



Human Dimensions of Wildlife: An International Journal

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/uhdw20>

Assessing the Role of Zoos in Wildlife Conservation

Andrew Tribe Senior Lecturer^a & Rosemary Booth^a

^a University of Queensland, Gatton, Gatton,
Queensland, Australia

Version of record first published: 23 Aug 2006.

To cite this article: Andrew Tribe Senior Lecturer & Rosemary Booth (2003):
Assessing the Role of Zoos in Wildlife Conservation, Human Dimensions of Wildlife: An
International Journal, 8:1, 65-74

To link to this article: <http://dx.doi.org/10.1080/10871200390180163>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.tandfonline.com/page/terms-and-conditions>

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae, and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand, or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

Assessing the Role of Zoos in Wildlife Conservation

ANDREW TRIBE
ROSEMARY BOOTH

University of Queensland, Gatton
Gatton, Queensland, Australia

Despite their popularity and place in our recreational history, in recent years zoos have undergone considerable change in both their structure and function. While remaining attractive places of entertainment, zoos today also emphasize their contribution to wildlife conservation. This article reviews the role of zoos in wildlife conservation and discusses the effectiveness of their present policies and actions. It is apparent that the major contribution comes through their ex situ actions, including education programs, and captive breeding and management of wildlife. However, recently, zoos have also become more involved with in situ conservation, predominantly through recovery programs for endangered species in cooperation with government authorities and local communities. However, such activities are expensive, and a major obstacle for zoos has always been to strike a balance between commercial success and professional conservation credibility. The opportunities for zoos lie in transforming themselves from traditional animal displays to interactive, entertaining conservation centres that bridge the gap between their captive collections and free-range wildlife.

Keywords zoos, wildlife conservation, education, research, captive breeding

Introduction

For more than 100 years, zoos have held a prominent position in society. Indeed, for many people, their first, most intimate, and most extensive experience of wild animals has come from a zoo. Yet despite their history and place in our culture, zoos have undergone considerable change in both their structure and function over the past 20 years.

There are an estimated 10,000 zoos worldwide, receiving an estimated 600 million visitors annually (IUDZG/CBSG [IUCN/SCC], 1993). Of these, approximately 1000 predominantly western zoos participate in national, regional, or international zoo federations (IUDZG/CBSG [IUCN/SCC], 1993). Membership of these

Address correspondence to Andrew Tribe, Senior Lecturer, School of Animal Studies, University of Queensland, Gatton, Gatton Queensland 4343, Australia. E-mail: a.tribe@mailbox.uq.edu.au

federations requires a commitment to joint conservation goals aiming to provide positive attitudes to wildlife; assist in the conservation of the world's living resources; highlight the importance of maintaining biodiversity; and foster the concept of ecologically sustainable development (IUDZG/CBSG [IUCN/SCC], 1993).

Zoos are still seen by some as being superficial, expensive, ineffective, and therefore indefensible. For instance, the Australian and New Zealand Federation of Animal Societies and the Born Free Foundation are opposed to keeping wild animals in captivity for human entertainment (ANZFAS, 1996; Hewitt, 2000). Others are simply skeptical of the conservation claims of zoos, believing them to be merely window dressing. As Scott (2001) writes: "Despite their protestations to the contrary, zoos are still menageries. The only difference is that their Public Relations are more efficient and some of them do a little serious captive breeding and research on the side."

Bartos and Kelly (1998) suggest that to overcome this criticism, "a summary of measurable contributions by zoos in the areas of education, conservation, research and tourism is of critical importance in demonstrating the contribution of these institutions to the whole community."

This article provides an initial step in examining and comparing the measurable conservation actions of the western federated zoos. In particular, it will discuss the zoo industry and its increasing role in conservation, and provide examples of its current conservation actions. Finally, conclusions will be drawn about these actions and of the need to assess their effectiveness.

Methods

This assessment was compiled using a combination of current literature review, interviews of zoo management in Australia and the United Kingdom, and ongoing surveys of zoo managers, zoo staff, and zoo visitors.

Zoos and their Role in Conservation

Zoos may be defined as collections of captive wild animals that are displayed to the public so that they are easier to observe than in nature (modified from IUDZG/CBSG [IUCN/SCC], 1993). Conservation may be defined as an action that effectively enhances the survival of species and habitats (IUDZG/CBSG [IUCN/SCC], 1993). The actions required by zoos to dedicate their potential to conservation have been defined in the World Zoo Conservation Strategy (IUDZG/CBSG [IUCN/SSC], 1993), while the Zoo Futures 2005 document (WZO, 1995) guides zoos in implementing it. Specifically, its aims include: to convince zoos and conservation agencies that conservation is the greatest purpose of zoos; to identify conservation areas where zoos can contribute; to assist in setting conservation policies and priorities; and to encourage participation in the global zoo network.

