



N. A. river otters: San Francisco Zoo, California

“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.)

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. throughout the exhibit. 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 non-abrasive 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)

Development of enrichment ideas should be goal-oriented, proactive, based upon the animal’s natural history, individual history, and exhibit constraints, and should be integrated into all aspects of their captive management. Providing the appropriate enclosure designs (e.g., land/water ratios, pool/land designs), substrates, and furnishings for each otter species are essential components of any enrichment program. Enrichment should encourage otters to behave as they would in the wild, as closely as possible. Successful enrichment techniques include, variation of exhibit schedule or exhibit mates (where appropriate only), re-arranging of exhibit furniture/features, complete change of furniture (some of the old should always be retained to maintain the animal’s scent and an element of the familiar), scents, sounds, toys (natural and artificial), herbs, spices, different substrates for digging/rolling, food items, and novel presentation of food items. It is important that enrichment items are not merely thrown in an exhibit and allowed to stay for extended periods – an enrichment program is only successful and useful if actively managed and constantly reviewed to ensure it encourages natural behaviors. The AAZK Enrichment committee provides the follow general guidelines about enrichment:

“The goal of enrichment should be to maximize the benefit while minimizing unacceptable risks. All enrichment should be evaluated on three levels: 1) whether the enrichment item itself poses an unacceptable risk to the animals; 2) what benefit the animals will derive from the enrichment; and 3) whether the manner of enrichment delivery is apt to lead to problems.

A written plan of action that eliminates the most dangerous risk factors while maintaining the benefits of a challenging and complex environment can help animal managers develop a safe and successful enrichment program. Keepers should evaluate new and creative enrichment ideas with their managers and staff from other departments (curatorial, janitorial, maintenance, veterinary, nutritional, etc.) to decrease the frequency of abnormal and stereotypic behaviors or low activity levels, and to fine-tune enrichment ideas. For enrichment to be safely provided, it is strongly recommended that each institution establish enrichment procedures, protocols, and a chain of command that keepers can follow.” (AAZK Enrichment Committee)

The AAZK Enrichment Committee also provides an excellent cautionary list for the various types of enrichment provided (accessed through www.aazk.org). This list includes key questions that should be answered for all enrichment items or programs to assess potential hazards. For example:

1. Can the animals get caught in it or become trapped by it?
2. Can it be used as a weapon?
3. Can an animal be cut or otherwise injured by it?
4. Can it fall on an animal?
5. Can the animal ingest the object or piece of it? Is any part of it toxic, including paint or epoxy?
6. Can it be choked on or cause asphyxiation or strangulation?
7. Can it become lodged in the digestive system and cause gut impaction or linear obstruction?
8. In a multi-species exhibit or other social grouping, could a larger or smaller animal become stuck or injured by the object or get hung up on it?
9. Can it destroy an exhibit?
10. If fecal material is used for enrichment, has it been determined to be free from harmful parasites?
11. Is food enrichment included as part of the animals' regular diet in a manner that will reduce the risk of obesity?
12. When introducing animals to conspecifics or in a multi-species exhibit, are there sufficient areas for them to escape undesirable interactions?
13. Can the manner of enrichment presentation (i.e., one item or items placed in a small area) promote aggression or harmful competition?
14. Has browse been determined to be non-toxic?
15. Do the animals show signs of allergies to new items (food, browse, substrates, etc.)?
16. Does the enrichment cause abnormally high stress levels?
17. Does the enrichment cause stimulation at a high level for extended periods of time that do not allow the animal natural down time in the species' normal repertoire (e.g., constant activity for public enjoyment when the animal would normally be inactive in its native habitat)?

Factors that should be considered when determining how often behavioral or environmental enrichment is offered include the species and individual(s) involved as well as the physical characteristics of the exhibit. Large, complex exhibits with appropriate enclosure designs, substrates, and furnishings may offer ample opportunities for animals to exercise natural behaviors with infrequent enrichment (once daily). Other exhibits or individuals may require more frequent enrichment (multiple times per day). Husbandry staff should monitor all individuals in an exhibit and structure an enrichment schedule for the needs of those animals, providing them opportunities several times a day to interact positively with their environment. Enrichment should never be offered on a regular schedule, instead times, items, and delivery methods should be rotated so there is always an element of novelty associated with each item or activity. It is important to note that the provision of well-designed, complex environments is the foundation of a successful enrichment program. This is particularly true for

some of the more sensitive otter species such as *L. brasiliensis*, but applies to all of the otter species due to their inquisitive nature and high-activity level.

References:

Gabbert, A. 1999. *An "Otterly" Enriching Environment*. Shape of Enrichment. Vol. 8, No. 2, May 1999.

