

**NORTH AMERICAN
RIVER OTTER**
Lontra (Lutra) canadensis

Husbandry Notebook, 2nd Edition

Edited by:

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THE 284 PAGE 2ND EDITION OF THE NORTH AMERICAN RIVER OTTER HUSBANDRY NOTEBOOK (MARCH 2001) IS BEING SOLD THROUGH THE JOHN BALL ZOO SOCIETY, GRAND RAPIDS, MICHIGAN. ALL PROCEEDS FROM THE SALE OF THIS VOLUME ARE PLACED INTO AN OTTER CONSERVATION ACCOUNT FOR THE AMERICAN ASSOCIATION OF ZOOS AND AQUARIUMS (AZA) OTTER SSP. THESE FUNDS ARE FOR USE IN OTTER RESEARCH AND FIELD CONSERVATION PROGRAMS.

THIS CD CONTAINS ONLY THE TABLE OF CONTENTS AND THREE SAMPLE CHAPTERS. FOR INFORMATION ON PURCHASING THE NOTEBOOK PLEASE CONTACT LISA HANN AT JBZSLISA@HOTMAIL.COM, OR, 616-336-4301, JOHN BALL ZOO SOCIETY, 1300 W. FULTON, GRAND RAPIDS, MI 49504. FOR QUESTIONS REGARDING N. A. RIVER OTTERS CONTACT THE AZA OTTER SSP COORDINATOR, DUSTY LOMBARDI AT: DLOMBARD@COLSZOO.ORG; N.A. OTTER (NARO) POINT PERSON: JAN REED-SMITH AT: JRSOTTER@ISERV.NET, OR, NARO STUDBOOK KEEPER, DAVE HAMILTON AT: HAMILTON@KNOXVILLE-ZOO.ORG.

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CHAPTER 1

TAXONOMY

INTRODUCTION

The scientific name for the North American otter was *Lutra canadensis*; it is now *Lontra canadensis*.

*“The generic name **Lutra**, proposed by Brisson in 1762, is the Latin name for otter. The specific name **canadensis**, proposed by Schreber in 1776, refers to Canada, with the Latin suffix, ensis, meaning ‘belonging to’ because the species was first described from Canada. The common name otter has a northern European origin; in Old English, otor; in Middle English, oter; in Swedish, utter; in Danish, odder; in German, otter.”* (Baker, 1983)

The ongoing discussion regarding the generic status of the New World otters appears to have been settled, at this point, in favor of *Lontra* as proposed by van Zyll de Jong in 1972. This is largely due to increased acceptance of van Zyll de Jong’s analysis and the recent work of Klaus Koepfli and Robert K. Wayne at U.C.L.A.

In accordance with the use of *Lontra* by van Zyll de Jong (1972, 1987), Wozencraft (1993), and the work of Koepfli and Wayne (unpublished thesis, 1998) *Lontra* will be used in this manual. (See Taxonomic Overview)

CURRENT OTTER TAXONOMY AND COMMON NAMES

ORDER	Carnivora
FAMILY	Mustelidae
SUBFAMILY	Lutrinae
GENUS	<i>Lontra</i> (Gray, 1843)
SPECIES	<i>canadensis</i> (Schreber, 1776)
SUBSPECIES	<i>L. c. canadensis</i> , <i>L. c. kodiacensis</i> , <i>L. c. lataxina</i> , <i>L. c. mira</i> <i>L. c. pacifica</i> , <i>L. c. periclyzomae</i> <i>L. c. sonora</i>

The generic designation of *Lontra* instead of *Lutra* was widely adopted in the late 1990’s. *Lontra* is now accepted for all of the new world river otter species (which includes the N. A. otter, Neotropical otter, Southern otter, and Marine otter), by ISIS, the IUCN/SSC Otter Specialist Group, The Wildlife Society, Society of Mammalogists and other recognized organizations.

Common Names

Otter, common otter, North American river otter, land otter, Fischotter (German), Fisher (this usage most likely started as a deliberate falsification), river otter, water dog, Ku-tet-tahx (Potawatomi), loutre (French-Canadian), Neeg-keek (Chippewa), nutria norteamericana (Spanish), lontra canadese (Italian)

HISTORICAL OTTER TAXONOMY

Lontra (Lutra) canadensis, Schreber 1776 Synonyms:

- | | |
|---|---|
| <i>Mustela hudsonica</i> , Desmarest 1803 | <i>Lutra braziliensis</i> , De Kay 1842 |
| <i>Mustela canadensis</i> , Turton 1806 | <i>Latax lataxina</i> , Gray 1843 |
| <i>Lutra hudsonica</i> , Cuvier 1823 and many others | <i>Latax canadensis</i> Gray 1865 |
| <i>Lutra brasiliensis</i> , Harlan 1825 & Godman 1826* | <i>Lontra canadensis</i> Flower 1929* |
| <i>Lutra vulgaris</i> variety <i>canadensis</i> , Wagner 1841 | |

* Harris (1968) indicates these terms were used improperly by the individuals indicated, when doing further research, be alert to this kind of incorrect usage.

Subspecies

Harris (1968) listed 20 subspecies:

- | | | | |
|--------------------------|--------------------------|-------------------------|----------------------------|
| <i>Lutra canadensis</i> | <i>L.c pacifica</i> | <i>L.c. sonora</i> | <i>L.c. vancouverensis</i> |
| <i>canadensis</i> | <i>L.c. degener</i> | <i>L.c. interior</i> | <i>L.c. mira</i> |
| <i>L.c. nexa</i> | <i>L.c. periclyzomae</i> | <i>L.c. texensis</i> | <i>L.c. yukonensis</i> |
| <i>L.c. brevipilosus</i> | <i>L.c. evexa</i> | <i>L.c. kodiacensis</i> | |
| <i>L.c. optiva</i> | <i>L.c. preblei</i> | <i>L.c. vaga</i> | |
| <i>L.c. chimo</i> | <i>L.c. extera</i> | <i>L.c. lataxina</i> | |

Toweill & Tabor (1982) and Hall & Kelson (1959) list 19 subspecies, leaving out *Lutra canadensis mira*, which they list as *Lutra mira* (the Prince of Wales Island otter).

In the 1981 edition of *The Mammals of North America*, Hall revises the 1959 (Hall & Kelson) listing of 19 subspecies as follows:

1959 EDITION	1981 EDITION
<i>Lutra canadensis canadensis</i>	<i>Lutra canadensis canadensis</i>
<i>L. c. degener</i>	Schreber 1776
<i>L. c. kodiacensis</i>	<i>L. c. kodiacensis</i> Goldman 1935
<i>L. c. interior</i>	<i>L. c. lataxina</i> Cuvier 1823
<i>L. c. lataxina</i>	
<i>L. c. texensis</i>	
<i>L. c. vaga</i>	
<i>L. c. mira</i>	<i>L. c. mira</i> Goldman 1935
<i>L. c. vancouverensis</i>	
<i>L. c. brevipilosus</i>	<i>L. c. pacifica</i> Rhoads 1898
<i>L. c. evexa</i>	
<i>L. c. extera</i>	
<i>L. c. nexa</i>	
<i>L. c. optiva</i>	
<i>L. c. pacifica</i>	
<i>L. c. preblei</i>	
<i>L. c. yukonensis</i>	
<i>L. c. periclyzomae</i>	<i>L. c. periclyzomae</i> Elliot 1905

<i>L. c. sonora</i>	<i>L. c. sonora</i> Rhoads 1898
---------------------	---------------------------------

Van Zyll de Jong's 1972 suggested subspecies revision agreed with Hall's 1981 revision with one difference; van Zyll de Jong incorporated the 20th subspecies listed by Harris (1968), *L. c. chimo* in *L. c. canadensis*.

Mammal Species of the World, A Taxonomic and Geographic Reference (1993) edited by Wilson & Reeder lists the North American river otter as *Lontra canadensis*. Twenty-two subspecies synonyms given are: *americana* Wyman 1847; *atterima* Elliot 1901; *brevipilosus* Grinnell 1914; *californica* Baird 1857; *chimo* Anderson 1945; *degener* Bangs 1898; *destructor* Barnston 1863; *evexa* Goldman 1935; *hudsonica* Merriam 1899; *interior* Swenk 1920; *kodiacensis* Goldman 1935; *lataxina* Cuvier 1823; *mira* Goldman 1935; *mollis* Gray 1843; *nexa* Goldman 1935; *optiva* Goldman 1935; *pacifica* Grinnell 1933; *paranensis* Elliot 1901; *preblei* Goldman 1935; *vaga* Bangs 1898; *vancouverensis* Goldman 1935; *yukonensis* Goldman 1935

TAXONOMIC OVERVIEW – A SUMMARY

The following overview of the taxonomic treatment of North American river otters (*Lontra [Lutra] canadensis*) is not exhaustive, but should be viewed as an historical introduction to otter systematics.

