Northern River Otter

Lontra canadensis (Schreber, 1777)

Margaret K. Trani and Brian R. Chapman

CONTENT AND TAXONOMIC COMMENTS

The Nearctic northern river otter was recognized as distinct from Eurasian genera by van Zyll de Jong (1972, 1987). Wozencraft (1993) and Baker et al. (2003) followed van Zyll de Jong in using *Lontra* as the generic name. However, some authors (e.g., Whitaker and Hamilton 1998) continue to place the species in genus *Lutra*. Seven subspecies currently are recognized (Hall 1981, Lariviere and Walton 1998); one subspecies (*L. c. lataxina*) occurs in the South. The life history of the northern river otter is reviewed by Toweill and Tabor (1982), Melquist and Dronkert (1987), Lariviere and Walton (1998), and Melquist et al. (2003).

DISTINGUISHING CHARACTERISTICS

The northern river otter has a large, long body with short legs and a hydrodynamic shape that distinguishes it from other mustelids. Feet are pentadactyl and plantigrade with interdigital webbing pronounced on the longer toes of the hind foot (Melquist et al. 2003). The tail is about one-third of total length and tapered from base to tip. Measurements are: total length, 890–1200 mm; tail, 350–520 mm; hind foot, 100–140 mm; ear, 20–30 mm; weight, 4.5–15 kg. Females are 3–21% smaller than males (Blundell et al. 2002). The short, thick, and glossy pelage ranges from dark brown to dark reddish-brown dorsally, and pale brown to silver-gray ventrally. The throat and muzzle often are silvery gray to brownish-white. The ears are round and inconspicuous. The small eyes are positioned anteriorly (Lariviere and Walton 1998). The muzzle is broad with stiff vibrissae bordering the nose. The skull is relatively flat with a short, broad rostrum; the cranium narrows at the eye sockets. The auditory bullae are flattened. The teeth are adapted for crushing and cutting. The dental formula is I 3/3, C 1/1, P 4/3, M 1/2 = 36 (Figure 1). See keys for details.

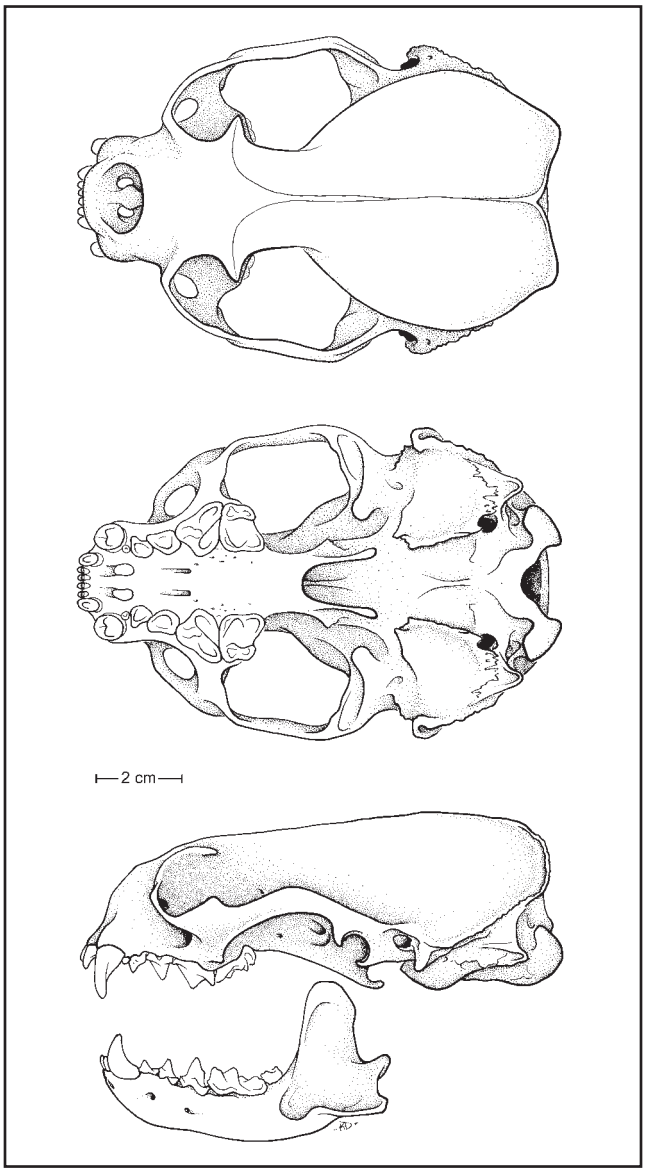

Figure 1. Dorsal, ventral, and lateral view of cranium and lateral view of mandible of *Lontra canadensis* from Eleuthera, Bahama Islands (USNM 122018,