The WZCS encourages zoos to support conservation both in situ (in the wild) and ex situ (in the zoo). In situ activities include endangered species rescue, habitat protection and restoration, reintroduction, and supplementation. Ex situ activities include the genetic management and captive breeding of threatened species, education, and research.

The contribution of zoos to conservation can be categorised as direct wildlife management, research, conservation education, and financial contributions to conservation.

Direct Wildlife Management

Genetic Management and Captive Breeding (ex situ)

The federated zoos now manage their captive collections as a large single collection (Mitchell, 1991). That is, animals in zoos are increasingly managed according to both regional and international cooperative species management programs in which the genetic diversity, population size, and geographic origin of the founders are all accounted for. This greatly enhances the reintroduction potential of captive-bred populations both now and into the future (Mitchell, 1991).

This genetic management of zoo collections is facilitated regionally through the various zoo federations, and globally through the International Species Inventory System (ISIS). This organization serves 482 zoological institutional members from 54 countries worldwide, representing approximately half the world's federated zoos and aquaria. The aim of ISIS members is to have self-sustaining captive collections that can act as insurance for wild populations. ISIS data indicates that 92% of new zoo mammals and 71% of birds are now captive bred.

Zoos have also become involved in captive breeding for reintroduction, a process that when done effectively can play an important role in the conservation of endangered species (Rahbek, 1993; Wilson & Stanley Price, 1994). The Golden Lion Tamarin Conservation Program (GLTCP) is a good example. With sound genetic and demographic management of this species, from a captive population of approximately 70 individuals in 1972 to over 500 animals in the 1980s, surplus captive-bred stock were made available for reintroduction (Kleinman, Beck, Dietz, Ballou, & Coimbra-Filho, 1986). In the first 10 years of the program, the size of the known wild population increased by 20%, with about 17% of the tamarins being reintroduced captive borns and their descendants (Beck, Rapaport, Stanley Price, & Wilson, 1994).

In Australia zoos participate in at least 35 recovery programs, which include 16 mammals, 10 birds, 6 reptiles, and 2 amphibians (de Koff, 1998). Craig, Barlow, Wilcken, Hopkins, and Lees (1999) maintain that Australian zoos now have a well-defined role to play in the conservation of Australian threatened wildlife in collaboration with State and Federal government agencies.

The role of zoos in captive breeding is probably of only limited value in conserving wildlife (Dixon & Travers, 1994; Hancocks, 1992), however, in the light of three major constraints. The first is that there is limited space available for captive breeding, or devoted to holding threatened species (Bartos & Kelly, 1998; Seal, 1991). The second constraint is the high cost of producing captive-bred animals in zoos. For instance in Australia it has been estimated to cost on average \$6,546 for each native animal produced for reintroduction (Perth Zoo, 2000). Reintroduction of captive-bred wildlife requires monitoring and improvement if it is to have a significant conservation impact (Mallinson, 1995). A third constraint is the availability of secure suitable habitat. Alibhai and Jewell (1994) estimate that it costs more than 16 times as much to maintain a black rhino in captivity than to protect enough appropriate wild habitat to support it.

In Situ Wildlife Conservation

An increasing number of zoos now recognize the importance in situ conservation efforts (Durrell & Mallinson, 1998; Mallinson, 1998, 2003). In 1992, less than 325 in situ conservation projects were being supported by American Zoological Association zoos, while by 1999 the number had increased to over 650 (Conway, 1999). Similarly, federated zoos in the United Kingdom supported 177 in situ projects in 2000, an increase of 61% since 1995 (The Federation of Zoological Gardens of Great Britain and Ireland, 2001). If this trend continues, Conway (1999) believes that zoos could become the primary nongovernment field conservation organisations, and in so doing increase the number of taxa they save to tens of thousands. The extraordinary in situ conservation contribution of Jersey Zoo and its supporting charitable trust, the Durrell Wildlife Conservation Trust (DWCT) are discussed elsewhere (see Mallinson, 2003).

