these areas from those activities of people that are incompatible with otter survival. National parks and other protected areas are prone to environmental disturbances outside their boundaries. Herein lies the crux of the problem concerning the conservation of otters in Asia.

With the exception of the sea otter, little is known about the natural behavior and ecology of the Asian otters, apart from the summaries in general field guides and mammalogy references like Medway (1978), Lekagul and McNeely (1977), Roberts, (1977), and Nowak and Paradiso (1983). This information is summarized below, as presented at the Fifth International Otter Colloquium (Foster-Turley in press).

Asian Small-Clawed Otter--*(Aonyx cinerea)*
The Asian small-clawed otter is the smallest of the world's otters, rarely weighing more than 5 kilograms. A gregarious species, it is often seen in large groups of up to 15 animals (Furuyu, 1977), and captive studies suggest that these groups are composed of an alpha breeding pair and their offspring from successive litters (Foster-Turley and Engfer 1988). Asian small-clawed otters have unusual hand-like front paws with increased tactile sensitivity (Radinsky 1968) and reduced webbing, which they use to forage for their prey of crustaceans, mollusks, and small fish. Asian small-clawed otters are found from Palawan (Philippines) through Indonesia, Southeast Asia, southern China, and westwards through the Himalayan foot-hills of Bangladesh, Bhutan, and Nepal. A disjunct population occurs in southern India (see Figure 1).

Smooth Otter-- *(Lutra perspicillata)*
Smooth otters are so-named for their shorter, smoother coats, as compared to the similar-sized sympatric *Lutra* species. From captive studies (Desai in press) this otter appears to be monogamous and is usually seen year-round in small family groups. . Although little is known about the ecology of this species, it is known to occur in a variety of Asian habitats, from mangroves, to freshwater wetlands and large forested rivers. The smooth otter is distributed throughout southern Asia from Indonesia, through Southeast Asia, and westwards through southern China and India, with an isolated population in Iraq (see Figure 2). In most of its range it is sympatric with the Asian small-clawed otter and sometimes the other Lutra species. Of all the Asian otters, this one seems to be the most common through most of its range.

Eurasian Otter--*(Lutra lutra)*
The Eurasian otter has been well studied in Europe (Chanin 1985; Mason and Macdonald 1986a), but its ecology in Asia remains unknown. Eurasian otters are primarily fish-eaters, although they also eat other vertebrates and crustaceans. In Europe these otters tend to be solitary and generally at low density when found in freshwater rivers and marshes, but are more numerous in coastal environments where food is more plentiful. In Asia, they are very elusive and rare. They are especially susceptible to human-induced disturbances and thus occur mostly in higher altitude streams and other remote areas. The Eurasian otter is widely distributed throughout all of Eurasia from Western Europe to the Northern Pacific coast and South through Central and Southeast Asia (see Figure 3).

Hairy-Nosed Otter--*(Lutra sumatrana)*
The hairy-nosed otter is the rarest and the least known of the Asian otters and is also the most difficult to identify in the field. It gets its name from the presence of hair on its rhinarium; in most other respects it is similar to the Eurasian otter. It is probably verging on extinction in the northern parts of its range, and is of uncertain status elsewhere. This otter was once found from southern Indochina and Thailand through Malaysia and Indonesia (Sumatra, Java, and Borneo), although its current distribution is unknown (see Figure 4).

Information for the following country by country accounts compiled from data presented at the First International was Asian Otter Symposium held in Bangalore, India, in October 1988, and from responses to a questionnaire mailing. All correspondents providing information on their countries are gratefully acknowledged in Appendix 2.

Country Accounts

Afghanistan
The Eurasian otter has been recorded, but there is no recent information on its status.

Bangladesh
Species Present
Asian small-clawed otter, smooth otter, Eurasian otter

Status and Distribution
All species of otters were once widespread throughout the country but habitat destruction and human encroachment now confines them mostly to certain wetland areas and remaining tracts of forest.

The Asian small-clawed otter is very rare and found in small numbers in forested areas in Chittagong and the Chittagong Hill Tracts, in wetlands in Sylhet and in the Sunderban Forest in Khulna. It is non-existent in most populated and agricultural areas, although it has been sighted in homestead areas around Dhaka.

The smooth otter is the most common otter throughout Bangladesh, although its distribution and numbers are shrinking. It is common in forested areas in Barisal, Chittagong, and the Chittagong Hill Tracts, in the wetlands and homestead areas of Mymensingh, and the Sunderbans Forest and homestead areas of Khulna. This otter is common in homestead areas around Dhaka and is also occasionally sighted in all other districts of Bangladesh.

The Eurasian otter is very rare and found in small numbers in forested areas in Chittagong and the Chittagong Hill Tracts and in the wetlands of Mymensingh and Sylhet districts. It is non-existent in agricultural and homestead areas throughout the country except for occasional sightings in Dhaka and Mymensingh districts.

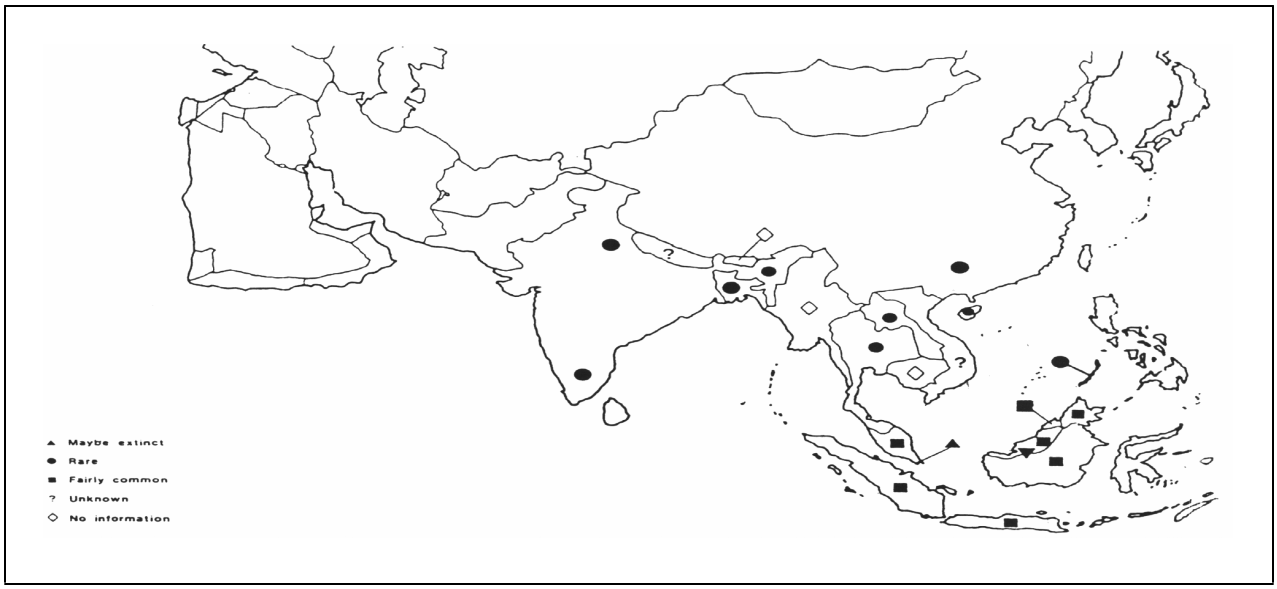
Legal Status

Protected: internal and external trade and local consumption are banned.

