THE RIVER OTTER JOURNAL

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I'm the new Grand Canyon River Otter Reintroduction Program Good Will Ambassador!

By "Noah," (as told to Tracy Johnston)

Have you heard about the National Park Service's possible Grand Canyon North American River Otter reintroduction program? Well neither had I, but now I'm the good will ambassador for the project. In June 2000, several groups of park and wildlife officials, scientists and interested parties each spent ten days surveying portions of Arizona's Grand Canyon for the feasibility of a river otter reintroduction program.

The reason for a river otter reintroduction program is a little complicated. It seems there is a species of fish called the Humpback Chub that lives in the Grand Canyon. Unfortunately the Humpback Chub currently faces extirpation by an over-abundance of its two main predators, carp and Rainbow Trout. With the absence of indigenous, natural predators for these fishes—like the Pike minnow or river otter—the Humpback Chub's survival is now in danger. Well guess which of *those two* the American public is most likely to sponsor in a reintroduction program? There's just no contest—it's the river otter! That's why the National Park Service is studying the possibility of reintroducing us back into the canyon.

This is where I come in; in addition to photo opportunities and public appearances to create good will for the program, preliminary plans are being made to study what I would eat while I swim parts of the Grand Canyon. Here's how it would work: I would be "crate-trained" to return to my handler on command. Then I would receive a radio telemetry implant, so I could be tracked and rescued by helicopter if necessary. Then next summer, my handler, a group of scientists and I would travel down the Grand Canyon. (Of course, I would swim and they would follow along in rafts.) Then the scientists would monitor my scat to determine what types of fishes, amphibians and crustaceans I eat along the way. This would assist in determining whether reintroducing my fellow river otters back into the canyon would help control the carp and trout populations, thus aiding the Humpback Chub with its survival. Plus, it would return members of my species back to our natural habitat.

Noah takes a break at a Missouri rest stop.
Photo by Tracy Johnston

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River Otter Alliance Mission

The River Otter Alliance promotes the survival of the North American River Otter *(Lutra Canadensis)* through education, research and habitat protection. We support current research and reintroduction programs, monitor abundance and distribution in the United States, and educate the general public through our newsletter, THE RIVER OTTER JOURNAL, on the need to restore and sustain River Otter populations.

Our goal is to be a center of communications among wildlife biologists, environmental organizations, fishermen, and all interested parties on a national and international basis, in order to ensure the healthy future of the North American River Otter.

Grand Canyon Good Will Ambassador

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While these plans are being made, I'm just getting acquainted with my new home in southwestern Colorado, not so far from the Grand Canyon. While my parents and two sisters still live at the Otter Habitat in York Haven, Pennsylvania, this July I picked up my tail and moved to the Rocky Mountain Ark Wildlife Rehabilitation Center in Telluride, Colorado. With the help of Ark Director, Melissa "Lissa" Margetts and the River Otter Alliance Secretary, Tracy Johnston, I traveled across the country over the July 4th holiday weekend. To somewhat all of our surprise, we managed not to be thrown out of any motels along the way by using side doors in the dark of night and by turning the television up to full-volume to cover my gregarious chirping, squawking and grunting. Of course, I made as much noise as I possibly could. I also made sure to use every last dry towel in the room after all my baths. But fortunately, we made it without incident.

Right now I'm spending the lazy days of summer with my two new best friends, Sushi, a two-year old Asian Small Clawed Otter and Yetti, a two-month-old Canadian Lynx. Times are good here at the Ark; Sushi, Yetti and I play, romp and swim in our enclosure all day long. There are also four other North American River Otters here to keep us company: Jaws, Peewee, Sadie and Sophie. So, I'm just enjoying my summer as a young pup until I am called to duty to represent my species as *The Good Will Ambassador for the Grand Canyon river otter reintroduction program!*

Author's note: Noah has since been renamed "Splash" by the winner of the Telluride Library's "You Otter Read More" children's summer reading program. See the articles on pages 3 and 10-11 for more information on North American River Otters in the Grand Canyon.

Noah (on left) and sister Hannah at 14 weeks old .
Photo by Tracy Johnston

Noah investigates the motel bathroom.
Photo by Tracy Johnston

Noah (a.k.a. Splash, on left) and Sushi at the Rocky Mountain Ark Wildlife Center.
Photo by Tracy Johnston

Splash in the Grand Canyon

Contributed by Rocky Mountain Ark Wildlife Center

Keep your ears open for a splash in the Grand Canyon. This is a special kind of splash. One that wiggles and swims. Listen for the adventures of "Splash" the river otter. Splash is a Telluride local and he resides at Rocky Mountain Ark Wildlife Center with Lissa Margetts. "He is in training," Margetts says for his role as the initial study subject in the possible reintroduction of otters into the Grand Canyon. "He is learning to climb into a kennel on command, walk on a lead and come when he is called." These skills are not necessary if he was to be permanently released into the wild, but that will not be his role in this project. His adventure is proposed to start in the summer of 2001. His job will be to catch and eat fish, frogs and snakes, find bank beaver dams to sleep in and keep a troop of biologists on their toes while following him down the Colorado River, just doing what otters do. He will have a radio telemetry implant under his skin to help in tracking him. "We will have him kennel up every night, weight him, collect his scat and analyze it to see what he is eating."

