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Geographical variation and current knowledge on breeding patterns of Neotropical accipitrid raptors

Julio Amaro Betto Monsalvo

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Dissertação apresentada ao Programa de Pós-Graduação em Ecologia, do Instituto de Ciências Biológicas da Universidade de Brasília, como requisito parcial para a obtenção do título de Mestre em Ecologia.

Orientador: Prof. Dr. Miguel Ângelo Marini

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Dissertação de mestrado

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“(...) in museum drawers, where many major discoveries are made(...)”

Stephen Jay Gould, 1979

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RESUMO

Estudos de história de vida em aves frequentemente restringem-se ao paradigma latitudinal de variação nos tamanhos de ninhada, ignorando o valor dos *trade-offs* entre os diferentes parâmetros, como o comprimento da estação reprodutiva (*breeding season length*; BSL). Acredita-se que este parâmetro apresente também uma clina latitudinal, com um aumento da duração em direção aos trópicos. Também há evidências de variação latitudinal nas estações reprodutivas entre táxons próximos, mas há muito se debate a capacidade de aves de baixas latitudes responder a mudanças no comprimento do dia. Resultados de estudos feitos na América do Sul e no Hemisfério Sul como um todo desafiam o paradigma latitudinal de BSLs. A maioria dessas pesquisas foca em comunidades de Passeriformes, ignorando espécies de maior tamanho corporal como rapinantes, mas é essencial verificar se os padrões se sustentam entre diferentes clados de aves. Além disso, esse conhecimento pode ser relevante para o manejo e conservação das espécies. Analisei a ocorrência de variações geográficas em parâmetros reprodutivos de Accipitridae neotropicais. No primeiro Capítulo, motivado pela ausência de uma revisão recente e abrangente do estado-da-arte que englobasse toda a região Neotropical, examinei lacunas no conhecimento sobre a biologia reprodutiva dessas aves. Compilei 457 referências bibliográficas, produzidas desde a última revisão similar (Bierregaard 1995), com registros reprodutivos de 56 espécies. Ainda que 66% destas espécies tenham apresentado incrementos no estado de conhecimento, para sete o ninho ainda não foi descrito, e/ou há uma completa ausência de informação sobre comportamentos reprodutivos. Dentre estas, o antigo “clado *Leucopternis*” segue como o caso mais problemático. Forneço uma classificação atualizada de níveis de conhecimento sobre a biologia reprodutiva dos Accipitriformes neotropicais, e apresento uma lista de 24 espécies prioritárias para estudos sobre biologia reprodutiva, considerando tanto lacunas no conhecimento quanto atual relevância para a conservação. A revisão realizada no Capítulo

1 serviu de base e viabilizou as análises do Capítulo 2, usando dados do clado 'buteonines', um diversificado grupo monofilético de Accipitridae, com biologia reprodutiva relativamente bem conhecida. Verifiquei nesse Capítulo se esses raptores apresentam padrões de variação geográfica nas estações reprodutivas. Obtive 1541 registros de ninhos de 27 espécies da região Neotropical, da literatura e também de 16 coleções de ovos em museus. Os registros foram divididos em amostras ('*units*'), entre diferentes faixas latitudinais, de acordo com a filogenia e atributos ecológicos e biogeográficos relevantes, e também entre ecorregiões. Diferenças significativas foram encontradas entre as estimativas de início da estação reprodutiva (*initiation of the breeding season*; IOB) de diferentes faixas latitudinais: as médias de populações tropicais do sul divergiram daquelas tanto das populações tropicais do norte (ANOVA; $Q = 5{,}987$; $P < 0{,}001$) quanto das temperadas do sul ($Q = 6{,}731$; $P < 0{,}001$). Estimativas de IOB são negativamente correlacionadas com a latitude ($r = -0{,}667$, $r^2 = 0{,}445$, $P = 0{,}018$). Valores de BSL variaram significativamente menos que os de IOB (testes *a posteriori* Fligner-Kileen para coeficientes de variação), e não encontrei suporte para a predição de que duração das estações reprodutivas das populações de diferentes espécies em uma mesma faixa latitudinal divergem significativamente das de outras faixas. Além disso, populações migrantes e não-migrantes não tiveram BSLs significativamente distintos, e nenhum tipo de "efeito de ilha" ocorreu com os BSLs de populações insulares em vários níveis de isolamento. As estações reprodutivas de buteonines iniciam muito mais cedo que as de Passeriformes, e provavelmente também que as de outros Accipitridae, tanto em uma mesma área quanto em outras regiões do globo. Há um padrão de clinas latitudinais nos IOBs, com as estações reprodutivas começando até 100 dias antes do equinócio em ambas as faixas tropicais, porém mais atrasadas na faixa temperada. Essas conclusões sugerem que estímulos de comprimento dos dias sejam a principal causa proximal definindo o início das estações reprodutivas dessas

aves. Também sugiro que imprevisibilidade climática não necessariamente selecionaria maiores estações reprodutivas em aves; e demonstrei que, entre buteonines neotropicais, BSLs de migrantes de curtas distâncias são muito similares aos de não-migrantes, indicando ausência de restrições temporais para sua reprodução. Isolamento reprodutivo e/ou evolutivo de populações insulares por si só pode não levar a uma maior divergência em parâmetros reprodutivos em relação a populações continentais. Devido a escassez de dados comportamentais e ecológicos para a maioria destas espécies, especialmente no norte e centro da América do Sul, ressalto a relevância de conduzir estudos detalhados com populações distintas, e evidencio como a cuidadosa análise de coleções oológicas pode preencher algumas lacunas de conhecimento. Também demonstro como pesquisas podem prover novas evidências e postular hipóteses testáveis, mesmo com dados muito distantes do ideal.

Palavras-chave: Accipitriformes, biologia reprodutiva, buteonines, clina latitudinal, história de vida, lacunas no conhecimento, prioridades de pesquisa.

ABSTRACT

Avian life-history studies are mostly restricted to the latitudinal paradigm of clutch-size variation, ignoring the value of trade-offs between the different parameters. One of these parameters is the breeding season length (therefore, BSL), considered to also present a latitudinal cline, increasing toward the tropics. Moreover, there is evidence that nesting seasons diverge latitudinally among closely-related taxa, but the perception of day-length variation by birds at lower latitudes has long been debated. Results from studies conducted in South America and through the Southern Hemisphere challenges BSL's latitudinal paradigm. Most of these studies focus on passerine communities, overlooking larger species such as raptors, but it is essential to verify if patterns hold true across bird clades. Also, such knowledge about breeding biology is relevant for species' management and conservation. I analyzed the occurrence of geographical variation in breeding parameters of Neotropical accipitrid raptors. In the first Chapter, motivated by the lack of a recent, comprehensive survey of the state-of-the-art spanning the entire Neotropics, I examined gaps of knowledge on these birds' breeding biology. I compiled 457 references, produced since the last similar review (Bierregaard 1995), that reported breeding of 56 species. Although 66% of the evaluated species had an improvement on the state of knowledge, for seven species nests have not been described yet, and/or there is a complete absence of information about their breeding behavior. Among these, the former "*Leucopternis* clade" remains the most problematic case. I provide an update of current levels of knowledge about the breeding biology of Neotropical Accipitriformes, and present a list of 24 priority species for breeding biology studies, considering both information gaps and current conservation relevance. The review performed on Chapter 1 was the baseline and allowed the analyses made in Chapter 2, that used data of the buteonines clade, a diversified monophyletic group of accipitrid raptors, with relatively well-known breeding biology. In the second Chapter, I verified whether these raptors present patterns of geographical variation in breeding seasonality. I obtained 1541 nest records from 27 species of the Neotropical region, from literature and also 16 museum egg collections. Records were divided between samples (‘units’), among latitudinal ranges, according to phylogeny and relevant ecological and biogeographical traits, and also between ecoregions. Significant differences were found between estimates of initiation of the breeding season (IOB) from different latitudinal ranges: the means of southern tropical units differed from those of both northern tropical (ANOVA; $Q = 5.987$; $P < 0.001$) and southern temperate ones ($Q = 6.731$; $P < 0.001$). Estimates of IOB are also negatively correlated with latitude ($r = -0.667$; $r^2 = 0.445$; $P = 0.018$). Values of BSL varied significantly less than those of IOB (*a posteriori* Fligner-Kileen tests for coefficients of variation), and I found no support for the prediction that breeding season lengths of populations of different species within a same latitudinal range will significantly diverge from other ranges’. Also, migrants and non-migrant units had no significantly different BSLs, and no kind of “island effect” occured with BSLs of units on islands, in any level of isolation. Neotropical buteonine’s breeding seasons start earlier than those of passerines, and probably earlier than other accipitrids, either in the same range or elsewhere. There is a pattern of latitudinal clines in the IOBs as their seasons start up to 100 days before vernal equinox in both tropical ranges, but later on the temperate range. These findings suggest that day-length stimuli are the main proximate clues determining the onset of their breeding seasons. I also suggest that unpredictability on climate do not necessarily select for longer breeding seasons in birds, and demonstrate that among Neotropical buteonines, short-distance migrants have BSLs very similar to those of non-migrants, indicating no substantial time-constraints for their breeding activities. Reproductive and/or evolutionary isolation of insular populations alone may not select for increasing divergence in breeding parameters, relative to mainland populations. Due to the scarcity of ecological and behavioral data for most of these species, particularly in northern and central South America, I highlight the relevance of conducting detailed studies with different populations, and also how scrutiny of oological collections could fill some gaps of knowledge. I also demonstrate how, even with data far from ideal, research can provide new evidence and put forward testable hypotheses.

Keywords: Accipitriformes, buteonines, breeding biology, information gaps, latitudinal cline, life-history, reproduction, research priorities.

INTRODUÇÃO GERAL

A teoria da história de vida trata do ciclo de vida dos organismos, buscando explicar o que causa as diferenças em parâmetros demográficos que compõe seu fenótipo (Ricklefs 2000). Quaisquer variações em tais parâmetros são conectadas através de uma série de *trade-offs* (Mason 1985, Stearns 1992, Ricklefs 2000, Newton 2010). Um destes, de particular importância, é a duração da temporada reprodutiva (*breeding season length*, ou BSL; Ricklefs e Bloom 1977). Foi proposto que as variações latitudinais nos tamanhos de ninhada (*clutch-sizes*; Moreau 1944), poderiam resultar de um aumento das BSL, das altas latitudes em direção aos trópicos (Murray 2001). Isso aumentaria as oportunidades para os pais criarem ninhadas adicionais na mesma estação reprodutiva, selecionando assim menores tamanhos de ninhada em baixas latitudes (Griebeler et al. 2010).

Mas, a situação tornou-se menos clara com novos estudos realizados na América do Sul, cuja avifauna parece contradizer esse paradigma latitudinal ao combinar BSLs curtas e ninhadas também pequenas (e.g., Auer et al. 2007, Lima e Roper 2009, Marini et al. 2012, Marques-Santos et al. 2015). Entretanto, boa parte da informação disponível vem de estudos centrados em Passeriformes, e desde os primeiros trabalhos sobre o tema está claro que os padrões de sazonalidade podem variar muito entre os táxons (Baker 1938, Skutch 1950). De fato, parâmetros de história de vida se relacionam a outros atributos além dos fatores ecológicos, tais como tamanho corporal, filogenia e biogeografia (Brawn 1991, Jetz et al. 2008). Uma maneira de diminuir a influência de parâmetros intrínsecos como preditores dos padrões reprodutivos é estudar um grupo taxonômico abaixo do nível de Família (e.g., subfamílias ou gêneros; Murphy 1989, Kulesza 1990).

A Família Accipitridae é um dos mais bem estudados clados entre as aves (Krüger e Radford 2008). Nessa Família, o clado ‘buteonines’, com monofilia suportada pela maioria das análises genéticas recentes (Riesing et al. 2003, Griffiths et al. 2007, Lerner et al. 2008), é um dos mais diversificados. São Accipitridae predominantemente Neotropicais, que apresentam muitos indicativos de adaptabilidade rápida aos ambientes (e.g., Riesing et al. 2003, Hull et al. 2008, Amaral et al. 2009). Dessa forma, a influência de preditores extrínsecos dos parâmetros de história de vida tem o potencial de ser particularmente evidente, em análises com este clado. Além disso, o entendimento da biologia reprodutiva de raptores também tem um papel fundamental para sua efetiva conservação (De Labra et al. 2013). Sabe-se, por exemplo, que muitos aspectos reprodutivos são parâmetros de manejo altamente recomendados, para programas de conservação das populações de Accipitridae (Krüger 2000, Ferguson-Lees e Christie 2001, Trejo 2007a, Krüger e Radford 2008).

Esta dissertação teve como objetivo principal analisar a ocorrência de variações geográficas em parâmetros reprodutivos de Accipitridae neotropicais. No primeiro Capítulo, realizei uma análise das lacunas no conhecimento sobre a biologia reprodutiva dessas espécies, indicando táxons, regiões e/ou parâmetros ainda carentes de estudos. Foi feito um levantamento abrangente do estado-da-arte do conhecimento sobre a reprodução de 56 espécies, por meio de revisão bibliográfica, resultando na localização de 457 referências. Comparei o estado atual de conhecimento com o cenário de décadas atrás (Bierregaard 1995), e assim criei uma classificação atualizada de prioridades de pesquisa dentre esses raptores. No segundo Capítulo investiguei a ocorrência de padrões geográficos na sazonalidade reprodutiva dos buteonines, padrões estes bem conhecidos para outros grupos de aves (e.g., Yom-Tov et al. 1994, Murray 2001), mas ainda não adequadamente testados para raptores. Por meio de mais de 1500 registros reprodutivos oriundos da região Neotropical, obtidos da literatura e também de 16 coleções de diversos museus ao redor do mundo, testei diversas hipóteses baseadas em paradigmas estabelecidos para a história de vida de aves.

CAPÍTULO 1

Breeding biology of Neotropical Accipitriformes: current knowledge and research priorities

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Breeding biology of Neotropical Accipitriformes: current knowledge and research priorities

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ABSTRACT: Despite the key role that knowledge on breeding biology of Accipitriformes plays in their management and conservation, survey of the state-of-the-art and of information gaps spanning the entire Neotropics has not been done since 1995. We provide an updated classification of current knowledge about breeding biology of Neotropical Accipitridae, and define the taxa that should be prioritized by future studies. We analyzed 457 publications produced since 1995 that reported breeding of 56 species. There is a persistent scarcity, or complete absence, of information about the nests of eight species, and about breeding behavior of another ten. All former "*Leucopternis*" hawks remain the largest gap of breeding data among Neotropical Accipitridae. Albeit 66% of the 56 evaluated species had some improvement on knowledge about their breeding traits, research still focus disproportionately on a few regions and species, and the scarcity of breeding data on many South American Accipitridae persists. We noted that analysis of vouchers from both a citizen science digital database and museum egg collections significantly increased breeding information on some species, relative to recent literature. We created four groups of priority species for breeding biology studies, based on knowledge gaps and threat categories at global level: (Group I; great scarcity of information, plus higher categories of threat) *Leptodon forbesi*, *Cryptoleucopteryx plumbea*, and *Buteogallus lacernulatus*; (Group II; breeding data have recently increased, but threat categories are high) *Spizaetus isidori*, *Accipiter gundlachi*, *B. coronatus*, *Pseudastur occidentalis*, and *Buteo ventralis*; (Group III; 'Near Threatened' species with still scarce breeding information) *A. poliogaster*, *A. collaris*, *Buteogallus aequinoctialis*, and *P. polionotus*; and (Group IV; other priority cases) *Buteo ridgwayi*, *B. galapagoensis*, four eagles (*Morphnus guianensis*, *Harpia harpyja*, *Spizaetus ornatus* and *Buteogallus solitarius*), *Leptodon cayanensis*, *A. superciliosus*, *Buteogallus schistaceus*, and the three *Leucopternis* hawks. We also discuss how novel breeding data can show in what manners different species and populations are responding to environmental changes.

KEY-WORDS: eagles, hawks, information gaps, life history, raptors, reproduction

INTRODUCTION

Accipitriformes (Osprey, kites, hawks, and eagles; families Pandionidae and Accipitridae) is an extremely diversified and successful clade of diurnal raptors (Ferguson-Lees & Christie 2001, Márquez *et al.* 2005, Amaral *et al.* 2009, Dickinson & Remsen 2013). Knowledge about the breeding biology of this clade, and about the idiosyncratic breeding patterns of each species and subspecies, plays a central role in effective conservation of these species (De Labra *et al.* 2013).

Many breeding aspects of Accipitriformes are in fact important parameters for management and conservation programs. For instance, clutch size is directly related to population size, and thus inversely proportional to the risk of extinction (Krüger & Radford 2008). Conversely, their reproductive rates are related to population density (Krüger 2000). Also, nest site choices reveal habitat selection by these raptors (Ferguson-Lees & Christie 2001), and therefore make evident their sensitivity to environmental changes (Trejo 2007a).

Bierregaard (1995) reviewed the knowledge available at that time about various aspects of the biology of diurnal raptors that breed mainly in Central and South America. Regarding the breeding biology, the author showed that nests of 11 species and breeding behavior of 15 were not described. Moreover, most research concentrated on a few regions, such as further north of the Neotropics (*e.g.*, southern part of North America, Guatemala). Breeding data on most South American populations, subspecies and species were lacking (Bierregaard 1995).

More recently, similar reviews were done only on a few South American countries (Pardiñas & Cirignoli 2002, Trejo *et al.* 2006, Trejo 2007a, b, Raimilla *et al.* 2012, Cortés *et al.* 2013). These studies assessed from four to 28 species, and just two reviews (Trejo 2007a, b) dealt with a larger amount (55 species). All these analyses comprised only studies conducted in the specific country(ies), and so none included raptors that occur north of the Southern Cone of South America. Consequently, these surveys left out of one of the world's most deficient areas on bird breeding data, the Amazon Basin (Xiao *et al.* 2016), as well as about 20 species of Accipitriformes (Whitacre & Burnham 2012, Del Hoyo *et al.* 2016a).

Countries that produce most scientific publications on Neotropical birds, including on the breeding biology of certain taxa, do not have English as their native language (Heming *et al.* 2013, Freile *et al.* 2014). For instance, all recent reviews on South

American raptor research were written in Spanish (save their abstracts), with the exception of Trejo *et al.* (2006). Yet, there is still a visibility bias affecting science made in such countries (Cabot & De Vries 2004, Lortie *et al.* 2007), making it not easily accessible for researchers that do not read Spanish or Portuguese (see Bierregaard 1995).

Moreover, many information on the natural history of Neotropical raptors come from studies not specifically designed for this aim (Cortés *et al.* 2013). Such studies often are published at small, local journals or bulletins (Figueroa, *in litt.*). Thus, important advances in knowledge are hardly visible to ornithologists from other countries. Indeed, Bierregaard (1995) mentioned that 'obscurity' of certain Latin American journals may have prevented him from collecting information from them. However, since then, internet access to many of these journals greatly improved (*e.g.*, El Hornero, from Argentina; http://digital.bl.fcen.uba.ar), allowing more complete reviews to be made. Also, during the last two decades, the ornithological community in South America increased considerably, boosting the number of publications (Vuilleumier 2004, Freile 2005, Freile *et al.* 2014).

Citizen science (Cohn 2008) may also play a relevant role in improving the scarce knowledge on Neotropical avifauna. Such collaborative initiatives are already providing 'digital vouchers' for local scientific studies (*e.g.*, Cunha & Fontenelle 2014, Santos 2014) and thus allowing the elucidation of diverse information referring to poorly-known species (Lees & Martin 2014). Citizen science tools are particularly important for regions with persistent scarcity of bird breeding data in the literature, such as mid-latitudes of South America (Baker 1938, Bierregaard 1995). So, it is pertinent to include in reviews information from these novel tools.

Scrutiny of oological (egg) collections from museums could also be useful for avian breeding biology research (McNair 1987). Yet, very few researchers in the Neotropics used museum eggs for analyzing breeding traits of diurnal raptors (*e.g.*, Denis *et al.* 2013, Hayes 2014), the most frequent approach being the presentation of revised summaries of some specific collections (*e.g.*, Román & Wiley 2012). Also, Bierregaard (1995) did not provide information on museum eggs when evaluating knowledge on breeding biology of diurnal raptors, albeit such data is to some extent included in past literature (*e.g.*, Belcher & Smooker 1934). The amount of information that we (unpubl. data) and other authors (Murphy 1989, Olsen & Marples 1993) obtained from museum egg sets strongly suggests that such sources could provide data not easily obtainable from other sources.

Considering the above, there is a need for a new comprehensive survey of the state-of-the-art of knowledge on the breeding biology of Neotropical Accipitriformes, and an update on research priorities. So, we reviewed and analyzed the literature produced in the entire American continent on 56 species of Neotropical Accipitriformes since Bierregaard's (1995) review. We created an updated classification of current levels of knowledge of the breeding biology of these raptors, evaluating the progress made in the last decades. Finally, we achieved our main objective: to define the taxa that should be prioritized by future studies. We also discuss the information gaps; ponder on their possible causes, implications, and potential solutions to the lack of breeding data; and present additional information obtained from alternative sources such as a citizen science database and museum collections. To conclude, we briefly exemplify how breeding data can show the ways that different species and populations are responding to environmental changes.

METHODS

Taxa

According to the latest classification adopted by the American Ornithologists' Union (NACC 2017, Remsen *et al.* 2018 – therefore, AOU), there are 28 genera and 67 species of Accipitriformes occurring in the Neotropical region. We follow Bierregaard's (1995) criteria by not including species with centers of distribution outside the Neotropics (see below), and Nearctic taxa that do not breed in there (which excluded the family Pandionidae from the analysis). Thus, we perform the most comprehensive recent review of Neotropical raptors, including 56 species. Our subspecies division follows Dickinson & Remsen (2013).

Categories and scoring criteria, and major changes in classification

We used two categories concerning reproduction, largely based on Bierregaard (1995) and Trejo (2007a). Under 'nest', the information that we analyzed includes the physical description of the nest, as well as its seasonality and location, clutch size, and description of eggs. That is, all aspects, mostly 'physical', related to the early nesting stage. Under 'breeding behavior', we included breeding displays of adult birds; descriptions of copulating and parental behaviors; incubation and fledging times; development of the young (both morphological and behavioral); the period of dependence of juvenile(s) after its first flights (post-fledging dependency period); and more detailed information – provided by relatively few studies – such as spatial distribution of breeding pairs, rate of reproductive success, nest productivity, and subsequent dispersal and survival of juveniles.

The numerical scores assigned in the classificatory scale of knowledge also follow the criteria of Bierregaard (1995) and Trejo (2007a): (0) no information; (1) only anecdotal/scattered reports; (2) detailed study of one breeding pair or event; (3) study of more than one pair in the same population, and/or a substantial amount of anecdotal reports of representative areas of the species' range; (4) detailed studies of separate populations in different portions of the species' range; and (5) detailed information from the entire range of the species.

Besides producing an updated classification of current levels of knowledge about the breeding biology of these raptors, these scores act as an intuitive measuring scale to signal whether some reproductive aspects and taxa still need more studies (see also 'Research recommendations and conservation relevance'). More importantly, they allowed a comparison between our scores and those reported by Bierregaard (1995), to assess whether levels of knowledge changed in the last decades, and thus identify persistent gaps.

Classification had to be evaluated and updated, due to changes since 1995. Two of these changes were the recent splits of Cuban Black Hawk *Buteogallus gundlachii* and Common Black Hawk *B. anthracinus* (Wiley & Garrido 2005), and of the "Gray Hawk" complex (*Buteo nitidus*/*B. plagiatus*; Millsap *et al.* 2011). On the first case, Bierregaard did not report a separate score for the then subspecies *gundlachii*, what prevented us of making a comparison of levels of knowledge about this taxon then and now. Nevertheless, as few studies after 1995 were located (*e.g.*, García-Quintas & Ávila 2012, Ferrer-Sánchez & Rodríguez-Estrella 2016), apparently there is still little breeding data for the Cuban Black Hawk.

For *Buteo nitidus*/*B. plagiatus*, the split of the taxon into southern and northern forms facilitates the evaluation of its case, and we chose to consider the scores attributed to "*Buteo nitidus*" by Bierregaard (1995), as default for both species. On the other hand, that author reported different scores for the taxa *Accipiter ventralis*, *A. chionogaster* and *A. erythronemius*, but these are currently classified as subspecies of the Sharp-shinned Hawk *A. striatus* (Remsen *et al.* 2018). In turn, Sharp-shinned Hawk was not included in Bierregaard's review, for having a center of distribution outside Central and South America. So, we also excluded this species from our analysis because comparing scores of knowledge was impossible.

Other splits adopted by Bierregaard (1995), but not maintained on current classification, are "*Accipiter chilensis*" (subspecies of Bicolored Hawk *A. bicolor*), "*Buteogallus subtilis*" (included three subspecies of Common Black Hawk) and "*Buteo poecilochrous*" (subspecies of Variable Hawk *Geranoaetus (Buteo) polyosoma*). We ignored the scores that author separately assigned to each of these taxa, and analyzed only those ascribed to the currently recognized species. Yet, we commented on the status of some of these subspecies when relevant.

Literature search methods and sources

We screened the Global Raptor Information Network (GRIN; http://www.globalraptors.org/grin/indexAlt.asp) until October 2016. This database focus solely on raptors, concentrating information on diurnal species from around the world and includes bibliography of other renowned databases on raptors such as The Peregrine Fund and Raptor Information System. We analyzed the literature on reproduction of the 56 species after 1994, indicated in the section 'Breeding' in the species accounts. We also searched for other studies whose titles refer to reproductive aspects, mainly the bibliography contained in the topic 'Breeding biology'. In some isolated cases, we considered in this review breeding data not published in other sources and made available by researchers in the GRIN database.

We chose to use Google Scholar (http://scholar.google.com/) as the main tool to complement GRIN reference search because we noted it was able to locate the same references found with Scopus and Searchable Ornithological Research Archive (SORA; http://elibrary.unm.edu/sora), search tools also chosen by almost all recent revisions (Trejo 2007a, b, Raimilla *et al.* 2012, Cortés *et al.* 2013). The search terms we used were all possible scientific names recently assigned for these species (except for those variables only in the suffix, which were already supplied by the search heuristic), combined with each of the following terms: nest, ninho, nido, nidificação, anidamiento, anidación, reprodução, reproducción, breeding, and biologia reprodutiva. The great redundancy of results when using somewhat similar terms indicated the effectiveness of the choices, and terms like 'nesting' and 'biología reproductiva' were discarded.

We searched for all kinds of references, from articles in any category of scientific journal, through monographs, conference abstracts and posters, to technical reports and unpublished manuscripts. We reviewed citations contained in the references, even though most were already found in key word searches. Yet, we could not retrieve 27 (5.6%) of the

484 references produced between 1995-2016 (Appendix II), neither through requesting directly from their authors nor from databases such as The Peregrine Fund.

We also screened and retrieved information from a bibliographical review of Brazilian birds (Oniki & Willis 2002), and the following books: Bird *et al.* (1996), Sick (1997), Machado *et al.* (1998), Arballo & Cravino (1999), Höfling & Camargo (2002), Fontana *et al.* (2003), Reichle *et al.* (2003), Wheeler (2003), Willis & Oniki (2003), Antas (2004), Mikich & Bérnils (2004), De La Peña (2005), Márquez *et al.* (2005), Sigrist (2006), Eisermann (2007), Gussoni & Guaraldo (2008), Whitacre (2012), Straube *et al.* (2014), and Alvarado *et al.* (2015).

Exclusion and inclusion search criteria

As previously mentioned, Bierregaard (1995) claimed that antiquity or 'obscurity' of certain journals, particularly Latin Americans', prevented him from gathering information from them. Yet, he did include some of these studies that were cited in 'more broadly distributed journals'. We verified that some of these old Latin American journals (*e.g.*, El Hornero) were already scrutinized by recent reviews (Trejo 2007a, b, Raimilla *et al.* 2012). Notwithstanding, we could not determine with certainty which studies prior to 1995 were not included by Bierregaard, given that his study lacks a complete list of references. So, we opted to consider only papers published from that year on, to avoid repeating data already collected. After all, one of our aims was to get a clear picture of the amount of research done in the last decades, and not previously.

We also assume that papers from 1995 would not have been included by Bierregaard. Although depending on the date of completion of his search (not stated in the paper), the author may have included at least some of these, information contained in such studies is not consistent with certain scores assigned by him [*e.g.*, the Gray-backed Hawk *Pseudastur occidentalis*, studied by Vargas (1995)]. This fact suggests that in most cases inclusion of these papers in that review may not have occurred. Nevertheless, only a few studies from 1995 were found in our review, suggesting that the influence of possible duplicate data on the different species would be irrelevant.

Some books contain secondary information often without direct citation of the original data (*e.g.*, Ferguson-Lees & Christie 2001, Márquez *et al.* 2005, Sigrist 2006). With no clear indication of each of their sources in the text, we could not retrieve the original studies' year, or sometimes even geographic region. Thus, we also chose to not include such breeding reports, except when text suggests it was an original data.

Research recommendations and conservation relevance

We created a four-group classification of research priorities on species' breeding aspects, based mostly on knowledge gaps (by means of the assigned numerical scores), but also considering current threat categories at the global level (IUCN 2017). Group I includes species with great scarcity of available information about their reproduction, combined with higher categories of threat. Group II comprises species whose studies have advanced, albeit very little since Bierregaard's (1995) review, but which are at some higher threat category. Group III includes species whose knowledge is still scarce and are currently 'Near Threatened' according to IUCN. Finally, Group IV represents species framed in three possible situations: i) the knowledge about their breeding has not increased (although it was already very high) and also are in some greater category of threat; ii) the remaining species considered 'Near Threatened'; or iii) species not threatened, but of which nothing or practically nothing is known about their reproduction and/or have at least one of the topics of breeding aspects classified as '1' (see 'Categories and scoring criteria, and major changes in classification' above).

Screening of the Handbook of Birds of the World and WikiAves

The Handbook of Birds of the World (HBW) was the baseline for Bierregaard's (1995) gap analysis and until today is considered a reference for current knowledge about biology of bird species (*e.g.*, Trejo *et al.* 2006, Xiao *et al.* 2016). Thus, we opted to review information in the online version 'HBW Alive' (http://www.hbw.com/). Our purpose was to determine if data available regarding reproductive aspects (topic 'Breeding', in each species account) were commensurate with the actual state of knowledge about these subjects.

The online database WikiAves (www.wikiaves.com) is a collaborative tool launched in 2008, that allows posting of photographic records of bird species that occur in Brazil. This initiative has a great advantage over other popular citizen science platforms, such as eBird (ebird.org), by working with digital vouchers and not lists. Also, we are not aware of initiatives from other Neotropical countries (*e.g.*, http://www.wikiaves.com.ar/inicio.php) that are equally reliable and allow similar content-based searches of their records (see below). Considering the enduring scarcity of avian breeding records from South American mid-latitudes (Baker 1938, Heming *et al.* 2013), the fact that WikiAves focus on Brazil is particularly convenient.

We searched for breeding records of 25 species in this database. The low number of species was due primarily to the scope of WikiAves, which only contains species present in Brazil. In addition, we chose to review only species that obtained scores less than '3' in at least one of the categories, or those with values equal to or greater than that, but for which there was a marked relative scarcity of South American data. In the 'Advanced Search' tool for photos, we used (separately) the filters: ‘Egg’, ‘Nest’, ‘Juvenile’, ‘Copulating’, ‘Incubating’, ‘Courting’, ‘Caring/Feeding its chick(s)’, and ‘Making nest’. The search was made in October 2016 and we included only records whose identification was considered secure – both at specific level and, in the case of breeding behaviors and/or stages that were clearly illustrated in the photographic record. Records already present in papers located in the survey were discarded.

Museum egg records

Eggs and labels were photographed in the following egg collections between 2014-2017: Western Foundation of Vertebrate Zoology - WFVZ (Camarillo, USA), Natural History Museum - NHMUK (Tring, UK), National Museum of Scotland - NMS (Edinburgh, UK), Muséum national d'Histoire naturelle - MNHN (Paris, France), Naturhistoriches Museum - NMW (Wien, Austria), Instituto de Ivestigación de los Recursos Biológicos “Alexander von Humboldt” - IAVH (Villa de Leyva, Colombia), Museo Argentino de Ciencias Naturales “Bernardino Rivadavia” - MACN (Buenos Aires, Argentina), Museo La Plata - MLP (La Plata, Argentina) and in Brazil, Museu de Zoologia da Universidade de São Paulo - MZUSP (São Paulo), Museu Nacional do Rio de Janeiro - MN (Rio de Janeiro), Museu Paraense “Emilio Goeldi” - MPEG (Belém), and Coleção Ornitológica "Marcelo Bagno" - COMB (Brasília). We also visited the online egg collections of the Field Museum of Natural History - FMNH (Chicago, USA), and the Arctos Collaborative Collection Management Solution (arctos.database. museum), and had access to data of the egg collection of the Smithsonian Institution (USNM, Washington, D.C., USA), and the American Museum of Natural History (AMNH, New York, USA). Finally, we consulted the catalog of the Cris-Rivers Region Museum (CRRM, Oradea, Romania; Béczy 1971).

These authors’ previous experience suggests that diurnal raptors’ eggs collected in the United States can outnumber those from all other New World countries together, on a ratio of roughly nine to one (unpubl. data). Also, Bierregaard (1995) verified that when the distribution of a species reaches the southern part of North America, it tends to be much more studied there than in the rest of its range. Considering the above, we opted to not include museum data from the United States in this analysis. Breeding information from that country certainly is already overly represented in literature, and augmenting it with museum records would only exacerbate this bias.

Museum egg sets are a proven reliable source (McNair 1987), but a few inconsistencies in the records of certain collectors have been reported (Hellmayr & Connover 1949, Thorstrom & Kiff 1999). Thus, we carefully validated species identification based on our own experience, on remarks from other researchers, and also resorting on other references that provide clutch sizes, egg measurements and descriptions (*e.g.*, the GRIN database). A few species suffer from faulty information about their eggs and clutches in the literature, and these cases are still being validated by us. Such egg sets are not assigned to any species here, but are included in the total number of sets we found from the Neotropics. In the proccess of validating eggs' identification, measurements were standardized using the software ImageJ (Bridge *et al.* 2007, Troscianko 2014).

RESULTS

We retrieved information from 457 references with breeding data of these 56 species of Accipitridae (Appendix I). This is a substantial increase in the number of references since Bierregaard's (1995) review (431 references) – which covered many other aspects of biology, included also Falconidae, and had no date limitation. We found ten references and citations referring to data from captive birds, but these were not included in our review given the uncertainty involving raptors' breeding aspects in unnatural conditions (Cabot Nieves *et al.* 2013).

Much of the breeding data we found came from inventories that provide a list of species for one or more localities, often highlighting new occurrences or noteworthy records (*e.g.*, Bodrati *et al.* 2010), or research addressing ecological aspects of bird communities of a given region (*e.g.*, Cintra & Naka 2012). Observations on the breeding activity of some species are frequently included in such studies (*e.g.*, Hennessey *et al.* 2003), and it is common for raptors to receive some prominence (*e.g.*, Greeney & Nunnery 2006). However, such reports still remain mostly anecdotal (*e.g.*, Ruvalcaba-Ortega & González-Rojas 2009). For instance, nest records often do not provide any information on nest content or stage (*e.g.*, Bodrati *et al.* 2010), frequently because the nest was presumably inaccessible to the researchers (*e.g.*, Bellatti 2000). Many times all that can be concluded is that the species was 'nesting' in a given locality, during a quite long period of time (*e.g.*, Cavicchia & Garcia 2012).

Of the 11 species of Neotropical accipitrids for which the nest had not been described prior to 1995, eight remain undescribed or present only anecdotal/scattered reports (Table 1). Of 15 species with no information about their breeding behavior in 1995, little or no additional information is still not available for ten. Cases with only superficial anecdotal descriptions of nests and breeding behaviors represented 15 and 14 species, respectively, in 1995. This condition remains unchanged for only two, Tiny Hawk *Accipiter superciliosus* and Rufous Crab Hawk *Buteogallus aequinoctialis*. Yet, 66% of the analyzed species (*N*=37) showed an increase in knowledge; of these, nearly half (*N*=19) showed an increase in only one of the categories, and the remaining in both.