Threats

1. Habitat destruction due to human encroachment. Forests are now restricted to less than 9% of the total land area, and more land is continually being cleared for agricultural or maricultural use. Brushy cover near homestead areas is disappearing due to fuelwood collection, and herbaceous plants and aquatic vegetation in wetland areas are also collected for fuel.
2. Otters are killed because of perceived competition with fishermen. More than five million people are dependent on fishing for their livelihood and many of these fishermen still depend on tame otters to drive fish into their nets. Historically these otters have been reared in captivity.
3. Otters are hunted illegally for the fur trade and sometimes for meat. CITES reports that 3,558 skins of smooth otter, originating from Bangladesh, entered international trade in 1980, with a further 427 in 1982.
4. Large-scale local embankment, and dike, dam, and road construction throughout the country is altering the free flow of water and drying up some bodies of water.
5. Heavy use of pesticides and fertilizers is contaminating many ponds and water bodies in rural Bangladesh.

Figure 6.1. Distribution of the Asian small-clawed otter *(Aonyx cinerea).*



Conservation Priorities

1. Legal protection and conservation programs for wetlands and other threatened habitat and species need to be developed. Specifically, the existing Bangladesh Wildlife (Preservation) Act of 1973 needs to be updated and enforced.
2. Complete surveys of otter habitats need to be continued to identify key potential areas for otter and wetland conservation efforts.
3. Key wetland areas should be declared as otter sanctuaries.

4. Environmental and other factors should be surveyed to determine the cause of otter declines.
5. People should be encouraged in social forestry. This will enable people to meet their fuelwood needs without removing the vegetation cover around the bodies of water.
6. Awareness among the local people about the conservation of these species should be pursued through a publicity campaign.
7. A well-considered captive breeding, public display, and possible future reintroduction program should be started.
8. A study should be made of the fishing communities that use trained otters and a cooperative society should be developed for the education and training of these fishermen in otter conservation.

Bhutan

The Asian small-clawed otter, the Eurasian otter, and the smooth otter historically occurred in Bhutan, but no current information is available.

Brunei

The Asian small-clawed otter, the smooth otter, and the hairy-nosed otter historically occurred in Brunei, but no current information is available.

Burma

The Asian small-clawed otter, the smooth otter, and the Eurasian otter historically occurred in Burma. Salter (1982) considered the smooth otter to be widely distributed, but no other current information is available. The extensive wetlands in this country are likely to represent important otter habitat.

Cambodia

The Asian small-clawed otter, the smooth otter, the hairy-nosed otter and the Eurasian otter historically occurred in Cambodia but no current information is available. The extensive Tonle Sap wetlands are likely to be important otter habitat.

China

Species Present

Asian small-clawed otter, smooth otter, Eurasian otter

Status and Distribution

The populations of all otters in China are declining; a fact reinforced by the declining numbers of otter furs traded in recent years.

The Asian small-clawed otter is mainly distributed in Yunnan, Guangdong (including Hainan Island), Guangxi, and Fujian Provinces.

The smooth otter is currently only found in southwestern Yunnan province and the coastal area of Guangdong Province (Zhongshan County and Taishan County.)

The Eurasian otter is found throughout China from the northern regions, where it occurs alone, to the southern provinces, where it is sympatric with the Asian small-clawed otter and the smooth otter.

Legal Status

The Eurasian otter and the Asian small-clawed otter were listed in the protected animal list (class II) by the Commission for Environmental Protection, the State Council in July 1987.

Threats

1. Habitat alteration due to logging and resulting siltation damaging the streams and wetland habitats of otters.
2. Large-scale water pollution is causing the loss of fish and contamination of the otters' food sources.
3. Otters are hunted for their furs, a valuable monetary resource, especially in Guangdong Province, but also in Sichuan,' Hunan, Hubei, and Jiangzi Provinces and throughout the otters' range. Under the China Wildlife Act of November 1988, otters cannot be hunted without permission from the provincial department of forestry.
4. Otters are hunted for their livers, which are thought to have medicinal value.

Conservation Priorities

1. Overall surveys of otters and their habitats are necessary in order to assess the status of otters, the reasons for their decline, and to identify particular wetlands of importance in their conservation.
2. The habitat of otters needs protection throughout China.
3. Existing protected areas that already contain otters need to be more intensively patrolled and scientifically managed. New otter reserves need to be developed and similarly protected.
4. In-depth studies need to be carried out on the otter species in China.
5. Public education needs to be initiated and a non-profit, non-governmental organization needs to be established to protect otters and their habitats.

Hong Kong

Species Present

Asian small-clawed otter (?), Eurasian otter

Status and Distribution

The Eurasian otter was formerly present in the northwest New Territories on the shores of Deep Bay. It has been largely absent for the past 30 years apart from a single individual present at the WWF-Hong Kong Mai Po Nature Center during early 1986. The Asian small-clawed otter probably once occurred in Hong Kong, but there are no recent records of its presence.

Legal Status

Otters are fully protected under the Wild Animals Protection Ordinance, Cap. 170. Trade in otters is controlled under the Animals and Plants (Protection of Endangered Species) Ordinance, Cap. 187, which is the enabling legislation for CITES in Hong Kong.

Threats

1. The otter species probably disappeared from Hong Kong due to hunting for pelts and for livers, which are thought to have medicinal value.
2. Habitat disturbances, such as the development of housing estates and fish ponds, have reduced available otter habitat.
3. Increasing problems of industrialization in Hong Kong and the adjacent Shenzhen Special Economic Zone in China are leading to increasing threats of pollution by PCBs and heavy metals.

Conservation Priorities

1. WWF-Hong Kong is looking into the possibility of reintroducing otters to Hong Kong.
2. Otters imported from China are no longer sold for food in Hong Kong, but live otters may still be imported into the territory--this should be investigated.

India

Species Present

Asian small-clawed otter, smooth otter, Eurasian otter

Status and Distribution

All otters in India are becoming increasingly rare outside of national parks and wildlife sanctuaries, and are threatened in many areas due to reduction in prey biomass, poaching, and reduction of habitat. The remaining otters in India are in fragmented populations and are rarely encountered outside the protected areas.

The Asian small-clawed otter is thought to be the rarest otter in India. It is found in the Himalayan foothills from Kulu in Himachal Pradesh eastwards to the northeast hill states; in the plains of Assam and West Bengal; in the higher elevations of hill ranges of Coorg (Kodagu) in Karnataka; in Goa; and in the Nilgiris and the Palni Hills (Tamil Nadu). There have been no recent sightings or captures of this otter in the high ranges of Kerala, however. It is absent over the whole of central India.

The smooth otter is found throughout India from the Himalayas southwards. It is reported in the states of Kerala, Andhra Pradesh, Mizoram, West Bengal, Gujarat, Himachal Pradesh, Uttar Pradesh, Bihar, Madhya Pradesh, Karnataka, Punjab, and Maharashtra. In most of these states, the otter populations have declined in areas in which they were once quite common outside of the protected areas. There are very good populations in the Periyar and Nagarahole National Parks.

The information on the Eurasian otter in India is vague, but it is known to occur in the foothills of the western Himalayas and in the southern Indian states of Kerala, Tamil Nadu, Karnataka, and in Goa. In the protected areas in the Terai, and foothills of the Himalayas (for instance in the Dudhwa and Corbett National Parks), there are thriving populations.

Legal Status

The Asian small-clawed otter is included in Schedule 1, and the Eurasian otter and the smooth otter are included in Schedule II (Part 11) of the Indian Wildlife (Protection) Act of 1972. AU otters are

covered under Part A of Schedule I of the Export (Trade) Control Order, 1988. Certain wetlands containing otters have been declared as wildlife sanctuaries and national parks.

