Chapter 31
Otters in Captivity

Jan Reed-Smith and Shawn Larson

Abstract In 2015 there were a minimum of 1621 otters of eight species (Asian small-clawed otter *Aonyx cinereus*, Sea otter *Enhydra lutris*, Spotted-necked otter *Hydrictis maculicollis*, N.A. river otter *Lontra canadensis*, Marine otter *Lontra felina*, Neotropical otter *Lontra longicaudis,* Eurasian otter *Lutra lutra,* Smooth-coated otter *Lutrogale perspicillata*, and Giant otter *Pteronura brasiliensis*) held in major zoos and aquariums. Husbandry, or the care and management of otters in captivity, has improved gradually over the last two decades. Fifty years ago recommendations were made that outlined the need for large, complex land areas and other features key to ensuring high levels of otter welfare, which many ex situ facilities, such as zoos, aquariums, and rehabilitation facilities, have now adopted. Increased welfare of captive otters is due partially from improved environmental conditions such as better habitat design, and partially from improved understanding of otter nutritional and health needs. This chapter discusses otter species kept in captivity and focuses on their care and well-being. This includes husbandry improvements over the last few decades, as well as some of the continuing concerns regarding otter welfare in zoos, aquariums, and rehabilitation situations. We address the benefit of multi-institutional research into welfare issues and the potential benefit of improving habitat designs allowing otters a greater choice and control over their environment.

31.1 Introduction

In 2015 there were a minimum of 1621 otters of eight species (Asian small-clawed otter *Aonyx cinereus*, sea otter *Enhydra lutris*, spotted-necked otter *Hydrictis maculicollis*, North American (NA) river otter *Lontra canadensis*, marine otter *Lontra*

J. Reed-Smith (✉)
Otters in Zoos and Aquariums Task Force, IUCN/SSC Otter Specialist Group, Lake Odessa, 48849 Michigan, USA
e-mail: jrsotter@iserv.net

S. Larson
Seattle Aquarium, Seattle, Washington, USA

A. Butterworth (ed.), *Marine Mammal Welfare*, Animal Welfare 17,
DOI 10.1007/978-3-319-46994-2_31

felina, neotropical otter *Lontra longicaudis*, Eurasian otter *Lutra lutra*, smooth-coated otter *Lutrogale perspicillata*, and giant otter *Pteronura brasiliensis*) (ISIS 2015) held in major zoos and aquariums. The number of animals actually held in captivity is in reality much higher as the International Species Information System (ISIS) database reflects only those animals reported by member institutions. For example, the Asian (Oriental) small-clawed otter, the most commonly held species in captivity, has 1567 animals listed in the 2015 international studbook (Duncan 2016 Pers Comm).

The second most commonly held species is the North American river otter with 305 individuals held, and the least common is the marine otter with one captive individual (ISIS 2015). There are currently at least 78 sea otters in captivity in the United States, Canada, Europe, and Japan (Casson 2015; Ishihara 2016, Pers Comm.). These numbers are likely to be underestimates as reported facility holdings represent many of the largest zoos and aquariums and do not take into account otters held at nonmember institutions, small facilities, wildlife parks, or rehabilitation facilities.

31.2 Zoos and Aquariums

The creation of studbooks (genealogical registries of animal's parentage and birth location) has benefited the ex situ management of otters greatly. These records have allowed zoos and aquariums to manage the gene pool to limit inbreeding and the tracking of breeding success, as well as other life history parameters such as longevity. There are several examples of this successful management: In 2000 roughly 39% of the NA river otters in the ISIS database were captive born, and by 2015 50% were captive born (n = 259) (Hamilton 2016, Pers Comm). The median life expectancy for this species in captivity is 11.7 years, and the longevity record is 21.64 years (Hamilton 2016). In contrast the life span for this species in the wild is approximately 8–9 years. Robin (1987) reported that in 1985, 50% of Eurasian otters were captive born and in 2015 approximately 77% were captive born (Rey 2016, Pers Comm.) indicating a shift in the origin of captive animals with time; median life expectancy in captivity is 10 years and the longevity record is 19 years (Capber 2007). In 2015, 96% of the Asian small-clawed otters were reported to be captive born, whereas the 1961–1970 studbook data reported only 26% as captive born; life expectancy in the wild is unknown, while the median life span for this species in the US captive population is 14 years for males and 11.2 years for females (Duncan 2016, Pers Comm.).