The Wildlife Conservation Society (WCS), based at the Bronx Zoo/Wildlife Conservation Park, oversees more than 300 field projects in 52 countries, including being directly involved in more than 115 parks and reserves protecting about 61 million hectares (Conway, 1999). However, as Rabb (2000) records, few institutions are in a position to manage large natural areas by themselves, and the importance of involving local people and organisations in these field conservation projects is increasingly being recognised as a key factor in their long-term success (see Mallinson, 2003).

Research

The WZCS emphasises the research role of zoos and the requirements for them to implement major and effective programs (IUDZG/CBSG [IUCN/SSC], 1993; Kelly, 1997). Today many zoos actively collaborate with research organisations, and as Feistner and Price (2000) point out, by combining their resources, zoos and universities can carry out research and training that individually they would be unable to do.

There is a flow of information from zoo researchers to field scientists that can assist in providing new insights into species biology and management, while reciprocally data collected in the field can enhance efforts in captive breeding. Ryder and Feistner (1995) have reviewed new research initiatives being undertaken by zoos and found that reproductive and genetic technologies have particular significance for conservation and management of threatened species. They conclude that this role needs to be expanded and developed as wildlife populations and biological diversity continue to decline.

Conservation Education

With 600 million visitors annually, zoos have great potential for public education. Further, the opportunity for close and carefully managed encounters, plus the scope for fixed displays and talks makes education generally easier to provide than in a free-ranging setting. Consequently, Hancocks (2001) concludes that probably the greatest opportunity for zoos to contribute to conservation in reality is to "cultivate environmental sensitivity among their hundreds of millions of patrons." Thus they have been described as "the sleeping giant of the wildlife education and conservation field" (Kellert, 1987).

The development of zoos as educational establishments has mirrored their change from menagerie to conservation park. Rather than being seen as merely biological curiosities, zoos nowadays strive to display their animals as part of the overall environment, and to utilize them in a variety of both formal and informal educational roles. The concept of ecology and the relationship between animals and their habitat has become a central theme of zoos' educational messages (Woollard, 1998).

Formal education is now a prominent feature in zoos in many western countries as well as in Singapore and Hong Kong, with structured programs for schools, and increasing involvement in tertiary education. In a review of zoo education in the United Kingdom and Ireland, Woollard, (1999) found that 71% of zoos had an education department and 73% taught visiting school pupils, with more than 750,000 pupils visiting these zoos in 1996.

In Australia, the larger zoos also have a significant commitment to education. The Melbourne Zoo Education Service, for instance, has established itself over the 20 years of its existence as a world leader, with in excess of 120,000 children utilising it each year (Melbourne Zoo, 1999). Taronga, Perth, and Adelaide Zoo have similar education services.

Assessing zoo education activities is difficult (Bartos & Kelly, 1998), and critics of captive animal displays suggest that their effectiveness is still unclear (Jamieson, 1985, 1995; Ollason, 1993; Scott, 2001). Overseas, a number of studies have attempted to evaluate this (Broad, 1996; Kellert & Dunlap, 1989; Kreger & Mench, 1995; Ogden, Lindburg, & Maple, 1993; Orams, 1996; Tarrant, Bright, & Cordell, 1997). In general, they found that exposure to wildlife in combination with some form of interpretation was associated with increased support for conservation

of both the target species and wildlife in general (Moscardo, Woods, & Greenwood, 2001).

Conservation messages can be communicated through informal education of visitors. In Australia, conservation issues were communicated to the public for an average of 65% of the threatened species in collections, mainly through signs and keeper talks (de Koff, 1998). There is evidence that the majority of visitors learn more from interactive keeper presentations than from static displays (Anderson, 1992; Broad & Weiler, 1997, 1998; Moscardo, 1996, 1998; Simpkin, 1994).

Mazur (1995) has questioned the effectiveness of zoo education programs by concluding that while visitors whom she surveyed exhibited a significant level of awareness about endangered species and habitat destruction, it was still not clear that they had gained an awareness of conservation from their zoo experience. Hutchins (1999) claims that zoo educational goals must be more directed, have specific outcomes, and that zoos should develop effective tools to measure the impact of their educational programs on people's attitudes and behaviour. Only then, he argues, will zoos really know what effect they are having.

Financial Contributions to Conservation

Zoos invest considerable amounts of money in the pursuit of their conservation objectives. For instance, in the United Kingdom, federated zoos contributed approximately \$4.5 million to in situ conservation projects in 1995, and this has risen to more than \$15 million in 2000. In addition, specific campaigns since 1996 have raised a further \$1 million from public donations for other conservation projects for a range of species from tigers to medicinal leeches (The Federation of Zoological Gardens of Great Britain and Ireland, 2001).