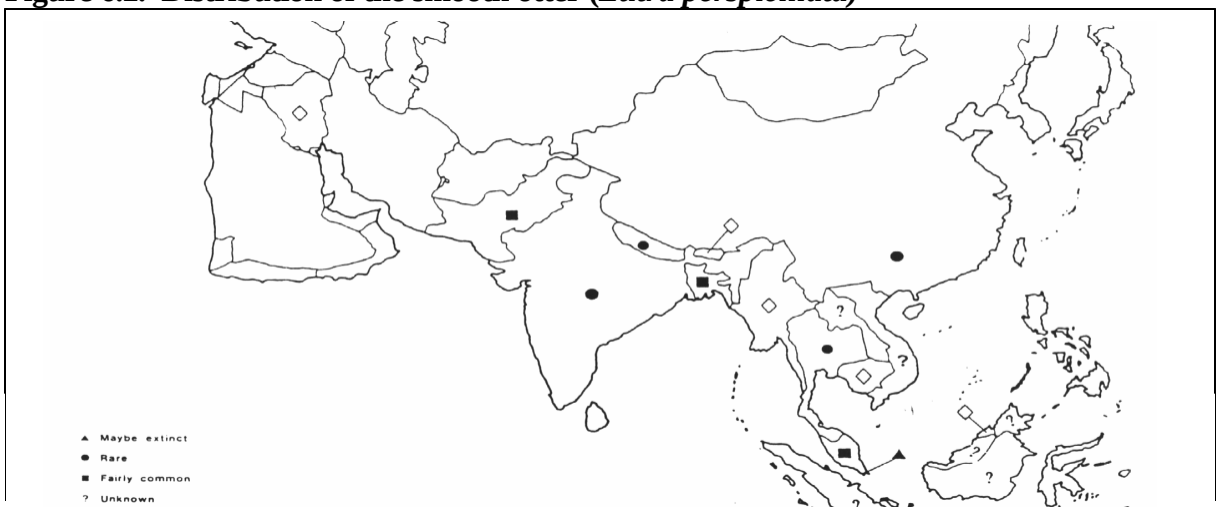
Threats

1. Habitat destruction resulting from reclamation of wetlands for agricultural purposes, deforestation, and the construction of dams and barrages across rivers pose the greatest threats to Indian otters. Decimation of fish fauna due to various factors is also a major cause of declines in populations of otters.
2. Pollution of waterways with industrial, agricultural, and municipal wastes threatens to contaminate the food chain on which otters depend.
3. Otters are sometimes killed for their pelts and there is evidence of illegal export via Bangladesh and Nepal to European and other fur markets. It is not clear whether this is a continuing problem. They are also hunted by tribal people for their meat and in Mizoram, male otters are killed for their sexual organs, which are thought to have medicinal value by the Burmese people across the border.

Conservation Priorities

1. Legal trade in Asian otter pelts should be banned internationally to prevent the smuggling of otter pelts across Indian borders, where they are then exported to the Western World.
2. More detailed surveys of otters should be conducted throughout India to get a more accurate indication of which species of otters are found in which locations, and their current status.
3. Effective protected areas should be established wherever possible in areas where otters survive and where there is good potential for the conservation of viable otter populations. In existing wildlife sanctuaries fishing should be carefully regulated (as is currently the case in national parks) to enhance the prey base of the otters. Where protected areas have been established at the edge of reservoirs and rivers, these adjacent bodies of water should also be included in the protected areas to conserve these neighboring otter habitats more efficiently.
4. Otters should be promoted as the symbol of Indian wetlands, to encourage more public participation in their protection. Public education programs should also be devised to increase awareness of the value of otters and the wetlands they stand for.
5. More scientific studies are needed on the behavior, ecology, food, and habitat requirements of otters in India.

Figure 6.2. Distribution of the smooth otter (*Lutra perspicillata)*



Indonesia

Species Present

Asian small-clawed otter, smooth otter, Eurasian otter, hairy-nosed otter

Status and Distribution

The Asian small-clawed otter is found in Java, Sumatra, and Kalimantan, and possibly in the Lesser Sunda Islands. It is reported in the Riau and Lingga archipelagos off Sumatra, and on the island of Sumatra in the Padang-Sugihan Wildlife preserve (Sumatra Selatan), the Way Kabas Game Reserve (Lampung) and the Lunang peatswamp forests (Sumatra Barat). In Java, it is reported in Muara Bobos (Java Barat), Cilacap/Segara Anakan (Java Tengah) and upstream areas of Cigenter and Cikareng in Ujung Kulon National Park. In Kalimantan, this species is reported along the Upper Kapuas River (Kalimantan Barat), Pleihari (Kalimantan Selatan), and the upper reaches of Sungai Mahakam (Kalimantan Timur).

The smooth otter is found in Sumatra, Java, and Kalimantan. It has recently been reported in Sungai Bahau in East Kalimantan and historical records dating to the turn of the century report it in the environs of Jakarta, on Java. No recent sightings in this location have been confirmed, however.

The Eurasian otter is found only on the island of Sumatra, were it has been recorded in the peatswamp forests of Berbak Game Re-serve (Jambi province); in mangroves in the Banyuasin Musi River Delta (Sumatra Selatan); and in freshwater swamp forests and the Way Kanan of the Way Kambas Game Reserve (Lampung).

The hairy-nosed otter is widely distributed in Sumatra, Kalimantan, and Java, where it inhabits freshwater and coastal areas, especially mangroves. In Sumatra it is reported in the Padang-Sugihan Wildlife Reserve (Sumatra Selatan), the Way ,Kambas Game Reserve (Lampung), Ketambe (Aceh), and on Bangka Island off the Sumatra coast. In Kalimantan it is reported in the Sungai Kapuas and near Pontianak (Kalimantan Barat) and in the upper reaches of the Sungai Barito (Kalimantan Tengah). The hairy-nosed otter is also found along the northwest coast of Ujung Kulon National Park and along the north and south coasts of West Java.

Legal Status

No legal protection

Threats

1. Conversion of primary forest into agriculture holdings in the lowlands has destroyed much of the available habitat and necessary cover. Between 65% and 80% of the forests in the lowlands of Sumatra have already been lost.
2. Extensive embankment of canals and rivers to control flashflooding destroys otter dens and reduces bank vegetation needed for cover.
3. Heavy use of pesticides in agriculture, the dumping of toxic wastes from factories, and domestic wastes and detergents from human settlements are contaminating many rivers and water systems in Indonesia, causing a severe threat to the entire aquatic food chain, including otters.

4. The draining of wetlands in Sumatra and Kalimantan for agriculture and human settlement destroys important otter habitats and results in a decline in prey species.
5. Gravel extraction from riverbeds in Sumatra destroys otter habitats and increases levels of suspended sediments in the water with resulting deleterious effects on fish.

Conservation Priorities

1. More scientific studies and data are needed to assess the distribution, numbers, habitat requirements, behavior, and ecology of the otter species in Indonesia.
2. As a logical follow-up to the IUCN/WWF Wetlands Campaign, the habitat requirements of a number of keystone species, including otters should be assessed, and conservation areas should be established for their protection.
3. Captive breeding and possible re-introductions into protected areas should be undertaken.
4. Otters should be given legal protection in Indonesia, although it is known that legal protection alone will not ensure the otters' survival there.

Iran

The Eurasian otter is known to occur in Iran, but no recent information is available.

Iraq

The Eurasian otter and a disjunct population of the smooth otter are known to occur in Iraq, but no current information is available.

Israel

Species Present

Eurasian otter

Status and Distribution

Virtually extirpated in the coastal regions. Good populations still exist in the Jordan river catchment, including Lake Tiberias, but because almost the entire population is concentrated in the one system, it must be considered threatened. Within the system, otters occur in uplands, agricultural lowlands, and fish ponds (Macdonald et ai. 1986).

Legal status

Protected

Threats

1. Gross pollution of rivers (sewage, pesticides) in the coastal plain and potential threat of pollution, mainly from agricultural pesticides, in the Jordan river.
2. Destruction of riparian habitat for agricultural intensification.
3. Construction of reservoirs on tributary streams.
4. Mortality on roads.

Conservation Priorities

1. Analyses of dead otters and of their food supply for pollutants to assess potential threats to the population in the Jordan catchment.
2. Deduce levels of pollution in watercourses of the coastal plain.

