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Abstract	For a migratory bird, the costs and benefits of utilizing a given migratory strategy vary according to the biotic (e.g., physiology) and abiotic (e.g., weather) constraints it experiences throughout the year. In the New World, closely related migratory species migrate to breeding grounds located across a wide range of latitudes, from northern North America to southern South America. Because the ultimate goal of a bird on spring migration is to successfully arrive on the breeding grounds in a timely manner, events that occur during the breeding season (e.g., amount of time available to breed) could affect, through selection pressures, the behavior of birds on spring migration. Variation across north temperate, tropical, and south temperate latitudes in breeding strategies, breeding season length, and availability of food during the breeding season has been well documented in various bird species. Thus, such factors as migratory strategies, risk of mortality on migration, and effects of climate change on migratory patterns may also vary predictably, depending on the latitude, both north and south of the Equator, at which a migratory population breeds. Comparing such patterns across the New World, using interdisciplinary approaches and the latest in technological advances, holds promise for better understanding how migratory birds accomplish these spectacular journeys.

Keywords (separated by '-')	Latitude - Neotropical austral migration - Nearctic-Neotropical migration - Southern Hemisphere - Tropics

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REVIEW

The potential for comparative research across New World bird migration systems

Alex E. Jahn · Víctor R. Cueto

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Abstract For a migratory bird, the costs and benefits of utilizing a given migratory strategy vary according to the biotic (e.g., physiology) and abiotic (e.g., weather) constraints it experiences throughout the year. In the New World, closely related migratory species migrate to breeding grounds located across a wide range of latitudes, from northern North America to southern South America. Because the ultimate goal of a bird on spring migration is to successfully arrive on the breeding grounds in a timely manner, events that occur during the breeding season (e.g., amount of time available to breed) could affect, through selection pressures, the behavior of birds on spring migration. Variation across north temperate, tropical, and south temperate latitudes in breeding strategies, breeding season length, and availability of food during the breeding season has been well documented in various bird species. Thus, such factors as migratory strategies, risk of mortality on migration, and effects of climate change on migratory patterns may also vary predictably, depending on the latitude, both north and south of the Equator, at which a migratory population breeds. Comparing such patterns across the New World, using interdisciplinary approaches and the latest in technological advances, holds promise for better understanding how migratory birds accomplish these spectacular journeys.

Keywords Latitude · Neotropical austral migration · Nearctic-Neotropical migration · Southern Hemisphere · Tropics

How migratory birds successfully arrive at their destination in a timely manner has been a question that ornithologists have pursued for more than a century (reviewed by Berthold 2001; Newton 2008), yet we still do not understand the ecological basis of the decisions that define an individual's migratory strategy (Barlein and Coppack 2006; Hedenström 2008). At what speed to fly? How and where to stopover? When to depart? When to arrive?

This is due in large part because: (1) most research on bird migration has focused on specific behavioral and physiological adaptations, whereas the avian migration syndrome involves a varied set of behavioral and physiological adaptations whose functions are difficult to elucidate on a piecemeal basis (Dingle 2006). In contrast, an integrative, interdisciplinary approach has the potential to yield novel insights into the evolution of the traits associated with migration (Barlein and Coppack 2006; Bowlin et al. 2010), (2) implementing a standardized set of protocols across multiple study sites on different continents is a daunting task requiring fluid communication between researchers, (3) the technological limitations of following individual birds across large distances has precluded such research, and (4) most bird migration research has been focused on a limited set of migration systems and species, namely those that breed at north temperate latitudes, where most researchers and financial resources are concentrated (Jahn et al. 2004).

Across New World bird migration systems, numerous species are derived from common ancestors (Levey and Stiles 1992; Rappole 1995; Joseph 1997), such that

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comparing migration strategies across species affords a unique opportunity to evaluate the adaptive value of a given migration strategy, within a phylogenetic context (Dingle 2008). Factors that vary with latitude such as the length of the breeding season and distance to wintering grounds may be correlated with a migratory strategy. Indeed, latitudinal comparisons of breeding strategies (Martin et al. 2000; Russell et al. 2004; Auer et al. 2007; Dingle 2008), hormone levels (Robinson et al. 2010b), metabolic rates (Wiersma et al. 2007), and growth rates (Ricklefs 1976) have yielded many important insights into the evolution and regulation of life history strategies in general (reviewed by Robinson et al. 2010b). In contrast, such comparative research is still rare in studies of the strategies birds use to migrate, with comparisons between migration systems almost exclusively limited to why birds migrate (e.g., Boyle and Conway 2007; Jahn et al. 2012).