Lisa Margettes, Splash, and Yetti

Photo courtesy of Rocky Mountain Ark Wildlife Center

Otters are high on the food chain in the river system and are indicators of the health of our aquatic environment. The first conference on otter reintroduction into the Grand Canyon was held at the Museum of Northern Arizona in January. Biologist and representatives from the U.S. Fish and Wildlife, Arizona Division of Wildlife, University of New Mexico, Colorado Division of Wildlife, the National Park Service, and the Colorado Plateau Institute for Natural Sciences all attended. Margetts was invited as an expert on otters and breeding them in captivity. "I figure that with introducing an endangered species into a National Park, by the time everyone lifts their leg and pees on this project to mark it as their own, it may take years before we actually release an animal into the water," says Margetts. "These are just the preliminary proposal stages of a very extensive project. Nothing is final until an otter is permanently released." Grand Canyon National Park and the Northern Arizona University Aquatic Research Center have already financed preliminary aquatic biology surveys down the canyon this summer to determine the potential for adequate otter habitat. Ms. Margetts was asked to take part in one of those ten-day trips. "It is a chance of a lifetime to be involved in this from the ground up. The raft trip was not just for fun. We tested water, counted Cladophora and Nematodes, photographed beaver dams and seeing as how this was a working trip and we were on the job, we wore ties every day with our swimsuits."

Ph.D. candidate Lee Ann Compton has submitted a grant proposal to the National Park Service for doing a food preference study using Margetts' other otters. This study will provide solid evidence upon which to make predictions on the impact of otters on the native fish populations in the canyon. Telluride Liquors has started an EnviroCents fund drive and the otter is the first recipient. So if you see an otter on a harness in town, he's in training; give him a pat and a sardine, and put your change in the donation cans and listen for a "Splash" in the Grand Canyon.

Partnership

From a book of Burmese Folk Tales by Helen G. Tracer (1968)

An otter and a coyote lived near a river, and after awhile decided to form a partnership. They agreed that they would pool all the food each was to gather, and that they would share it equally at the end of the day.

On the first day of their partnership, the otter caught some crayfish, and the coyote caught a carp. The food was shared equally, and the partners were satisfied.

On the second day, the coyote caught a fish stranded on the sand bar, but the otter had an off-day and could find nothing. Faithful to the agreement, the coyote shared the carp with the otter.

On the third day, the coyote had no luck at all, but the otter went fishing and succeeded in catching a huge trout. Now, as the otter was greedy, he announced, "I will cut the fish into four parts. I will take the head and the belly, and you can take the rest."

"Be fair," replied the coyote, "I shared my catch equally with you yesterday."

"And I am sharing the fish equally with you, also," argued the otter. "You will get two pieces and I will get two pieces."

"But you intend to take the tastier parts," protested the coyote.

"Remember, it is I who caught the trout," boasted the otter and they argued for a long time, getting nowhere, until they agreed to ask the mountain lion to help them settle their disagreement.

The wise mountain lion listened patiently to the evidence presented by each one. Then, taking a sharp stone, he cut the fish right down the center from head to tail into two equal parts. "Now both of you shall have a piece of the fat belly," he explained, "and both of you shall have a piece of the tasteless tail."

So the otter and the coyote went away quite satisfied, and they lived in happy partnership for many days.

— Contributed by John Mulvihill

North American River Otter
Photo by Tracy Johnston

North American River Otter Diet

By Judy Berg

Editor's Note: The following is an excerpt from Judy's contribution to the IUCN Otter Action Plan 2000 (currently in press). The Otter Action Plan serves fundamentally as a guide and reference for individuals, institutions, and nations who are engaged in activities with the various otter species of the world.

The diet of river otters in North America has been aptly reviewed by Toweill and Tabor (1982) and later by Melquist and Dronkert (1987). These authors reviewed published data covering North America from the east coast to the west coast. The methodology most often used was the frequency of occurrence of food categories in comparing the different studies. Diet analysis came from scats (spraints), or from the contents of intestines, stomachs, or complete digestive tracts. Since the above reviews, more recent data has been published by Manning (1990), Serfass et al (1990), Mack (1994), Reid et al (1994) and Berg (1998). The results of most research conducted in North America have shown that the river otter diet is composed primarily of fish. This is the case for fresh water otters and those living in the marine environment (Stenson et al 1984).

Although all authors agree that river otters are opportunistic feeders, according to Melquist and Dronkert 1987:633 "River otters consume prey that provide adequate caloric benefits from a minimal amount of energy expenditure." Therefore, Toweill and Tabor 1983:695 stated that "...abundant slow-swimming fish species will be selected as food by otters more often than their abundance in the water would indicate." Slow-moving fish include the forage or non-game families such as Catos-tomidae (i.e., suckers), Cyprinidae (i.e., minnows), and Ictaluridae (i.e., catfish). This is further substantiated by Melquist and Dronkert's review and by studies published since (Manning 1990; Serfass et al 1990; Mack 1994; Reid et al 1994; and Berg 1998). Game fish such as the Salmonidae family, comprise a smaller portion of the otters' diet and are taken in lesser numbers than their abundance in the waters (Toweill and Tabor 1982; Melquist and Dronkert 1987).