CONSERVATION STATUS

The northern river otter has a global rank of Secure (NatureServe 2007). It is classified Secure in Georgia and Apparently Secure in Alabama, Arkansas, Louisiana, Mississippi, North Carolina, and Virginia. Kentucky, Tennessee, and Texas consider the species Vulnerable. It is Imperiled in Oklahoma and is Unranked in Florida and South Carolina. The otter is protected under the Convention for the International Trade of Endangered Species of Fauna and Flora (CITES) because of concerns regarding trade in the European otter. The otter is closely monitored by states that allow harvest (Leopold and Chamberlain 2001). With the exception of Oklahoma, all southern

states consider the northern river otter a furbearing species with varying regulations on method of take and bag limit.

DISTRIBUTION

The northern river otter historically occurred throughout most major drainages and riverine habitats of the continental United States and Canada (Hall 1981, Choate et al. 1994). Excessive harvest, water pollution (including pesticide bio-magnification from fish consumption), and wetland drainage for agriculture and other development resulted in widespread population decline (Melquist et al. 2003). Between 1982–1995, otter reintroduction and population enhancement efforts were undertaken in Kentucky, Oklahoma, Virginia, Tennessee (including Great Smoky Mountains National Park), and North Carolina (Tango et al. 1991, Raesly 2001). Currently, the river otter is distributed throughout the South (Figure 2), including all of Virginia (Handley 1992, Linzey 1998; M. Fies, Virginia Game and Inland Fisheries, personal communication), North Carolina (Lee et al. 1982, Webster et al. 1985), Georgia (Laerm et al. 1981; J. Ozier, Georgia Department of Wildlife Resources, personal communication) and most waterways in South Carolina (Cothran et al. 1991, J. Butfiloski, South Carolina Department of Natural Resources, personal communication). The otter also is present throughout the waterways of Florida (Whitaker and Hamilton 1998; K. Hodges, Florida Fish and Wildlife Conservation Commission, personal communication), Alabama (Lauhachinda 1978, Whitaker and Hamilton 1998), Mississippi (Kennedy et al. 1974, Jones and Carter 1989), Louisiana (Lowery 1974, Leopold and Chamberlain 2001, Scognamillo et al. 2003), eastern Texas (Davis and Schmidly 1994, Jackson et al. 1998; J. Young, Texas Parks and Wildlife Department, personal communication), eastern Oklahoma (Caire et al. 1989, Shackleford and Whitaker 1997, White and Hoagland 1997), Arkansas (Tumlison and Karnes 1987, Sealander and Heidt 1990), Kentucky (Raesly 2001; L. Patton, Kentucky Department of Fish and Wildlife Resources, personal communication), and Tennessee (Griess and Anderson 1987, Kennedy 1991; G. Anderson, Tennessee Wildlife Resources Agency, personal communication).

ABUNDANCE STATUS

Reliable census procedures for the river otter have not been developed, and few states have reliable estimates of population numbers. Biologists in Kentucky, Texas, and Virginia note stable to increasing populations (M. Fies, Virginia Department of Game and Inland Fisheries; J. Young, Texas Parks and Wildlife Department; and L. Patton, Kentucky Department of Fish and Wildlife Resources, personal communication). Expanding populations are reported in Arkansas, Alabama, Georgia, South Carolina, Oklahoma, and Tennessee (Melquist and Dronkert 1987, Raesly 2001). The species is relatively common statewide in Florida (K. Hodges, Florida Fish and Wildlife Conservation Commission, personal communication), Georgia (J. Ozier, Georgia Department of Wildlife Resources, personal communication), Alabama (M. Sievering, Alabama Department of Conservation and Natural Resources), Mississippi (R. Flynt, Mississippi Department of Wildlife, Fisheries, and Parks), and Arkansas (B. Sasse, Arkansas Game and Fish Commission, personal communication). Leopold and Chamberlain (2001) report stable populations in Louisiana and North Carolina. Average density throughout the river otter range is 1 otter/4 km of waterway (Lariviere and Walton 1998, Whitaker and Hamilton 1998). In Texas, Foy (1984) reported 1 otter/71–106 ha in coastal marshlands, while Shirley et al. (1988) observed 1 otter/86 ha in similar habitat in Louisiana.