Appendices:

Appendix A: How can a zoo enclosure be enriched – broad concepts

Appendix B: Enrichment items – Tables

Appendix C: AAZK Enrichment Committee, Enrichment Caution List

Appendix A

“How Can a Zoo Enclosure be Enriched?”*

(Excerpt from: Reed-Smith 2001: N. A. River Otter Husbandry Notebook)

Physical Environment

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

Social Environment

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

Occupational Enrichment

- Learning
- Training
- Puzzles

Food

- | | |
|-----------|-----------------------|
| Type | Presentation |
| Novelty | Hidden |
| Variety | Whole Food |
| Treats | Dispersed |
| Delivery | Live Food |
| Frequency | Processing Time, etc. |

The Senses

- | | |
|--------------------------------------|-----------------|
| Auditory | Taste |
| e.g. Taped Vocalizations | Variety |
| Olfactory | Novelty |
| Scents | Seasonal Change |
| Faeces (conspecifics, other species) | |
| Spices | |
| Tactile | |
| Texture | |
| Manipulable Objects | |
| Novelty | |

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

Appendix B: ENRICHMENT ITEMS – Table (Reed-Smith 2001)

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	Mussels	Whole apples/oranges
		Frisbees		
Leaf piles	Tunnels	Tubs of water	Krill	Fruit & berries (incl. grapes, blueberries, strawberries)
		Carpet over board		
Rocks, all sizes for play & manipulation	Stream bed	Rubber-coated heating pad*	Eels – naturally found	Small pumpkins/squash
Knot holes	Running water	Astro turf	Shrimp	Omnivore biscuits
Bark sheets	Jacuzzi-like jets in pool	Floating plastic toys	Aquatic insects – naturally found	Monkey chow
Pine cones		Phone Books		Pigs ears
Mud	Islands in pools	Swim through plastic ring	Mice – naturally found	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*		Hamster ball w/ treat
Turkey feathers		Warm water hose		
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. The same holds true for cardboard.**

The table below lists items used at various North American facilities for behavioral and environmental enrichment of otters.

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

* These items should be monitored for safety.

Point Defiance Zoo and Aquarium, Oregon, USA – ASC otter

Non-food items

- Boomer balls & Jolly balls
- Bowling pins
- Brushes
- Bucket lids
- Beer kegs, feed barrels & trash cans
- Feed bags
- Clover clumps
- Milk crates, Plastic wagons & Plastic logs
- Water cooler bottles
- Grass flats/clumps
- Hang paper maché figures
- Hollow coconut shells
- Oscillating fan, wind chimes, & bubble machine (outside of enclosure)
- Large logs, rearrange furniture, etc.
- Leaves, sand, and rock piles
- PVC tubes
- Towels, clothes, blankets
- Cardboard boxes and tubes (caution needed when using paper products that can become wet)
- Laser pointer
- Nature tapes
- Perfume/body sprays & Glad scented sprays

- Traffic cones
- Hummus
- Ice piles
- Rose petals
- Burlap sacs
- Straw piles
- Reindeer antlers
- Varied of feeding devices & times
- Nyla bones
- Spices and extracts
- Mirror

Food items

- Honey smears
- Blood popsicles
- Cooked chicken
- Crickets
- Horse meat
- Meal worms
- Peanut butter
- Pinkies
- Dry cat food
- Milk bones
- Tuna

Columbus Zoo and Aquarium, Ohio, USA – N. A. river otter/ASC otter

Non-food items

- Bobbin with smelt rubbed on it
- Whole coconuts to roll around
- Yellow pages
- Bengay[™] ointment inside a boomer ball
- Log switching between animal exhibits
- Regular Alka Seltzer[®] in PVC tube (very small holes in PVC)
- Corn stalks
- Blocks of recycled plastic with holes drilled in them to dig food items out
- Crickets in PVC tube feeder
- PVC shaker toys
- Milk crates, cardboard box, use with caution
- Pinecone soaked in scents
- Extracts – vanilla, almond, lemon & spices
- Elephant manure
- Deodorant spray
- Reindeer antlers & pronghorn sheaths
- Paper maché

- Pig ears and cow hooves
- Painting
- Mustard or tomato sauce
- Large black kong toy
- Floating PVC tube to swim through

Food items

- Liver
- Anchovy paste
- Hard boiled eggs, apples, pumpkins, carrots, blueberries
- Gelatin jigglers
- Live crawdads, live trout in pool, crickets
- Frozen smelt ice blocks
- Blood popsicles
- Knuckles
- Beef hearts
- Mice and rats

Appendix: C

AAZK Enrichment Committee, Enrichment Caution List

http://www.aazk.org/committees/enrichment/comm_enrichment_title.php

The AAZK Enrichment Committee offers several useful resources that can be accessed through the web site.

