Feathered Roots and Migratory Routes

Immigrants and Birds in the Anthropocene

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Abstract

Human mobility necessitates that people adapt not only to a new society but also to a new natural environment and biodiversity. We use birds as biodiversity proxies to explore the place experiences of 26 Latin Americans adapting to Canada and the United States. Using interviews with open-ended questions, we prompted participants to identify birds that were linked to remarkable experiences in both places of origin and immigration, which we coded respectively as "roots" and "routes." Participants reported foundational *keystone species* linked to their cultural heritage and conspicuous *key species* they associated with self-realization in the new place. *Linking species*, involving connections between roots and routes, triggered a process of place recalibration in association with *key* and *keystone* birds that worked as points of reference. We suggest that biodiversity offers critical social functions that need to be addressed by social integration programs promoting conviviality between humans and nature in the Anthropocene.

Keywords

Anthropocene, *becoming*, ethno-ornithology, immigration, more-than-human, social-ecological change

Despite extensive research charting the ecological value of biodiversity and its contribution to human well-being (MA 2005), we have made comparatively less progress unraveling and detailing its sociocultural functions (Winthrop 2014). Moreover, now that humans have become a major geological force, rapid social-ecological changes have created novelty to such an extent that scientists propose a new geological epoch, the Anthropocene (Crutzen 2002; Lewis 2015). In this epoch, increasing climatological and ecological change is accompanied by an equally accelerated social change driven by global markets, instant communication systems, and increasing human mobility (Blunt 2007; Gidoomal 2003).

These social-ecological changes have challenged traditional approaches to the study of human-nature relationships (Steffen et al. 2011; Ogden et al. 2013) and encouraged scholarly attention to the

outcome of emerging and unprecedented human-nature encounters (García-Quijano et al. 2011). This work recognizes that the impacts of climate change on the human psyche necessitate interdisciplinary fields and frameworks that better integrate more subtle dimensions of our relationship with nature (e.g., Piguet et al. 2011; Essl et al. 2012; Fresque-Baxter and Armitage 2012). Consider the meaning of culture in the natural scientific literature on ecosystem services. UNESCO (2002) defines culture as "the set of distinctive spiritual, material, intellectual and emotional features of . . . a social group, [encompassing] . . . lifestyles, ways of living together, value systems and beliefs." In contrast, the ecosystem services literature presumes that people from different cultures benefit from biodiversity through similar means, mostly defined in terms of economic indicators (Winthrop 2014). There is a tendency to conceive cultural backgrounds as monolithic categories (e.g., Asian, Latino, or European culture), ignoring the fact that cultural relationships with nature are not uniform within nations and regions, or even cultures, and may also evolve and adapt to changes (Given 1995; Teel et al. 2007; Buijs et al. 2009). These shortcomings suggest a limited empirical basis for reflecting on the way that human mobility, as an Anthropocene social driver, may redefine our relationship with nature (Steffen et al. 2011; Lorimer 2012).

A similar disciplinary shortcoming can be found in the way that social scientists conceptualize nature. Environmental psychologists, geographers, and sociologists have studied the connectedness between complex human dimensions, such us psychological well-being, happiness, and sense-of-place, and nature (e.g., Ryan and Deci 2001; Morgan 2011; Manzo and Devine-Wright 2014). However, nature is conceived in a relatively static way without considering, for example, the diversity of functions, behaviors, and identities of species that are important to people (e.g., Pitkänen et al. 2011).

Other fields, such as ethnobiology, more-than-human geography, and human-animal studies, search for more specific connections between people and local biodiversity, considering animals and plants as relevant actors for human life and culture (Sarmiento 2010; Head and Gibson 2012). These fields encompass a broad array of cultural manifestations, ranging from people's identity to cultural expressions of their worldview, such as art, medicine, ritual, and weather forecasting (Maffi 2005; Toledo and Barrera-Bassols 2008). In most cases, ethnoecologists focus on long-term nature–culture coevolution, and perhaps, as a result, their approaches less commonly address situations where immigrants or travelers have more recent connections with local eco-

systems (e.g., Volpato et al. 2008; Laird et al. 2011). Human geographers and human-animal researchers, conversely, have advanced theoretical and methodological work integrating immigrants' experiences, but again mostly centered on human practices and animals as cultural representations (e.g. Elder et al. 1998; Jerolmack 2009; see critique in Lorimer 2010).

In summary, while natural scientists tend to perceive human societies as static units, most social scientists do the same with biodiversity. However, the problem is not entirely disciplinary: it is also a product of the fact that (a) human-nature relationships become increasingly problematic in the context of accelerated social change and increasingly contested cultural values about nature; and (b) rapid ecosystem change is forming novel assemblages of new and local species (Hobbs et al. 2013). Seeing these changes as two sides of the same coin of the multinatural character of the Anthropocene, we must challenge extant categories of nature and culture using empirical research (Lorimer 2012).

Birds and People in the Age of Mobility

At the intersection of place, human mobility, and ethno-ornithological studies, the research reported here investigates the connection between people on the move (immigrants) and concrete, verifiable and well-known components of a place's biodiversity (birds). Our aim here is to explore how biodiversity, represented by birds, plays specific social functions for immigrants' adjustment to new places. Just as ecologists traditionally identify ecological functions of birds in ecosystems (e.g., pollination and seed dispersion), this work analogously explores the social functions of birds for people's sense-of-place.

Sense-of-place, in this regard, can be conceived as a complex and multidimensional human faculty that comprises physical, emotional, psychological, and social linkages with a geographical location (Tuan 1977; Relph 1997), providing identity (Proshansky et al. 1983) and attachment to built, natural, and social place features (Gieryn 2000; Scannell and Gifford 2010). Sense-of-place, until very recently, was thought to be in tension with human mobility, leading to studies comparing place attachment and identity in immigrants versus long-term residents (Hernández et al. 2007). Recent studies, however, have shown that people may feel attached to several locations around the world by remarkable experiences and social networks (Gustafson 2001; Manzo and Devine-Wright 2014). Accordingly, scholars have begun

to examine whether changes in the natural (e.g., climate change) and social (e.g., mobility and immigration) environment affect people's connections with places (Fresque-Baxter and Armitage 2012; Manzo and Devine-Wright 2014), and, if so, whether there might be more fruitful ways to conceive human-nature relationships in the Anthropocene (Pizarro et al. accepted).