“The subfamily (Lutrinae) comprises 13 extant species for which four to eight different genera have been recognized and variously divided into two or three tribes. The oldest fossil otters are found in early Miocene deposits, represented by the genus Mionictis, dating approximately to 20 million years ago, ...

“ Previous systematic studies have relied primarily on the overall similarity of cranial and dental characters to infer relationships of otters. However, despite using similar morphological characters, different methods of systematic analysis have led to a number of taxonomic revisions of the Lutrinae during this century. Studies based on classical systematic approaches (Pohl, 1919; Pocock, 1921), evolutionary systematics (Simpson, 1945; Sokolov, 1973; Davis, 1978; Willemsen, 1992), phenetics (van Zyll de Jong, 1972, 1987), and cladistics (van Zyll de Jong, 1987) have reached different conclusions regarding relationships.”

Koepfli & Wayne, 1998

The evolutionary approach: Davis' treatment.

In 1978 J. Davis reviewed the previous taxonomic treatment of the *Lutrinae* and published his work utilizing behavioral characteristics and baculum type as key indicators of Lutrine taxonomic standing.

Due to the “plasticity” of otter behavior, behaviorally based taxonomic criteria are not regarded as reliable. However, Davis proposed that the use of otter vocalizations was dependable because, “...the plasticity of behavior is far less evident in the vocalizations of otters”. Some calls are common to all species (warning growl) but others, such as the contact and affectional calls, “...appear to be peculiar to each of the monotypic genera, and closely similar among the species within each of the polytypic genera *Aonyx* and *Lutra*.”

Characteristics of the Tribes of Lutrinae (Davis, 1978)

Lutrini

Morphological – Penis completely internal, no preputial button. Baculum slightly curved, not tapered markedly, with a sharp distal bend, like a hockey stick. Bend is dorsal in New World species, ventral in Old World species. All digits are strongly clawed. Webbing between digits extensive.

Behavioral – Sociable; pairing more or less casual and limited to breeding season; male not permitted near cubs. Anxiety call an aspired H!. An affectional call a low, staccato, usually monotoned guttural or nasal chuckle Hunh-hunh-hunh-hunh. Contact call a monosyllabic, uninflected chirp.”

Aonychini

Morphological – Penis tip protrudes beyond abdominal wall as a preputial button, except in *Enhydra*. Baculum moderately curved, shaped like a baseball bat, heavy at proximal end, tapering distally with a grooved distal knob. Digits may be heavily clawed (*Pteronura*, *Lutrogale*, *Enhydra*), weakly clawed (*A. cinerea*), or clawless (*A. capensis*) except for digits 2, 3, and 4 of hind paws, which bear small grooming claws. Interdigital webbing variable in extent, least in clawless, greatest in clawed species.

Behavioral – Social; pairing is more or less permanent; male participates in rearing young from early age with the exception of *Enhydra* where pairing is casual with no male parental role. Anxiety call an aspired H!. Contact call a rising and falling circumflex chirp. No chuckle; affectional call is circumflex in at least some species.”

Hydrictini

Morphological – Penis completely internal, no preputial button. Baculum slightly curved, shaped like a baseball bat in general outline, heavy at proximal end, tapering distally, with a grooved distal knob. Fore and hind digits strongly clawed. Webbing between digits extensive.

Behavioral – Sociable; pairing is more or less casual; male not permitted near young cubs. Anxiety call as aspired F!. Affectional call a burbling series of metallic chirps, reminiscent of the *Lutra* chuckle but inflected and not nasal or guttural. Contact call mono-or di-syllabic but not inflected.”

The phenetic approach: van Zyll de Jong's treatment.

At one time, phylogenetic relationships were difficult to study in the *Lutrinae* due to the limited number of useful characteristics. As van Zyll de Jong put it: “*The only characters readily available for a study of all species of otters are those that may be derived from traditional museum specimens, which consist of skulls and skins. Postcranial elements have a less than complete representation in collections. As many species of otters are now rare or endangered, the possibility of obtaining additional material is poor.*” (van Zyll de Jong, 1987)

To conduct his phenetic analysis of 12 otter species from seven genera, van Zyll de Jong analyzed a large number of skulls, a limited number of skins, and a limited number of postcranial specimens. A variety of “...bivariate relationships of the skull and dentition were analyzed allometrically and the overall similarities of nearly all species of *Lutrinae* were estimated using taxonomic distance.” In addition, he made a number of “...other qualitative and descriptive comparisons”. On the basis of all these

comparisons, he concluded that, "...there are probably four recent species of river otter in the Western Hemisphere, corresponding to the North American *Lutra canadensis*, the Neotropical *Lutra annectens-enudris-platensis* group (*Lutra longicaudis*), the Chilean *Lutra provocax* and the southern Pacific coastal form *Lutra felina*." "Evidence further suggests that the relationship of the American river otters with *Lutra lutra* and other Old World species of that genus is not as close as was formerly assumed. Aside from differences in skull and dentition, the marked differences in the known bacula may be regarded as significant evidence of their distinctness." (van Zyll de Jong, 1972)

In 1987, van Zyll de Jong again addressed the *Lutrinae* concluding, "...the New World river otters (*Lontra*), is a monophyletic group phylogenetically linked to the African and Asian clawless otters (*Aonyx* and *Amblonyx*). The other group, their Old World ecological counterparts (*Lutra*), constitutes a different clade. *Enhydra* and *Pteronura* are the most divergent of the living otters, the former being closer to the clawless otters and the latter to the smooth-coated otter (*Lutrogale*), which in turn is phylogenetically close to the Old World river otters (*Lutra*)."

Wilson and Reeder (1993) published these comments on van Zyll de Jong's treatment of otter taxonomy: "van Zyll de Jong argued that the New World otters represent a single radiation and questioned whether *Lutra* (sensu stricto) or *Aonyx* was the closest sister group. There has been no published work to refute his hypothesis, although it has not received general acceptance. Hall (1981) chose not to question the monophyletic nature of the group, but to lower it to the subgeneric rank, feeling that the characters were not sufficient enough to warrant generic distinction. Regardless of the 'morphological gap' between the monophyletic New World otters and the Old World otters, if *Lutra* (sensu stricto) is the closest sister group, then inclusion within *Lutra* could be maintained. However, if, as van Zyll de Jong (1987) suggested, *Aonyx* is the closest outgroup, then recognition at the generic level is necessary."

Analyses of otter phylogenetic relationships using mitochondrial DNA sequences: Koepfli and Wayne approach.

"Mitochondrial DNA sequences provide independent information that can be used to corroborate or falsify phylogenetic hypotheses derived from morphological data." Koepfli and Wayne, "obtained the complete nucleotide sequence of the cytochrome *b* (*cyt b*) gene to investigate the following phylogenetic" controversy: "monophyly or diphyly of the river otters classified in the genera *Lutra* and *Lontra*..."

"Phylogenetic analyses consistently recovered the same clades but the hierarchical relationships among these clades varied depending on how the data matrix was weighted. The trees based on maximum parsimony and maximum-likelihood indicate that...the otters are divided into three clades, one containing the North American river, neotropical and marine otters; another containing the sea, Eurasian, spotted-necked, cape clawless and small-clawed otters; and one containing the giant otter." (Koepfli & Wayne, 1998)

The work of Koepfli and Wayne further showed that the North American and Eurasian otter lineages diverged approximately eleven to fourteen million years ago, sometime during the middle Miocene. In addition, the three *Lontra* species, only the North American, Neotropical and Marine otters were studied, no samples from the southern river otter were available, were shown to form a "well supported monophyletic grouping in all of the phylogenetic analyses."

