

An appetite for connection: why we need to understand the effect and value of feeding wild birds

Darryl Jones

Environmental Futures Centre, Griffith University, Nathan, QLD 4111, Australia. Email: d.jones@griffith.edu.au

Birds and people

People have had a long and passionate relationship, of great depth and complexity, with birds. Beyond utilitarian uses such as providing food and feathers, birds feature in the religious, ceremonial and spiritual dimensions of many societies. Many are revered as totems and gods, feared as spirits and demonic messengers, and valued as symbols and exemplars (Sax 2007; Weidensaul 2007). More prosaically, huge numbers of people, from all walks of life throughout the world, seek birds, not to worship or hunt but 'simply' to watch. Bird-watching appears to be the largest nature-based pastime in the world and the number of participants continues to increase (Jones and Buckley 2001; Cordell and Herbert 2002). The ubiquity and scale of this activity has led to considerable research attention, with environmental psychologists exploring knowledge of birds as indicators of ecological awareness, resource economists and tourism researchers revealing the scale and significance of bird-watching as an industry, and sociologists expanding on the cultural meanings of birds in different settings (see e.g. Rhode and Kendell 1994; Schultz 2000; Birkhead 2008; Green and Jones 2010).

Although there is no denying the scale and importance of bird-watching, there is another facet of the relationship between humans and birds that is even more common and certainly more intimate: the virtually universal practice of feeding wild birds. Although attracting birds by the provision of food is probably the most widespread and popular form of human–wildlife interaction throughout the world (Fuller *et al.* 2008; Robb *et al.* 2008) remarkably little is known about the practice (Jones and Reynolds 2008). This lack of reliable knowledge is becoming increasingly important. In Australia, concerns about the implications and effects of feeding have resulted in a widely acknowledged but largely unofficial opposition to the practice. This contrasts with the United States of America (USA) and United Kingdom (UK) where most bird and conservation organisations actively promote the practice as an important conservation activity (Toms 2003; Cornell Lab of Ornithology, Citizen science toolkit, see <http://www.birds.cornell.edu/citscitoolkit/toolkit>, accessed 12 January 2011). Both the promotion and opposition to feeding are, however, based on alarmingly little evidence and also tend to ignore the considerable complexity of this multidimensional phenomenon (Fuller *et al.* 2008).

The longer history and the far more overt practice of feeding in the northern hemisphere seems to relate to its origins as a humane response to the plight of hungry birds during winter (Weidensaul 2007). Well-publicised 'hard winters' in the early 20th century,

during which thousands of birds were found frozen in city streets, seem to have given impetus to mass 'outreach to the birds' movements in the USA (Goodwin 1978). From these important emotional origins has developed a massive industry, with poorly understood – but likely profound – influences over large areas (Robb *et al.* 2008). In the UK, for example, the survival of several species appears to be sustained at least in part by the provision of seed (Sterry and Toms 2008). The general approval of the practice in the northern hemisphere has also resulted in clear and practical advice for feeders. An abundance of sources provide detailed information on how and what to feed and guidelines on best practice (e.g. Burton and Holden 2003; National Bird-Feeding Society, 'Feeding for the best', see <http://www.birdfeeding.org/>, accessed 2 February 2011; see Table 1). In contrast, those feeding birds in Australia, though many and widespread (see WildWatch, at <http://abc.net.au/tv/wildwatch>, accessed 1 February 2011) have largely operated as free agents (Howard 2006), many aware of the apparent stigma of their hobby but passionately committed to 'their' birds anyway (Jones and Howard 2006). Accepting such desire and motivation on the part of the people so engaged is an important component in attempts to understand the effect and implications of this important and intimate relationship (Ishigame and Baxter 2007; also 'Birds and People: A Global Celebration of Birds in Human Culture', see <http://www.birdsandpeople.org>, accessed 1 April 2011). It is time to acknowledge that feeding of wild birds is an important activity for large numbers of people; that the practice may be a significant form of connecting with nature; and that, frankly, it is here to stay. Equally, we need to recognise that the ecological and conservation dimensions of the phenomena are vastly different to those of the northern hemisphere and that the ecological implications and effects are likely to be very different. For all these reasons, it is time to take feeding seriously.

Wild-bird feeding: here and there

Globally, provisioning wild birds is occurring on a colossal scale. In the northern hemisphere numerous surveys of participation rates have found 34–75% of households in the USA and UK were engaged in the practice (Cowie and Hinsley 1988; Rogers 2002; US Fish & Wildlife Service 2002). This activity is explicitly endorsed by organisations such as the British Trust for Ornithology (BTO), the Royal Society for the Protection of Birds (RSPB) and the Cornell Lab of Ornithology (CLO), who actively promote feeding as a 'positive investment in the survival of our birds' (e.g. Sterry and Toms 2008; Royal Society for the Protection of

Table 1. A small sample of the many online sources of information, advice and opinion on feeding of wild birds, including some major citizen science projects (all sites verified 1 April 2011)