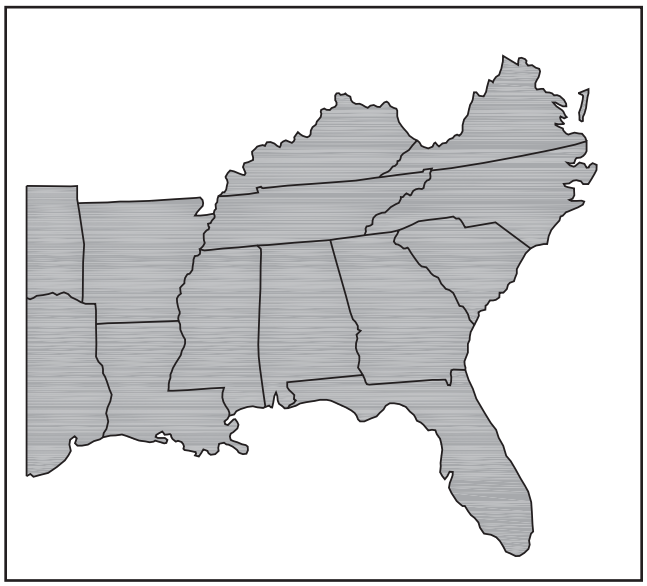

Figure 2. Distribution of *Lontra canadensis* in the South.

PRIMARY HABITATS

The northern river otter uses a variety of aquatic habitats including coastal estuaries, marshes, wetlands, rivers, and streams (Melquist and Dronkert 1987). Individuals are less common in brackish and salt-water areas, except in the tidal zones of large rivers (Brown 1997). In Florida, the otter inhabits mixed hardwood swamps, wet prairies, coastal scrub, sloughs, and canals (Cox and Kautz 2000). Habitat selection is influenced by water quality, availability of forage fish, and suitable denning sites

(Toweill and Tabor 1982). Important habitat components include slow moving water with deep pools, abundant fish, and shoreline vegetation (Chapman and Feldhamer 1982, Allen 1987). American beaver (*Castor canadensis*) ponds on intermittent streams provide habitat conducive to the river otter; lodges, submerged trees, and logjams provide shelter and foraging areas (Rosell et al. 2005). The otter uses dens dug by other animals, as well as natural shelters such as hollow trees, tall marsh grasses, and riverbank thickets (Chapman and Feldhamer 1982). Mech (2003) provided an unusual record of an otter inhabiting a small pond in a golf course within an urban area. Home range size averages between 8–78 km^2 (Bischof 2003) and is a function of habitat, prey species, and social status (Nowak 1999). The northern river otter may travel >80 km of stream course throughout the year (Cox and Kautz 2000).

REPRODUCTION

The northern river otter is polygamous. The breeding season is December–April with estrus lasting 42–46 days (Lauhachinda 1978, Nowak 1999). Delayed implantation lengthens gestation by 288–375 days (Leopold and Chamberlain 2001). Time of development, when corrected for delayed implantation, ranges between 60–63 days (Humphrey and Zinn 1982). The peak birthing period occurs between March–April (Leopold and Chamberlain 2001). Mean litter size is 2.9 young, with a range of 1–6 (Toweill and Tabor 1982). Neonates are blind, helpless, and covered with fine fur. They are weaned at 3 months; dispersal typically occurs at 12–13 months of age. Sexual maturity is reached at 2 years for females (Melquist and Dronkert 1987). Male otters, although capable of breeding their second year, may not breed until 5–7 years old when they are large enough to defend a territory (Leopold and Chamberlain 2001). Family groups include an adult female and her offspring. Longevity in the wild is estimated at 15 years; some animals have lived 25 years in captivity (Melquist and Dronkert 1987).