Probably the most significant increases in knowledge were for Barred Hawk *Morphnarchus princeps* and White-throated Hawk *Buteo albigula,* followed by Gray-bellied Hawk *Accipiter poliogaster*, Chaco Eagle *Buteogallus coronatus*, Gray-backed Hawk and Rufous-tailed Hawk *Buteo ventralis*, and also Rufous-thighed Kite *Harpagus diodon.* The following species also had a significant increase in knowledge about the two breeding categories: Black-and-white Hawk-Eagle *Spizaetus melanoleucus*, Black-collared Hawk *Busarellus nigricollis*, Long-winged Harrier *Circus buffoni,* Crane Hawk *Geranospiza caerulescens,* Solitary Eagle *Buteogallus solitarius* and Short-tailed Hawk *Buteo brachyurus*. On the other hand, very scant information were found for the former "*Leucopternis*" hawks, currently classified in five genera. Even the best-known species in this polyphyletic group of ten species (Amaral *et al.* 2009), the Barred Hawk and the White Hawk *Pseudastur albicollis,* either have only anecdotal reports of distinct areas of the species' range, or detailed studies of nests of the same population (*e.g.*, Muela & Valdez 2003, Cisneros-Heredia 2006, Gelis & Greeney 2007, Draheim 2012).

As Bierregaard (1995) also noted, we found a persistent concentration of studies further north of the Neotropics. Guatemala still stood out due to the quantity and quality of research developed by the Peregrine Fund's Maya Project, which resulted in a large number of published studies on raptor biology (*e.g.*, Seavy & Gerhardt 1998, Seavy *et al.* 1998, Thorstrom & Quixchán 2000, Whitacre *et al.* 2002), ultimately leading to the publication of a book (Whitacre 2012). The Southern Cone of South America also have a large amount of research developed in Chile, already emphasized by Bierregaard, and Argentina (*e.g.*, Jiménez 1995, Trejo *et al.* 2001, Ojeda *et al.* 2003, Medel Hidalgo *et al.* 2015, Pérez 2015, Rivas-Fuenzalida *et al.* 2015).

Even for species considered already relatively well known, with both categories scoring 3 or 4, there is a lasting shortage of research on South American populations or subspecies. This was the case for the White-tailed Kite *Elanus leucurus*, the Swallow-tailed Kite *Elanoides forficatus*, and the Zone-tailed Hawk *Buteo albonotatus*, among others. We also found little or no information about the breeding biology of some subspecies of some polytypic species, including the “Cuban Kite” *Chondrohierax uncinatus wilsonii*, considered a full species, and critically endangered, by IUCN; “Mangrove Black Hawk” *Buteogallus anthracinus subtilis*, included in a separate species by Bierregaard (1995; see also ahead); Pearl Kite *Gampsonyx swainsoni magnus*; and Snail Kite *Rostrhamus sociabilis major*. Additional comments in Table 1 indicates taxa and/or regions in which research is critically needed.

Although incomplete, some sets of new studies revealed both similarities and divergences in breeding behavior between different populations. For instance, the cooperative behavior of Harris's Hawks *Parabuteo unicinctus*, well known in the United States, at the time of Bierregaard’s (1995) review was not reported from the rest of their range. Due to the work of Silva & Olmos (1997) in southeastern Brazil, there is now good evidence that cooperative breeding must occur in at least one population of the nominate subspecies. On the other hand, Short-tailed Hawk’s breeding traits such as duration of the post-fledging dependency period and nest defense behaviors diverge not only among the different subspecies but even within the same country (Monsalvo 2012).

The species formerly called the “Gray Hawk” was separated into two species by Millsap *et al.* (2011), amendment accepted by the AOU (Remsen *et al.* 2018). However, most recent studies of “*Buteo nitidus*”, all published prior to this split (*e.g.*, Patrikeev 2007, Ruvalcaba-Ortega & González-Rojas 2009), focused on the current northern species (Gray Hawk, *B. plagiatus*). Thus, the status of the Gray-lined Hawk (*B. nitidus sensu* AOU) remains the same. Although the number of references found was similar (ten and seven, respectively; Appendix I), information about Gray Hawks comes from almost 100 breeding events, at about ten different locations. Whereas for Gray-lined Hawks, only six records were found, and some of these information could not have their localities confirmed. It is not possible to determine with certainty, for example, if data on the eggs of the latter provided in recent literature (Sick 1997, Reichle *et al.* 2003) do not, in fact, refer to the northern species (see ahead).

Based on the criteria put forward before (see ‘Categories and scoring criteria, and major changes in classification’ in the Methods), the highest priority species for research on their breeding aspects are, as follow: White-collared Kite *Leptodon forbesi*, Plumbeous Hawk *Cryptoleucopteryx plumbea*, and the White-necked Hawk *Buteogallus lacernulatus* (Group I); Black-and-chestnut Eagle *Spizaetus isidori*, Gundlach's Hawk *Accipiter gundlachi*, Chaco Eagle, Gray-backed Hawk, and Rufous-tailed Hawk (Group II); Gray-bellied Hawk, Semicollared Hawk *Accipiter collaris*, Rufous Crab Hawk and Mantled Hawk *Pseudastur polionotus* (Group III); and the two island species of *Buteo* hawks (Ridgway's *B. ridgwayi* and Galapagos *B. galapagoensis*), four eagles (Crested *Morphnus guianensis*, Harpy *Harpia harpyja,* Ornate Hawk-Eagle *Spizaetus ornatus* and Solitary Eagle), Gray-headed Kite *Leptodon cayanensis*, Tiny Hawk, Slate-colored Hawk *Buteogallus schistaceus*, and the three *Leucopternis* hawks (Group IV).

For at least 18 of the 56 species analyzed, we concluded that the information provided in the 'Breeding' topic in the HBW is outdated, although recent reviews have treated that material as informative of the state-of-the-art (Trejo *et al.* 2006, Xiao *et al.* 2016). In the WikiAves database, we compiled a total of 174 photographic records representing breeding aspects, for 18 of the 25 species surveyed (Appendix III). No reliable records were available for the remainder of the species. For one of these 18 species, Gray-bellied Goshawk, which had detailed literature records of only one or two breeding pairs (De Vries & Melo 2000, Thorstrom 2002, Boesing *et al.* 2012), inclusion of data from WikiAves augmented its assessment score (Table 2).

Another species for which WikiAves allowed a change in the assigned score was the White-collared Kite, whose only nesting record (Brito 2013; also quoted by HBW) is posted on that platform. It is also noteworthy the case of the Rufous-thighed Kite, for which WikiAves provides 42 records of at least 15 distinct breeding events in six different states of Brazil, including pairs with nesting accompanied throughout, and even in consecutive years. In addition to these three species, another five showed a significant increase in breeding records from South America, although these not have allowed an effective change in their scores (Table 2).

We located 730 egg sets from Neotropical countries, besides 6 records of eggs laid in captivity in this same region. Of these 730, 706 could be soundly assigned to some species (Table 3), from which over 58% pertain to only four species: White-tailed Kite, Common Black Hawk, Roadside Hawk *Rupornis magnirostris*, and Gray Hawk. Around 88% of the total of clutches of these four species were collected in Mexico. This country is also the origin of almost two-thirds of the egg sets of all 31 species reliably identifed in museum collections. Argentina and Chile are respectively the second and third countries with more clutches collected, but with much smaller amounts, each below 10% of the total.

We corrected the identification of four clutches, all in the WFVZ collection and all previously recognized as misidentified by L. Kiff (Appendix IV). We verified that their correct identifications probably agree with those tentatively suggested by him in the data slips accompanying these egg sets. We highlight the relevance of the egg sets assigned to White-rumped and Gray-lined Hawks, as they almost doubled the number of breeding reports for each of these species. Overall appearance and dimensions from the former's eggs are similar to those reported by Zilio & Mendonça-Lima (2012), the only other clutch known for the White-rumped Hawk, but museum eggs are slightly larger. Unfortunately, the clutches of Gray-lined Hawk that we located are essentially the same widely used as reference for this species (Belcher & Smooker 1934), yet their measurements are within the range described for the allospecies Gray Hawk *B. plagiatus* (Del Hoyo *et al.* 2016b).

Also relevant are egg sets from the subspecies *Gampsonyx swainsoni magnus* (*N*=1) and *Rostrhamus sociabilis major* (*N*=7), both largely absent in recent literature. We also located five clutches of the "Mangrove Black Hawk" (former "*Buteogallus subtilis*"), for which Bierregaard (1995) found no breeding information in literature (but see Wetmore 1965). Likewise, in our literature review we located only poorly detailed, scattered reports of nesting in a few localities of its range (Barrantes 1998, Pérez-León 2007, Alava *et al.* 2011). Relative to recent literature, museum eggs allowed a substantial increase in breeding information for a total of six species.

DISCUSSION

Breeding knowledge is not yet uniformly distributed across different regions for most species of Neotropical Accipitridae, with many areas lacking more studies about their populations or subspecies. The main evidence of this poor distribution of breeding data is the fact that we have not assigned any new score of '5' (*i.e.*, detailed information coming from the entire range). Information on many South American Accipitridae is still scant, even after two decades (Bierregaard 1995). With exception of a few restricted-range subspecies, most of the least-studied populations occur in mid-latitudes of South America or in the Amazon Basin, a situation that barely improved in the last eight decades (Baker 1938, Xiao *et al.* 2016).

The regions where most quality-research are still concentrated are near the limits of many species' ranges. Some aspects of the behavior of a species could be geographically restricted (Thiollay 1989), and its breeding aspects can be distinct at extreme limits of its geographical distribution (Kennedy *et al.* 1995). Thus, generalizations about the breeding biology of raptors become highly susceptible to errors (Bierregaard 1995, Trejo 2007a). Albeit results show that the informative potential of geographically isolated data and anecdotal descriptions shall not be discarded (Whitacre & Burnham 2012), we emphasize the importance of conducting detailed studies with different populations.

Most of the recent studies that provide some new information on breeding aspects of Neotropical Accipitriformes are generalist in nature. The lack of detail of anecdotal reports may be due to logistical limitations and to the studies' scope, but it is also likely that it is often due to unawareness of the relevance of the material that the researcher has at his disposal. Whichever the reason, an emblematic outcome of this, is one occasional report of "breeding" that, if well described, would be the first description on any reproductive aspect of the Black-faced Hawk *Leucopternis melanops* (Cintra & Naka 2012). Because of the lack of detailed information, this report could not be properly attributed by us to any of the categories assessed (Table 1). Additionally, it is possible that such lack of detail may be caused by imperfections in the peer-review system (Figueroa, *in litt.*), or in publication policies of the journals, that that do not give opportunity to the publishing of complete information on natural history.

A few of the less abundant and restricted-range species still attract most of the attention of field ornithologists. Bierregaard (1995) already remarked on the oddness of a scarcity of breeding information for some common species, while a few, and not necessarily common ones (*e.g.*, Harpy Eagle), are increasingly well studied. For example, knowledge about the breeding behavior of the Gray-headed Kite, a conspicuous and widespread species (Thorstrom et al. 2012), is still mostly anecdotal (Table 1; Appendix I). Figueroa (2015) stated that among potential causes for these information gaps of common raptors, may be the species' own 'commonness', associated with a number of other biases of research focus in ornithology. On the other hand, knowledge of all the former "*Leucopternis*" species still can be considered the largest gap of breeding data among Neotropical Accipitridae, from Bierregaard's (1995) review to this work.

We noted that records posted in the WikiAves database could attenuate gaps in knowledge about some raptors in middle latitudes of South America. However, possibly the weakest point of this database is precisely its geographical limitation to Brazil. We believe that the development of similar initiatives in other Neotropical countries should be helpful as a complementary measure to elucidate diverse information on the biology of this region's avifauna (Lees & Martin 2014). We also stress the importance of the use of digital vouchers in such citizen science tools, making possible for the researchers the correction of misidentifications. It is particularly relevant when it come to diurnal raptors, a group renowned for having problematic identification in the field (Griffiths & Bates 2002, Seipke *et al.* 2006, 2011), leading to errors in citizen science records (Bailey 2015) and even in published peer-reviewed studies (De Vries & Melo 2002, Alves *et al.* 2017).

We also reinforce the importance of 'conventional' vouchers in museums (McNair 1987), as they offer the same benefits as exposed above. They make possible to verify previous identifications (*e.g.*, Griffiths & Bates 2002; Appendix IV), and therefore prevent the perpetuation of cascading errors. By using museum egg sets, this study and others (Murphy 1989, Olsen & Marples 1993, Hayes 2014) also gathered breeding data that could not be obtained from other sources, such as literature. Such fact is clearly illustrated in the cases of taxa with substantial increases in number of breeding records after the scrutiny of oological collections (see Table 3).

Museum data on some diurnal raptors can yet be very limited. For instance, we stress the need for collecting additional information on eggs of both White-rumped and Gray-lined Hawks, since our validation of the identification of their museum sets must be seen as conditional. In fact, sometimes the very same egg sets we analyzed are the only (or at least the major) source for egg measurements of a species provided by any reference. In such cases, only by carefully scrutinizing all references ever produced on a given species, and also by examining closely-related species, it is possible to avoid circular reasoning in validating the identification of these eggs. Perhaps some species' eggs still are unknown, if literature information are based in sets with questionable identification.

We also verified that oological collections undergo the same geographic bias found in both recent and former (Bierregaard 1995) literature breeding records. Essentially the same regions (*i.e.*, northernmost and southermost Neotropical countries, and the United States) predominate with respect to amount of breeding data. Trinidad and Tobago is an exception to this pattern, because the work of egg collectors (*e.g.*, Belcher & Smooker 1934) seems to be the ultimate source of almost all reproductive information on its raptors (Herklotts 1961, Ffrench 1991). In fact, no recent literature reference was found for this country.

Proper knowledge of breeding parameters is necessary to better understand how different species and populations respond to environmental changes (Marini *et al.* 2010, D'Elia *et al.* 2015). Such information is particularly relevant for diurnal raptors, as they: provide important environmental services, preying upon potential pests and invasive species (Estes *et al.* 2011, Speziale & Lambertucci 2013, Martins & Donatelli 2014); act as flagship species (Sergio *et al.* 2008, Donázar *et al.* 2016); and as indicators of environmental quality (Jullien & Thiollay 1996, Blendinger *et al.* 2004, Thiollay 2007).

Recent studies (*e.g.*, Alexandrino *et al.* 2016) are putting in check traditional classifications of sensitivity to disturbance, widely used for Neotropical avifauna, such as the landmark database by Stotz *et al.* (1996). In fact, little is actually known about the extent to which each species of Neotropical raptor fits in the sensitivity gradient (Bierregaard 1995, Touchton *et al.* 2002, Roda & Pereira 2006).

As mentioned before, nest site choices of Accipitridae demonstrate habitat selection (Ferguson-Lees & Christie 2001), and so highlight their sensitivity to environmental changes (Trejo 2007a). Then again, recents studies indicate a need to update sensitivity classifications of some Accipitridae. For example, Harpy Eagles and Short-tailed Hawks have an alleged need for nest sites in relatively pristine native forest (Albuquerque 1995). Yet, such allegation does not match a series of recent breeding records that demonstrate a much greater degree of tolerance, with successful nesting reported at human-altered habitats (Silva 2007, Monsalvo 2012, and references therein). These recent reports also showed that both prey delivery rates and fledgling success in such situations are similar or higher than those on more pristine habitats. Nonetheless, nesting in such modified conditions might lead to still undetected impacts, like higher nest predation risks (Newton 2010). Thus, further studies are necessary, to verify the occurrence of possible negative effects.

Open-country raptors are generally considered to be less threatened than forest species (*e.g.*, Piana & Marsden 2014), as mentioned by Bierregaard (1995). In fact, recent research show that suitable habitats for species such as the Roadside Hawk might increase with anthropogenic changes (Carrete *et al.* 2009), and lead to a substantial rise in nest productivity, in human-modified habitats (Panasci & Whitacre 2002). On the other hand, we also retrieved studies that claim that other raptors of open habitats may be negatively impacted by changes in land use. Throughout the Americas, species such as Cinereous Harriers (Camilotti *et al.* 2008), Chaco Eagles (Albuquerque *et al.* 2006), and even White-tailed Hawks *Geranoaetus albicaudatus* (Brown & Glinski 2009) are apparently losing breeding areas. In any case, there is a shortage of data about how environmental changes affect the breeding of different species and populations. So, for proper management of such potentially affected populations, additional research on reproductive rates is essential.

The relevance of studying generalist and abundant ones should not be disregarded, given the extremely significant participation of raptors in trophic webs (Estes et al. 2011). Breeding range expansions have been reported recently for some generalist species, such as *Buteo* hawks (Williams *et al.* 2007, Sandoval 2009). These expansions result in insertion of these raptors into new food webs, interacting with populations of prey species with which they had no previous contact. Some Accipitriformes prey upon introduced or invasive species (Wheeler 2003, Pineda-López *et al.* 2012, Martins & Donatelli 2014), and the effects of the latter on breeding parameters of native predators still demand further investigation (Speziale & Lambertucci 2013). For instance, in breeding areas invaded by introduced prey, rates of reproductive success of some Snail Kite populations are increasing (Cattau *et al.* 2016), highlighting how raptors can indeed be providers of relevant environmental services.

This assessment of current knowledge of the breeding biology of Neotropical Accipitriformes indicated that, albeit 66% of the evaluated species had some improvement on levels of knowledge, the scarcity of breeding data on many South American Accipitridae persists. Yet, we noted that vouchers from both a citizen science digital database and oological collections resulted in a significant increase in breeding information for a total of 13 species, relative to recent literature. There is a persistent need for research to be conducted north of the Southern Cone of South America, and we recommend that breeding biology studies should focus on the 24 species selected as research priorities. Knowledge of the breeding biology of Accipitridae not only plays a key role in enabling proper management and conservation of their populations. It also will point the way for more efficient studies in the future, generating better data about the biology of these predators and, in the final analysis, on the functioning of ecosystems as a whole (Bierregaard 1995, Trejo 2007a).

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TABLES

Table 1. Assessment of current knowledge on the breeding biology of 56 species of Neotropical Accipitriformes.

Species	Bierr. Nest	Bierr. Behav	Nest	Breeding behavior	Research priority	Comments
Elanus leucurus	4	4	4	4	no	Lack of more detailed data from most regions, mainly South America
Gampsonyx swainsonii	3	3	3	3	no	Still a lack of behavioral data from most regions, particularly later stages
Chondrohierax uncinatus	4	3	4	4	no	Most data missing from South America; nothing from subspecies *wilsonii*
Leptodon cayanensis	1	0	3	1	IV	Detailed data from only two areas; very few behavioral data, particularly later stages
Leptodon forbesi	0	0	0	1	I	Only breeding displays
Elanoides forficatus	3	3	4	4	no	Many detailed studies, but there is still a lack of detailed data from other areas
Morphnus guianensis	2	2	3	3	IV	Some detailed studies, but still a lack of behavioral data in many regions
Harpia harpyja	4	3	4	4	IV	Still a lack of detailed data from some portions of the range (e.g., Atlantic Forest)
Spizaetus tyrannus	3	3	3	4	no	Still a lack of detailed data from many regions
Spizaetus melanoleucus	1	1	3	3	no	Isolated cases and incomplete observations
Spizaetus ornatus	4	4	4	4	IV	New data did not change status
Spizaetus isidori	3	2	3	3	II	Still a lack of detailed data from many regions
Busarellus nigricollis	1	1	3	3	no	Still a lack of detailed data from many regions
Rostrhamus sociabilis	4	4	4	4	no	Many detailed studies, but still missing data from most regions/subspecies

Helicolestes hamatus	3	3	3	3	no	New data did not change status; only one population studied in detail
Harpagus bidentatus	3	1	3	3	no	Only one population studied in detail; still a lack of behavioral data
Harpagus diodon	1	0	3	3	no	Isolated cases and incomplete observations; still a lack of behavioral data
Ictinia plumbea	3	3	4	3	no	Still a lack of more behavioral data from many regions
Circus cinereus	3	1	3	3	no	Lack of more detailed data from many regions
Circus buffoni	1	1	3	3	no	Lack of more detailed data from many regions
Accipiter poliogaster	0	0	2	3	III	Basically, just one or two pairs studied in detail
Accipiter superciliosus	1	1	1	1	IV	Still very little information
Accipiter collaris	0	0	0	1	III	Only information of specimens on breeding condition
Accipiter gundlachi	3	1	3	3	II	Some detailed studies, but coming from a few areas
Accipiter bicolor	3	3	3	3	no	Most data missing for two subspecies; new data but several old ones discarded
Geranospiza caerulescens	1	1	3	3	no	Only one population studied in detail
Cryptoleucopteryx plumbea	0	0	0	0	I	No new data
Buteogallus schistaceus	0	0	0	0	IV	No new data
Buteogallus anthracinus	4	4	4	4	no	Still a lack of South American data, especially from subspecies *subtilis*
Buteogallus aequinoctialis	1	1	1	1	III	Still very little information
Buteogallus meridionalis	4	3	4	3	no	New data did not change status; still a lack of detailed data from many regions

Buteogallus lacernulatus	0	0	0	1	I	Only displays
Buteogallus urubitinga	3	3	4	3	no	Still a lack of more behavioral data from most regions
Buteogallus solitarius	1	1	3	3	IV	Data on nests or late stages (nothing in between); lack of data from most regions
Buteogallus coronatus	1	1	4	3	II	Many detailed studies, but there is still a lack of more behavioral data from many regions
Morphnarchus princeps	0	0	3	3	no	Most data missing from many regions
Rupornis magnirostris	3	3	4	3	no	Some detailed studies, but still a lack of behavioral data from most regions/subsp.
Parabuteo unicinctus	4	4	4	4	no	New data did not change status; but evidence of cooperative behavior in Brazil
Parabuteo leucorrhous	1	1	2	3	no	Isolated cases and incomplete observations
Geranoaetus albicaudatus	3	3	3	3	no	Detailed data only of two subspecies; lack of detailed data from many regions
Geranoaetus polyosoma	3	3	4	3	no	Still a lack of more behavioral data
Geranoaetus melanoleucus	3	3	4	3	no	Some detailed studies, but still a lack of more behavioral data from many regions
Pseudastur polionotus	0	0	1	1	III	Very little information
Pseudastur albicollis	3	3	3	3	no	New data did not change status; only one population studied in detail
Pseudastur occidentalis	0	1	3	3	II	Only one population studied in detail
Leucopternis semiplumbeus	1	0	1	1	IV	No significant advances
Leucopternis melanops	0	0	?	?	IV	No real advances

Leucopternis kuhli	0	0	1	0	IV	Only one nest
Buteo plagiatus	3	3	4	3	no	Still a lack of detailed data from most regions
Buteo nitidus	3	3	3	3	no	New data did not change status; many missing data, incl. more egg descriptions
Buteo ridgwayi	5	4	5	4	IV	New data did not change status; still a lack of more behavioral data
Buteo albigula	1	0	4	3	no	Breeding status in northern range still uncertain; many missing data, incl. on eggs
Buteo brachyurus	1	1	3	3	no	Lack of more detailed data from most regions, mainly South America
Buteo galapagoensis	5	5	5	5	IV	-
Buteo albonotatus	3	2	3	3	no	Still limited to the northern range
Buteo ventralis	1	0	3	3	II	Still limited to Chile; many missing data, including more egg descriptions

Bierr. Nest and Bierr. Behav = scores assigned by Bierregaard (1995), on Nest and Breeding behavior respectively; Nest and Breeding behavior = scores assigned by this study. Scores: (0) no information; (1) only anecdotal/scattered reports; (2) detailed study of one breeding pair or event; (3) study of more than one pair in the same population, and/or substantial amount of anecdotal reports of representative areas of the range; (4) detailed studies of separate populations in different portions of the range; and (5) detailed information from the entire range. Shaded cells denote improvements on knowledge in the last decades. Research priority = whether species should be prioritized by future studies on breeding biology, and for those that should, the priority group (I-IV) to which it was assigned; names of such species are also given in bold letters. Further explanations on the main text. Taxonomic ordering follows AOU (2018).

Table 2. Results of the search for photographic breeding records from the WikiAves database, for 25 species of Neotropical Accipitriformes.

Species	Change in score(s)	Comments
Elanus leucurus	no	Many records of different stages and populations, but did not change status
Chondrohierax uncinatus	no	Only three or four breeding pairs; always more southernly records
Leptodon cayanensis	no	Only one nest, not monitored
Leptodon forbesi	**Nest = 1**	The first nest of the species, also cited in HBW
Spizaetus melanoleucus	no	Little informative and poorly distributed records
Rostrhamus sociabilis	no	Many records of different stages and populations, but did not change status
Helicolestes hamatus	no	Only two breeding localities, records of later breeding stages
Harpagus bidentatus	no	Three records from the same locality, presumably of the same pair
Harpagus diodon	no	Some breeding events monitored thoroughly, including same pair in different years
Accipiter poliogaster	**Nest = 3**	Little informative and always more southernly records
Accipiter superciliosus	no	Nothing
Accipiter bicolor	no	Only three records, with no new information on subspecies

Geranospiza caerulescens	no	Very diverse breeding stages, especially of the subspecies *flexipes*
Buteogallus schistaceus	no	Nothing
Buteogallus anthracinus	no	Only one nest, no new information
Buteogallus aequinoctialis	no	One copulation record
Buteogallus lacernulatus	no	No reliable records
Parabuteo leucorrhous	no	Nothing
Pseudastur polionotus	no	Only one nest, not monitored
Pseudastur albicollis	no	Only two nests, no new information
Leucopternis melanops	no	Nothing
Leucopternis kuhli	no	Nothing
Buteo nitidus	no	Some poorly distributed records
Buteo brachyurus	no	Many records of different stages and populations, but did not change status
Buteo albonotatus	no	No reliable records

Change in score(s) = whether scores assigned previously in our review, for the two categories concerning reproduction (‘Nest’ and ‘Breeding behavior’, see Table 1) augmented with inclusion of data from WikiAves. Shaded cells denotes any substantial addition of new information, relative to recent literature.

Table 3. Results of the search for museum egg records of Neotropical Accipitriformes.

Species	No. of sets	Comments
Elanus leucurus	65	Mostly from Mexico; also southern South America
Gampsonyx swainsonii	2	From Colombia and Peru; the latter of subspecies *G. s. magnus*
Chondrohierax uncinatus	8	All from Mexico; eggs from Trinidad were misidentified
Leptodon cayanensis	5	Three of these were misidentified as other species
Elanoides forficatus	4	From Brazil and Venezuela
Morphnus guianensis	1	From Panama; presumably from the wild but no further details known
Harpia harpyja	1	From Amazon Basin; plus 6 clutches laid in captivity
Spizaetus ornatus	1	From Guatemala, at the same site of Peregrine Fund’s Maya Project
Busarellus nigricollis	4	All sets but one from Paraguay
Rostrhamus sociabilis	34	Most from South American countries; seven clutches of *R. s. major*
Ictinia plumbea	18	Records from throughout the species' range
Circus cinereus	7	All sets from Chile
Circus buffoni	6	All sets but one from Argentina

Accipiter bicolor	3	One misidentified clutch was discarded (Lloyd and Kiff 1999)
Geranospiza caerulescens	5	All sets from Mexico
Buteogallus anthracinus	100	90% from Mexico; five clutches of "Mangrove Black Hawk"
Buteogallus meridionalis	25	Around half from Mexico and the other half from South America
Buteogallus urubitinga	14	Mostly from Mexico; also northern South America
Buteogallus solitarius	1	From Mexico
Rupornis magnirostris	142	Mostly from Mexico; others scattered throughout the species' range
Parabuteo unicinctus	43	Mostly from Mexico
Parabuteo leucorrhous	4	Largely increased the total number of breeding reports
Geranoaetus albicaudatus	10	Records scattered through the species' range
Geranoaetus polyosoma	43	Only one set from its northern range; 11 from the Falkland Islands
Geranoaetus melanoleucus	23	All sets from its southern range
Pseudastur albicollis	1	From Trinidad
Buteo plagiatus	104	All sets but one from Mexico
Buteo nitidus	3	All from Trinidad; seemingly no other eggs of the species are known

Buteo brachyurus	13	All sets but one from Mexico
Buteo galapagoensis	5	No new information added
Buteo albonotatus	11	From its northern range; one misidentified as *Busarellus nigricollis*

No. of sets = number of soundly identified egg sets. Shaded cells denotes any substantial addition of information, relative to recent literature. Further explanations on the main text.

CAPÍTULO 2

Geographical variation on breeding seasonality patterns of Neotropical buteonines (Accipitridae)

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ABSTRACT

Life-history studies were always somehow curbed on the latitudinal paradigm of clutch-size variation, long ignoring the value of trade-offs between the different life-history parameters. One of such parameters is the breeding season length (therefore, BSL), frequently considered to also present a latitudinal cline, increasing toward the tropics. Notwithstanding, most studies focus only on passerine communities, and larger species such as raptors are generally overlooked. So, it is fundamental to verify if patterns hold true across a wider variety of bird groups and clades. I verified whether patterns of geographical variation in breeding seasonality, postulated to occur in birds, are present in Neotropical buteonines, a monophyletic and diverse clade of Accipitridae. We predicted that, within a same latitudinal range, i) populations of different species will be similar both in the initiation of the breeding season (IOB) and in its length (BSL), significantly diverging from other latitudinal ranges'; ii) migrants and non-migrant populations will have significantly different BSLs; and iii) an "island effect" occur with BSLs of populations on islands, caused by higher degree of isolation. I searched for original breeding records of this clade on literature sources and also on 16 museum egg collections, focusing on records with known dates and localities. I obtained 1541 records of active nests from 27 species, which were classified according to clades, latitudinal ranges (Tropical North – TropN; Tropical South, TropS; and Temperate South, TempS), other relevant ecological and biogeographical traits, and also ecoregions. For each unit, I defined the IOB date, and also calculated the BSL. Significant differences were only found between IOB estimates of different latitudinal ranges, with the mean of TropS units differing from those of both TempS ($Q = 6.731$; $P < 0.001$) and TropN ($Q = 5.987$; $P < 0.001$). Also, estimates of IOB are negatively correlated with latitude ($r = -0.667$, $r^2 = 0.445$, $P = 0.018$). Values of BSL consistently varied less than those of IOB, in all latitudinal ranges, and also among clades (but on the latter not significantly). Compared to passerine communities, Neotropical buteonine's season occurs relatively much earlier, as expected for larger birds. There is a pattern of latitudinal clines in the IOBs, with seasons starting up to 100 days before equinox in both tropical ranges, and a little later on the temperate range. In this regard, Neotropical buteonines seem to start breeding consistently earlier than other accipitrids, either in the same range or elsewhere. The findings suggest that accipitrid raptors respond to day-length stimuli, and these are the main proximate clues determining the onset of their breeding seasons. We also suggest that unpredictability of climate do not necessarily select for longer breeding seasons in birds; and that among Neotropical buteonines, short-distance migrants have BSLs very similar to those of non-migrant populations, indicating no substantial time-constraints for their breeding seasons. Further conclusions are impaired by the scarcity of ecological and behavioral data for most Neotropical species, particularly for north and central South America.

Keywords: hawks, island effect, latitudinal trends, life-history, migration, raptors, reproduction

INTRODUCTION

Raptors: an outcast group in avian life-history paradigms

The role of raptors in avian life-history theory always seemed to be more of a confounding factor than that of a model species. At the dawn of the theory, Moreau (1944) included a few of the then called “Accipitres” in his keystone study on clutch-size variation in the Old World. The author described clutch-size differences (increasing clutch-sizes from the equator and tropics into higher latitudes) not only between distantly related species but also between similar ones and even intra-specifically. Whilst Moreau analyzed birds from equatorial and southern Africa and also Europe, a subsequent study by Lack (1947) presented the same pattern in European birds. Therein, Lack introduced some exceptions, such as a few hawks whose clutch-sizes increased also across a longitudinal gradient.

Slowly, clutch-size variation started to establish as an universal theory (Vuilleumier 2004), and soon hypotheses started to be put forward to explain these patterns. Lack (1947) presented latitudinal variation in day-length as a likely explanation for differences in clutch-sizes, acting at the same time as a proximate and an ultimate factor. Species such as large accipitrid raptors, however, posed a challenge to Lack’s argument that the mean clutch-size of a given bird always represent the maximum number of offspring that the parent could possibly raise. Amadon (1964) subsequently conciliated the small clutch-size of these predators with Lack’s argumentation, claiming that even this was, indeed, the highest breeding rate possible to them.

At that same decade, Ashmole (1963) introduced new concepts to explain the geographical and climatic correlates of clutch-size variation. The author argued that factors which directly influence population density and stability might have indirect effects on reproductive rates, by means of food availability. The more seasonal the environment, the more losses populations will suffer (e.g., during winter and/or non-breeding season), and then more food resources will be available per breeding pair in the next breeding season, what in turn would permit larger clutch-sizes. Therefore, large-sized, K-selected birds with low mortality rates have populations always closer to the carrying capacity, and hence low breeding rates (Newton 2010).

Cody (1966) contributed to this hypothesis by further demonstrating how environmental instability selected for larger clutch-sizes, and opposite conditions result in smaller ones, such as occur on coastal regions and oceanic islands (Lack 1947). Cody (1966) also proposed that geographic isolation had higher probability of leading to divergences in clutch-sizes between insular populations and their relatives in mainland, what could be correlated by the occurrence of, at least, a different subspecies on the island. Stability arguments are consistent with patterns of larger clutches in seasonally drier habitats, exposed by Moreau (1944) and Marchant (1960). Still, raptors provide contradictory support to these explanations, as Olsen and Marples (1993) found occurrence of smaller clutch-sizes on insular areas, but on the other hand, not of larger ones on drier environments.

Seasonality continuously has been somehow related to clutch-size in life-history studies, and it is most certainly one of the most important drivers of variation within this breeding trait (Jetz et al. 2008). Yet, not so many of the early researchers discussed how clutch-size might interact with breeding seasonality and the timing of reproduction (Snow 1962, Royama 1966). Drent and Daan (1980) thoroughly discussed these relationships and also presented the notion of a compromise between current and future breeding attempts, namely second broods in the same breeding season. Again, raptors introduced some oddities to this already complex situation. Lack (1947) early noted the ability of these and other birds to produce second clutches when prey availability was high. In fact, Nearctic raptors are well-known for taking this ability further on, as females are capable of adjusting their clutch-sizes using food availability in the pre-laying stage as a predictive clue of the food supply their young will subsequently have (Winkler 2004).

Research also emphasized the importance of ecological aspects less obvious than carrying capacity and availability of food, such as the prevalent strategy of breeding as early in the season as possible to maximize fitness (Perrins 1970, Morrison 1998). It was demonstrated that raptors and other groups of birds are able to adjustments not only of clutch-sizes but also of the timing of breeding. Raptors advance breeding when food supplies are high (Newton 2010) and may rely on environmental cues to tune the initiation of breeding to meet favorable feeding opportunities for the future offspring (Balen 1973, Faaborg et al. 1980, Santana and Temple 1988, Winkler 2004).

Yet, apart from the studies mentioned above, clutch-size research long ignored the value of trade-offs between the different life-history parameters, related to energy and resources allocation and all under selective pressures (Mason 1985, Stearns 1992, Ricklefs 2000, Newton 2010). So, a large portion of this intricate scenario with a number of interacting factors that ultimately result on different probabilities of a breeding pair successfully fledging its young (that is, that potentially contribute to its fitness) was often missed. This situation persist until this century and led Martin (2004) to argue for a broader scope in life-history studies, beyond the traditional clutch-size discussions.

An overview of breeding seasonality studies with birds

Ricklefs and Bloom (1977) were one of the first authors to emphasize how avian productivity is the outcome of many parameters, including breeding season length (therefore, BSL). As Murray (2001) concisely stated, a promising alternative hypothesis to the latitudinal variation of clutch-size could be that, as breeding seasons grow longer toward the equator, the probability of replacement-clutching (or multiple-brooding, not necessarily related to the loss of a previous clutch; Morrison 1998, Newton 2010) also grows. Longer seasons would select for smaller clutches (Griebeler et al. 2010), as a small reproductive effort accounts for less impacts in future parental productivity and/or survival (Drent and Daan 1980) and smaller re-nesting intervals (Snow 1962).

Murray (2001) further claims that this argument found support on longer BSLs in lower latitudes than in higher, and smaller clutch-sizes in the former cases. Also, on a few exceptions to this ‘rule’ coming from more seasonal regions in the tropics, where breeding season is shorter but clutches are larger (e.g., Marchant 1960). This notion of clinal variation with longer breeding seasons in the tropics is deeply rooted in avian life-history theory (MacArthur 1964, Ricklefs 1966, Ricklefs and Bloom 1977, Skutch 1985, Newton 2010), and would extend even to other amniote clades (Roper et al. 2010). However, support for it is not so unequivocal. Both older and more recent studies (e.g., Moreau 1936, Baker 1938, Moreau 1944, Yom-Tov 1987, Yom-Tov et al. 1994, Wikelski et al. 2003, Whitacre and Burnham 2012) present a number of exceptions that ultimately lead to questioning whether this was a rule at all.