Country	Website	Project manager – Project or site notes
Australia	http://www.birdsinbackyards.net/ http://canberrabirds.org.au/ http://www.parks.tas.gov.au/index.aspx?base=2980	Birds Australia – Birds In Backyards project Canberra Ornithologists Group – Canberra Garden Bird Survey Parks Tasmania – Keeping Wildlife Wild program
New Zealand	http://www.nzbirds.com/more/feed.html http://www.landcareresearch.co.nz/research/biocons/gardenbird/	New Zealand Birds – advice on feeding Landcare Research – A key government agency, established the Garden Bird Survey with Forest & Bird and the Ornithological Society of NZ
USA	http://www.birds.cornell.edu/citscitoolkit/toolkit http://www.birds.cornell.edu/pfw/AboutBirdsandFeeding/abtbirds_index.html http://www.eastbaynature.com/tips.htm http://www.birdfeeding.org/	The Cornell Lab of Ornithology– Citizen Science pages The Cornell Lab of Ornithology (CLO) – Project FeederWatch East Bay Nature, California – one of many US sites promoting feeding and providing information National Bird-Feeding Society – the major organisation associated with feeding birds in the USA
UK	http://forums.gardenweb.com/forums/wildlife http://www.rspb.org.uk/advice/helpingbirds/feeding/ http://www.bto.org/volunteer-surveys/gbw http://www.ufaw.org.uk/gbhi.php	An important US site for debate over the pros and cons of feeding Royal Society for the Protection of Birds – advice on feeding birds British Trust for Ornithology – Garden BirdWatch Universities Federation for Animal Welfare – The Garden Bird Health Initiative

Birds, ‘Helping birds’, see <http://www.rspb.org.uk/advice/helpingbirds/feeding/>, accessed 1 April 2011). The result is a massive, global birdseed and peripherals industry estimated to be worth hundreds of millions of dollars. In the USA during 2002, ~82 million householders distributed over 450 million kilograms of seed (US Fish & Wildlife Service 2002); the latest estimation of value of the industry in that country was \$US4.5 billion annually (Fair 2006). In the UK, recent estimates suggest that British feeders outlay £240–290 million each year on seed, dispensers and other peripherals (Jones and Reynolds 2008). Importantly, the practice of feeding is thoroughly dominated by the use of a small number of seed-types; although still frequently used, home-made suet (fat) balls, bird ‘puddings’ and sugar-water mixtures are minor components of the overall smorgasbord (Toms 2003).

In Australia, many would view the scale of this phenomenon with astonishment and possibly alarm (Seipen and Stanley 1996; Petrie *et al.* 2003). Certainly, a clear anti-feeding sentiment among wildlife and conservation agencies and birding organisations is strongly evident and widely acknowledged in Australia (Howard and Jones 2004; Ishigame and Baxter 2007; Jones 2008). Although the principal focus of this opposition has been on feeding in reserves and parks (Orams 2002), several agencies have seriously contemplated banning even domestic feeding (D. Jones, unpubl. data). Just why this widespread opposition has developed here remains a minor mystery (Howard 2006) but would repay a careful historical investigation.

In reality, and despite considerable discouragement and censure, participation rates in Australia are virtually identical to those of the rest of the world: a series of studies have consistently found levels between 38 and 57% from all corners of the country (Rollinson *et al.* 2003; Howard and Jones 2004; Ishigame and Baxter 2007). An appreciation of the popularity – and durability – of this interaction in Australia has recently resulted in preliminary discussions on guidelines for feeding (Plant 2008), as well as on alternatives such as attracting birds through garden design (Parsons 2008). However, significant concerns remain.

Should we be worried?

One of the reasons that many are concerned is that the practice of feeding has been associated with an alarming array of effects on the birds and the environment more generally (Green and Higginbottom 2000; Orams 2002). These include the spread of disease, nutritional imbalances, enhancement of introduced or unpopular species, increased aggression, the creation of ‘ecological traps’, increases in unpopular species, including vermin, and, most frequently mentioned, the possibility of dependency on anthropogenic foods (Anderson *et al.* 1997; O’Leary and Jones 2006). (Only some of these concerns are further discussed here; see Orams 2002, Ishigame *et al.* 2006 and Fuller *et al.* 2008 for further discussion.) These negatives are countered by proponents who point out that feeding birds has many benefits, such as the improved survival of wintering birds, enhancement of certain threatened populations, and an increase in general environmental awareness among people who feed birds (e.g. see Burton and Holden 2003; Sterry and Toms 2008).

A sober assessment of the available evidence for each of these points – both negative and positive – quickly stalls, however, because there is a lack of reliable empirical evidence (Jones and Reynolds 2008). Although there are endless anecdotes relating to a particular issue, many of the published studies are often too localised to allow useful extrapolation. Important exceptions to such generalisations are studies of several avian diseases whose spread has been linked to use of feeders. The best known of these was the conjunctivitis epidemic among American House Finches (*Carpodacus mexicanus*) in the eastern USA, a phenomenon initially reported among birds visiting feeders (Dhondt *et al.* 2001). The subsequent monitoring of the spread of the disease was achieved by recruiting large numbers of feeder operators in one of the most effective examples of large-scale ‘citizen science’ (Hochachka and Dhondt 2000). This army of motivated participants enabled researchers to follow the outbreak through its peak *c.* 2004 (when ~15% of the eastern population of House Finches were infected) and the later ‘plateau’ phase (Cornell Lab

of Ornithology, Project FeederWatch, see http://www.birds.cornell.edu/pfw/AboutBirdsandFeeding/abtbirds_index.html, accessed 2 October 2010). The House Finch Disease Project was wound up in 2009 with advice that included the statement: ‘Feeding birds may not necessarily increase the rate of disease spread’ (http://www.birds.cornell.edu/pfw/AboutBirdsandFeeding/abtbirds_index.html), a view that reflects the acute sensitivity to inferring possible effects of the use of feeders in the USA (see especially the reaction to a controversial article in the *Wall Street Journal*; Sterba 2002; Erickson 2003).