Calls for comparative studies of adaptations for migration across species and hemispheres have been advanced in the past (Piersma et al. 2005; Dingle 2008). We support such calls, and argue that, in the New World, such comparative research offers the maximum potential to test the adaptive value of a given migratory strategy (Dingle 2008) because of the wide range of environmental challenges to migration found across the Americas, among a wide range of closely related taxa.

An overview of New World bird migration systems

Broadly speaking, five forms of long-distance bird migration exist in the New World: (1) migration between north temperate breeding grounds of North America and Neotropical wintering grounds (i.e., Nearctic-Neotropical migration, or North American Temperate-Tropical migration; sensu Joseph 1997), (2) migration within north temperate latitudes of North America (i.e., North American Cool-Temperate migration; sensu Joseph 1997), (3) migration within tropical latitudes (i.e., intratropical migration; Faaborg et al. 2010), (4) migration between south temperate breeding grounds and tropical wintering grounds of South America (i.e., South American Temperate-Tropical migration; sensu Joseph 1997), and (5) migration within south temperate latitudes of South America (i.e., South American Cool-Temperate migration; sensu Joseph 1997). These last two systems comprise Neotropical austral migration (Cueto and Jahn 2008; hereafter "austral migration"), in which birds migrate wholly within South America.

We evaluated the number of species shared by the Nearctic-Neotropical and austral migration systems using the database of Parker et al. (1996). Fifty-three genera have species that migrate in both of these systems, of which 17 genera have at least 2 species migrating in each system (Table 1). Notably, 23 species have populations migrating in both systems (Table 1). One group that stands out is the Tyrannidae (New World flycatchers). This is a highly migratory family in both North and South America, with 25 % of species migratory in North America (Rappole 1995) and 23 % migratory in South America (Chesser 1994).

Environmental and avian life history variation across the New World

There is well-documented latitudinal variation in New World avian life history strategies, climate and primary productivity:

1. A slower life history strategy in the south: South temperate and tropical breeding birds tend to have smaller clutch sizes (Martin 1996; Martin et al. 2000, 2006; Jetz et al. 2008; Yom-Tov et al. 1994; Auer et al. 2007), a longer time to independence (Russell et al. 2004), and higher adult survival (Rowley and Russell 1991; Martin 1996; Johnston et al. 1997) than north temperate breeders (reviewed by Wiersma et al. 2007; Robinson et al. 2010b).
2. Reduced seasonality in the south: The Southern Hemisphere is primarily covered by oceans, while the Northern Hemisphere is characterized by large landmasses. As a result, the Southern Hemisphere's climate is more buffered, with a milder and drier climate than most of the Northern Hemisphere (Yom-Tov et al. 1994; Dingle 2008). In the New World, seasonality in temperate South America is diminished relative to similar latitudes north of the equator (Paruelo et al. 1998, 2007). As a result, compared to North America, food resources for many South American bird species are likely to be available for a longer period of time during the breeding season relative to northern latitudes, as documented in Australia (Rowley and Russell 1991). This strongly suggests a weaker (i.e., more gradual and less pronounced) spring flush in food resources for birds at south temperate latitudes relative to similar latitudes north of the Equator (Rowley and Russell 1991).
3. Higher inter-annual variability in primary productivity in the south: south temperate latitudes are characterized by higher variability in net primary production than north temperate latitudes, in part due to the El Niño Southern Oscillation (Goetz et al. 2000). This could translate to more unpredictable food levels for migrant species that breed at south temperate latitudes relative to those at north temperate latitudes.