Sea otters were first held in captivity in 1955 at the Woodland Park Zoo in Seattle, Washington (Brennan and Houck 1996). Because of their success in housing sea otters, these animals have become increasingly popular exhibit animals over the decades. The numbers of sea otters held in captivity grew steadily in the last half of the twentieth century in the United States, with one event dramatically increasing their numbers. In 1989, as a result of the Exxon Valdese Oil Spill in Prince William

Sound, Alaska, 37 of the hundreds of rescued northern sea otters were deemed non-releasable and placed in facilities around the world (Gruber and Hogan 1990; VanBlaricom et al. 2015). Since then the number of captive sea otters has remained steady in the United States at approximately 40 animals with approximately equal numbers of northern (*E.l. kenyoni*) and southern sea otters (*E.l. nereis*). More recently, in the twenty-first century, there has been a shift with increasing numbers of wild southern and decreasing numbers of northern sea otters being placed into captivity due to an increase in the numbers of stranded and non-releasable southern sea otter pups (Johnson and Mayer 2015).

Sea otters in captivity exhibit a wide range of activities associated with a full life history, such as performing a range of daily behaviors, reaching expected longevity, and breeding successfully. This is thought to be due, in part, to the fact that the captive environments may mimic the small home ranges and tight family social groups found in wild sea otters (Larson and Bodkin 2015). Sea otters are highly social and should not be kept alone, ideally being kept in female-only groups or groups of females with one male. Some facilities keep male-only groups, and this mix often stimulates aggression, which must be managed by providing access to large pools with areas for individuals to escape from each other or other methods such as contraceptive drugs to reduce testosterone and aggression between mature males. The longevity record for this species is 27 years, while life span in the wild for males is 10–15 years and for females is 15–20 years (Casson 2015). Sea otters have been successfully bred in captivity since the late 1970s, with the first captive sea otter pups raised from conception to adulthood (2 years of age) in 1979. Eleven pups have since been born and ten have survived to adulthood (Fig. 31.1). In recent years North American facilities housing sea otters, in conjunction with the US Fish and Wildlife Service, have agreed to a moratorium on breeding of captive sea otters to preserve space required for rescued non-releasable sea otters from threatened populations listed under the Endangered Species Act (ESA) (VanBlaricom et al. 2015).

Fig. 31.1 Sea otter (*Enhydra lutris*) and pup. *Image credit*: P. McMahon, Seattle Aquarium

Fig. 31.2 Eurasian otter (*Lutra lutra*) enclosure at Otter-Zentrum, Hankensbüttel, Germany; an example of natural exhibits. *Image credit*: J. Reed-Smith

Husbandry, or the care and management of otters, has improved gradually over the last two decades. Early recommendations by Duplaix-Hall (1972, 1975) and Crandall (1964, 1974) first pointed out the need for large, complex land areas and other features key to ensuring high levels of otter welfare (Fig. 31.2). Later publications expanded and reemphasized these features (Reuther 1991; Reed-Smith 1994, 2012; Melissen 2000). These publications, increased experience with various otter species, and a growing use of a wide variety of enrichment (Coe 2009) and training methods leading to voluntary participation by otters in routine health examinations (Morabito and Dunn 2007, 2008; Scherrens 2014) have led to overall improvement of otter care and welfare.