Other prey consumed by otters include crustaceans, mollusks, amphibians, insects, birds, and small mammals. Across North America, where and when crustaceans are locally abundant, especially crayfish, otters may utilize them to a greater degree. Crayfish are an important part of their diet during the summer months in the interior regions and western coast (Manning 1990; Serfass et al 1990; Mack 1994; and Berg 1998) and during the winter months in north-eastern Alberta Canada (Reid et al 1994) and in the southeastern United States (Chabreck et al 1982; Cooley 1987). In the beaver swamps of Arkansas, crayfish dominate their diet in both winter and spring (Tumlison and Karnes 1987). In the coastal regions where crabs occur, otters will forge on them (Chabreck et al 1982; Modafferi and Yocum 1980; and Toweill 1974) except in British Columbia where they were considered to be a food item only when fish were rare (Stenson et al 1984). Mollusks have been reported as an infrequent primary prey in some locations but may actually be a secondary prey item ingested from a preferred otter fish source, Catostomidae (Reid et al 1994). Amphibians, particularly frogs, have been reported in the otters' diet especially in the eastern half of the United States (Toweill and Tabor 1982 and Melquist and Dronkert 1987). Otters feed on insects both as primary prey and secondary prey from consumed fish. Reid et al (1994) studying otter diet in northeastern Alberta Canada, found insects to be the second most heavily eaten prey group behind fish as the first, especially during the summer months.

Avian species are a food item in some regions of the country, particularly in the coastal regions of the United States and portions of Canada. Birds most often taken are waterfowl (Toweill and Tabor 1982; Reid et al 1994) and, along the Pacific Coastal areas, also some colonial ground nesting birds (Quinlan 1983;

Melquist and Dronkert 1987). This may be a seasonal preference when these bird species are most abundant.

Mammals have been reported infrequently in the otters' diet (Melquist and Dronkert 1987; Serfass et al 1990; Reid et al 1994) but are not a major food source. They most often include small mammals and/or riparian species.

Some of the seasonal variation in the otters' diet during winter in the colder climates of North America is determined not only by prey abundance but also by habitat conditions that control otters' access to air and water when ice covers the waterways (Reid et al 1994). Also, the spawning seasons of various fish species determines their predation by otters depending primarily on the depth of water used and the species speed and agility (Reid et al 1994).

North American River Otter
Photo by Melanie Haire

According to Serfass et al (1990), adult otters can consume 1 - 1.5 kg of fish per day. Fish in the coastal regions of British Columbia taken by otters were in the mid-size range with the majority being 15 - 35 cm in length (Stenson et al 1984). In inland areas of the United States, otters consumed various aquatic prey ranging from 2 - 50 cm in length with prey from the major fish families being larger than 30 cm (Melquist and Hornocker 1983), except in Wisconsin where they consumed fish mainly 7.5 - 20 cm in length (Beckel 1990).

Editor's Note: Contact the River Otter Alliance for article references.

President's Message

Judy Berg

To the Native American cultures, the otter represents joy, playfulness, and sharing. Yes, otters do give us feelings of joy when we are fortunate to observe them, whether in the wild or under appropriate conditions in captivity. Even if we just find their signs in the natural world, we can use our imaginations to 'see' them behaving…and if we will admit it, we also can feel like joining them in their playful antics.

During my years of river otter research I was fortunate to observe them in the wild on a few occasions and 'see' them through their signs on others. That time is irreplaceable, and was enough for me to decide to make another and different contribution that, hopefully, will contribute to the assurance of their future survival. Towards that goal, David and I have moved to a place which may help me achieve that contribution. We now live in the magical world of red rock country in Sedona, AZ. This is a retreat where people, engaged in various art forms and imagination levels, live and work encased within Mother Nature's womb.

Although river otters are listed as being able to occur on Oak Creek, which flows through Sedona, according to Red Rock State Park officials they have not been documented. The creek does flow throughout the year and through some healthy riparian habitat, but fluctuations in water depth and other issues about which we don't know may prevent the otter's existence in this area. However, further north where the Colorado River flows through the Grand Canyon, there may be a future otter reintroduction attempt. (See stories on pages 1-3 and 10-11, and look for future articles in our Journal on this reintroduction.) If this does occur, one or two may decide to search for another water source (with difficulty) and come to our area of the world. In the meantime, my imagination will bring them to me.

River otters do give so much to us all, from feelings of happiness to being a high-level indicator species of problems in our great 'Medicine Waters.' Now we can all give something back to them. We can contribute to our Journal. Whether a few words or many, an anecdotal personal experience or scientific information, your articles are appreciated by our readers. By sharing with others our knowledge about otters, by educating others on their value, by studying some aspect of their life (or their death), or by preserving their natural environment, each one of us can make a difference.

We can renew our memberships or become new members. We can all give input to our River Otter Alliance as to how our group can do more to contribute to the otters' survival. Please share with us your responses to the idea about an education box to be sent to schools or environmental institutions! (Please refer to the President's Message in the Spring 2000 issue.)

Remember, joyfulness and sharing are special gifts from the otters to us and, in return, to them from us. Please make your difference in their survival.

— Judy Berg, President

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Visit the River Otter Alliance Web Page at www.otternet.com/ROA

Otter Updates

By Tracy Johnston

• Melanie Cain-Sage, Curator of the Humane Association of Wildlife Care & Education Inc. (H.A.W.K.E.) rehabilitation center in Elkton, Florida, is compiling and analyzing data on the causes of death in North American River Otters. The purpose is to aid in the prevention of unnecessary otter deaths by publishing the findings in articles and eventually a book. If you have information—such as necropsy reports or findings—please fax them to Melanie at 904-692-4755. She can also be reached by telephone at 904-692-1777.