Individually, Jersey Zoo and its associated DWCT have an in situ conservation budget for 2001 of approximately \$9 million (J. Mallinson, personal communication, November 2001). This covers their overseas projects and the International Training Program where indigenous people are trained in conservation techniques to ensure ongoing protection of species and habitats. It represents 23% of the gross income of the zoo and the Trust.

If zoos are to make a real contribution to biodiversity conservation, Kelly (1997) has suggested that zoos should commit a minimum of 10% of operating income to research and conservation activities. Some are already achieving this. Perth Zoo, for example, in their 1999/2000 annual report listed the total costs associated with producing seven threatened species for reintroduction programmes as \$1,066,951. In the same year total revenue was \$5,909,138. Conservation expenditure thus represented 18% of their gross income.

However, many zoos are still apparently contributing little in financial terms to conservation projects. In a 1999 survey, Bettinger and Quinn (2000) found that while American Zoo Association zoos and aquaria had strengthened their support for conservation and research projects over the previous decade, on average,

facilities still spent only 0.1% of their operating budget in these areas. Their data included money spent on captive research, field conservation, and staff time.

Most zoos have great difficulty finding additional resources to become involved in conservation programs (Mitchell, 1994). In recent years the immense increase in leisure time, personal mobility, and a much wider choice of attractions for a day out, many zoos have experienced declining attendances that in turn has affected their financial ability to improve the visitor experience and their capacity to contribute to conservation (see Mallinson, 2003).

Donations can provide significant potential for raising additional revenue for conservation in zoos. Several zoos in the United States have conservation contribution machines for visitors to donate cash towards the conservation of their chosen species. In Australia, some zoos offer behind-the-scenes tours for gold coin donations to channel funds directly to regional in situ conservation projects.

It is unknown how zoo participation in conservation affects levels of visitation, and little information exists about the expectation, interest, or satisfaction of visitors with the role of zoos in conservation (MacAllister, personal communication, September 2001). Without a proven link, some zoos seem reluctant to fully embrace their conservation potential, apparently believing that money spent on conservation will not be compensated for by increased visitor revenue. In so doing, such zoos may in fact be missing out on important marketing and fund-raising opportunities. Gipps (1993) proposes that the problem with zoo management is that it does not realise that "conservation can sell tickets," and if zoos are to attract visitors and private and public financial support, then in the future they will have to work harder at promoting their conservation activities. For an industry committed to supporting wildlife conservation it is clear that more information is needed about the role that conservation can play in supporting the industry.

Conclusions

Zoos have undertaken activities that have addressed the WZCS's three major initiatives: supporting conservation of endangered species and their natural ecosystems; offering support and facilities to increase scientific knowledge to benefit conservation; and promoting an increase in public and political awareness. In so doing, they have become key partners in many captive breeding and reintroduction programs.

Zoos cannot work alone in this recovery task, and their relationships with government and other local conservation agencies have greatly improved with recent achievements in joint field projects. However, further progress is still to be made. If zoological organisations are to continue their work to conserve biodiversity, it is critical that they continue to adapt, otherwise they run the risk of becoming extinct themselves (Kelly, 1997). Two major and related challenges

have confronted zoos during recent years, and will inevitably continue to do so into the future: commercial viability and conservation credibility.

Acknowledgments

The authors would like to thank both the CRC for Sustainable Tourism and the Hermon Slade Foundation for their continued and generous support for this project.

