

Editorial

Journal of Zoological and Botanical Gardens—Open Access Journal Devoted to Ex Situ Research and Conservation of our Planet's Biodiversity

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Received: 23 November 2020; Accepted: 23 November 2020; Published: 5 December 2020



I am delighted to launch a new open access journal devoted to ex situ research and conservation of our planet's biodiversity. It is the latest example of a journal devoted to these topics, most of which belong to longstanding associations committed to zoos, aquaria, and botanical gardens. Among others, the *Journal of Zoo and Wildlife Medicine* (official publication of the European Association of Zoo and Wildlife Veterinarians and the American Association of Zoo Veterinarians), *Der Zoologische Garten Zeitschrift für die gesamte Tiergärtnerei (Neue Folge)* (official journal of the Verband der Zoologischen Gärten e.V. and the World Association of Zoos and Aquariums), the *Journal of Zoos and Aquarium Research* (a free open-access initiative of the European Association of Zoos and Aquaria), the *BG Journal* (published by Botanic Gardens Conservation International), *Sibbaldia—The International Journal of Botanic Garden Horticulture* (published by the Royal Botanic Garden Edinburgh). Other journals not belonging to any specific association are *Zoo Biology* and the *Revista del Jardín Botánico Nacional*. However, none of these journals concerns both captive animals and plants. Thus, the *Journal of Zoological and Botanical Gardens* is the first international, peer-reviewed journal that provides an advanced forum for studies on both animals and plants kept in zoos, aquaria, and botanical gardens. It offers a unique opportunity to have the most updated research insights into each individual institution and discipline, but also a chance to treat common issues relating to their missions and aims, responding to the need of a multidisciplinary partnership approach [1].

The ambition of this new journal is to extend its focus well beyond the traditional scopes of zoos, aquaria, and botanical gardens, including a holistic approach to the conservation of fauna and flora of our planet. This means placing the keeping of animals and plants well beyond its traditional mission of entertainment and education [2]. The journal draws together expertise from biophysical, biological, conservation, social sciences, and humanities to explore basic and applied research questions concerning the ecology, conservation, management, and sustainability of our planet's biodiversity.

Keeping wild animals and plants for display is an ancient tradition that can be traced back to 1490 BCE (Before Common Era), while the Egyptian Royal Gardens of Thutmose III have been dated about 1000 BCE [3,4]. However, since their first appearance zoos, aquaria, and botanical gardens have changed dramatically in their aims and scopes, and further changes are expected in the future [5]. Our mission is to contribute to this evolution and offer new insights and research advances on the biodiversity of our planet. Our focus will be specially devoted to the conservation of endangered species, and will stimulate an outstanding debate on the role and mission of zoos, aquaria, and botanical gardens in the third millennium. Conservation thinking in zoos dates back to 1945 [6]. At the first World Conference on Breeding Endangered Species in Captivity in 1972 [4], Gerald Durrell advocated for linking zoos' ex situ activities to conservation needs. By that time, the number of institutions engaged in the captive breeding of animals and plants involved in conservation had grown exponentially, as well as the need for a more proactive and coordinated response from the global conservation

community [1]. The growing awareness of a human-driven biodiversity extinction crisis led to the International Convention on Biological Diversity (CBD), which entered into force on 29 December 1993, and was signed by 168 countries [7]. In the same year the International Union of Directors of Zoological Gardens (then IUDZG, now the World Association of Zoos and Aquariums) wrote its first World Zoo Conservation Strategy [4,8].

The convention recognized the importance of integrating in situ efforts with ex situ projects. Specifically, article 9 of the CBD requires signatory parties to:

“ ... as far as possible and as appropriate, and predominantly for the purpose of complementing in-situ measures: (a) Adopt measures for the ex-situ conservation of components of biological diversity, preferably in the country of origin of such components; (b) Establish and maintain facilities for ex-situ conservation of and research on plants, animals and micro-organisms, preferably in the country of origin of genetic resources; (c) Adopt measures for the recovery and rehabilitation of threatened species and for their reintroduction into their natural habitats under appropriate conditions; (d) Regulate and manage collection of biological resources from natural habitats for ex-situ conservation purposes so as not to threaten ecosystems and in-situ populations of species, except where special temporary ex-situ measures are required ... ”[9].

Thus zoos, aquaria and botanical gardens were officially recognized among the institutions dedicated to captive propagation for conservation. Zoos, aquaria, and botanical gardens offer an essential connection to the natural world, especially for the half the world’s population living in cities [4,10], stressing their role in education and the dissemination of conservation values and strategies.