Remarkably similar characteristics surround the discovery and monitoring of the protozoan disease *Trichomoniasis gallinae* in the UK, which was declared an epidemic in 2005 (Robinson *et al.* 2010). Unlike the conjunctivitis, *Trichomoniasis* is fatal for most infected Common Greenfinch (*Chloris chloris*) and Common Chaffinch (*Fringilla coelebs*), and has resulted in declines of affected populations of 35 and 21% respectively, between 2007 and 2009 in the UK (Robinson *et al.* 2010). Again, the role of feeders appeared to be somewhat equivocal. Although there is no doubt that infections are more likely owing to the cramming of birds at feeding stations, the highly gregarious social behaviour of the two main species suggested that any infection was likely to spread quickly. Less-social British finches, though also susceptible, have been far less affected (Robinson *et al.* 2010). *Trichomoniasis* has often been detected in wild populations of many species, but outbreaks appear to have short durations (Real *et al.* 2000). Nonetheless, one such event in California in 2006 among native Band-tailed Pigeons (*Patagioenas fasciata*) and Mourning Doves (*Zenaida macroura*) led to a rare call for a temporary cessation of feeding by wildlife authorities (California Department of Fish and Game 2006). Thankfully to date, no similar feeder-related epidemics have occurred in Australia although there is considerable potential for such a phenomenon. Certainly the sporadic detection of Psittacine Beak and Feather Disease among cockatoos and lorikeets, as well as clostridia, have frequently provided cause for concern; such outbreaks have been cited as reasons for the banning of feeding (NPWS 2003). Despite the rather dramatic examples mentioned above, the rarity of such events emphasises that there is little evidence for a clear role for use of feeders in transmission of disease.

A significant feature of bird feeding as practiced in Australia is the heavy provision of meat as the main food (Rollinson *et al.* 2003). With larger, predatory birds, such as Australian Magpies (*Cracticus tibicen*), butcherbirds (*Cracticus* spp.) and Pied Currawongs (*Strepera graculina*) being among the most frequent – and favoured – visitors to feeding stations (Rollinson *et al.* 2003; Ishigame and Baxter 2007), a wide variety of meats, such as mince, sausage and organs, are used to attract these species. This raises several issues: risk of disease associated with communal feeding, the potential for bacterial spread owing to feeding on raw meats, as well as the potential nutritional effect of heavy use of fatty processed foods. Unfortunately, we know very little about any of these issues, although one experimental study of captive Magpies found consistently raised cholesterol levels in birds eating a diet of processed sausage meat (Ishigame *et al.* 2006).

Feeding really does change things

Although little is known about the negative effects of feeding birds on their ecosystems, the fundamental influence of food

supply on the lives of animals has long been appreciated, largely through many carefully conducted supplementary feeding experiments (see Martin 1987; Robb *et al.* 2008). These studies have explored, for example, the influence of the timing, quantity and quality of food provisioning on hatching and laying dates, clutch-size, and survival of chicks and fledglings (Boutin 1990; Newton 1998). This work on a huge variety of species means that we can now be reasonably certain about some important likely outcomes of feeding. First, wintering birds supplied with additional foods have greatly enhanced survival, and second, food supplementation almost always advances the key reproduction dates: laying, hatching, fledging and, often, re-nesting (Chamberlain *et al.* 2005; Fuller *et al.* 2008). Thus, supplemented birds typically breed earlier and more often. However, evidence for direct benefits to fitness, such as producing larger clutches and enhancing hatching survival is far less obvious (Robb *et al.* 2008). In an important recent experiment conducted in the UK, Great Tits (*Parus major*) and Blue Tits (*Cyanistes caeruleus*) were provided with supplementary foods over three consecutive breeding seasons (Harrison *et al.* 2010). This unusually long duration for the experiment found that whereas laying date was earlier and incubation duration reduced as expected, clutch-sizes and hatching success were actually lower than unfed populations. The importance of these findings, acknowledged directly by the researchers (Harrison *et al.* 2010), was that these breeding parameters closely resembled what had been noted among urban populations of several species of British birds, many of which habitually use feeders (Chamberlain *et al.* 2009). Given the assumption that feeders enhance urban bird populations, these are sobering discoveries, although the mechanisms are far from being understood.