References

- Alibhai, S. K., & Jewell, Z. C. (1994). *Saving the last rhino: In-situ conservation or captive breeding*. Unpublished report for the Rhino Foundation.
- Anderson, L. L. (1992). Informative animal shows. *Journal of the International Association of Zoo Educators*, 25, 1–4.
- ANZFAS (1996). *Policy compendium*. Collingwood, Victoria: Australian and New Zealand Federation of Animal Societies Inc.
- Bartos, J. M., & Kelly, J. D. (1998). Towards best practice in the zoo industry: Developing key performance indicators as benchmarks for progress. *International Zoo Yearbook*, 36, 143–157.
- Beck, B. B., Rapaport, L. G., Stanley Price, M. R., & Wilson, A. C. (1994). Reintroduction of captive-born animals. In P. J. S. Olney, G. M. Mace, & A. T. C. Feistner (Eds.), *Creative conservation: Interactive management of wild and captive populations* (pp. 265–286). London: Chapman & Hall.
- Bettinger, T., & Quinn, H. (2000). *Conservation funds: How do zoos and aquariums decide which project to fund?* Proceedings of the AZA Annual Conference, St. Louis, Missouri, 52–54.
- Broad, G. (1996). Visitor profile and evaluation of informal education at Jersey Zoo. *Dodo: Journal of the Jersey Wildlife Preservation Trusts*, 32, 166–192.
- Broad, S., & Weiler, B. (1997). *Tigers and tourists: The learning opportunities of captive wildlife exhibits*. Proceedings of the Australian Tourism & Hospitality Research Conference, Sydney, New South Wales. Bureau of Tourism Research, Canberra, Australian Capital Territory, 88–105.
- Broad, S., & Weiler, B. (1998). Captive animals and interpretation: A tale of two tiger exhibits. *Journal of Tourism Studies*, 9(1), 14–27.
- Conway, W. (1999). *Linking zoo and field, and keeping promises to dodos*. Proceedings of the 7th World Conference on Breeding Endangered Species: Linking zoo and field research to advance conservation. Cincinnati Zoo, May 22–26, 1999, pp. 5–11.
- Craig, M., Barlow, S., Wilcken, J., Hopkins, C., & Lees, C. (1999). *Zoo Involvement in the Australasian species recovery process*. Proceedings of the 7th World Conference on Breeding Endangered Species: Linking Zoo and Field Research to Advance Conservation. Cincinnati Zoo May 22–26, 1999, pp. 215–225.
- de Koff, G. (1998). *Conservation efforts of Australasian zoos—A review*. Unpublished report for Australian Regional Association of Zoological Parks and Aquaria (ARAZPA) Sydney, New South Wales.

- Dixon, A., & Travers, W. (1994). *The Zoo Inquiry*. World Society for the Protection of Animals and The Born Free Foundation, Horsham, West Sussex, UK.
- Durrell, L., & Mallinson, J. J. C. (1998). The impact of an institutional review: A change of emphasis towards field conservation programmes. *International Zoo Yearbook*, 36, 1–8.
- The Federation of Zoological Gardens of Great Britain and Ireland (2001). *In-situ conservation projects*. Unpublished report presented at AGM, London Zoo, London, May, 2001.
- Feistner A. T. C., & Price, E. (2000). *Working together for conservation: A win-win strategy for zoos and universities*. Proceedings of the 2nd Annual Symposium on Zoo Research. Federation of Zoological Gardens of Great Britain and Ireland, 6–7 July, Paignton, Devon.
- Gipps, J. (1993, November 19). Zoo survival. *The Independent*, p. 24.
- Hancocks, D. (2001). *A different nature the paradoxical world of zoos and their uncertain future*. Berkeley: University of California Press.
- Hewitt, N. (2000, Winter). Action stations—Zoo check is go! *Wildlife Times*, p. 17.
- Hutchins, M. (1999). *Zoos, aquariums and wildlife conservation: Future trends and current challenges*. Proceedings of the 7th World Conference on Breeding Endangered Species: Linking zoo and field research to advance conservation. Cincinnati Zoo, 22–26, May 1999, pp. 1–4.
- IUDZG/CBSG (IUCN/SSC) (1993). *The World Zoo conservation strategy: The role of zoos and aquaria of the world in global conservation*. Chicago: The Chicago Zoological Society.
- Kellert, S. R. (1987). The educational potential of the zoo and its visitor. *Philadelphia Zoo Review*.: Philadelphia Zoological Society.
- Kellert, S. R., & Dunlap, J. (1989). *Informal learning at the zoo: A study of attitudes and knowledge impacts*. Report to the Zoological Society of Philadelphia.
- Kelly, J. D. (1997). Effective conservation in the twenty-first century: The need to be more than a zoo. One organisation's approach. *International Zoo Yearbook*, 35, 1–14.
- Kleinman, D. G., Beck, B. B., Dietz, J. M., Ballou, J. D., & Coimbra-Filho, A. F. (1986). Conservation program for the golden lion tamarin: Captive research and management, ecological studies, educational strategies, and reintroduction. In K. Benirschke (Ed.), *Primates, the road to self-sustaining populations* (pp. 959–970). New York: Springer-Verlag.
- Kreger, M. D., & Mench, J. A. (1995). Visitor interactions at the zoo. *Anthrozoos*, 8(3), 143–158.
- Mallinson, J. C. (1995). Conservation breeding programmes: An important ingredient for species survival. *Biodiversity and Conservation*, 4, 617–635.
- Mallinson, J. J. C. (1998). *The diverse role of zoos in a changing world: From zoological parks to conservation centres*. Proceedings of the ARAZPA/ASZK Conference, Sydney, NSW, pp. 10–19.
- Mallinson, J. J. C. (2003). A sustainable future for zoos and their role in wildlife conservation. *Human Dimensions of Wildlife*, 8(1), 59–63.
- Mallinson, J. C., & Hartley, J. R. M. (1997). Partnerships in conservation. *Dodo, Journal of the Jersey Wildlife Preservation Trusts*, 33, 8–13.
- Mazur, N. (1995). *Perceptions of the role of zoos in conservation: An Australian case study*. Proceedings of the ARAZPA/ASZK Annual Conference, Perth, Western Australia, pp. 102–109.
- Melbourne Zoo (1999). *Annual Report, 1998–1999*. Zoological Parks and Gardens Board, Victoria, Australia. Royal Melbourne Zoological Gardens.