To address these issues, we turn to birds because they are fitting representatives of biodiversity that are highly dynamic, cosmopolitan, and mobile. Birds occur within a broad range of socio-ecological landscapes, ranging from the wildest areas to the most populated cities in all biomes (Birdlife International 2013; 2016). Moreover, many birds seasonally migrate long distances, thereby connecting continents and biomes, and distant wild ecosystems with urban areas. For example, Bar-Tailed Godwits (*Limosa lapponica*) perform a 12,000 km nonstop flight from Alaska to New Zealand and Australia (Gill et al. 2008), and a variety of species of neotropical migrants connect Mesoamerican rainforests with urban woodlots and forest in eastern North America (Burke et al. 2001).

Birds also have been part of human material and symbolic cultures since time immemorial (Tidemann and Gosler 2010), so they are likely to represent a full range of complex human interactions with nature. For example, while some species represent extremely utilitarian relationships, like battery hens, others are taken up as heraldic animals or national symbols, such as the Andean condor (*Vultur gryphus*) in nations along the Andes (Ibarra et al. 2012). In between these extremes, birds include everything from poorly known endangered and even extinct species (e.g., the Eskimo Curlew [*Numenius borealis*]) to cosmopolitan urban dwellers that are often ignored (e.g., House Sparrow [*Passer domesticus*] and feral Rock Pigeon [*Columba livia*]).

There is evidence that birds have an important role in the sense-of-place of immigrants. For example, when European immigrants settled around the world in the early nineteenth century, they introduced species from Europe as a way to keep ties with home. With time, local species also came to provide that foundation, becoming strong symbols of identity during the creation of new nation-states (e.g., the Bald Eagle [*Haliaeetus leucocephalus*] for the United States). In the twentieth century, many of the once-loved European species either went extinct or became known as "pests" in their new settings (e.g., the European Starling [*Sturnus vulgaris*] in North America), with the focus for conservation efforts and national pride shifting to local "native species" (Aslin and Bennett 2000). This shift in social values towards nature has

not been fully considered in light of increasingly complex patterns of immigration in the twenty-first century (see Vertovec 2007).

To begin to address this void, this study examined recent immigrants' narratives about birds as they settled in new places. We specifically explored the meaning of birds in the life of Latin Americans settling in the United States and Canada. Following the framework of "roots and routes" of Gustafson (2001), we identified the circumstances in which immigrants felt that species of birds represent *roots* to places of origin or childhood and *routes* to new places of destiny or immigration. More specifically, we sought to better understand the relevance of birds to people's sense-of-place in the context of increased human mobility, documenting species, meanings, experiences, and feelings that contributed to immigrants' perceptions of, and attitudes towards, birds and nature. We conclude by introducing broader concepts of "becoming" (*sensu* Deleuze and Guattari 2004) and conviviality (Hinchliffe and Whatmore 2009) as possible ways to conceptualize human-bird relationships in the Anthropocene.

Methods

Research Design, Participant Profile, and Recruiting Process

This study used a qualitative approach to document how bird species were considered meaningful by participants as they settled in a new place. As stated above, participants may identify birds and attribute significance to them due to their biological (shape, size, behavior) or ecological (habitat, migration) characteristics and/or for their cultural role (e.g., as national symbol), but also for personal reasons. These bird meanings, therefore, represent social-ecological units of study because they contain both sociocultural and ecological information about human-bird relations. In particular, the bird species and meanings documented were triangulated and verified with information in ornithological and geographical studies, including bird field guides, ornithological research (e.g., Marzluff and Angell 2005), and ethnobiology, which often include sociocultural information about species and places named by the participants (see Creswell 2007; Davies 2008).

Between 2012 and 2014, the lead author conducted interviews with 26 Latin Americans who had recently settled in Canada or the United States (one to six years of residency). Interviews covered the entire life span of participants, including open-ended questions and prompts concerning their experiences of birds in the context of place and mobility

(Appendix 1). After obtaining ethics clearance (University of Waterloo ORE #19166), participants who were interested in birds before they emigrated (e.g., birdwatchers, ornithologists, and environmental educators) were recruited to increase the reliability of participants' reports about bird species and to center the analysis in accurate assessment of bird-place-person relationships. With the sole exception of time of residence (greater than one year), we did not restrict participants by social factors such as age, gender, or income. To maximize the diversity of participants, several recruiting methods were used, including announcements on birding-related internet social networks, direct contact with participants in the field (e.g., at birding sites), professional social networks, and snowball sampling. Most participants were contacted by the latter two methods as in related social-ecological studies (Buizer et al. 2012; Vanwindekens et al. 2013).

Interviews were conducted in Spanish by Skype, telephone, or in person. They typically lasted one to two hours and, as all participants agreed, were digitally recorded using a Zoom H1 audio recorder. In most cases, interviews were followed with further short exchanges over Skype or email. When possible, the lead author conducted participant observation while birdwatching with participants in local urban parks in Ontario, Canada, or during trips abroad (e.g., the United States and Colombia).

The interviews were broad and conversational, with open-ended questions and prompts about participants' experiences with birds (Creswell 2007; see Appendix 1). The study took a longitudinal approach, beginning with the respondents' childhood bird experiences and addressing, from there, their entire lifespan. The interview went back in time as far as they were able to remember, including times when they were not interested in birds or trained to identify them. This approach extensively explored lived experiences, inquiring about personal, social, cultural, and environmental factors that respondents considered relevant for their relationship with birds and places (van Manen 1997). As indicated above, we verified the identities of dubious species. We also revisited and corroborated attributed bird meanings, place details, and informative passages and stories to improve data quality and precision.

Data Processing and Analysis

Interview audio-recordings were transcribed using InqScribe software. Participant anonymity was ensured by assigning random names to participants in file names and transcript text. Places, bird names, and