Japan

Species Present

Eurasian otter

Status and Distribution

Although the Eurasian otter was historically found throughout Japan it is probably nearly extirpated today. In 1986, a dead otter was found in Kouchi Prefecture, but since then no other living or dead otters have been sighted, and their continued existence has been confirmed only through field signs. The number of field signs has been decreasing year by year, but there remains some possibility that a few individuals still exist in southwest Kochi Prefecture.

Legal Status

The Eurasian otter has been protected as a special national natural monument of Japan since 1965.

Threats

1. The main reason for their decline is water pollution and the destruction of their habitat by industrial development, agricultural chemicals, and synthetic detergents. Water pollution has caused the depletion of their food and may have directly damaged their health.
2. Otters have been rapidly losing their habitat due to the destruction of shores and banksides, and through the construction of many dams in the mountains.
3. Otters are considered by fisherman to be competitors. This conflict has undermined conservation efforts.
4. Hunting for fur (for domestic markets) may still be a problem in the last remaining possible otter habitat, in Kochi Prefecture.

Conservation Priorities

1. A thorough survey needs to be undertaken in the areas where there is a possibility of the otters' existence, especially in southeast Kochi Prefecture, to assess how many otters remain.
2. The remaining otter habitat needs to be protected from any disturbances. All industrial development should be banned in this area and the water quality needs to be strictly controlled. Strict laws must be enforced to prohibit hunting or harming any remaining otters.
3. As depletion of clean fish reserves is thought to be a principal reason for the decline of otters, fish cultivation ponds could be set up within the habitat of the otter.
4. Captive breeding and reintroduction projects should be seriously considered in Japan.
5. Public education needs to be carried out to resolve opposition to otter conservation.

Jordan

Species Present

Eurasian otter

Status and Distribution
'Threatened. Restricted to the rivers Jordan, Yarmouk, and Zarka, the only permanent waterways in the Kingdom. No previous information is available on distribution, so it is not known if any change has occurred.

Legal Status
Protected under the Agriculture Act No. 20, 1973 which protects wildlife in general.

Threats
1. Water pollution; all three river systems are polluted.
2. Accidental drowning in fishing nets.
3. Accidental killing in traps set for other species, such as leg traps set for wild boar.

Conservation Priorities
1. Field survey to determine more precisely the distribution of the species in Jordan.
2. Tissue analysis of otters found dead for PCB's, pesticides and metals.
3. Retention of the dense vegetation present (for security reasons) along the rivers Jordan and Yarmouk.

Laos
Species Present
Asian small-clawed otter, smooth otter (?), Eurasian otter

Status and Distribution
Otter populations are small in Laos because of habitat destruction and human encroachment The smooth otter might occur but there are no recent records.

The Asian small-clawed otter is found in the central part of the country, especially in Nam Song river, Nam Soung wetland, and Nam Sang and Nam Kading rivers.

The Eurasian otter is found in Nam so, Oudomsay province, in the northern part of the country, and Sekong and Sekhamane, Attapeu province in the southern part of the country.

Legal Status
In the past, Laos did not have any measure to protect otters. During 1988, the Department of Forestry began preparing a law to protect wildlife in the country, and this law is scheduled to be completed shortly, ready for final approval by the national assembly. Based on this law, all otters in Laos will be declared protected animals.

Threats
1. Habitat destruction due to deforestation along river banks.

2. People kill otters because of supposed competitor for fish.
3. Lack of protected areas and wildlife law to protect otters.

Conservation Priorities

1. The highest priority is to establish protected areas in Laos such as forest reserves and wildlife sanctuaries, including rivers, wetlands, and marshes. If this happens, otters as well as other wildlife, will have a more secure future.
2. The new wildlife law needs to be approved and implemented, in order to protect otters and other wildlife in Laos.

Lebanon

The Eurasian otter occurs in adjacent rivers in Israel, probably present, but no recent information is available.

Malaysia

Species Present

Asian small-clawed otter, smooth otter, Eurasian otter (?), hairy-nosed otter

Status and Distribution

The Asian small-clawed otter and the smooth otter are relatively common throughout Peninsular Malaysia, while the current existence of the Eurasian otter and the hairy-nosed otter on the peninsula is unconfirmed. In Sabah and Sarawak on the island of Borneo, at least three species of otter occur: the hairy-nosed otter, the smooth otter, and the Asian small-clawed otter.

The Asian small-clawed otter is common throughout the rice fields, mangroves, and wetlands of Peninsular Malaysia, with the highest numbers being recorded from the state of Kedah. In East Malaysia, this species is also widely reported from all areas of Sabah and Sarawak.

The smooth otter is common throughout Peninsular Malaysia, inhabiting mangroves, rivers, rice fields, and wetlands throughout the peninsula. The greatest numbers of this otter have been recorded from the state of Kedah. In East Malaysia it appears to be more rare.

The Eurasian otter was recorded by Medway on Langkawi Island off the west coast of Peninsular Malaysia in 1978, but since then no other records of this species have been confirmed anywhere in the country.

The hairy-nosed otter is reported from scattered localities in East Malaysia but has not been recorded from Peninsular Malaysia n recent years. If it still exists in Peninsular Malaysia, it is thought to remain in the rivers at higher altitudes, far from human presence.

Legal Status

All species of otters are totally protected under the Wildlife Enactment 76172.

Threats

1. Encroachment by humans into their habitat has resulted in both the Eurasian otter and the hairy-nosed otter becoming rare and possibly disappearing entirely from Peninsular Malaysia. Both the Asian small-clawed otter and the smooth otter appear more able to withstand proximity to humans.
2. The conversion of estuarine areas into aquaculture and agriculture schemes will reduce the otters' available habitat, if not properly controlled.
3. Removal of cover from paddyfields will greatly reduce the available sites for otter dens and shelter, especially where these areas border the mangrove feeding grounds for both the Asian small-clawed otter and the smooth otter.
4. The excessive use of pesticides in paddyfields and agricultural schemes may contaminate the food chain, with deleterious effects on the otter populations.
5. Otters in paddyfields are often regarded as pests by the farmers, and they are sometimes killed or captured as cubs for pets.

Conservation Priorities

1. More research is needed on the distribution and status of all the species of otters in Malaysia, with special efforts made to identify remaining populations of the Eurasian otter and the hairy-nosed otter.
2. An in-depth study of the habitat and ecological requirements of the Asian small-clawed otter and the smooth otter should be initiated' in a location where they are found coexisting and in healthy numbers. This study could be used to formulate more detailed plans for their conservation throughout their ranges, in Malaysia and elsewhere.
3. Areas known to be preferred otter habitats should be conserved to ensure the continuity of a healthy otter population in Malaysia. In particular, the mangrove forests on the West coast of Malaysia should be preserved, as this is an important habitat for both the smooth otter and the Asian small-clawed otter. If remnant populations of the Eurasian otter and the hairy-nosed otter are found, their remaining habitats should receive the strictest protection.
4. The use of pesticides should be monitored to determine their effects on the otters and their food species.
5. There is a need to educate farmers on the role of otters in controlling pests such as rats in their paddyfields. Farmers should also be encouraged to maintain areas of shrubs and dense vegetation around their fields to provide necessary cover for the otters in these areas.
6. There is a need for stricter compliance with the wildlife protection laws in some areas where otters are found.

Mongolia

Species Present

Eurasian otter

Status and Distribution

Otters exist in very low population densities in three areas (Stubbe et al. 1989): eastern Mongolia in the river system of Chalchin-gol; northern Mongolia in many small rivers belonging to the Jenissei System; and western Mongolia in the tipper parts of the river Chod in the High Mongolian Altai.

Legal Status
Otters have been on the Protected Animal List (Class 1) since 1930.

Threats
No detailed information though habitat loss may be important.

Conservation Priorities
Otters should be re-introduced to areas where they are absent and where the habitats have not been destroyed and fish and other prey resources are adequate.