However, there are still some areas of concern regarding overall welfare of otters in ex-situ facilities, which include:

- Too many facilities are housing otters in small barren- or concrete-based enclosures (Fig. 31.3) and/or inappropriately devoting too much space to water for the majority of otter species (the sea otter is the exception).
- Exposure to loud noises or inappropriate light cycles (Morgan and Tromborg 2007) and to large crowds when otters have no access to places of refuge. Inadequate denning sites for pregnant females continue to be an issue for some species and in some situations. For a good overview of zoo animal welfare and

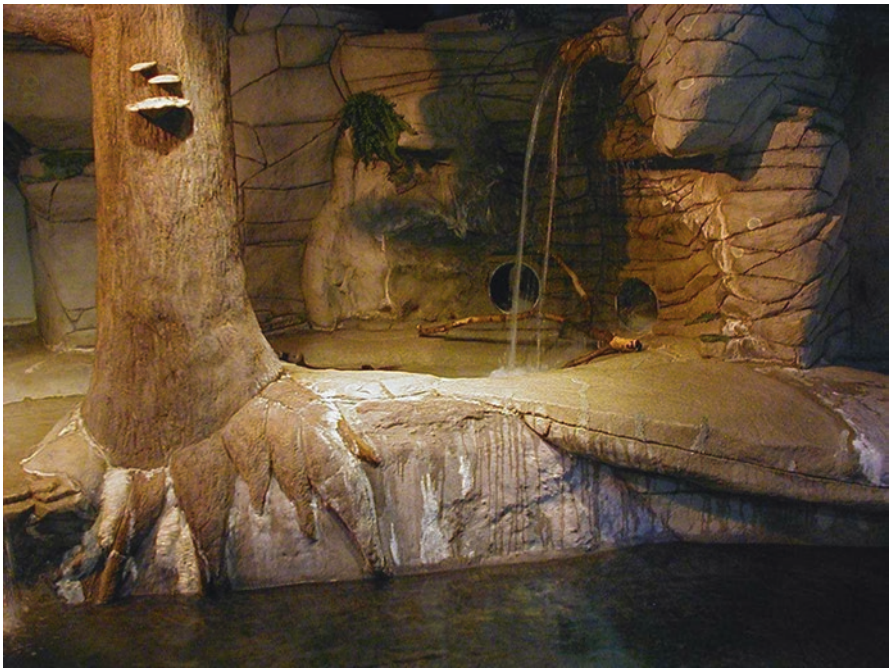

Fig. 31.3 An otter enclosure which has only concrete as a surface. *Image credit*: J. Reed-Smith

the possible ramifications of captive environments that should be considered consult (Morgan and Tromborg 2007).

- Latrine (areas where otters deposit feces and urine) management, scent, and access to variable substrates are important for otter welfare. Otters are scent oriented and latrines play an important signaling role (except for the sea otter which is entirely marine and does not scent mark), such that the daily cleaning and disinfection of these areas can disrupt this communication tool (Morgan and Tromborg 2007). The ability to role/rub on various surfaces is behaviorally important to the maintenance of a healthy coat. Otters also like to dig and root around, and the health of their feet can be compromised by continually damp or wet surfaces (except for the sea otter). It is important to consider whether otters that are kept primarily on concrete surfaces are able to perform many of these activities. If not, then this is probably not appropriate and alternative substrates should be provided.
- Appropriate exhibit size. Too often otters are viewed as small animals and thus kept in small spaces. Instead their comparatively large home ranges in the wild should be considered, and sufficient space must be provided.
- Too often otters are confined for long periods in small, unstimulating holding spaces. Many facilities have turned to innovative enrichment techniques to deal with this, but exploring options that allow otters access 24 h a day to both the

Fig. 31.4 (**a** and **b**) Pueblo Zoo offers *L. canadensis* "on (a) and off exhibit (b)" yards allowing for 24-h access, temporary separation, or mixing of group composition. *Image credit*: J. Reed-Smith

holding and enclosure areas should be considered and further tested (Figs. 31.4a,b and 31.6a,b).
- There are reported perceptions by field biologists that Asian small-clawed otter cubs held in nonregulated situations (wildlife facilities and as pets) outside the United States sometimes look stunted, which has led to speculation that unregulated inbreeding, poor nutrition, and/or chronic stress may be occurring in these populations (Morgan and Tromborg 2007).
- The keeping of Asian small-clawed otters as pets should be discouraged. This is a practice of growing concern particularly in parts of Asia.
- Inadequate medical care at poorly regulated facilities.