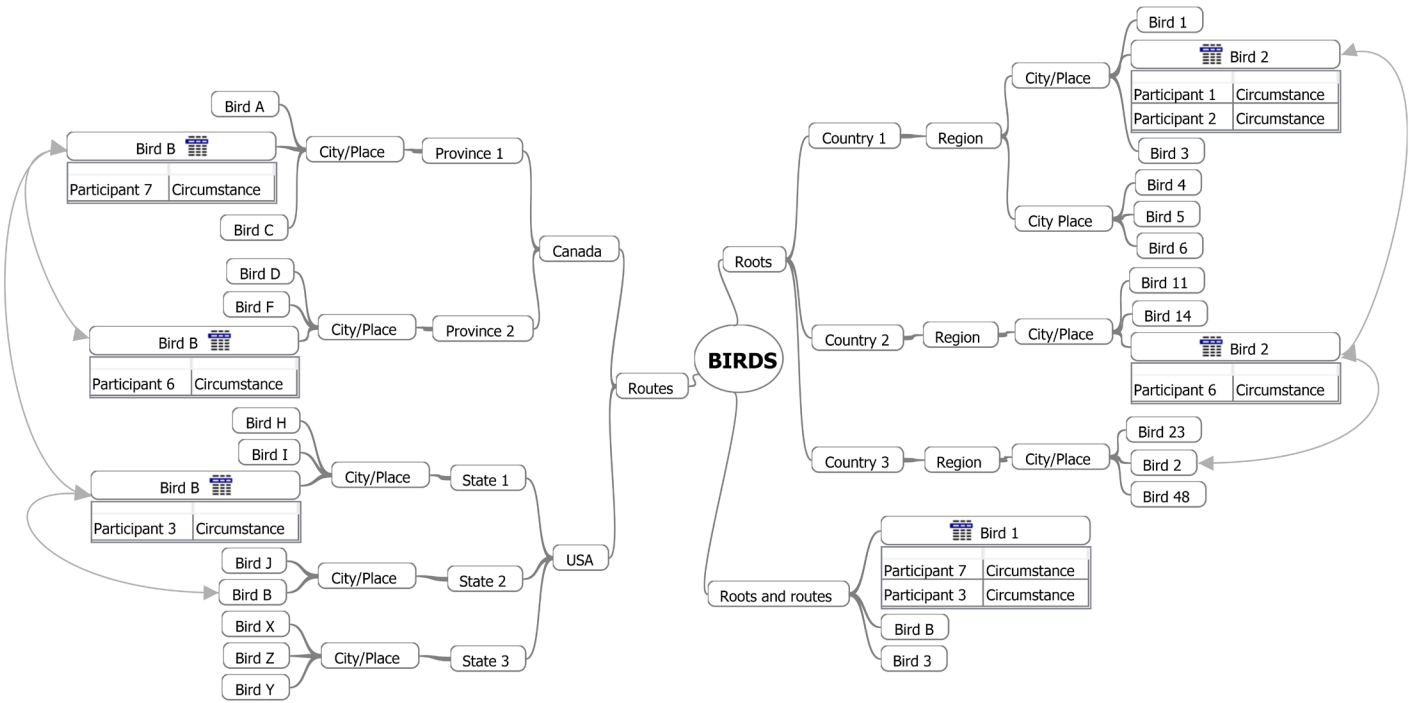

Figure 1 ■ Design of mind map (Freemind 1.0) organizing birds and their meaning reported by participants.[1]

their meanings were collected from the transcripts and were organized using the mind-map software Freemind 1.0.1 (Wheeldon and Faubert 2009). The mindmap had three branches collecting birds and their meanings from participants' experiences (Figure 1, A): one branch from species from Latin American roots, a second for species in North American routes, and a third for species that participants recognized in both roots and routes.

In each branch, hierarchical nodes (Figure 1, B, C, and D) were used to organize birds by country, region (province or state), city, and/or location. For each species mentioned at the end of each node, we also registered participants' associations, such as "memory from childhood," "cultural symbol," and "soundscape." When the association was unclear, we noted the circumstances around the experiences, such as "while working," "family camping trip," or "walking on a trail in the new place." We called these associations "meanings", coded them using comprehensive themes, and stored them alongside the bird name nodes in the mindmap (Figure 1, E). Graphical hyperlinks connected the same species mentioned in separate locations (e.g., Figure 1. F).

In a further analysis, we called bird meanings *becomings* (see Deleuze and Guattari 2004), a concept we introduce later in the discussion. We illustrate and support these findings with translated quotations from the interview transcripts, which we connected to the theory via the use of diagrams (Creswell 2007; Manzo and Devine-Wright 2014).

Results

Our participants (n = 26: 12 women and 14 men) were originally from Latin American countries, with the exception of one participant born in Europe and raised in South America. Their knowledge about birds was variable, and they ranged from being amateur birdwatchers to ornithologists by training. Although participants had different backgrounds, they were able to identify birds as part of functional groups (e.g., seedeaters and raptors), at some taxonomic level (e.g., family, genera, and species), and in relation to habitat.

Taken as a whole, participants' life histories represent a wide geographical range of several countries and socio-ecological situations within the Americas. From Chile to Puerto Rico, participants mentioned nine countries and 57 cities, towns, and locales situated in several regions. These regions included the Caribbean bioregion (e.g., Puerto Rican moist and dry forests), Ecuadorian and Colombian portions of

Amazonia, the Northern Andes (e.g., Santa Marta montane forest), the Central Andes (e.g., Bolivian Yungas) and several ecoregions in southern South America, from the Atacama Desert to the sub-Antarctic temperate forest (Dinerstein et al. 1995). Natural, rural, and urban locations were equally mentioned, including some of the largest cities in the region such as Lima (8.4 million, Peru), Santiago de Chile (6.3 million, Chile), Medellin (2.1 million, Colombia), Quito (1.6 million, Ecuador), and La Paz (0.8 million, Bolivia) (United Nations 2015).

Participants' routes in North America were also diverse. Although their routes in North America number only one-third as many as their roots, they included four Canadian provinces and six American states, including the ecoregions of Eastern Temperate and Tropical Wet Forest, Mediterranean California Chaparral and Woodlands, Marine West Coast Forest, and the Great Plains (CEC 1997). Participants' social contexts in their routes were more homogenous than in their roots, as they mostly (77%) settled in medium-size cities (population ~0.5 million or less) and mentioned semiurban or urban places, with the exception of Yellowstone National Park in the United States and Gwaii Haanas National Park on the west coast of Canada.

Despite individual differences, most participants were able to recall birds in most of the places they had lived. The level of taxonomic identification and detail varied among participants according to their life stages and locations. This meant that some birds were broadly reported as general taxonomic groups, such as herons (Ardeidae) and gulls (Laridae), or functional groups, such as raptors or shorebirds. However, most participants named birds at the level of species, including *a posteriori* identification using their current knowledge, meaning that some participants were able to recall and identify birds from their own memories.

A remarkable difference was found in the number of taxa reported in roots and routes, with twice as many bird species mentioned in the former (146) than the latter (72). In contrast, the number of mentions of bird encounters per participant across all interviews varied less between roots and routes, with 339 and 306 mentions, respectively. This means that some participants were just as able to mention birds from their routes, despite the more narrow set of species known in Canada and the United States.