Nepal

Species Present
Asian small-clawed otter (?), smooth otter, Eurasian otter (?)

Status and Distribution
Otters are declining throughout Nepal. Information is vague on the existence and whereabouts of the Eurasian otter and the Asian small-clawed otter in Nepal. The smooth otter appears to remain in isolated populations in the Koshi, Narayani, Karnali, and Mahakali rivers.

Legal Status
Protected under the Aquatic Animal Conservation Act.

Threats
1. Habitat destruction (including deforestation along waterways), and river pollution threaten the otter population.
2. Otters in Nepal are still illegally hunted for their pelts, which are made into collars and cuffs of overcoats ladies' sport coats and trimmings. They are also hunted for their meat and uterus in females, which is thought to have medicinal value.
3. Large hydroelectric projects and dams have fragmented the North Korea otter populations. In Particular, the Narayani, Koshi, Mahakali, and Karnali rivers until twenty years ago were connected with the Ganges river system, but the construction of a dam has isolated these systems. These isolated and fragmented populations of otters are susceptible to the deleterious effects of inbreeding along with other more immediate pressures.

Conservation Priorities
1. It is essential to conserve the watershed of Gandaki, Koshi, and Karnali rivers, particularly the riverbank plant communities and aquatic ecosystems, to provide proper habitat for the otters remaining in these areas.
2. More research is needed on the ecology and behavior of otters in Nepal, including their breeding requirements, the effect of fish swarming on the seasonal migrations of otters, and the vulnerability of otters during flood and drought.

3. A feasibility study should be carried out to see whether irrigation systems developed near the barrage can support otters and forage fish. If so, diversions of irrigation canal water could be made to create otter havens.
4. Educational material should be assembled to dispel the myth of the utility of the uterus and meat of the otter as a medicinal substance. Hunting otters for skins should also be discouraged.
5. The Aquatic Animal Conservation Act of the Nepal Government should be enforced.

North Korea

Species Present

The Eurasian otter probably occurs, but there is no recent information.

Pakistan

Species Present

Smooth otter, Eurasian otter

Status and Distribution

The Eurasian otter was once widely distributed in the rivers and streams of the northern part of the country. The smooth otter occurred over major parts of the Indus Plain and was quite common in the Indus River system in lakes, streams, and canals. Due to various factors, both species have now been confined to water reservoirs and some undisturbed remote areas, as described below.

The smooth otter is common and found in Bannau and Dera Ismail Khan districts of North West Frontier Province; Mianwali, Muzaffargarh, Rahimyar Khan, and Khanewal districts of Punjab; and Hyderabad and Sukkur districts of Sindh. Its population is mainly restricted to water reservoirs at dams and barrages.

The Eurasian otter is rare and occurs in rivers and streams of Chitral, Dir, Swat, and Mansehra districts of North West Frontier Province. It also occurs in the Northern areas and Azad Kashmir. Its population is restricted to remote areas away from human populations.

Legal Status

Both species are totally protected.

Threats

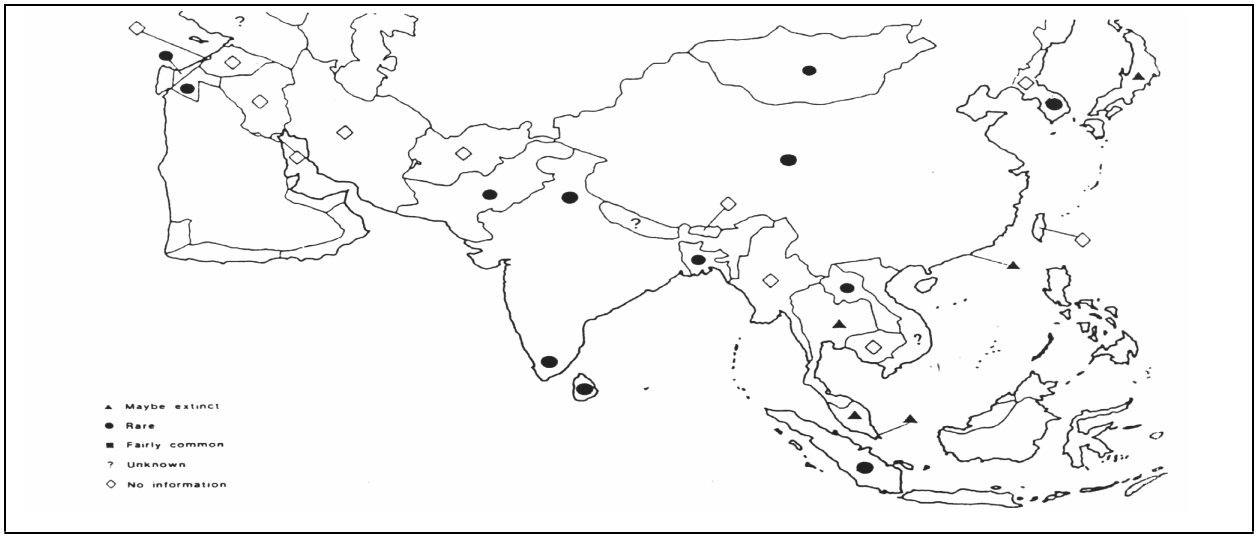
1. Construction of barrages has checked the natural flow of water in the rivers. Major parts of the rivers Jhelum, Chenab, Ravi, and Sutlaj remain dry during most of the year, bearing no suitable habitat for otters except water reservoirs at dams, barrages, and head works, where permanent water is available.
2. Overhunting: otters have been excessively harvested in the past, which has been one of the major factors contributing to their decline.
3 Since otters are considered to be serious pests with regard to fisheries, they are often under extreme persecution by fishermen and owners of fish farms.

4. Disturbance by human settlement. The ever-increasing human population has eliminated otters from the more disturbed parts of their former ranges and consequently they are now restricted to more remote and undisturbed areas.

Conservation Priorities

1. Extensive surveys should be conducted to identify key otter habitats, to determine the exact status of otters and to pinpoint causes of their decline.
2. Key wetland areas should be declared otter sanctuaries.
3. A publicity campaign is essential for public awareness.
4. Captive breeding studies should be started.

Figure 6.3. Distribution of the Eurasian Otter (*Lutra lutra)* in Asia.



Philippines

Species Present

Asian small-clawed otter

Status and Distribution

The Asian small-clawed otter is distributed in rivers, creeks, estuaries, and tidal areas throughout Palawan. It has been sighted most often in Brooke's Point, Narra, Bamraza, and St. Paul's Bay.

Legal Status

Protected by Proclamation No. 219, and amended by Proc. Nos. 1232 and 1440, which declare the whole province of Palawan as a Game Refuge and Bird Sanctuary. Aside from this, the otter has no specific legal protection in Palawan.

Threats

1. The greatest threat is loss of suitable habitat as a result of shifting cultivation, mining and logging activities, construction of roads and other infrastructure, and increase in human settlements. These disturbances lead to siltation and eutrophication of rivers and coastal areas where the otters feed.
2. Otters are collected for pets and, possibly, for meat.

Conservation Priorities

1. A basic research and conservation program is needed to learn more about this otter's status, distribution and ecological requirements on Palawan.
2. Stricter protection is needed, including the designation of riparian reserves as otter havens.

Singapore

The, Asian small-clawed otter, the smooth otter, and the hairynosed otter once probably occurred in Singapore. Nearby Peninsular Malaysia has good populations of the Asian small-clawed otter and smooth otter, but all species of otter in Singapore are now believed to be extirpated.

South Korea

Species Present

Eurasian otter

Status and Distribution

Endangered. Once found in rivers, lakes, and estuaries throughout the country, except for Chung Nam province, but now rarely occurs anywhere. There are captive specimens in Kumgang Zoo (Busan), the Forestry Research Institute, and Kyeong Hee University (Seoul).