The CBD COP held in 2010 adopted a revised and updated Strategic Plan for Biodiversity for the 2011–2020 period. The strategy included the Aichi Biodiversity Targets, 20 time-bound, measurable targets to be met by the year 2020 [11].

Targets 1, 12, and 13 unambiguously highlighted the role of zoos, aquaria and botanical gardens. Specifically, Target 1 aimed at raising awareness of the values of biodiversity through the Communication, Education, and Public Awareness (CEPA) program. Among the indicators of the target are the number of visits to natural history museums, zoos, and botanical gardens, and the number of school biodiversity education programs or officially accredited teaching materials. Target 12 required that by 2020, the extinction of threatened species be prevented, and their conservation status, particularly of those most in decline, be improved and sustained. Actions include both the protection of sites where the threatened species are located (in situ protection), and ex situ measures that could complement in situ actions. Target 13 required that by 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, be maintained, and that strategies be developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity. This placed a special focus on the role of gene banks, germoplasm banks, and on cultural and ethnographical heritages.

Unfortunately, the 14th and most recent CBD COP in 2018 [12] recognized that, despite many positive actions, most of the Aichi Biodiversity Targets were not on track to be achieved by 2020. Thus, progress needed to be accelerated by developing communication strategies and tools for education and awareness raising related to biodiversity, as a means to promote behavioral change for its conservation and sustainable use. These targets should also guide our journal in the near future.

There are also other relevant conservation issues to which zoos, aquaria, and botanical gardens contribute, and which should therefore be part of our future commitments. Exhibiting a wide variety of animals and plants, these institutions are often involved in international movement and trade of wild and captive-bred animals, many of which are protected under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (known as CITES, signed in Washington in 1973, and further amended in 1979 and 1983). As underlined by CITES Secretary-General John Scanlon at the annual conference of the World Association of Zoos and Aquariums (WAZA) in 2017, zoos and aquaria—and I add botanical gardens—can support the CITES by offering their expertise in

conservation, animal welfare, education, and outreach to raise awareness and lift up the quality of zoos and aquaria that are not WAZA members.

Our journal could specifically help to improve awareness of the wide range of regulations and legislative provisions on animal welfare, and lead the progress of techniques and behavioral research addressing this issue. This is especially important, considering that animal welfare is often the first concern of visitors to zoos and aquaria [4]. In addition, expert staff at zoos, aquaria, and botanical gardens can assist authorities in distinguishing captive-bred from wild specimens, and help in identifying species found in trade.

The central role of these institutions in ex situ conservation should not obscure the importance of linkages between ex situ and in situ conservation [4], especially in the extrapolation of knowledge acquired from research in zoos, transfer of skills, testing of methodologies, and education on specific conservation issues. This linkage explains why zoos, aquaria, and botanical gardens are today increasingly investing in in situ conservation, especially through financing campaigns [4]. This mission was further fostered by recent recognition of the limitations of ex situ conservation [4], and by legislative requirements in some countries, like the European Union Council Directive 1999/22/EC relating to the keeping of wild animals in zoos [13].

Finally, during these pandemic times, I cannot avoid citing the relevant role that epidemiological studies of distantly related species kept close to each other could contribute to the research on spillover risk and prevention, as well as on the arrival and spreading of new pests and diseases brought by alien species. A recent example is the rabbit hemorrhagic disease virus (RHDV, Lagovirus europeus GI.1) that induces a contagious and highly lethal hemorrhagic disease in rabbits [14–16].

Thanks to its wide editorial board and with the support of the Multidisciplinary Digital Publishing Institute (MDPI), the *Journal of Zoological and Botanical Gardens* would like to join forces with existing journals and provide a high-quality open access journal reaching the standard quality produced by already well established MDPI journals like *Animals*, *Biology*, *Life*, and *Plants*, that have qualified for a high rank (Q1) in Agriculture and Biological Science and in Environmental Science subject areas.

Conflicts of Interest: The author declares no conflict of interest.