• Friends of the Sea Otter and the International Otter Survival Fund report severe and unexplained declines in the Alaskan (90%) and California (12%) sea otter populations over the last five years. While the 2000 spring census of the California sea otter was encouraging, the situation of Alaskan sea otters is critical. U.S. Geological Survey sea otter expert, Dr. James Estes, and colleagues suspect the reason for the decline in the Alaskan sea otter population may include a dramatic increase in killer whale predation upon sea otters due to declines in Steller sea lion and harbor seal populations. The decline in sea lion and seal populations appear to be a result of regime shifts and over-fishing of critical fish resources.

• In a May 29, 2000, e-mail broadcast, International Otter Survival Fund Head of Operations, Paul Yoxen, reported "We have just heard from our Asia coordinator, Dr. Padma da Silva, that the hairy-nosed otter has been found by Dr. Dang and Dr. Anh in the U Minh Ha area of Vietnam. This is an area of 11,000 hectares of natural peat swamp forest, replanted Melaleuca forest and swamps, which the Vietnam government plans to make an international reserve." Until three one-month-old hairy-nosed otters were found in Thailand last year, the species was thought possibly to be extinct. (See "Otters in Asia" and "The Hairy-Nosed Otter in Thailand" articles in the Spring 2000 issue of The River Otter Journal.)

Hairy-Nosed Otter
Photo courtesy of Jan Reed-Smith

• The VIII International Otter Colloquium will be held in Valdivia, Chile, January 20–25, 2001. According to the Otter Colloquium web page (www.ottercolloquium.cl/), the seminar is "oriented to all people, especially biologists, conservationists and friends of otters who work, have experience or are interested in the conservation of biodiversity, wetlands, otter communities, marine and freshwater ecosystems, and also people who work, have experience or are interested in the change of human attitudes toward the nature and its biodiversity." Additional information is available on the Colloquium web page or by contacting:

Dr. Gonzalo Medina Vogel
Instituto de Ecologia y Evolucion
Universidad Austral de Chile
Castilla 567
Valdivia, Chile

Phone: +56 63 293061 (office)
Fax: +56 63 221344
Cell: +56 09 4688932
E-mail: gmedina@valdivia.uca.uach.cl

• Antony Taggart, Executive Director of Zoo Peru Inc. is soliciting ideas, thoughts and funds to build a new giant river otter exhibit at the Quistococha Zoo, located in the northern area of Peru. The zoo houses only native animals which have been brought to the zoo through confiscations and donations. The new otter exhibit will incorporate part of the zoo's lake and a large section of rainforest. A type of cyclone wire mesh will act as an external barrier for the otters, but will allow most fish to pass freely in and out of the exhibit allowing a constant fresh food source to enter the enclosure. For more information, contact Mr. Taggart by e-mail at: zooperu-inc@mailcity.com.

• Alabama hairdresser Phil McCory was inspired to discover a unique way to remove crude oil from water after watching news footage of a sea otter furiously attempting to clean oil from its fur following the *Exxon Valdez* oil spill. McCoy reasoned if fur could soak up oil, then so could human hair. He successfully tested his hypothesis in his son's wading pool by using a pair of his wife's pantyhose stuffed with hair clippings from his salon. The success of McCory's theory has since been confirmed at NASA's Marshall Space Flight Center and Texas A&M University. His original concept has now evolved into a two-sided "hair mat" that can vary in size and is produced easily with a needle punch machine. The oil absorbed into the reusable mats can be extracted and recycled. McCory is currently searching for a manufacturer.

Remembering Why

By Kurt Butkiewicz

As a fortunate individual who was blessed with a 10+ year career working with exotic animals, I became somewhat accustomed to living a unique experience each day. Enhancing most of these days were the antics of the otters in our collection. Having been out of the animal-field limelight for about 2 years now, I keep this passion close through networking and occasional educational presentations. More directly, I continue to experience this lifestyle in a quieter way; by spending time outdoors cherishing the wilderness and all of its inhabitants. It is in these natural surroundings that I believe I have discovered the true reward behind my past career.

Living in New England, my outdoor activities include whale-watches and seal spotting, along with the typical hiking, camping, fishing, bicycling, photography, etc. As I am certain many of you can relate, the sounds of birds and squirrels, the occasional deer in the distance, the spray of a whale spouting, or the sight of a seal pup nursing draws my attention, makes me *awe,* and gets filed away with many other memories. That is, until recently.

It was dusk during a fishing trip at a small reservoir in Rhode Island. My partner and I were on shore at a small opening in the cattails. The birds were growing quiet and the big fish were just starting to bite. We were getting into a groove; cast and reel, cast and reel, when suddenly our rhythm was disrupted. A rustling noise occurred not twenty feet from where we stood. We knew of deer and raccoons in the area, as well as coyotes and skunks. We hoped to see either of the former. After several moments, reality hit: it was none of those that we suspected. As you have probably guessed by now, it was an otter. While we were the only people on the water at this hour, we weren't the only creatures knowing that this was prime shore-fishing time.

Standing quietly, in awe, we simply watched as the otter scratched near tree roots, rolled in the grass, then shot into the water with only the slightest ripple on the surface. Momentarily lifting its head high above the water, it was evident that we weren't the only ones going home with fish stories this evening; its mouth was empty. Our stares were affixed as several more unsuccessful attempts finally resulted in a catch. It was a chain pickerel. A tubular, bony type of fish measuring about 11 inches. The otter swam nearby and hauled its catch just far enough ashore to begin tearing at it without risk of the fish getting away. With a new excitement, we chose not to disrupt the events and prepared to continue on with our own fishing efforts. That is, until another noise arose.