Zoos and aquariums have improved the health care of otters consistently over the years. Partially this is due to improved environmental conditions from better exhibit design and partially to improved understanding of otter nutritional needs and health concerns. This is an area where veterinarians and nutritionists have been able to contribute greatly to the welfare of otters. Improvements in this area also have been aided by the trend to adapt operant conditioning (training) techniques to solicit cooperation from otters in health-care procedures, eliminating the need to forcibly capture and restrain or anesthetize the animal. These training practices have proven to be effective, as well as potentially enriching for the otters, by stimulating their inquisitive natures (Morabito and Dunn 2007, 2008; Scherrens 2014). As a result of reproductive physiology work conducted in zoos, data has been collected on verifying pregnancy and gestational length allowing facilities to better anticipate births and prepare for them (Larson et al. 2003; Da Silva and Larson 2005; Bateman et al. 2009). This research has also led to better understanding of other aspects of reproductive physiology and the use and impact of contraception (Larson et al. 2003, 2012; Bateman and Swanson 2007, 2013, 2014; Bateman et al. 2009, 2011).

The ability to engage in a wide range of behaviors is generally the first focus of captive animal welfare evaluation and often includes aspects of behavior and sociability. As mentioned above the tendency of many facilities to use too much concrete or other hard surfacing in exhibits continues to be a problem. This limits the animals' ability to engage in exploratory, foraging, digging, grooming, social, and play behavior. The lack of complexity in many exhibits inhibits these behaviors, and this may, or may not, lead to stereotypical behavioral patterns. Many institutions have enrichment programs in place to stimulate a wide range of behaviors and to address stereotypies that may, or may not, be due to stress. This is well intended, sometimes successful (Foster-Turley and Markowitz 1982; Nelson 2010), but too often becomes routine and of limited use (Morabito and Bashaw 2012). Further studies and documentation of the success of these programs are required. To date, the majority of enrichment studies have focused on

changes in how, or how often, otters are fed (Foster-Turley and Markowitz 1982; Ross 2002; Hawke et al. 2004; Hasenjager 2011). Results as to its efficacy are mixed due to limited sample size, species-specific applications, and differing methodologies. At least in one study, Morabito and Bashaw (2012) suggested that pairing an auditory cue with feedings could reduce anticipatory behaviors associated with meal times. Further study into ways to enrich otter feeding through altered methods/timing of food delivery and allowance of more choice and engagement from the otters is required (Foster-Turley and Markowitz 1982; Gothard 2007; Morabito and Bashaw 2012).

A new direction in habitat design is currently being promoted (Coe 2005, 2012, 2014, 2016 Pers Comm; CLR Design 2016), which suggests a move toward allowing animals greater choice and control over their environment through concepts such as "rotation exhibits" (Coe 2014), "raceway networks" (Coe 2014), and what Coe (2005) calls the "unzoo." If these concepts are applied to otters in the future, particularly allowing them to move between exhibits of compatible species, overall welfare may improve via extension of their ability to choose where they want to be, an increase in their daily ranging abilities, an increase in their living-space complexity, the provision of opportunities for group members to join and separate, and by stimulating bored otters through enhanced foraging (Gothard 2007) (Figs. 31.4a,b, 31.5, and 31.6a,b). These housing options should be further explored. Other ongoing issues regarding the expression of natural behaviors, which are being actively debated, include the housing of otters in inappropriate social groupings and the inability of individuals to escape stressful situations.

Fig. 31.5 Wild spotted-necked otter or speckle-throated otter (*Hydrictis maculicollis*) in vegetated habitat selected for resting by many otter species. *Image credit*: J. Reed-Smith

Fig. 31.6 (**a**) Asian small-clawed otter (*Aonyx cinereus*) transferring between their exhibit and that of macaques via a tunnel at Rockhampton Zoo, Australia. *Image credit*: K. Hickey (**b**) Otters exiting a macaque enclosure at Rockhampton Zoo, Australia. *Image credit*: K. Hickey

31.3 Rehabilitation Programs

The successful rehabilitation of otter cubs/pups requires an extended time period (typically 12 months or more), adequate facilities, limited exposure to humans, no exposure to dogs, the ability to pair singletons with other orphans, and access to a safe place where a "soft" release (with supplemental feeding for the initial release period) can be supported (Green 1991; Yoxon 2003, 2013; McTurk and Spelman 2005; Haire 2009, 2011). This approach of soft release is often successful (Haire 2009; Yoxon 2003, 2013; Thibodeaux 2016, Pers Comm.) but unfortunately is not utilized by the majority of rehabilitators. While it is known that cubs are sometimes released prematurely (too young) leading to problems, there is almost nothing reported about the fate of these animals. The process of rehabilitating injured sea otters is well documented and in general is thought to be successful, specifically when surrogate mothers (adult captive females otters) are used to raise the orphaned pups (VanBlaricom et al. 2015; Johnson and Mayer 2015).