Beyond the possible influences on the breeding outcomes for the species being fed, it is also important to consider which species are the main beneficiaries of the provisions. In most cases, this is all too self-evident: those bold enough to access the feeders. Although there are always local exceptions, most birds utilising these sources of food are those already common (Cannon *et al.* 2005; Parsons *et al.* 2006). In urban areas such species are, by necessity, those that have become habituated to the presence and activities of people (Chace and Walsh 2006); species unable to tolerate or accommodate human-dominated environments tend to have disappeared long ago (Chamberlain *et al.* 2005). Indeed, Fuller *et al.* (2008) has recently demonstrated that feeding of garden birds in the UK greatly enhances the abundance of local feeder-using species but did not influence species richness: more birds but not more species.

It is also important to take a broader perspective, beyond the feeding table. Anthropogenic influences are also implicated in the dramatic increases in a range of species that are rarely intentionally fed. Corvid populations, for example, are continuing to expand throughout the world, almost certainly owing to the relative easy of access to a variety of anthropogenic foods, including an abundance of discarded waste and road-kill (Marzluff and Angell 2007). In Australia, virtually every large city has experienced massive increases in the number of Rainbow Lorikeets (*Trichoglossus haematodus*), a trend attributed to the popularity of nectar-bearing shrubs and trees being planted in suburban gardens (White *et al.* 2005). The same food source appears to be enhancing the well-known effects of Noisy Miners

(*Manorina melanoccephala*). Similar examples abound, all with a familiar lesson: even good intentions can have unexpected influences (see Catterall 2004). Could feeding also be implicated in enhancing populations of such species to the detriment of others?

The decline in avian biodiversity is of profound concern to most of us, and the possibility that a human activity as common as feeding may be implicated is alarming. This seemingly logical connection, however obvious and tempting to make, is, however, far from linear. The dramatic changes in abundances among urban species have been well documented (e.g. Low 2002; Catterall 2004) although the influences at play are proving to be difficult to untangle (Major *et al.* 2001). Perhaps the most pertinent such example of unexpected findings concerns the issue of dependency, the number one concern of both proponents and opponents alike (Howard and Jones 2004): with so much human-provided food so easily available, it is argued that many birds must surely become reliant on this food, perhaps even losing their natural foraging skills. Thus, the widely publicised ‘Golden Rule’ of feeding: once you start, don’t stop (e.g. Toms 2003). However, several recent studies looking specifically at this issue have found that a variety of species (including suburban Australian Magpies, British tits and Scrub Jays (*Aphelocoma coerulescens*) (Cowie and Hinsley 1988; Fleischer *et al.* 2003; O’Leary and Jones 2006)), all with easy access to anthropogenic foods, used only small proportions of this food, but especially so when feeding their chicks. Most impressive of all, a population of North American Black-capped Chickadees (*Poecile atricapillus*) studied over several harsh winters in Maine showed no dependency on feeders and survived even when the feeders were suddenly withdrawn (Brittingham and Temple 1992).

One of the generalisations that can be drawn from such studies is that many species appear to be far more discerning than expected in terms of the types and amounts of foods used (Chapman and Jones 2009). On the other hand, many of the foods exploited by urban birds are designed to be easily digestible; a few fatty chips or slices of salami may have a disproportionate dietary effect than a far greater amount of natural foods (Ottoni *et al.* 2009). In a Tasmanian study, Silver Gulls (*Chroicocephalus novaehollandiae*) consuming a large proportion of human foods in their diet tended to be heavier on average than those with a mainly natural diet (Auman *et al.* 2008). Similar findings have been associated with specific sites where supplementary foods have been used to attract certain species for easy viewing (Orams 2002). Interestingly, it is becoming clear that such sites are often monopolised by a small number of behaviourally dominant individuals, who obtain a disproportionate amount of the food being offered (Chapman and Jones 2010, *in press*). Thus, any adverse effects attributable to the foods may be being concentrated in a few animals, potentially limiting the risks to the local population.

Enhancing the connection

Although the examples provided here suggest that we are starting to understand some specific aspects of the practice of feeding, they also demonstrate how little we really know about so complex and so common a phenomenon as wild-bird feeding. Although we can begin to form reliable perspectives on a range of physiolog-

ical, ecological and behavioural facets of the practice, we remain remarkably uncertain about one of the most fundamental questions associated with feeding: why do people feed birds? Although there are many seemingly obvious reasons – pleasure, providing food, enjoying their company, bring them closer to observe, and so on – I am aware of only two studies that have delved deeper in an attempt to discern aspects of the motivation for providing food for other species. In the first, Peter Howard asked people feeding birds to express their motivation in their own words (Howard and Jones 2004; Howard 2006). As well as confirming the expected reasons listed above, many people also stated that they fed birds for various ethical or moral reasons, a typical response being paraphrased as ‘Humans have done so much damage to nature, I am trying to give something back’. Such perspectives strongly suggest far more diverse and profound dimensions to the seemingly simple practice of feeding than may have been suspected. They also emphasise the importance of investigating how birds are ‘valued’ in Australia, a task recently begun by Ainsworth *et al.* (2010).

The second study (Schrieber 2010), recently completed in the UK, discerned remarkably similar motivations to those of the Australia respondents of Howard and Jones (2004), despite the differing conditions and species. Although the emotional attachment was obvious, UK feeders expressed strong feeling of ‘protection’ and ‘attachment’; people were committed to providing assistance and care for ‘their’ birds.