Birds from Both Roots and Routes

Participants recalled primarily terrestrial birds, shorebirds, and wetland species. They named only five seabirds, including Black-Browed Albatross (*Thalassarche melanophris*), banded penguins (*Spheniscus* spp.) and Atlantic Puffins (*Fratercula arctica*). Birds from their roots were mostly resident species, while migratory (both short- and long-distance) species were more prominent in participants' routes. Besides local species, participants also named various human-introduced species, such as House Sparrows, feral Rock Pigeons, and European Starlings, in both roots and routes.

The majority of birds mentioned were wild species, although domesticated fowl, such as Domestic Geese (*Anser anser*), several breeds of chickens (*Gallus gallus*), and ducks (Anatidae), were prevalent in memories of childhood. Caged birds and pets are included in this category, as well as three songbirds and five species of wild domesticated parrots (family Psittacidae, including macaws, amazons, and cockatoos). Four mythological birds appeared in participants' narratives, including the human witch-bird *Tue-tue* (rural south-central Chile), the grandmother barn owl *Sirra* (Chilean sub-Antarctic temperate forest, see Rozzi 2010), the bad omen *Allaimama* (Peruvian rainforest), and "the mighty bird that gave origin to all hummingbirds" (Ecuador). These three categories—domestic, pet, and mythical birds—accounted for participants' deepest childhood memories, representing strong cultural heritage about birds in Latin America (Ibarra et al. 2012).

Wild birds from the roots comprised a vast and diverse assemblage of 146 birds belonging to 61 families. Parrots (Psittacidae, 9 species), finches and sparrows (Emberizidae, 9 species), tanagers (Thraupidae, 8 species), and flycatchers (Tyrannidae, 8 species) were the families mentioned most frequently. Resident (54%) and partially migratory (19%) species were more often mentioned than fully migratory birds. Birds from roots represented an assortment of 13 wild, rural, and highly urbanized environments. The most frequently mentioned were common birds such as the Great Kiskadee (*Pitangus sulphuratus*), the Blue-Gray Tanager (*Thraupis episcopus*), the Rufous-Collared Sparrow (*Zonotrichia capensis*), and the Vermilion Flycatcher (*Pyrocephalus rubinus*).

Participants mostly mentioned birds from their roots by their common names, which exhibit local variation. These different names signify cultural meanings and significance for people living in different locations. For example, the Blue-Gray Tanager had different names in Colombia (*Azulejo*, referencing the blue color of a form of Spanish-

Portuguese painted tin-glazed ceramic tilework), Venezuela (*azulejo de jardín*), and Peru (*violinista*, meaning violinist, reflecting the melodic and high-pitched song of the bird). Similar variation was found in the case of the Great Kiskadee, called *bichofué* in Colombia and *pipile* or Víctor Díaz in Peru, each one—including the English version—representing onomatopoeia[2] of the bird's song. The Rufous-Collared Sparrow was mentioned by Chileans, Peruvians, Bolivians, and Colombians, and its names derived from different indigenous languages, such as Quechua (*piquitanga*) and Mapudungun (*chinkol*) (Rozzi 2010).

In Canada and the United States, participants identified and interacted with a smaller pool of 72 species belonging to 33 families. Warblers (Parulidae, 10 species), hawks (Accipitridae, 6 species), crows (Corvidae, 5 species), and owls (Strigidae, 5 species) were the dominant groups (27% of total species). At first, participants recognized birds by large taxonomic or functional groups (e.g., woodpeckers, sparrows, and raptors), with recognition of individual species being a secondary process that came after a verbal description. They celebrated the abundance and close proximity of large species of raptors (e.g., hawks, eagles, and owls) and large-legged birds (e.g., herons, storks, and cranes) as well as the arrival each spring of neotropical migratory species. Participants mentioned with enthusiasm or excitement species that met each of these three characteristics (abundant, large, and migratory) such as the Sandhill Crane (*Grus canadensis*) and Tundra Swan (*Cygnus columbianus*). Almost all respondents identified the same habitat generalists such as Northern Cardinal (*Cardinalis cardinalis*) and Blue Jay (*Cyanocitta cristata*).

Keystone, Key, and Linking Birds

Deepening our analysis, we recognize significant birds in roots as *keystone species* and within routes as *key species*. The concept of *keystone species* in this work connotes the meaning of "foundation" or "root" similar to the concept of biocultural keystone proposed by Ibarra et al. (2012). *Key species* connote in turn the meaning of "unlocking" or "opening" (i.e., the gateways to new places). When species form connections between roots and routes, we classify them as *linking species* (Table 1). We found that each of these types of species were important triggers in the evolution of place experiences of Latin American immigrants in Canada and the United States. For instance, all but four of the respondents identified at least one of 30 linking birds that collectively

Table 1 ■ Keystone, key, and linking taxa for participants' roots-and-routes. Taxa are listed in descending order of mentions, number of countries (roots: range 2 to 4), number of Canadian provinces and US states (routes: range 2 to 5), and number of participants (linking taxa: range to 4).

Roots – *Keystone Species*	**Routes – *Key Species***	***Linking Species***
Hawks (*Buteos* spp.)	Northern Cardinal	American Robin$_{T}$
Herons (Ardeidae)	Black-Capped Chickadee	Herons$_{STE}$
Hummingbirds (Trochilidae)	Blue Jay	Osprey$_{S}$
Owls (Strigiformes)	American Robin	Barred Owl$_{E}$
Blue-Gray Tanager	Owls (Strigiformes)	Wood Warblers$_{S}$
Rufous-Collared Sparrow	Wood Warblers (Parulidae)	Great Horned Owl$_{T}$
Shorebirds	Bald Eagle	Owls (Strigiformes)$_{TE}$
Bananaquit (*Coereba flaveola*)	Osprey	Grackle (*Quiscalus* spp.)$_{ST}$
Barn Owl	American Crow	House Sparrow$_{I}$
Guans and allies (Cracidae)	Snowy Owl (*Bubo scandiacus*)	Anhinga$_{T}$
House Sparrow$_{I}$	Sandhill Crane	American Crow$_{E}$
Great Kiskadee	Red-Tailed Hawk	Woodpeckers$_{TE}$
Tapaculos (*Rhinocryptidae*)	Red-Winged Blackbird (*Agelaius phoeniceus*)	Northern Flicker$_{T}$
American Kestrel (*Falco sparverius*)	Ducks (Anatidae)	Pileated Woodpecker$_{TE}$
American Redstart	Mallard (*Anas platyrhynchos*)	Prothonotary Warbler
American Yellow Warbler	European Starling$_{I}$	Blackburnian Warbler
Andean Condor	Great Blue Heron (*Ardea Herodias*)	American Yellow Warbler
Blue-black Tanager (*Tangara vassorii*)	Northern Flicker (*Colaptes auratus*)	American Redstart