31.4 Conclusions: Assessing the Welfare of Otters in Captivity

The value of assessing animal welfare is widely accepted; however all too often inadequate steps are taken to assess welfare objectively. Measurement tools can assist staff in understanding whether their efforts to stimulate natural behaviors are successful. As an example Morabito and Bradshaw (2012) evaluated the influence of increasing the number of feedings for NA river otters, and they suggested that

this approach may be more successful at reducing feeding-related stereotypies by pairing food delivery with a specific cue. This would eliminate the power of other cues such as keeper approach stimulating inappropriate anticipatory behavior.

More empirical research is required across institutions to assess current otter conditions. A practical first step to assessing otter welfare in zoos and aquariums could be to begin with "activity budgets" and "space usage." There has been much written on the difficulty of defining welfare (Maple and Purdue 2013) as well as the difficulties in interpreting results via measures of physiological and behavioral changes (Mason and Mendl 1993). Dawkins (2004) argues for simplifying our questions when measuring animal welfare to two basic questions asked concurrently: (1) "Are the animals healthy?" and (2) "Do they have what they want?". Addressing these questions in an objective, standardized, and multi-institutional manner would provide tools for facilities to move from acceptable or good otter welfare to great otter welfare. Creating factual, documented activity budgets for individual otters is a first step. A good second step would be to assess enclosure usage patterns for each animal by mapping where, and how long, each otter is spending its time. These two tools together would allow managers to evaluate enrichment programs, to understand the impact of exhibit design, and to make improvements based on the actions and reactions of their specific captive otters.

References

HL, Swanson WF (2007) Comparative assessment of semen processing and cryopreservation methods for genome resource banking of North American river otter spermatozoa. Proceeding of the 10th international otter colloquium. Hwacheon, South Korea, 10–16 Oct. p 47

Bateman HL, Bond JB, Campbell M, Barrie M, Riggs G, Snyder B, Swanson WF (2009) Characterization of basal seminal traits and reproductive endocrine profiles in North American River otters and Asian small-clawed otters. Zoo Biol 28:107–126

Bateman HL, Pelican K, Swanson WF (2011) Assessing the efficacy of a GnRH agonist implant (Deslorelin) to reduce reproductive and stress hormone levels and behavioural aggression in single-sex groups of captive Asian small-clawed otters. Abstract. Hystrix, Italian J Mammal supp. p 88

Bateman HL, Swanson WF (2013) Reliability of fecal progesterone analysis for pregnancy diagnosis and parturition timing in North American river and Asian small-clawed otters. Proceeding of wild musteloid conference. Published by Wildlife Conservation Research Unit, Department of Zoology, University of Oxford, 8–21 March 2013

Bateman HL, Swanson WF (2014) Re-establishing reproductive cyclicity in a female Asian small-clawed otter following Suprelorin-induced contraception: a case study. Reprod Fertil Dev 27:172

Brennan EJ, Houck J (1996) Sea otters in captivity: the need for coordinated management as a conservation strategy. Endanger Species Update 13:61–67

Capber F (2007) Veterinary care of Eurasian otters (*Lutra lutra*) at the otter breeding center Hunawihr (France). IUCN Otter Species Group Bull 24(1):47–62

Casson CJ (2015) Sea otter studbook report. In: Larson SE (ed) Sea otter conservation workshop IX proceedings. Seattle Aquarium, Seattle, Washington. 27–29 March 2015. pp 17–18

CLR Design (2016) Evolutionary thinking in habitats. Personal communication. http://www.clrdesign.com/. Accessed 9 Dec 2016