Ricklefs (2000) commented on the need to abandon the commonly used approach in life-history studies, of relying on untested concepts to build new arguments. So, we need to first validate what is actually known (that is, based on reliable evidences) on tropical avifauna (especially Southern Hemisphere’s) latitudinal variation of breeding traits. Yom-Tov et al. (1994) argue that latitudinal clutch-size clines are utterly absent in South American birds, with nothing like the steep increase verified north of the equator. Moreover, Marques-Santos (2014) verified that breeding seasons in South America are consistently shorter than those from equivalent latitudes in the north, and noted that these lengths do not seem to vary in any predictable way throughout the continent. The author claimed that areas such as humid forests in the temperate zone and tropical savannas (around 10° north of those) shared essentially the same BSLs, whilst within similar latitudes, either equatorial or temperate, the timing of breeding do not varied between areas with very distinct climates.

Despite some indications of year-round breeding in northern equatorial regions (e.g., Snow and Snow 1964), since the first studies there is also evidence that in many other tropical areas undefinite breeding seasons do not occur (e.g., Moreau 1944, Skutch 1950), even in humid forests within five degrees south of the equator (Moreau 1936). An apparently very long breeding season of a tropical bird community may also be deceptive, as it does not mean that it is presented by all its species (e.g., Johnson et al. 2012), nor that they are breeding at the same time (Newton 2010). The very own concept of 'year-round breeding' in lower latitudes deserve further attention. First, it should be noted that even when a species breed through the whole year, each individual might have its own, discrete breeding cycle (Miller 1965, Wingfield et al. 1992). Secondly, what appear to be an opportunistic breeder that readily respond to any favorable opportunity, in a closer inspection might turn to be a species with its own seasonal pattern, becoming "reproductively refractory" to stimuli during part of the year (Hahn 1998).

As also noted since the earliest breeding seasonality studies, nesting seasons of birds from different species, taxa and/or food guilds can substantially diverge within a same area (e.g., Skutch 1950). Some early authors dismissed the idea that it should happen as a mechanism to minimize interspecific competition, and presented calculations indicating that breeding activities within tropical communities would be highly synchronic (MacArthur 1964). Yet, accumulating field evidence from both hemispheres shows that even with most of the breeding activities converging to a similar period (e.g., up to 77% of the studied species in some cases; Sanaiotti and Cintra 2001), there are underlying patterns of species nesting preferentially or entirely at some specific time of the year (Bell 1982, Oniki and

Willis 1983, Cruz and Andrews 1989, Olsen and Marples 1993). Also, specific BSL estimates vary up to tenfold between each other (Marques-Santos et al. 2015).

So, even if we discard the concept of season-partitioning (Ricklefs 1966; but see also Oniki and Willis 1983), differences among species do occur. These reflect, among other factors, divergent peaks of availability of different food resources (Skutch 1950, Winkler 2004, Newton 2010), as Olsen and Marples (1993) and Whitacre and Burnham (2012) verified with raptors. This fact highlight the need for information coming from groups of birds as different as possible, and not the prevalent practice of focusing only on rather small birds that offer, quoting Robinson et al. (2010), a “limited range of body sizes and associated life-history traits”. For instance, the convergent peak of breeding between many species in an area can simply represent coincident peaks of food availability, as Sanaiotti and Cintra (2001) noted. Different feeding guilds, if included in such analysis, could lead to very different seasonality patterns (Baker 1938).

Most studies on passerine communities, or with a broader scope on local avifaunas of lower northern latitudes and the Southern Hemisphere, found that breeding usually start with the onset of spring (e.g., Moreau 1936, Di Giácomo 2005, Auer et al. 2007, Repenning and Fontana 2011, Marques-Santos et al. 2015). Also, analyses consistently shows that most birds tend to be wet season nesters, but a few species (e.g., some raptors and/or carnivore birds) might nest a little earlier, on late dry season (Skutch 1950, Bell 1982, Oniki and Willis 1983, Cruz and Andrews 1989, Wikelski et al. 2003). At temperate and tropical regions of the Old World, *Buteo* hawks and other large accipitrids also start to breed with the onset of spring, soon after or a little before the beginning of wet season (Newton 2010), and most diurnal raptors included in seasonality studies in the Neotropics also nest on spring (Marini et al. 2012, Hayes 2014).

In his seminal study of avian breeding seasons, Baker's (1938) main conclusions can be summarized as: i) diurnal raptors' breeding seasons start earlier from higher to tropical latitudes, at a very steep rate; ii) most "Accipitres" (at that time, this included Falconidae) breed just once a year; iii) they may lay eggs when day-lengths are around 11 hours; and iv) at lower northern latitudes, breeding seasons start in the first or last months of the year, and therefore before vernal equinox. Albeit some authors dismissed the idea that tropical birds use variations in photoperiod as cues to regulate their breeding cycles (Lack 1950, Wingfield et al. 1992, Newton 2010), both older and recent studies support day-length's important role (Miller 1965, Wikelski et al. 2000, Lima and Roper 2009, Repenning and Fontana 2011). For instace, Hau et al. (1998) conclusively showed that even in forests less than 10° north of the equator, changes in photoperiod are perceived by a passerine and induce physiological changes leading to breeding condition.

Most life-history theory was built upon the avifauna of northern temperate regions, a rather small fraction of the world's species diversity and with atypically large clutches, unparalleled in other regions (Jetz et al. 2008). Martin (2004) argued that such a divergent system might ultimately be ruled by local processes hardly relevant elsewhere in the world. Thus, when considering a comparison between northern and southern regions, distinct faunal composition even within contiguous regions (Ortega and Arita 1998) can lead to confounding or completely meaningless conclusions (Baker 1938, Wikelski et al. 2000, Martin 2004). Biogeographical patterns can account for variability on both life-history traits themselves, and also on the intrinsic and extrinsic factors influencing them (Cardillo 2002, Jetz et al. 2008).

For instance, some Southern Hemisphere studies raised doubts about the constancy of the trade-off between larger clutches and shorter seasons in drier environments. In Australia, it occurs in some bird clades but not in others (Yom-Tov 1987, Olsen and Marples

1993). Also, BSLs of Australian passerines can indeed be rather long (even longer than at similar latitudes elsewhere; Wyndham 1986), and its clutch-sizes small. Yet, the latter trait was shown to be a biogeographical ‘signature’ of this continent’s endemic warm-blooded vertebrates (Yom-Tov 1987; see also below), consistently verified with other bird groups such as raptors (Olsen and Marples 1993). When rainfall is reduced, BSLs can be longer rather than shorter, maybe as a strategy to cope with unpredictable favorable conditions (Wyndham 1986) , a trait also found in a Nearctic accipitrid population (Patten and Erickson 2000).

Due to decreased and less predictable seasonal variation, most migrant birds that breed in South America tend to travel shorter distances, do not cross significant geographical barriers, are less time-limited during migration, and therefore face milder mortality rates in the non-breeding season than boreal (*sensu* Hayes 1995), long-distance migrants (Chesser 1994, Dingle 2008, Jahn and Cueto 2012). Clutch-sizes of the former are not likely to be larger, whilst their breeding seasons most probably will be relatively long, leading (at least theoretically) to more broods per season (Yom-Tov et al. 1994). This assumption of longer BSLs is based on the lack (or at least attenuation) of both a significant time-constraint for breeding activities (Clarke et al. 2003, Johnson et al. 2012) and of a time of post-migration recovery before reproduction – as birds probably arrive on the breeding grounds in better conditions, contrary to migrants of longer distances (Murphy 1989, Forchhammer et al. 2002).

Also, dates of initiation of breeding season (therefore, IOB) of short-distance migrants may vary more between the years (Coppack and Both 2003). In general, short-distance migrants seems to be more responsive to environmental changes, including among diurnal raptors (Therrien et al. 2017), and are also more capable of breeding earlier than long-distance ones (Murphy 1989). Again, there are many exceptions to these general rules.

Repenning and Fontana (2011) argue that some migrant passerines from temperate South America do not have delayed IOBs, but even so present shorter BSLs, a pattern reminiscent of Nearctic temperate non-migrants. Clarke et al. (2003) found a much different pattern in Australia, where another short-distance migrant passerine seemingly exhibited a mixture of traits: post-migration recovery, a shorter BSL, but small clutches with multiple-brooding like sedentary species.

Much of the supposed patterns of Southern Hemisphere birds were never subject of closer inspection (even less between a wider array of species) and still need proper verification. Looking at raptors, despite their diverse fauna in the Southern Cone (Dingle 2008), migratory behavior is thought to be rare throughout South America, according to Bildstein (2004). Also in accordance to this author, irruptive behavior are reasonably common among this continent’s migrants, agreeing with a scenario of unpredictable resources (Newton 2010). However, migratory status ascribed to some species is controversial. For instance, species long treated as non-migrants (Bierregaard 1995) exhibit ‘cryptic’ migratory behavior just recently detected (Lees and Martin 2014; see also “Classification of the data” in Methods).

Considering the arguments above, it is plain that we still urgently need a much wider view to better comprehend the patterns of geographical variation of avian life-history traits, a plea already put forward by some authors (Martin 1996, Marini et al. 2012). South America still poses as a challenge to the current latitudinal paradigm, with many studies reporting seemingly contradictory combinations of short BSLs and small clutches (e.g., Auer et al. 2007, Lima and Roper 2009, Marini et al. 2012, Marques-Santos et al. 2015). It is also noteworthy the necessity of standardizing the comparisons (Johnson et al. 2012, Marques-Santos 2014), as many analyses cite and discuss one another’s results without considering the different methods employed (see “Controlling for limitations”, in Methods).

It is also fundamental to scrutinize how some patterns might hold true across a wider variety of bird groups and clades (Robinson et al. 2010), and whether they exist at all. Unfortunately, the scarcity of basic ecological and behavioral data on Southern Hemisphere birds is an enduring problem, being repeatedly stressed by many studies (Baker 1938, Partridge and Harvey 1988, Olsen and Marples 1993, Newton 2010), and affecting most Neotropical species (Bierregaard 1995, Alves et al. 2008, Capítulo 1). Many seasonality studies, irrespective of their approach, attempt to draw comprehensive conclusions about possible general patterns, but based on hardly representative samples such as nests of less than 10 species (e.g., Mezquida 2002, Wikelski et al. 2003). Regardless of the quality of the research, this fact further impairs the use of such information on reliable comparisons across a wider range of bird taxa.

Breeding seasonality of Neotropical raptors: how much is actually known?

Very few information on seasonality can be added for Neotropical raptors, besides what was presented above, as these birds tend to be largely left out of field surveys on breeding seasons. Of all the references cited in this study, only four recent ones include raptor species in seasonality analyses. Two included one species each, being one nocturnal (and rather small) bird of prey (Repenning and Fontana 2011), and one diurnal (Mezquida and Marone 2001). Only Marini et al. (2012) and Hayes (2014) presented data from more species, but still just two or three. Remarkably, with the first breeding seasonality studies, the situation of raptors never was much better (Skutch 1950, Snow and Snow 1964). It is worth noting that early authors consistently found at least somewhat different seasonality patterns between these and the other birds (e.g., Baker 1938, Lack 1950, Marchant 1960).

Most Neotropical breeding data presented in some key references on diurnal raptors (e.g., Ferguson-Lees and Christie 2001, Newton 2010, Del Hoyo et al. 2017) have important limitations. Firstly, they are based on an incomplete or currently outdated set of studies (see Capítulo 1). More important, 'seasonality' information most of the time consist of no more than anecdotal information on breeding dates coming from scattered studies, virtually all included here in this seasonality analyses. Or, are generalizations based on other tropical regions of the world, possibly largely unverified to occur in the Neotropics. For instance, Newton (2010) argues for a greater occurrence of second clutches within a season in lower latitudes, facilitated by longer BSLs. However, the author present but a few tropical raptor species actually known to nest more than once a year, and state that definite breeding seasons occur even in equatorial regions. In Australia, most accipitrids have discrete breeding seasons and nest once a year, and multiple-brooding is restricted to the smaller species such as small kites (Olsen and Marples 1993). Also, no case of multiple-brooding was verified among forest raptors in Central America, nor elsewhere in the Neotropical region (Whitacre and Burnham 2012).

Another current problem is the fact that much information on diurnal raptors' breeding seasons is based on outdated classification of older reports. The former 'Falconiformes' was a polyphyletic clade (Remsen et al. 2017), but many data on seasonality patterns are only available for Falconidae (e.g., Baker 1938, Newton 2010), now known to be phylogenetically much closer to passerines than to accipitrids (Cracraft 2013). Phylogenetic effects on breeding seasonality were already noted by Baker (1938) in the 1930's, and have been constantly suggested in more recent breeding bird literature (e.g., Yom-Tov et al. 1994, Tieleman et al. 2004, Marques-Santos et al. 2015). Thus, comparisons that ignore phylogenetic effects on breeding parameters can yield confounding conclusions (Kulesza 1990, Martin 1996, Wikelski et al. 2000, Martin 2004).

Controlling for phylogeny might lead to smaller sample sizes (Robinson et al. 2010), but results may be more robust (e.g., Koenig 1986, Badyaev and Ghalambor 2001).

Nevertheless, when dealing with lower taxonomic levels (e.g., subfamilies or genera; Murphy 1989, Kulesza 1990), phylogenetic factors tend to be less relevant than ecological ones, facilitating the isolation of extrinsic drivers (Partridge and Harvey 1988). Comprehensive analyses controlling for phylogeny (Kulezsa 1990, Jetz et al. 2008) consistently indicate that latitude somehow ‘captures’ environmental and/or ecological variables that affect birds’ life-history. In what seems to be the more complete study of this kind with raptors, Olsen and Marples (1993) found few, less marked, and somewhat unexpected clinal variations among a number of breeding traits of Australian species. The stronger latitudinal trend the authors found was not on clutch-size, but instead on IOB dates.

Investigating new breeding patterns or, conversely, the same ones but on different taxa, may provide novel evidence for revising long-prevailing paradigms (Marini et al. 2012, Whitacre and Burnham 2012), or even help postulate new hypotheses (Mezquida 2002). So, the main objective of this study is to verify whether patterns of geographical variation in breeding seasonality, assumed to occur in birds, are present in the diurnal raptors’ fauna of the Neotropical region. Within a monophyletic accipitrid clade, we will test the following hypotheses:

i) the breeding seasons of populations are influenced by their latitude (Murray 2001). We predict that within a same latitudinal range, populations of different species will be similar both in the initiation of the breeding season (IOB) (Baker 1938, Olsen and Marples 1993) and in its length (BSL) (Marques-Santos et al. 2015), being significantly different from other latitudinal ranges. Also, tropical areas north and south of the equator will significantly diverge of each other in these aspects (Yom-Tov et al. 1994);

ii) as migratory behavior is one of the intrinsic factors thought to affect life-history traits in vertebrates (Hutchings and Morris 1985), the length of the breeding season is influenced by presence or absence of migratory behavior in a population (Yom-Tov et al. 1994). Therefore, prediction is that within a same latitudinal range, migrants and non-migrant populations will have significantly different BSLs;

iii) some kind of "island effect" occur with respect to breeding seasons of populations on islands, caused by higher degree of isolation (Cody 1966). Prediction is that BSLs of insular populations of accipitrids will significantly differ from those of mainland ones, in the same latitudinal range, because most of the former consist at least in Evolutionarily Significant Unities (*sensu* White and Kiff 2000).

METHODS

Taxa. This analysis will focus on an Accipitriformes clade named 'buteonines'. The term have almost a hundred years of usage (reviewed by Griffiths et al. 2007), but it is not widely taxonomically accepted anymore (e.g., Dickinson and Remsen 2013, Remsen et al. 2017). Yet, it can be useful to denote a currently un-named, diversified clade of medium to large-sized accipitrids (Amadon 1982), strongly supported by most recent analyses (Riesing et al. 2003, Griffiths et al. 2007, Lerner et al. 2008), with only minor disagreements, such as to the position of a few New World kites and basal Old World taxa. It was thought to diverge from other raptors from the subfamily Accipitrinae around 12.5 million years ago, and in this study, we will specifically refer to node 75 at Fig. 1. We based on the same general breeding ranges assigned to New World species by Amaral et al. (2009), excluding from our analyses all wholly Nearctic buteonines. In all cases, classification followed Dickinson and Remsen (2013), including at subspecific level, with relationships among higher taxonomic levels based on Cracraft (2013).

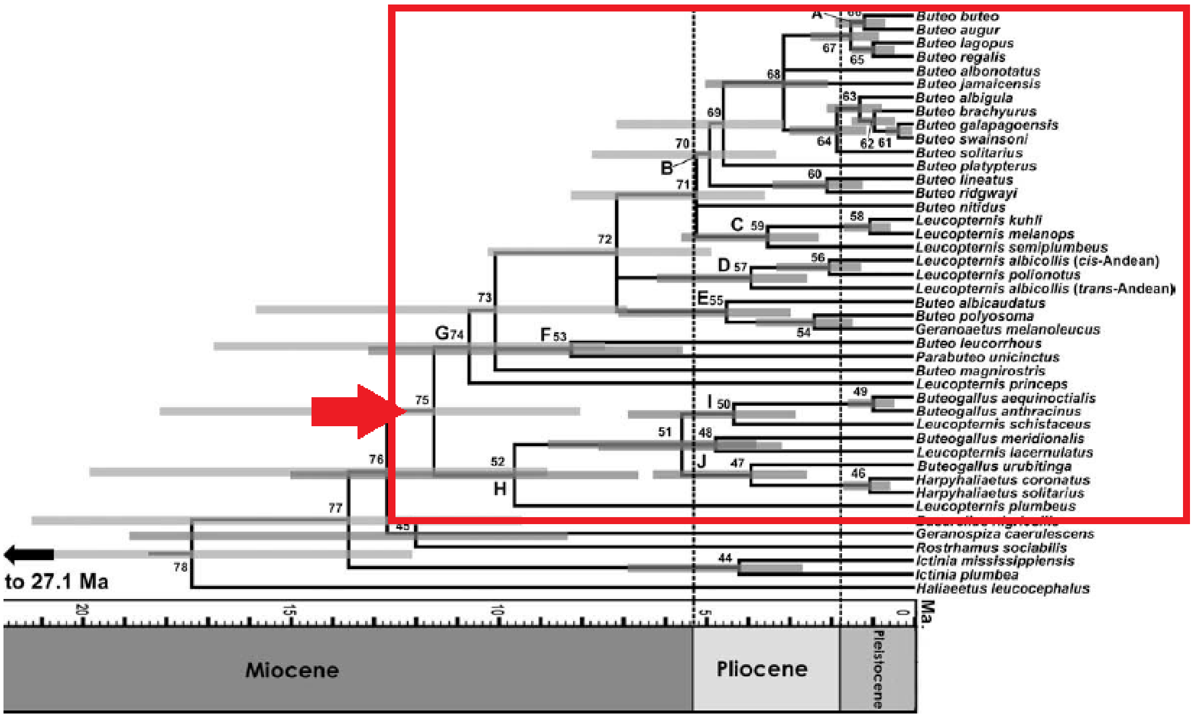

Figure 1. Estimates of divergence time (in millions of years ago; Ma.) of buteonines (*Haliaeetus leucocephalus* as outgroup) according to Amaral et al. (2009). For this study's purpose, the cladogram illustrates the major clade analysed by us: starting at node 75 (red arrow) and including the taxa inside the red polygon, except wholly Nearctic and/or Old World species. Nomenclature are not the same used here, and also a few buteonine species included by us are not shown (see Appendix 1). Image modified from figure 4 in Amaral et al. (2009, p. 710).

Search methods and sources. We searched for original breeding records of this clade with the procedure described previously (Capítulo 1), the main exception being that there was no date limitation anymore. Again, we chose to not include secondary breeding reports from references that provided no clear indication of the source of each original data. For estimating breeding seasonality, the first including criteria were records with known dates, to the level of month at least. Also, any breeding report with no indication of locality was discarded, except when referred to particularly small countries and/or to a region that was entirely within one of the latitudinal ranges (see next subsection).

Categories and classification of the data. We obtained records of active nests (see next subsection for reasoning) assigned to some month from 27 species (from most basal to derived): eight species from the genus *Buteogallus,* two from monotypic genera (*Morphnarchus* and *Rupornis*), two from *Parabuteo*, three *Geranoaetus,* one *Pseudastur*, one *Leucopternis,* and ten from the genus *Buteo* (Appendix 1). We did not control for phylogeny at a finer scale, due to sample sizes being probably too small for generating meaningful results. Still, we opted to verify possible, unexpected low-level phylogenetic effects (Murphy 1989, Kulesza 1990), by maintaining a simple classification of each sample to its respective 'clade'. Whilst depicting existent phylogenetic affinities (Amaral et al. 2009), these putative clades do not correspond to uniform levels of taxonomic proximity (i.e., there are groups both above and below genus level), but rather to what should also reflect consistent ecological, biogeographical and/or evolutionary dissimilarities between these groupings. As Appendix 1 shows, seven clades were chosen, labeled (from basal to derived): *Buteogallus*, Other basal, *Geranoaetus*, *Leucopternis*, Basal buteos, Tropical buteos, and Buzzards.

Most species samples were split into a number of smaller units (therefore, 'units'), based primarily in the latitude in which the population occur. Partly based on Bildstein (2004), three latitudinal ranges were chosen: between the Tropic of Cancer (23°26′12.9″N) and the equator, termed Tropical North – TropN; between the equator and the Tropic of Capricorn (23°26′12.9″S) – Tropical South, TropS; and below the Tropic of Capricorn – Temperate South, TempS. This division was adopted due to reduced sample sizes of each species (see next subsection). Nevertheless, we follow this same pattern throughout the manuscript, labeling regions, species etc. as either tropical or temperate based on latitude alone, except if otherwise noted.

Besides this main geographical organization, we generated polygons using the method of affinity propagation (AP) clustering, with the package APCluster of the R software (Bodenhofer et al. 2011). Polygons were determined using coordinates of all original breeding records located in these study (that is, not only of active nests – see next subsection), together with shapefiles from World Wildlife Fund's "Terrestrial Ecoregions of the World" (TEOW; Olson et al. 2001). The ultimate choice of Polygons (Appendix 2) also took into account distinct compositions of buteonine faunas among these. All analyses involving this Polygons organization will therefore be referred as Polygon Analyses. Polygons located mostly or entirely below the Tropic of Capricorn were classified as Temperate ones, whislt those at lower latitudes were treated as Equatorial (i.e., mean latitudes lower than 10°, following Baker (1938) criterium) and Tropical ones. We followed this same reasoning when referring to equatorial regions/zones elsewhere in the text.

Units were classified under a number of categories that briefly describe their main ecological and biogeographical traits, given the potential importance of both. Migratory behavior is a complicated issue, especially when it comes to the Southern Hemisphere, with much unclear, redundant or conflicting terminology (Chesser 1994, Hayes 1995, Joseph 1997, Bildstein 2004, Jahn and Cueto 2012). Because longer-distances migration is not recorded in diurnal raptors populations breeding in the Neotropics (Bildstein 2004, Dingle 2008), we chose to classify units that perform any kind of migration or significant irruptive movements into one same category ('Migrant', score = 1). Non-migratory, sedentary units were simply termed 'Non-migrants' (score = 0).

The assignment of each unit into these two labels was difficult, given conflicting or rather imprecise information found on the literature. Thus, we carefully scrutinized and compared information and evidence given mainly by four sources: Bildstein (2004), Dickinson and Remsen (2013), Amaral et al. (2009), and the GRIN database (2016). A few corrections have been made, such as the case of *Geranoaetus albicaudatus*. The species was labeled as 'partial migrant' by Bildstein (2004) and GRIN (2015a), but as the former himself raised doubts about this treatment, which was further questioned by Amaral et al. (2009), we chose to treat it as Non-migrant also based on our own field experience. Also, personal field experience (JABM) was used for dismissing the classification of *Pseudastur polionotus* as migrant (Bildstein 2004, GRIN 2015b).

The distinction between mainland units and those that occur in islands (except islands from inland waters) was simply made through the labels 'Mainland' and 'InsPop', respectively. When intra-specific ecological differences within a latitudinal range are not so accentuated and at least 80% of the records have the same ecological, biogeographical and/or evolutionary traits (e.g., migratory behavior), the entire set was treated as one unit. We opted to only apply further subdivisions when i) at least 20 breeding records within each latitudinal unit belong to a prevailing ecological category (e.g., 37 records of TempS *G. polyosoma* are of Mainland active nests), **and** ii) the split of a smaller number of records into a subdivision is based on some intrinsic, particularly relevant distinction of these, that could affect results' interpretation.

For instance, island records of *G. polyosoma* include isolated populations that differ from mainland ones on the absence of color polymorphism (*G. p. exsul*; Shirihai et al. 2015 – treated as separate species by Ferguson-Lees and Christie 2001), or of migratory behavior (Falklands populations; GRIN 2013). As a further example, over 88% of *Buteogallus anthracinus* records from the range of the nominate subspecies, come from the continent rather than from islands, so this entire unit was assigned under Mainland category. A separation was applied to active nests from the ranges of its other subspecies, which until recently were raised to species level (*B. subtilis*; see Clark 2007 and Amaral et al. 2009 for lumping arguments). These populations probably are at least an Evolutionarily Significant

Unity (*sensu* White and Kiff 2000), also with different migratory behavior from the nominate (Bildstein 2004).

When appropriate, we briefly compaired very closely related units, whether conespecifics, sister species or somewhat in between these two (see Discussion). However, we opted not to evaluate food guilds with respect to IOBs (e.g., Olsen and Marples 1993, Newton 2010), because of the very large geographical ranges of each unit, as there is evidence that accipitrids' breeding parameters respond to rather local and often distinct seasonal patterns of food abundance (Helander 1983, Whitacre and Burnham 2012).

Controlling for limitations. Unfortunately the records' spatial and temporal distribution did not allow a higher level of geographical or temporal refinement, and in fact limitations imposed by sample sizes or quality are a common issue faced by similar studies (e.g., Moreau 1936, Ricklefs and Bloom 1977, Yom-Tov 1987, Mezquida and Marone 2003, Auer et al. 2007, Johnson et al. 2012). Many previous analyses dealt with each year's breeding season separately. In this study, records are scant for many units or at least considered in insufficient numbers to be fragmented between the different years and retain statistical power (Auer et al. 2007). As consequence of broader geographical magnitude than the majority of similar studies (e.g., Snow and Snow 1964, Mason 1985, Cruz and Andrews 1989, Clarke et al. 2003, Repenning and Fontana 2011), we believe it is inappropriate to use numbers such as five nests per unit (Marques-Santos et al. 2015). Also, we opted to only statistically analyze units whose records came from five or more different breeding seasons/years – except in Polygon Analyses.

Pooling a great number of years into a single estimate is not unprecedented in breeding seasonality studies (e.g., Mason 1985, Auer et al. 2007), but we are aware that a number of biases can be thus introduced, and/or much information is lost. Atypical years, when breeding season timing or extension may be affected by different conditions (Skutch 1950, Marchant 1960, Brawn 1991, Mezquida 2003), are simply undetectable at this scale. Also, the chances of obtaining particularly early nest dates theoretically increase with the number of years sampled, therefore leading to a larger representation of earliest IOBs in such ‘year-rich’ samples. Accordingly, atypically late breeding records might as well become easier to find when looking at more years, so BSLs estimates can also increase in these cases, as noted by Auer et al. (2007). Moreover, this may lead to combinations of earliest and latest dates probably not biologically plausible to occur together in any given year.

With these issues in mind, we performed *a priori* statistical tests on our data, aiming to pinpoint any possible source of bias (see next subsection). Careful, parsimonious interpretations must follow as, for instance, a longer BSL estimate might be fruit of either an indeed broader season, one with highly variable extension (e.g., Mezquida 2003) or timing at each year (e.g., Skutch 1950, Brawn 1991), or even all these factors acting together. On the other hand, narrower estimates would still incorporate the information of much less flexible and probably shorter breeding seasons within a given region. Indeed, posterior interpretation of the analyses indicated that even if present, biases most probably did not affect the validity of many conclusions taken from the comparisons. Nevertheless, as samples with less than 20 active nests may underestimate BSL (Marques-Santos et al. 2015), and yielded longer BSL estimates as this number increases up to 20 (see Results and Discussion), we decided to exclude such units from BSL analyses.

Many studies on seasonality of reproduction in birds define the IOB based on the first nests of the season, and still in their early stages, such as egg-laying (Mezquida 2002, Clarke et al. 2003, Smith and Moore 2004, Marques-Santos et al. 2015), or even nest building (Lima and Roper 2009). Such precise dates are obtained only through close monitoring of breeding pairs in the field. Albeit we are sure that our samples preclude reliable conclusions if we chose to perform extremely restrictive analyses, selecting much more ‘loose’ breeding evidence for seasonality estimates would be equally misleading. Information such as breeding displays of adult birds and descriptions of copulating behaviors, birds carrying nest material, juveniles in the post-fledging dependency period and/or performing play behavior, might be reliable indications of breeding activity in a given locality, for many bird groups. Yet, it present questionable value for phenology estimates when dealing with accipitrid raptors. The main reason is that none of these behaviors can be soundly traced back to one specific stage of a breeding attempt (Wiley and Wiley 1981, Monsalvo 2012, Raimilla et al. 2015, Woolaver et al. 2015).

Circumstances also led us to adopt a more comprehensive approach in defining breeding seasonality, such as the one chosen by Ferguson-Lees and Christie (2001), whom relied on nests with either eggs or young in an attempt to verify latitudinal variation in the reproduction of diurnal raptors. The widely-used term ‘active nest’ (here, AN), despite its historic and intrinsic limitations (Steenhof et al. 2017), is the best alternative left for literature records and was already chosen by other authors reporting seasonality (Di Giácomo 2005). We also included as active nests, records of eggs and laying stages, incubating/brooding parents, nestlings and juveniles in the fledgling stage. Backdating was only used when done by the reference itself, or when it delivered precise information for the calculation.

We excluded nests explicitly stated as still under construction (e.g., Lüthi 2011), or reports of ‘nesting behavior’ in which no active nest was actually found (e.g., Silva-Rodríguez et al. 2008). Yet, we included records of young birds at nests, even though it is frequently reported using imprecise terms (e.g., Wetmore 1965, De La Peña 2005), and may refer to birds in the post-fledging dependency period returning to the nest long after their first flights (Monsalvo 2012). Still, juveniles not associated to any nest (Rivas-Fuenzalida et al. 2016), were not used for estimates, even when clearly dependent on their parents for food (Greeney and Nunnery 2006). Also when discussing the results, we followed the same reasoning, avoiding any definition of breeding season whose start precedes the egg-laying stage, and that ends after the fledgling stage. We indicate whenever additional breeding information that does not refer to active nest stages is provided for a clarifying purpose.

Estimating IOB and BSL. After disconsidering information on the years (except what noted otherwise in the previous subsection), the IOB was set as the earliest date in a regular series of records, i.e., not necessarily the earliest date of the year, but considering the sequence of months with breeding records for that unit (or Polygon; see ahead). As an example, temperate populations of *Buteogallus coronatus* (unit Bg_cor temp; Appendix 1) have no records for the months of June and July, so its season in TempS range was estimated to begin in August and end in May. There was no need for an uninterrupted sequence of months with active nest records of a unit, because an interval was always longer than the others, allowing us to pinpoint the months corresponding (theoretically) to its non-breeding season.

The only correction while estimating IOB was applied to *Rupornis magnirostris*' TropN unit (Rupor 1; Appendix 1), whose earliest dates/months were extremely incompatible compared to other TropN units and, more importantly, came from a study (Navarro et al. 2007) that gave an interval of around six months as the time range in which its active nest records were made. In this case, we validated a sounder IOB date by checking the first month of this interval that matched an active nest record from another reference. After identifying the month each breeding season seem to begin, we searched for the record with the earliest day of the month, and defined it as the IOB date of that unit. Often, records have no information on the day, so we assigned these cases to day 15 of the month (following Marques-Santos 2014).

After IOB date was defined, we standardized it by transforming into a number relative to the vernal equinox (Auer et al. 2007, Marques-Santos 2014). Following Britannica (2015), we set approximate equinox dates as March 20 in the Northern Hemisphere, and September 22 in the Southern. As the most recent nest dates used in IOB estimates are from 2012 (Pérez 2015), and vernal equinox arrive almost one day earlier each 100 years (Sagarin 2001), dates before 1913 were calculated relative to equinox dates on March 21 and September 23. Dates before the equinox are negative numbers, and after are positive. Two IOB dates extremely distant from equinox (up to around six months) were assigned anterior to it rather than after.

We identified the latest date of the breeding seasons following the same procedure, except that we did not account for any relation to equinox date. The number of days of the year from the IOB until this last date, is the BSL estimate for each unit. We computed and present IOB and BSL estimates for all units but, partly based on our *a priori* tests (previous subsection), we assigned threshold values for treating estimates as relevant and including them in subsequent statistical tests: i) units with records from five or more different years (*sine qua non* condition); ii) for IOBs, units with more than nine active nests; and iii) for BSLs, units of more than 19 active nests.

Polygon Analyses followed this same overall reasoning, but with a few exceptions. Namely; i) IOBs and BSLs for each Polygon were estimated not based on units' dates, but on the earliest and the latest dates of **any** active nest record within the Polygon; ii) due to smaller geographical scales, threshold value for statistical tests were assigned as more than 15 active nests for each Polygon – for this reason, we pooled Polygons 3 and 12 into Polygon '14'; and iii) we did not transformed IOBs to numbers relative to equinox date, as some Polygons encompassed both Hemispheres.

In the text, except when otherwise noted, median values were favored over means to report representative values for groups, as the latter can be less informative for highly varied values such as these samples'. Also, for this reason, coefficients of variation (CV) are also reported.

Statistical analyses. All tests were made with the Past software (Hammer et al. 2001), with significance levels of 0,05. *A priori* tests consisted of Ordinary Least Sum of Squares (OLS) linear regressions. In addition to these and Polygon Analyses (see ahead), two tests were performed to compare IOB estimates. We first verified whether IOB estimates changes between units of different latitudinal ranges (Test A), ignoring at this moment any differences in migratory behavior and if units were Mainland's or insular. Due to significant heteroscedasticity between the groups (Levene´s test, from medians; *P*(same var.) = 0.027), and also unbalanced and small-sized samples (McDonald 2014b), we used unequal-variance (Welch) version of one-way ANOVA for the comparison. For *post-hoc* pairwise comparisons, we chose a version of Tukey's HSD test. The second IOB analysis (Test B) was done *a posteriori* and verified if the estimated dates were significantly different between Migrants and Non-migrants TempS units (see below). Test B consisted of a two-sample t-test, after checking for normal distributions and homoscedasticity (McDonald 2014a).

Three tests were performed to assess BSL variation. We first evaluated whether estimates varied between the three latitudinal ranges (Test C), using one-way ANOVA. Just two migrant tropical units were eligible for testing possible influence of migratory behavior (Test D), each from one hemisphere and with other ecological, biogeographical and/or evolutionary dissimilarities. So, we parsimoniously chose to perform Test D only between the TempS units, aiming more meaningful results. Another test (E) assessed whether Mainland units differed from insular ones (InsPop) on their BSLs. Again, only one southern unit qualified to the test, and apparent deviations within this same species (*Buteo* *galapagoensis*) between the two hemispheres (yet possibly because of diverging sample sizes; Appendix 1) drove us to do the test using just TropN units. To both Tests D and E we used two-sample t-tests, after checking for normal distributions and homoscedasticity.

Based on differences observed in the previous comparisons, we did a number of *a posteriori* Fligner-Kileen tests for coefficients of variation. To account for similar sampling conditions, we included just IOB estimates based on more than 19 active nests. Because of the test's limitations, we turned all IOBs into positive numbers, what should not affect the results as all these estimates were negative and so intrinsic variation did not change. We assessed if IOB estimates indeed varied more than BSL's, within each latitudinal range (Tests F, G, and H). We also compared coefficients of variation of both IOB and BSL estimates, between the two clades with more units (*Buteogallus* and *Geranoaetus*; Tests I and J). Finally, Polygon Analyses tested the occurrence of latitudinal variation in both IOB and BSL estimates. To verify if each of these estimates, separatedly, correlated with latitude (Tests PolyA and PolyB), we performed robust OSL linear regressions. Mean latitude of each Polygon was obtained using the coordinates of its northernmost and southernmost nest records.

At last, to explore whether distinct clades composition might have had some influence on the outcomes of the comparisons of IOB estimates between the three latitudinal ranges, we used hierarchical clustering to check which ranges were more similar with regard to clades' presence-absence and abundance. Two algorithms were chosen, Unweighted pair-group average (UPGMA) and Ward's method, to verify robustness of the groupings through the different methods. For the same reason, three indices were used in UPGMA, all for abundance data: Cosine similarity, Chord distance and Bray-Curtis (Ward's method uses Euclidean distance). Data analyzed was the number of units per clade within each of the latitudinal ranges. We checked both the entire composition of the range and another scenario with only the relevant-sized units used for the estimates, to verify whether they diverge. Each dendrogram resulted from 100 bootstrap replicates.