FOOD HABITS

The northern river otter feeds primarily on fish and other aquatic vertebrates and invertebrates (Cooley 1983, Melquist and Dronkert 1987). Fish are preyed upon in proportion to their occurrence and density, and in inverse proportion to their swimming ability (Melquist et al. 2003). Slow moving fish such as suckers (*Catostomus* spp.), sunfish (*Lepomis* spp.), carp (*Cyprinus* spp.), shiner (*Notropis* spp.), and bullhead (*Ictalurus* spp.) are common prey (Leopold and Chamberlain 2001). In Alabama and Georgia, Lauhachinda and Hill (1977) reported 12 families of fish consumed including bass (Centrarchidae), bowfin (*Amia calva*), and perch (*Perca* spp.). Crayfish also comprise a major portion of the diet (Griess 1987). Noordhuis (2002) found that crayfish (*Procambarus* and *Cambarus* spp.) comprised significant portions of the summer and winter diet in Georgia, while Tumlison and Karnes (1987) reported crayfish in 73% of otter scats in Arkansas when water levels were high. Other prey taken include frogs (*Rana* spp.), salamanders (*Amphiuma* and *Ambystoma* spp.), mudpuppy (*Necturus maculosus*), and water snakes (*Nerodia* spp.; Chabreck et al. 1982, Lizotte and Kennedy 1997). Turtles rarely are found as a dietary item (Toweill and Tabor 1982). Although reported infrequently, mammalian prey includes the common muskrat (*Ondatra zibethicus*), American mink (*Mustela vison*), nutria (*Myocastor coypus*), eastern cottontail (*Sylvilagus floridanus*), and white-tailed deer (*Odocoileus virginianus*; Lizotte and Kennedy 1997, Leopold and Chamberlain 2001). Mollusks (e.g., bivalves and aquatic gastropods), aquatic insects, and various waterfowl are consumed opportunistically (Lauhachinda and Hill 1977, Logsdon 1989, Miller 1992, Lizotte 1994). Carrion is rarely consumed (Melquist et al. 2003).

ASSOCIATED SPECIES

The northern river otter inhabits a diversity of aquatic habitats and is associated with numerous mammals in the South, including the long-tailed weasel (*M. frenata*), American mink, northern raccoon *(Procyon lotor*), common muskrat, and nutria. American beaver and river otter territories frequently overlap. The otter benefits from beaver activities that provide den sites and improve fish habitat by impounding streams (Melquist et al. 2003); population levels are correlated for the two species in many locations (Rosell et al. 2005). The American alligator (*Alligator mississippiensis*) and American crocodile (*Crocodylus acutus*) are the only aquatic predators of the river otter (Lariviere and Walton 1998). Terrestrial predators of young otter include the coyote (*Canis latrans*), red fox (*Vulpes vulpes*), bobcat (*Lynx rufus*), and domestic dog (*C. familiaris*; Bischof 2003). In South Carolina, Bergan (1990) observed a bobcat taking an American coot (*Fulica americana*) from a river otter. Competition between the American mink and river otter is minimal due to differential foraging strategies (Leopold and Chamberlain 2001); the former is primarily non-piscivorous, while the otter is piscivorus (M. Ford, U. S. Forest Service, personal communication). The river otter is proficient at capturing fish and may influence non-game fish populations; game fish are not an important part of the diet (Toweill and Tabor 1982).

VULNERABILITY AND THREATS

Otter reintroduction combined with regulatory protection and improved furbearer management have proven successful in restoring populations throughout the South (Serfass et al. 1998). Continued threats include the pollution of aquatic environments (e.g., siltation, pesticide residues), clearing of bottomland forest and riparian habitat, and wetland modification (Sealander and Heidt 1990, Handley 1991, Choate et al. 1994). The river otter is susceptible to aquatic pollution and serves as an indicator of ecosystem health (Lariviere and Walton 1998). Fish and crayfish are known methylmercury vectors; their dominance in the diet has potential for bioaccumulation levels of toxicological concern (Basu et al. 2005, Yates et al. 2005). Exposure to other environmental contaminants, including petroleum products, heavy metals, polychlorinated biphenyls, and aluminum silicates is well documented (Kimber and Kollias 2000). The disappearance of the otter in portions of Tennessee and Kentucky was attributed to increased acid drainage from coal-mining operations (Lauhachinda 1978).

The river otter is susceptible to a variety of diseases including canine distemper, rabies, respiratory tract disease, jaundice, hepatitis, and feline panleucopenia (Davidson and Nettles 1988, Bischof 2003). Based on pathogenicity and prevalence, important endoparasites include several trematodes, nematodes, cestodes, and acanthocephalans (Kimber and Kollias 2000). Ectoparasites are rare and few cause disease (Kimber and Kollias 2000); species that may be most significant for reintroduction programs include the ticks *Ixodes banksi*, *Amblyomma americanum*, and *Dermacentor variabilis*. Other parasites include fleas and sucking lice (Lariviere and Walton 1998).