Roots – *Keystone Species*	**Routes – *Key Species***	***Linking Species***
Burrowing Owl (*Athene cunicularia*)	Barred Owl (*Strix varia*)	Cape May Warbler (*Sethophaga tigrina*)
Eared Dove (*Zenaida auriculata*)	House Sparrow$_{I}$	Blackpoll Warbler (*Sethophaga striata*)
Feral Rock Pigeon$_{I}$	House Finch (*Haemorhous mexicanus*)	Black-Crowned Night Heron (*Nycticorax nycticorax*)
Great Egret	Brown Thrasher (*Toxostoma rufum*)	Feral Rock Pigeon$_{I}$
Oropendolas (*Psarocolius spp.*)	Raptors (hawks, eagles, and owls)	Turkey Vulture (*Cathartes aura*)
Osprey	Hawks	Hawks$_{T}$
Scarlet Macaw (*Ara macao*)	Red-Shouldered Hawk (*Buteo lineatus*)	Red-Tailed Hawk
Swallows (Hirundinidae)	Cooper's Hawk (*Accipiter cooperii*)	American Coot (*Fulica Americana*)
Vermilion Flycatcher	Northern Mockingbird	Black-Capped Chickadee
	Woodpeckers (Picidae)	Hummingbirds$_{TE}$
	Pileated Woodpecker (*Dryocopus pileatus*)	Black-Necked Stilt (*Himantopus mexicanus*)
	Tufted Titmouse (*Baeolophus bicolor*)	Nuthatches (*Sitta* spp.)$_{E}$
	Black-and-White Warbler (*Mniotilta varia*)	American Kestrel
	Prothonotary Warbler (*Protonotaria citrea*)	
	Blackburnian Warbler (*Sethophaga fusca*)	
	American Yellow Warbler	
	Eastern Bluebird (*Sialia sialis*)	
	Herons	

S – Accompanying species; T – Taxonomical equivalents; E – Ecological Equivalent; I – Introduced species

compose an assemblage of cosmopolitan and neotropical species (Table 1). In some cases, linking birds were the same species in roots and routes (*accompanying species*), whereas in others they were new species that resembled birds from their roots in terms of morphology (*taxonomic equivalents*) or habitat and behavior (*ecological equivalents*) (Figure 2).

Several participants of the same nationality mentioned accompanying species, such as the Anhinga (*Anhinga anhinga*, Ecuador) and the Great Horned Owl (*Bubo virginianus*, Chile). Other birds were recognized by people from different countries, such as Venezuelans and Chileans with the Osprey and Venezuelans and Puerto Ricans with the American Redstart (*Setophaga ruticilla*) and Yellow Warbler (*S. petechia*). The cosmopolitan House Sparrow and feral Rock Pigeon also fit into this category for people from large urban areas in Colombia, Peru, and Bolivia. Significantly, warblers (*reinitas* in Spanish) were first identified as a group, and then individualized as species, being especially remembered by Puerto Ricans.

The most emblematic case of taxonomic equivalents was the American Robin (*Turdus migratorius*), which resembles the Chiguanco Thrush (*T. chiguanco*) for Peruvians and the Austral Thrush (*T. falklandii*) for Chileans. Specifically, American Robins were "reddish Austral trushes (*zorzales colorados*)" for Chilean participants Fritz and Roseana. Similarly, Northern Mockingbirds (*Mimus polyglottos*) evoked two South American relatives (*M. thenca* [Chile] and *M. dorsalis* [Bolivia]). In some cases, participants confused similar-looking species, such as the Red-Tailed (*Buteo jamaicensis*) and Rufous-Tailed Hawk (*B. albigula*).

On the other hand, the most obvious cases of ecological equivalents were North American tree-cavity excavators (e.g., woodpeckers, flickers, and nuthatches) that behave similarly to South American species (e.g., woodcreepers). Remarkably, participants sometimes associated completely unrelated species, such as the American Crow (*Corvus brachyrhynchos*) in North America and the Chimango Caracara (*Milvago chimango*) in Chile. Both species are intelligent, gregarious scavengers that live in close proximity with humans (see Marzluff and Angell 2005). Moreover, both species roost in large numbers in the tops of tall trees in urban parks and plazas during the winter. This association between birds, their habitat, and their habits was a powerful connection between participants' roots and routes. In some instances, the distinction between taxonomic and ecological equivalency was less pronounced and some species could fit into any of the above three categories. Participants, for example, recognized herons and shorebirds in a collective manner, connecting a combination of bird features, behavior, and habitat.

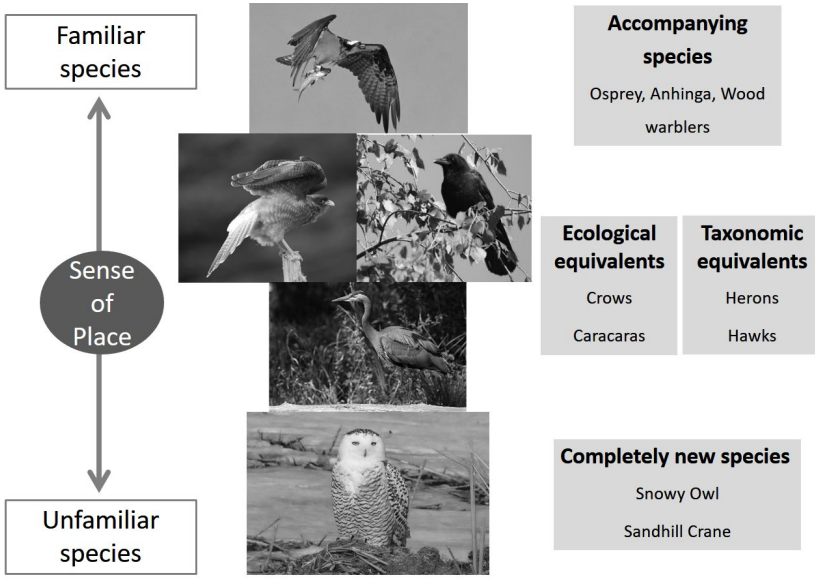

Figure 2 ■ Participant-named species that varied in terms of familiarity between roots and routes.[3]

A bird species that deserves special mention is the Northern Cardinal. Cardinals were new for all participants and recognized as a *key species*. However, they were immediately associated with other red and conspicuous birds, from roots, which also inhabit cities and semi-urban locations. In this way, participants aesthetically linked Northern Cardinals (members of family Cardinalidae) with completely unrelated species, including the Vermilion Flycatcher (family Tyrannidae, Colombia) and the Crimson-Backed Tanager (*Ramphocelus dimidiatus*, family Thraupidae, Colombia). These participants, then, drew a connection based on neither taxonomic nor ecological bird features, but instead on the color red.