RESULTS

***A priori* tests.** Ordinary Least Sum of Squares (OLS) linear regression indicated a significant correlation between number of nest records (therefore, n) in a unit and its BSL estimate ($r^2 = 0.286$, *P*(uncorrel.) < 0.001). Still, we noted that the largest samples (n > 100) were of three north tropical units, so thoroughly studied (Hilty and Brown 1986, Panasci and Whitacre 2000, 2002, Thorstrom et al. 2005, 2007) and sometimes with so much high-quality data, that it seemed unlikely that their BSL estimates were much incorrect. A new series of OLS regressions were run, excluding these largest samples, and testing two other combined ranks of units: $20 \leq n \leq 100$; and n < 20. As only the last showed a significant correlation ($r^2 = 0.529$; *P*(uncorrel.) < 0.001), we concluded that the first correlation was possibly spurious, biased by the largest samples.

Similar tests were run for IOB and BSL estimates versus the number of years with records for each unit. We performed OSL regressions with units divided by four scores of years, from 2 to 4, from 5 to 9, from 11 to 17, and equal or larger than 20; and their respective IOB estimates. No significant correlation occurred, and also none when pooling all sizes of years' samples and its resultant IOBs together. A significant non-normal distribution of regression's residuals (*P*(normal) = 0.003) further suggested that the predictive ability of the number of years for IOB estimates was rather poor ($r^2 = 0.043$).

Linear regressions for BSL estimates, with the same four scores of years, resulted in significant correlations for the intermediate scores, but also, and more importantly, when all units were put together ($r^2 = 0.107$, *P*(uncorrel.) = 0.034). This set of preliminary tests showed that we may not rule out possible influence of the unit's sample sizes (whether number of active nests or, especially, number of years) on its BSL estimates. Yet, this possible bias does not disprove estimates' importance as an approximation of the real data's trends, chiefly for comparative purposes and for the generation of new testable hypotheses. Also, we noted that mean BSL estimates increased much less with greater increases in number of years, corroborating the rather weak correlation.

Latitudinal ranges. The TropN latitudinal range has 21 units, being particularly rich on the *Buteogallus* clade (seven units pertaining to six different species), but also holding more clades than all other ranges (Table 4). Island raptors are especially frequent in it, with five units being classified as InsPop and another five containing insular records in smaller proportions. Three of these units are of island endemic species (*Buteogallus gundlachii*, *Buteo ridgwayi*, and *Buteo galapagoensis*), and there is also a number of other Evolutionarily Significant Unities (including subspecies of *B. platypterus* and *B. jamaicensis*), as well as islands with unnamed but differentiated populations. On the other hand, Migrants are rare (*N*=3 units).

Three TropN units have the largest samples of active nests, and one of these have records from more years in these study (*N*=34 yrs), but in general, this range's samples were not particularly 'year-rich' (mean = 8.3 yrs). Only two units have IOB dates subsequent to the equinox. All relevant-sized units apparently start to breed within less than 100 days before the equinox (Fig. 2; median = -54; *N*=13), with some variation between these (range = 15 December – 11 March). BSL estimates are also very diverse, even within relevant values (range = 71 – 339 days; *N*=9), the median being around six months.

TropS range contains 15 units, also with prevalence of *Buteogallus* spp. (Table 5). All units are entirely from mainland areas, except the southern *Buteo galapagoensis*'

Table 4. Buteonines units from the Tropical North (TropN) latitudinal range.

Species	**Unit**	***N***	**Years (min.)**	**IOB (day of the year)**	**IOB (formula)**	**BSL (days)**
Buteogallus anthracinus 'nominate'	Bg_ant nom	94	24	15	-64	201
Buteogallus anthracinus '*subtilis*'	Bg_ant subt	12	6	25	-54	141
Buteogallus gundlachii	Bg_gundl	38	5	46	-33	181
Buteogallus aequinoctialis	Bg_aeq	24	5	46	-34	140
Buteogallus meridionalis	Bg_merid 1	102	9	15	-64	339
Buteogallus urubitinga	Bg_urub 1	13	8	76	-3	215
Buteogallus solitarius	Bg_solit N	7	3	105	26	122
Morphnarchus princeps	Morph N	1	1	56	-23	NA
Rupornis magnirostris	Rupor 1	163	34	15	-64	181
Parabuteo unicinctus	Par_uni trop	5	4	70	-9	126
Parabuteo leucorrhous	Par_leuc 1	2	1	46	-33	28
Geranoaetus albicaudatus	G_albic 1	18	11	15	-64	262
Pseudastur albicollis	Pseud N	4	3	66	-13	42
Buteo plagiatus	plagiat	40	16	70	-9	71
Buteo nitidus	nitidus	10	4	41	-38	88
Buteo ridgwayi	ridgwayi	224	8	15	-64	304
Buteo platypterus	platypt	20	6	62	-17	73
Buteo brachyurus	brachy 1	15	12	43	-37	107
Buteo galapagoensis	galapag N	3	3	166	87	59
Buteo albonotatus	albonot	6	4	33	-47	106
Buteo jamaicensis	jamaic	60	8	349	-95	152

N = number of active nests (ANs). Years (min.) = minimum number of years from which the AN records came from. IOB (day of the year) = number of the day of the year with the earliest AN of the unit's breeding season. IOB (formula) = the same date, but relative to the vernal equinox; negative numbers are dates before the equinox. BSL (days) = estimated length of the unit's breeding season, in days.

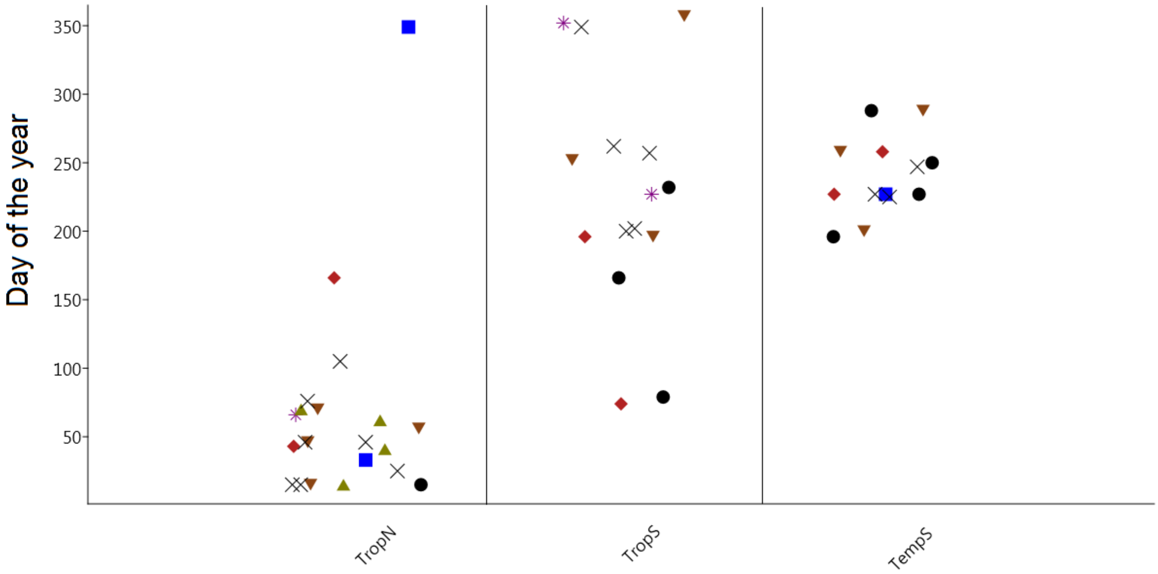

Figure 2. Days of the year corresponding to the initiation of breeding season (IOB) of Neotropical buteonines units, among three latitudinal ranges: Tropical North (TropN, between Tropic of Cancer and the equator), Tropical South (TropS, between equator and Tropic of Capricorn) and Temperate South (TempS, below the Tropic of Capricorn). Different symbols represent units of different clades: X = *Buteogallus*; inverted triangle = Other basal; circle = *Geranoaetus*; asterisk = *Leucopternis*; triangle = Basal buteos; diamond = Tropical buteos; square = Buzzards. Within each range, units' points are randomly distributed relative to X axis, for easy viewing. Further explanations on the main text.

(galapag S), and migratory behavior is even rarer than in TropN, prevailing just in *Geranoaetus polyosoma* (G_pol north). TropS sample sizes are also very poor (means = 14.3 active nests and 4.6 years, respectively), even preventing BSL estimates in four cases. The two units mentioned above are the only with IOB dating more than 100 days away from the equinox, and the three IOB dates after it are based on very few active nest records each. Still, there is considerable variation between estimates (Fig 2; range = 20 March – 23 December).

Estimates of BSL are around 200 days in units above threshold values, varying very little (CV = 15%; *N*=4), and rarely of less than four months when considering all sample sizes.

Table 5. Buteonines units from the Tropical South (TropS) latitudinal range.

Species	**Unit**	***N***	**Years (min.)**	**IOB (day of the year)**	**IOB (formula)**	**BSL (days)**
Buteogallus meridionalis	Bg_merid 2	8	7	262	-3	26
Buteogallus lacernulatus	Bg_lacer	1	1	349	84	NA
Buteogallus urubitinga	Bg_urub 2	8	5	257	-8	110
Buteogallus solitarius	Bg_solit S	1	1	200	-65	NA
Buteogallus coronatus	Bg_cor trop	12	6	202	-63	191
Morphnarchus princeps	Morph S	6	2	357	92	136
Rupornis magnirostris	Rupor 2	23	9	196	-69	215
Parabuteo leucorrhous	Par_leuc 2	3	3	252	-13	49
Geranoaetus albicaudatus	G_albic 2	4	4	232	-33	83
Geranoaetus polyosoma 'tropical'	G_pol north	20	7	79	-186	249
Geranoaetus melanoleucus	G_mel trop	20	6	166	-99	183
Pseudastur albicollis	Pseud S	1	1	227	-38	NA
Leucopternis kuhli	L_kuhli	1	1	352	87	NA
Buteo brachyurus	brachy 2	7	3	196	-69	153
Buteo galapagoensis	galapag S	97	13	74	-191	184

N = number of active nests (ANs). Years (min.) = minimum number of years from which the AN records came from. IOB (day of the year) = number of the day of the year with the earliest AN of the unit's breeding season. IOB (formula) = the same date, but relative to the vernal equinox; negative numbers are dates before the equinox. BSL (days) = estimated length of the unit's breeding season, in days.

TempS latitudinal range is composed of 13 units, with slight predominance of the *Geranoaetus* clade, which includes the only InsPop therein (Table 6). This range also hold the largest number of Migrants (*N*=5 units), and even very small fractions of two Non-migrant units exhibit migratory behavior as well. TempS' samples have the largest average

Table 6. Buteonines units from the Temperate South (TempS) latitudinal range.

Species	**Unit**	***N***	**Years (min.)**	**IOB (day of the year)**	**IOB (formula)**	**BSL (days)**
Buteogallus meridionalis	Bg_merid 3	80	28	247	-18	169
Buteogallus urubitinga	Bg_urub 3	20	25	225	-40	162
Buteogallus coronatus	Bg_cor temp	43	24	227	-38	273
Rupornis magnirostris	Rupor 3	46	29	258	-7	181
Parabuteo unicinctus	Par_uni temp	27	20	200	-65	270
Parabuteo leucorrhous	Par_leuc 3	2	2	288	23	NA
Geranoaetus albicaudatus	G_albic 3	33	17	227	-38	122
Geranoaetus polyosoma 'continent'	G_pol cont	37	16	250	-15	89
Geranoaetus polyosoma 'islands'	G_pol ins	7	2	288	22	123
Geranoaetus melanoleucus	G_mel temp	83	23	196	-69	215
Buteo albigula	albigula	52	11	258	-7	212
Buteo brachyurus	brachy 3	8	2	227	-38	184
Buteo ventralis	ventralis	51	8	227	-38	153

N = number of active nests (ANs). Years (min.) = minimum number of years from which the AN records came from. IOB (day of the year) = number of the day of the year with the earliest AN of the unit's breeding season. IOB (formula) = the same date, but relative to the vernal equinox; negative numbers are dates before the equinox. BSL (days) = estimated length of the unit's breeding season, in days; NA in this case refer to two records from the same day of the year.

amount of years (mean = 15.9), and only three units with less than 20 active nests. All IOB dates are in general much closer to vernal equinox than the dates from the tropical ranges: less than 70 days before equinox, or more rarely (*N*=2, with very small sample sizes) in the month after it. Most estimates of BSL are of more than five months, ranging from 89 to 273 days in relevant-sized units (*N*=10).

Figure 3 further illustrates differences between the three latitudinal ranges with respect to estimates. Showing only relevant-sized units (and excluding all with less than 20 active nests, not used for BSL estimates), the much smaller variation in IOB dates of TempS units becomes evident. It is also clear the wider ranges of IOB and BSL estimates in TropS and TropN units, respectively. The restricted ranges of variation in TropN IOBs and TropS BSLs are also remarkable.

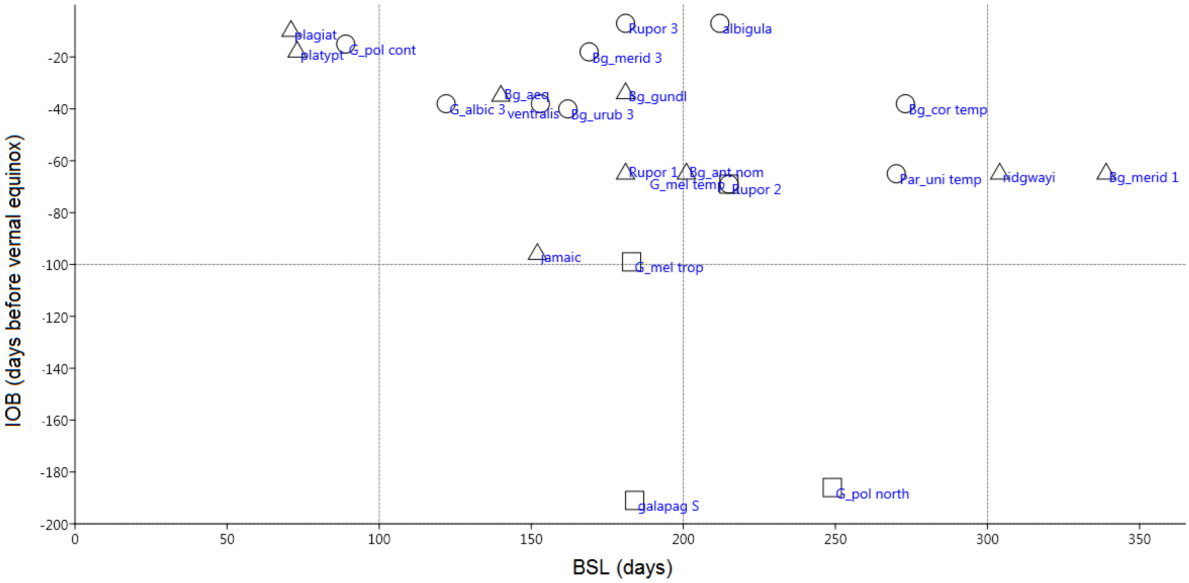

Figure 3. Comparison between estimates of initiation of breeding season (IOB) and breeding season length (BSL), of Neotropical buteonines units from three latitudinal ranges: Tropical North (triangles), Tropical South (squares) and Temperate South (circles). Y axis refer to day number relative to vernal equinox, hence negative values. Labels refer to units' acronyms (see Tables 4-6 and Appendix 1).

IOB and BSL analyses. In Test A, means of IOBs from the three latitudinal ranges were significantly different (*F* = 4.630, *df* = 9.342; *P* = 0.040; Fig. 4). *Post-hoc* Tukey HSD indicated that the mean of TropS units differed from those of both TempS (*Q* = 6.731, *P* < 0.001) and TropN (*Q* = 5.987, *P* < 0.001), but the last two did not differ between them (*P* = 0.645). We found no evidence that TropS deviated substantially from the other ranges with respect to clades, as all dendrograms pointed to a higher similarity between this range and TempS, whilst TropN diverged more. A fair amount of variation occurred throughout the algorithms, indices and the two scenarios (all units vs. relevant-sized), but the same pattern was consistently maintained (Appendix 3).

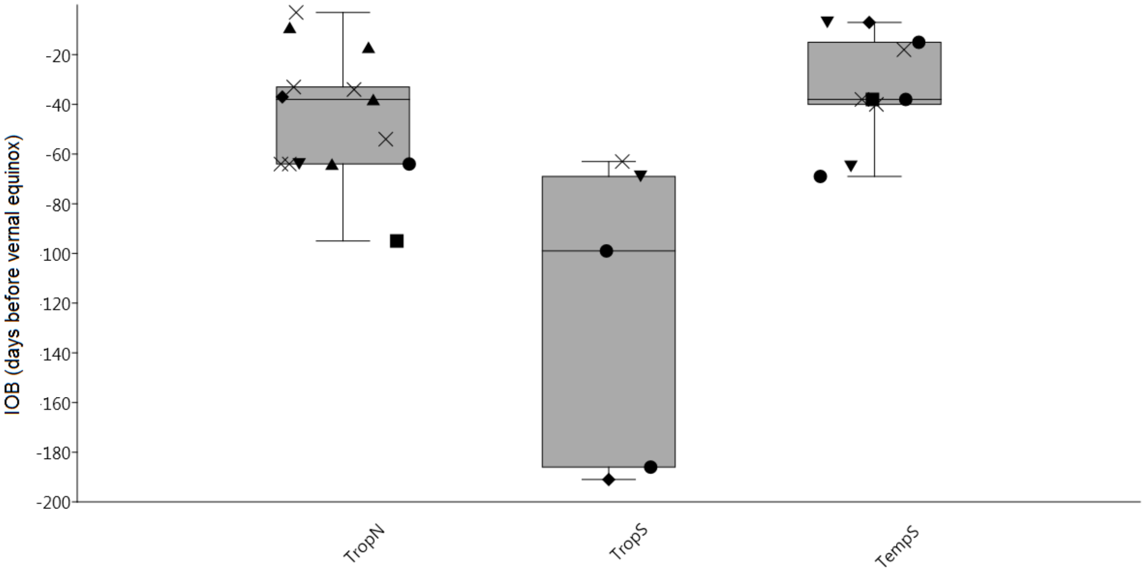

Figure 4. Estimates of initiation of breeding season (IOB) of Neotropical buteonines units, among three latitudinal ranges: Tropical North (TropN), Tropical South (TropS) and Temperate South (TempS). Y axis refer to day number relative to vernal equinox (hence negative values). Different symbols represent units of different clades: X = *Buteogallus*; inverted triangle = Other basal; circle = *Geranoaetus*; asterisk = *Leucopternis*; triangle = Basal buteos; diamond = Tropical buteos; square = Buzzards. Within each range, units' points are randomly distributed relative to X axis, for easy viewing. Further explanations on the main text.

Levene's test performed with BSL estimates of the three ranges found no heteroscedasticity (*P*(same var.) = 0.316, from medians), and the one-way ANOVA (Test C) showed that their means did not differ (*F* = 0.193, *P* = 0.826; Fig. 5). Tests D and E also yielded non-significant values after comparing the means of BSL estimates between Migrants and Non-migrants (*t* = 0.979, *P* = 0.356), and between Mainland and InsPops (*t* = 0.071, *P* = 0.946). Similarly, IOB means were similar between TempS Migrants and Non-migrants (Test B; *t* = 0.041, *P* = 0.968). Yet, the latter's BSL estimates are generally longer and more heterogeneous.

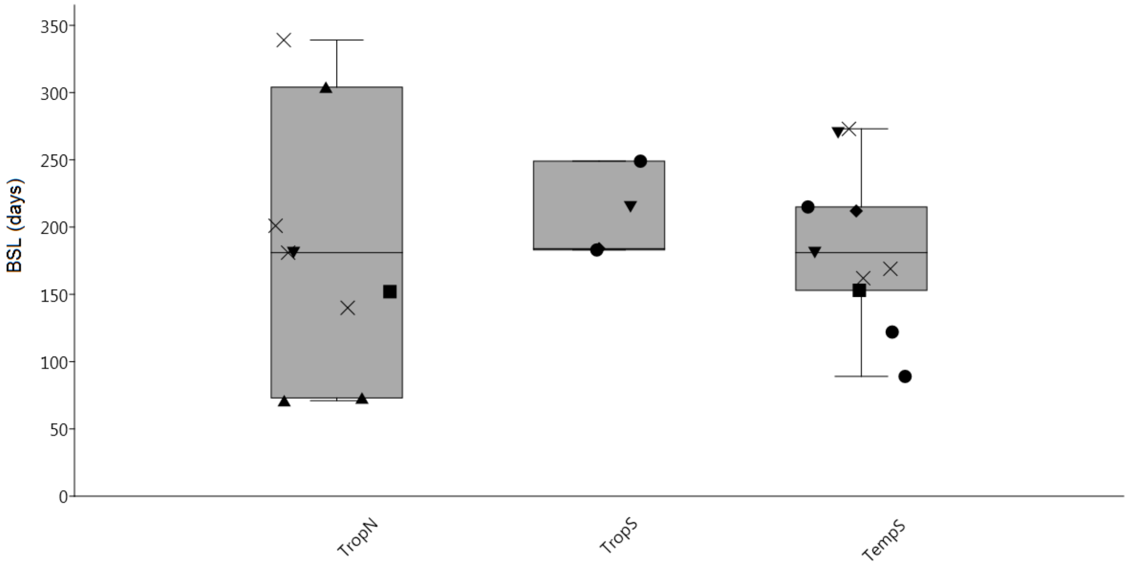

Figure 5. Estimates of breeding season lengths (BSLs, in days) of Neotropical buteonines units, among three latitudinal ranges: Tropical North (TropN), Tropical South (TropS) and Temperate South (TempS). Different symbols represent units of different clades: X = *Buteogallus*; inverted triangle = Other basal; circle = *Geranoaetus*; asterisk = *Leucopternis*; triangle = Basal buteos; diamond = Tropical buteos; square = Buzzards. Within each range, units' points are randomly distributed relative to X axis, for easy viewing. Further explanations on the main text.

As expected, the first Fligner-Kileen test (Test F) showed that IOB estimates of TempS units had significantly more variation than their BSL estimates (*P* = 0.029), and the same applied for the TropS range (Test H; *P* = 0.041), probably driven by its earliest IOB dates. In TropN units, albeit estimates of IOB varied consistently more than BSL's, difference was not statistically significant (*P* = 0.202).

Clades. Test I indicated that IOB variation is significantly larger in *Geranoaetus* than in *Buteogallus* (*P* = 0.040), but this did not hold after removal of an outlying unit of the former (*P* = 0.090). Variation within these two clades' BSL estimates (Test J) was not significant (P = 0.187). Despite IOB estimates were always more heterogeneous than BSL's (Table 7), Fig. 6 shows that the range of BSL estimates for *Buteogallus* was a little wider than that of *Geranoaetus*. The graphic also reveal that a few conspecific units can greatly diverge in their estimates, whether of BSL (e.g., *Buteogallus meridionalis*) or of both BSLs and IOBs (e.g., *G. polyosoma*). Other appear more constrained, such as *G. melanoleucus*. A few clades vary much more widely in IOB than in BSL estimates, such as the Buzzards and particularly Tropical buteos, whilst Basal buteos behave the opposite way. The concentration of almost all units' IOB dates within 100 days before equinox is also remarkable.

Table 7. Variation within the estimates of IOB and BSL, for the two clades of buteonines with more units.

Clade	No. of units	Years (mean)	IOB estimates	CV	Not included	BSL estimates	CV	Not included
Buteogallus	7	17,14	-64 to -18	40,582	84	140 to 339	34,019	26
Geranoaetus	5	13,8	-186 to -15	81,714	23	89 to 249	38,31	83; 262

No. of units = number of units of the clade; Years (mean) = mean number of years included in each unit's estimates; IOB estimates = extreme values among the units, from the most distant to the closer day relative to equinox; CV = coefficient of variation of these estimates; Not included = outlying IOB estimates not included in the analysis due to units' small sample sizes, positive numbers being dates after the equinox; BSL estimates = extreme values among the units, in days; CV = coefficient of variation of these estimates; Not included = BSL estimates (also in days) not included in the analysis due to units' small sample sizes.

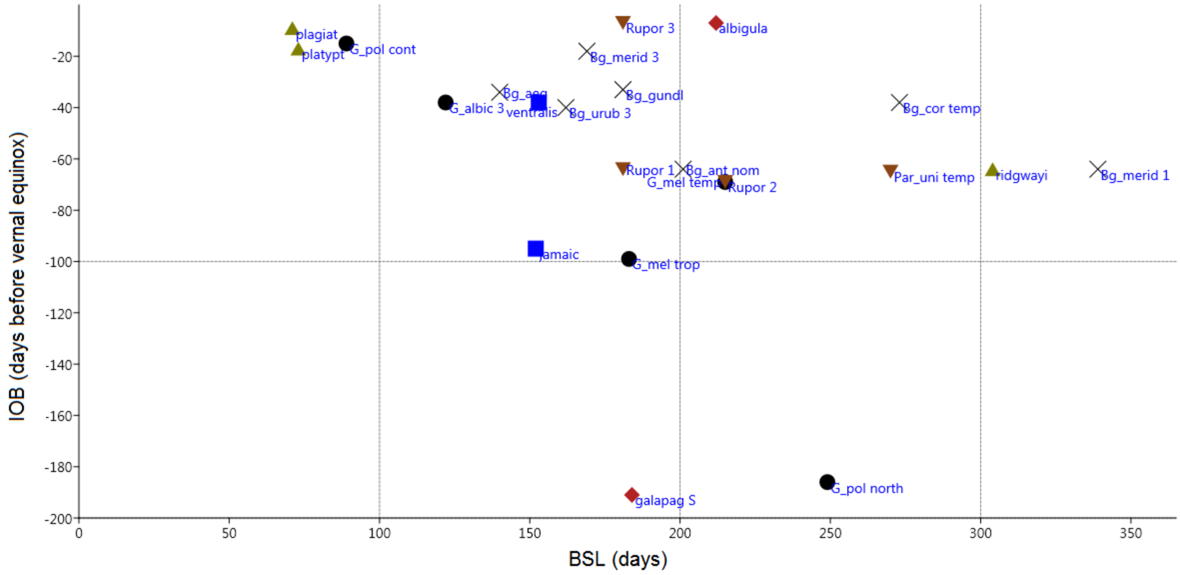

Figure 6. Comparison between estimates of initiation of breeding season (IOB) and breeding season length (BSL), of all Neotropical buteonines units. Y axis refer to day number relative to vernal equinox (hence negative values). Different symbols represent units of different clades: X = *Buteogallus*; inverted triangle = Other basal; circle = *Geranoaetus*; asterisk = *Leucopternis*; triangle = Basal buteos; diamond = Tropical buteos; square = Buzzards. Labels refer to units' acronyms (see Tables 4-6 and Appendix 1). Further explanations on the main text.

Polygon analyses. Table 8 presents a summary of data on each Polygon. The median value of BSL estimates is roughly eigth months (239 days). Through the year, there is a clear delay on IOB estimates from more northernly to more southernly Polygons, as shown by Figure 7. Moreover, both north Tropical and south Temperate Polygons have IOBs much closer to their respective vernal equinox, than those from south Tropical Polygons. Equatorial estimates are much more intriguing, as no clear pattern could be noted. Estimates of IOB of each Polygon are negatively correlated with its mean latitude (Test PolyA, Fig. 8; r = -0.667). Correlation is not very strong, but is statistically significant (r^2 = 0.445, P(uncorrel.) = 0.018). With BSL, estimates are distributed with no clear pattern among Polygons at distinct latitudes (Fig. 9), and correlation was not significant (Test PolyB; r = 0.256, r^2 = 0.065, P(uncorrel.) = 0.410).

Table 8. Information on each Polygon generated to assess geographical variation in breeding seasonality of Neotropical buteonines.

Polygon	***N***	**Mean latitude**	**Latitudinal category**	**IOB (day of the year)**	**BSL (days)**
1	24	-18,4417	Tropical	105	267
2	100	-0,21667	Equatorial	74	184
4	18	-50,1833	Temperate	258	122
5	145	-38,425	Temperate	227	243
6	27	10,94167	Tropical	21	145
7	296	19,01667	Tropical	15	212
8	331	20,15833	Tropical	15	334
9	85	-15,2	Tropical	166	245
10	170	-26,1417	Temperate	227	212
11	26	1,5	Equatorial	357	235
13	127	-30,8917	Temperate	196	304
14*	192	5,158333	Equatorial	15	339

Polygon 14* = merging of Polygons 3 and 12. *N* = number of active nests (ANs) within the Polygon. Mean latitude = mean between the latitudes of its northernmost and southernmost AN records. Latitudinal category = Polygon classification based on its mean latitude. IOB (day of the year) = number of the day of the year with the earliest AN of the Polygon's breeding season. BSL (days) = estimated length of the breeding season within the Polygon, in days. Further explanations on the main text.

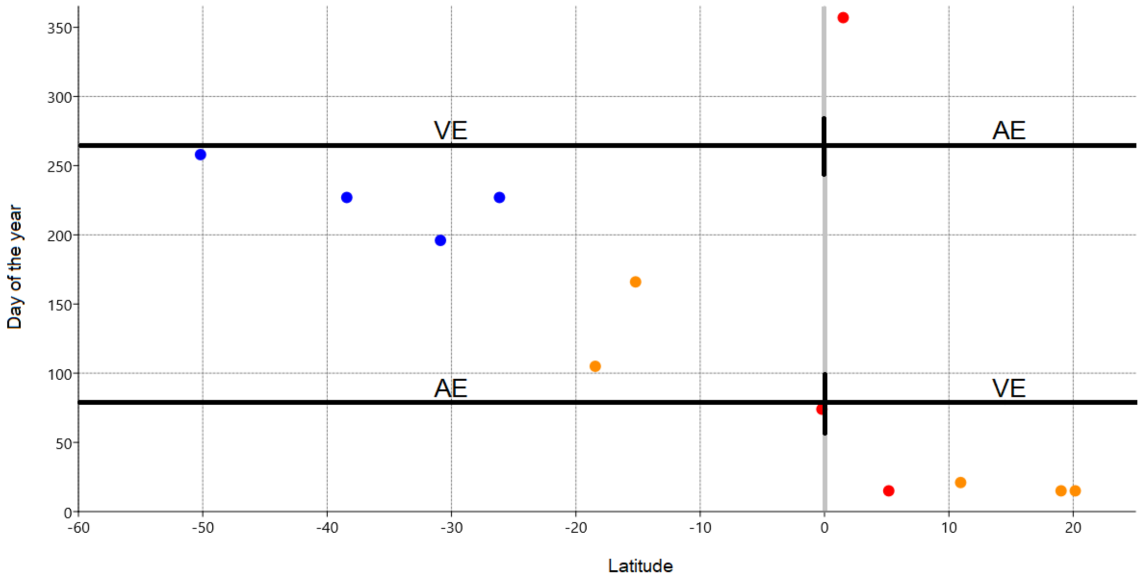

Figure 7. Day of the year corresponding to the initiation of breeding season (IOB) of Neotropical buteonines, in twelve Polygons at different latitudes. Negative values on the X axis represent latitudes below the equator. Different colors denote distinct latitudinal categories: blue = Temperate; orange = Tropical; red = Equatorial. Thick horizontal lines mark equinox dates in each Hemisphere; VE = vernal equinox; AE = autumnal equinox. Further explanations on the main text.

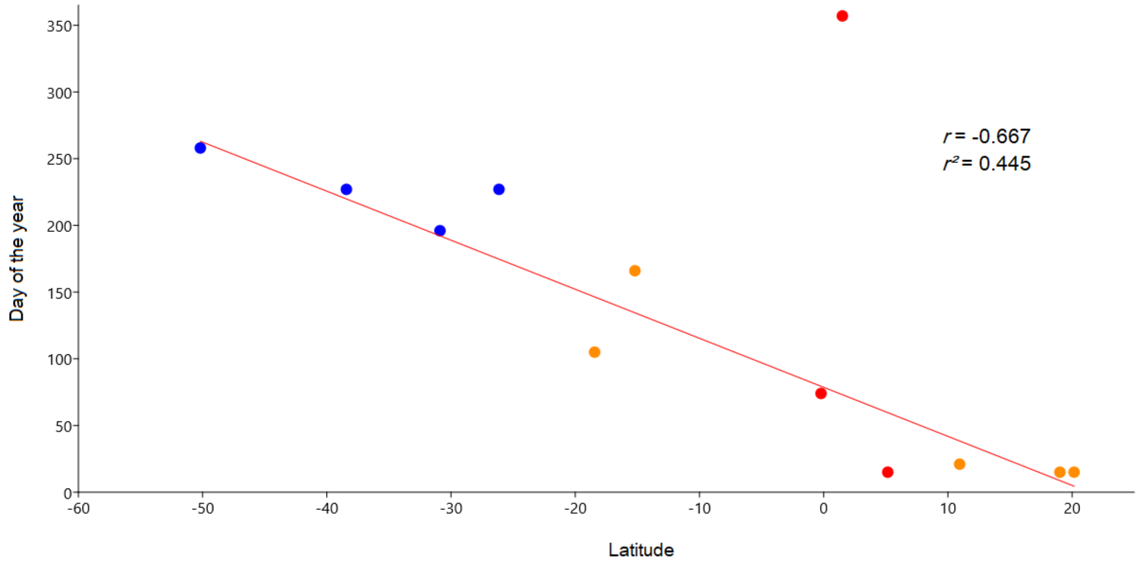

Figure 8. Robust OLS linear regression of initiation of breeding season (IOB) of Neotropical buteonines in twelve Polygons, and the latter's mean latitudes. Negative values on the X axis represent latitudes below the equator. Different colors denote distinct latitudinal categories: blue = Temperate; orange = Tropical; red = Equatorial. Day of the year of IOB estimate of each Polygon are negatively correlated with its latitude. Further explanations on the main text.

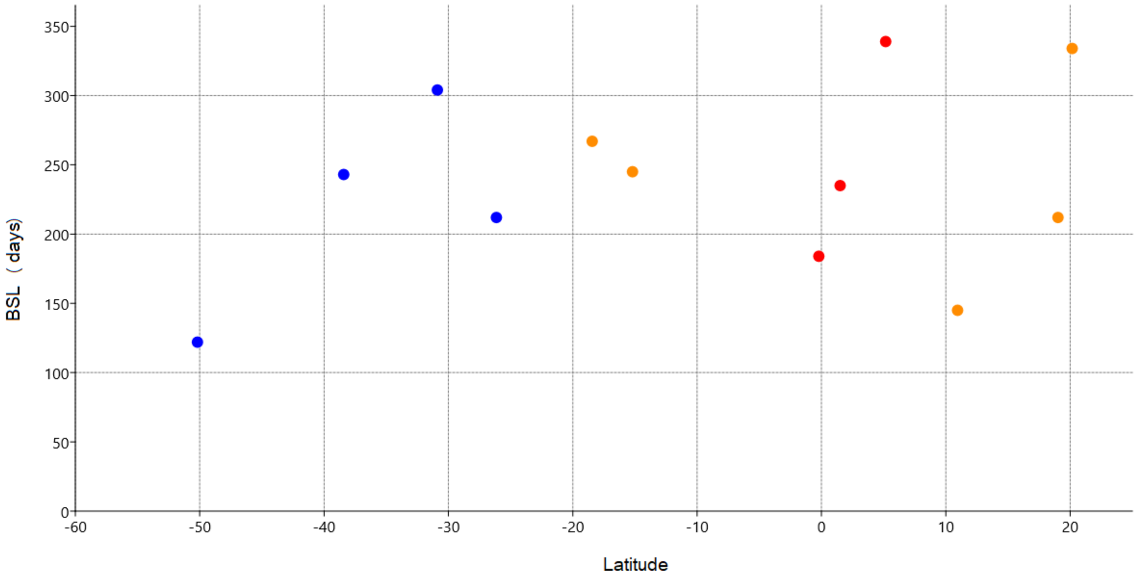

Figure 9. Estimates of breeding season length (BSL) of Neotropical buteonines, in twelve Polygons at different latitudes. Negative values on the X axis represent latitudes below the equator. Different colors denote distinct latitudinal categories: blue = Temperate; orange = Tropical; red = Equatorial. Further explanations on the main text.

DISCUSSION

Latitudinal trends. We found that date of initiation of breeding of Neotropical buteonines, but not the length of their breeding seasons, vary with latitude. The whole picture is consistent with observations from Baker (1938) and Olsen and Marples (1993), with delaying dates toward higher latitudes. Nevertheless, the greater differences are within Southern Hemisphere’s IOB estimates, especially those from a few units. Three of these units consist of species that are either geographically restricted, or at least have its earlier breeding dates (that is, the ones used to estimate IOB), coming from Ecuador. For instance, literature sources indicate that tropical *Geranoaetus polyosoma* populations consistently starts to breed in March or possibly even earlier in the northern limits of their range, in Ecuador (Marchant 1960) and Peru (Lüthi 2011). That is, more than six months before Southern Hemisphere’s vernal equinox.