MANAGEMENT SUGGESTIONS

The otter can cause damage to fish hatchery operations and commercial catfish (*Ictalurus* spp.) farms in the South. The relatively long distances the northern river otter travels and the linear nature of its habitats provide challenges for management. Strict harvest and population monitoring are needed, along with the development of accurate and reliable census procedures. Because the species cannot persist in polluted aquatic systems, management actions to improve or maintain water quality are necessary to ensure viable populations (Allen 1987). The facultative association between the otter and the American beaver suggests that management plans consider the two species in synchrony (Sealander and Heidt 1990, Chilelli et al. 1996). Other management activities include the provision of vegetative cover and natural debris adjacent to wetlands, structural diversity along shorelines, permanent surface water, and enhanced pool to riffle ratios (Allen 1987). The conservation of wetlands and riparian areas are critical to the future success of the northern river otter (Melquist et al. 2003).

REFERENCES

Allen, A. W. 1987. The relationship between habitat and furbearers. Pages 164–179 *in* M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, editors. Wild furbearer management in North America. Ontario Ministry of Natural Resources, Toronto, Canada.

Baker R. J., L. C. Bradley, R. D. Bradley, J. W. Dragoo, M. D. Engstrom, R. S. Hoffman, C. A. Jones, F. Reid, D. W. Rice, and C. Jones. 2003. Revised checklist of North American mammals north of Mexico, 2003. Occasional Papers, Museum of Texas Tech University. 229:1–23.

Basu, N., A. Scheuhammer, N. Grochowina, K. Klenavic, D. Evans, M. O'Brien, and H. Chan. 2005. Effects of mercury on neurochemical receptors in wild river otters (*Lontra canadensis*). Environmental Science and Technology 39:3585–3591.

Bergan, J. F. 1990. Kleptoparasitism of a river otter, *Lutra canadensis*, by a bobcat, *Felis rufus*, in South Carolina (Mammalia: Carnivora). Brimleyana 16:63–65.

Bischof, R. 2003. Status of the northern river otter in Nebraska. The Prairie Naturalist 35:117–120.

Blundell, G. M., M. Ben-David, and R. T. Bowyer. 2002. Sociality in river otters: Cooperative foraging or reproductive strategies? Behavioral Ecology 13:134–141.

Brown, L. 1997. Mammals of Florida. Windward Publishing, Miami, Florida, USA.

Caire, W., J. D. Tyler, B. P. Glass, and M. A. Mares. 1989. Mammals of Oklahoma. University of Oklahoma, Norman, Oklahoma, USA.

Chabreck, R. H., J. E. Holcombe, R. G. Linscombe, and N. E. Kinler. 1982. Winter foods of river otters from saline and fresh environments in Louisiana. Proceedings of the Annual Conference of Southeastern Association of Fish and Wildlife Agencies 36:473–483.

Chapman, J. A., and G. A. Feldhamer, editors. 1982. Wild mammals of North America. Johns Hopkins University, Baltimore, Maryland, USA.

Chilelli, M., B. Griffith, and D. J. Harrison. 1996. Interstate comparisons of river otter harvest data. Wildlife Society Bulletin 24:238–246.

Choate, J. R., J. K. Jones, Jr., and C. Jones. 1994. Handbook of mammals of the south-central states. Louisiana State University, Baton Rouge, Louisiana, USA.

Cooley, L. S. 1983. Winter food habits and factors influencing the winter diet of river otter in north Florida. Thesis, University of Florida, Gainesville, Florida, USA.

Cothran, E. G., M. H. Smith, J. O. Wolff, and J. B. Gentry. 1991. Mammals of the Savannah River Site. Savannah River Site National Environmental Research Park Program SRO-NERP-21:1–176.

Cox, J. A., and R. S. Kautz. 2000. Habitat conservation needs of rare and imperiled wildlife in Florida. Office of Environmental Services, Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida, USA.

Davidson, W. R., and V. F. Nettles, 1988. Field manual of wildlife diseases in the southeastern United States. University of Georgia, Athens, Georgia, USA.

Davis, W. B., and D. J. Schmidly. 1994. The mammals of Texas. Texas Parks and Wildlife, Austin, Texas, USA.

Foy, M. K. 1984. Seasonal movement, home range, and habitat use of river otter in southeastern Texas. Thesis, Texas A&M University, College Station, Texas, USA.