REFERENCES - TAXONOMY

- Baker, R. H. 1983. *Michigan Mammals*. Michigan State Univ. Press, East Lansing, Michigan
- Corbet, G. B. & J. E. Hill, 1986. *A World List Of Mammalian Species*. British Museum and Cornell University Press, Ithaca, New York.
- Davis, Joe, 1977. *A Classification Of The Otters, Summary Of A Revision In Progress*. paper presented at the First Working Meeting of the IUCN/SSC Otter Specialist Group in Paramaribo, Suriname, 27 – 29 march, 1977.
- Davis, Joe, 1978. *A Classification Of Otters*; in OTTERS, Duplaix, N. editor, Proceedings IUCN Otter Specialist Group Meeting, Paramaribo, Surinam, 27 – 29 March 1977; IUCN Publication, New Series, Gland, Switzerland.
- Hall, E. R. Ph.D., 1981. *The Mammals Of North America*. Vol. II, 2nd Edition. John Wiley & Sons, New York.
- Hall, E. R. Ph.D. & K. R. Kelson, 1959. *The Mammals Of North America*. Ronald Press Co., New York.
- Harris, C. J. 1968. *Otters, A Study Of Recent Lutrinae*. Weidenfeld & Nicolson, London, England.
- Hershkovitz, P. 1972. *The Recent Mammals Of The Neotropical Region: A Zoogeographical And Ecological Review*. 311-421. In: Evolution, Mammals and Southern Continents. A. Keast, F. O. Erk, B. Glass, editors. New York State Univ. Press
- International Species Information System (ISIS), 1999. *Mammal Taxonomic Directory*. Apple Valley, Minnesota. 12101 Johnny Cake Ridge Road, Bldg. A, Rm. 6, Apple Valley, MN 55124-8151. 952-997-9500. Fax: 952-432-2757. isis@isis.org
- IUCN/Foster-Turley, P, S. Macdonald & C. Mason, eds., 1990. *Otters, An Action Plan For Their Conservation*. Kelvyn Press, Inc. Broadview, Il. Publ. Services – Chicago Zoological Society, Brookfield, Il.
- Jenkins, J. H. 1983. *The Status And Management Of River Otter (Lutra canadensis) In North America*. Acta. Zool. Fennica 174:233 – 235.
- Kellnhauser, J. T. 1982. *The Acceptance Of Lontra Gray For The New World River Otters*. Can. J. Zool. 61:278-279.
- Koepfli, Klaus & Robert K. Wayne. 1998. *Molecular Phylogenetics Of Otters*. Unpublished working paper from Department of Organismic Biology, Ecology and Evolution, Univ. of Calif. at Los Angeles, CA 90095-1606.
- Lariviere, Serge & L. R. Walton, 1998. *Lontra canadensis*. Mammalian Species No. 587, pp. 1 – 8. American Society of Mammalogists.
- Pocock, R. I., 1921. *On The External Characters Of Some Species Of Lutrinae (Otters)*. Proc. Zool. Soc. Lond. 1921:535-546.
- Pohl, H. 1919, 1920. *Die Unterfamilie Der Lutrinae*. Arch. Naturgesch. 85 Ab. H. Heft 9:1-247.
- Serfass, T. L., 1994. *Conservation Genetics And Reintroduction Strategies For River Otter*. An unpublished Ph.D. dissertation, Penn. State Univ., Happy Valley, Pennsylvania.

Sokolov, I. I., 1973. *Evolutionary Trends And The Natural Classification Of Otters (Lutrinae, Mustelidae, Fissipedia)*. (In Russian.) Bull. Mosc. Nat. Soc. 78(6):45-52.

van Zyll de Jong, C. G., 1972.. *A Systematic Review Of The Nearctic And Neotropical River Otters (Lutra, Mustelidae, Carnivora)*. Royal Ontario Museum, Life Sci. Contrib. 80:1-104.

van Zyll de Jong, C. G., 1987. *A Phylogenetic Study Of The Lutrinae (Carnivora; Mustelidae) Using Morphological Data*. Can. J. Zool. 65:2536-2544.

Wilson, D. E. & D. M. Reeder, 1993. *Mammal Species Of The World A Taxonomic And Geographic Reference*, 2nd Edition. Smithsonian Institution Press, Washington D. C. & London.

Wright, Clarence, 1988 *Otter Questionnaire*. Lincoln Park Zoological Gardens, 2200 N. Cannon Drive, Chicago, IL 60614.

CHAPTER 3

STATUS

“During the late 1800’s and early 1900’s, the synergistic effect of wetland destruction, pollution, and overexploitation for furs was devastating to North American river otter populations. Additional otter losses were due to road kills, accidental drowning in fishing nets and ‘incidental take during beaver trapping’.” (Foster-Turley et al. 1990)

The beginning of the 20th century saw the introduction of conservation measures that prompted the initial recovery of the river otter in some areas. These were, restricted trapping and hunting seasons, increased public awareness and education, and, the preservation of wetlands. These early efforts have been aided in the latter half of the 20th century by habitat restoration in some areas and re-stocking/translocation projects.

“The reintroduction and restocking of beavers from the 1920’s to the 1950’s also had a positive influence on otter populations.” Because beaver dams increase wetland area and otters frequently use beaver lodges as denning sites, the otters benefit from a , *“...facultative commensalism with beavers.”* (Foster-Turley 1990)

In the 1970’s, Nilsson & Vaughn (1978) estimated that the river otter was found in only 33% of its former range. The causes of this were listed as: intensive trapping, pollution, destruction of habitat by clearing land, draining marshes, and channelizing streams.

In 1971 Ed Park published these results from a survey he conducted of all the U. S. states and Canadian provinces where otters had historically occurred:

“Otters are evidently still plentiful enough in the East to warrant a trapping season in most of the Atlantic Coast states from Maine to Florida, and in the Gulf Coast states, including Texas, which also admits “no large population present in the state.” The three Great Lakes states of Michigan, Minnesota, and Wisconsin have adequate otter populations, as do the northwestern states of Washington, Oregon, Nevada, Idaho, Montana, and Wyoming.”

“...From Colorado: “No otter have been observed in Colorado for many years.” Indiana: “The last authentic record of the presence of otter in the state was of one shot by a hunter in Posey County on December 7, 1942.” Oklahoma: “There are no otters in Oklahoma.” South Dakota: “No otter or otter literature.” West Virginia: “West Virginia sustained a small population of otter until approximately 15 years ago.”

“Many other states report the otter as rare. A report from North Dakota said, “Two reports of otters in North Dakota in recent years indicate that this valuable furbearer may not be entirely extinct within the state.” A report from Iowa read, “Otter is a pretty rare item in Iowa in recent decades. Occasional one turns up in nets of commercial fishermen in Mississippi river along NE border.”

“So, while many states still claim to have a few otters, they are almost gone from the vast central part of our country – from North Dakota to Texas and from West Virginia to Utah.”

“Canada and Alaska, of course, still have many otters, with trapping seasons in Alaska and all the Canadian provinces.”

(Park 1971)

Jenkins (1983) adds: *“Today the otter is essentially absent from the interior of the U.S. and the arid southwest where it was always rare. There can be little doubt that habitat destruction, unregulated trapping, and water pollution eliminated otters over wide areas of the interior of the country and in the more industrialized parts of North America.”*

Although in the 1990 Otter Action Plan the IUCN Otter Specialist Group considered the North American river otter as a species receiving adequate protection, they made several suggestions for areas needing study, these suggestions included: *“Critical evaluations of current status determinations are of highest priority for this species, especially in states and provinces where harvest is permitted.”*

A telephone survey of the Fish and Wildlife Agencies of Canada and the 49 U.S. states with historic otter populations was conducted by Reed-Smith in 1994. At that time much of the status data was anecdotal or based on experience and “gut feeling” versus definitive status surveys.

In 1994 many of the states that allowed trapping had very small harvest limits; the bag limit was essentially set to cover incidental trapping of otter by beaver trappers. (This was not universally true, some states and Canada reported heavier trapping of otter.) Due to the decline of the fur market over the last decade or two, several states indicated that interest in otter trapping was minimal. Because of this lack of interest in fur trapping in general, some states had seen a dramatic increase in beaver populations. The increase in beaver numbers had often resulted in a concomitant increase in the otter population due to the improved river otter habitat created by the beaver.

The 1994 survey results showed the beginning of a reversal in the decline of the fur market. Many states and all of the Canadian provinces reported a rise in otter pelt value, in some cases tripling, at least doubling, over the previous two to three years (1992 – 1994). To a large extent, the price jump was believed to be due to an increased interest in otter pelts in the world fur market, particularly in Asia.

As of 1995 most states were still reporting limited intentional trapping of otter however, Canada reported more active otter trapping.