Bird feeding is also worthy of a far greater level of attention for the fundamental reason that it is one of the principal forms of human–wildlife interaction in the contemporary world. For increasing numbers of urban dwellers, the main venue of any interaction with wild animals will be with the birds they encounter within the suburban environments in which they live (Miller and Hobbs 2002). For many, a simple visitation by a lorikeet or Magpie may represent a vital link with the natural world; ‘commonness’ need not be dismissed as simply ‘common’ (Gaston and Fuller 2008). For others, ‘their’ backyard birds represent a critical indication of how nature is coping with the human onslaught. And they are right: having long abandoned the city as a lost cause, ecologists are now discovering urban areas as rich, diverse and dynamic ecosystems with the study of urban environments rapidly becoming prominent in the vibrant emerging field of urban ecology (Hostetler 1999; McDonnell *et al.* 2009).

One of the key incentives for these attempts to understand the urban ecosystem is the recognition that this is the environment in which increasing numbers of us actually live (Miller and Hobbs 2002). Exploring the implications of human actions for other species is especially vital when the effects may be occurring literally in our own backyard. Conducting research in cities and suburbs is not, however, for the faint-hearted. As well as the innumerable logistical challenges of working in a human-dominated landscape, the presence of all those often opinionated, frequently motivated, people can be bewildering. But it is also an immense opportunity. By carefully recruiting the interest and time of huge numbers of urban residents in reporting the birds in local areas, programs such as *Project FeederWatch* in the USA (http://www.birds.cornell.edu/pfw/AboutBirdsandFeeding/abtbirds_index.html) and *Garden BirdWatch* in the UK (see <http://www.bto.org>, accessed 13 January 2011) have provided

information of inestimable importance (Sterry and Toms 2008). Birds Australia's own version, *Birds in Backyards*, is currently underway (see <http://birdsinyard.net>, accessed 23 January 2011) and the Canberra Ornithologists Group's *Garden Bird Survey* recently completed 25 years of reporting (Canberra Ornithologists Group 2011). The scale, detail and coverage of this largely volunteer labour-force could never be replicated by even the most organised research group (Silvertown 2009). The many bird atlasing projects, almost all conducted entirely by armies of volunteers, are excellent examples of what can be achieved by 'citizen scientists' (Dunn and Weston 2008). These unpaid (and sometimes, paying) devotees are dramatically improving the precision of our understanding of processes such as changing distributions and the timing of migrations (see e.g. Chamberlain *et al.* 2005). And although there are legitimate concerns about the quality of the data collected (Cohn 2008), there are equally good examples of how such limitations can be addressed (<http://www.birds.cornell.edu/citscitoolkit/toolkit>) and how the volunteers can be recruited and retained (Wolcott *et al.* 2008).

An appreciation of the large numbers of people actively engaged in wild-bird feeding – and by people intrinsically motivated (Howard and Jones 2004) – suggests that those feeding birds could represent a valuable pool of potential citizen scientists, as already recognised elsewhere (e.g. see Dhondt *et al.* 2001; Harrison *et al.* 2010). Indeed, by their involvement in this pastime, some participants, at least, appear to conform to the attributes necessary to ensure high levels of reliable data collection (see Silvertown 2009; Mulder *et al.* 2010): commitment, previous experience in long-term projects, and a strong degree of personal interest in the study subjects. If the issues discussed in this article are as important as proposed, the time is right to begin a partnership with this unusually well suited group of co-workers.

It's time

The phenomenon of wild bird-feeding in Australia is both immensely popular and its ecological effect poorly understood. Given the scale of the practice, its ecological influence may be significant on many levels: populations, nutrition, disease, interspecific competition and others. Similarly, the implications for the people involved may be considerable, potentially promoting general environmental awareness, or even more profound values of connectedness with nature (Miller and Hobbs 2002; Louv 2005). These influences and implications may occur, but at present, we simply cannot say much with certainty if this is so. Nonetheless, what is clear from the few studies so far completed is that people feeding birds are passionately engaged and care deeply about the welfare of 'their' birds. In any pursuit, such devotion typically fosters a desire for further information and guidance. Currently, people feeding birds in Australia know that there is no point in seeking such advice; none exists locally and almost all information from other countries simply does not apply here. The result is that, every day, thousands of sincerely concerned people provide food for birds without advice or guidance and many worry about whether they may be harming the birds they care about deeply (Jones and Howard 2006). Some resources are available to give pointers as to best practice when feeding Australian birds (Plant 2008, 2010) but empirical studies are

urgently required to assess the effects of large-scale feeding on the populations on the birds that live among us. People will continue to attract birds to their backyards with food. It's time to understand how they can do so with maximum benefit and minimum harm.