Otter at Aquarium of Niagara in Niagara, NY.

Photo by Kurt Butkiewicz

Another noise was another otter. This otter ignored the presence of the first, making me assume that they already knew each other. This otter was either a more experienced hunter or just lucky; in my fishing time I've come to believe that it's all the same. In any case, it caught a fish on its first dive entering the water, swam a bit further away, and disappeared into the trees with its bounty. Finishing its savory meal of pickerel, the first otter took chase into the woods and they both vanished, unseen again by us the rest of that evening.

Several minutes later, coming out of our shock, we discussed the events described and the point that both otters seemed oblivious to our presence. Did they realize that we were there? Did they know it but sense we were harmless to them? Did they think we wouldn't notice them or maybe think they could get away if we were to threaten them? I didn't have the answers then and surely never will. What I do know is that I learned something very important from that night's events.

I reflect back and see how awe-struck I really was. I couldn't have taken my eyes off of those little furry creatures that evening for anything. At first I laughed at these feelings from someone like me; someone who has held, fed, cleaned, and often played with this same type of animal. I thought that maybe my shock was because of the setting. Maybe it was because I did not know these particular otters. Maybe it was because the whole occurrence was so unexpected. Then I realized it was all of these and more.

Experience had made me oftentimes stale to such occurrences. I have experienced so many different natural-setting activities and have dealt with so many animal issues during my career, my mind had become numb to the reality of what I worked with for all of those years. Now being caught off guard in this situation, I was able to experience these creatures in a way that I always worked so hard to portray to visitors and students. I was reminded why I feel so passionately about my many animal experiences. I was reminded why I enjoy sharing every aspect of any animal with others. I was reminded why everyone I ever presented animals to had a certain look in their eyes.

Working with animals is not about a daily routine. It's about much, much more. It's a chance to share each experience with others caught in the *awe* of the moment. Working with otters, or any sort of animal, is truly a special opportunity. Now I remember why.

Responses of River Otters to Oil Contamination: A Captive Study

By Merav Ben-David, Dept. of Zoology and Physiology, University of Wyoming and the Institute of Arctic Biology, University of Alaska Fairbanks.

The controversy surrounding the rehabilitation of oiled wildlife is fueled by our emotional need to assist animals that were affected by our actions (i.e., oil spills) and our meager knowledge of the success of our rehabilitation efforts. Unfortunately, contamination of marine, terrestrial, and freshwater ecosystems by petroleum hydrocarbons has become a recurring, worldwide problem, with no end in sight. Numerous spills of various magnitudes leave in their wake dying and suffering wildlife. Annually, numerous professional and volunteer hours, as well as large sums of money, are spent on rehabilitation of animals following oil spills, and yet professionals faced with the dilemma "to rehabilitate or euthanize" have little information upon which to base such a decision. Making this decision will require knowledge of the physiological effects of exposure to crude oil on the animals, the feasibility of cleaning and nursing the animals to good health, as well as the potential survivorship of the rehabilitated animals after release back in the wild.

Numerous studies on fishes, birds, and mammals investigated biomarker responses (i.e., liver-enzymes and other blood proteins indicative of physiological damage) to crude oil of individual animals, population-level responses (i.e., declines in number of animals in contaminated areas), as well as established protocols for cleaning and rehabilitation. Nonetheless, because these studies failed to explore the relations between physiological damage from petroleum hydrocarbons and performance of daily tasks by animals, or post-release survival of rehabilitated wildlife, information from these studies would give professionals little assistance in determining the fate of oiled animals during a future oil spill.

Investigations in Prince William Sound, Alaska, following the *Exxon Valdez* oil spill in 1989 revealed that coastal river otters *(Lontra canadensis)* on oiled shores had lower body mass compared with otters living on nonoiled shores. Otters from oiled shores had higher levels of several liver enzymes and blood proteins (i.e., biomarkers), than did otters from nonoiled habitats. In addition, otters from oiled areas selected different habitat characters, had larger home ranges, and less diverse diets than those in nonoiled areas. These observed differences between river otters from oiled shores and those from nonoiled areas suggested that oil contamination had an effect on physiological and behavioral processes in these coastal otters. Nonetheless, although these data strongly indicated a correlation between oil contamination and physiological stress in river otters, this evidence was largely circumstantial. Also, it was difficult to assess from the data collected in Prince William Sound whether the damage was a direct result of oiling or a secondary response to food limitation. Lastly, it was unclear from these studies what would be the success of rehabilitation and post-release survival of oiled river otters in future oil spills.

A group of otters cuddling and grooming on top of a sleeping box at the Alaska Sealife Center

Photo courtesy of Merav Ben-David

To establish the effects of exposure to petroleum hydrocarbons on physiology and behavior of river otters and to test the success of post-release survival, we initiated a captive study at the Alaska Sealife Center in Seward, Alaska, in which oil was administered to river otters under controlled conditions. Our goals were to determine: 1. Which liver and blood enzymes respond directly to oil administration; 2. How the ensuing physiological damage would affect the ability of otters to dive and catch fishes; 3. How long would rehabilitation take; 4. How well will the otters survive in the wild after release; and 5. Which factors will affect their survivorship.