Bird Meanings and Significance

Participants attribute a wide range of meanings to birds, whether regarding birds in themselves or their personal experiences with them. Accordingly, bird meanings were classified in two large thematic groups: meanings based on bird agency and those based on human experience (Tables 2 and 3). The bird-agency theme included meanings related to birds' morphology, behavior, and habitat. Meanings in this category

Table 2 ■ List of codes for bird meanings attributed by participants related to bird agency in roots-and-routes. Codes were comprehensively organized in code groups and listed in order of prominence.

Code Group	Roots	Routes
Habitat	Temperate forest	Urban
	Altiplano (Andean Plateau)	Wetland
	Wetlands	Lakes
	Urban	Grasslands
	Semiurban	Plains
	Amazonia	High mountain
	High Andes	Beach
	Rainforest	
	Mountain cloud forest	
	Caribbean coast	
	Arid Pacific coast	
	Pine plantation	
Features of the Landscape	Soundscape/Vocalization	Everyday
	Colourful/Aesthetics	Spectacular
	Nesting	Aesthetics
	Abundant	Soundscape
	Everywhere	Behavior
	Adaptation	Nesting
	Social behavior	Abundance
	Ecological functioning	Red
	Large	Common
		Interaction
		Conspicuous
		Everywhere
		Blue
Classification	Endemic	New species
	Domestic	Invasive/Native
	Invasive/Native	Endemic
Connection	Other species	Roots
	Habitats	Routes

Code Group	Roots	Routes
Seasons and Cycles		Seasons
		Spring
		Daily cycles
		Residents
		Migration
		Winter

Table 3 ■ List of codes for bird meanings attributed to human experience in roots-and-routes. Codes were comprehensively organized in code groups and listed in order of prominence.

Code Group	Roots	Routes
Trajectory	Work	Challenge
	Challenge	Work
	Knowledge	Knowledge
	Study	
	Commitment	
Identity	Place	Local symbol
	Childhood memory	Place
	Cultural identity	Home
	Regional identity	Feeder
	Country	
	Home	
Experience	Everyday	First bird
	Close encounters	Discovery
	Exploration and discovery	Close encounters
	First bird	Mixed feelings
	Interaction	Too different
Social Interactions	Family	Family
	Friends	Friends
	Co-workers	Co-workers
Practices	Birding	Birding
	Pet	
	Trapping	
	Falconry	

reflected the capacity of birds to be noticed and make themselves noticed by humans (see Bennett's [2010] concept of agency). Meanings related to human experience, on the other hand, drew respondents' attention to bird memories from childhood or linkages to cultural traditions or heritage.

Bird-agency meanings accounted not only for attributes, but also for circumstances, places, or habitats in which bird-human interactions occurred. Overall, birds were memorable for participants when they, for example, saw the birds distinctively "performing" like "wood-peckers" or "fly-catchers." Birds were also notable when they distinctively "look" like species that taxonomically are classified as woodpeckers or flycatchers. Again, a mix of previously known ecological roles and taxonomic equivalency provided a basis for comparison between participants' experiences with birds and places between roots and routes (Figure 3).

There were considerable differences between some bird-agency meanings of roots and routes. For instance, in their roots participants were collectively more inclined to associate birds with a large diversity of habitats. In their routes, conversely, participants focused on bird shape, behavior, or abundance, mostly in urban habitats where birds were prominent features of specific places or landscape (Table 2). Wetlands were an exception to the pattern of associating birds by their shape or behavior, as participants commonly mentioned herons in wetlands and used them as references in their roots.

Some birds in respondents' routes were strongly associated with seasonality. For instance, warblers and cranes were associated with spring, when they migrate, and owls with winter, when they start their reproductive cycle. With the exception of hawks, participants individualize species (e.g., the Northern Mockingbird) in association with their behaviors, aesthetic qualities (e.g., large size or colorful plumage), or attributes of their populations, such as abundance or rarity.

Turning to human-experience meanings, participants tied birds to their intimate lives, as symbols of their memories and identity. Birds were not uniquely meaningful by their own agency, but also by evoking or working as "conduits" of emotions and experiences. Birds of cultural importance, such as national birds (e.g., the Scarlet Macaw, Venezuela) in some cases can represent a complex multinational belonging, such as the Andean Condor for nations along the Andes. Participants also recognized birds as symbols in their new places, including "official" provincial or state bird symbols (e.g., the Atlantic Puffin in Newfound-

land and Labrador, Canada) and in popular culture. These species are depicted in stained glass ornaments in southern Ontario homes and stores or as mascots of popular sport teams and public schools, meaning that newcomers can easily recognize them.

Recalibrating Roots and Routes

Participants iteratively organized their experiences with birds (i.e., human experiences) and birds themselves (i.e., bird agency) in a range of familiarity (Figure 2). Participants encountered unfamiliar and familiar birds and situations in their new places, provoking conflicted feelings. Some feelings evoked memories from previous experiences, whereas others provoked new and even *sui generis* experiences. These connections with birds—back to the past, anchored in the present, and forward to the future—create a "sense" of place that is iteratively calibrated through time by socializing with peers. In other words, birds acted as "points of reference" in a process whereby people's experiences with birds, peoples, and places generate varying degrees of emotional distance between roots and routes (Figure 2). By fixating on basic morphological or behavioral patterns of birds, such as, for example, herons standing tall and still (and "elegant," as participant Roseanna stated), participants recalibrate wetlands of Wisconsin with "similar" habitats in Amazonia and southern Chile.

In the routes, birds were not only points of reference for participants recalibrating place in its physical dimension; they were also important in a process of identity recalibration. For instance, birds tied to professions, occupations, or social activities were linked to participants' self-realization (see Ryan and Deci 2001). This means that linking species such as warblers were tremendously significant to the continuity of participants' identity as, for example, birdwatchers or ornithologists. Both place and identity recalibration work together, so linking species mirrored both personal achievements and physical dimensions of places (Figure 3).