References

- Ainsworth, G. B., Aslin, H. J., Garnett, S. T., and Weston, M. (2010). Twitching for values in the human domain: how do Australians value native birds? In 'Australasian Wildlife Management Society Annual Conference', 1–3 December 2010, Torquay, VIC. (Birds Australia.) [Abstract].
- Anderson, T., Bitossi, K., Berhammer, L., Cahill, D., Denning, D., Lanham, S., Lowe, C., Muller, A., and Pinwill, S. (1997). Wildlife feeding: is it a problem? University of Queensland, Gatton, QLD.
- Auman, H. J., Meathrel, C. E., and Richardson, M. (2008). Supersize me: does anthropogenic food change the body condition of Silver Gulls? A comparison between urbanized and remote, non-urbanized areas. *Waterbirds* **31**, 122–126. doi:10.1675/1524-4695(2008)31[122:SMDAFC]2.0.CO;2
- Birkhead, T. R. (2008). 'The Wisdom of Birds.' (Bloomsbury: London.)
- Boutin, S. (1990). Food supplementation experiments with terrestrial vertebrates: patterns, problems and the future. *Canadian Journal of Zoology* **68**, 203–220. doi:10.1139/z90-031
- Brittingham, M. C., and Temple, S. A. (1992). Does winter feeding promote dependency? *Journal of Field Ornithology* **63**, 190–194.
- Burton, R., and Holden, P. (2003). 'RSPB Birdfeeder's Guide.' (Dorling Kinderley: London.)
- California Department of Fish and Game (2006). DFG asks Northern Californians to slow avian disease. California Department of Fish and Game, Sacramento, CA. Available at <http://dfga.ca.gov/news/news06.06041.html> [Verified 13 May 2007].
- Canberra Ornithologists Group (2011). Garden Birds of Canberra. Canberra Ornithologists Group, Canberra. Available at <http://garden.canberrabirds.org.au/> [Verified 13 January 2011].
- Cannon, A. R., Chamberlain, D. E., Toms, M. P., Hatchwell, B. J., and Gaston, K. J. (2005). Trends in the use of private gardens by wild birds in Great Britain 1995–2002. *Journal of Applied Ecology* **42**, 659–671. doi:10.1111/j.1365-2664.2005.01050.x
- Catterall, C. P. (2004). Birds, garden plants and suburban bushlots: where good intentions meet unexpected outcomes. In 'Urban Wildlife: More than Meets the Eye'. (Eds S. K. Burger and D. Lunney.) pp. 21–31. (Royal Zoological Society of NSW: Sydney.)
- Chace, J. F., and Walsh, J. J. (2006). Urban effects on native avifauna: a review. *Landscape and Urban Planning* **74**, 46–69. doi:10.1016/j.landurbplan.2004.08.007
- Chamberlain, D. E., Vickery, J. A., Glue, D. E., Robinson, R. A., Conway, G. J., Woodburn, R. J., and Cannon, A. R. (2005). Annual and seasonal trends in the use of garden feeders by birds in winter. *Ibis* **147**, 563–575. doi:10.1111/j.1474-919X.2005.00430.x
- Chamberlain, D. E., Cannon, A. R., Tom, M. P., Leech, D. I., Hatchwell, B. J., and Gaston, K. J. (2009). Avian productivity in urban landscapes: a review and meta-analysis. *The Ibis* **151**, 1–18. doi:10.1111/j.1474-919X.2008.00899.x
- Chapman, R., and Jones, D. N. (2009). Feeding the ducks: quantifying a common wildlife–human interaction. *Sunbird* **39**, 19–28.
- Chapman, R., and Jones, D. N. (2010). Duck diversity in greater Brisbane: native species, domestic races and the influence of feeding. *Sunbird* **40**, 1–9.
- Chapman, R., and Jones, D. N. Foraging by native and domestic ducks in urban lakes: behavioural implications of all that bread. *Corella*, in press.
- Cohn, J. P. (2008). Citizen science: can volunteers do real research? *Bioscience* **58**, 192–197. doi:10.1641/B580303
- Cordell, H. K., and Herbert, N. G. (2002). The popularity of birding is still growing. *Birding* **34**(1), 54–61.