N. A. River Otter (<i>Lontra canadensis</i>) – U. S. Wild Population Status - Table (IUCN/SSC Otter Action Plan 1990, Reed-Smith 1994/95, IUCN/SSC Otter Action Plan 2000)			
STATE	IUCN OAP 1990	REED-SMITH 1994	SERFASS (UNPUBL. 2000)
Alabama	HP, SP	HP, SP	HP, IP
Alaska	HP, SP	HP, SP	HP, SP
Arizona *	HNP, SP	HNP, SP, T	HNP, SM-RE, SS
Arkansas	HP, IP	HP, IP	HP, IP
California	HNP, SP	HNP, SP, SS locally,	HNP, SP
Colorado *	HNP, DP	HNP, US, E	HNP, E,
Connecticut	HP, SP	HP, IP	HP, IP
Delaware	HP, SP	HP, SP	HP, SP
Florida	HP, SP	HP, SP	HP, SP
Georgia	HP, IP	HP, IP	HP, IP
Idaho	HNP, SP	HNP, IP	HNP, SP-IP
Illinois *	HNP, US	HNP, IP, E	HNP, T,
Indiana *	Extirpated, US	HNP, E	HNP, E
Iowa*	HNP, IP	HNP, SP, SM, T	HNP, IP, T
Kansas *	HNP, IP	HNP, IP, SM	HNP, IP
Kentucky *	HNP, IP	HNP, IP, PM	HNP, IP, PM
Louisiana	HP, SP	HP, SP	HP, SP
Maine	HP, SP	HP, SP to IP	HP, SP
Maryland *	HP, IP	HP, IP	HP, IP
Massachusetts	HP, SP	HP, IP	HP, SP
Michigan	HP, SP	HP, SP	HP, IP
Minnesota*	HP, SP	HP, IP	HP, SP
Mississippi	HP, SP	HP, SP to IP	HP, IP
Missouri *	HNP, IP	WL	HP, IP
Montana	HP, SP	HP	HP, IP
Nebraska *	HNP, IP	HNP, IP, E	HNP, E
Nevada	HP, SP	HP & HNP (county dependent), SP	HP, SP
New Hampshire	HP, IP	HP, SP, U to C	HP, SP
New Jersey	HP, SP	HP, SP to IP	HP, SP
New Mexico	HNP, US	extirpated	extirpated
New York *	HP, IP	HP, IP	HP, SP
North Carolina *	HP, IP	HP, SP to IP	HP, IP
North Dakota	HNP, IP	HNP, regarded as extirpated	HNP, regarded as extirpated
Ohio *	HNP, SP	HNP, IP, E	HNP, IP, E ***
Oklahoma *	HNP, IP	HNP, IP	HNP, IP
Oregon *	HP, SP	HP, IP	HP, SP
Pennsylvania *	HNP, SP	SS, IP	HNP, SS, IP
Rhode Island	HNP, IP	HNP, IP, PM	HNP, IP
South Carolina	HP, SP	HP, SP	HP, IP
South Dakota*	HNP, US	HNP, US, T	HNP, T
Tennessee *	HNP, IP	HP & HNP, T in part, SP to IP	HP, IP, T
Texas	HP, IP	HP, SP	HP, IP
Utah *	HNP, US	HNP, US, SM, SS, SM	HNP, SP, SS
Vermont	HP, IP	HP, SP, C	HP, SP
Virginia*	HP, SP	HP, IP to DP dependent on area,	HP, SP-IP
Washington	HP, SP	HP, IP to SP dependent on area	HP, IP
West Virginia *	HNP, IP	HNP, PM	HNP, PM
Wisconsin	HP, IP	HP, SP to IP, C	HP, IP
Wyoming	HNP, IS	HNP, US to DP, PS, SM	HNP, PM

LEGEND: HNP – Harvest Not Permitted; HP – Harvest Permitted; SP – Stable Population; DP – Declining Population; US – Unknown Status; IP – Increasing Population; E – State Endangered Species List; T – Threatened; SS – Species of Special

Concern/Risk; **PM** - Protected Mammal; **WL** – Watch Listed; **SM** – Small Population; **U** - Uncommon; **C** – Common; **RE** – Reintroduced * **Restocking or translocation projects have taken/are taking place.**

2000 Status, State comments:

Alaska – There is no limit during the open season which extends from 01 December to 15 February in Units 1 – 4 and from 10 November to 15 February in Unit 5. The Alaska Fish and Wildlife web site (www.state.ak.us/akpages/FISH.GAME/notebook/furbearer/rvrotter.htm) states that 1,200 to 2,400 pelts are harvested annually in Alaska.

California – Numbers in Northern California are increasing, “...I do know from studies done in '94 - '96 that otters are adapting well to suburban and even urban habitats in some areas of Northern California. This includes resident otters in tertiary treatment marshes next to an extraordinarily busy freeway, suburban transients in swimming pools thriving on cat food, and migrating otters moving through the delta among industrial marshes (loaded with toxics by the way). (M. Graham, pers. comm.)

Florida - <http://www.riverotter.org/> This is a web site dedicated to river otters in Florida. It contains a page where otter sightings can be posted.

Illinois – 346 (192.154) otters were released in Illinois between 1994 and 1997. Their web site is at www.inhs.uiuc.edu/dnr/fur/index.html.

Michigan – DNR figures from the state of Michigan show that since 1992-1992 when 887 otters were trapped the pelt take has increased. 1993-1994 N/A; 1994-1995: 1,521; 1995-1996: 1,115; 1996-1997: 1,416. (Cooley, T. et al. 1993, 1995, 1997, 1997)

Ohio - *** The state endangered status will probably be reviewed and changed in the near future. The state otter population was estimated to be about 1,700 and increasing in 2000. (Dwyer per. com.)

N. A. River Otter (<i>Lontra canadensis</i>) – Canadian Wild Population Status - Table (IUCN/SSC Otter Action Plan 1990, Reed-Smith 1994/95, IUCN/SSC Otter Action Plan 2000)			
PROVINCE	IUCN OAP 1990	REED-SMITH 1994	REED-SMITH 2001
Alberta *	HP, SP	HP to HNP dependent on area, SP to IP dependent on area.	HP, to HNP dependent on area, SP to IP.
British Columbia	HP, SP	HP, SP	HP, SP
Manitoba	HP, SP	HP to HNP dependent on area, SP, U to C	HP, SP, C
New Brunswick	HP, SP	HP, SP	HP, SP
Newfoundland	HP, SP	HP, SP, C	HP, SP
Northwest Territories	HP, SP	HP, SP(?)	HP, SP
Nova Scotia	HP, SP	HP, SP	HP, SP
Ontario	HP, SP	HP, SP	HP, SP
Prince Edward Island		extirpated	extirpated
Quebec	HP, SP	HP, SP	HP, SP
Saskatchewan	HP, SP	HP, SP, C	HP, SP
Yukon	HP, SP	HP, SP	HP, SP

LEGEND: HNP – Harvest Not Permitted; HP – Harvest Permitted; SP – Stable Population; DP – Declining Population; US – Unknown Status; IP – Increasing Population; E – State Endangered Species List; T – Threatened; SS – Species of Special Concern; PM - Protected Mammal; WL – Watch Listed; SM – Small Population; U - Uncommon; C – Common;
*- Restocking or translocation projects have taken/are taking place.

Alberta – There are about 2000 trappers registered in Alberta and 1700 registered fur management areas. Between 1990 and 2000 332 otter pelts were harvested selling for a mean price of \$112.63 (Canadian). Otters are trapped under a quota system; listed as a “green list” species.

Manitoba – The number of otters taken per year period in Manitoba were: 1983 – 1988: average of 2,290; 1988 – 1993: average of 1,219; 1993 – 1998: average of 1,904; 1997 – 1998: 2,021; 1998 – 1999: 1,690. The average auction value of the pelts was: 1983 – 1988: \$41.60; 1988 – 1993: \$44.74; 1993 – 1998:

\$83.71; 1997 – 1998: \$79.54; 1998 – 1999: \$60.48 (Canadian dollars) The pelt is considered to be in its prime from mid-November to the end of December. Ranked as S5 = secure, widespread and abundant.

New Brunswick – The total number of otter pelts exported in 1998/99 was 433 in 1999/2000 it was 410. The per pelt value in the 1998/99 season was roughly \$46.63 (Canadian), in 1999/2000 it was \$82.45 (Canadian). Trapping is permitted in zones 1 to 11 from October 13 to January 27; zones 13 to 27 the season extends from November 4 to January 27; zone 12 the season opens October 21 and ends January 27.

Yukon - Because otter are not generally targeted by Yukon trappers fewer than 50 are usually taken each winter and just 12 otters were trapped in the 1998-99 fur harvest season, the average pelt price was \$60.00 (Canadian).

In 1994, all Canadian provinces reported an increased interest in trapping otters due to an increased interest in otter pelts from Europe and Asia. At that time it was believed that what in recent years had predominantly been incidental trapping of otter, would switch to an intentional annual otter take as a result of the increase in price. For that reason, every province reported that bag limits, or the use of no bag limit for otter, would be reviewed annually.