We found strong evidence of latitudinal variation on *G. polyosoma*'s breeding seasonality. Active nests records (Greeney et al. 2011), as well as other breeding evidence (Cabot et al. 2010a), indicate that nesting of this species may extend until July in its northern range, maybe up to September (Moore 1934), whilst other references state that their eggs were found year-round in Ecuador (Ferguson-Lees and Christie 2001). Remarkably, we did not find active nest records of this species before September farther south in tropical Chile, agreeing with Marchant (1960). Most nest dates there came from the end of November, agreeing also with Ferguson-Lees and Christie (2001). In a similar way, considerable latitudinal differences in egg dates of Andean diurnal raptors were already verified by two independent analyses of breeding seasonality on Andean Condor *Vultur gryphus* (Sáenz-Jiménez et al. 2016, Marini et al. in preparation). It was also suggested the existence of clinal variations in clutch-size of *Geranoaetus polyosoma*, with an increase toward higher latitudes (Jiménez 1995).

Another interesting point is the convergence in IOB dates of Ecuadorian *G. polyosoma* and *Buteo galapagoensis*, two not closely related and ecologically very distinct buteonines (see Appendix 1). About the latter, Muñoz (2012) suggest that March is part of its nesting season, and other authors reported young at nests since May (Supplemental Table S1). Ferguson-Lees and Christie (2001) and Newton (2010) stated that this species' eggs may be present through the whole year, albeit Lack (1950) raised doubts that eggs were laid before April. Even if our IOB date is a slight overestimation, active nests records clearly shows that *B. galapagoensis* start to breed in the first half of the year, more than 100 days before Southern Hemisphere's equinox. This pattern is clearly different from all other Southern Hemisphere's units, but coincident with tropical *G. polyosoma*.

The similarity between some atypical estimates on the equatorial region and the prevalent IOB pattern of the opposite hemisphere is uncanny. It raises the possibility that, when very close to the equator, at least some diurnal raptors can breed irrespective to vernal equinox, and rather closer to the autumnal, as suggested by Baker (1938). Other distantly related buteonines with odd active nest dates in the equatorial zone, *Morphnarchus princeps* and *Leucopternis kuhli* (respectively, from Polygons 11 and 14), could support that fact. Yet, their units have exceptionally poor samples to draw any conclusion. These two records come from regions with equatorial, fully humid climate (Af *sensu* Kottek et al. 2006), very unlike the seasonally dry areas of Ecuador that yielded the early dates of *G. polyosoma* and *B. galapagoensis*. It also lead to questioning if the previously discarded 'outlying' IOB date of *Rupornis magnirostris* (Navarro et al. 2007) might be in fact correct, albeit it come from a more northern latitude.

Rainfall is constantly suggested as a factor regulating avian breeding seasonality (Mezquida 2003, Repenning and Fontana 2011). It would be more relevant in the tropics (Baker 1938), especially for raptors (Newton 2010), including *G. polyosoma* (Cabot et al. 2010a). Wyndham (1986) hypothesized that BSLs are longer in areas with reduced and unpredictable rainfall, as supported by Patten and Erickson (2000). Also, it was suggested that such unpredictability select for variability in breeding seasons' timing and extension (Winkler 2004, Newton 2010). The fairly long BSL estimate for *B. galapagoensis* (around six months; Table 5), and Ecuadorian active nest dates of *G. polyosoma* (Supplemental Table S1), apparently support these two hypotheses, as their records came from areas with such attributes. Faaborg et al. (1980) already suggested that an early onset of wet season could lead to earlier breeding in *B. galapagoensis*, whilst the divergent breeding season of *G. polyosoma* farther north might result of atypical and somewhat less favorable conditions faced by populations at species' range margins (e.g., Kennedy et al. 1995).

Yet, we did not find definite indicative that BSLs of accipitrids become more variable in any unpredictable environment, with the exception of Ecuadorian units. Wyndham (1986) alleged that such arid areas of Ecuador are unparalleled in the Southern Hemisphere in many climatic aspects. Farther south in the continent, results were totally different from the exposed above. With decreased but unpredictable seasonal variations on climate (and therefore food supplies) in the Southern Cone (Jahn and Cueto 2012), year-to-year variation in breeding seasons could rise accordingly (Skutch 1950, Marchant 1960, Brawn 1991, Mezquida 2003). Likewise the chances of overestimating BSLs for the temperate range, when pooling together records from many years, also would increase (Auer et al. 2007, Marques-Santos 2014). This whole situation could theoretically be aggravated when larger number of years are contained in each unit sample, as *a priori* tests suggested. Still, BSL estimates from the southern temperate range did not differ significantly from the tropical ones, and also varied relatively little within TempS range (CV = 32.102%).

Therefore, our analyses found no further support for the unpredictability hypothesis of longer BSLs (Wyndham 1986), and thus we disagree that it should be applied to avian populations in general (Winkler 2004, Newton 2010), unless further evidence came to be found elsewhere than the dry areas of Australia and Ecuador (see also “Absence of phylogenetic constraints at lower taxonomic levels”). Nevertheless, IOB estimates varied significantly more than BSLs within the temperate range, but our samples prevent concluding whether this reflects increased variability on the dates between years. Also, both Migrants and Non-migrant units from there were not statistically different in this aspect, so we have no support for a relation with migratory behavior neither (see “Undetected effects of migratory behavior and isolation”).

In some respects, the northern tropical range was the most heterogeneous in seasonality estimates. This might be linked to the higher diversity of clades among its units, relative to other ranges’ diversities. Nonetheless, there is no evidence that such diversity significantly affected the analyses’ results (see “Absence of phylogenetic constraints at lower taxonomic levels”). Dates of IOB varied in a predictable way, never approaching autumnal equinox and consistent with most TropS IOBs of relevant sample sizes. Whitacre and Burnham (2012) reported breeding season of a Central American raptor community to start slightly later than our IOB estimates for TropN range. It may be an outcome of our broader geographical scope, leading to the assembling of dates earlier than that community’s. Polygon 7, which includes the area studied by those authors, also has an earlier IOB date, and a longer BSL than those reported by them. Baker (1938) found a pattern of diurnal raptors’ breeding seasonality consistently similar to our findings, within TropN range (Fig. 10). Some of the differences probably may be due to the inclusion of other taxa under

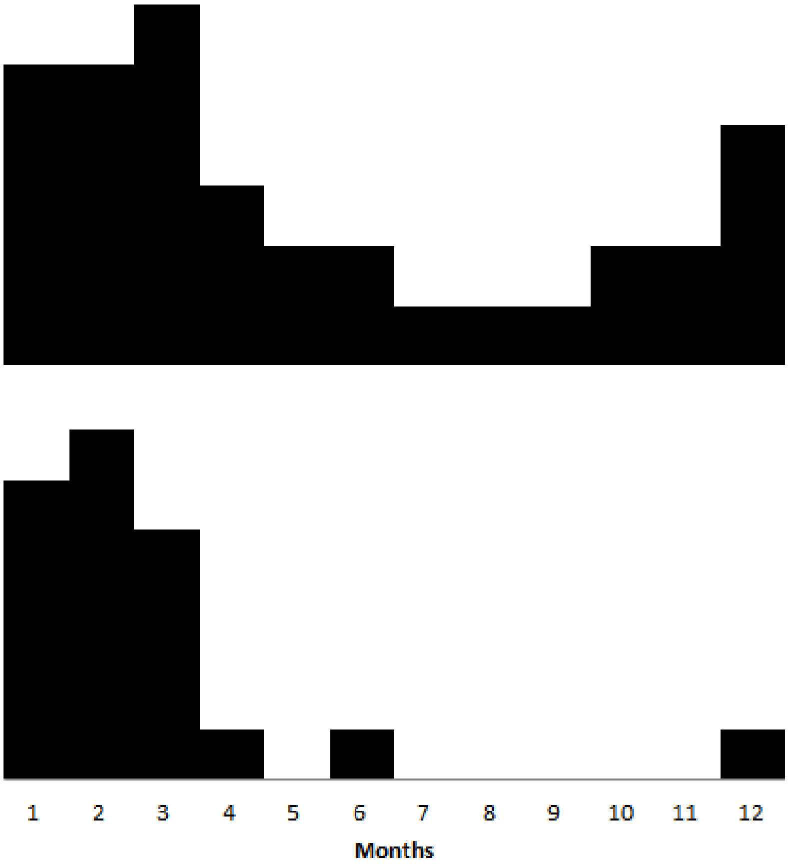

Figure 10. Comparison of dates of initiation of breeding season (IOB) in the Tropical North (TropN) latitudinal range (below; this study), and roughly the same range (0 - 20° N) in the study of Baker (1938; above). Baker’s plot presents IOBs per month of the year, for species of diurnal raptors (“Accipitres”, plotted with ‘Coraciiformes’ for having the same pattern). Our plot shows the totals of IOBs per month, for buteonines’ units. Top plot re-drawn from ‘text-figure 16’, in Baker (1938, p. 577).

“Accipitres” in the plot, and our taxonomic scope being much narrower.

Values of BSL consistently varied less than those of IOB, in all three latitudinal ranges (and also, yet untested, in the analysis of migration). This indicates that at least no significant bias was introduced in these analyses – since we found evidence that increasing number of years included in each unit could account for a slight elevation in their BSL estimates. Lengths of breeding seasons also did not vary in any predictable way when comparing Polygons (Fig. 9), but their estimates were consistently longer than those calculated for most units. Such result is expected, as estimates for Polygons were obtained by pooling many different species together (but see “Absence of phylogenetic constraints at lower taxonomic levels”). Unfortunately, southern tropical units with relevant-sized samples are very scant. The much bigger variation among TropS range’s IOB estimates than among BSLs is hardly explanatory, as it should have been induced by two highly deviated estimates discussed previously.

Including temperate range and ignoring equatorial ‘atypicals’, almost all Neotropical buteonines seem to start breeding well before spring. A few earliest IOB dates are even before the onset of winter, but generally speaking, these accipitrids are mostly winter breeders. Compared to passerine communities at both lower northern latitudes and through the Southern Hemisphere (e.g., Cruz and Andrews 1989, Wikelski et al. 2003, Di Giácomo 2005, Auer et al. 2007, Marques-Santos et al. 2015), Neotropical buteonine’s season come relatively much earlier. This was expected as larger birds tend to breed earlier, due to longer nesting cycles (Winkler 2004). Albeit significant climate variation occur between regions (Kottek et al. 2006), these birds can be considered mostly dry season nesters, as Skutch (1950) tentatively suggested (based on only one species).

Relationship with day-length. There is a pattern of IOBs starting up to 100 days before equinox when both tropical ranges are considered. Such pattern considerably diverges from some seasonality data on tropical accipitrids from other biogeographical realms, that initiate breeding much closer to or after the vernal equinox (Bell 1982, Newton 2010). Yet, there may be convergence with local climatic seasonality, as most of these species (particularly the larger-sized) are dry season nesters. Results from Australia (Olsen and Marples 1993) are barely comparable due to presence of many taxa phylogenetically very distant from buteonines, but especially because presentation of data was not clearly separated by latitudinal ranges. The only detailed information obtained is that one comparable-sized species of Accipitrinae (*Hieraaetus morphnoides*; Dunning 2008) lay some time before the equinox in the tropical range, and closer to or a little after it in higher latitudes. That is, also delayed relative to Neotropical buteonines.

The delayed initiation dates from temperate South America are more similar with breeding data of other temperate regions' accipitrids, consistent with the concept of higher convergence in breeding seasonality at higher latitudes (Newton 2010). Yet, IOBs of buteonines are also relatively earlier at this continent. For instance, Newton (2010) showed that the breeding season of a Palearctic *Buteo* hawk starts subsequent to vernal equinox. More importantly, in Nearctic temperate regions buteonines seldom start laying before March, and most breeding seasons begin either very close to or after the equinox (Rodewald 2017). South America's temperate range lies at relatively lower latitudes (Yom-Tov et al. 1994), but the same applies to Australia and some accipitrids may start breeding later there than at the former (Olsen and Marples 1993). Decreased climate seasonality in the continent also do not seems to be the cause, as other Neotropical Accipitrinae (e.g., Hayes 2014) also appear to breed later than buteonines. Phylogenetic constraints are also not an explanation, since the buteonines from temperate North America mentioned above are, on average, closer to some South American species (actually, many pertain to the same species) than the latter are to other sympatric Neotropical buteonines analyzed by us. Finally, relation with size

(Newton 2010) also do not seems possible, for the same reason above. A longer nesting cycle might be an explanation (Winkler 2004, Whitacre and Burnham 2012; but see next subsection), yet certainly this subject still demands investigation.

The steady relation between IOB dates and the equinox suggest that accipitrid raptors ‘track’ day-length changes through the year to adjust their breeding seasons (Olsen and Marples 1993). It does not mean that photoperiod itself is an ultimate factor selecting for specific breeding seasons (Lack 1947). In fact, Baker (1938) early noted that “neither a long day, nor yet a rapidly increasing day, are necessary concomitants of rapid reproduction by birds”. Albeit that author noted that laying do not occur at extremely short day-lengths, he verified that neither raptors nor other birds start breeding at the longest days of the year, but before them, as supported by Newton (2010) and clearly shown by our results. Support for day-length as a predictive long-term environmental cue perceived by birds to onset breeding has already been demonstrated with passerines (Miller 1965, Lima and Roper 2009), suggesting that such trait may be widespread in many different tropical vertebrates (Wikelski et al. 2000). Yet, we stress that most data presented for raptors on this subject come from Falconidae (Baker 1938, Newton 2010), a group much closer to passerines (Cracraft 2013), and hence expected to respond similarly.

Also, besides the proximate cue of day-length, it is still unclear which other ‘supplementary information’ (Hau 1998) diurnal raptors could perceive to further fine-tune their breeding timing. Some authors argue for a prominent role of temperature (particularly on temperate regions; Baker 1938, Balen 1973, Lima and Roper 2009), or possibly of many different factors interacting with each other (Skutch 1950, Repenning and Fontana 2011). Others argue that rainfall would be more relevant than temperature in the tropics (Baker 1938), and more closely linked to prey availability for raptors, especially on drier regions (Newton 2010), as Cabot et al. (2010a) suggested for *G. polyosoma*. Thus, the ultimate factor will necessarily be food availability (Snow 1962, Perrins 1970, Santana and Temple 1988), that for tropical raptors could also act as a proximate cue (Newton 2010). In larger-sized raptors, earlier breeding could be necessary to adjust the timing of their offspring's food demands with their prey's usually shorter life cycles (Winkler 2004).

Undetected effects of migratory behavior and isolation. Migratory behavior was found not to influence BSL, albeit Non-migrants consistently presented sightly longer breeding seasons. With these evidence, we support that also in Neotropical diurnal raptors, short-distance migrants (at least from temperate range) are not substantially different from sedentary populations in breeding seasonality, like verified with South American passerines (Yom-Tov et al. 1994). Yet, we do not discard that migratory status is not properly assigned for many Neotropical diurnal raptors (e.g., Bierregaard 1995, Bildstein 2004, Amaral et al. 2009, Lees and Martin 2014). A delayed IOB is also seemingly absent on the migrant units analyzed by us, like the results obtained by Murphy (1989).

We do not rule out the existence of some time-constraint for migrants' breeding, probably similar to that presented by some passerines from that same temperate region (Repenning and Fontana 2011). In buteonines, this constraint may rely on some stage of the active nest. Yet, at least in two closely related species of Tropical buteos, *Buteo albigula* and *B. brachyurus*, incubation and nestling periods do not seem to diverge between migrants and non-migrant populations, subspecies and species (Ojeda et al. 2003, Meyer 2004, Rizkalla et al. 2009, Monsalvo 2012). These similarities are in agreement with the findings of Ricklefs and Bloom (1977), of little geographical variation in the nesting cycle of passerines from different communities.

A possible time-constaint for some migrant species could be the duration of fledgling stage. There are a few isolated observations of non-migrant volant juveniles consistently lingering in the nest, for a period more than three times longer than that recorded for migrant juveniles (Monsalvo 2012, and references therein). This could further confound the assessment of a nest stage, something already dubious in literature records (Steenhof et al. 2017). However, longer fledgling stages in non-migrants do not hold true for other New World *Buteo* hawks (e.g., Santana and Temple 1988), so in many other accipitrid species, differences might actually be in longer incubation and nestling periods (Newton 2010, Whitacre and Burnham 2012).

The absence of any clear ‘island effect’ on breeding traits of birds on tropical islands also occurred in other previous studies (Cody 1966, Crowell and Rothstein 1981). Yet, it was expected that substantial levels of reproductive and/or evolutionary isolation could lead to increasing divergence in breeding parameters (Lack 1947, Cody 1966). The Neotropical region is relatively rich in buteonines treated as Evolutionarily Significant Unities, particularly in the Caribbean, with insular raptors ranging from isolated and differentiated island populations without a *nomem* (e.g., *Buteogallus urubitinga* in Trinidad), to others recognized as full, island endemic species (e.g., *Buteo ridgwayi*) (White and Kiff 2000). Thus, there are phylogenetic evidence that the island populations that we analyzed are indeed isolated from mainland, despite the impressive dispersal capabilities of the buteonines group (Amaral et al. 2009).

The absence of detectable differences on breeding traits of insular populations is even more surprising, when considering that some *Buteo* hawks presents a number of signals of fast adaptability to new environments, with behavioral plasticity leading to quick diversification. For instance, most insular endemic buteos might have diverged from mainland taxa very recently (Riesing et al. 2003, Hull et al. 2008), and the Caribbean also holds a number of possible ‘cryptic’ species of buteonines (White and Kiff 2000). Moreover, island buteos may present very unusual breeding behaviors such as prevalence of polyandry

(Faaborg and Patterson 1981; but see Cabot et al. 2010b, Rivas-Fuenzalida 2015), also denoting the plasticity mentioned before.

Despite the above, other studies on insular *Buteo* hawks reported that their nesting cycles did not diverge from conspecific or closely related mainland populations (Woolaver et al. 2015). With some species, on the other hand, breeding season can start much earlier, and both laying dates within the population and stages such as post-fledging dependency period can last much longer than with temperate regions' populations (Santana and Temple 1988). Again, the non-inclusion of this last stage on our estimates (also due to the non-existence of this kind of data for most Neotropical populations), and the fact that comparison was made within a same latitudinal range, might respond for no significant difference in BSL. We suggest that, as insular populations of accipitrids are exposed to the same day-lengths and similar environmental seasonality than adjacent mainland's, and all else being equal (Cody 1966), BSLs are not expected to differ.

Absence of phylogenetic constraints at lower taxonomic levels. We carefully verified for the occurrence of possible underlying phylogenetic effects. First, *a posteriori* comparisons between the two predominant clades, *Buteogallus* and *Geranoaetus*, found no reliable differences between them, regarding variation on IOB and BSL estimates. Both genera are composed of similar-sized (503 – 2950g for *Buteogallus* spp. vs. 501 – 3200 g for *Geranoaetus* spp.; Dunning 2008), fairly large soaring raptors of varied but mostly opportunistic feeding habits, with a few exceptions (GRIN 2016). They seemingly maintained the overall pattern of IOBs closer to the equinox in the temperate range than in the tropics. Yet, as estimates for *Geranoaetus* units were always more varied than those of *Buteogallus*, we do not discard a phylogenetic effect.

We speculate that polymorphic populations are more able to respond in more diversified ways to geographical gradients, due to the increased genetic variability linked to color polymorphism (Fowlie and Krüger 2003). Among *Geranoaetus* spp. variation was more pronounced in species with color polymorphism (*G. polyosoma* and *G. albicaudatus*, yet the latter had most units below threshold values of relevant size) than in the monomorphic *G. melanoleucus*. Also, all *Buteogallus* species are monomorphic with respect to plumage coloration (Erize et al. 2006). Polymorphism has already been related to other demographic parameters on accipitrids, that could ultimately lead to a lower risk of extinction relative to monomorphic populations (Krüger and Radford 2008).

Despite the wide variety of buteonine clades included in this study, even pairwise comparisons between closely-allied units were impaired by insufficient or highly divergent sample sizes (Table 9). Probably the only trustworthy assessment is comparing the pair *Buteo jamaicensis* and *B. ventralis*. Their sample sizes were equivalent in both numbers of active nests and years included for each unit, but these diverged in all other categories but phylogeny: latitudinal range, hemisphere, biogeography and migratory behavior. Both taxa probably pertain to the same species (Clark 1986, Riesing et al. 2003) or at least superspecies (Remsen et al. 2017). Whilst BSL was essentially the same between the two (around five months), the north tropical *B. jamaicensis* starts its breeding season more than twice as early, relative to vernal equinox, than the south temperate *B. ventralis*.

This case is a very emblematic example of our overall findings, with estimates of IOB from higher latitudes being delayed relative to tropical ones, and lengths of breeding seasons varying, in general, less – or at least less predictably. It is remarkable that in eastern United States, BSL of *B. jamaicensis* can last around seven months, at a similar latitudinal range and in populations with the same migratory behavior of *B. ventralis* (Preston and Beane 2009). This raises further doubts about the applicability of Wyndham’s (1986)

Table 9. Comparisons of sister taxa of Neotropical buteonines, with regard to categories, and to variation in IOB and BSL estimates.

	Clade	**Species**	**Unit**	**Latit. range**	**Island category**	**Migrant category**	***N***	**Years (min.)**	**IOB**	**BSL**
ST 1	***Buteogallus***	*Buteogallus anthracinus*	Bg_ant nom	TropN	Mainland	1	94	24	-64	201
		Buteogallus gundlachii	Bg_gundl	TropN	InsPop	0	38	5	-33	181
ST 2		*Buteogallus meridionalis*	Bg_merid 1	TropN	Mainland	0	102	9	-64	339
			Bg_merid 3	TempS	Mainland	0	80	28	-18	169
ST 3	**Other basal**	*Rupornis magnirostris*	Rupor 1	TropN	Mainland	0	163	34	-64	303
			Rupor 2	TropS	Mainland	0	23	9	-69	215
			Rupor 3	TempS	Mainland	0	46	29	-7	181
ST 4	***Geranoaetus***	*Geranoaetus polyosoma*	G_pol north	TropS	Mainland	1	20	7	-186	249
			G_pol cont	TempS	Mainland	1	37	16	-15	89
ST 5		*Geranoaetus melanoleucus*	G_mel trop	TropS	Mainland	0	20	6	-99	183
			G_mel temp	TempS	Mainland	1	83	23	-69	215
ST 6	**Buzzards**	*Buteo jamaicensis*	jamaic	TropN	InsPop	0	60	8	-95	152
		Buteo ventralis	ventralis	TempS	Mainland	1	51	8	-38	153

ST = sister taxa; Migrant category = (1) Migrant, (0) Non-migrant; *N* = number of active nests (ANs); Years (min.) = minimum number of years from which the AN records came from; IOB = date of the earliest AN of the unit's breeding season, relative to equinox (negative numbers = before the equinox); BSL = estimated length of the unit's breeding season, in days.

hypothesis of longer BSLs to accipitrids of temperate South America. And also, further support the pattern of overall shorter breeding seasons in this continent (Auer et al. 2007, Lima and Roper 2009, Marini et al. 2012, Marques-Santos et al. 2015).

Observed differences in IOB estimates were probably not explained by distinct faunal composition, as indicates the comparison of clades' frequencies between the latitudinal ranges presented before (Appendix 3). The two ranges more similar with respect to clades' presence-absence and abundance, were the most different in IOB estimates. So, these outcomes further denotes the reliability of such comparative analyses when performed within lower taxonomic levels (Partridge and Harvey 1988, Murphy 1989, Kulesza 1990). This approach also effectively removes possible confounding effects of body size (e.g., Yom-Tov 1987) on breeding parameters, as no pattern of larger-sized species breeding earlier (consistently found at Family level or above; Winkler 2004, Newton 2010, Whitacre and Burnham 2012) was apparent in our analyses.

***A posteriori* hypotheses, conclusions and recommendations.** Results suggest that accipitrid raptors respond to day-length stimuli, and these may be the main proximate clues determining the onset of their breeding seasons (Olsen and Marples 1993). Also, we suggest that selection is for IOB dates mostly before the vernal equinox in tropical range, and more delayed ones in higher latitudes (sometimes after equinox; Baker 1938). And, relative to the equinox, Neotropical populations of buteonines apparently start breeding consistently earlier than other accipitrids, either in the same range or elsewhere. In equatorial regions, there may be no selection for breeding seasons of buteonines' populations to start always somewhat closer to vernal equinox. So, we predict that such seasons may start either closer to this, or to the autumnal one, because day-lengths at both these times of the year do not differ substantially in these areas (Baker 1938).

Unpredictability on climate do not necessarily select for longer breeding seasons in birds, as factors other than this may affect the outcome. So, Wyndham (1986) hypothesis of BSLs longer in areas with reduced rainfall and unpredictable seasonal variations on climate should not apply to any drier environment and any avifauna associated to it. Also, among Neotropical buteonines, short-distance migrants do not seem to face substantial time-constraints for their breeding seasons, and therefore their BSLs are indeed very similar to those of non-migrant populations (Repenning and Fontana 2011). Yet, there may be significant differences between them in the lengths of at least some stage of the nesting cycles (Santana and Temple 1988, Newton 2010). We predict that in most of these species, volant juveniles of non-migrants spend more time associated to the nest than migrant ones (Monsalvo 2012, Whitacre and Burnham 2012).

Among insular populations of birds, reproductive and/or evolutionary isolation alone do not select for increasing divergence in breeding parameters relative to mainland closely-related populations (Cody 1966), if both are exposed to the same overall conditions (day-lengths, environmental seasonality etc.). So, we predict that isolated populations of buteonines in temperate islands will present longer BSLs than closely-related mainland’s at similar latitude, because of decreased environmental seasonality experienced by the former. Albeit precluded by our samples, our analyses hinted that a promising subject would be to verify if increased genetic variability of polymorphic raptor populations (Fowlie and Krüger 2003) can lead to more variation in breeding parameters among geographical gradients. We speculate that, all else being equal, a buteonine population without color polymorphism may have less varied breeding traits than a polymorphic one.

We consistently found evidences of geographical variation in Neotropical buteonines' reproductive aspects, despite the shortage of data on different populations. The assessment of the magnitude of such differences are compromised until more ecological and behavioral data are available for lower latitudes and/or Southern Hemisphere birds (Partridge and Harvey 1988, Martin 1996, Heming et al. 2013). The scarcity of breeding information highlights how much research is still needed for most Neotropical species (Bierregaard 1995, Alves et al. 2008), particularly north of the Southern Cone of South America (Baker 1938, Capítulo 1). Regardless of the need for field observations, the amount of information we and other authors (Murphy 1989, Olsen and Marples 1993, Hayes 2014) gathered from museums confirms how careful scrutiny of oological collections could help fill some gaps in knowledge (McNair 1987). Moreover, we also advocate that, even with data far from ideal, a parsimonious approach can indeed provide novel evidence, and put forward new testable hypotheses (Mezquida 2002, Lima and Roper 2005).

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APPENDICES

Appendix 1. Samples of active nests' records ('units') of 27 species of Neotropical buteonines.

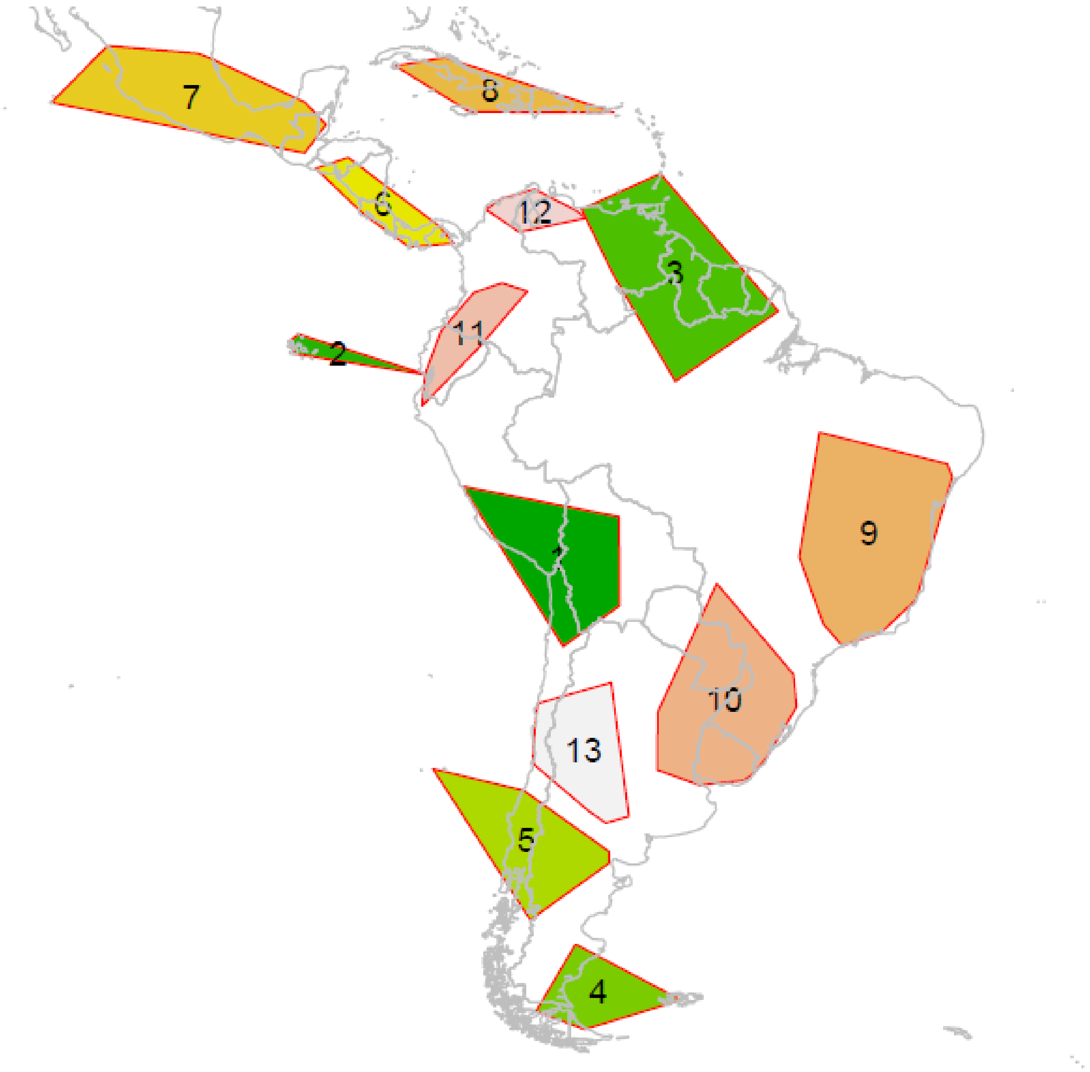
Unit	**Species**	**Latit. range**	**Assigned clade**	**Included subspecies**	**Migrant category**	**Island category**
Bg_ant nom	*Buteogallus anthracinus* 'nominate'	TropN	*Buteogallus*	*anthracinus*	1	Mainland
Bg_ant subt	*Buteogallus anthracinus* '*subtilis*'	TropN	*Buteogallus*	*bangsi, rhizophorae*	0?	Mainland
Bg_gundl	*Buteogallus gundlachii*	TropN	*Buteogallus*	NA	0	InsPop
Bg_aeq	*Buteogallus aequinoctialis*	TropN	*Buteogallus*	NA	0	Mainland
Bg_merid 1	*Buteogallus meridionalis*	TropN	*Buteogallus*	NA	0	Mainland
Bg_merid 2	*Buteogallus meridionalis*	TropS	*Buteogallus*	NA	0	Mainland
Bg_merid 3	*Buteogallus meridionalis*	TempS	*Buteogallus*	NA	0	Mainland
Bg_lacer	*Buteogallus lacernulatus*	TropS	*Buteogallus*	NA	0	Mainland
Bg_urub 1	*Buteogallus urubitinga*	TropN	*Buteogallus*	*ridgwayi, urubitinga*	0	Mainl+InsPop
Bg_urub 2	*Buteogallus urubitinga*	TropS	*Buteogallus*	*urubitinga*	0	Mainland
Bg_urub 3	*Buteogallus urubitinga*	TempS	*Buteogallus*	*urubitinga*	1	Mainland
Bg_solit N	*Buteogallus solitarius*	TropN	*Buteogallus*	*sheffleri*	0	Mainland
Bg_solit S	*Buteogallus solitarius*	TropS	*Buteogallus*	*solitarius*	0	Mainland
Bg_cor trop	*Buteogallus coronatus*	TropS	*Buteogallus*	NA	0	Mainland
Bg_cor temp	*Buteogallus coronatus*	TempS	*Buteogallus*	NA	0	Mainland
Morph N	*Morphnarchus princeps*	TropN	Other basal	NA	0	Mainland

Morph S	*Morphnarchus princeps*	TropS	Other basal	NA	0	Mainland
Rupor 1	*Rupornis magnirostris*	TropN	Other basal	(several)	0	Mainland
Rupor 2	*Rupornis magnirostris*	TropS	Other basal	*magniplumis, saturatus*	0	Mainland
Rupor 3	*Rupornis magnirostris*	TempS	Other basal	*pucherani, magniplumis*	0	Mainland
Par_uni trop	*Parabuteo unicinctus*	TropN	Other basal	*harrisi*	0	Mainland
Par_uni temp	*Parabuteo unicinctus*	TempS	Other basal	*unicinctus*	0	Mainland
Par_leuc 1	*Parabuteo leucorrhous*	TropN	Other basal	NA	0	Mainland
Par_leuc 2	*Parabuteo leucorrhous*	TropS	Other basal	NA	0	Mainland
Par_leuc 3	*Parabuteo leucorrhous*	TempS	Other basal	NA	0	Mainland
G_albic 1	*Geranoaetus albicaudatus*	TropN	*Geranoaetus*	*colonus, hyposdodius*	0	Mainl+InsPop
G_albic 2	*Geranoaetus albicaudatus*	TropS	*Geranoaetus*	*albicaudatus*	0	Mainland
G_albic 3	*Geranoaetus albicaudatus*	TempS	*Geranoaetus*	*albicaudatus*	0	Mainland
G_pol north	*Geranoaetus polyosoma* 'tropical'	TropS	*Geranoaetus*	*fjeldsai, poecilochrous, polyosoma*	1	Mainland
G_pol cont	*Geranoaetus polyosoma* 'continent'	TempS	*Geranoaetus*	*polyosoma, fjeldsai*	1	Mainland
G_pol ins	*Geranoaetus polyosoma* 'islands'	TempS	*Geranoaetus*	*exsul, polyosoma*	0	InsPop
G_mel trop	*Geranoaetus melanoleucus*	TropS	*Geranoaetus*	*melanoleucus, australis*(northern Andes)	0	Mainland
G_mel temp	*Geranoaetus melanoleucus*	TempS	*Geranoaetus*	*australis, melanoleucus*(Argentina)	1	Mainland

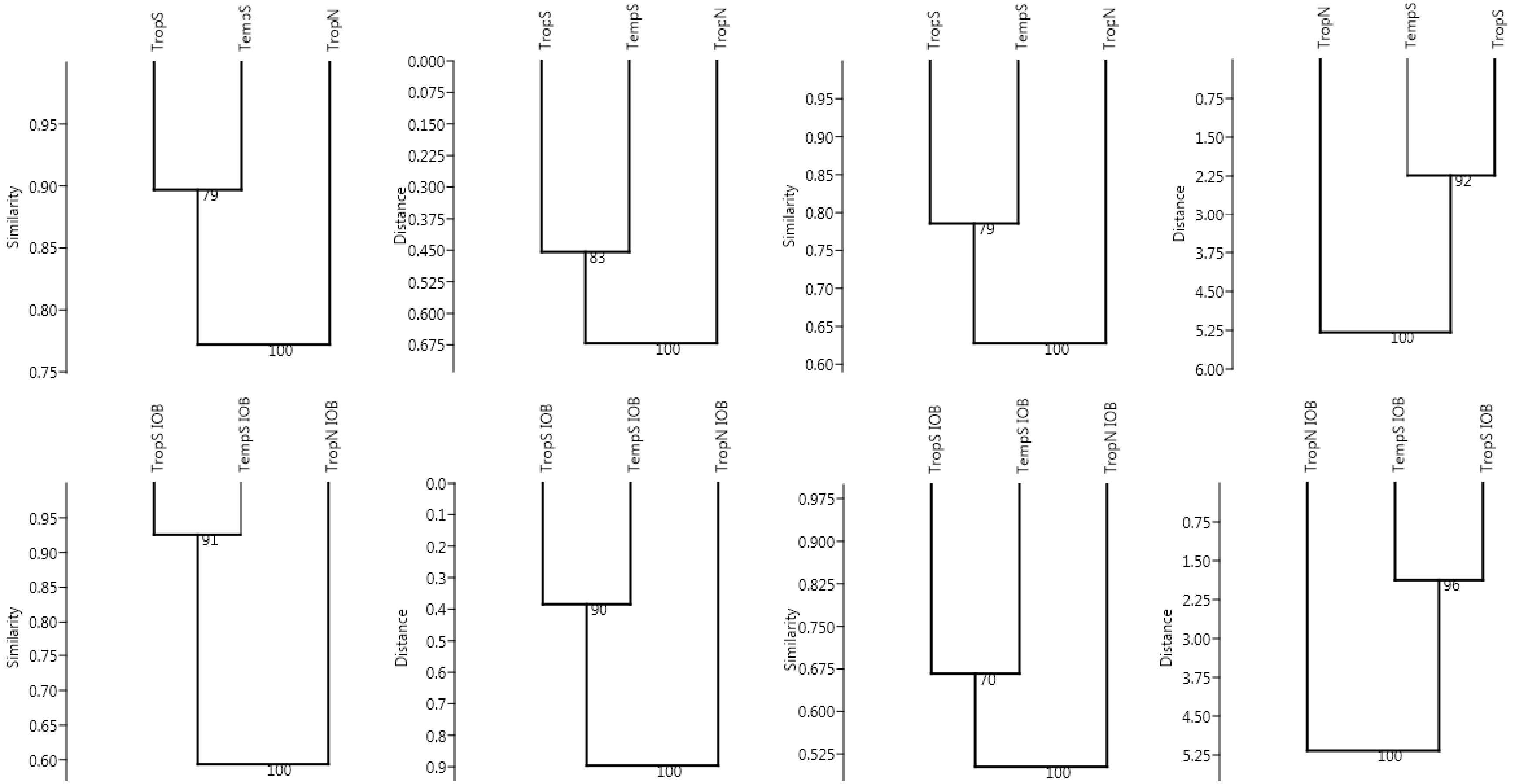
Pseud N	*Pseudastur albicollis*	TropN	*Leucopternis*	*costaricensis, albicollis*	0	Mainl+InsPop
Pseud S	*Pseudastur albicollis*	TropS	*Leucopternis*	*albicollis*	0	Mainland
L_kuhli	*Leucopternis kuhli*	TropS	*Leucopternis*	NA	0	Mainland
plagiat	*Buteo plagiatus*	TropN	Basal buteos	NA	0	Mainland
nitidus	*Buteo nitidus*	TropN	Basal buteos	*nitidus*	0	Mainl+InsPop
ridgwayi	*Buteo ridgwayi*	TropN	Basal buteos	NA	0	InsPop
platypt	*Buteo platypterus*	TropN	Basal buteos	*brunnescens, rivierei, antillarum*	0	InsPop
albigula	*Buteo albigula*	TempS	Tropical buteos	NA	1	Mainland
brachy 1	*Buteo brachyurus*	TropN	Tropical buteos	*fuliginosus, brachyurus*	1	Mainland
brachy 2	*Buteo brachyurus*	TropS	Tropical buteos	*brachyurus*	0	Mainland
brachy 3	*Buteo brachyurus*	TempS	Tropical buteos	*brachyurus*	0	Mainland
galapag N	*Buteo galapagoensis*	TropN	Tropical buteos	NA	0	InsPop
galapag S	*Buteo galapagoensis*	TropS	Tropical buteos	NA	0	InsPop
albonot	*Buteo albonotatus*	TropN	Buzzards	NA	1	Mainl+InsPop
jamaic	*Buteo jamaicensis*	TropN	Buzzards	*jamaicensis, socorroensis, solitudinis*	0	InsPop
ventralis	*Buteo ventralis*	TempS	Buzzards	NA	1	Mainland

Latitudinal range: (TropN) between the Tropic of Cancer and the equator; (TropS) between the equator and the Tropic of Capricorn; (TempS) latitudes below the Tropic of Capricorn. Migrant category: (1) Migrant; (0) Non-migrant. Island category: Mainland = records from continental mainlands; InsPop = records coming from any kind of insular population (except islands from inland waters); Mainl+InsPop = sample with both categories, each of these accounting for less than 80% of the unit’s records. Further explanations on the main text.

