The potential of Social Network Analysis as a tool for the management of zoo animals

PE Rose*†‡ and DP Croft†

† Centre for Research in Animal Behaviour, Psychology, University of Exeter, Washington Singer, Perry Road, Exeter EX4 4QG, UK
‡ Wildfowl & Wetlands Trust, WWT Slimbridge Wetland Centre, Slimbridge, Gloucestershire GL2 7BT, UK
* Contact for correspondence and requests for reprints: p.rose@exeter.ac.uk

Abstract

Social Network Analysis (SNA) enables the fine scale of animal sociality and population structure to be quantified. SNA is widely applied to questions relating to behavioural ecology but has seen little use in the application to zoo animal management, despite its clear potential. Investment in social bonds between individuals positively affects health status, welfare state, long-term fitness and lifetime reproductive output. Such positive affective states can be maintained consistently within captive situations if more information is known about the social preferences of the individuals that are kept. Disruption to social bonds may lead to impoverished welfare and stress to individuals which have seen their social support compromised. The patterning of social relationships between individuals also influences how space is utilised and how animals interact with resources provided for them. With more detailed knowledge of the social structure of a group or population, social groupings (for example, for captive breeding) can be specifically designed to minimise social stress. Likewise, enhancing the chances of successful reproduction can be achieved if we understand the role that each individual within a network plays and how these roles may impact on the behaviour of others. This paper discusses key aspects of SNA applicable to zoo-based researchers wishing to investigate the social lives of zoo animals. We present a review of how SNA can be used to assess social behaviour and highlight directions for future research. Our aim is to stimulate new research to ultimately improve our understanding of reproductive success, decision-making, group leadership, animal health and enclosure use. We conclude that what can be learned about the dynamics of social zoo-housed species using SNA can directly impact on husbandry decisions and help underpin excellent standards of animal welfare.

Keywords: animal welfare, evidence-based husbandry, group structure, social network analysis, social organisation, zoo animal behaviour

Introduction

Growth in the scientific rigour by which animal welfare is measured (Hill & Broom 2009) can allow for more accurate assessment of infringement and maintenance of positive welfare. New evidence-based husbandry approaches (Melki 2009), and welfare assessment via positive affective states and subjective experiences (Whitham & Wielebnowski 2013), enable zoos to manage populations in more biologically relevant situations. Social interaction and patterns of association are important to health, welfare and the fitness of individuals (Price & Stoinski 2007; Silk et al 2009). In several species, it has been shown that investment in stable relationships with conspecifics positively impacts upon lifespan and reduces physiological stress across different life stages (Archie et al 2014; Fürthauer et al 2014). By assessing why specific individuals chose to invest time with (or avoid) conspecifics, decisions relating to the movement of animals between groups can be taken more soundly. Long-term animal welfare, measured using a paradigm of individual experience and state within a managed environment (Bracke & Hopster 2006; Clark 2011), can be enhanced by this evidence-based approach to group husbandry, as has been seen in farm animal research (Boe & Færevik 2003). Research into the social behaviour of group-living mammals demonstrates the importance of social bonds and the benefits of structured relationships to individual and population welfare (Boccia et al 1997; Krause & Ruxton 2002, Silk 2007a,b; Silk et al 2009, 2010a,b). Stable social relationships can enhance reproductive success, health status, welfare state and longevity (Krause & Ruxton 2002, Silk 2007a,b). The social fine structure of animal populations thus has consequences at both individual and population level. Understanding these effects has the potential to improve the management of captive species by helping identify areas of management that infringe on an individual’s attempts at choosing its social environment; for example, by informing enclosure design so that proximity between individuals is not forced. The number of species currently studied regarding this ‘social function’ is limited, but it would appear that many familiar zoo animals live in