In summary, “...North American river otters are most abundant in wetland areas of the Mississippi river delta and adjacent Gulf Coast (east Texas to Florida), the Atlantic Coast (Florida to Newfoundland, excluding large metropolitan areas such as New York City, Washington D. C., and Philadelphia), the Great Lakes region, the southern Hudson Bay region, and the Pacific Coast (northern California to Alaska).”

(Foster-Turley et al. 1990)

CITES LISTING

In 1977 N. A. river otters were listed as an Appendix II species by CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora).

“Appendix II: Species are not presently threatened with extinction, but may become so unless their trade is regulated. Import permits are not required, but an export permit or re-export certificate must accompany each shipment. Export permits can be issued as long as the export will not be detrimental to the survival of the species. Re-export certificates are required for species previously imported.

“■ All CITES wildlife shipments must enter and leave the U.S. through customs ports designated by FWS, unless an exception is obtained. Shipments must comply with the International Air Transport Association Live Animal Regulations (IATA) and CITES Transport Guidelines.

“■ CITES establishes procedures to regulate the import and export of species threatened by trade. The treaty covers animals and plants, whether dead or alive, or any readily recognizable part or derivative of that animal or plant.

“■ The ESA (Endangered Species Act) designated the Interior Department both the management and scientific authority for CITES in the U.S. The FWS/Office of Management Authority reviews the effects of wildlife and plant trade and issues or denies permits. The FWS/Office Scientific Authority determines whether the issuance of the permit will not be “detrimental” to the survival of the species.” (AZA 1994)

IUCN RED LIST – IUCN/SSC OTTER SPECIALIST GROUP SUGGESTED LISTING

The N. A. river otter (*Lontra canadensis*) was not listed on the 1994 IUCN (International Union for the Conservation of Nature) Red List. In 1999 the IUCN/SSC Otter Specialist Group reviewed the Red Book

listings of all 13 extant otter species and recommended that *L. canadensis* be listed as Lower Risk. It is unknown at the time of publication if their recommendation will be adopted. (Reuther 2000)

OTTER/HUMAN RELATIONSHIP

First and foremost, river otters are frequently confused with sea otters. Stand at any otter exhibit in any zoo or aquarium and you will soon hear comments similar to these: “I love otters.” “It is so much fun to watch them float on their back and use a rock to break open a clam then run and slide in the snow or mud!” Confusion like this is not the fault of the zoo visitor. It comes from the high profile of the sea otter, a focus only on the word otter, and a basic unfamiliarity with wildlife. It is the job of zoos and aquariums to change this.

Otters in the wild are appreciated, tolerated, persecuted or trapped; it all depends on where the otters are and who you are talking to. Otters can be viewed as pests by home owners, boat owners and anglers. They can have serious economic impact on fish ponds, they are not looked on kindly by some beaver trappers, and of course, they are trapped themselves for their beautiful fur. Thus far, with some sound conservation measures passed in the late 1960’s and 1970’s the river otter has been a true conservation success story despite all the previous mentioned people who may not be too happy to have an otter visit their stream, river, or lake. However, this could change quickly, especially if pollution continues to go unchecked. (See also Native American Tales and Legends)

OTTERS IN CAPTIVITY

ISIS Zoological Institution Census – Table (As of June 2000)	
<i>Lontra canadensis</i> (no subspecies)	1994: 83.69.3 = 155 @ 67 institutions 2000: 92.99.5 = 196 @ 87 institutions
<i>Lontra canadensis</i> (hybrid) *possible <i>L.c.canadensis/L.c.lataxina</i> hybrid; true status unknown	1994: ---- none identified 2000: 0.3.0 = 3 @ 2 institutions
<i>Lontra canadensis canadensis</i>	1994: 20.17.0 = 33 @ 19 institutions 2000: 20.16.2 = 38 @ 21 institutions
<i>Lontra canadensis degener</i>	1994: ---- none identified 2000: 1.1.0 = 2 @ 1 institution
<i>Lontra canadensis lataxina</i>	1994: 15.18.0 = 33 @ 17 institutions 2000: 18.14.2 = 34 @ 22 institutions
<i>Lontra canadensis pacifica</i>	1994: 6.4.0 = 10 @ 5 institutions 2000: 4.3.0 = 7 @ 5 institutions
Total # of animals in ISIS institutions (1994)	124.104.3 = 231
Total # of animals in ISIS institutions (2000)	125.146.9 = 280 total (120.140.6 = 266**)
Total # ISIS institutions in 1994 with <i>L. canadensis</i>	95**
Total # ISIS institutions in 2000 with <i>L. canadensis</i>	114 (99**)

ISIS = International Species Information System. This is a member computerized database, not all institutions/facilities/rehab centers, etc. holding this species participate. It can be assumed that there are at least half again the total number of river otter listed here in captivity, if not more. ISIS is located at: <http://www.worldzoo.org/> 12101 Johnny Cake Ridge Road, Bldg. A, Rm. 6, Apple Valley, MN 55124-8151. 952-997-9500. Fax: 952-432-2757. isis@isis.org.

** North American institutions

REFERENCES - STATUS

- AZA (American Association of Zoos and Aquariums), 1994. *Manual Of Federal Wildlife Regulations. Vol. Two (B): Laws & Regulations.* pg. Intro-131. Bethesda, Maryland
- Baker, R. H. 1983. *Michigan Mammals.* Michigan State Univ. Press, East Lansing, Michigan
- Corbet, G. B. & J. E. Hill, 1986. *A World List Of Mammalian Species.* British Museum and Cornell University Press, Ithaca, New York.
- Foster-Turley, P, S. Macdonald & C. Mason, eds., 1990. *Otters, An Action Plan For Their Conservation.* Kelvyn Press, Inc. Broadview, Il. Publ. Services – Chicago Zoological Society, Brookfield, Il. IUCN/SSC Otter Specialist Group.
- Hall, E. R. Ph.D., 1981. *The Mammals Of North America.* Vol. II, 2nd Edition. John Wiley & Sons, New York.
- Hall, E. R. Ph.D. & K. R. Kelson, 1959. *The Mammals Of North America.* Ronald Press Co., New York.
- Harris, C. J. 1968. *Otters, A Study Of Recent Lutrinae.* Weidenfeld & Nicolson, London, England.
- Hershkovitz, P. 1972. *The Recent Mammals Of The Neotropical Region: A Zoogeographical And Ecological Review.* 311-421. In: Evolution, Mammals and Southern Continents. A. Keast, F. O. Erk, B. Glass, editors. New York State Univ. Press
- ISIS (International Species Information System), *Lontra canadensis Species Abstract 31 December 1999.* 12101 Johnny Cake Ridge Road, Bldg. A, Rm. 6, Apple Valley, MN 55124-8151. 952-997-9500. Fax: 952-432-2757. isis@isis.org
- Jenkins, J. H. 1983. *The Status And Management Of River Otter (Lutra canadensis) In North America.* Acta. Zool. Fennica 174:233 – 235.
- Lariviere, Serge & L. R. Walton, 1998. *Lontra canadensis.* Mammalian Species No. 587, pp. 1 – 8. American Society of Mammalogists.
- Melquist, W. E. & M. G. Hornocker. 1983. Ecology of River Otters in West Central Idaho. The Wildlife Society Monographs, No. 83, 60p.
- Nilsson, G. & A. S. Vaughan. 1978. A turning point for the river otter. National Parks and Conservation Magazine 52(4):10 – 15.
- Park, E. 1971. *The World of the Otter.* J. B. Lippincott Co., New York.
- Reed-Smith, J. 1994/95. *North American River Otter, Lontra canadensis, Husbandry Notebook.* John Ball Zoo, Grand Rapids, MI 49504
- Reuther, C. 2000. *Status Of Otters In The World, With Special Reference To Their Popularity And To Education And Public Relations Activities For Their Conservation.* In: Proceedings of the Workshop on CONSERVATION AND PUBLIC AWARENESS OF OTTERS. National Museum of Nat. Sci., Taichung, ROC & Tatchia Visitor Center, Yushan Nat. Park, ROC. 09 – 12 December 1999. C., Santiapillai & H. Sasaki editors. Otter Research Group, Japan, email: i79677g@wisdom.cc.kyushu-u.ac.jp (Sasaki).
- Serfass, T. L., 1994. *Conservation Genetics And Reintroduction Strategies For River Otter.* An unpublished Ph.D. dissertation, Penn. State Univ., Happy Valley, Pennsylvania.

van Zyll de Jong, C. G., 1972.. *A Systematic Review Of The Nearctic And Neotropical River Otters (Lutra, Mustelidae, Carnivora)*. Royal Ontario Museum, Life Sci. Contrib. 80:1-104.

van Zyll de Jong, C. G., 1987. *A Phylogenetic Study Of The Lutrinae (Carnivora; Mustelidae) Using Morphological Data*. Can. J. Zool. 65:2536-2544.