References

1. Mallinson, J.J.C. A Sustainable Future for Zoos and Their Role in Wildlife Conservation. *Hum. Dimens. Wildl.* **2003**, *8*, 59–63. [CrossRef]
2. Carr, N.; Cohen, S. The Public Face of Zoos: Images of Entertainment, Education and Conservation. *Anthrozoös* **2011**, *24*, 175–189. [CrossRef]
3. Hill, A.W. The history of and function of botanic gardens. *Ann. Mo. Bot. Gard.* **1915**, *2*, 185–240. [CrossRef]
4. Zimmermann, A. The role of zoos in contributing to in situ conservation. In *Wild Mammals in Captivity: Principles and Techniques for Zoo Management*; Kleiman, D.G., Thompson, K.V., Baer, C.K., Eds.; University of Chicago Press: Chicago, IL, USA, 2010; pp. 281–287.
5. Gippoliti, S. Ex-situ conservation programmes in European zoological gardens: Can we afford to lose them? *Biodivers. Conserv.* **2010**, *21*, 1359–1364. [CrossRef]
6. Baratay, E.; Hardouin-Fugier, E. *Zoo: A History of Zoological Gardens in the West*; Reaktion Books: London, UK, 2002.
7. Convention on Biological Diversity. History. Available online: <https://www.cbd.int/history/> (accessed on 1 November 2020).
8. IUDZG; CBSG. *The World Zoo Conservation Strategy*; Chicago Zoological Society: Brookfield, IL, USA, 1993.
9. Convention on Biological Diversity. Article 9. Ex-situ Conservation. Available online: <https://www.cbd.int/kb/record/article/6885?RecordType=article> (accessed on 1 November 2020).
10. Miller, B.; Conway, W.; Reading, R.; Wemmer, C.; Wildt, D.; Kleiman, D.; Monfort, S.; Rabinowitz, A.; Armstrong, B.; Hutchins, M. Evaluating the conservation mission of zoos, aquariums, botanical gardens and natural history museums. *Conserv. Biol.* **2004**, *18*, 86–93. [CrossRef]
11. Convention on Biological Diversity. TARGET 13—Technical Rationale Extended. Available online: <https://www.cbd.int/sp/targets/rationale/target-13/> (accessed on 1 November 2020).

12. Convention on Biological Diversity. COP-14. Available online: <https://www.cbd.int/meetings/COP-14> (accessed on 1 November 2020).
13. Simonin, D.; Gavinelli, A. The European Union legislation on animal welfare: state of play, enforcement and future activities. In *Animal Welfare: From Science to Law*; Hild, S., Schweitzer, L., Eds.; La Fondation Droit Animal, Éthique et Sciences: Paris, France, 2019; pp. 59–70.
14. Buehler, M.; Jesse, S.T.; Kueck, H.; Lange, B.; Koenig, P.; Koenig, P.; Jo, W.K.; Osterhaus, A.; Beineke, A. Lagovirus europeus GI. 2 (rabbit hemorrhagic disease virus 2) infection in captive mountain hares (*Lepus timidus*) in Germany. *BMC Vet. Res.* **2020**, *16*, 1–6. [[CrossRef](#)] [[PubMed](#)]
15. Cassey, P.; Hogg, C.J. Escaping captivity: the biological invasion risk from vertebrate species in zoos. *Biol. Conserv.* **2015**, *181*, 18–26. [[CrossRef](#)]
16. Lindhout, P.; Reniers, G. Reflecting on the safety zoo: Developing an integrated pandemics barrier model using early lessons from the Covid-19 pandemic. *Saf. Sci.* **2020**, *130*, 104907. [[CrossRef](#)] [[PubMed](#)]

Short Biography of Author



Anna Loy is Associate Professor of Zoology at the Department of Biosciences and Territory at the University of Molise since 2007, where she teaches zoology for undergraduate students and zoology and ecology of vertebrates for the master's degree. She is also president of the Italian Mammal Society (www.mammiferi.org) since 2018, and co-chair of the IUCN Otter Specialist Group (<https://www.otterspecialistgroup.org/osg-newsite/>) since 2019. She received her academic training in Biological Science (laurea cum laude, 1981) and earned her PhD (1992) in evolutionary ecology at the University of Rome "Sapienza" in Italy. She has published more than 70 peer-reviewed papers (Scopus h-index 20) mainly focused on the biology, ecology, evolution, and conservation of European mammals. She is co-editor, with Paolo Ciucci, of the "Carnivore" volume of the Handbook of European Mammals (Zachos and Hacklander Eds.) by Springer. Her research interests include the biology, ecology, and conservation of vertebrates, mainly using niche and species distribution modelling, geometric morphometrics, as well as genetic and genomic approaches.

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