- Mitchell, G. F. (1991). Conserving biological diversity: A view from the zoo. *Today's Life Sciences*, 3, 10–18.
- Mitchell, G. F. (1994). A perspective of zoos in a changing environment. Australian Academy of Technological Sciences and Engineering. *Focus*, 81, 23–25.
- Moscardo, G. (1996). Mindful visitors: Heritage and tourism. *Annals of Tourism Research*, 23(2), 376–397.
- Moscardo, G. (1998). Interpretation and sustainable tourism: Functions, examples and principles. *Journal of Tourism Studies*, 9(1), 2–13.
- Moscardo, G., Woods, B., & Greenwood, T. (2001). *Status Assessment of Wildlife Tourism in Australia Series: Understanding Visitor Perspectives on Wildlife Tourism* (Wildlife Tourism Research Report No. 2) Gold Coast, Queensland, Australia: CRC for Sustainable Tourism.
- Ogden, J. J., Lindburg, D. F., & Maple, T. L. (1993). The effects of ecologically-relevant sounds on zoo visitors. *Curator*, 36(2), 147–157.
- Ollason, R. J. (1993). Getting the message across. *Journal of the International Association of Zoo Educators*. Proceedings of the 11th IZE Congress, Taronga Zoo, May 1992, vol. 29, p. 186.
- Orams, M. (1996). *The effectiveness of an education program in managing marine tourism*. Proceedings of the 1996 World Congress on Coastal and Marine Tourism, pp. 9–43.
- Perth Zoo (2000). *Annual Report, 1999–2000*. Perth, Western Australia: Zoological Board of Western Australia.
- Rabb, G. B. (2000). *Zoos and aquariums as conservation centres and centres of care*. The World Association of Zoos and Aquariums Minutes of the Scientific Session (WAZA) Section, 55th Annual Conference, Palm Springs, California, Vol. 1, 1–24.
- Rahbeck, C. (1993). Captive breeding—A useful tool in the preservation of biodiversity? *Biodiversity and Conservation*, 2, 426–439.
- Ryder, O. A., & Feistner, A. T. C. (1995). Research in zoos: A growth area in conservation. *Biodiversity and Conservation*, 4, 671–677.
- Scott, S. (2001). Captive breeding. In B. Jordan (Ed.), *Who Cares For Planet Earth? The Con In Conservation* (p. 72). Brighton: Alpha Press.
- Seal, U.S. (1991). *The role of captive breeding in conserving wildlife*. Proceedings of a Symposium of the Zoological Society of London, 62, 145–163.
- Simpkin, L. (1994). *Interpretation: Starting with tourists*. Proceedings of the Third Annual Conference of Interpretation Australia Association Inc. Charles Sturt University, Albury, New South Wales, pp. 184–188.
- Tarrant, M. A., Bright, A. D., & Cordell, H. K. (1997). Attitudes toward wildlife species protection: Assessing, moderating and mediating affects in the value-attitude relationship. *Human Dimensions of Wildlife*, 2(2), 1–20.
- Wilson, A., & Stanley Price, M. R. (1994). Reintroduction as a reason for captive breeding. In P. J. S. Olney, G. M. Mace, & A. T. C. Feistner (Eds.), *Creative conservation: Interactive management of wild and captive populations* (pp. 243–264). London: Chapman & Hall.
- Woollard, S. P. (1998). The development of zoo education. *International Zoo News*, 45(7), 422–426.
- Woollard, S. P. (1999). A review of zoo education in the United Kingdom and Ireland. *International Zoo News*, 46(1), 20–24.
- WZO (1995). *Zoo Futures 2005*. World Zoo Organisation–International Union of Directors of Zoological Gardens.