Griess, J. M., and B. Anderson. 1987. Reintroduction of the river otter into the Obed Wild and Scenic River in Tennessee. Proceedings of the Southeast Nongame and Endangered Species Symposium 3:167–175.

Hall, E. R. 1981. The mammals of North America, Second edition. John Wiley and Sons, New York, New York, USA.

Handley, C. O. Jr. 1991. The mammals. Pages 539–616 *in* K. Terwilliger, coordinator. Virginia's endangered species: Proceedings of a symposium. McDonald and Woodward, Blacksburg, Virginia, USA.

Handley, C. O., Jr. 1992. Terrestrial mammals of Virginia: Trends in distribution and diversity. Virginia Journal of Science 43:157–169.

Humphrey, S. R., and T. L. Zinn. 1982. Seasonal habitat use by river otters and Everglades mink in Florida. Journal of Wildlife Management 46:375–381.

Jackson, M. A., D. Fertl, and J. F. Bergan 1998. Recent records of the river otter (*Lutra canadensis*) along the Texas Gulf Coast. Texas Journal of Science 50:243–247.

Jones, C., and D. H. Carter. 1989. Annotated checklist of the recent mammals of Mississippi. Occasional Papers of The Museum, Texas Tech University 128:1–9.

Kennedy, M. L. 1991. Annotated checklist of mammals of western Tennessee. Journal of the Tennessee Academy of Science 66:183–185.

Kennedy, M. L., K. N. Randolph, and T. L. Best. 1974. A review of Mississippi mammals. Natural Science Research Institute, Eastern New Mexico State University 2:1–36.

Kimber, K. R. and G. V. Kollias. 2000. Infectious and parasitic diseases and contaminant-related problems of North American river otters (*Lontra canadensis*): A review. Journal of Zoo and Wildlife Medicine 31:452–472.

Laerm, J., L. B. Logan, M. E. McGhee, and H. Newhauser. 1981. Annotated checklist of the mammals of Georgia. Brimleyana 7:121–135.

Lariviere, S., and L. R. Walton. 1998. Lontra canadensis. Mammalian Species 587:1–8.

Lauhachinda, V. 1978. Life history of the river otter in Alabama with emphasis on food habits. Dissertation, Auburn University, Auburn, Alabama, USA.

Lauhachinda, V., and E. P. Hill. 1977. Winter food habits of river otters from Alabama and Georgia. Proceedings of the annual Conference of Southeast Association of Fish and Wildlife Agencies 31:246–253.

Lee, S. D., J. B. Funderburg, Jr., and M. K. Clark. 1982. A distributional survey of North Carolina mammals. Occasional Papers of the North Carolina Biological Survey 1982-10:1–70.

Leopold, B. D. and M. J. Chamberlain. 2001. Carnivorous furbearers. Pages 248–277 *in* J. Dickson, editor. Wildlife of the southern forests: Habitat and management. Hancock House, Blaine, Washington, USA.

Linzey, D. W. 1998. The mammals of Virginia. McDonald and Woodward, Blacksburg, Virginia, USA.

Lizotte, R. E. 1994. Biology of the river otter (*Lutra canadensis*). Thesis, Memphis State University, Memphis, Tennessee, USA.

Lizotte, R. E., and M. L. Kennedy. 1997. Demography and food habits of the river otter (*Lutra canadensis*) in western Tennessee. Journal of the Tennessee Academy of Science 72:56–62.

Logsdon, C. W. 1989. Ecology of reintroduced river otters, *Lutra canadensis*, in Land Between the Lakes, Kentucky. Thesis, Murray State University, Murray, Kentucky, USA.

Lowery, G. H., Jr. 1974. The mammals of Louisiana and its adjacent waters. Louisiana State University, Baton Rouge, Louisiana, USA.

Mech, L. D. 2003. Incidence of mink, *Mustela vison*, and river otter, *Lutra canadensis*, in a highly urbanized area. Canadian Field Naturalist 117:115–116.

Melquist, W. E., and A. E. Dronkert. 1987. River otter. Pages 627–641 *in* M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, editors. Wild furbearer management and conservation in North America. Ontario Ministry of Natural Resources, Toronto, Canada.

Melquist, W. E., P. P. Polechla, and D. Toweill. 2003. River otter. Pages 708–734 *in* J. A. Feldhamer, B. C. Thompson, and J. A. Chapman, editors. Wild mammals of North America: Biology, management, and conservation. Johns Hopkins University, Baltimore, Maryland, USA.