Wilson, D. E. & D. M. Reeder, 1993. *Mammal Species Of The World A Taxonomic And Geographic Reference*, 2nd Edition. Smithsonian Institution Press, Washington D. C. & London.

CHAPTER 11

BEHAVIORAL and ENVIRONMENTAL ENRICHMENT

“What is an enriched environment? It is one that allows animals to perform natural behaviors, gives animals control over their lives, eliminates frustration, makes captive environments more interesting, gives animals more choice, and allows animals to be more active. Enrichment of the enclosure involves the physical environment including shape, size and complexity. Complexity consists of an animal environment such as visual barriers, climbing or traveling structures, substrates, rest/sleep areas and temporal complexity. Manipulable objects such as toys and vegetation, the opportunity to use five senses, and the social environment are all beneficial to the animal. The types of food offered, the frequency and presentation play a large role in enriching the lives of our captive charges.

(Grams, K. 2000. *Exhibitory and Enrichment of North American River Otters (*Lontra canadensis*) at The Arizona-Sonora Desert Museum*. Animal Keepers’ Forum, Vol. 27, No. 4. Quotation is referencing a presentation given by D. Shepherdson & J. Mellen at the First Environmental Enrichment Conference in Portland, Oregon, 1992.)

The Webster’s New Universal Unabridged Dictionary lists these definitions: *Behavior* – manner of behaving; conduct....it expresses external appearance or action. *Enrich* – to make rich or richer; to give greater value or importance to.

In his book, *Behavioral Enrichment in the Zoo*, H. Markowitz refers to zoos evolving into the “best possible facilities”, defining best as follows: “1) *The best possible home for animals that have been removed from their natural habitat.* 2) *The best educational recreational experiences for zoo visitors.* 3) *The best provision for research of all kinds beneficial to the resident species.*”

These are all definitions and goals easily agreed upon. How we achieve them is another matter, primarily because every animal is unique and will respond to different stimuli, and all zoo professionals are unique and will develop different solutions.

In the case of *Lontra canadensis*, zoos have a wonderful opportunity to teach our visitors about a native animal. Our enrichment goals should aid this education effort and create an environment that promotes good health and the otters natural high activity level, playfulness and curiosity.

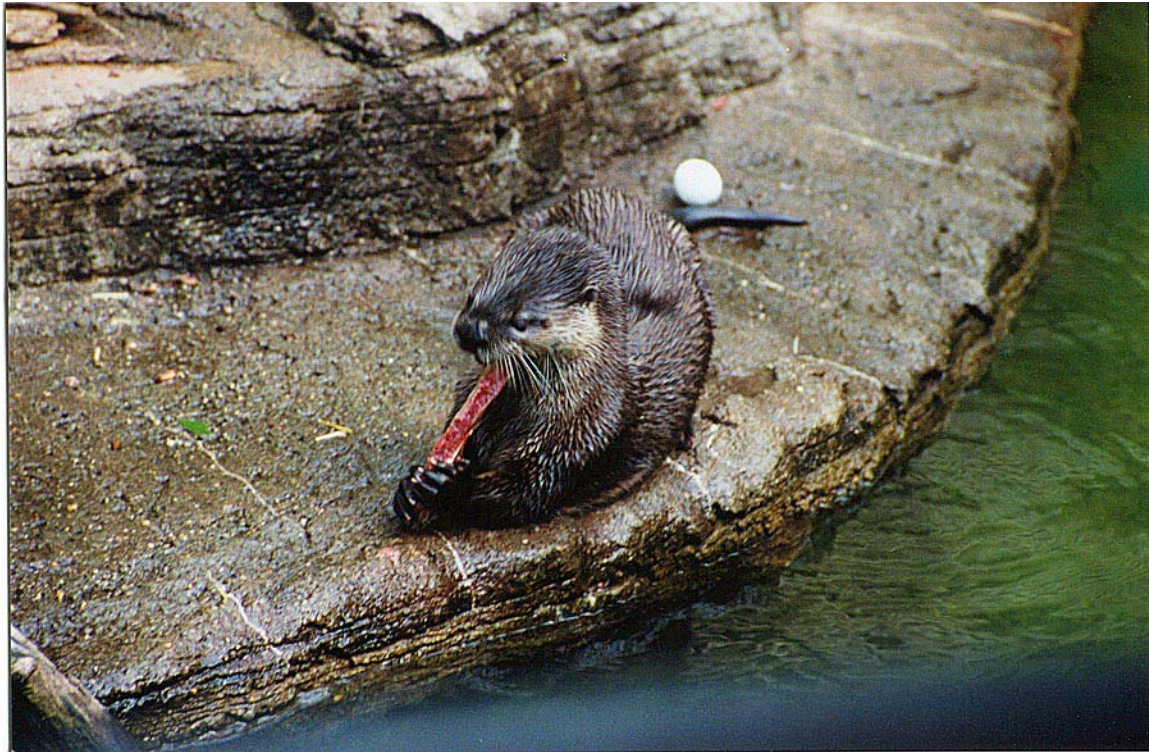
There are some general guidelines that should be kept in mind when designing an enrichment program for any animal: the target species (in this case, otters) natural history should be researched; goals and objectives should be identified in advance; aberrant or unnatural behaviors should not be promoted; any activity should be approved by the appropriate supervisory personnel; questions regarding toxicity/safety of an item should be reviewed with a veterinarian, nutritionist, chemist, curator, and/or botanist; responses should be documented to determine if an enrichment item/activity is successful, or not; treat delivery methods should not promote begging behavior; not all enrichment should be food, don’t forget smell, sight, sounds, and touch; and, remember, when it comes to enrichment, variety is truly the spice of life.

This chapter will cover some of the many enrichment items tried by contributing institutions; keep in mind: not all of them were successful, some were not successful at first but when introduced repeatedly over time they eventually elicited a response; if animals are introduced at a young age to novel situations and items, they will be more responsive to new things through adulthood; and, what may have proven safe for one animal could present a problem for another, vigilance is the key.

The first edition of the husbandry manual contained the results, institution by institution, of the Central Park Wildlife Center's North American River Otter Enrichment Survey circulated in 1993. This edition will list all of the items used, or tried, that were mentioned in that survey as well as some new ones. Items requiring explanations are listed separately.

ENRICHMENT ITEMS - Table				
Natural	Exhibit Furniture	Non-edible manmade	Live Food	Edibles
Soil, sand, mulch, etc.	Climbing areas (technically available in all exhibits, i.e. cliffs, ledges, etc.)	Boomer balls – all sizes & various products like the “spoolie” & “ice cube”	Fish (smelt, shiners, gold fish, trout, salmon, mackeral, tilapia)*others listed below	Ice blocks w/ fish, fish-sicles, fish cubes, etc. krill cubes, clam cubes, etc.
Grass, sedges, etc.	Logs (on land, submerged, floating; hollow &/or solid)	Ice blocks, cubes, pops, etc.	Crayfish	Frozen or thawed sand eels
Trees	Rocks (not artificial)	Natural snow & ice	Crickets	Fish pieces
Bushes	Waterfall	Dog chews, rawhide treats	Fly-in birds	Scattered carrot pieces
Vines, “vine hoops”	Stream	PVC cricket feeder	Giant mealworms	Chicken necks
Aquatic plants	Sticks	Buckets	Earthworms	Mice
Hay, straw, grass, leaves, wood wool as bedding	Browse (leafy branches on land &/or floating)	Blankets, burlap, hammock, non-fraying rags	Freshwater clams	Whole fish – frozen or thawed
Grass piles	Slides	Barrels of water Frisbees	Mussels	Whole apples/oranges
Leaf piles	Tunnels	Tubs of water Carpet over board	Krill	Fruit & berries (incl. grapes, blueberries, strawberries)
Rocks, all sizes for play & manipulation	Stream bed Running water	Rubber-coated heating pad*	Eels – naturally found	Small pumpkins/squash
Knot holes	Holts	Astro turf	Shrimp	Omnivore biscuits
Bark sheets	Jacuzzi-like jets in pool	Floating plastic toys	Aquatic insects – naturally found	Monkey chow
Pine cones	Islands in pools	Phone Books	Mice – naturally found	Pigs ears
Mud		Swim through plastic ring		Frozen blood blocks, cubes, etc.
Sod				
Bank over-hangs	Bridges made from logs, etc.	Kids puzzle balls, Frisbees, billiard balls, hard balls	Frogs – naturally found	Hard-boiled eggs
Floating wood blocks	Stumps	Diff. size pieces of PVC pipe & fittings	Grubs	Day-old chicks Crabs
Pine needles	Natural fiber mat	Kong chews	Chub	Melons
Other animal urines	Movable sand box	Metal bowls & pans	Minnows	Coconuts
Powdered scents & herbs	Logs brought from other exhibits	Plastic containers & bottles*	Bluegill	Frozen feline balls
Fresh herbs	Log ladder	Bread tray	Clams	Milk bones
Extracts – i.e. vanilla, etc.	Non-sprayed Xmas trees	Kids plastic slide, house	Mud minnows	Screw pine nuts, unsalted peanuts
Grapevine balls	Moving soil pots	Stock tank		Krill patties
Shells	Hanging logs w/ holes for food	Hanging tub* Warm water hose		Hampster ball w/ treat
Turkey feathers				
Corn Stalks	Snow Piles	Vari-kennel		Gelatin Jigglers
Blowing bubbles into exhibit	Piles of ice cubes	Tubs w/ different substrates		Corn on the cob Chicken necks
Kudzu vines		PVC tube hung for climbing in.		Yogurt w/ fish
Cow Hooves				Unsalted ham