Table 1 Number of species shared by the Neotropical austral and Nearctic-Neotropical migration systems

Family/Genus	Neotropical austral migrants	Nearctic-Neotropical migrants	Species with populations in both migration systems
Anatidae			
Dendrocygna	2	2	*D. bicolor*
Cygnus	1	1	
Anas	8	10	*A. cyanoptera*
Oxyura	1	1	
Podicipedidae			
Podiceps	1	2	
Phalacrocoracidae			
Phalacrocorax	3	3	
Ardeidae			
Botaurus	1	1	
Nycticorax	1	2	*N. nycticorax*
Butorides	1	1	
Cathartidae			
Cathartes	1	1	*C. aura*
Accipitridae			
Elanoides	1	1	*E. forficatus*
Ictinia	1	2	*I. plumbea*
Circus	1	1	
Accipiter	3	2	*A. striatus*
Buteo	2	8	
Falconidae			
Falco	2	4	*F. peregrinus*
Rallidae			
Gallinula	1	1	*G. chloropus*
Porphyrio	1	1	*P. martinica*
Fulica	3	1	
Charadriidae			
Charadrius	2	5	
Haematopodidae			
Haematopus	1	1	
Scolopacidae			
Gallinago	1	1	
Laridae			
Larus	3	13	
Gelochelidon	1	1	*G. nilotica*
Sterna	2	4	
Thalasseus	1	3	*T. maximus, T. sandvicensis*
Rynchopidae			
Rynchops	1	1	*R. niger*
Columbidae			
Columbina	1	1	
Patagioenas	1	2	
Cuculidae			
Coccyzus	3	2	
Caprimulgidae			
Caprimulgus	3	3	
Trochilidae			
Anthracothorax	1	1	

Table 1 continued

Family/Genus	Neotropical austral migrants	Nearctic-Neotropical migrants	Species with populations in both migration systems
Alcedinidae			
Megaceryle	1	1	
Tyrannidae			
Camptostoma	1	1	
Empidonax	1	13	
Contopus	1	4	
Pyrocephalus	1	1	*P. rubinus*
Legatus	1	1	*L. leucophaius*
Myiodynastes	1	2	*M. maculatus*
Tyrannus	3	7	*T. melancholicus*
Myiarchus	2	4	*M. tuberculifer*
Tityridae			
Pachyramphus	2	1	
Vireonidae			
Vireo	1	12	*V. olivaceus*
Hirundinidae			
Stelgidopteryx	1	1	
Progne	3	5	*P. chalybea*
Tachycineta	3	2	
Troglodytidae			
Troglodytes	1	2	*T. aedon*
Turdidae			
Turdus	2	1	
Motacillidae			
Anthus	2	2	
Emberizidae			
Zonotrichia	1	7	
Cardinalidae			
Piranga	1	2	*P. flava*
Icteridae			
Sturnella	2	2	
Fringillidae			
Carduelis	1	4	
Total	88	158	23

Genera in bold are those with at least two species migrating in each migration system. Based upon Parker et al. (1996; in Stotz et al. 1996); taxonomy according to the American Ornithologists' Union checklists of North and South American birds

Therefore, three factors might be noted: (1) annual productivity (i.e., number of eggs and young produced) is lower but adult survival is higher in the tropics/south temperate latitudes versus north temperate latitudes, (2) food resources are likely available for a longer part of the south versus north temperate breeding season, and (3) there is higher interannual climatic variation at south versus north temperate breeding grounds. Such a pattern strongly suggests that substantial variation should also exist in the migratory strategies of populations breeding north versus south of the Equator.

Potential questions

We offer three questions relevant to understanding how migratory birds cope with the challenges to a life on the move, for which comparative research across the New World could provide new insights:

Which mechanisms drive spring migratory strategies? Because the ultimate goal of spring migration is to arrive successfully on breeding grounds and reproduce, events occurring during the breeding season may exert a selection pressure on spring migratory strategies. For example, due to a steep decline in reproductive success as the breeding season progresses (e.g., Murphy 1986, 1988; Regosin and Pruett-Jones 1995; Martin 1987), many migrants have a limited window of time in which to successfully reproduce, such that properly timing arrival on breeding grounds is very important to successful reproduction (Lack 1968; Møller 1994; Kokko 1999; Smith and Moore 2005; Visser et al. 2006).