Legal Status

Protected by the Cultural Properties Management Law, as a Natural Monument (Number 330). Any person who has illegally captured this species is liable to be sentenced to at least two years in prison.

Threats

No detailed information, though habitat loss is believed to be a severe problem.

Conservation Priorities

1. Conservation of the natural environment of otters and protection from artificial destruction.
2. Environmental Impact Assessment studies are needed where water flow is to be altered by large-scale construction of dams and roads.
3. Research needed for captive breeding efforts.

SriLanka

Species Present

Eurasian otter

Status and Distribution

Otters once were commonly observed throughout Sri Lanka in a variety of habitats including streams, rivers, lakes, lagoons, and paddyfields. Although in smaller numbers now, otters are, still found in all the major river systems, from the brackish water estuaries to the headwaters at altitudes over 2,000 in. As the lowland dry zones are receiving increasing human pressures, the mountainous areas may provide the remaining safe havens for otters.

Legal Status
No information available.

Threats
1. Pesticide pollution of the waterways is a potential threat to otters in Sri Lanka, although much rice is still cultivated using traditional methods instead of a heavy reliance on chemical fertilizers and pesticides.
2. Massive hydroelectric schemes, such as the Accelerated Mahaweli Development Project, divert rivers and greatly reduce riparian habitat necessary for otter survival.
3. Over-cutting of lowland forests, with a decline in forest cover from 2.9 million hectares in 1965 to 1.6 million hectares in 198 1, is also reducing available riparian habitat for otters.
4. Overexploitation of mangroves for fuel, food, and fiber, and the conversion of mangrove land to coconut and cinnamon plantations, housing schemes, and tourist hotels greatly reduces the amount of this rich habitat available to otters.

Conservation Priorities
1. Strict controls are needed on the amount of deforestation and chemical contamination of river systems in Sri Lanka.
2. Surveys need to be carried out throughout Sri Lanka to determine the whereabouts of viable populations.
3. Areas of sufficient remoteness, difficulty of terrain, and density of cover to provide natural protection from people should be preserved as otter havens.
4. More scientific studies need to be carried out on the behavior and ecology of the otters in Sri Lanka before serious environmental problems threaten their survival.

Syria
The Eurasian otter occurs in adjacent rivers in Israel and Jordan, so it is probably present in Syria, but no recent information is available.

Taiwan
The Eurasian otter once occurred in Taiwan, but no current information is available.

Thailand
Species Present
Asian small-clawed otter, smooth otter, Eurasian otter (?), hairy-nosed otter (?)

Status and Distribution
All otters in Thailand are severely threatened due to habitat destruction, pollution of waterways, and human encroachment Two species, the Eurasian otter and the hairy-nosed otter, may already have disappeared from Thailand.

The Asian small-clawed otter is still found in many wildlife sanctuaries and national parks in Thailand, where it frequents streams, rivers, marshy wetlands, and the sea coasts. Outstanding numbers are found in the western-forested arm and in the marshy wetlands in southern Thailand, including Nung Tung Tong Reserve and Pattani and Songkla Provinces.

The smooth otter still occurs in the Huay Kha Khaeng Reserve in western Thailand; in the Tapi River, Phru-Toa-Dang Peat Swamp Forest, Bang Lan Dam and Ao Phangnga National Park in the south; and in the Mun River in the northeast.

Legal Status

All four otter species were officially declared protected wild animals of the first category by the Ministerial Regulation No. 10 in 1975, in accordance with the Wild Animals Reservation and Protection Act B.E. 2503 1960). According to this act, no persons shall kill protected wild animals of the first category except for educational purposes or scientific research. Trading of otter skins and carcasses is also prohibited by law.

Threats

1. Municipal, agricultural, and industrial wastes in most waterways throughout Thailand have severely threatened otter populations.
2. Habitat destruction, including logging and hydroelectric projects which alter river systems, have reduced the habitat available to otters. The hydroelectric dams replace natural rivers with steep-sided reservoirs devoid of surrounding cover and thus unsuitable for otter habitation. The changing of mangrove forest into shrimp and fish aquaculture projects also diminishes otter habitats and puts otters in more direct competition with man.
3. Competition with people for fish supplies has resulted direct killing of otters in areas where they would otherwise, occur.
4. Insufficient enforcement of existing wildlife laws and reserved areas provide little more than "paper" protection for otters and their remaining habitats.

Conservation Priorities

1. A complete survey of otters and their remaining handles needs to be initiated quickly to pinpoint areas of critical concern for each otter species. Efforts should be made to determine areas where small pockets of the Eurasian otter and the hairy-nosed otter might still occur.
2. Habitats that still contain otter populations should be declared “otter reserves” and legal action should be taken to protect these areas. Existing protected areas also need to be more closely monitored and protected.
3. Public education programs should be initiated to develop awareness of the importance of conservation of otters and other wetland inhabitants and of a clean environment in general.
4. Reintroduction programs should not be considered at this time; efforts should focus instead on protecting the habitats of the remaining otters in Thailand. Only if and when the overall pollution problems are solved, can otters be reintroduced into areas where they now no longer occur.

Turkey

Species Present
Eurasian otter

Status and Distribution
No systematic observations. Said by Turan (1984) to have a wide distribution, occurring in most rivers and lakes around the Black Sea and some rivers draining the Aegean Sea. Also known from the European part of Turkey.

Legal Status
No information available.

Threats
Threats may be the intensification of agriculture in the lowlands, the building of irrigation canals, and the draining Of some wetlands.

Conservation Priorities
A full field survey of this country, with its many important wetlands, is urgently required.

Vietnam
Species Present
Asian small-clawed otter (?), smooth otter (?), Eurasian otter hairy-nosed otter (?)

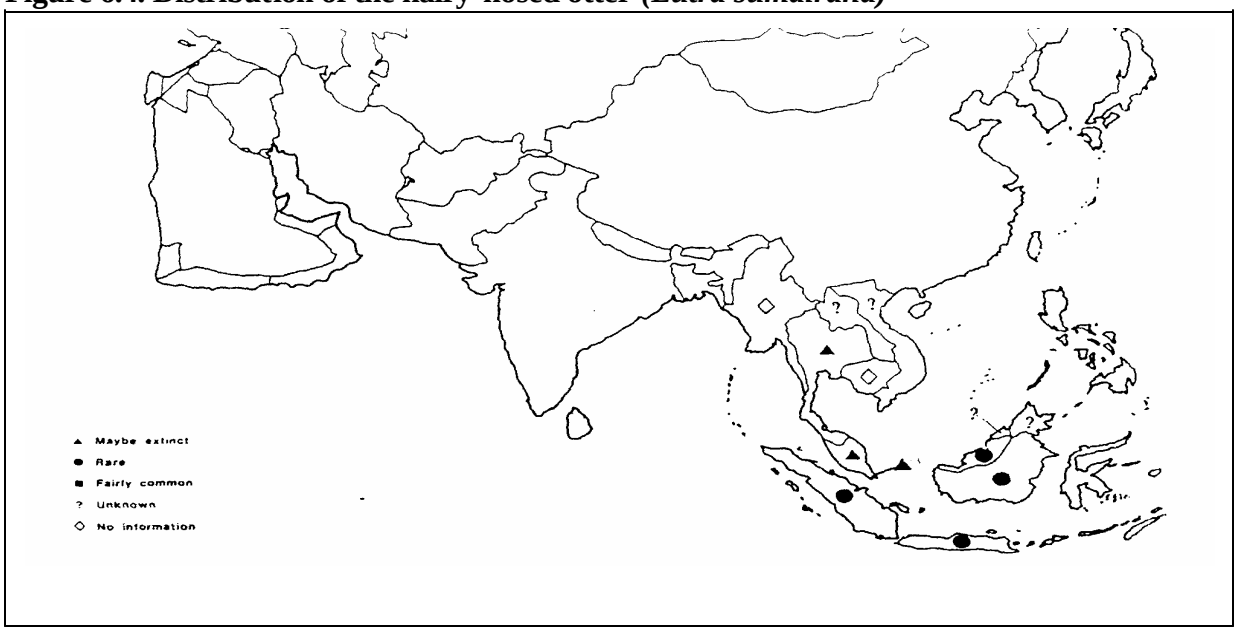
Status and Distribution
Otters are widely distributed in Vietnam, from the south to the north, in a variety of habitats including rivers, streams, swamps, lakes in the highlands, deltas, and along seashores and near shore islands. There are old records of all four Asian species, but there is great uncertainty about the current status of any of them. Although it is known that otters still occur in reasonable numbers, their specific identity needs to be clarified.