We live-captured fifteen wild, adult male river otters in 4 nonoiled areas in western Prince William Sound. The otters were transferred under sedation via air to the Alaska Sealife Center (ASLC) in Seward, Alaska, where they were held in captivity from May 1998 to March 1999. Because male river otters in coastal environments usually occur in large groups (up to 21 individuals) we opted to house the otters as one large group in an area of 90 square meters surrounding 5 saltwater pools. This area was divided into 9 smaller enclosures that could be sealed off in case the need to isolate an animal from the rest of the group occurred. Thirteen plywood boxes lined with fleece blankets were stationed throughout the enclosure and blankets were replaced, washed, and dried every day. Totes with fresh water for drinking and washing were provided and cleaned and refilled daily. We individually marked the otters by cutting their fur in a small unique pattern on their back, nape, or flanks.

The otters quickly adjusted to the enclosure and established sub-groups within the artificial settings we provided. Play, mutual grooming, and cuddling were quickly established.

One of the enclosures contained a large pool (4.5 m diameter by 3 m depth). In this pool, we offered the otters live fishes (adult pink salmon, kelp greenling, and rockfish) two to three times a week. We had three reasons for offering the otters live prey. First, we wanted to provide the otters with as much activity as possible to ensure their adjustment to and well-being in captivity. Second, we wanted to ensure that the otters would maintain their hunting instincts so that their post-release survival would not be compromised. Third, we used the hunting sessions to determine the effects of damage from oil on the otters' ability to dive and catch fishes. In addition to the live prey, otters were fed frozen fishes on a daily basis and diet was supplemented with vitamins and minerals.

We started administering the oil in August, allowing the animals 2.5 months to acclimate to the enclosure, feeding regimes, and handling. At the end of this acclimation period, otters were assigned to 3 experimental groups of 5 individuals each. The control group received no oil. This group provided us with baseline information on the response of otters to captivity without the additional effects of oiling. The low-dose group received 0.1 g of oil every other day. This amount of oil was still present in mussels in Prince William Sound in 1996, seven years after the spill. This group provided information on the responses of otters to low levels of long-term oil contamination in the environment. The high-dose group received 1 g of oil every other day. This amount of oil was present in mussels in Prince William Sound shortly after the spill. This group provided information on the responses of otters to acute levels of oil contamination.

We weathered (comparable to 2 weeks weathering) Prudhoe Bay Crude oil in the lab and fed it to the otters in gel capsules hidden in fishes. Fishes were hand-fed to each otter to ensure that each animal received the appropriate dose. Oil feeding lasted 100 days from August 21 to November 28, 1998. Data collection continued for 100 additional days of rehabilitation until March 8, 1999. ASLC veterinarian closely monitored the health of the animals, and appropriate medications were provided during the acclimation, experimental and rehabilitation period. Interestingly, an outsider observing the otters would not have been able to decide which animal belonged to which experimental group. Externally, no visible responses to oiling were noticeable.

An otter feeding on a kelp greenling it just caught in the large saltwater pool at the Alaska Sealife Center.

Photo courtesy of Merav Ben-David

Prior to the exposure to oil, a series of tissue sampling, diving physiology, and behavioral observations on foraging behavior and success was conducted on each individual otter. Additional sampling sessions were conducted every 3 weeks until March 1999. For each sampling session, otters were sedated with Telazol or Ketamine with a dart and a blow-gun. The biomarker responses of the captive river otters to oil ingestion provided mixed results in relation to our expectations. Several parameters such as hemoglobin (and associated red blood cells) and white blood cells, decreased in the oiled animals compared to controls. Other enzymes and proteins increased in the oiled ones. However, several of the enzymes and proteins we measured exhibited no relation to oil administration. With the results from our captive study, we are now able to conclude that these parameters did not increase in the wild river otters from oiled shores of Prince William Sound because of direct contact with petroleum products, but rather from other environmental conditions related to the spill.

More importantly, our results suggested that opposing physiological processes were concurring in the oiled otters. Elevated production of some enzymes resulted in reduction in others and masked the direct effects of crude oil. We were able to alert other professionals that the use of an individual biomarker as indicator of exposure to pollutants may lead to erroneous conclusions because interactions in live animals can be complicated and act in opposite directions.

We were also able to determine that ingestion of oil influenced the function of the otters' gut. Our data indicated that oil ingestion reduced the retention time of food in the gut (i.e., shorter time between consumption and defecation). This reduction in retention time resulted in lower absorption of the fat portion of the diet in the oiled otters, including the petroleum hydrocarbons. Thus, it seems that the ingestion of large quantities of weathered crude oil could reduce absorption of oil hydrocarbons causing a reduction in their toxic effects. While this is a positive effect, reduction in retention time of food and reduction of fat absorption is likely to negatively affect body condition of animals in the wild. This may explain our observation that coastal river otters on oiled shores of Prince William Sound had lower body mass compared with otters living on nonoiled shores.

To establish the effects of the physiological damage on exercise physiology and diving ability, we measured oxygen consumption in the captive otters exercising on a motorized treadmill. We also observed diving and foraging behavior of otters offered live fishes. We suspected that the oiled otters would perform poorly compared with the controls because the exposed otters became anemic relative to controls (i.e., suffered from reduction in hemoglobin levels). We found that exercising river otters with decreased hemoglobin levels consumed more oxygen than ones with normal hemoglobin levels did. These otters could not transport as much oxygen in their blood and had higher breathing and heart rates than nonoiled otters. This translated to a nearly 40% increase in energetic cost of their terrestrial locomotion. Oiled otters also performed fewer dives when chasing fishes, representing a potential decrease of 64% in capture rate of prey. For wild free-ranging river otters, such increases in energetic costs and decreases in capture success of prey may tip the scale between life and death. Our data strongly support the idea that changes in behavior of oiled river otters following the *Exxon Valdez* oil spill in 1989 were influenced by oil induced reduction in hemoglobin, the associated increases in energetic costs, and reduced diving ability. Oiled river otters from Prince William Sound included more slow intertidal fishes and crabs in their diet. These prey types would be easier to catch for otters that suffer from reduced diving ability.