Optimal migration theory distinguishes between three limiting factors molding migration strategies (Alerstam and Lindström 1990; Åkesson and Hedenström 2007; Hedenström 2008): (1) Time-selected migration: migrants are most limited by available time to breed, such that arriving on breeding grounds as early as possible is of highest fitness value; (2) Energy-selected migration: migrants are most limited by adequate food resources during the journey; and (3) Predation-selected migration: migrants are most limited by the risk of predation during migration. Most optimal migration models assume that time minimization is the most relevant currency for a migrant, and that selection favors a maximization of migration speed (Hedenström 2008).

However, because the amount of time available to breed varies with latitude, often with a wider temporal window in which to breed at lower latitudes, the costs of arriving at low latitude breeding grounds a little "late" may not be as severe (and the benefits of on-time arrival not as great) as for populations that breed at higher latitudes. Furthermore, because there is (1) a larger reproductive payoff (i.e., number of young produced) at north temperate latitudes than at tropical or south temperate latitudes, and (2) potentially more predictable food resources in spring at north temperate latitudes than at south temperate latitudes (see above), migratory birds breeding at north temperate latitudes may be willing to take more risks on spring migration to arrive first, employing a more time-selected migratory strategy than those breeding at tropical and south temperate latitudes, which may be more energy- or predator-selected. As a result, although differences in the speed of migration between years may exist (e.g., Marra et al. 2005), species that breed at north temperate latitudes should on average migrate faster in spring than those to tropical or south temperate latitudes.

Such a strategy could translate to other differences between Nearctic-Neotropical and austral migrants. For example, although seasonal carry-over effects have been shown in a handful of Nearctic-Neotropical migrants (e.g., American Redstarts, *Setophaga ruticilla*; Marra et al. 1998), if the migratory period of intratropical and austral migrants is much longer, seasonal carry-over effects could be "washed out" before the beginning of the next phase of their annual cycle.

During which part of the annual cycle is mortality highest? Although high mortality during migration and winter has long been suspected for migratory birds breeding at north temperate latitudes (Sherry and Holmes 1996, 2002), little information is available on mortality during migration for austral migrants. Because of the generally shorter migration distances of austral migrants, many of which have overlapping breeding and winter ranges (Chesser 1994; Stotz et al. 1996), and because austral migrants generally migrate over land and do not have to cross any major topographical barriers (Chesser 1994) versus Nearctic-Neotropical migrants, many of which cross the Gulf of Mexico, mortality during migration may not be as high for austral migrants. Additionally, if austral migrants are not as time-limited as Nearctic-Neotropical migrants (see above), they may take fewer risks on spring migration, leading to decreased mortality during that part of their annual cycle, relative to their northern counterparts. Rather, given the relatively high nestling mortality rates of birds breeding in the Neotropics (e.g., Mezquida and Marone 2001), the greatest bottleneck to survival for intra-tropical migrants and austral migrants may be during the nestling stage.

How does climate change affect migratory birds in different contexts? Research at north temperate latitudes demonstrates that many birds are migrating and arriving earlier in spring (e.g., Hüppop and Hüppop 2003; Van-Buskirk et al. 2009), expanding their ranges northward (LaSorte and Thompson 2007), migrating later in fall (e.g., Sparks and Mason 2001; Gilyazov and Sparks 2002), and changing the date of egg laying (e.g., McCleery and Perrins 1998; Dunn and Winkler 1999). Additionally, research from the Northern Hemisphere indicates that the adaptive value of the advancement of reproductive schedules could be constrained because migration cycles are primarily under the control of endogenous rhythms and periodic cues, independent of temperature (Coppack and Both 2003). We know almost nothing about the sensitivity to climate change of migratory species that breed at tropical and south temperate latitudes, and the broad variation in life history strategies among temperate versus tropical species precludes generalizing how flexible migrants across the planet are to climate change. Because genetic and phenotypic variation in migratory traits is relatively high, migrants in general may quickly adapt to climate change; however, the strength of the response to selection may be constrained by life history traits operating outside of the migration period (Coppack and Both 2003).