- Cowie, R. J., and Hinsley, S. A. (1988). Feeding ecology of Great Tits (*Parus major*) and Blue Tits (*Parus caeruleus*) breeding in suburban gardens. *Journal of Animal Ecology* **57**, 611–626. doi:10.2307/4928
- Dhondt, A. A., Hochachka, W. M., Altizer, S. M., and Hartup, B. K. (2001). The House Finch hot zone: citizen science on the trail of an epidemic. *Living Bird* **20**, 24–30.
- Dunn, A. M., and Weston, M. A. (2008). A review of terrestrial bird atlases of the world and their application. *Emu* **108**, 42–67. doi:10.1071/MU07034
- Erickson, L. (2003). *Wall Street Journal* feeding article distorts truth. Available at <http://www.laurierickson.com/Birds/Conservation/WSJDistortions1.html> [Verified 3 September 2007].
- Fair, J. (2006). Should we feed birds? *BBC Wildlife* **24**(1), 46–48.
- Fleischer, A. L., Bowman, R., and Woolfenden, G. E. (2003). Variation in foraging behaviour, diet and time of breeding in Florida Scrub-Jays in suburban and wildland habitats. *Condor* **105**, 515–527. doi:10.1650/7224
- Fuller, R. A., Warren, P. H., Armsworth, P. R., Barbosa, O., and Gaston, K. J. (2008). Garden bird feeding predicts the structure of urban avian assemblages. *Diversity & Distributions* **14**, 131–137. doi:10.1111/j.1472-4642.2007.00439.x
- Gaston, K. J., and Fuller, R. A. (2008). Commonness, population depletion and conservation biology. *Trends in Ecology & Evolution* **23**, 14–19. doi:10.1016/j.tree.2007.11.001
- Goodwin, D. (1978). 'Birds of Man's World.' (British Museum of Natural History: London.)
- Green, R. J., and Higginbottom, K. (2000). The effects of non-consumptive wildlife tourism on free-ranging wildlife. *Pacific Conservation Biology* **6**, 183–197.
- Green, R. J., and Jones, D. N. (2010). Practices, needs and attitudes of birdwatching tourists in Australia. CRC for Sustainable Tourism, Gold Coast, QLD.
- Harrison, T. J. E., Smith, J. A., Martin, G. R., Chamberlain, D. E., Bearhop, S., Ronn, G. N., and Reynolds, S. J. (2010). Does food supplementation really enhance productivity of breeding birds? *Oecologia* **164**, 311–320. doi:10.1007/s00442-010-1645-x
- Hochachka, W. N., and Dhondt, A. A. (2000). Density-dependent decline of host abundance resulting from a new infectious disease. *Proceedings of the National Academy of Sciences of the United States of America* **97**, 5303–5306. doi:10.1073/pnas.080551197
- Hostetler, M. (1999). Scale, birds and human decisions: a potential for integrative research in urban ecosystems. *Landscape and Urban Planning* **45**, 15–19. doi:10.1016/S0169-2046(99)00025-0
- Howard, P. (2006). The beast within: an exploration of Australian constructions of wildlife. Ph.D. Thesis, Griffith University, QLD.
- Howard, P., and Jones, D. N. (2004). A qualitative study of wildlife feeding in south-east Queensland. In 'Urban Wildlife: More than Meets the Eye'. (Eds S. K. Burger and D. Lunney.) pp. 55–62. (Royal Zoological Society of NSW: Sydney.)
- Ishigame, G., and Baxter, G. S. (2007). Practice and attitudes of suburban and rural dwellers to feeding wild birds in south-east Queensland, Australia. *Ornithological Science* **6**, 11–19. doi:10.2326/1347-0558(2007)6[11:PAAOSA]2.0.CO;2
- Ishigame, G., Baxter, G. S., and Lisle, A. T. (2006). Effects of artificial foods on the blood chemistry of the Australian Magpie. *Austral Ecology* **31**, 199–207. doi:10.1111/j.1442-9993.2006.01580.x
- Jones, D. N. (2008). Feed the birds. *Wingspan* **18**(1), 16–19.
- Jones, D. N., and Buckley, R. (2001). Bird-watching tourism in Australia. CRC for Sustainable Tourism, Gold Coast, QLD.
- Jones, D. N., and Howard, P. (2006). Wildlife feeding in urban areas: an indecent obsession? *Wildlife Australia* **38**(3), 18–20.
- Jones, D. N., and Reynolds, S. J. (2008). Feeding birds in our towns and cities: a global research opportunity. *Journal of Avian Biology* **39**, 265–271. doi:10.1111/j.0908-8857.2008.04271.x
- Louv, R. (2005). 'Last Child in the Woods.' (Workman Publishing: New York.)
- Low, T. (2002). 'The New Nature.' (Viking: Melbourne.)
- Major, R. E., Christie, F. J., and Gowling, G. (2001). Influence of remnant and landscape attributes on Australian woodland bird communities. *Biological Conservation* **102**, 47–66. doi:10.1016/S0006-3207(01)00090-8
- Martin, T. E. (1987). Food as a limit on breeding birds: a life-history perspective. *Annual Review of Ecology and Systematics* **18**, 453–487. doi:10.1146/annurev.es.18.110187.002321
- Marzluff, J. M., and Angell, T. (2007). 'In the Company of Crows and Ravens.' (Yale University Press: New Haven, CT.)
- McDonnell, M. J., Hahs, A. K., and Breusle, J. H. (2009). 'Ecology of Cities and Towns.' (Cambridge University Press: Cambridge, MA, USA.)
- Miller, J. R., and Hobbs, R. J. (2002). Conservation where people live and work. *Conservation Biology* **16**, 330–337. doi:10.1046/j.1523-1739.2002.00420.x
- Mulder, R. A., Guay, P.-J., Wilson, M., and Coulson, G. (2010). Citizen science: recruiting residents for studies of tagged urban wildlife. *Wildlife Research* **37**, 440–446. doi:10.1071/WR10007
- NPWS (2003). Feeding link to Psittacine Beak and Feather Disease. NSW National Parks and Wildlife Service, Sydney. Available at <http://www.environment.nsw.gov.au/animals/TheDangersOfFeedingLorikeets.htm> [Verified 1 July 2003].
- Newton, I. (1998). 'Population Limitation in Birds.' (Academic Press: London.)
- O'Leary, R., and Jones, D. N. (2006). The use of supplementary foods by Australian Magpies *Gymnorhina tibicen*: implications for wildlife feeding in suburban environments. *Austral Ecology* **31**, 208–216. doi:10.1111/j.1442-9993.2006.01583.x
- Orams, M. B. (2002). Feeding wildlife as a tourism attraction: a review of issues and impacts. *Tourism Management* **23**, 281–293. doi:10.1016/S0261-5177(01)00080-2
- Ottoni, I., de Oliveira, F. F., and Yound, R. J. (2009). Estimating the diet of urban birds: the problems of anthropogenic food and food digestibility. *Applied Animal Behaviour Science* **117**, 42–46. doi:10.1016/j.applanim.2008.11.002
- Parsons, H. (2008). Guidelines for enhancing urban bird habitat. *Wingspan* **18**(1), 24–27.
- Parsons, H., Major, R. E., and French, K. (2006). Species interactions and habitat associations of birds inhabiting urban areas of Sydney, Australia. *Austral Ecology* **31**, 217–227. doi:10.1111/j.1442-9993.2006.01584.x
- Petrie, M., Walsh, D., and Hotchkiss, D. (2003). 'Encountering Wildlife Without Feeding.' (Queensland Parks and Wildlife Service: Brisbane.)
- Plant, M. (2008). Good practice when feeding birds. *Wingspan* **18**(1), 20–23.
- Plant, M. (2010). Supplementary feeding of wild birds in Australia: a national pursuit! In 'Australasian Wildlife Management Society Annual Conference', 1–3 December 2010, Torquay, VIC. (Birds Australia.) [Abstract]
- Real, J., Mañosa, S., and Muñoz, E. (2000). Trichomoniasis in a Bonelli's Eagle population in Spain. *Journal of Wildlife Diseases* **36**, 64–70.
- Rhode, C. L., and Kendell, A. D. (1994). 'Human Well-being, Natural Landscapes and Wildlife in Urban Areas: A Review.' (English Nature: London.)
- Robb, G. N., McDonald, R. A., Chamberlain, D. E., and Bearhop, S. (2008). Food for thought: supplementary feeding as a driver of ecological change in avian populations. *Frontiers in Ecology and the Environment* **6**, 476–484. doi:10.1890/060152
- Robinson, R. A., Lawson, B., Toms, M. P., Peck, K. M., Kirkwood, J. K., Chantrey, J., Clatworthy, I. R., Evans, A. D., et al. (2010). Emerging infectious disease leads to rapid population declines of common British birds. *PLoS ONE* **5**(8), e12215. doi:10.1371/journal.pone.0012215
- Rogers, J. (2002). Bird feeding: another viewpoint. *Alberta Naturalist* **31**, 1–11.
- Rollinson, D., O'Leary, R., and Jones, D. N. (2003). The practice of wildlife feeding in suburban Brisbane. *Corella* **27**, 52–58.
- Sax, B. (2007). 'Crow.' (Reaktion Books: London.)