At the end of the rehabilitation period (i.e., 100 days) the otters were deemed in good health and ready for release. On February 22-24, 1999, the otters were surgically implanted with radio-transmitters which were fitted with mortality sensors. Animals were kept in the facility for 4 additional weeks until they fully recovered from the surgery. On March 21, 1999, the animals were released at the site of their original capture in Prince William Sound, and aerial monitoring began 5 days after release and continued on a biweekly bases until June, 2000.

Of the 15 adult male river otters, 2 animals survived, 10 died, and 3 were missing at the end of 442 monitoring days. This translates to a 17% survival rate, which is significantly lower than that of wild river otters that we have been monitoring between 1997 and 1999 (76%). Causes of mortality in the newly released otters were mainly accidents, predation, and starvation, while the wild otters seemed to succumb mainly to starvation. Oiling group, age, location of release, or body condition (i.e., % body fat), did not influence the fate of the otters. Hemoglobin, however, seemed an important factor. Animals with lower hemoglobin levels died sooner after release compared with animals with higher hemoglobin levels, although all animals had what veterinarians established to be normal levels for captive river otters. This result fits well with our con-

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Status of Southwest River Otters, Lontra Canadensis Sonora, in the Colorado River through Grand Canyon National Park

By Lee Ann Compton, Northern Arizona University Department of Biology

History of Taxonomy

The taxonomy of the Lutrinae has undergone several changes. Early classifications of this group recognized as many as nineteen species and sixty-three subspecies. Corbet and Hill (1980) identified four genera and thirteen species. This classification seems to be commonly accepted (Mason 1990). An additional change was made to the taxonomy when van Zyll de Jong (1987) provided evidence that the New World river otters should be separated from *Lutra* into the genus *Lontra*. Otters found north of the U.S.-Mexico international boundary are northern river otters, *Lontra canadensis* (Hall 1981). The southwest river otter, *Lontra canadensis sonora*, is considered the only naturally occurring subspecies in Arizona and the remainder of the Colorado River drainage (Cockrum 1960; Hoffmeister 1986). This subspecies historically occupied the Gila and Salt rivers and their major tributaries. The original designation of this subspecies was based on Mearn's (1891) examination of three specimens taken from Arizona and housed at the American Museum of Natural History. Rhoads (1898) used those descriptions to designate the subspecies *sonora*. The taxonomy is controversial due to the limited number of specimens, but is generally based upon size and geographic isolation. The Sonoran subspecies is the second largest of the seven currently recognized subspecies. The skull of the Sonoran subspecies is larger and more angular in shape as well as being flatter and less convex with inflated tympanic bullae (Hoffmeister 1986). The only published account questioning the subspecies designation is by van Zyll de Jong (1972) who states that more specimens are necessary to confirm its distinctness. Current studies are investigating the genetic variation among *Lontra canadensis* from the southwest using museum specimens (P. Polechla, per comm. 1999).

Historical Distribution and Status

The historical and current distribution of *Lontra canadensis sonora* is difficult to document for several reasons. Otters are notoriously secretive in nature and not as easily observed as more terrestrial mammals. Additionally, they have never existed in great densities in this arid region (Jenkins 1983; Cockrum 1960). To date, a total of only six specimens of this subspecies have been collected and there are very few other substantiated sightings (Table 1). *Lontra canadensis sonora*, previously identified as a Category 2 animal by the U.S. Fish and Wildlife Service, has no current federal status. In the late 1980's *L. c. sonora* was considered for endangered status but it was determined at that time that there was insufficient evidence to support the existence of the separate subspecies (Bates 1988). The Arizona Game and Fish listed the Sonoran subspecies as threatened in 1988, but that list has since been replaced.

Colorado, Nevada and California consider *Lontra canadensis sonora* to be extirpated from their portions of the Colorado River drainage (Bradley 1986). Otters have been considered rare and have been totally protected in Utah since 1899 (Rawley 1982). New Mexico has conducted surveys along portions of the San Juan River to document the presence of otters in that portion of the Colorado drainage, but these surveys have not yielded any otter sign to date (Polechla 1999 pers. comm.).

The earliest published account of otter's existence in Arizona is from 1889 by Vernon Bailey of the U.S. Biological Survey (Merriam 1890). Throughout the late 1800's and continuing up to the early 1970's there were several reported sightings of river otters in the Colorado River drainage. From the 1970's to the early 1990's there were fewer otter sightings reported and none substantiated. There have been several explanations offered as to why otter populations have declined. It is generally accepted that there are a multitude of contributing factors including; changes in water quality, habitat degradation, human encroachment, changes in native fish species composition, hunting and trapping (Britt and Phelps 1980; Spicer 1987; Bich 1988). Bich (1988) also indicated that areas with severe water fluctuations were unfavorable otter habitat. Additionally, early observations of otters in the Grand Canyon near the confluence of Bright Angel Creek show that otters occupied the area only during the winter and early spring, but were not seen during the late spring floods (Spicer 1987). Some authors have concluded that the present day regulated conditions of the Colorado through the Grand Canyon may be more favorable for otters (Carothers and Brown 1991).