* Any item used from this list should be cleared with zoo management and carefully monitored. The items with asterisks should be closely watched, I do not know if any problems ever arose with these things. **Many people use paper products however caution should be exercised, there have been problems when the paper becomes wet and “glues” itself to an animals mouth.** (C. Lent per. com.) **The same holds true for cardboard.**



Hard boiled eggs and rib bones are favorite enrichment treats.

“How Can a Zoo Enclosure be Enriched?”

From: *Compendium of Enrichment Ideas*, Proceedings of 1st Conference on Environmental Enrichment 1993, Oregon Zoo, 4001 S. W. Canyon Rd., Portland, Oregon 97221.

Physical Environment

- Size & Shape
- Complexity
 - Visual Barriers
 - Climbing/Travel Structures
 - Substrates
 - Rest/Sleep Areas
- Temporal Complexity
- Manipulable Objects
 - Toys
 - Vegetation

Food

- Type
 - Novelty
 - Variety
 - Treats
- Delivery
- Frequency

Social Environment

- Conspecific
 - Group size and composition (wild as a model)
- Contraspecific
 - Mixed Species

Occupational Enrichment

- Learning
 - Training
 - Puzzles
- Presentation
 - Hidden
 - Whole Food
 - Dispersed
 - Live Food
 - Processing Time, etc.

The Senses

Auditory

e.g. Taped Vocalizations

Olfactory

Scents

Faeces

Spices

Tactile

Texture

Manipulable Objects

Novelty

Taste

Variety

Novelty

Seasonal Change

Case Study – Brookfield Zoo – Illinois River Exhibit – Off-Exhibit Enrichment

Contact: Joyce Peterson, Sr. Keeper (The Swamp)

1.2 N. A. River Otters are housed in this exhibit. At this time the females are exhibited together; the females and the male are rotated onto the exhibit for half days. Husbandry procedure training is done while the animals are off exhibit. Some procedures are demonstrated during public educational talks while the animals are on exhibit; the keeper stands in an adjacent area.

“Off-exhibit holding: A row of five holding cages connected by shift doors; two are ‘dry cages’ with nest boxes, bedding and rugs; three are ‘wet cages’, two with small pools in the floor (21”x 4’x3’d), the third with a removable stock tank (4’ diameter, 2 1/2’ deep). Cement floors; 1”square wire mesh on front and doors, painted cement/plaster walls. Cages approx. 6’ x 6’ x 6 1/2’ high. Otters off exhibit for the night.”

There is an extensive enrichment program in place for the otters in the Swamp building. Their repertoire of items includes most of what is listed in the Enrichment Items Table. In addition they make good use of the following things in holding:

- ◆Hard, plastic childrens’ climbing toys including slides, pails, floating pickle, boat, plane (hung from eye bolts in the ceiling), balls, house (about 2’ x 2’ suitable for the animals to climb and sleep on), “crib toys” – hung on side of holding den so the animals can push the knobs (these are watched to ensure that nothing is broken off).

- ◆Lids from pots and pans.

- ◆Large Boomer Ball with 10 – 12” hole cut out and bedding of some sort put inside (animals can climb inside).

- ◆Duck decoys.

- ◆Cargo nets.

- ◆Plastic bread trays hung from the wall so they fold down with carpet in it.

- ◆Assorted pieces and sizes of carpet, towels and natural fiber mats.

- ◆Mirrors

- ◆Food bowls

- ◆Medium Boomer Ball –several holes cut out and a PVC piece stuck through it; hung from the ceiling.

The staff of the Swamp Building are continuously reinventing their enrichment program. For more information contact the Swamp Keepers or Joyce Peterson or Dori Rog – Swamp Enrichment Coordinators. 708-485-0263 ext. 673.

Enrichment Ideas

This list is not exhaustive and not all of these ideas have been tried with otters. Before using any of the fabricated toys, i.e. puzzle feeders, etc., make sure no animals can accidentally become caught inside while under water.

Brush Pile Feeder (Law et. al 1990) – Place meat or other food items under a brush pile. Can also use a rock pile or logs.

Dog Chews – Try different things with them, i.e. hang them, soak them in water, fish juice, blood, etc.

“The four slide-able rings (with retaining tracks) cover the four access holes drilled along the length of the tube. The ring has a hole that matches those on the tube. Once the ring slides to match both holes, items can be reached.”

This idea may be better suited to Asian small clawed otters but could be used for N. A. if something like fish pieces were put in (because otters will tend to take the toy out of the water) and the rings made moveable and easily pushed with noses.

Boomer Ball Feeder (C. E. E. 1993) – Adapted from an idea for sea otters submitted by Oregon Coast Aquarium. Drill holes in any size Boomer Ball. Hole size should be large enough to allow the insertion of ice cubes (these help hold the fish in) and fish pieces.

Ice Cube Mountain (C. E. E. 1993) – Oregon Coast Aquarium. *“Large buckets of ice cubes are dumped in piles at various locations on the deck of the exhibit. Frozen butter clams are hidden under the piles of ice.”* This idea was used for sea otter but could easily be adapted to river otter.

Animal Shower (C. E. E. 1993) – Brookfield Zoo *“Animal can walk or swim to an area in the pool or enclosure and self activate the operation of a shower head located in the area.”* (E. Krajniak) He suggests using a motion sensor like the ones used to turn lights on. Mount a shower head to a water source using a hose. *“Go back to the water valve you are going to hook the hose up to for water. At this point install an electric solenoid valve (you want a solenoid valve that is normally closed when the power is off and opens when you turn the power on.) Next run an electric power line to the motion sensor. Run two wires from the electric wire that would normally turn on lights, when the sensor senses motion, it will turn on the water instead of the lights.”* (E. Krajniak)

Mirrors – Place outside the exhibit, preferably on under water viewing window.

Floating Bag (G. Ziegler) – *“... food items inside a loosely tied mealworm bag (small muslin cloth bag) and tossed in the pool. Our otter played with it longer than anything I've observed. She had a hard time opening the bag, but finally got it.”*

There are an unlimited number of variations and combinations for the enrichment ideas and items listed here. As stated earlier, any one idea may work for some animals and not others; it may take awhile for an animal to respond to any given item so try it more than once; be watchful for adverse reactions, even with previously used items; be creative, and, share. If you find a novel approach send it in to Otterkeeper@otternet.com (join by contacting jrsotter@iserv.net), the enrichment Listserve at: ENRICH@lists.aza.org (join by contacting jackbell@humboldt1.com), the Shape of Enrichment (1650 Minden Dr., San Diego, CA 92111-7124), or AAZK Animal Keeper's Forum.