Appendix 2. Polygons generated by Affinity propagation (AP) clustering, using coordinates of all Neotropical buteonines' breeding records obtained in this study, and shapefiles from WWF's "Terrestrial Ecoregions of the World" (TEOW; Olson et al. 2001). Polygons 3 and 12 were later merged into one ('Polygon 14').



Appendix 3. Hierarquical clustering dendrograms of buteonine clades' composition among the three latitudinal ranges, with respect to clades' presence-absence and abundance. Data analyzed was the number of units per clade within each range. Dendrograms in the top row refer to the range's entire faunal composition (i.e., all units, regardless of their sample sizes); and in the bottom, scenario with only relevant-sized units used for IOB estimates. From left to right, indices are: Cosine similarity, Chord distance and Bray-Curtis (all three with algorithm Unweighted pair-group average – UPGMA); and Euclidean distance (Ward's method). The percentage of bootstrap replicates where nodes are supported is presented on the dendrograms. All results point out to a higher similarity between both Southern Hemisphere's ranges.



CONSIDERAÇÕES FINAIS

A principal mensagem provida pelo Capítulo 1 é extremamente preocupante: a comunidade científica ainda sabe muito pouco sobre a reprodução de raptores diurnos na América do Sul, especialmente nas menores latitudes. A grande adaptabilidade demonstrada (ou ao menos, sugerida) por muitas espécies acaba dificultando o progresso de nosso entendimento sobre elas. Primeiramente, populações distintas podem diferir muito mais em sua biologia reprodutiva do que inicialmente pensávamos. E com tanta plasticidade nas respostas, não surpreende que ainda saibamos tão pouco sobre como tais populações respondem a mudanças ambientais, de maneiras que podem até soar incoerentes com o que nosso conhecimento prévio sugeria.

A tendência em um quadro como esse é de nos preocuparmos mais com as espécies sob maiores graus de ameaça, como aquelas restritas a florestas primárias. Por mais que muitos destes resultados realmente passem essa mensagem, espero ter destacado como ornitólogos da América Latina têm suas espécies ‘preferidas’, dentre estas muitas que se enquadram na situação exposta acima. Mas as mais generalistas são deixadas de lado, e é surpreendente ver como não sabemos quase nada sobre algumas destas, tão mais facilmente ‘estudáveis’. Ainda pior é a situação daquelas que não são consideradas ameaçadas, mas também não são de forma alguma generalistas, e acabam caindo em uma espécie de limbo de desconhecimento que oculta riscos reais à persistência de suas populações, caso dos antigos (e atuais) *Leucopternis* spp..

Os problemas que apresentamos no Capítulo 1 ecoam de forma muito clara no Capítulo seguinte. Como mencionamos, optei por analisar os buteonines pois realmente pareciam a melhor opção de objeto de estudo. Mas mesmo um grupo diversificado e relativamente bem estudado, de espécies muitas vezes generalistas, acabou revelando uma maior escassez de dados reprodutivos em quantidade e qualidade aceitáveis, do que esperava encontrar. Por mais que conheçamos em média relativamente bem sobre esse clado e sua reprodução, a distribuição geográfica dessas informações mostra que na realidade o que mais temos são apenas recortes, que podem nem sempre ser representativos. Vide o exposto mais acima.

Nenhuma das situações apresentadas é exatamente nova, como mostram os comentários de Baker há 80 anos, sobre a urgência em obter mais dados reprodutivos sobre aves da região tropical sul da América do Sul, repetidos por Bierregaard há mais de duas décadas, quando analisou o estado do conhecimento sobre os raptores do Neotrópico. Justamente por não ser um quadro recente, e por mostrar sinais de melhora a um ritmo tão lento, que toda a atenção que puder atrair para esse problema, a meu ver ainda é pouca.

O conhecimento científico avança de modo mais lento e menos seguro com essas limitações. Mas como outros também já frisaram, ainda assim é possível produzir novos conhecimentos sobre a avifauna neotropical. Por exemplo, as coleções oológicas espalhadas em museus ao redor do mundo contém dados às vezes mais detalhados sobre um estágio fundamental do período de nidificação dos raptores, do que a maior parte da literatura fornece. Obviamente, todo cuidado é pouco com esse tipo de informação. Mas há possíveis meios de validá-la (ex., relações alométricas tamanho da fêmea vs. medidas do ovo), e isso pode levar tanto a correções, como às vezes até a novas ‘(re-)descobertas’.

E acima de tudo, ornitólogos que realizam estudos de história de vida precisam abandonar as generalizações pouco cuidadosas. Pressupostos do Neártico são transpostos para o Hemisfério Sul, de Passeriformes para seus predadores, e de uma população no limite de sua distribuição para toda sua área de ocorrência. Esses tem sido procedimentos tão predominantes nessa área, que tornam-se tão preocupantes e podem restringir tanto os reais avanços no conhecimento, quanto a falta de informação por si só.

MATERIAIS SUPLEMENTARES

Appendices I, II, III e IV – referentes ao Capítulo 1/manuscrito submetido à RBO

Supplemental Table S1 – referente ao Capítulo 2

APPENDIX I

Literature references with breeding data of 56 species of Neotropical Accipitriformes, produced between 1995-2016.

Species	Located references
Elanus leucurus	Erichsen et al. 1996; McMillian & Pranty 1997; Sick 1997; Pranty & McMillian 1997; Arballo & Cravino 1999; Carvalho et al. 2001a; Maceda & Kin 2001; Wheeler 2003; Antas 2004; Leveau et al. 2004; Chatellenaz 2005; De La Peña 2005; Di Giacomo 2005; Joppert 2007; Niemela 2007; Pérez León 2007; Scheibler 2007; Carvalho Filho et al. 2008; Gussoni & Guaraldo 2008; González-Acuña et al. 2009; Chatellenaz et al. 2010; Furman & Bastías 2012; Montalvo et al. 2014; Alvarado et al. 2015; Camacho-Varela & Acosta-Chaves 2015; Romano et al. 2015
Gampsonyx swainsonii	Martínez 1998; Reichle et al. 2003; Di Giacomo 2005; Jones 2005; Strewe et al. 2009; Sandoval et al. 2010
Chondrohierax uncinatus	Ericson & Amarilla 1997; Di Giacomo 2000; Thorstrom et al. 2001; Clark 2002; 2003; Krügel 2003; Reichle et al. 2003; Clark 2004; Brush 2005; Rappole et al. 2007; Carvalho Filho et al. 2008; Thorstrom & McQueen 2008; Canuto 2009; Whitacre & Vásquez 2012; Sampaio et al. 2013; Phillips et al. 2015
Leptodon cayanensis	Thorstrom 1997; Bornschein & Reinert 2000; Carvalho Filho et al. 2002; Cabanne 2005; Carvalho Filho et al. 2005; Olmos et al. 2006; Carvalho Filho et al. 2008; Canuto 2009; Bodrati et al. 2010; Ghizoni-Jr. & Azevedo 2010; Thorstrom et al. 2012
Leptodon forbesi	Pereira et al. 2006; Dénes 2009; Dénes et al. 2011
Elanoides forficatus	Meyer & Collopy 1995; Gerhardt et al. 1997; Sykes et al. 1999; Coulson 2001; Blihovde 2002; Coulson 2002; Naka et al. 2002; Willis & Oniki 2002; Reichle et al. 2003; Gerhardt et al. 2004; Meyer et al. 2004; Soehren 2004; Zimmerman 2004; Azevedo & Di-Bernardo 2005; Brown et al. 2007; Carvalho Filho et al. 2008; Coulson et al. 2008; Crease 2009; Gruber 2009; Lopes et al. 2009; Whitehead & Jones 2009; Bodrati et al. 2010; Chiavacci et al. 2011; Gerhardt et al. 2012a; Carpenter & Allen 2013; Enge et al. 2014; Kjeldsen (year?)
Morphnus guianensis	Whitacre et al. 2002; Mikich & Bérnils 2004; Vargas-González et al. 2006b; Raine 2007; Cintra & Naka 2012; Whitacre et al. 2012a; Crease & Tepedino 2013; Gomes 2014; Gomes & Sanaiotti 2015; Sanaiotti et al. 2015
Harpia harpyja	Chebez 1995; Alvarez et al. 1996; Alvarez-Cordero 1996; De Lucca 1996; Sick 1997; Andrade 1998; Galetti & Carvalho Jr 2000; Ibáñez et al. 2002; Piana 2002; Rettig 2002; Sanaiotti 2002; Hennessey et al. 2003; Peterson et al. 2003; Willis & Oniki 2003; Mikich & Bérnils 2004; Suárez et al. 2004; Luz 2005; Muñiz-López 2005; Silveira et al. 2005; Olmos et al. 2006; Pereira & Salzo 2006; Vargas-González et al. 2006a; Vargas-González et al. 2006b; Giudice et al. 2007; Pacheco et al. 2007; Piana 2007; Silva 2007; Anfuso et al. 2008; Trinca et al. 2008; Pinheiro & Dornas 2009; May 2010; Seymour et al. 2010; Sánchez-Lalinde et al. 2011; Ubaid et al. 2011; Vargas-González & Vargas 2011; Aguiar-Silva et al. 2012; Cintra & Naka 2012; Muñiz-López et al. 2012; Rotemberg et al. 2012; O'Shea & Ramcharan 2013; Aguiar-Silva et al. 2014; Vargas-González et al. 2014; Aguiar-Silva et al. 2015; Kuniy et al. 2015; Sanaiotti et al. 2015; Sousa et al. 2015; Watson et al. 2016; Rotenberg et al. (year?)
Spizaetus tyrannus	Sick 1997; Olmos et al. 2006; Sigrist 2006; Lopes & Braz 2007; Canuto 2008; Carvalho Filho et al. 2008; Jones & Komar 2008; Phillips 2009; Pimentel & Olmos 2011; Canuto et al. 2012; Cintra & Naka 2012; Whitacre et al. 2012b; Straube et al. 2014; Meyer 2016
Spizaetus melanoleucus	Andrade et al. 1996; Sick 1997; Reichle et al. 2003; Anderson et al. 2004; Eisermann 2007; Canuto 2008; Carvalho Filho et al. 2008; Canuto 2009; Phillips 2009; Phillips & Seminario 2009; Bodrati et al. 2010; Canuto et al. 2012; Whitacre & Burnham 2012; Kohler & Rezini 2013

Spizaetus ornatus	Sick 1997; Thorstrom 1997; Andrade & Andrade 1998; Brandt 1998; Naveda-Rodríguez 2002; Seipke & Cabanne 2002; Reichle et al. 2003; Greeney et al. 2004; Mikich & Bérnils 2004; Naveda-Rodríguez 2004; Mendonça-Lima et al. 2006; Giudice 2007; Canuto 2008; Carvalho Filho et al. 2008; Canuto 2009; Kirwan 2009; Phillips 2009; Joenck et al. 2011; Canuto et al. 2012; Cintra & Naka 2012; Whitacre et al. 2012c; Joenck et al. 2013; Phillips & Hatten 2013; Harvey et al. 2014; Kjeldsen (year?)
Spizaetus isidori	Valdez & Osborn 2002; Strewe & Navarro 2003; Valdez & Osborn 2004; Roesler et al. 2008; Greeney et al. 2011; Castañeda 2012; Araóz & Alvedaño 2013; Zuluaga & Echeverry-Galvis 2016
Busarellus nigricollis	Sick 1997; Di Giacomo 2000; Reichle et al. 2003; Willis & Oniki 2003; Antas 2004; Chatellenaz 2005; De La Peña 2005; Di Giacomo 2005; Márquez et al. 2005; Chatellenaz et al. 2010; Knight 2010; Bertassoni et al. 2012; Evangelista et al. 2012
Rostrhamus sociabilis	Rodgers Jr. 1996; Sick 1997; Valentine-Darby et al. 1997; Bennetts et al. 1998; Palmer 1998; Valentine-Darby et al. 1998; Angehr 1999; Arballo & Cravino 1999; Bennetts & Kitchens 1999; Dreitz et al. 1999; Bennetts & Kitchens 2000; Dreitz 2000; Dreitz & Duberstein 2001; Dreitz et al. 2001; Rodgers Jr et al. 2001; Welch & Kitchens 2001; Beissinger & Snyder 2002; Bennetts et al. 2002; Dreitz et al. 2002a; b; Petracci & Basanta 2002; Reichle et al. 2003; Rodgers Jr & Schwikert 2003; Wheeler 2003; Antas 2004; Dreitz et al. 2004; Chatellenaz 2005; De La Peña 2005; Angehr 2006; Jiménez & Zook 2007; Rodgers Jr. 2007; Carvalho Filho et al. 2008; Jones & Komar 2008; Reichert 2009; Alvarez-López & Kattan 2010; Chatellenaz et al. 2010; Palmer 2011; Bowling et al. 2012; Posso et al. 2012; Reichert et al 2012; Román & Wiley 2012; Fortes & Denis 2013; Hernández-Vázquez et al. 2013; Machado et al. 2015; Cattau et al. 2016; Bencke & Pereira (year?)
Helicolestes hamatus	Greeney et al. 2004
Harpagus bidentatus	Schulze et al. 2000; Walther 2003; Greeney et al. 2004; Carvalho Filho et al. 2008; Greeney & Gelis 2008; Cintra & Naka 2012; Schulze et al. 2012
Harpagus diodon	Azevedo et al. 2003; Cabanne 2005; Azevedo et al. 2006; Sigrist 2006; Cabanne & Roesler 2007; Carvalho Filho et al. 2008; Canuto 2009; Bodrati et al. 2010; Lees & Martin 2014
Ictinia plumbea	Seavy et al. 1997; Sick 1997; Seavy et al. 1998; Reichle et al. 2003; Antas 2004; Cabanne 2005; Chatellenaz 2005; De La Peña 2005; Di Giacomo 2005; Angehr 2006; Carvalho & Bohórquez 2007; Pérez León 2007; Carvalho Filho et al. 2008; Gussoni & Guaraldo 2008; Salvador-Jr & Silva 2009; Bodrati et al. 2010; Chatellenaz et al. 2010; Jacomassa 2011; Seavy et al. 2012; Pinto-Ledezma & Justiniano 2013; Chatellenaz 2015; Maciel et al. 2016; Kjeldsen (year?)
Circus cinereus	Saggese & De Lucca 1995; Donázar et al. 1996; Maurício & Dias 1996; Sick 1997; Arballo & Cravino 1999; Bó et al. 2000; Bó et al. 2004; Jaksic et al. 2002; De La Peña 2005; Baladrón et al. 2007; Camilotti et al. 2008; Capllonch et al. 2011; Alvarado et al. 2015
Circus buffoni	Bó et al. 1996; Sick 1997; Arballo & Cravino 1999; Bó et al. 2004; Chatellenaz 2005; Carvalho Filho et al. 2008; Kirwan & Shirihai 2008; Chatellenaz et al. 2010; Alvarado et al. 2015
Accipiter poliogaster	De Vries & Melo 2000; 2002; Thorstrom 2002; Bodrati et al. 2010; Lima & Ribeiro 2011; Boesing et al. 2012
Accipiter superciliosus	Hennessey et al. 2003; Thiollay 2007; Carvalho Filho et al. 2008; Bodrati et al. 2010
Accipiter collaris	Cuervo et al. 2008
Accipiter gundlachi	Rompré et al. 1999; Wallace et al. 1999; Peña et al. 2012; Ferrer-Sánchez & Rodríguez-Estrella 2014; Ferrer-Sánchez 2015; Ferrer-Sánchez & Rodríguez-Estrella 2016

Accipiter bicolor	Pavez & González 1998; Thorstrom & Kiff 1999; Thorstrom & Quixchán 2000; Reid et al. 2002; Figueroa et al. 2004a; b; Mikich & Bérnils 2004; Ojeda et al. 2004; Carvalho Filho et al. 2005; Figueroa et al. 2007; Marini et al. 2007; Azpiroz & Menéndez 2008; Carvalho Filho et al. 2008; Canuto 2009; Bodrati et al. 2010; Zorzin 2011; Thorstrom 2012; Hayes 2014; Alvarado et al. 2015; Medel Hidalgo et al. 2015; Rivas-Fuenzalida 2015a; Rivas-Fuenzalida et al. 2015b
Geranospiza caerulescens	Sick 1997; Arballo & Cravino 1999; Sutter et al. 2001; Ángel 2002; Reichle et al. 2003; Chatellenaz 2005; Sigrist 2006; Carvalho Filho et al. 2008; Canuto 2009; Sutter 2012
Cryptoleucopteryx plumbea	-
Buteogallus schistaceus	-
Buteogallus anthracinus	Barrantes 1998; Barradas García et al. 2004; Márquez et al. 2005; Barradas-García & Morales-Mávil 2007; Clark 2007b; Pérez León 2007; Flesch 2008; Sadoti 2008; Flesch 2009; Ruvalcaba-Ortega & González-Rojas 2009; Alava et al. 2011; Marín unpubl. data apud GRIN 2012c; Sadoti 2012; Uribe-Hernández et al. 2012; Smith & Finch 2013; Etzel et al. 2014; Licence & McCarty 2015; Boal (year?)
Buteogallus aequinoctialis	Mikich & Bérnils 2004
Buteogallus meridionalis	Narozky & Martelli 1995; Best et al. 1996; Sick 1997; Andrade & Andrade 1998; Arballo & Cravino 1999; Reichle et al. 2003; Antas 2004; Chatellenaz 2005; De La Peña 2005; Di Giacomo 2005; Navarro et al. 2007; Carvalho Filho et al. 2008; Strewe et al. 2009; Chatellenaz et al. 2010; Marini et al. 2012; Maurício et al. 2013; Camacho-Varela et al. 2015; Silva & Machado 2015
Buteogallus lacernulatus	Carvalho Filho et al. 2008; Canuto 2009
Buteogallus urubitinga	Best et al. 1996; Seavy & Gerhardt 1998; Arballo & Cravino 1999; Di Giacomo 2000; Naveda-Rodríguez 2002; Reichle et al. 2003; Antas 2004; Naveda-Rodríguez 2004; Chatellenaz 2005; De La Peña 2005; Di Giacomo 2005; Carvalho Filho et al. 2006; Carvalho Filho et al. 2008; Canuto 2009; Chatellenaz et al. 2010; Gerhardt et al. 2012b; Kjeldsen (year?)
Buteogallus solitarius	Mee et al. 2002; Strewe & Navarro 2003; Jones 2005; Clark 2007a; Seminario et al. 2011; Phillips 2012; Phillips & Martinez 2013; Phillips et al. 2014
Buteogallus coronatus	Sick 1997; Bellocq et al. 1998; Andrade & Andrade 1998; Carvalho et al. 2002; Maceda et al. 2003; Mikich & Bérnils 2004; De La Peña 2005; Di Giacomo 2005; Albuquerque et. al. 2006; Barcellos & Accordi 2006; Granzinolli et al. 2006; Torres et al. 2006; Bragagnolo et al. 2007; Lobos et al. 2007; Maceda 2007; Maceda et al. 2007; Carvalho Filho et al. 2008; Tizianel 2008; Chiaravalloti et al. 2009; Sarasola et al. 2010; Banhos & Sanaiotti 2011; Lobos et al. 2011; Berkunsky et al. 2012; Fandiño & Pautasso 2013; Urios et al. 2014; Kilpp 2015; Montalvo et al. 2015; Barbar et al. 2016
Morphnarchus princeps	Sánchez & Sánchez-M. 2002; Muela & Valdez 2003; Márquez et al. 2005; Greeney & Nunnery 2006; Gelis & Greeney 2007; Greeney et al. 2008
Rupornis magnirostris	Panasci 1995; Best et al. 1996; Capllonch 1997; Maragliano & Montalti 1997; Arballo & Cravino 1999; Panasci & Whitacre 2000; Carvalho et al. 2001b; Höfling & Camargo 2002; Naka et al. 2002; Panasci & Whitacre 2002; Reichle et al. 2003; Antas 2004; Bó et al. 2004; Chatellenaz 2005; De La Peña 2005; Di Giacomo 2005; Marini et al. 2007; Navarro et al. 2007; Carvalho Filho et al. 2008; Gussoni & Guaraldo 2008; Salvador-Jr & Silva 2009; Santos & Rosado 2009; Santos et al. 2009; Verea et al. 2009; Bodrati et al. 2010; Chatellenaz et al. 2010; Cavicchia & Garcia 2012; Cintra & Naka 2012; Mojica 2012; Panasci 2012; Panasci unpubl. data apud GRIN 2012b; Uribe-Hernández et al. 2012; Romano et al. 2015
Parabuteo unicinctus	Blue 1996; Silva & Olmos 1997; Arballo & Cravino 1999; Gerstell & Bednarz 1999; Patten & Erickson 2000; Maceda & Kin 2001; Willis & Oniki 2003; De La Peña 2005; Márquez et al. 2005; Dwyer 2006; Figueroa 2006; Figueroa & González-Acuña 2006; Jenner et al. 2007; Pérez León 2007; Dwyer & Mannan 2009; Ellis et al. 2009; Cavicchia & Garcia 2012; Furman & Bastías 2012; Alvarado et al. 2015

Parabuteo leucorrhous	Freile & Chaves 2000; Mikich & Bérnils 2004; Greeney & Nunnery 2006; Tobias & Seddon 2007; Zilio & Mendonça-Lima 2012
Geranoaetus albicaudatus	Sick 1997; Bellatti 2000; Granzinolli 2003; Reichle et al. 2003; Di Giacomo 2005; Actkinson 2006; Granzinolli & Motta-Junior 2006; Actkinson et al. 2007; Granzinolli & Motta-Junior 2007; Rappole et al. 2007; Carvalho Filho et al. 2008; Haralson 2008; Actkinson et al. 2009; Brown & Glinski 2009; Salvador-Jr & Silva 2009; Greeney et al. 2011; Maurício et al. 2013; Motta-Junior et al. (year?)
Geranoaetus polyosoma	Jiménez 1995; Donázar et al. 1996; Jaksic & Lazo 1999; Bó et al. 2004; De La Peña 2005; Alvarado & Figueroa 2006a; Cabot & De Vries 2009; Cabot et al. 2010a; b; Greeney et al. 2011; Hahn et al. 2011; Lüthi 2011; Alvarado et al. 2015; Shirihai et al. 2015
Geranoaetus melanoleucus	De Lucca & Saggese 1995; Hiraldo et al. 1995; Narozky & Martelli 1995; Best et al. 1996; Donázar et al. 1996; Sick 1997; Arballo & Cravino 1999; Jaksic & Lazo 1999; Sousa 1999; Bellatti 2000; Pavez 2001; Saggese & De Lucca 2001; Bencke et al. 2003; De La Peña 2005; Trejo et al. 2006b; Zorzin et al. 2007; Salvador-Jr. et al. 2008; Chatellenaz et al. 2010; Arriagada et al. 2011; Lüthi 2011; De Lucca & Saggese 2012; Alvarado et al. 2015; Ignazi 2015; Pérez 2015; Raimilla et al. 2015; Lemos 2016
Pseudastur polionotus	Willis & Oniki 2002; Corrêa et al. 2008; Canuto 2009; Bencke et al. 2003
Pseudastur albicollis	Draheim 1995; Cisneros-Heredia 2006; Cintra & Naka 2012; Draheim et al. 2012
Pseudastur occidentalis	Vargas 1995; Best et al. 1996
Leucopternis semiplumbeus	Ferguson-Lees & Christie 2001
Leucopternis melanops	Ferguson-Lees & Christie 2001; Cintra & Naka 2012
Leucopternis kuhli	Kirwan 2009
Buteo plagiatus	Bibles & Mannan 2004; Werner 2004; Brush 2005; Patrikeev 2007; Rappole et al. 2007; Flesch 2008; Flesch & Saavedra 2008; Flesch 2009; Ruvalcaba-Ortega & González-Rojas 2009; Sandoval 2009 ?; Vargas-Masís & Ramírez 2012
Buteo nitidus	Sick 1997; Reichle et al. 2003; Navarro et al. 2007; Sandoval 2009 ?; Strewe et al. 2009; Cintra & Naka 2012
Buteo ridgwayi	Thorstrom 2002; Thorstrom et al. 2005; 2007; Woolaver et al. 2013a; b; c; Woolaver et al. 2014
Buteo albigula	Gelain et al. 2001; Trejo et al. 2001; Ojeda et al. 2003; Pavez et al. 2004; Trejo et al. 2004; Trejo et al. 2006a; Silva-Rodríguez et al. 2008; Henry & Aznar 2009; Rivas-Fuenzalida et al. 2013; Alvarado et al. 2015; Rivas-Fuenzalida et al. 2015c
Buteo brachyurus	Carvalho et al. 2001b; Jones 2002; Wheeler 2003; Meyer 2004; Meyer 2005; Meyer & Zimmerman 2007; Rappole et al. 2007; Williams et al. 2007; Brush 2008; Carvalho Filho et al. 2008; Flesch 2008; Rizkalla et al. 2009; Salvador-Jr & Silva 2009; Howell 2010; Snyder et al. 2010; Monsalvo 2012; Enge et al. 2014; Straube et al. 2014; Oliveira et al. 2015; unknown author (year?)
Buteo galapagoensis	Faaborg et al. 1995; DeLay et al. 1996; Bollmer et al. 2003; Whiteman & Parker 2004a; 2004b; Bollmer et al. 2005; Jaramillo & Vargas 2010; Rivera et al. 2011; Muñoz 2012
Buteo albonotatus	Kennedy et al. 1995; Sick 1997; Pérez León 2007; Carvalho Filho et al. 2008; Flesch 2008; Howell 2010; Olmos & Albano 2012
Buteo ventralis	Matus & Barría 1999 apud Imberti 2003; Figueroa et al. 2000; Rivas-Fuenzalida et al. 2009; 2011; Norambuena et al. 2012; Medel Hidalgo et al. 2013; Norambuena et al. 2013; Raimilla et al. 2013; Rivas-Fuenzalida & Asciones-Contreras 2013; Figueroa unpubl. data apud GRIN 2015; Rivas-Fuenzalida 2015b; Rivas-Fuenzalida & Asciones-Contreras 2015; Rivas-Fuenzalida et al. 2015a; Rivas-Fuenzalida et al. 2016

APPENDIX II

Literature references with breeding data of Neotropical Accipitriformes, produced between 1995-2016, but not retrieved in this review.

Citation	Title
Altamirano *et al.* 2012	[Nesting habits of the birds of the Andean temperate forests of Chile]
Alvarado & Figueroa 2006b	[Function of reverse sexual dimorphism in the reproductive behavior and parental care of the Chilean Hawk (*Accipiter chilensis*), in the Nevados de Chillan biological corridor, Chile]
Anderson 1999	Tawahka Project, Honduras: 1999 field season report
Bildstein *et al.* 2007	Neotropical raptors
Canuto 2010	Ecology of a raptor community (Cathartidae, Accipitridae, and Falconidae) in a forest fragment: Rio Doce National Park, Minas Gerais, Brazil.
Couve & Vidal 2004	[Birds of Torres Paine National Park, Patagonia, Chile]
Donaghy Cannon 2001	Breeding ecology of cooperatively polyandrous Galapagos Hawks (*Buteo galapagoensis*) on Santiago Island, Galapagos
Figueroa *et al.* 2001	Records of the White-throated Hawk (*Buteo albigula*) and notes on its hunting methods and movements in the Andes of central-southern Chile
Giudice 2006	Tree architecture as a determinant factor in the nest tree selection of Harpy Eagles (*Harpia harpyja*)
Gómez de Silva 2010	? (citation in the GRIN database; no further details located)
Jones 2004	Central America
Kirwan *et al.* 2006	Neotropical notebook
Levenstein 2008	Reproductive ecology of the cooperatively polyandrous Galapagos Hawk on Santiago Island, Galapagos
Lobos & Alvarado 2006	[Mutualism between the Crowned Solitary Eagle (*Harpyhaliaetus coronatus*) and the Monk Parakeet (*Myiopsitta monacha*) during nest building in the Telteca Natural Forest Reserve, Department of Lavalle, Mendoza Province, Argentina]
Marsden *et al.* 2016	Winter nesting of White-tailed Kite in south Texas
Martínez-Sánchez & Will 2010	? (citation in the GRIN database; no further details located)
Meyer & Arnett 1996	Age-class distinctions and delayed reproduction of American Swallow-tailed Kites in Florida
Meyer *et al.* 1995	Depressed success of American Swallow-tailed Kites (*Elanoides forficatus*) nesting in introduced Australian Pines (*Casuarina* spp.)
Muela *et al.* 2003	The Harpy Eagle: biology, restoration and hacking procedures

Muñiz-López 2007a	Ecology, biology and habitat of the Harpy Eagle (*Harpia harpyja*)
Muñiz-López 2007b	The Harpy Eagle in Ecuador: the rainforest 'air spirit'
Pineda *et al.* 2016	New location for and first record of nesting Pearl Kite (*Gampsonyx swainsoni*) in El Salvador
Sánchez 2000	[Behavior of the Galapagos Hawk (*Buteo galapagoensis*) during the incubation period and morphological variation between populations at Espanola, Santa Fe, Isabela and Antiago(sic) Islands, Galapagos, Ecuador]
Troy & Stahlecker 2008	Status of a distinct population of Common Black-hawks in southeastern New Mexico: 2002-2003
Woods & Woods 1997	Atlas of breeding birds of the Falkland Islands
Woolaver 2011	Ecology and conservation genetics of Ridgway's Hawk *Buteo ridgwayi*

APPENDIX III

Results of the search for photographic breeding records of 25 species of Neotropical Accipitriformes, on the WikiAves database.

Species	Records' reference numbers
Elanus leucurus	WA1251178; WA1253853; WA1263279; WA1272398; WA1272409; WA1279861; WA1281964; WA1288071; WA1290781; WA1293418; WA1300395; WA1376684; WA1499798; WA1720428; WA1721934; WA1770437; WA1835635; WA1835637; WA1837761; WA1841067; WA1904171; WA2037143; WA2071064; WA2090188; WA21325; WA21537; WA2271383; WA250965; WA466357; WA661980; WA698506; WA719423; WA729366; WA732823; WA915133; WA915840; WA915852; WA936035
Chondrohierax uncinatus	WA1160532; WA1688095; WA1937776; WA1968066; WA1981003
Leptodon cayanensis	WA723947; WA723948
Leptodon forbesi	WA938449
Spizaetus melanoleucus	WA1140737; WA1140739; WA1370302; WA1378059; WA1438023; WA195643; WA2206395; WA2242350; WA2249207; WA2322423
Rostrhamus sociabilis	WA1214147; WA1218422; WA1280372; WA147627; WA1493450; WA1588325; WA1771055; WA2021254; WA2021256; WA2108507; WA226747; WA24193; WA36753; WA474247; WA484024; WA64884; WA696195; WA696196; WA81214; WA819399
Helicolestes hamatus	WA1589021; WA1966794; WA953944
Harpagus bidentatus	WA2198552; WA2240795; WA668871
Harpagus diodon	WA1156861; WA1200479; WA1228366; WA123732; WA1237599; WA14961; WA14962; WA1966820; WA1966889; WA206624; WA209513; WA219297; WA219978; WA222095; WA222762; WA244381; WA250110; WA251551; WA252886; WA255778; WA255779; WA255914; WA257012; WA275906; WA280598; WA507006; WA73820; WA76435; WA76436; WA76815; WA785304; WA819506; WA82627; WA860802; WA861618; WA884512; WA887671; WA887710; WA889684; WA897892; WA900167; WA98349
Accipiter poliogaster	WA1920902; WA1985763; WA1989199; WA1992309; WA1994808; WA2005934; WA2034929; WA2047459; WA2132296; WA2319849; WA779787
Accipiter superciliosus	-
Accipiter bicolor	WA106136; WA1744297; WA89938
Geranospiza caerulescens	WA140630; WA141005; WA1444043; WA1565980; WA1649149
Buteogallus schistaceus	-
Buteogallus anthracinus	WA950092
Buteogallus aequinoctialis	WA1503515

Buteogallus lacernulatus	-
Parabuteo leucorrhous	-
Pseudastur polionotus	WA1570081; WA1570097; WA1581106
Pseudastur albicollis	WA215803; WA722126
Leucopternis melanops	-
Leucopternis kuhli	-
Buteo nitidus	WA1184610; WA1392108; WA2187978; WA2187993; WA388429; WA476978; WA506191
Buteo brachyurus	WA1116480; WA1356894; WA1356902; WA176090; WA176091; WA2033914; WA225567; WA33877; WA513759; WA513770; WA513777; WA513781; WA513790; WA513819; WA513828; WA819112; WA819113
Buteo albonotatus	-

APPENDIX IV

Proposed corrections to four misidentified museum egg sets of Neotropical Accipitriformes. Arguments referring to geographical distribution are not presented since all species involved are sympatric at these collection localities (Del Hoyo et al. 2016a).