Comparisons across New World migration systems also offer a way to address migration-related questions other than those listed above. For example, optimality models of daily migration speed, fuel loads, and distance (Åkesson and Hedenström 2007) could be compared across migration systems to understand how robust such models are under different conditions. Additionally, Sandberg and Moore (1996) set forth several hypotheses to explain why migratory birds arrive on the breeding grounds with extra fat, several of which include predictions which rely upon comparisons at high versus low latitudes. Extending such comparisons to high latitudes south of the Equator could test the generality of such hypotheses at a truly global scale. Finally, because successful migration requires accurate orientation/navigation, and because navigational cues available to birds may vary across latitudes (e.g., the Sun compass, and Earth's magnetic field), a comparison of the navigational toolkit available to migrants breeding in different hemispheres could unveil novel suites of navigational mechanisms.

Conducting the type of research proposed here often demands strong research collaborations and coordination across several countries located on different continents, posing formidable logistical obstacles to research, which likely explains in large part the lack of such studies in the literature on bird migration to date. However, modern day ornithologists have at their disposal a wide range of tools necessary to conduct research at spatial scales heretofore unequaled. Emerging technologies permit unsurpassed opportunities for tracking migratory birds (e.g., Stutchbury et al. 2009; Robinson et al. 2010a), for collecting data on their physiology and ecology (Cooke et al. 2004; Cagnacci et al. 2010), and for harnessing the power of "citizen scientists" via websites that allow data sharing (e.g., BirdTrack, eBird, WorldBirds). Additionally, the advent of high throughput genetic sequencing and the development of phylogenies across a wide range of taxa increasingly permit phylogenetic comparisons across various levels of organization (i.e., population to family). Utilizing such techniques while employing the comparative method to evaluate patterns across migration systems promises many novel insights into how and why birds migrate—and how best to conserve them—in the twenty-first century.

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References

Åkesson S, Hedenström A (2007) How migrants get there: migratory performance and orientation. Bioscience 57:123–133

Alerstam T, Lindström Å (1990) Optimal bird migration: the relative importance of time, energy, and safety. In: Gwinner E (ed) Bird migration: physiology and ecophysiology. Springer, Berlin, pp 331–351

Auer SK, Bassar RD, Fontaine JJ, Martin TE (2007) Breeding biology of passerines in a subtropical montane forest in northwestern Argentina. Condor 109:321–333

Barlein F, Coppack T (2006) Migration in the life history of birds. J Ornithol 147:121

Berthold P (2001) Bird migration: a general survey, 2nd edn. Oxford University Press, Oxford

Bowlin MS, Bisson I-A, Shamoun-Baranes J, Reichard JD, Sapir N, Marra PP, Kunz TH, Wilcove DS, Hedenström A, Guglielmo CG, Åkesson S, Ramenofsky M, Wikelski M (2010) Grand challenges in migration biology. Integr Comp Biol 50:261–279

Boyle WA, Conway CJ (2007) Why migrate? A test of the evolutionary precursor hypothesis. Am Nat 169:344–359

Cagnacci F, Boitani L, Powell RA, Boyce MS (2010) Animal ecology meets GPS-based radiotelemetry: a perfect storm of opportunities and challenges. Philos Trans R Soc Lond B 365:2157–2162

Chesser RT (1994) Migration in South America, an overview of the Austral system. Bird Conserv Int 4:91–107

Cooke SJ, Hinch SG, Wikelski M, Andrews RD, Kuchel LJ, Wolcott TG, Butler PJ (2004) Biotelemetry: a mechanistic approach to ecology. Trends Ecol Evol 19:334–343

Coppack T, Both C (2003) Predicting life-cycle adaptation of migratory birds to global climate change. Ardea 90:369–378

Cueto VR, Jahn AE (2008) Sobre la necesidad de tener un nombre estandarizado para las aves que migran dentro de América del Sur. El Hornero 23:1–4

Dingle H (2006) Animal migration: is there a common migratory syndrome? J Ornithol 147:212–220

Dingle H (2008) Bird migration in the southern hemisphere: a review comparing continents. Emu 108:341–359

Dunn PO, Winkler DW (1999) Climate change has affected the breeding date of tree swallows throughout North America. Proc R Soc Lond B 266:2487–2490