Legal Status
No information available.

Threats
Habitat destruction due to increasing human settlements along rivers in Vietnam.

Conservation Priorities
An accurate survey and scientific investigation of the ecological and biological characteristics of otters in Vietnam is necessary as an initial conservation effort The existence of all four species requires confirmation.

Figure 6.4. Distribution of the hairy-nosed otter *(Lutra sumairana)*



ASIAN SMALL-CLAWED OTTER
1997 SURVEY QUESTIONS

Health:

-Do you perform regular routine physical examinations on your otters?

Yes • ---How often?_____ No •

-Does the routine exam include hematology and scrum chemistry analysis?

Yes • No •

-What type of veterinary care do you have access to in your collection?

Full time veterinarian on staff? •
Part time veterinarian on staff or contract? • Hours per week_____
Contract veterinarian on call when needed? •
Other_____

-Please list the primary veterinarian to contact regarding otter health concerns.

Name_____
Phone_____
Fax_____
E-mail_____

-Please identify the most common clinical health problems seen in your otters, excluding renal and cystic calculi. Please check those that you have noted in your animals and add any other items you have seen. Feel free to elaborate and give details regarding frequency and cause, etc.

A. Dental problems • _____
B. Abscesses • _____
C. Diarrhea and/or vomiting • _____
D. Fur plucking • _____
E. Spinal disease • _____
F. Neonatal deaths • _____
G. Lameness • _____
H. Pneumonia • _____
I. Dermatitis • _____
J. Salmonellosis • _____
K. Nutritional deficiencies • _____
L._____
M._____
N._____

-Do you routinely perform postmortem examinations on all otters? Yes • No •

-Do you perform histopathology on all otters? Yes • No •

-Who performs the histopathology?_____

-Would you be interested in using a specific pathologist identified by the SSP for all of your otter cases? Yes • No•

-Urolithiasis:

-Do you routinely radiograph your otters for uroliths? Yes • No •

How often?_____

-Please list the otters currently in your collection and their urolith status. Use the following scale:

For the renal calculi: - (none), + (1-2 mm renal calculi), + + (3-5 mm calculi), + + + (> 5 mm calculi).

For cystic calculi: - (none), + (currently has calculi), +/- (had cystic calculi surgically removed and currently has none).

Studbook#	Sex	DOB	Left Kidney	Right Kidney	Cystic calculi	Age 1st dx
_____	___	_____	_____	_____	_____	_____
_____	___	_____	_____	_____	_____	_____
_____	___	_____	_____	_____	_____	_____
_____	___	_____	_____	_____	_____	_____
_____	___	_____	_____	_____	_____	_____

-Do you have uroliths analyzed routinely? Yes • No •

Where are they analyzed?_____

-Do you routinely vaccinate your otters? Yes • No •

What products are used?_____

-Are new animals quarantined before being placed in with exhibit animals?

Yes • How long?_____

No •

-How often are fecal samples checked for parasites? _____

-List any common parasites you have encountered:

_____

_____

_____

-Are your otters exposed to mosquitoes? Yes • No •

-Are they on heart worm preventative? Yes • No•

-What is the preferred method of immobilization of otters in your facility?

_____

-How are animals identified at your institution? Check all that apply:

Visual identification •

Tattoo •

Computer identification chip •

Other • _____

-Do you regularly weigh your animals? Yes • How often?_____
No •

Information Submitted By:_____; Phone:_____;
FAX:_____; E-Mail:_____

Nutrition:

-How many otters are in your collection? What are the sexes and ages of your otters and their physiological condition?

(For each otter):
ISIS#_____
Sex: M_____ F_____ Unk_____
Weight (g):_____ Date weight taken:_____
Birth Date:_____
Circle Physiological State: Juvenile/nursing Adult/maintenance
Juvenile/weaned Adult/breeding
Adult/lactating Adult/geriatric

-What are all of the items in the diet currently offered to your otters (g of item/otter/day)? Please include complete manufacturer name for commercial products and recipes for in-house mixes (by weight or standard measure). Add another page if necessary.
Commonly used food items are listed below:

Manufactured Feeds- Amount (g/otter/d)
Commercial Cat Food_____
Commercial Dog Food_____
Hills ZuPreem Canned Feline_____
Nebraska Canine_____
Nebraska Feline_____
Nebraska Bird of Prey_____
Purina Fit' n'Trim _____
Purina Mink Chow _____
Other_____

Meats-
Beef Heart _____
Horsemeat _____
Other_____

Fish/Seafood-
Capelin _____
Crayfish _____
Smelt _____
Trout _____
Other_____

Insects-
Crickets _____
Mealworms_____
Other_____

Vegetables-

Apple _____
Carrot _____
Lettuce_____
Sweet Potato _____
Other_____

Supplements-

Calcium carbonate_____
Vitamin E Supplement_____
Wheat Germ _____
Other_____

-Have your otters ever reproduced on this diet? Yes • No •

-Is the quantity of food you offer measured in a consistent, standard, quantifiable manner (by weight, cups, tablespoons, etc.)? Yes • No •

-If yes, please indicate how:_____

-If by volume, what are the corresponding weights of those volumes?

_____
_____

-Is intake monitored on a regular basis (daily, weekly, monthly)?_____

-Is consumption judged on a general basis (half, most, etc.) or is intake actually quantified (weigh in, weigh out)?_____

-Are consumption records for each otter available? Yes • No •

-Would you be willing to participate in an intake study? Yes • No •

-Are there any alternative diets offered (growing, pre-lactating, geriatric, weight loss, diabetic, etc.)?_____

-If so, please include ingredients and amounts (same form as question 2).

-How long has each otter been offered its respective diet?

_____
_____
_____

-Have you ever had your diet or a portion of your diet analyzed? If so, why and what methods were used (chemical/lab, computer)?

_____
_____
_____

-If the nutrient content (via analysis) of the current diet or portions of the diet is available, please list (attach another page if necessary).

_____

_____

-How many times per day are the otters fed or do they have access to food at all times?

_____

-What are the feeding locations for the diet (i.e. on exhibit, off exhibit, both on and off exhibit, in a pan, on the floor, in a box, etc.)?

_____

_____

-Are there any food items used as behavioral enrichment (crickets, lettuce, crayfish, frogs, etc.)? If so, please list the food items, frequency of use, and quantity.

_____

_____

-How is potable water provided for the otters (i.e. pool, stream, tub, etc.)?

_____

_____

-Are there any seasonal changes in the diet offered?

_____

_____

-Are there any seasonal changes in dietary intake (i.e. increase in winter)?

_____

_____

-Are there any pertinent feeding behaviors (competition, search behaviors, coprophagy, etc.)?

_____

_____

-Is there defined stimulation for feeding behavior?

_____

_____

-Have you experienced any diets or diet items that have been associated with causing any of the following problems: regurgitation, poor coat quality, chronic loose stool, aggression, death?

_____

_____

-Are there any diagnosed nutritionally related deficiencies, toxicities, or other disorders in your otters (i.e. calculi, etc.)?