- Schrieber, L. A. (2010). Why we feed wild birds: a case study of BTO members motivations for feeding birds in their gardens. M.Sc. Thesis, University College, London.
- Schultz, P. W. (2000). Empathizing with nature: the effects of perspective taking on concern for environmental issues. *Journal of Social Issues* **56**, 391–406. doi:[10.1111/0022-4537.00174](https://doi.org/10.1111/0022-4537.00174)
- Seipen, G., and Stanley, J. (1996). Please, don't feed the animals. *Ranger* **35**, 22–24.
- Silvertown, J. (2009). A new dawn for citizen science. *Trends in Ecology & Evolution* **24**, 467–471. doi:[10.1016/j.tree.2009.03.017](https://doi.org/10.1016/j.tree.2009.03.017)
- Sterba, J. P. (2002). American backyard feeders may do harm to wild birds: feeding wild birds lures pests, predators, causing illness and distorting populations. *Wall Street Journal* (12 December) 1.
- Sterry, P. and Toms, M. (2008). 'Garden Birds and Wildlife.' (British Trust for Ornithology: Thetford, UK.)
- Toms, M. (2003). 'The BTO/CJ Garden Birdwatch Book.' (British Trust for Ornithology: Thetford, UK.)
- US Fish & Wildlife Service (2002). National survey of fishing, hunting and wildlife-associated recreation. (US Fish & Wildlife Service, Department of the Interior: Arlington, VA.) Available at http://wsfrprograms.fws.gov/Subpages/NationalSurvey/National_Survey.htm [Verified 1 April 2011].
- Weidensaul, S. (2007). 'Of a Feather: A Brief History of American Birding.' (Harcourt: Orlando, FL.)
- White, J. G., Antos, M. J., Fitzsimons, J. A., and Palmer, G. C. (2005). Non-uniform bird assemblages in urban environments: the influence of street-scape vegetation. *Landscape and Urban Planning* **71**, 123–135. doi:[10.1016/j.landurbplan.2004.02.006](https://doi.org/10.1016/j.landurbplan.2004.02.006)
- Wolcott, I., Ingwersen, D., Weston, M. A., and Tzaros, C. (2008). Sustainability of a long-term volunteer-based bird monitoring program. *Australian Journal on Volunteering* **13**, 48–53.