Case Study – Clearwater Marine Aquarium (Angela Gabbert – Marine Mammal Trainer)

The Clearwater Marine Aquarium has an extensive inventory of enrichment items. All food items are placed on a preset schedule to insure they are not relied on too heavily. Each animal has a record kept of what their response was to a particular item. When animals are sent out a list of enrichment items used with that animal is sent with them. Items in their inventory include:

Black and green Astro turf	“Power” chew by Hertz	Carpet pieces
Dive rings	Green gators, hard plastic toy	Hard balls, various sizes
Toy store bowling ball & pins	Hard plastic boats	Holy ball (blue w/holes)
Hard plastic horse shoes	Kong toys	Lrg. red bucket
Mega blocks (lrg. Lego like toy)	Hard plastic purple shovel	Colored dive sticks
PVC pieces, elbow sized	PVC tunnels (12 ¾ in. diameter – various lengths)	
Hard plastic rakes & shovels	“Yapples” – cubes	Shark shovels (toys)
Blue “Jolly” ball	Large traffic cone	Big yellow boat
Bubble maker	Bubble wand	Cat condo-supervised
Cat house	Cat scratching post-supervised	Fire hydrant sprinkler
Funky sprinkler	Garth’s rope toy	Gray sprinkler
Green Lego piece	Green Mega blocks	Mega block dumpster
Mini PVC tunnel	Nylabone	Pink/blue egg ball
Purple bucket	PVC swing	Dental kong
Red dog chew toy	Dumbbell	Quattro toy
Shoe cat bed	Small blue boat	Waffle bat
Hard plastic whales	Hard plastic slides	Hard plastic toys
Hard plastic igloos	Towels	Spanish moss
Apples	Crickets	Hard Boiled eggs
Grapes	Kiwi fruit	Night crawlers
Bananas	Raspberries	Strawberries

All toys are carefully checked to insure there are no breakable pieces. All new items are given only when the animals are supervised, some are only offered while the animals are supervised.

Remember!

When developing your otter enrichment program do not forget the importance of your exhibit design. A complex, well thought out exhibit will provide a multitude of enrichment options. Exhibit furniture can be moved (both onshore and “offshore”) and should be changed periodically to introduce novelty to the animals’ environment. It is preferable to offer a variety of substrates. This affords the animals a choice of where to do their grooming and allows for a range of exploratory behaviors which can be encouraged by planting toys, food items, etc. Pools, streams, waterfalls, etc. need to be varied in depth; if possible, water bodies in the same exhibit should also offer different features such as degree of turbulence, shore composition, and submerged fixtures like logs, rocks, etc. Stones, rocks, pebbles, and sand placed along the shoreline, or as part of shallow water bodies, offer a rich medium for manipulation by the otters and hiding of treats and toys. Temporal enrichment can be a valuable option for those exhibits designed with adequate off-exhibit holding facilities. Animals can be rotated on and off exhibit providing them with the opportunity to explore different spaces, get away from the public or other animals for awhile, pursue a more natural behavior cycle like following the scent of an estrous female, and finally, periodic rotation of animals stimulates activity in the exhibit and creates an opportunity for keepers to introduce other enrichment items to the exhibit. Indoor exhibits should offer temperature gradients to allow animals the choice of where they want to be and outdoor exhibits should provide varying degrees of shade. Sleeping/hiding place choices should be available in any exhibit type.

And finally, when looking for new enrichment items keep these criteria in mind: *“First, the object must be large enough so that it cannot be ingested. Second, it must be strong enough to stand up to their teeth. Third, it cannot have any sharp edges that could cut the otters. Fourth, it cannot have any small parts that could break off...”* (Gabbert 1999)

Colorado Ocean Journey – Case Study

Enrichment is divided into four categories: Training, Natural, Food creation, Plastic/synthetic.

Training: This facility spends a great deal of time working with their animals, there can be as many as three training sessions per day conducted off-exhibit. The animals are trained to go off exhibit, participate in a variety of husbandry procedures, and go back on exhibit.

Natural: Aspen branches, mixed leaves, hay, bamboo, cedar mulch, live crayfish, live shiners.

Food Creation: Ice bucket, ice cubes, krill cubes, clam juice cubes, watermelon juice cubes, fish juice cubes, s/o mix juice ice, krill cubes, ice balls, snow, rosemary, oregano, thyme, milk, peanut butter, red apple, green apple, peach, pear, carrot, HB egg, strawberry, blueberry, cranberry, honeydew melon, watermelon, cantelope, red grape, green grape, pumpkin, clam, chicken, feline diet, smelt, broccoli, dog biscuit, feeder tube, coconut, pecans, bananas, milk bones, corn, mint, basil, sweet potato, portabella mushrooms, shitake mushrooms, plum, pomegranate, mussels, oysters, cilantro, snap peas, peanuts, walnuts, dill, coffee grounds (Ethiopian), lemon juice.

Plastic/synthetics: Ferret logs, boomer balls with and without holes, Frisbees, “Boomer” spindles, Nyla ball, gray rock, abalone.

ENRICHMENT RESOURCES

The Shape of Enrichment – <http://enrichment.org/publication.html>

Enrichment Listserve – join by email jackbell@humboldt1.com

AAZK Enrichment Committee – <http://www.enrich.org/aazk>

CAZA Enrichment Listserve Archives – <http://www.caza.org/enrich/>

Environmental Enrichment Scrapbook – <http://www.well.com/user/abs/dbs/eesb/>

Environmental Enrichment (EE) for Captive Animals – <http://www.iwec.org/enrichment.htm>

Animal Enrichment – <http://www.geocities.com/RainForest/Vines/8435/ak/enrich/index.htm>

Environmental Enrichment – <http://www.wwwspace.co.uk/~abwak/enrich.htm>

AAZK Forum Magazine – Monthly publication. 3601 W. 29th St., Ste 133, Topeka, KS 66614, www.AAZK.org

Shape of Enrichment – Quarterly publication. 1650 Minden Dr., San Diego, CA 92111-7124

REFERENCES - ENRICHMENT

- Adams, S. & G. Babladelis, 1987. *An Ecological Approach to Animal Groups in Zoos*. Int. Zoo News 145:14 – 22 & 146:8 – 15.
- Carlstead, K.; J. Seidensticker & R. Baldwin. 1991. *Environmental Enrichment for Zoo Bears*. Zoo Biol. 10:3 – 16.
- Gabbert, A. 1999. *An “Otterly” Enriching Environment*. Shape of Enrichment. Vol. 8, No. 2, May 1999.
- Grams, K. 2000. *Exhibitry And Enrichment Of North American River Otters (Lontra Canadensis) At The Arizona Sonora Desert Museum*. Animal Keepers’ Forum, Vol. 27. No. 4 , pp 171 – 183.
- Hawke, L., P. Lauer, D. Bartholomeusz & Z. Steen. 2000. *Effects of Increased Food Dispersal and Random Feeding Time/Place on Stereotyped Behaviours in Otters At Adelaide Zoo*. Intl. Zoo News Vol. 47(2): 71 – 81.
- King, C. 1993. *Environmental Enrichment: Is It For The Birds?* Zoo Biol. 12: 509 – 512.
- Law, G.; H. Boyle; J. Johnston, & A. Macdonald. 1990. *Food Presentation, Part 2: Cats*. RATEL 17(4):103 – 106.
- Maple, T. & L. Perkins, 1996. *Enclosure Furnishings And Structural Environmental Enrichment*. In: Wild Mammals In Captivity: Principles And Techniques. D. Kleiman, M. Allen, K. Thompson & S. Lumpkin editors, Univ. of Chicago Press, p 212 - 222
- Markowitz, H. 1982. *Behavioral Enrichment In The Zoo*. Van Nostrand Reinhold Co., New York.
- McKenzie, S.; A. Chamove & A. Feistner. 1986. *Floor Coverings and Hanging Screens Alter Arboreal Monkey Behavior*. Zoo Biol. 5:339 – 348.
- Mellen, J. D., V. J. Stevens, & H. Markowitz, 1981. *Environmental Enrichment For Servals, Indian Elephants And Canadian Otters, Felis Serval, Elephas Maximus, Lutra Canadensis At Washington Park Zoo*. Int. Zoo Yb. 21: 196 – 201
- Shepherdson, D. 1991. *A Wild Time At The Zoo: Practical Enrichment For Zoo Animals*. AAZPA 1991 Annual Conference Proceedings.
- Shepherdson, D. 1992. *Environmental Enrichment: An Overview*. AAZPA 1992 Conference Proceedings.
- Shepherdson, D. 1993. *Environmental Enrichment Ideas and Information*. Printed by: D. Shepherdson, Metro Washington Park Zoo (now Oregon Zoo), 4001 SW Canyon Rd., Portland, OR 97221-2799.
- Shepherdson, D., J. D. Mellen, & M. Hutchins, (editors) 1998. *Second Nature, Environmental Enrichment For Captive Animals*.
- Sequeria, G. 1993. *Evaluation of Enrichment Devices For Captive North American River Otters (Lutra canadensis)*. AAZK Animal Keeper’s Forum, Vol. 20, No. 10:359 – 363.