Faaborg J, Holmes RT, Anders AD, Bildstein KL, Dugger KM, Gauthreaux SA Jr, Heglund P, Hobson KA, Jahn AE, Johnson DH, Latta SC, Levey DJ, Marra PP, Merkord CL, Nol E, Rothstein SI, Sherry TW, Sillett TS, Thompson FR III, Warnock N (2010) Recent advances in understanding migration systems of New World Landbirds. Ecol Monogr 80:3–48

Gilyazov A, Sparks TH (2002) Change in the timing of migration of common birds at the Lapland nature reserve (Kola Peninsula, Russia) during 1931–1999. Avian Ecol Behav 8:35–47

Goetz SJ, Prince SD, Small J, Gleason ACR (2000) Interannual variability of global terrestrial primary production: results of a model driven with satellite observations. J Eophys Res 105:20077–20091

Hedenström A (2008) Adaptations to migration in birds: behavioural strategies, morphology and scaling effects. Philos Trans R Soc Lond B 363:287–299

Hüppop O, Hüppop K (2003) North Atlantic Oscillation and timing of spring migration in birds. Proc R Soc Lond B 270:233–240

Jahn AE, Levey DJ, Smith KG (2004) Reflections across hemispheres: a system-wide approach to New World bird migration. Auk 121:1005–1013

Jahn AE, Bravo SP, Cueto VR, Levey DJ, Morales MV (2012) Patterns of partial avian migration in northern and southern temperate latitudes of the New World. Emu: http://dx.doi.org/10.1071/MU10091

Jetz W, Sekercioglu CH, Böhning-Gaese K (2008) The worldwide variation in avian clutch size across species and space. PLoS Biol 6:e303. doi:10.1371/journal.pbio.0060303

Johnston JP, Peach WJ, Gregory RD, White SA (1997) Survival rates of tropical and temperate passerines: a Trinidadian perspective. Am Nat 150:771–789

Joseph L (1997) Towards a broader view of Neotropical migrants: consequences of a re-examination of austral migration. Ornitol Neotrop 8:31–36

Kokko H (1999) Competition for early arrival in migratory birds. J Anim Ecol 68:940–950

Lack D (1968) Ecological adaptations for breeding in birds. Methuen, London

LaSorte FA, Thompson FR III (2007) Poleward shifts in winter ranges of North American birds. Ecology 88:1803–1812

Levey DJ, Stiles FG (1992) Evolutionary precursors of long-distance migration: resource availability and movement patterns in Neotropical landbirds. Am Nat 140:447–476

Marra PP, Hobson KA, Holmes RT (1998) Linking winter and summer events in a migratory bird using stable-carbon isotopes. Science 282:1884–1886

Marra PP, Francis CM, Mulvihill RS, Moore FR (2005) The influence of climate on the timing and rate of spring bird migration. Oecologia 142:307–315

Martin TE (1987) Food as a limit on breeding birds: a life history perspective. Annu Rev Ecol Syst 18:453–487

Martin TE (1996) Life history evolution in tropical and south temperate birds: what do we really know? J Avian Biol 27:263–272

Martin TE, Martin PR, Olson CR, Heidinger BJ, Fontain JJ (2000) Parental care and clutch sizes in North and South American birds. Science 287:1482–1485

Martin TE, Bassar RD, Bassar SK, Fontaine JJ, Lloyd P, Matthewson HA, Niklison AM, Chalfoun A (2006) Life-history and ecological correlates of geographic variation in egg and clutch mass among passerine species. Evolution 60:390–398

McCleery RH, Perrins CM (1998) Temperature and egg-laying trends. Nature 391:30–31

Mezquida ET, Marone L (2001) Factors affecting nesting success of a bird assembly in the central Monte Desert, Argentina. J Avian Biol 32:287–296

Møller AP (1994) Sexual selection and the barn swallow. Oxford University Press, Oxford

Murphy MT (1986) Temporal components of reproductive variability in eastern kingbirds (*Tyrannus tyrannus*). Ecology 67:1483–1492

Murphy MT (1988) Comparative reproductive biology of kingbirds (*Tyrannus* spp.) in eastern Kansas. Wilson Bull 100:357–376