Reintroductions in the Colorado River Drainage

The history of the Sonoran subspecies becomes even more confused by the introduction of different subspecies of river otters into the Colorado River drainage (Figure 1). Between 1978 and 1991, one hundred and forty-one non-native otters have been released into the Colorado River drainage at four different localities. Two reintroductions

Colorado River Otter Reintroduction Program

Photo by Jerry Claassen

have occurred in Colorado. Between 1978 and 1984, forty-five otters were released into the headwaters of the Colorado River in Rocky Mountain National Park. Between 1988 and 1991, twenty-seven river otters were released into the Dolores River. Both of these reintroduction efforts reported success and significant dispersal from release sights (Beck 1991). The state of Utah successfully released twenty-three river otters into the Green River between 1989 and 1990. Arizona has also released river otters into the Verde River. Beginning in 1981 through 1983, forty-six animals (Christensen 1984) were released into that system and the populations appear to be self-sustaining (Hanna et al. 1994). The Verde River is part of the Colorado River drainage but it is unlikely that these animals could disperse beyond the less hospitable portions of the Gila River.

Observations from the Grand Canyon

Fossil remains, taken from Stanton's Cave in the Grand Canyon, indicate that river otters occurred along the Colorado River as early as 10,000 years before present (Mead 1981). From 1889 when Vernon Bailey reported his sighting till present, there have been few but consistent observations of river otters in the Grand Canyon. Figure 2 outlines the number of reports during these years. These reports range significantly in reliability (Spicer 1987), but none of them can be unquestionably confirmed. There have been no specimens or photographs of otters from the park, however, four photographs of possible otter tracks do exist. In 1946 E.T. Cook, a gauging station attendant at Phantom Ranch took a photograph of otter tracks (photo on file at GCNP). Ruffner et al. (1978) observed and photographed "indistinct" tracks in 1975, but those were never confirmed as otter (photo with author). A track observed in 1982 by Larry Van Slyke was also photographed, but is unclear (photo on file at GCNP). In 1985 Larry Stevens collected a scat sample from the Grand Canyon that was initially identified as otter by Kerry Christensen, but has not yet been analyzed or confirmed (Stevens pers. comm. 1999). Most recently, in 1999, a photograph of a possible otter track was taken by Elaine Leslie (GCNP biologist) but has yet to be confirmed (Leslie pers. comm. 2000).

The Future of River Otters in Grand Canyon National Park

Since reintroductions of otters into the Colorado River drainage began in 1978, it is possible that observations from the Grand Canyon since that time are a result of dispersed animals from other locations. It is also possible that remnant populations of the Sonoran subspecies still occupy that area. Grand Canyon National Park has a survey scheduled for June 2000. If otters are observed, or even trapped, it is unlikely that scientist will be able to determine subspecies classification since the designation of sonora is based on skull morphology and measurements. There are many questions that still need to be addressed before reintroduction or recovery efforts should be made in this area. It is essential that reasons for river otter population declines be examined. Some scientists (Polechla pers. comm. 1999; Austin pers. comm.; Speicer 1987) believe that it is important to conduct more extensive surveys of other possible remnants of native populations such as the White Mountains of Arizona.

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Editor's Note: Contact the River Otter Alliance for article references.

Responses of Otters to Oil Contamination: A Captive Study

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clusion regarding the effects of hemoglobin levels on energetic costs and diving ability. It is possible that animals with lower hemoglobin levels expended more energy, became weak, and thus were more prone to encounter predators and experience accidents. Alternatively, it is possible that the extended period the animals spent in captivity made them less wary of natural hazards.

The results of our study would hopefully provide other professionals with tools with which to make the decision "to rehabilitate or euthanize." Although the responses to oil contamination differ from species to species, a general pattern can be discerned. Exposure to oil may result in a significant physiological damage, but rehabilitation may be achieved even with exposure to high levels of hydrocarbons. Animals that will require an extended period of rehabilitation in captivity will likely perish following release and should be either maintained in captivity or humanely euthanized. In the wild, even low levels of exposure to hydrocarbons may cause significant increases in energetic costs and reduction in foraging success—especially for diving mammals and birds—and thus release of rehabilitated wildlife in previously contaminated areas may prove detrimental to their subsequent survival.

For us, exposing river otters to petroleum hydrocarbons was an emotionally difficult task. We have been working with these animals in the wild since 1989 and have captured, handled, and observed over 160 individuals through the years. Naturally, we developed an affection and appreciation for these fascinating animals. We hope that wildlife professionals will rely on our findings in making their rehabilitation decisions, and that the industry and regulating authorities will make efforts to minimize the occurrence and magnitude of oil spills.

The River Otter Alliance is a non-profit, tax-exempt group which is organized to promote the survival of the North American River Otter *(Lutra Canadensis)* though education, research, reintroduction, and habitat protection.

All work and efforts for this organization and newsletter are on a volunteer basis by those who share a common concern for the welfare of the river otter and its habitat. We invite all interested persons to contribute their time at any level of the organization.

The River Otter Alliance

6733 South Locust Court
Englewood, Colorado 80112

INSIDE:
The Autumn 2000 update on the Grand Canyon river otter reintroduction program, research news, and interesting stories!