Socialization catalyzed the recalibration of participants' place and identity (Figure 3). As mentioned earlier, birds were an important medium of socialization in the lives of all participants. In the new place, therefore, the possibility of sharing experiences with birds with other people was essential for both participant's social life and sense-of-place. In Javier's words, for example, the wetlands of North Florida became more familiar when he shared his bird observations:

> . . . and I said, YES! I know this bird, and *I told somebody*: we have that bird in Ecuador and it's found in Amazonia. It can be found, like here, in the swamps, but I never saw an Anhinga together with cormorants! There are a lot of cormorants in here. *These casual conversations* somehow transported me back to Ecuador. Perhaps after that, the landscape [of Florida] became more familiar to me. [emphasis added]

This *sui generis* experience of Anhingas together with cormorants prompted an emotional relocation of place (i.e., being "transported back"), creating a link of familiarity between Florida and Ecuador. Javier makes this realization conscious for himself when he verbally shares this experience with "somebody," reflecting the linkages between place recalibration and socialization. The participants widely shared a realization of the importance of peers and friends for the recalibration of bird experiences.

Although uncommon, there were also instances where recalibration did not occur, and there was a sense of disconnection between roots and routes. In different ways, all participants felt this disconnection initially, except for one of them; they overcame it with time and the achievement of new social connections around birds. Two participants who failed to make this reconnection showed poor local knowledge of birds and a pessimistic attitude toward local avifauna. For example, Ezra expressed his frustration with Florida's avifauna:

> I had the opportunity to go birding to some lakes close by, but honestly, I felt frustrated and it made me miss Peru even more. . . . in the jungle, you are overwhelmed with so many things, sounds and colors, but here it is always the same, the same—just crows! Just crows! Birds don't have colors. . . . I lost motivation, to the point that I didn't bring my binoculars the last time I came back [from Peru].

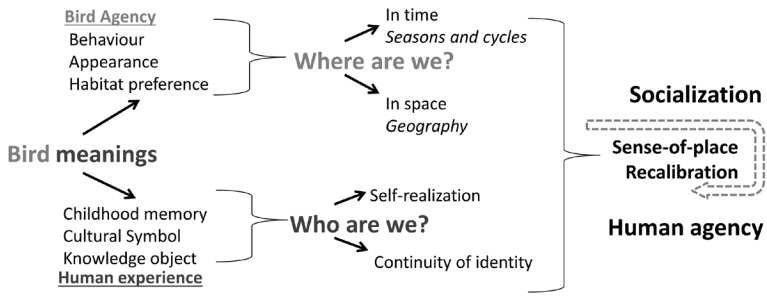

Figure 3 ■ Process of sense-of-place recalibration.[4]

In contrast, participant Ezra, who originated in the same country and who lived in the same city in Florida, stated: "I think that there are very beautiful birds [here]. I did not see birds like these in Peru, nor in the countryside or in the city. . . . Nevertheless, the other birds that I saw [here], I said: how rare they are! How rare and beautiful! . . . I never saw crows before in my life."

The participants revealed that the reconstruction of their social lives and identities around birds was as important as the birds themselves. Participant Marquis, for example, recalibrates his identity with birds by expanding his birding horizons and joining birding organizations:

> Here I realized that bird identification is harder than in Chile because you have birds such as sparrows, thrushes, and, of course, the warblers . . . so, I started to "get the deal" [*agarrar la onda*] [of birding], and it wasn't easy at the beginning, but I start to get involved, little by little, and join the Audubon Society, where I have helped to find birds and participated in field trips with them.

Marquis helps to demonstrate the extent to which place recalibration is a dynamic process that involves social interactions and negotiation of identities, which represented the case for 24 out of 26 participants.

Discussion

Bird Socio-ecological Functions: Sense-of-Place Recalibration, Becoming, and Conviviality

Our study has shown that birds have a diversity of roles (e.g., key, keystone, linking species) in the sense-of-place of immigrants who have previous experiences with birds. Their experiences account for a variety of geographical locations (8 countries, 57 places), socioeconomic situations (rural and metropolitan), and life-stages (from childhood to adulthood). We recognize, nonetheless, that our results may not generalize to other people, so recommend the expansion of this research to other socioeconomic groups, in other geographical areas (see Johnson et al. 2004).

Regardless, we have shown how bird functions embodied meanings that interweave places, bird agency, and the human experience in 92 percent of our participants. In this manner, birds can assist immigrants recalibrating their sense-of-place and identity. Such complexity can be framed from a different perspective to say that participants also *become* the birds that they study, look for, and work with (*sensu* Deleuze and

Guattari 2004). As we stated earlier, the connection between the main research finding (place recalibration) and the philosophical concept of *becoming* requires more explanation, as we find that these *bird becomings* have further (and practical) implications for both the study of human-nature relationships and the conservation of bird species in the Anthropocene.

Philosophers derive the meaning of "becoming" from its archaic Greek form, to be in a process of constant change. In our reading of this process, people (in the case of this research) may obtain new properties from their participation in assemblages or collections of things (Deleuze and Guattari 2004). In the process of flight and moving, in and out, from one assemblage to another (i.e., place), there are a wide range of possible *becomings* as people and birds encounter each other. Deleuze and Guattari call the process of such moving "deterritorialization," suggesting that there is an overlap between assemblages or places and personal identity. This is consistent with our research framework of roots and routes, and the idea of a mobile place identity in recent sense-of-place literature (Gustafson 2001; Manzo and Devine-Wright 2014). We should not, however, confuse this process with *displacement*, which is coercive; instead, it refers to the recognition of the interconnectedness between the self and the environment like a "rhizome" that horizontally spreads "roots and shoots" with no single or fixed identity or territory (Deleuze and Guattari, 2004). Bird *becomings* are therefore rhizomatic and boundless (Figure 2), facilitating the place-making process as a means to integrate biodiversity within personal identity. Although this research focused on the role played by birds in the lives of immigrants, bird *becomings* were considered as units of study in larger and emerging patterns of relationships within shifting socio-ecological assemblages, where the relevance for human needs emerged from the coexistence with birds in their places (Lorimer 2010; Collins et al. 2011; Head and Gibson 2012).

In addition to *bird becomings*, our identification of birds as a medium of social life reveals that human-biodiversity relationships are multidimensional and iterative. People can make sense-of-place through birds when they share experiences with others. This realization implies that human-nature relationships are evidently social and enacted from a multidirectional flow of *conviviality* between people, birds, and the environment. Geographers coined the term *conviviality* to conceptualize this form of "living together" whereby people and wildlife establish a multiplicity of associations, especially in urban environments (Hinchliffe and Whatmore 2009). Certainly, becoming and conviviality are two

concepts that require more exploration, although they already offer a wider perspective of human-nature relationships in the Anthropocene, bridging natural science, social science, and humanities with concrete research outcomes (*bird becoming* as a unit of study) and having direct applications for conservation and environmental education.