Coe J (2005) The Unzoo alternative. ARAZPA/SEAZA joint conference, 5 April 2005, Melbourne, Australia. https://www.researchgate.net/publication/263470731_The_Unzoo_Alternative. Accessed 9 Dec 2016

Coe J (2009) Collaborative enrichment. 9th international conference on environmental enrichment, Torquay, UK, 31 May–05 June 2009. Jon Coe Design, Healesville, Australia. http://www.joncoedesign.com/pub/PDFs/CollaborativeEnrichment2009.pdf. Accessed 9 Dec 2016

Coe J (2012) Design and architectures: Third generation conservation, post-immersion and beyond. Future of zoos symposium, 10–11 February 2012, Canislus College, Buffalo, NY. http://www.zoolex.org/publication/coe/design+architecture2012.pdf. Accessed 9 Dec 2016

Coe J (2014) Next generation rotation exhibits: raceway networks and space to explore. Power point presentation, Zoo and aquarium annual conference/New Zealand branch conference, 25–28 March 2014, Auckland Zoo, New Zealand. http://www.joncoedesign.com/pub/Talks/RotationZAA2014/index.htm. Accessed 9 Dec 2016

Crandall LS (1964 & 1974) The management of wild mammals in captivity: otters. Univ. Chicago Press, Chicago, London, pp 337–348

Dawkins MS (2004) Using behaviour to assess animal welfare. Anim Welf 13:S3–S7

Da Silva IM, Larson S (2005) Predicting reproduction in captive sea otters (*Enhydra lutris*). Zoo Biol 24:73–81

Duplaix-Hall N (1972) Notes on maintaining river otters in captivity. Int Zoo Yearbook 12:178–181

Duplaix-Hall N (1975) River otters in captivity: a review. In: Martin RD (ed) Breeding endangered species in captivity. Academic, London, pp 315–327

Foster-Turley P, Markowitz H (1982) A captive behavior enrichment study with Asian small-clawed river otters (*Aonyx cinerea*). Zoo Biol 1:29–43

Gothard N (2007) What is the proximate cause of begging behaviour in a group of Asian short-clawed otters? IUCN Otter Species Group Bull 24(1):14–35

Green RE (1991) Otters: a case study in rehabilitation. Wild aid guide to Scotland. Skye Environmental Centre Ltd, Isle of Skye

Gruber JA, Hogan ME (1990) Transfer and placement of non-releasable sea otters in aquariums outside Alaska. In: Bayha K, Kormendy J (eds) Sea otter symposium: proceedings of a symposium to evaluate the response effort on behalf of sea otters after the T/V Exxon valdez oil spill into Prince William sound. Anchorage, Alaska, 17–19 April 1990. US fish and wildlife service, biological report 90 (12):428–431. US Department of the Interior Fish and Wildlife Service, Washington, DC

Haire M (2009) Study of post-release data in the North American River otter (*Lutra canadensis*). Wildl Rehab Bull 27(1):3–17

Haire, M (2011) Successful hand-rearing and rehabilitation of north american river otter (*Lontra canadensis*), sections 1–3. http://www.otterspecialistgroup.org/Library/TaskForces/OCT.html. Accessed 9 Dec 2016

Hasenjager MJ (2011) Effects of increased feeding frequency on captive North American river otter (*Lontra canadensis*) Behavior. MSc thesis, Michigan State University, p 86

Hawke L, Lauer P, Bartholomeusz D, Steen Z (2004) Effect of increased food dispersal and random feeding time/place on stereotyped behaviors in otters at Adelaide Zoo. http://torontozoo.com/meet_animals/enrichment/otter_enrichment.htm. Accessed 9 Dec 2016

ISIS (2015) International species information system. http://www2.isis.org/Pages/Home.aspx. Accessed 9 Dec 2016

Johnson A, Mayer K (2015) The value of rescuing, treating, and releasing live-Stranded Sea otters. In: Larson SE, Bodkin JL, Van Blaricom GR (eds) Sea otter conservation. Academic, New York, pp 235–255

Larson S, Belting T, Rifenbury K, Fisher G, Boutelle SM (2012) Preliminary findings of fecal gonadal hormone concentrations in six captive sea otters (*Enhyra lutris*) after Deslorelin implantation. Zoo Biol 00:1–14. doi:10.1002/zoo.21032