Dietary Enrichment

- Food enrichment, if uncontrolled, can lead to obesity, tooth decay and deviation from the normal diet can cause nutritional problems. Keepers can consult with the nutritionist or commissary staff to determine the best method of introducing novel food items.
- New food items introduced without analysis may cause colic, rumenitis or metabolic acidosis in ungulates.
- Food items can spoil and cause animal illness if left in the exhibit for extended periods of time. Enrichment food items should be removed within a reasonable amount of time to prevent spoilage.
- Animals can have adverse reactions to toxic plants and chemicals. Keepers should be able to correctly discern between toxic and browse plants, ensure that browse is free of fertilizers and herbicides and wash plants to remove free ranging bird and animal feces and debris.
- Foraging or social feedings may give rise to aggression and possible injuries within the animal population.
- Competition for enrichment items may lead to social displacement of subordinate animals. These concerns can be minimized by providing enough enrichment to occupy all of the animals within the population.
- Carcass feedings for omnivores and carnivores may be hazardous if the source of the carcass is not determined and appropriate precautions taken. Diseased animals, chemically euthanized animals or those with an unknown cause of death are not appropriate for an enrichment program. Freezing the carcasses of animals that are determined to be safe to feed to exhibit animals can help minimize the risk of parasitism and disease. Providing enough carcasses in group feedings can minimize competition and aggression within an exhibit.
- Carefully introducing a group of animals to the idea of social feedings can be done by moving carcass pieces closer together at each feeding until the animals are sharing one carcass. This can allow social carnivores to exhibit normal dominance posturing while minimizing the possibility of aggression. During live feedings, prey animals may fight back. Care should be taken to ensure such prey can only inflict superficial wounds on zoo animals.
- Cage furniture may interrupt flight paths or entangle horns and hooves if poorly placed. Careful planning can prevent this.
- If unsecured, some items may fall on an animal or be used as a weapon and cause injuries.
- If position is not thoughtfully considered, limbs and apparatus may provide avenues for escape or may block access into exhibit safety zones, leaving subordinate animals feeling trapped and vulnerable.
- Animals that crib or chew wood should be provided with non-toxic limbs and untreated wood furniture.
- Water features should be tailored to the inhabitants to prevent drowning and ensure that animals such as box turtles can right themselves if they flip over on their backs.
- Animals can be injured in filtration systems if water intake areas are not protected.
- Substrates should provide adequate traction and not cause an intestinal impaction if ingested.
- Caution should be exercised when ropes, cables, or chains are used to hang or secure articles to prevent animals from becoming entangled. Generally, the shortest length possible is

recommended. Chain can be covered with a sheath such as PVC pipe; swivels can be used to connect the chain to the enrichment item to minimize kinking.

Olfactory Enrichment

- Scents from different animals or species can lead to aggression if there is an assertion of dominant animals or subordinate animals attempting to use enrichment to advance their status in the hierarchy.
- Animal feces used for olfactory enrichment should be determined to be parasite free through fecal testing and as with other animal by-products such as feathers, sheds, wool and hair, come from only healthy animals. Many of these items can be autoclaved for sterilization.
- Perfumes can be overwhelming to some animals (and keepers) and are therefore best used in open, ventilated areas.
- Some spices may be too strong or toxic to some animals.

Auditory Enrichment

- When provided with audio enrichment, animals may be less threatened by deflected sounds rather than those directed at the animals.
- Some animals may have adverse reactions to recordings of predator calls and should be closely observed when this type of enrichment is provided.
- Providing the animals with an option for escape or the means to mobilize for confrontation when predator calls are played can lessen the stress of this type of enrichment and allow the animals to investigate the sounds and their environment over a period of time.

Manipulable Enrichment

- Individual parts or enrichment devices may be swallowed resulting in choking or asphyxiation.
- If ingested, indigestible enrichment items may cause a gut impaction or linear obstruction.
- Broken items may have sharp edges that can cut an animal. Only items that are appropriate for the species should be provided. For example, some devices will hold up to the play of a fox but not a wolf
- When building or designing enrichment items from wood, it may be wise to use dovetail cuts and glue rather than screws and nails. Rounded corners and sanded edges can prevent the animals from getting splinters.
- Many paints and other chemicals are toxic if eaten. When providing enrichment involving paint or other chemicals, only non-toxic items should be used.
- If used, destructible items such as cardboard boxes and paper bags should be free of staples, tape, wax, strings or plastic liners. In general the Otter SSP advises against using these items.