_____
_____

-Is there any public feeding allowed? Yes • No •

-Do other animals have access to the otters' diet (in a mixed species exhibit)? If so, do they consume it?_____

-Do otters have access to other diets? If so, do they consume them (what items)?

_____
_____

Information Submitted By:_____; Phone:_____;
FAX:_____; E-Mail:_____

Reproduction:

-List length of estrous cycles observed in your females, please give females age:

F1(age)_____ Length of estrous cycle_____

F2(age)_____ Length of estrous cycle_____

-What is the duration of estrus seen in your females? Please give females age and duration of estrus:

F1(age)_____Estrus duration_____

F2(age)_____Estrus duration_____

-Please check any environmental cues that influence estrous:

photo period • temperature • humidity • other • (explain)_____

-Please be specific about above listed environmental changes, (i.e. hi or low temp., what temp., etc.).

-How long has the breeding pair been together? _____

-How old were they when introduced? Male_____ Female_____

-At what age did they first show breeding behavior? Male_____ Female_____

-At what age did they first breed successfully? Male_____ Female_____

- Are breeding pairs separated before or after estrus?_____

-If yes, how and for how long?_____

-If the breeding pair is housed in a group please give sex and ages of other group members:

Males _____ Females_____

_____ _____

_____ _____

-If you have multiple males do they compete for females?_____

-If yes, what are the ages of the competing males?_____

-Where does copulation occur?

In the water_____ On land_____ Out of sight of public_____

-Copulation is initiated by:Male_____Female_____Both_____ (please give a % of time).

-Do other group members interfere with copulation? Never___Seldom___Frequently___

Which sex?_____ What age?_____

-Does copulation occur dorsal/ventral_____ ventral/ventral _____

-How long does the copulatory act last?_____

-How frequently does copulation occur?_____

-What is the breeding season for your otters?_____

-Has this varied from year to year?_____

-If yes, how?_____

-Is a pregnant female separated from the group?_____

-If yes, when and how (kept in a holding, separate exhibit, etc.)_____

-If she is separated, is she kept alone?_____ With another animal (give age, sex and relationship of other animal)?_____

_____

-Please fill in the following information for all litters born at your institution:

Litter 1: Sire_____ Dam_____Group sex ratio_____
Breeding on_____ Born on_____ Sex ration of litter_____
Age of Dam_____ Age of sire:_____
Pups surviving: 0-10 days_____
10-30 days_____
30-60 days_____
60-90 days_____
90-1year_____
over 1yr_____

Litter 2: Sire_____ Dam_____Group sex ratio_____
Breeding on_____ Born on_____ Sex ration of litter_____
Age of Dam_____ Age of sire:_____
Pups surviving: 0-10 days_____
10-30 days_____
30-60 days_____
60-90 days_____
90-1year_____
over 1yr_____

Litter 3: Sire_____ Dam_____Group sex ratio_____
Breeding on_____ Born on_____ Sex ration of litter_____
Age of Dam_____ Age of sire:_____
Pups surviving: 0-10 days_____
10-30 days_____
30-60 days_____
60-90 days_____
90-1year_____
over 1yr_____

(If more space is required please use back of page)

-Is a pregnant females environment manipulated in any way?

temperature • humidity • photo period • additional nest boxes • where nest boxes are placed • type of bedding • other_____

-If yes to any of these, please specify and explain:_____

_____

-Did the females show a nest box preference?_____ If yes please describe box and where it was placed._____

-Do you change a breeding/pregnant/lactating females diet?_____ If yes how for each condition?

_____

_____

_____

-Please supply us with any birth weight statistics you have. Give sex and age of pup:

_____

_____

_____

-Please supply us with any pup weights/growth statistics or development bench marks you have collected (i.e. Xgrams @ 14 days; body length @ 14 days; eyes open at X days; first observed crawling @ X days):

_____

_____

_____

_____

-At what age were the pups weaned?_____

-Did you change the pups diet as they matured?_____ If yes, give age of diet changes and how it was changed.

_____

_____

_____

-Did other group members show aggression towards the pups?_____ If yes, please give age and sex of the aggressing animal(s).

_____

_____

_____

-At what age did the pups begin to show sexual behavior?_____

-At what age are pups separated from the group or each other?_____

-Have you observed any indication of temperature-linked sex determination?_____ If yes please explain.

_____
_____

-Have you done any work with artificial insemination? _____; semen collection? _____; semen cryopreservation? _____; ovulation prediction? _____; estrous cycle manipulation? ____; estrus and ovulation induction? _____; estrus and ovulation synchronization? _____; superovulation? _____.
If yes, please describe in detail and supply all relevant data:_____

Information Submitted By:_____; Phone:_____;
FAX:_____; E-Mail:_____

Exhibit: Include diagram if possible:
-Size in square feet or meters and shape of land area (i.e. rectangular, square etc.):_____

-Composition of substrate on land (i.e. soil, concrete, sand etc.):_____

-Does the land area have an irregular or uneven surface? If so what are the elevation differences?_____
_____

-What type of cage furniture is used?_____
_____

-Height of exhibit:_____

-Barrier material(s) (i.e. glass, concrete, chain link, etc.):_____
_____

-Height of barrier(s):_____
-Is the exhibit covered?_____ If so what is the material?_____

-Is a hot wire used to contain the animals?_____

-Are there any enrichment features incorporated in your exhibit?_____
_____

-Are live plants utilized?_____ If yes what type and number?_____
_____

Water features:
-Size in square feet or meters and shape of pool:_____
_____

-Depth and volume of pool:_____

-Depth gradient in the pool:_____

-Pool substrate and texture:_____

-Is filtration used?____ If so what type?_____

-Is the water heated?____ If so, what temperature is maintained?_____

-How often and how much of the water is changed?_____

-Are there any waterfalls or slides in the exhibit?_____
-Do the animals use these features?_____
-Is water available for drinking (not counting the pool)?_____

Environmental
-Is natural light available?_____

-Lighting type and wattage:_____
-Length of photo period:_____

Holding
-Number and size:_____

-Material holding cages are constructed of:_____

-Is there a pool?_____
-How many gallons and dimensions of pool:_____

-Is the holding area viewable by the public?_____

-Den boxes:_____
What are the den boxes made of?_____
Number of dens provided:_____
Dimensions of den box:_____
Is video taping possible?_____

Information Submitted By:_____; Phone:_____;
FAX:_____; E-Mail:_____

Management:

-What means are used to individually identify your otters?

- Transponder
- Tag
- Other_____

-What do you feel is the best method for the following:

Capture_____
_____

Restraint_____
_____

Handling_____
_____

-What is your experience with otter groups?

- single sex
- single sex sibs
- sibs
- adult pair and offspring
- implants
- vasectomy and/or castration

-Is there an age limit when introducing new otters:

- no
- yes what age?_____

-What methods have you used when introducing otters to each other?

_____
_____

Information Submitted By:_____; Phone:_____;
FAX:_____; E-Mail:_____

Behavior and Social Organization:

-What social groupings have you held otters in at your facility?_____
_____

-Was this grouping successful?_____
_____

-Elaborate on the group:
-Ages:_____
-Relations:_____
-Sexes:_____
-Length of Time:_____

-At what age do you remove young?_____

-Have you accomplished successful introductions?_____
-Ages:_____
-Relations:_____
-Sexes:_____
-Length of Time to Accomplish it:_____

-Have you noticed changes in group social behavior during breeding season?

- Yes
- No
- Other time When?_____

-What type of courtship behavior have you seen?_____
_____
-For how long?_____

-Have you observed copulation? • No • Yes(explain)_____
_____

-Describe parental care:_____
_____
_____

-Do you house otters in a mixed species exhibit? • No • Yes(explain)_____
_____

-Have you seen behavioral indicators of social stress? • No • Yes What behaviors?
_____
_____

Information Submitted By:_____; Phone:_____;
FAX:_____; E-Mail:_____

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