Larson SL, Bodkin JL (2015) The conservation of sea otters: a prelude. In: Larson SE, Bodkin JL, VanBlaricom GR (eds) Sea otter conservation. Elsevier Scientific Publications, USA, pp 2–20

Larson S, Casson CJ, Wasser S (2003) Noninvasive reproductive steroid hormone estimates from fecal samples of captive female sea otters (*Enhydra lutris*). Gen Comp Endocrinol 134:18–25
Maple TL, Perdue BM (2013) Zoo animal welfare. Springer, New York
Mason G, Mendl M (1993) Why is there no simple way of measuring animal welfare? Anim Welf 2(4):301–319
McTurk D, Spelman L (2005) Hand-rearing and rehabilitation of orphaned wild Giant otters, *Pteronura brasiliensis*, on the Rupununi River, Guyana, South America. Zoo Biol 24:153–167
Melissen A (2000) Eurasian otter (*Lutra lutra*) husbandry guidelines. Otterpark Aqualutra, Netherlands
Morabito PM, Dunn M (2007) Injection training 1.1 North American river otters (*Lontra canadensis*) using a PVC chute. Anim Behav Manag Alliance Wellspring 8(4):12–13
Morabito PM, Dunn M (2008) Injection training 1.1 North American river otters using a PVC chute. Animal Keepers' Forum 35:106–108
Morabito PM, Bashaw MJ (2012) A survey of abnormal repetitive behaviors in North American River otters housed in zoos. J Appl Anim Welf Sci 15(3):208–221
Morgan KN, Tromborg CT (2007) Sources of stress in captivity. Appl Anim Behav Sci 102:262–302
Nelson KO (2010) The Effects of Environmental Enrichment on a Stereotyped Swimming Pattern for a North American River Otter (*Lontra canadensis*). River Otter J XIX(1):8–11. River Otter Alliance. http://www.otternet.com/ROA/directory.htm. Accessed 9 Dec 2016
Reed-Smith J (1994) North American river otter (*Lontra canadensis*) husbandry notebook. John Ball Zoo, Michigan
Reed-Smith J (2012) North American river otter (*Lontra canadensis*) husbandry notebook, 4th edn. otterspecialistgroup.org http://www.otterspecialistgroup.org/Library/TaskForces/OCT/NARO_4th_Edition_Section_1_Chapters_1_to_6.pdf. Accessed 9 Dec 2016
Reuther C (1991) Otters in captivity—a review with special reference to *Lutra lutra.* In: Reuther C, Röchert R (eds) Proceedings V international otter colloquium, Hankensbüttel, Germany . Habitat (Aktion Fischotterschutz) 6:269–307
Robin K (1987) European river otter studbook. IUCN Otter Specialist Group Bull 2:42–44
Ross R (2002) The effect of a simple feeding enrichment strategy on the behavior of two Asian small-clawed otters (*Aonyx cinerea*). Aquat Mamm 28(2):113–120
Scherrens A (2014) Inspiring passion for the natural world, Birmingham Zoo AZA otter keeper workshop 2014 presentation, Denver, Colorado, 15–19 March 2014
VanBlaricom GR, Belting TF, Triggs LH (2015) Sea otter sin captivity: applications and implications of husbandry development, public display, scientific research and management, and rescue and rehabilitation for sea otter conservation. In: Larson SE, Bodkin JL, VanBlaricom GR (eds) Sea Otter Conservation. Elsevier Scientific, USA, pp 198–234
Yoxon G (2003) Caring for wild otters (2003) In: Conroy J, Gutleb A, Ruiz Olmo J, Yoxon G (eds) proceedings of the European otter conference 'Return of the otter in Europe—where and how? 30 June–05 July 2003. J International Otter Survival Fund 2
Yoxon G (2013) Exploring the depths: Eurasian otter rescue and rehabilitation. In: Parsons ECM, Bauer A, McCafferty D, Simmonds MP, Wright AJ (eds) An introduction to marine mammal conservation and biology. Jones & Bartlett, Burlington, MA