Miller, M.C. 1992. Reintroduction of river otters into Great Smoky Mountains National Park. Thesis, University of Tennessee, Knoxville, Tennessee, USA.

NatureServe. 2007. An online encyclopedia of life [Database]. Version 5.0. Association for Biodiversity Information. *http://www.natureserve.org/*.

Noordhuis, R. 2002. The river otter (*Lontra canadensis*) in Clark County, Georgia, USA: Survey, food habits, and environmental factors. IUCN Otter Specialist Group Bulletin 19:75–86.

Nowak, R. M. 1999. Walker's mammals of the world. Volume I. Johns Hopkins University, Baltimore, Maryland, USA.

Raesly, E. J. 2001. Progress and status of river otter reintroduction projects in the United States. Wildlife Society Bulletin 29:856–862.

Rosell, F., O. Bozser, P. Collen, and H. Parker. 2005. Ecological impact of beavers *Castor fiber* and *Castor canadensis* and their ability to modify ecosystems. Mammal Review 35:248–276.

Scognamillo, D. G., M. J. Chamberlain, and G. Linscombe. 2003. Spatial and temporal trends in river otter harvest in Louisiana. Proceedings of the Annual Conference Southeast Association of Fish and Wildlife Agencies 57:200–207.

Sealander, J. A., Jr., and G. A. Heidt. 1990. Arkansas mammals: Their natural history, classification and distribution. University of Arkansas, Fayetteville, Arkansas, USA.

Serfass, T. L., R. P. Brooks, J. M. Novak, P. E. Johns, and O. E. Rhodes, Jr. 1998. Genetic variation among populations of river otters in North America: Considerations for reintroduction projects. Journal of Mammalogy 79:736–746.

Shackelford, J., and J. Whitaker. 1997. Relative abundance of the northern river otter, *Lutra canadensis,* in three drainage basins of southeastern Oklahoma. Proceedings of the Oklahoma Academy of Science 77:93–98.

Shirley, M. G., R. G. Linscombe, N. W. Kinler, R. M. Knaus, and V. N. Wright. 1988. Population estimates of river otters in a Louisiana coastal marshland. Journal of Wildlife Management 52:512–515.

Tango, P. J., E. D. Michael, and J. I. Cromer. 1991. Survival and seasonal movements during otter restoration efforts in West Virginia. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 45:64–72.

Toweill, D. E., and J. E. Tabor. 1982. River otter. Pages 688–703 *in* J. A. Chapman and G. A. Feldhamer, editors. Wild mammals of North America. Johns Hopkins University, Baltimore, Maryland, USA.

Tumlison, R., and M. Karnes. 1987. Seasonal changes in food habits of river otters in southwestern Arkansas beaver swamps. Mammalia 51:225–231.

van Zyll de Jong, C. G. 1972. A systematic review of the Nearctic and Neotropical river otters (genus *Lutra*, Mustelidae, Carnivora). Royal Ontario Museum, Life Sciences, Contribution 80:1–104.

van Zyll de Jong, C. G. 1987. A phylogenetic study of the Lutrinae (Carnivora: Mustelidae) using morphological data. Canadian Journal of Zoology 65:2536–2544.

Webster, W. D., J. F. Parnell, and W. C. Biggs, Jr. 1985. Mammals of the Carolinas, Virginia, and Maryland. University of North Carolina, Chapel Hill, North Carolina, USA.

Whitaker, J. O. and W. J. Hamilton, editors. 1998. Mammals of the Eastern United States. Cornell University, Ithaca, New York, USA.

White, J., and J. Hoagland. 1997. Additional observations of the long-tailed weasel (*Mustela frenata*) and the river otter (*Lutra canadensis*) in southeastern Oklahoma. Proceedings of the Oklahoma Academy of Science 77:111–112.

Wozencraft, W. C. 1993. Order Carnivora. Pages 279–348 *in* D. E. Wilson and D. M. Reeder, editors. Mammal species of the world: A taxonomic and geographic reference. Smithsonian Institution, Washington, D. C., USA.

Yates, D. E., D. T. Mayack, K. Munney, D. C. Evers, A. Major, T. Kaur, and R. J. Taylor. 2005. Mercury levels in mink (*Mustela vison*) and river otter (*Lontra canadensis*) from northeastern North America. Ecotoxicology 14:263–274.