Newton I (2008) The migration ecology of birds. Elsevier, London

Parker TA III, Stotz DF, Fitzpatrick JW (1996) Ecological and Distributional Databases. In: Stotz DF, Fitzpatrick JW, Parker TA III, Moskovits DK (eds) Neotropical Birds: Ecology and Conservation. University of Chicago Press, Chicago, pp 18–436

Paruelo JM, Beltrán A, Jobbágy E, Sala OE, Golluscio RA (1998) The climate of Patagonia: general patterns and controls on biotic processes. Ecol Austral 8:85–101

Paruelo JM, Jobbágy EG, Oesterheld M, Golluscio RA, Aguiar MR (2007) The grasslands and steppes of Patagonia and the Rio de la Plata plains. In: Veblen T, Young K, Orme A (eds) The Physical Geography of South America. The Oxford Regional Environments Series. Oxford University Press, Oxford, pp 232–248

Piersma T, Pérez-Tris J, Mouritsen H, Bauchinger U, Bairlein F (2005) Is there a “migratory syndrome” common to all migrant birds? Ann N Y Acad Sci 1046:282–293

Rappole JH (1995) The ecology of migrant birds, a Neotropical perspective. Smithsonian Institution Press, Washington

Regosin JV, Pruett-Jones S (1995) Aspects of breeding biology and social organization in the scissor-tailed flycatcher. Condor 97: 154–164

Ricklefs RE (1976) Growth rates of birds in the humid New World tropics. Ibis 118:179–207

Robinson WD, Bowlin MS, Bisson I-A, Shamoun-Baranes J, Thorup K, Diehl RH, Kunz TH, Mabey S, Winkler DW (2010a) Integrating concepts and technologies to advance the study of bird migration. Front Ecol Environ 8:354–361

Robinson WD, Hau M, Klasing KC, Wikelski M, Brawn JD, Austin SH, Tarwater CE, Ricklefs RE (2010) Diversification of life histories in New World birds. Auk 127:253–262

Rowley I, Russell E (1991) Demography of passerines in the temperate southern hemisphere. In: Perrins CM, Lebreton J-D, Hirons JGM (eds) Bird population studies: Relevance to conservation and management. Oxford University Press, Oxford, pp 22–44

Russell EM, Yom-Tov Y, Geffen E (2004) Extended parental care and delayed dispersal: northern, tropical, and southern passerines compared. Behav Ecol 15:831–838

Sandberg R, Moore FR (1996) Fat stores and arrival on the breeding Grounds: reproductive consequences for passerine migrants. Oikos 77:577–581

Sherry TW, Holmes RT (1996) Winter habitat quality, population limitation, and conservation of Neotropical-Nearctic migrant birds. Ecology 77:36–48

Sillett TS, Holmes RT (2002) Variation in survivorship of a migratory songbird throughout its annual cycle. J Anim Ecol 71:296–308

Smith RJ, Moore FR (2005) Arrival timing and seasonal reproductive performance in a long distance migratory landbird. Behav Ecol Sociobiol 57:231–239

Sparks TH, Mason CF (2001) Dates of arrivals and departures of spring migrants taken from the Essex Bird Reports 1950–1998. Essex Bird Report 1999:154–164

Stotz DF, Fitzpatrick FW, Parker TA III, Moskovits DK (1996) Neotropical birds: Ecology and conservation. University of Chicago Press, Chicago

Stutchbury BJM, Tarof SA, Done T, Gow E, Kramer PM, Tautin J, Fox JW, Afanasyev V (2009) Tracking long-distance songbird migration by using geolocators. Science 323:896

VanBuskirk J, Mulvihill RS, Leberman RC (2009) Variable shifts in spring and autumn migration phenology in North American songbirds associated with climate change. Glob Change Biol 15:760–771

Visser ME, Holleman LJM, Gienapp P (2006) Shifts in caterpillar biomass phenology due to climate change and its impact on the breeding biology of an insectivorous bird. Oecologia 147: 164–172

Wiersma P, Muñoz-Garcia A, Walker A, Williams JB (2007) Tropical birds have a slow pace of life. Proc Natl Acad Sci USA 104:9340–9345

Yom-Tov Y, Christie MI, Iglesias GJ (1994) Clutch size in passerines of southern South America. Condor 96:170–177

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