Conservation in the Anthropocene: Becoming the "Birds of the Forest Interior"

In our study, the assemblage of 33 linking birds (Table 1) provided a foundation for most participants' place and identity recalibration. These species therefore are potentially meaningful for many people, perhaps motivating social actions for conservation. However, most linking and key species have a "least concern" conservation status (*sensu* IUCN 2012), and consequently ornithologists and birdwatchers give them little attention. Although we focused on immigrants who had a previous interest in birds, researchers may also disregard this bird assemblage as an "immigrant mindset" of only common birds and generalist species (e.g., Clarke and Agyeman 2011). It contains few endangered species and habitat specialists, such as the "birds of the forest interior" (e.g., Hooded Warbler, Burke et al. 2011). Yet this finding may also reflect immigrants' lack of access to or conviviality with the "forest interior," as participants all have a great interest in birds. Thus, instead of discounting *a priori* the value of these species of "least concern," we should encourage the transfer of meanings from known or common species to birds they have never seen before (e.g., Northern Cardinal).

The challenge, then, is how to encourage people (and not only immigrants) to engage in "becoming with the birds of the forest interior." Our participants strongly care about birds that are entwined in their own becoming; and, in general, the more attuned they feel in their routes, the more prone they are to participate in local bird conservation activities (see quote from Marquis, above). Participants who do not feel integrated in their social life and natural surroundings do not contribute to local conservation despite the wide expertise they have from their home countries (see Ezra quote above). This finding can be applied to two-step conservation programs, which first encourage conviviality of people with key species, other people, and local habitats; then, later, provide people opportunities to make connections with endangered birds. For example, these programs could recalibrate the red of the "urban" cardinal with the red of the neotropical migrant Scarlet Tanager (*Piranga olivacea*) in North America. Accordingly, we need to

craft participative conservation actions based on place (see Stewart et al. 2013) and conviviality, in which the socialization between long-term residents and newcomers in nature is horizontal and multidirectional, recognizing that we are *all* trying to make sense of the Anthropocene.

Birds represent multiple connections between roots and routes for highly mobile people. Newcomers may encounter the same linking species (migratory, cosmopolitan, and/or wide-ranging birds) or convey the equivalence of key species that evoke a sense-of-place (e.g., caracaras and crows). By their sounds and colors, linking and key species create familiarity (or a sense of unfamiliarity) that helps immigrants to recalibrate their place experience and identity. By these connections, people weave the agency of birds with features of themselves (e.g., cultural identity and personal achievements), thus becoming more attuned to the new place.

Throughout the recalibration process, the socialization of bird experiences was critical to place and identity making. The participation of birds in this process can be viewed as a function of birds for immigrants. People do not merely use birds alone as points of reference to recalibrate their sense-of-place; indeed, this recalibration rests upon social networks and interactions. As points of reference, *keystone*, *key*, and *linking* bird species facilitate a more dynamic and convivial understanding of the nonhuman world, in which *bird becomings* are useful and truly social-ecological units of study. The outcomes of this research of human-bird relationships in the Anthropocene may help to reorient bird conservation and environmental education initiatives.

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Notes

1. Figure 1: Birds reported were located in three separate branches (A) (roots, routes, and roots and routes) and hierarchically organized in nodes by locations (B, C, D). Participants and meanings were stored in attributes (E) of nodes containing bird names. Graphical hyperlinks (F) were used to visualize connections of species being reported in several locations.

2. Onomatopoeia refers to "words whose sound resembles their meaning" (Garcia et al. 2014). You can hear recordings of these species at http://neotropical.birds.cornell.edu.

3. Figure 2: This variation went from the recognition of shared species to completely new birds in their routes. In the middle, participants associated species by their physical similarity (taxonomic equivalents) and behavior and habitat (ecological equivalents). Photo source: Osprey by Robert Burton and Snowy Owl by Tom Koerner from U.S. Fish and Wildlife Service National Digital Library (public domain); Chimango Caracara by Jeff Johnson; American Crow and Great Blue Heron by Jose A. Tomasevic.

4. Figure 3: Meanings of birds integrate their ecological (bird agency) and social (birds as symbols in the human experience) functions. Both meanings attributed to bird agency and human experience form part of sense-of-place for Latin American immigrants in Canada and the United States. Birds socially function to foster people's imaginary relocation as points of reference in space and time (i.e., answering the question: Where am I?), and giving continuity to identities and realizations of people between roots and routes. Finally, these *bird-becomings* relocate place familiarity and identity, helping people to recalibrate their sense-of-place, iteratively (see discussion for more details).

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Appendix. Interviews' Questions, Prompts, and Components

These are some examples of the components, questions, and prompts that guided the interviews of Latin American immigrants about their experiences with birds in the context of place and mobility. Roots relate to components of attachments to places of origin, while routes reflect mobility processes to new places. The interviews explored these components in connection with people's experiences with birds and nature. Interviews, however, were conversational and broad, with the following being general questions and prompts that were used to inquire of participants experiences with birds.

Components

Roots (Origins)	**Routes (Mobilities)**
Place of birth	Trips/Journeys
Place of childhood/adulthood	Immigration experiences
Familiar places	Unfamiliar/New places
Social networks (*in-situ*)	Social networks (*ex-situ*)
Interesting/Resting places	Tourism, Recreation, Social activities
Nationality, Identity	Foreignness, Strangeness
Culture, Language, Traditions	Cultural interchange

Questions

- Tell me your history, where were you born? What do you remember from the place of your childhood? Where did you grow up?
- What is your first memory (or first memories) about birds? Do you remember birds of your birth place? Which ones? What did they evoke in you? Did you consider them personally or culturally meaningful or important to you, and if so, why?
- When did you immigrate/come to Canada/the United States? Tell me about your experience.
- What do you do here? What activities do you like to participate in? Who are your friends?
- Do you know any birds here? Are those birds new for you? Do you think that birds here are very different from those you knew in your birth place?
- Have you been involved in social activities related with birds in your new place? How did you become involved? What do you think about those activities? Do you like to have a birdfeeder in your backyard/participate in birding activities?
- Have you visited or moved to other places in between? Did you notice birds there?

Prompts and Probes

- Would you explain that further? Would you give me an example?
- Can you elaborate on that idea? Can you describe that experience/bird/place further?
- Is there anything else?