Set WFVZ 15561 - formerly assigned to Lined Forest-Falcon *Micrastur gilvicollis*.
Seemingly, no information exists on Lined Forest-Falcon's eggs (Bierregaard 1995, GRIN 2009, Bierregaard *et al.* 2016a). This one-egg set was obtained by G. D. Smooker, whose identifications have already been questioned (Thorstrom & Kiff 1999). More importantly, the egg is much larger than those of another similar-sized, closely-related *Micrastur* falcon (Thorstrom 2012). Thus, we doubt it could be properly atributed to Lined Forest-Falcon. Measurements, clutch-size and overall appearance are suitable with known clutches of the Gray-headed Kite measured by us and to other data presented by Thorstrom *et al.* (2012). Thus, it almost certainly belong to this species.
We recommend the treatment of this set as cfr. *Leptodon cayanensis*.

Set WFVZ 15951 - previously assigned to Black-collared Hawk *Busarellus nigricollis*.
Also from Smooker's collection. Measurements of this two eggs are much smaller than Black-collared Hawk's eggs (GRIN 2010), but consistent with those of Zone-tailed Hawk *Buteo albonotatus* (Bierregaard *et al.* 2016b), as suggested by L. Kiff on the data slip of this set. Yet, contrary to the previous and next cases, these species' overall appearances and 'field jizzes' are quite different (J.A.B.M., pers. obs.) to justify such a misidentification by the collector. Also, dimensions, clutch-size and general appearance of the eggs did not allow a rigorous identification. We do not discard that the clutch refer to Zone-tailed Hawk, but evidence is not conclusive as they may refer to other hawks as well.
We recommend that this set should not be treated as *Busarellus nigricollis*, and tentatively identify as cfr. *Buteo albonotatus*.

Sets WFVZ 16312 and 16313 - both formerly assigned to Hook-billed Kite *Chondrohierax uncinatus*.
These three eggs are very distinct from, and much larger than, Hook-billed Kite's (J.A.B.M., pers. obs., Di Giácomo 2000, Whitacre & Vásquez 2012). Both dimensions, clutch-sizes and overall appearance fits with Gray-headed Kite's clutches. Albeit measurements of the two-egg

clutch (WFVZ 16312) are slightly smaller than most Gray-headed Kite's, they fit with those of another two egg-clutch of this species, provided by Carvalho Filho *et al.* (2005).
We assign these sets to *Leptodon cayanensis*.

Supplemental Table S1. Complete list of original breeding records of buteonines in the Neotropics, retrieved from the literature and museums sets.

Museum acronym OR publication	Catalogue Number (museum sets)	Species Name	Breeding stage/info	N	Day	Month	Year	Country	State/Department	County
Alvarado Orellana & Figueroa Rojas 2006		*Geranoaetus polyosoma*	Egg(s)	1	25	9	2000	Chile		
Alvarado Orellana & Figueroa Rojas 2006		*Geranoaetus polyosoma*	Hatching	1	27	9	2000	Chile		
AMNH	8247	*Buteo albonotatus*	Egg(s)	1	2	2	1892	Costa Rica		
Andrade & Andrade 1998		*Buteogallus meridionalis*	Nestling stage	1	30?	9	1997	Brazil	Minas Gerais	Matozinhos
Arballo & Cravino 1999		*Geranoaetus albicaudatus*	Active nest(s)	1	15	12	1988	Uruguay	Flores	Arroyo Porongos
Arballo & Cravino 1999		*Geranoaetus albicaudatus*	Nestling stage	1	2	12	1998	Uruguay		
Arballo & Cravino 1999		*Buteogallus urubitinga*	Incubating	1		10	1982	Uruguay	Rocha	
Arballo & Cravino 1999		*Buteogallus meridionalis*	Incubating	1	11	10	1992	Uruguay	Tacuarembó	
Arballo & Cravino 1999		*Buteogallus meridionalis*	Active nest(s)	1	17	10	1996	Uruguay	Rocha	
Arballo & Cravino 1999		*Parabuteo unicinctus*	Active nest(s)	1	17	11	1995	Uruguay	Tacuarembó	
Arriagada et al. 2011		*Geranoaetus melanoleucus*	Active nest(s)	1		1	2007-2009	Chile	Aysén	
Banhos & Sanaiotti 2011		*Buteogallus coronatus*	Egg(s)	1	21	7	1945	Brazil	Espírito Santo	Santa Teresa
Banhos & Sanaiotti 2011		*Buteogallus coronatus*	Hatching	1		9	1945	Brazil	Espírito Santo	Santa Teresa
Banhos & Sanaiotti 2011		*Buteogallus coronatus*	Nestling stage	1		10	1945	Brazil	Espírito Santo	Santa Teresa
Banhos & Sanaiotti 2011		*Buteogallus coronatus*	YAN	1		11	1945	Brazil	Espírito Santo	Santa Teresa
Banhos & Sanaiotti 2011		*Buteogallus coronatus*	YAN	1		12	1945	Brazil	Espírito Santo	Santa Teresa
Banhos & Sanaiotti 2011		*Buteogallus coronatus*	Fledgling stage	1		1	1946	Brazil	Espírito Santo	Santa Teresa
Barbar et al. 2016		*Buteogallus coronatus*	YAN	1		5	2008	Argentina	La Pampa	
Barbar et al. 2016		*Buteogallus coronatus*	YAN	1		4	2009	Argentina	La Pampa	
Barbar et al. 2016		*Buteogallus coronatus*	YAN	1		3	2005	Argentina	Mendoza	
Barbar et al. 2016		*Buteogallus coronatus*	YAN	1		4	2008	Argentina	Mendoza	
Barbar et al. 2016		*Buteogallus coronatus*	YAN	1		8	2012	Argentina	San Juan	
Barradas García et al. 2004		*Buteogallus anthracinus*	Active nest(s)	2		1	2002-2003	Mexico	Veracruz	Catemaco
Barradas García et al. 2004		*Buteogallus anthracinus*	Active nest(s)	1		2	2002-2003	Mexico	Veracruz	Catemaco
Barradas García et al. 2004		*Buteogallus anthracinus*	Active nest(s)	1		3	2002-2003	Mexico	Veracruz	Catemaco
Barradas García et al. 2004		*Buteogallus anthracinus*	Active nest(s)	1		4	2002-2003	Mexico	Veracruz	Catemaco
Barradas García et al. 2004		*Buteogallus anthracinus*	Active nest(s)	1		5	2002-2003	Mexico	Veracruz	Catemaco
Barradas-García & Morales-Mávil 2007		*Buteogallus anthracinus*	Active nest(s)	2		2	2004	Mexico	Veracruz	Catemaco
Barradas-García & Morales-Mávil 2007		*Buteogallus anthracinus*	Active nest(s)	1		3	2005	Mexico	Veracruz	Catemaco
Barradas-García & Morales-Mávil 2007		*Buteogallus anthracinus*	Active nest(s)	1		2	2004	Mexico	Veracruz	Catemaco
Barradas-García & Morales-Mávil 2007		*Buteogallus anthracinus*	Active nest(s)	1		3	2005	Mexico	Veracruz	Catemaco
Barrantes 1998		*Buteogallus anthracinus*	Active nest(s)	1	25	3		Costa Rica	Puntarenas	Chomes
Barrantes 1998		*Buteogallus anthracinus*	Active nest(s)	1	3	6		Costa Rica	Puntarenas	Chomes
Belcher & Smooker 1934		*Geranoaetus albicaudatus*	Egg(s)	1	15	4	1928	Trinidad and Tobago	Trinidad	San Fernando
Belcher & Smooker 1934		*Geranoaetus albicaudatus*	Egg(s)	1	15	3	1930	Trinidad and Tobago	Trinidad	San Fernando

Belcher & Smooker 1934	*Buteo albonotatus*	Egg(s)	1	2	3	1927	Trinidad and Tobago	Trinidad	Diego Martin
Belcher & Smooker 1934	*Buteo nitidus*	Egg(s)	1	10	4	1926	Trinidad and Tobago	Trinidad	
Belcher & Smooker 1934	*Buteogallus meridionalis*	Egg(s)	1	25	3	1933	Trinidad and Tobago	Trinidad	
Belcher & Smooker 1934	*Buteogallus meridionalis*	Egg(s)	1	23	3	1927	Trinidad and Tobago	Trinidad	
Belcher & Smooker 1934	*Buteogallus meridionalis*	Egg(s)	1	16	4	1928	Trinidad and Tobago	Trinidad	
Belcher & Smooker 1934	*Buteogallus anthracinus*	Egg(s)	1	9	3		Trinidad and Tobago	Trinidad	
Belcher & Smooker 1934	*Buteogallus anthracinus*	Egg(s)	1	7	5		Trinidad and Tobago	Trinidad	
Belcher & Smooker 1934	*Buteogallus anthracinus*	Egg(s)	1	3	7		Trinidad and Tobago	Trinidad	
Belcher & Smooker 1934	*Buteogallus anthracinus*	Egg(s)	1	10	7		Trinidad and Tobago	Trinidad	
Belton 2003	*Rupornis magnirostris*	Active nest(s)	1	1	12	1977	Brazil	Rio Grande do Sul	Sapucaia do Sul
Belton 2003	*Buteogallus meridionalis*	Fledgling stage	1	20	2	1975	Brazil	Rio Grande do Sul	
Berkunsky et al. 2012	*Buteogallus coronatus*	Nestling stage	1	23	11	2007	Bolivia		
Berkunsky et al. 2012	*Buteogallus coronatus*	Nestling stage	1	1	12	2007	Bolivia		
Berkunsky et al. 2012	*Buteogallus coronatus*	Nestling stage	1	7	1	2008	Bolivia		
Berkunsky et al. 2012	*Buteogallus coronatus*	Nestling stage	1	15	11	2009	Bolivia		
Bollmer et al. 2003	*Buteo galapagoensis*	Active nest(s)	1		5	1998-2001	Ecuador	Galapagos Islands	
Bollmer et al. 2003	*Buteo galapagoensis*	Active nest(s)	1		6	1998-2001	Ecuador	Galapagos Islands	
Bollmer et al. 2003	*Buteo galapagoensis*	Active nest(s)	1		7	1998-2001	Ecuador	Galapagos Islands	
Bollmer et al. 2003	*Buteo galapagoensis*	Active nest(s)	1		8	1998-2001	Ecuador	Galapagos Islands	
Bollmer et al. 2005	*Buteo galapagoensis*	YAN	1		5	1998-2003	Ecuador	Galapagos Islands	
Bollmer et al. 2005	*Buteo galapagoensis*	YAN	1		6	1998-2003	Ecuador	Galapagos Islands	
Bollmer et al. 2005	*Buteo galapagoensis*	YAN	1		7	1998-2003	Ecuador	Galapagos Islands	
Bollmer et al. 2005	*Buteo galapagoensis*	YAN	1		8	1998-2003	Ecuador	Galapagos Islands	
Cabot & De Vries 2009	*Geranoaetus polyosoma*	Active nest(s)	1		11		Chile	Calama	
Cabot et al. 2010b	*Geranoaetus polyosoma*	Active nest(s)	6	21-27	11	2008	Chile	Antofagasta	Calama
Cabot et al. 2010b	*Geranoaetus polyosoma*	Active nest(s)	1	21-27	11	2008	Chile	Antofagasta	Calama
Cabot et al. 2010b	*Geranoaetus polyosoma*	Active nest(s)	3	21-27	11	2008	Chile	Antofagasta	Calama
Camacho-Varela et al. 2015	*Buteogallus meridionalis*	Incubating	1		3	2014	Costa Rica	Puntarenas	Laurel de Corredores
Camacho-Varela et al. 2015	*Buteogallus meridionalis*	Nestling stage	1		4	2014	Costa Rica	Puntarenas	Laurel de Corredores
Camacho-Varela et al. 2015	*Buteogallus meridionalis*	Nestling stage	1		5	2014	Costa Rica	Puntarenas	Laurel de Corredores
Camacho-Varela et al. 2015	*Buteogallus meridionalis*	Fledgling stage	1		6	2014	Costa Rica	Puntarenas	Laurel de Corredores
Canuto 2009	*Buteogallus lacernulatus*	Fledgling stage	1		12	2008	Brazil	Minas Gerais	
Carvalho et al. 2001	*Buteo brachyurus*	Active nest(s)	1		7	1999-2000	Brazil	Minas Gerais	Belo Horizonte
Carvalho et al. 2001	*Buteo brachyurus*	Active nest(s)	1		8	1999-2000	Brazil	Minas Gerais	Belo Horizonte
Carvalho et al. 2001	*Buteo brachyurus*	Active nest(s)	1		9	1999-2000	Brazil	Minas Gerais	Belo Horizonte
Carvalho et al. 2001	*Buteo brachyurus*	Active nest(s)	1		10	1999-2000	Brazil	Minas Gerais	Belo Horizonte
Carvalho et al. 2001	*Buteo brachyurus*	Active nest(s)	1		11	1999-2000	Brazil	Minas Gerais	Belo Horizonte
Carvalho et al. 2001	*Buteo brachyurus*	Active nest(s)	1		12	1999-2000	Brazil	Minas Gerais	Belo Horizonte
Carvalho et al. 2001	*Rupornis magnirostris*	Active nest(s)	1		7	1999-2000	Brazil	Minas Gerais	Belo Horizonte
Carvalho et al. 2001	*Rupornis magnirostris*	Active nest(s)	1		8	1999-2000	Brazil	Minas Gerais	Belo Horizonte

Carvalho et al. 2001		*Rupornis magnirostris*	Active nest(s)	1		9	1999-2000	Brazil	Minas Gerais	Belo Horizonte
Carvalho et al. 2001		*Rupornis magnirostris*	Active nest(s)	1		10	1999-2000	Brazil	Minas Gerais	Belo Horizonte
Carvalho et al. 2001		*Rupornis magnirostris*	Active nest(s)	1		11	1999-2000	Brazil	Minas Gerais	Belo Horizonte
Carvalho et al. 2001		*Rupornis magnirostris*	Active nest(s)	1		12	1999-2000	Brazil	Minas Gerais	Belo Horizonte
Carvalho et al. 2001		*Rupornis magnirostris*	Active nest(s)	1		9	1999-2000	Brazil	Rio de Janeiro	Rio de Janeiro
Carvalho et al. 2001		*Rupornis magnirostris*	Active nest(s)	1		10	1999-2000	Brazil	Rio de Janeiro	Rio de Janeiro
Carvalho et al. 2001		*Rupornis magnirostris*	Active nest(s)	1		11	1999-2000	Brazil	Rio de Janeiro	Rio de Janeiro
Carvalho et al. 2001		*Rupornis magnirostris*	Active nest(s)	1		12	1999-2000	Brazil	Rio de Janeiro	Rio de Janeiro
Carvalho et al. 2001		*Rupornis magnirostris*	Active nest(s)	1		1	1999-2000	Brazil	Rio de Janeiro	Rio de Janeiro
Carvalho et al. 2001		*Rupornis magnirostris*	Active nest(s)	1		2	1999-2000	Brazil	Rio de Janeiro	Rio de Janeiro
Carvalho et al. 2002		*Buteogallus coronatus*	Incubating	1		10	2001	Brazil	Minas Gerais	
Carvalho Filho et al. 2006		*Buteogallus urubitinga*	Hatching	1	26	10	2000	Brazil	Minas Gerais	Matozinhos
Carvalho Filho et al. 2006		*Buteogallus urubitinga*	Fledgling stage	1	2	1	2001	Brazil	Minas Gerais	Matozinhos
Carvalho Filho et al. 2006		*Buteogallus urubitinga*	Egg(s)	1	22	9	2001	Brazil	Minas Gerais	Matozinhos
Carvalho Filho et al. 2006		*Buteogallus urubitinga*	Nestling stage	1	10	11	2001	Brazil	Minas Gerais	Matozinhos
Carvalho Filho et al. 2006		*Buteogallus urubitinga*	Egg(s)	1	14	9	2002	Brazil	Minas Gerais	Matozinhos
Carvalho Filho et al. 2006		*Buteogallus urubitinga*	Egg(s)	1	14	10	2003	Brazil	Minas Gerais	Matozinhos
Carvalho Filho et al. 2006		*Buteogallus urubitinga*	Egg(s)	1	9	10	2004	Brazil	Minas Gerais	Matozinhos
Carvalho Filho et al. 2006		*Buteogallus urubitinga*	Nestling stage	1	15	9	2002	Brazil	Minas Gerais	Matozinhos
CAS - San Francisco	5851	*Buteo galapagoensis*	E+L	1	10	6	1932	Ecuador	Galapagos Islands	Baltra Island
CAS - San Francisco	793	*Buteo galapagoensis*	E+L	1	7	4	1906	Ecuador	Galapagos Islands	Isabela Island
CAS - San Francisco	2065	*Buteo galapagoensis*	Egg(s)	1	24	7	1906	Ecuador	Galapagos Islands	Santa Cruz Island
CAS - San Francisco	5842	*Buteogallus meridionalis*	Egg(s)	1	8	10	1927	Argentina	Tucumán	
CAS - San Francisco	5841	*Buteogallus urubitinga*	Egg(s)	1	30	9	1927	Argentina	Tucumán	
Cavicchia & Garcia 2012		*Parabuteo unicinctus*	Active nest(s)	1		1	2003-2006	Argentina		Buenos Aires
Cavicchia & Garcia 2012		*Parabuteo unicinctus*	Active nest(s)	1		2	2003-2006	Argentina		Buenos Aires
Cavicchia & Garcia 2012		*Parabuteo unicinctus*	Active nest(s)	1		3	2003-2006	Argentina		Buenos Aires
Cavicchia & Garcia 2012		*Rupornis magnirostris*	Active nest(s)	1		1	2003-2006	Argentina		Buenos Aires
Cavicchia & Garcia 2012		*Rupornis magnirostris*	Active nest(s)	1		2	2003-2006	Argentina		Buenos Aires
Cavicchia & Garcia 2012		*Rupornis magnirostris*	Active nest(s)	1		3	2003-2006	Argentina		Buenos Aires
Chapman 1929		*Pseudastur albicollis*	Active nest(s)	1	9	3	1929	Panama		
Cherrie 1926		*Rupornis magnirostris*	Active nest(s)	1		5		Venezuela		
Chiaravalloti et al. 2009		*Buteogallus coronatus*	Fledgling stage	1	28	1	2007	Brazil	Mato Grosso do Sul	Corumbá
Cisneros-Heredia 2006		*Pseudastur albicollis*	Active nest(s)	1	15	8	1996	Ecuador	Orellana	
COMB - Brasília	COMB-E0073	*Rupornis magnirostris*	Active nest(s)	1	14	10	2012	Brazil	Distrito Federal	Planaltina
COMB - Brasília	COMB-E0086	*Rupornis magnirostris*	Active nest(s)	1	1	11	2012	Brazil	Distrito Federal	Planaltina
De La Peña 2005		*Geranoaetus polyosoma*	Active nest(s)	1	5	12	1981	Argentina	Córdoba	San Alberto
De La Peña 2005		*Geranoaetus polyosoma*	YAN	1	27	11	1982	Argentina	Córdoba	San Alberto
De La Peña 2005		*Geranoaetus polyosoma*	Egg(s)	1	7	9	2003	Argentina	Neuquén	Collón Curá
De La Peña 2005		*Buteogallus urubitinga*	Egg(s)	1	2	10	1990	Argentina	Santa Fé	General Obligado

De La Peña 2005	*Buteogallus urubitinga*	Egg(s)	1	10	11	1997	Argentina	Santa Fé	San Justo
De La Peña 2005	*Buteogallus meridionalis*	Egg(s)	1	15	11	1971	Argentina	Santa Fe	Vera
De La Peña 2005	*Buteogallus meridionalis*	Egg(s)	1	26	9	1974	Argentina	Santa Fé	
De La Peña 2005	*Buteogallus meridionalis*	Active nest(s)	1	13	10	1983	Argentina	Santa Fé	San Javier
De La Peña 2005	*Buteogallus meridionalis*	Active nest(s)	1	23	11	1993	Argentina		
De La Peña 2005	*Parabuteo unicinctus*	YAN	1	15	9	1971	Argentina		
De La Peña 2005	*Parabuteo unicinctus*	YAN	1	15	10	1986	Argentina		
De La Peña 2005	*Parabuteo unicinctus*	Egg(s)	1	17	9	1987	Argentina		
De La Peña 2005	*Parabuteo unicinctus*	Active nest(s)	1	25	9	1988	Argentina		
De La Peña 2005	*Parabuteo unicinctus*	Egg(s)	1	6	9	1989	Argentina		
De La Peña 2005	*Parabuteo unicinctus*	Egg(s)	1	26	12	1990	Argentina		
De La Peña 2005	*Buteogallus coronatus*	Egg(s)	1	28	10	1979	Argentina	Santa Fé	
De La Peña 2005	*Buteogallus coronatus*	YAN	1	5	12	1982	Argentina	Santa Fé	
De La Peña 2005	*Rupornis magnirostris*	Egg(s)	1	7	11	1974	Argentina		
De La Peña 2005	*Rupornis magnirostris*	YAN	1	16	11	1974	Argentina	Santa Fé	Colmena
De La Peña 2005	*Rupornis magnirostris*	YAN	1	5	12	1991	Argentina	Santa Fé	Las Colonias
De La Peña 2005	*Rupornis magnirostris*	Egg(s)	1	13	12	1991	Argentina	Santa Fé	General Obligado
De La Peña 2005	*Rupornis magnirostris*	YAN	1	13	12	1991	Argentina	Santa Fé	General Obligado
De La Peña 2005	*Rupornis magnirostris*	YAN	1	11	11	1999	Argentina	Santa Fé	Santa Fé
De La Peña 2005	*Rupornis magnirostris*	Active nest(s)	1	28	9	2001	Argentina		
De Lucca & Saggese 2012	*Geranoaetus melanoleucus*	Laying	1		9	1987	Argentina	Santa Cruz	Deseado
De Lucca & Saggese 2012	*Geranoaetus melanoleucus*	Laying	1		10	1987	Argentina	Santa Cruz	Deseado
De Lucca & Saggese 2012	*Geranoaetus melanoleucus*	Active nest(s)	1		11	1987	Argentina	Santa Cruz	Deseado
De Lucca & Saggese 2012	*Geranoaetus melanoleucus*	Active nest(s)	1		12	1987	Argentina	Santa Cruz	Deseado
De Lucca & Saggese 2012	*Geranoaetus melanoleucus*	Active nest(s)	1		1	1988	Argentina	Santa Cruz	Deseado
DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		6	1990	Ecuador	Galapagos Islands	Santiago Island
DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		7	1990	Ecuador	Galapagos Islands	Santiago Island
DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		8	1990	Ecuador	Galapagos Islands	Santiago Island
DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		9	1990	Ecuador	Galapagos Islands	Santiago Island
DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		6	1990	Ecuador	Galapagos Islands	Isla Santa Fe
DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		7	1990	Ecuador	Galapagos Islands	Isla Santa Fe
DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		8	1990	Ecuador	Galapagos Islands	Isla Santa Fe
DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		9	1990	Ecuador	Galapagos Islands	Isla Santa Fe
DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		6	1990	Ecuador	Galapagos Islands	Santiago Island
DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		7	1990	Ecuador	Galapagos Islands	Santiago Island
DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		8	1990	Ecuador	Galapagos Islands	Santiago Island
DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		9	1990	Ecuador	Galapagos Islands	Santiago Island
DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		6	1991	Ecuador	Galapagos Islands	Santiago Island
DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		7	1991	Ecuador	Galapagos Islands	Santiago Island
DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		8	1991	Ecuador	Galapagos Islands	Santiago Island

DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		9	1991	Ecuador	Galapagos Islands	Santiago Island
DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		6	1991	Ecuador	Galapagos Islands	Santiago Island
DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		7	1991	Ecuador	Galapagos Islands	Santiago Island
DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		8	1991	Ecuador	Galapagos Islands	Santiago Island
DeLay et al. 1996	*Buteo galapagoensis*	YAN	1		9	1991	Ecuador	Galapagos Islands	Santiago Island
Di Giácomo 2005	*Geranoaetus albicaudatus*	Active nest(s)	1		8	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Geranoaetus albicaudatus*	Active nest(s)	1		9	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Geranoaetus albicaudatus*	Active nest(s)	1		10	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Geranoaetus albicaudatus*	Active nest(s)	9		8	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Geranoaetus albicaudatus*	Active nest(s)	9		9	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Geranoaetus albicaudatus*	Active nest(s)	9		10	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus urubitinga*	Egg(s)	1	>=28	8	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus urubitinga*	Egg(s)	1		9	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus urubitinga*	Egg(s)	1		10	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus urubitinga*	Egg(s)	1		11	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus urubitinga*	Egg(s)	1		12	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus urubitinga*	Egg(s)	1	<=22	1	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus meridionalis*	Egg(s)	2	>=4	9	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus meridionalis*	Egg(s)	2		10	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus meridionalis*	Egg(s)	2		11	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus meridionalis*	Egg(s)	1	<=6	12	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus meridionalis*	Active nest(s)	13	>=4	9	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus meridionalis*	Active nest(s)	12		10	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus meridionalis*	Active nest(s)	12		11	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus meridionalis*	Active nest(s)	12	<=6	12	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus coronatus*	Active nest(s)	1		8	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus coronatus*	Active nest(s)	1		9	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus coronatus*	Egg(s)	1		10	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus coronatus*	Incubating	1		11	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Rupornis magnirostris*	Egg(s)	4	30	9	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Rupornis magnirostris*	Egg(s)	4		10	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Rupornis magnirostris*	Egg(s)	4		11	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Rupornis magnirostris*	Egg(s)	3	<=17	12	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Rupornis magnirostris*	Active nest(s)	2	30	9	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Rupornis magnirostris*	Active nest(s)	2		10	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Rupornis magnirostris*	Active nest(s)	2		11	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Rupornis magnirostris*	Active nest(s)	1	<=17	12	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus coronatus*	Active nest(s)	1		10	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus coronatus*	Active nest(s)	1		11	1988-2004	Argentina	Formosa	
Di Giácomo 2005	*Buteogallus coronatus*	Active nest(s)	1		12	1988-2004	Argentina	Formosa	

Donázar et al. 1996	*Geranoaetus melanoleucus*	Laying	2		10	1991-1992	Argentina	Neuquén	Junin de los Andes
Donázar et al. 1996	*Geranoaetus polyosoma*	Laying	1		9	1991-1992	Argentina	Neuquén	Junin de los Andes
Donázar et al. 1996	*Geranoaetus polyosoma*	Laying	1		10	1991-1992	Argentina	Neuquén	Junin de los Andes
Euler 1900	*Rupornis magnirostris*	Egg(s)	1		10		Brazil		
Faaborg et al. 1980	*Buteo galapagoensis*	YAN	14	1 to 12	8	1977	Ecuador	Galapagos Islands	Santiago Island
Faaborg et al. 1980	*Buteo galapagoensis*	YAN	1		5	1979	Ecuador	Galapagos Islands	Santiago Island
Faaborg et al. 1980	*Buteo galapagoensis*	YAN	1		6	1979	Ecuador	Galapagos Islands	Santiago Island
Faaborg et al. 1980	*Buteo galapagoensis*	YAN	1		5	1979	Ecuador	Galapagos Islands	Santiago Island
Faaborg et al. 1980	*Buteo galapagoensis*	YAN	1		6	1979	Ecuador	Galapagos Islands	Santiago Island
Faaborg et al. 1980	*Buteo galapagoensis*	YAN	1		5	1979	Ecuador	Galapagos Islands	Santiago Island
Faaborg et al. 1980	*Buteo galapagoensis*	YAN	1		6	1979	Ecuador	Galapagos Islands	Santiago Island
Faaborg et al. 1980	*Buteo galapagoensis*	YAN	1		5	1979	Ecuador	Galapagos Islands	Santiago Island
Faaborg et al. 1980	*Buteo galapagoensis*	YAN	1		6	1979	Ecuador	Galapagos Islands	Santiago Island
Fandiño & Pautasso 2013	*Buteogallus coronatus*	Active nest(s)	1		10	2002	Argentina	Santa Fé	
Fandiño & Pautasso 2013	*Buteogallus coronatus*	Active nest(s)	1		11	2009	Argentina	Santa Fé	
Ferrer-Sánchez & Rodríguez-Estrella 2016	*Buteogallus gundlachii*	Active nest(s)	3		2	2002	Cuba		Ciego de Ávila
Ferrer-Sánchez & Rodríguez-Estrella 2016	*Buteogallus gundlachii*	Active nest(s)	2		3	2002	Cuba		Ciego de Ávila
Ferrer-Sánchez & Rodríguez-Estrella 2016	*Buteogallus gundlachii*	Active nest(s)	2		4	2002	Cuba		Ciego de Ávila
Ferrer-Sánchez & Rodríguez-Estrella 2016	*Buteogallus gundlachii*	Active nest(s)	2		5	2002	Cuba		Ciego de Ávila
Ferrer-Sánchez & Rodríguez-Estrella 2016	*Buteogallus gundlachii*	Active nest(s)	2		6	2002	Cuba		Ciego de Ávila
Ferrer-Sánchez & Rodríguez-Estrella 2016	*Buteogallus gundlachii*	Active nest(s)	2		7	2002	Cuba		Ciego de Ávila
Ferrer-Sánchez & Rodríguez-Estrella 2016	*Buteogallus gundlachii*	Active nest(s)	2		8	2002	Cuba		Ciego de Ávila
Ferrer-Sánchez & Rodríguez-Estrella 2016	*Buteogallus gundlachii*	Active nest(s)	3		2	2003	Cuba		Ciego de Ávila
Ferrer-Sánchez & Rodríguez-Estrella 2016	*Buteogallus gundlachii*	Active nest(s)	2		3	2003	Cuba		Ciego de Ávila
Ferrer-Sánchez & Rodríguez-Estrella 2016	*Buteogallus gundlachii*	Active nest(s)	2		4	2003	Cuba		Ciego de Ávila
Ferrer-Sánchez & Rodríguez-Estrella 2016	*Buteogallus gundlachii*	Active nest(s)	2		5	2003	Cuba		Ciego de Ávila
Ferrer-Sánchez & Rodríguez-Estrella 2016	*Buteogallus gundlachii*	Active nest(s)	2		6	2003	Cuba		Ciego de Ávila
Ferrer-Sánchez & Rodríguez-Estrella 2016	*Buteogallus gundlachii*	Active nest(s)	2		7	2003	Cuba		Ciego de Ávila
Ferrer-Sánchez & Rodríguez-Estrella 2016	*Buteogallus gundlachii*	Active nest(s)	2		8	2003	Cuba		Ciego de Ávila
Ferrer-Sánchez 2015	*Buteo jamaicensis*	Nestling stage	1	16	5	2012	Cuba	Ciego de Ávila	
Figueroa Rojas & González-Acuña 2006	*Parabuteo unicinctus*	YAN	1		1		Chile	Bío-bío	Concepcio´n
Figueroa Rojas & González-Acuña 2006	*Parabuteo unicinctus*	YAN	1		2		Chile	Bío-bío	Concepcio´n
Figueroa Rojas & González-Acuña 2006	*Parabuteo unicinctus*	YAN	1		3		Chile	Bío-bío	Concepcio´n
Figueroa Rojas & González-Acuña 2006	*Parabuteo unicinctus*	YAN	1		4		Chile	Bío-bío	Concepcio´n
Figueroa Rojas et al. 2000	*Buteo ventralis*	Active nest(s)	1	6 to 11	1	2008	Chile		
Friedmann & Smith 1955	*Buteo albonotatus*	YAN	1	1	5		Venezuela		
Gelain et al. 2001	*Buteo albigula*	Active nest(s)	1		9	1998-2001	Argentina	Río Negro	San Carlos de Bariloche
Gelain et al. 2001	*Buteo albigula*	Active nest(s)	1		10	1998-2001	Argentina	Río Negro	San Carlos de Bariloche

Gelain et al. 2001	*Buteo albigula*	Active nest(s)	1		11	1998-2001	Argentina	Río Negro	San Carlos de Bariloche
Gelain et al. 2001	*Buteo albigula*	Active nest(s)	1		12	1998-2001	Argentina	Río Negro	San Carlos de Bariloche
Gelain et al. 2001	*Buteo albigula*	Active nest(s)	1		1	1998-2001	Argentina	Río Negro	San Carlos de Bariloche
Gelain et al. 2001	*Buteo albigula*	Active nest(s)	1		2	1998-2001	Argentina	Río Negro	San Carlos de Bariloche
Gelain et al. 2001	*Buteo albigula*	Active nest(s)	1		3	1998-2001	Argentina	Río Negro	San Carlos de Bariloche
Gelain et al. 2001	*Buteo albigula*	Active nest(s)	1		4	1998-2001	Argentina	Río Negro	San Carlos de Bariloche
Gelain et al. 2001	*Buteo albigula*	Active nest(s)	1		12	2000	Argentina	Río Negro	San Carlos de Bariloche
Gelain et al. 2001	*Buteo albigula*	Active nest(s)	1		1	2001	Argentina	Río Negro	San Carlos de Bariloche
Gelain et al. 2001	*Buteo albigula*	Active nest(s)	1		2	2001	Argentina	Río Negro	San Carlos de Bariloche
Gelain et al. 2001	*Buteo albigula*	Active nest(s)	1		3	2001	Argentina	Río Negro	San Carlos de Bariloche
Gelain et al. 2001	*Buteo albigula*	Active nest(s)	1		1	2001	Argentina	Río Negro	San Carlos de Bariloche
Gelain et al. 2001	*Buteo albigula*	Active nest(s)	1		2	2001	Argentina	Río Negro	San Carlos de Bariloche
Gelain et al. 2001	*Buteo albigula*	Active nest(s)	1		3	2001	Argentina	Río Negro	San Carlos de Bariloche
Gelis & Greeney 2007	*Morphnarchus princeps*	Egg(s)	1	10 to 17	2	2004	Ecuador	Napo	Cosanga
Gelis & Greeney 2007	*Morphnarchus princeps*	Nestling stage	1		3	2004	Ecuador	Napo	Cosanga
Gelis & Greeney 2007	*Morphnarchus princeps*	Nestling stage	1		4	2004	Ecuador	Napo	Cosanga
Gelis & Greeney 2007	*Morphnarchus princeps*	YAN	1	8	5	2004	Ecuador	Napo	Cosanga
Gelis & Greeney 2007	*Morphnarchus princeps*	Egg(s)	1	23	12	2004	Ecuador	Napo	Cosanga
Gelis & Greeney 2007	*Morphnarchus princeps*	Hatching	1	19	1	2005	Ecuador	Napo	Cosanga
Greeney et al. 2011	*Geranoaetus melanoleucus*	Nestling stage	1	1	8	2004	Ecuador	Napo	Papallacta
Greeney et al. 2011	*Geranoaetus polyosoma*	Active nest(s)	1	23	7	2004	Ecuador	Napo	Papallacta
Hahn et al. 2011	*Geranoaetus polyosoma*	Active nest(s)	1		11		Chile	Juan Fernández Islands	
Hahn et al. 2011	*Geranoaetus polyosoma*	Active nest(s)	1		12		Chile	Juan Fernández Islands	
Hahn et al. 2011	*Geranoaetus polyosoma*	Active nest(s)	1		1		Chile	Juan Fernández Islands	
Hahn et al. 2011	*Geranoaetus polyosoma*	Active nest(s)	1		2		Chile	Juan Fernández Islands	
Haverschmidt 1968	*Buteogallus meridionalis*	Egg(s)	1	20	12		Suriname		
Haverschmidt 1968	*Buteogallus meridionalis*	Egg(s)	1	7	2		Suriname		
Haverschmidt 1968	*Buteogallus meridionalis*	Sitting	1	10	3		Suriname		
Haverschmidt 1968	*Geranoaetus albicaudatus*	YAN	1	26	4		Suriname		
Haverschmidt 1968	*Rupornis magnirostris*	YAN	1	7	2		Suriname		

Haverschmidt 1968	*Rupornis magnirostris*	Nestling stage	1	9	4		Suriname		
Haverschmidt 1968	*Rupornis magnirostris*	Incubating	1	19	4		Suriname		
Haverschmidt 1968	*Buteo nitidus*	Egg(s)	1	10	2		Suriname		
Haverschmidt 1968	*Buteo nitidus*	Nestling stage	1	4	5		Suriname		
Haverschmidt 1968	*Buteo nitidus*	YAN	1	12	2		Suriname		
Haverschmidt 1968	*Buteogallus urubitinga*	YAN	1	18	10		Suriname		
Haverschmidt 1968	*Buteogallus urubitinga*	Sitting	1	27	6		Suriname		
Haverschmidt 1968	*Buteogallus aequinoctialis*	Egg(s)	1	20	3		Suriname		
Hellebrekers 1942	*Rupornis magnirostris*	Egg(s)	2		3		Suriname		
Hellebrekers 1942	*Rupornis magnirostris*	Egg(s)	2		4		Suriname		
Hellebrekers 1942	*Rupornis magnirostris*	Egg(s)	1		5		Suriname		
Hellebrekers 1942	*Buteogallus aequinoctialis*	Egg(s)	3		2		Suriname		
Hellebrekers 1942	*Buteogallus aequinoctialis*	Egg(s)	2		3		Suriname		
Hellebrekers 1942	*Buteogallus aequinoctialis*	Egg(s)	2		4		Suriname		
Hellebrekers 1942	*Buteogallus aequinoctialis*	Egg(s)	2		5		Suriname		
Hellebrekers 1942	*Buteogallus aequinoctialis*	Egg(s)	1		6		Suriname		
Hengstenberg & Vilella 2005	*Buteo platypterus*	Incubating	3		3	2001	USA	Puerto Rico	Ceiba
Hengstenberg & Vilella 2005	*Buteo platypterus*	Hatching	3		4	2001	USA	Puerto Rico	Ceiba
Hengstenberg & Vilella 2005	*Buteo platypterus*	Fledgling stage	1		5	2001	USA	Puerto Rico	Ceiba
Hengstenberg & Vilella 2005	*Buteo platypterus*	Incubating	2		3	2002	USA	Puerto Rico	Ceiba
Hengstenberg & Vilella 2005	*Buteo platypterus*	Hatching	2		4	2002	USA	Puerto Rico	Ceiba
Hengstenberg & Vilella 2005	*Buteo platypterus*	Fledgling stage	1		5	2002	USA	Puerto Rico	Ceiba
Herklots 1961	*Pseudastur albicollis*	Sitting	1	7	3	1943	Trinidad and Tobago		
Herklots 1961	*Buteo brachyurus*	Active nest(s)	1		3	1942	Trinidad and Tobago		Chacachacare Island
Hilty & Brown 1986	*Buteo brachyurus*	Active nest(s)	1		2		Panama		
Hilty & Brown 1986	*Buteogallus anthracinus*	Fledgling stage	1	4	8		Colombia	Magdalena	
Hilty & Brown 1986	*Buteogallus meridionalis*	Active nest(s)	1	8	2		Colombia		
Hilty & Brown 1986	*Buteogallus meridionalis*	Incubating	1	30	3		Colombia		Cartagena
Hilty & Brown 1986	*Parabuteo unicinctus*	Fledgling stage	1		7		Colombia	Cauca	Popayán
Hilty & Brown 1986	*Parabuteo leucorrhous*	Active nest(s)	1		2		Colombia	Huila	
Hilty & Brown 1986	*Parabuteo leucorrhous*	Active nest(s)	1		3		Colombia	Huila	
Hilty & Brown 1986	*Geranoaetus albicaudatus*	Active nest(s)	1	21	4	1973	Colombia		Valle del Cauca
Hilty & Brown 1986	*Geranoaetus albicaudatus*	Active nest(s)	1		1		Colombia	Meta	
Hilty & Brown 1986	*Geranoaetus albicaudatus*	Active nest(s)	1		2		Colombia	Meta	
Hilty & Brown 1986	*Geranoaetus albicaudatus*	Active nest(s)	1		3		Colombia	Meta	
Hilty & Brown 1986	*Geranoaetus albicaudatus*	Active nest(s)	1		4		Colombia	Meta	
Hilty & Brown 1986	*Geranoaetus albicaudatus*	Active nest(s)	1		5		Colombia	Meta	
Hilty & Brown 1986	*Buteo albonotatus*	Incubating	2		8		Colombia		
Hiraldo et al. 1995	*Geranoaetus melanoleucus*	Active nest(s)	1		9	1991-1993	Argentina	Neuquén	Junin de los Andes
Hiraldo et al. 1995	*Geranoaetus melanoleucus*	Active nest(s)	1		10	1991-1993	Argentina	Neuquén	Junin de los Andes

Hiraldo et al. 1995		*Geranoaetus melanoleucus*	Active nest(s)	1		11	1991-1993	Argentina	Neuquén	Junin de los Andes
Hiraldo et al. 1995		*Geranoaetus melanoleucus*	Active nest(s)	1		12	1991-1993	Argentina	Neuquén	Junin de los Andes
Hiraldo et al. 1995		*Geranoaetus melanoleucus*	Active nest(s)	1		1	1991-1993	Argentina	Neuquén	Junin de los Andes
Hiraldo et al. 1995		*Geranoaetus melanoleucus*	Active nest(s)	1		2	1991-1993	Argentina	Neuquén	Junin de los Andes
Hiraldo et al. 1995		*Geranoaetus melanoleucus*	Active nest(s)	1		9	1991-1993	Argentina	Neuquén	Junin de los Andes
Hiraldo et al. 1995		*Geranoaetus melanoleucus*	Active nest(s)	1		10	1991-1993	Argentina	Neuquén	Junin de los Andes
Hiraldo et al. 1995		*Geranoaetus melanoleucus*	Active nest(s)	1		11	1991-1993	Argentina	Neuquén	Junin de los Andes
Hiraldo et al. 1995		*Geranoaetus melanoleucus*	Active nest(s)	1		12	1991-1993	Argentina	Neuquén	Junin de los Andes
Hiraldo et al. 1995		*Geranoaetus melanoleucus*	Active nest(s)	1		1	1991-1993	Argentina	Neuquén	Junin de los Andes
Hiraldo et al. 1995		*Geranoaetus melanoleucus*	Active nest(s)	1		2	1991-1993	Argentina	Neuquén	Junin de los Andes
IAvH - Colombia	IAvH-CJM-1530	*Buteo brachyurus*	Egg(s)	1	13	4	1962	Suriname	Paramaribo	
IAvH - Colombia	IAvH-CJM-1566	*Buteo jamaicensis*	Egg(s)	1	13	5	1934	Jamaica	Kingston	Constant Spring
IAvH - Colombia	IAvH-CJM-1487	*Buteo plagiatus*	Egg(s)	1	5	5	1961	El Salvador	La Libertad	
IAvH - Colombia	IAvH-CJM-4377	*Geranoaetus albicaudatus*	Egg(s)	1	15	7	1941	Suriname	Paramaribo	
IAvH - Colombia	IAvH-CJM-1573	*Geranoaetus albicaudatus*	Egg(s)	1	4	10	1966	Colombia	Santander	Tibú
IAvH - Colombia	IAvH-CJM-1485	*Geranoaetus melanoleucus*	Egg(s)	1	3	11	1940	Chile	Santiago	
IAvH - Colombia	IAvH-CJM-1497	*Geranoaetus polyosoma*	Egg(s)	1	5	10	1932	Chile	Atacama	
IAvH - Colombia	IAvH-CJM-1498	*Geranoaetus polyosoma*	Egg(s)	1	2	10	1943	Chile		
IAvH - Colombia	IAvH-CJM-1585	*Buteogallus aequinoctialis*	Egg(s)	1	5	7	1965	Suriname	Pará	Zanderij
IAvH - Colombia	IAvH-CJM-4341	*Buteogallus meridionalis*	Egg(s)	1	10	2	1960	Colombia	Meta	La Macarena
IAvH - Colombia	IAvH-CJM-1486	*Parabuteo unicinctus*	Egg(s)	1	30	9	1939	Chile	Santiago	
Ignazi 2015		*Geranoaetus melanoleucus*	Hatching	1	15	11	2008	Argentina		Bariloche
Jiménez 1995		*Geranoaetus polyosoma*	Laying	1		9		Chile		
Jiménez 1995		*Geranoaetus polyosoma*	Laying	1		10		Chile		
Jiménez 1995		*Geranoaetus polyosoma*	Laying	3		9		Chile	Santiago	Aucó
Jiménez 1995		*Geranoaetus polyosoma*	Laying	2		10		Chile	Santiago	Aucó
Jones 2002		*Buteo brachyurus*	Incubating	1	7	4		El Salvador	Morazán	Perquín
Kirwan 2009		*Leucopternis kuhli*	Sitting	1	18	12	2007	Brazil	Amazonas	
Lehmann 1957		*Geranoaetus albicaudatus*	Nestling stage	1		8		Colombia		Valle del Cauca
Lobos et al. 2007		*Buteogallus coronatus*	Active nest(s)	1		10	2004	Argentina	Mendoza	Lavalle
Lobos et al. 2007		*Buteogallus coronatus*	Active nest(s)	1		11	2004	Argentina	Mendoza	Lavalle
Lobos et al. 2007		*Buteogallus coronatus*	Hatching	1	16	12	2004	Argentina	Mendoza	Lavalle
Lobos et al. 2007		*Buteogallus coronatus*	Nestling stage	1		1	2005	Argentina	Mendoza	Lavalle
Lobos et al. 2007		*Buteogallus coronatus*	Active nest(s)	1		2	2005	Argentina	Mendoza	Lavalle
Lobos et al. 2007		*Buteogallus coronatus*	Active nest(s)	1		3	2005	Argentina	Mendoza	Lavalle
Lobos et al. 2011		*Buteogallus coronatus*	Active nest(s)	1		9	2005-2009	Argentina	Mendoza	Lavalle
Lobos et al. 2011		*Buteogallus coronatus*	Active nest(s)	1		10	2005-2009	Argentina	Mendoza	Lavalle
Lobos et al. 2011		*Buteogallus coronatus*	Active nest(s)	1		11	2005-2009	Argentina	Mendoza	Lavalle
Lobos et al. 2011		*Buteogallus coronatus*	Active nest(s)	1		12	2005-2009	Argentina	Mendoza	Lavalle
Lobos et al. 2011		*Buteogallus coronatus*	Active nest(s)	1		1	2005-2009	Argentina	Mendoza	Lavalle

Lobos et al. 2011	*Buteogallus coronatus*	Active nest(s)	1		2	2005-2009	Argentina	Mendoza	Lavalle
Maceda 2007	*Buteogallus coronatus*	Egg(s)	1		10	1999	Argentina	La Pampa	Loventué
Maceda 2007	*Buteogallus coronatus*	YAN	2		12	2001-2008	Argentina	La Pampa	Loventué
Maceda 2007	*Buteogallus coronatus*	YAN	2		1	2001-2008	Argentina	La Pampa	Loventué
Maceda 2007	*Buteogallus coronatus*	Fledgling stage	1		3	2001-2008	Argentina	La Pampa	Loventué
Maceda 2007	*Buteogallus coronatus*	Egg(s)	1		10	2003-2006	Argentina	La Pampa	Loventué
Maceda 2007	*Buteogallus coronatus*	Egg(s)	1		11	2003-2006	Argentina	La Pampa	Loventué
Maceda 2007	*Buteogallus coronatus*	Egg(s)	1		11	2007	Argentina	La Pampa	
Maceda et al. 2007	*Buteogallus coronatus*	Incubating	1		1	2004	Argentina	La Pampa	
Maceda et al. 2007	*Buteogallus coronatus*	Nestling stage	1		2	2004	Argentina	La Pampa	
Maceda et al. 2007	*Buteogallus coronatus*	Active nest(s)	1		1	2006	Argentina	La Pampa	
Macedo 1964	*Geranoaetus polyosoma*	Laying	1		4		Peru	Puno	
Macedo 1964	*Geranoaetus polyosoma*	Laying	1		5		Peru	Puno	
Mader pers. obs. apud GRIN	*Buteogallus meridionalis*	Active nest(s)	7		4		Venezuela	Guárico	
Mader pers. obs. apud GRIN	*Buteogallus meridionalis*	Active nest(s)	7		5		Venezuela	Guárico	
Mader pers. obs. apud GRIN	*Buteogallus meridionalis*	Active nest(s)	17		6		Venezuela	Guárico	
Mader pers. obs. apud GRIN	*Buteogallus meridionalis*	Active nest(s)	17		7		Venezuela	Guárico	
Mader pers. obs. apud GRIN	*Buteogallus meridionalis*	Active nest(s)	17		8		Venezuela	Guárico	
Mader pers. obs. apud GRIN	*Buteogallus meridionalis*	Active nest(s)	7		9		Venezuela	Guárico	
Mader pers. obs. apud GRIN	*Buteogallus meridionalis*	Active nest(s)	7		10		Venezuela	Guárico	
Marchant 1960	*Geranoaetus polyosoma*	Egg(s)	1	20	3	1955-1958	Ecuador	Guayas	
Marchant 1960	*Geranoaetus polyosoma*	YAN	1	>=20	3	1955-1958	Ecuador	Guayas	
Marchant 1960	*Geranoaetus polyosoma*	YAN	1	22	4	1955-1958	Ecuador	Guayas	
Marchant 1960	*Geranoaetus polyosoma*	YAN	1	<=5	5	1955-1958	Ecuador	Guayas	
Marchant 1960	*Geranoaetus polyosoma*	Egg(s)	1	5	5	1955-1958	Ecuador	Guayas	
Marini et al. 2007	*Rupornis magnirostris*	Egg(s)	1	1	9	1999	Brazil	Minas Gerais	
Marini et al. 2007	*Rupornis magnirostris*	Nestling stage	1	7	10	1999	Brazil	Minas Gerais	
Marini et al. 2007	*Rupornis magnirostris*	Egg(s)	1	29	8	1999	Brazil	Minas Gerais	
Marini et al. 2012	*Buteogallus meridionalis*	Incubating	1	19	9	2003	Brazil	Distrito Federal	
Marini et al. 2012	*Buteogallus meridionalis*	Hatching	1	6	10	2003	Brazil	Distrito Federal	
Maurício et al. 2013	*Geranoaetus albicaudatus*	YAN	1	10	11	2012	Brazil	Rio Grande do Sul	Cruz Alta
Maurício et al. 2013	*Buteogallus meridionalis*	Nestling stage	1	28	12	2004	Brazil	Rio Grande do Sul	Rio Grande
McLellan 1926	*Buteo jamaicensis*	Active nest(s)	2		5	1925	Mexico	Baja California	Revillagigedo Islands
McLellan 1926	*Buteo jamaicensis*	Hatching	1		4	1925	Mexico	Baja California	Revillagigedo Islands
Medel Hidalgo et al. 2013	*Buteo ventralis*	Incubating	1		10	2012	Chile	Araucanía	Curacautin
Medel Hidalgo et al. 2013	*Buteo ventralis*	Incubating	1		11	2012	Chile	Araucanía	Curacautin
Medel Hidalgo et al. 2013	*Buteo ventralis*	Incubating	1		12	2012	Chile	Araucanía	Curacautin
Medel Hidalgo et al. 2013	*Buteo ventralis*	Incubating	1		10	2012	Chile	Los Rios	Valdivia
Medel Hidalgo et al. 2013	*Buteo ventralis*	Incubating	1		11	2012	Chile	Los Rios	Valdivia
Medel Hidalgo et al. 2013	*Buteo ventralis*	Incubating	1		12	2012	Chile	Los Rios	Valdivia

Medel Hidalgo et al. 2013		*Buteo ventralis*	Incubating	1		10	2012	Chile	Los Rios	Paillaco
Medel Hidalgo et al. 2013		*Buteo ventralis*	Incubating	1		11	2012	Chile	Los Rios	Paillaco
Medel Hidalgo et al. 2013		*Buteo ventralis*	Incubating	1		12	2012	Chile	Los Rios	Paillaco
Medel Hidalgo et al. 2013		*Buteo ventralis*	Incubating	2		10	2008	Chile	Bio-Bio	Contulmo
Medel Hidalgo et al. 2013		*Buteo ventralis*	Incubating	1		10	2008	Chile	Araucanía	Victoria
MLP	2229	*Geranoaetus polyosoma*	Egg(s)	1	4	10	1927	Argentina	Tucuman	Famaillá
MLP	2230	*Buteogallus meridionalis*	Egg(s)	1	19	9	1926	Argentina	Tucumán	Famaillá
MLP	2233	*Buteogallus meridionalis*	Egg(s)	1	15	9	1932	Argentina	Tucumán	Famaillá
MLP	2234	*Buteogallus meridionalis*	Egg(s)	1	15	9	1933	Argentina	Tucumán	Famaillá
MLP	2231	*Buteogallus meridionalis*	Egg(s)	1	23	10	1930	Argentina	Tucumán	Simoca
MLP	2232	*Buteogallus meridionalis*	Egg(s)	1	23	10	1930	Argentina	Tucumán	Simoca
MLP	2221	*Buteogallus urubitinga*	Egg(s)	1	4	10	1927	Argentina	Tucumán	Famaillá
MLP	2222	*Buteogallus urubitinga*	Egg(s)	1	15	9	1929	Argentina	Tucumán	Simoca
MLP	2223	*Buteogallus urubitinga*	Egg(s)	1	26	9	1930	Argentina	Tucumán	Simoca
MLP	2224	*Buteogallus urubitinga*	Egg(s)	1	13	8	1932	Argentina	Tucumán	Simoca
MLP	2225	*Buteogallus urubitinga*	Egg(s)	1	28	8	1932	Argentina	Tucumán	Simoca
MLP	2217	*Rupornis magnirostris*	Egg(s)	1	22	11	1930	Argentina	Tucumán	Famaillá
MLP	2218	*Rupornis magnirostris*	Egg(s)	1	29	10	1931	Argentina	Tucumán	Famaillá
MLP	2219	*Rupornis magnirostris*	Egg(s)	1	9	10	1933	Argentina	Tucumán	Famaillá
MN - Rio de Janeiro	4851	*Buteogallus meridionalis*	E+L	1	24	9	1924	Brazil	Minas Gerais	Arcos
MN - Rio de Janeiro	4855	*Rupornis magnirostris*	E+L	1	20	10	1901	Brazil	Minas Gerais	Arcos
MN - Rio de Janeiro	4861	*Rupornis magnirostris*	E+L	1	26	9	1928	Brazil	Minas Gerais	Arcos
MN - Rio de Janeiro	4862	*Rupornis magnirostris*	Egg(s)	1	17	9	1923	Brazil	Minas Gerais	Arcos
Mojica 2012		*Rupornis magnirostris*	Active nest(s)	1		10	2010	Bolivia	Cochabamba	
Monsalvo 2012		*Buteo brachyurus*	Active nest(s)	1		11	2009	Brazil	São Paulo	São Paulo
Monsalvo 2012		*Buteo brachyurus*	Active nest(s)	1		12	2009	Brazil	São Paulo	São Paulo
Monsalvo 2012		*Buteo brachyurus*	Fledgling stage	1		1	2010	Brazil	São Paulo	São Paulo
Monsalvo 2012		*Buteo brachyurus*	Active nest(s)	1		2	2010	Brazil	São Paulo	São Paulo
Monsalvo 2012		*Buteo brachyurus*	Incubating	1		8	2010	Brazil	São Paulo	São Paulo
Monsalvo 2012		*Buteo brachyurus*	Incubating	1		9	2010	Brazil	São Paulo	São Paulo
Monsalvo 2012		*Buteo brachyurus*	Nestling stage	1		10	2010	Brazil	São Paulo	São Paulo
Monsalvo 2012		*Buteo brachyurus*	Fledgling stage	1		11	2010	Brazil	São Paulo	São Paulo
Morales & Fernández 1993		*Buteo nitidus*	Active nest(s)	1		2		Venezuela		
Morales & Fernández 1993		*Buteo nitidus*	Active nest(s)	1		4		Venezuela		
Motta-Junior et al. 2010?		*Geranoaetus albicaudatus*	Egg(s)	1		9	1998	Brazil	Minas Gerais	Juiz de Fora
Motta-Junior et al. 2010?		*Geranoaetus albicaudatus*	Nestling stage	1	11	11	1999	Brazil	Minas Gerais	Juiz de Fora
Muela & Valdez 2003		*Morphnarchus princeps*	Egg(s)	1	25	2	2002	Panama	Darien	
Muñoz 2012		*Buteo galapagoensis*	YAN	1		3	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		4	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		5	2011	Ecuador	Galapagos Islands	Santiago Island

Muñoz 2012		*Buteo galapagoensis*	YAN	1		6	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		7	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		8	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		3	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		4	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		5	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		6	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		7	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		8	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		3	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		4	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		5	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		6	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		7	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		8	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		3	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		4	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		5	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		6	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		7	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		8	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		3	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		4	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		5	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		6	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		7	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		8	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		3	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		4	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		5	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		6	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		7	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		8	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		3	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		4	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		5	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		6	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		7	2011	Ecuador	Galapagos Islands	Santiago Island
Muñoz 2012		*Buteo galapagoensis*	YAN	1		8	2011	Ecuador	Galapagos Islands	Santiago Island
MZS - Strasbourg	14121	*Buteogallus meridionalis*	Egg(s)	1	18	8	1905	Brazil	Pará	Chaves

MZS - Strasbourg	14122	*Buteogallus urubitinga*	Egg(s)	1	3	8	1905	Brazil	Pará	Mexiana
Narosky & Martelli 1995		*Geranoaetus melanoleucus*	Active nest(s)	1		10	1991	Argentina	Formosa	Clorinda
Narozky & Martelli 1995		*Buteogallus meridionalis*	Hatching	1	12	10	1991	Argentina	Formosa	
Navarro et al. 2007		*Buteo nitidus*	Nestling stage	1		3	2003	Venezuela	Bolívar	Río Caroní
Navarro et al. 2007		*Rupornis magnirostris*	Active nest(s)	2		1	2003	Venezuela	Bolívar	Río Caroní
Navarro et al. 2007		*Rupornis magnirostris*	Active nest(s)	2		2	2003	Venezuela	Bolívar	Río Caroní
Navarro et al. 2007		*Rupornis magnirostris*	Active nest(s)	2		3	2003	Venezuela	Bolívar	Río Caroní
Navarro et al. 2007		*Buteogallus meridionalis*	Egg(s)	1		9	2002	Venezuela	Bolívar	Río Caroní
Navarro et al. 2007		*Buteogallus meridionalis*	Egg(s)	1		10	2002	Venezuela	Bolívar	Río Caroní
Navarro et al. 2007		*Buteogallus meridionalis*	Egg(s)	1		11	2002	Venezuela	Bolívar	Río Caroní
Navarro et al. 2007		*Buteogallus meridionalis*	Egg(s)	1		12	2002	Venezuela	Bolívar	Río Caroní
Navarro et al. 2007		*Buteogallus meridionalis*	Egg(s)	1		1	2003	Venezuela	Bolívar	Río Caroní
Navarro et al. 2007		*Buteogallus meridionalis*	Egg(s)	1		2	2003	Venezuela	Bolívar	Río Caroní
Navarro et al. 2007		*Buteogallus meridionalis*	Egg(s)	1		3	2003	Venezuela	Bolívar	Río Caroní
Naveda-Rodríguez 2004		*Buteogallus urubitinga*	Hatching	1	6	7	2001	Venezuela		
NHM	1884-9-2-122-4	*Buteo plagiatus*	Egg(s)	1	3	4	1860	Guatemala	Baja Verapaz	San Jerónimo
NHM	1955-5-32	*Buteo plagiatus*	Egg(s)	1	13	4	1881	Mexico	Sinaloa	
NHM	1941-2-5-12	*Buteo galapagoensis*	Egg(s)	1	13	8	1897	Ecuador	Galapagos Islands	Ilha de Pinta
NHM	1898-1-4-356-358	*Geranoaetus polyosoma*	Egg(s)	1		11	1885	Chile		
NHM	1898-1-4-359-361	*Geranoaetus polyosoma*	Egg(s)	1		10	1885	Chile		
NHM	1926-6-1-22-3	*Geranoaetus polyosoma*	Egg(s)	1	19	10	1923	Argentina	Tierra del Fuego	
NHM	1935-1-29-39-40	*Geranoaetus polyosoma*	Egg(s)	1		10		Falklands	Hill Cove	
NHM	1935-1-29-41-42	*Geranoaetus polyosoma*	Egg(s)	1		10	1913	Falklands	Hill Cove	
NHM	1961.8.11	*Geranoaetus polyosoma*	Egg(s)	1		10	1947	Argentina	La Pampa	Alpachiri
NHM	1898-1-4-363	*Geranoaetus melanoleucus*	Egg(s)	1		10	1885	Chile		
NHM	1898-1-4-365-6	*Geranoaetus melanoleucus*	Egg(s)	1		10	1885	Chile		
NHM	1926-6-1-8	*Geranoaetus melanoleucus*	Egg(s)	1	11	11	1917	Argentina	Tierra del Fuego	
NHM	1928-7-6-32-33	*Geranoaetus melanoleucus*	Egg(s)	1	25	10	1927	Argentina	Tierra del Fuego	
NHM	1973.6.7	*Buteogallus anthracinus*	Egg(s)	1	13	4	1937	Trinidad and Tobago	Trinidad	
NHM	1884-9-2-140	*Buteogallus anthracinus*	Egg(s)	1	29	4	1860	Guatemala	Baja Verapaz	San Jerónimo
NHM	1941-4-3-688	*Buteogallus meridionalis*	Egg(s)	1	5	10	1905	Argentina	Santa Fé	General Obligado
NHM	1941-4-3-689	*Buteogallus meridionalis*	Egg(s)	1	17	11	1905	Argentina	Santa Fé	
NHM	1941-4-3-690	*Buteogallus meridionalis*	Egg(s)	1	25	11	1905	Argentina	Santa Fé	
NHM	1973.6.5	*Buteogallus meridionalis*	Egg(s)	1	4	11	1956	Paraguay		
NHM	1898-1-4-376-7	*Parabuteo unicinctus*	Egg(s)	1		10	1885	Chile		
NHM	1898-1-4-380-1	*Parabuteo unicinctus*	Egg(s)	1		10	1884	Chile		
NHM	1898-1-4-382-3	*Parabuteo unicinctus*	Egg(s)	1		10	1885	Chile		
NHM	1941-4-3-696	*Parabuteo leucorrhous*	Egg(s)	1		10	1905	Argentina		
NHM	no number	*Rupornis magnirostris*	Egg(s)	1	21	10	1887	Paraguay		
NHM	1941-4-3-692	*Rupornis magnirostris*	Egg(s)	1	30	9	1903	Argentina		

NHM	1941-4-3-693	*Rupornis magnirostris*	Egg(s)	1	10	11	1903	Argentina		
NHM	1941-4-3-694	*Rupornis magnirostris*	Egg(s)	1	1	10	1904	Argentina	Santa Fé	
NHM	1941-4-3-695	*Rupornis magnirostris*	Egg(s)	1	1	10	1905	Argentina	Santa Fé	
NHM	1973.6.6	*Rupornis magnirostris*	Egg(s)	1	4	4	1964	Mexico	Veracruz	
NHM	1973.6.4	*Buteogallus meridionalis*	Egg(s)	1	26	9	1925	Brazil	Minas Gerais	Dores do Indaiá
Norambuena et al. 2012		*Buteo ventralis*	Hatching	1		11	2008	Chile		Temuco
Norambuena et al. 2012		*Buteo ventralis*	Hatching	1		11	2009	Chile		Temuco
Norambuena et al. 2013		*Buteo ventralis*	Incubating	1	2	11	2012	Chile		Lago Ranco
Ojeda et al. 2003		*Buteo albigula*	Incubating	2		11	2001	Argentina		San Carlos de Bariloche
Ojeda et al. 2003		*Buteo albigula*	Active nest(s)	1		12	2001	Argentina		San Carlos de Bariloche
Ojeda et al. 2003		*Buteo albigula*	Active nest(s)	1		1	2002	Argentina		San Carlos de Bariloche
Panasci & Whitacre 2000		*Rupornis magnirostris*	Nestling stage	3		4	1994	Guatemala	Petén	
Panasci & Whitacre 2000		*Rupornis magnirostris*	Nestling stage	2		5	1994	Guatemala	Petén	
Panasci & Whitacre 2000		*Rupornis magnirostris*	Nestling stage	2		6	1994	Guatemala	Petén	
Panasci & Whitacre 2002		*Rupornis magnirostris*	Fledgling stage	1		6	1993-1994	Guatemala	Petén	
Panasci & Whitacre 2002		*Rupornis magnirostris*	Egg(s)	3		3	1993-1994	Guatemala	Petén	
Panasci & Whitacre 2002		*Rupornis magnirostris*	Egg(s)	3		4	1993-1994	Guatemala	Petén	
Panasci & Whitacre 2002		*Rupornis magnirostris*	Egg(s)	2		5	1993-1994	Guatemala	Petén	
Panasci & Whitacre 2002		*Rupornis magnirostris*	Egg(s)	7		3	1993-1994	Guatemala	Petén	
Panasci & Whitacre 2002		*Rupornis magnirostris*	Egg(s)	7		4	1993-1994	Guatemala	Petén	
Panasci & Whitacre 2002		*Rupornis magnirostris*	Egg(s)	6		5	1993-1994	Guatemala	Petén	
Panasci & Whitacre 2002		*Rupornis magnirostris*	Fledgling stage	1		7	1993-1994	Guatemala	Petén	
Pávez 2001		*Geranoaetus melanoleucus*	Laying	1		10	1987-1988	Chile		
Pávez 2001		*Geranoaetus melanoleucus*	Laying	2		10	1987-1988	Chile		
Pávez 2001		*Geranoaetus melanoleucus*	Active nest(s)	1		8	1987-1989	Chile		
Pávez 2001		*Geranoaetus melanoleucus*	Active nest(s)	1		9	1987-1989	Chile		
Pávez 2001		*Geranoaetus melanoleucus*	Active nest(s)	1		11	1987-1989	Chile		
Pávez 2001		*Geranoaetus melanoleucus*	Active nest(s)	1		12	1987-1989	Chile		
Pávez 2001		*Geranoaetus melanoleucus*	Active nest(s)	1		1	1987-1989	Chile		
Pavez et al. 2004		*Buteo albigula*	Laying	1		10	1998-2000	Chile		
Pavez et al. 2004		*Buteo albigula*	Active nest(s)	1		11	1998-2000	Chile		
Pavez et al. 2004		*Buteo albigula*	Active nest(s)	1		12	1998-2000	Chile		
Pavez et al. 2004		*Buteo albigula*	Active nest(s)	1		1	1999-2001	Chile		
Pérez 2015		*Geranoaetus melanoleucus*	Incubating	1		10	2012	Chile		Santiago
Pérez 2015		*Geranoaetus melanoleucus*	Active nest(s)	1		7	2012	Chile		Santiago
Pérez 2015		*Geranoaetus melanoleucus*	Active nest(s)	1		8	2012	Chile		Santiago
Pérez 2015		*Geranoaetus melanoleucus*	Active nest(s)	1		9	2012	Chile		Santiago

Pérez 2015	*Geranoaetus melanoleucus*	Active nest(s)	1		11	2012	Chile		Santiago
Pérez 2015	*Geranoaetus melanoleucus*	Active nest(s)	1		12	2012	Chile		Santiago
Pérez 2015	*Geranoaetus melanoleucus*	Active nest(s)	1		1	2013	Chile		Santiago
Pérez 2015	*Geranoaetus melanoleucus*	Active nest(s)	1		2	2013	Chile		Santiago
Pérez León 2007	*Buteogallus anthracinus*	Active nest(s)	1		2	2007	El Salvador		
Pérez León 2007	*Buteogallus anthracinus*	Active nest(s)	1		4		El Salvador		
Pérez León 2007	*Buteogallus anthracinus*	Active nest(s)	1		6		El Salvador		
Phillips & Martinez 2013	*Buteogallus solitarius*	Hatching	1		4	2011	Belize	Cayo	
Phillips & Martinez 2013	*Buteogallus solitarius*	Nestling stage	1		5	2011	Belize	Cayo	
Phillips & Martinez 2013	*Buteogallus solitarius*	Nestling stage	1		7	2011	Belize	Cayo	
Phillips & Martinez 2013	*Buteogallus solitarius*	Fledgling stage	1		8	2011	Belize	Cayo	
Phillips et al. 2014	*Buteogallus solitarius*	Nestling stage	1	30	6	2011	Belize	Cayo	
Phillips et al. 2014	*Buteogallus solitarius*	Nestling stage	1	31	7	2014	Belize	Cayo	
Ridgely 1981	*Buteo brachyurus*	Active nest(s)	1	16	2	1960	Panama	Colón	Escobal
Ridgely pers. obs. apud Phillips & Martinez 201	*Buteogallus solitarius*	Active nest(s)	1	19	7	1989	Peru		
Rivas-Fuenzalida 2015	*Buteo ventralis*	Nestling stage	1	22	12	2007	Chile	Araucanía	
Rivas-Fuenzalida 2015	*Buteo ventralis*	Incubating	1	31	10	2008	Chile	Araucanía	
Rivas-Fuenzalida & Asciones-Contreras 2013	*Buteo ventralis*	Incubating	1		10	2012	Chile	Araucanía	Malleco
Rivas-Fuenzalida & Asciones-Contreras 2013	*Buteo ventralis*	Active nest(s)	1		10	2012	Chile	Araucanía	Malleco
Rivas-Fuenzalida & Asciones-Contreras 2013	*Buteo ventralis*	Active nest(s)	1		11	2012	Chile	Araucanía	Malleco
Rivas-Fuenzalida & Asciones-Contreras 2013	*Buteo ventralis*	Active nest(s)	1		12	2012	Chile	Araucanía	Malleco
Rivas-Fuenzalida et al. 2011	*Buteo ventralis*	Incubating	3		9	2007-2010	Chile	Araucanía	
Rivas-Fuenzalida et al. 2011	*Buteo ventralis*	Incubating	3		10	2007-2010	Chile	Araucanía	
Rivas-Fuenzalida et al. 2011	*Buteo ventralis*	Incubating	2		11	2007-2010	Chile	Araucanía	
Rivas-Fuenzalida et al. 2011	*Buteo ventralis*	Active nest(s)	1		8	2007-2010	Chile	Araucanía	
Rivas-Fuenzalida et al. 2011	*Buteo ventralis*	Active nest(s)	1		12	2007-2010	Chile	Araucanía	
Rivas-Fuenzalida et al. 2011	*Buteo ventralis*	Active nest(s)	1		1	2008-2011	Chile	Araucanía	
Rivas-Fuenzalida et al. 2013	*Buteo albigula*	Incubating	4		11	2006-2010	Chile	Araucanía	
Rivas-Fuenzalida et al. 2013	*Buteo albigula*	Incubating	4		12	2006-2010	Chile	Araucanía	
Rivas-Fuenzalida et al. 2015a	*Buteo ventralis*	Hatching	1		11	2014	Chile	Cauquenes	Cayurranquil
Rivas-Fuenzalida et al. 2015a	*Buteo ventralis*	Active nest(s)	1		12	2014	Chile	Cauquenes	Cayurranquil
Rivas-Fuenzalida et al. 2015a	*Buteo ventralis*	Fledgling stage	1		9		Chile		Arauco
Rivas-Fuenzalida et al. 2015a	*Buteo ventralis*	Fledgling stage	1		10		Chile		Arauco
Rivas-Fuenzalida et al. 2015a	*Buteo ventralis*	Fledgling stage	1		11		Chile		Arauco
Rivas-Fuenzalida et al. 2015a	*Buteo ventralis*	Active nest(s)	1		9		Chile		Cautín
Rivas-Fuenzalida et al. 2015a	*Buteo ventralis*	Active nest(s)	1		10		Chile		Cautín
Rivas-Fuenzalida et al. 2015a	*Buteo ventralis*	Active nest(s)	1		11		Chile		Cautín
Rivas-Fuenzalida et al. 2015a	*Buteo ventralis*	Active nest(s)	1		9		Chile	Araucanía	Malleco
Rivas-Fuenzalida et al. 2015a	*Buteo ventralis*	Active nest(s)	1		10		Chile	Araucanía	Malleco
Rivas-Fuenzalida et al. 2015a	*Buteo ventralis*	Active nest(s)	1		11		Chile	Araucanía	Malleco

Rivas-Fuenzalida et al. 2015c	*Buteo albigula*	Fledgling stage	1	30	1	2014	Chile	Araucanía	Concepción
Rivas-Fuenzalida et al. 2016	*Buteo ventralis*	Hatching	1	7	12	2015	Argentina	Río Negro	San Carlos de Bariloche
Rivas-Fuenzalida et al. 2016	*Buteo ventralis*	Hatching	1		10	2014	Chile		
Rivas-Fuenzalida et al. 2016	*Buteo ventralis*	Hatching	1		11	2014	Chile		
Rivas-Fuenzalida et al. 2016	*Buteo ventralis*	Hatching	1		11	2013	Argentina	Río Negro	San Carlos de Bariloche
Rivas-Fuenzalida et al. 2016	*Buteo ventralis*	Hatching	1		12	2013	Argentina	Río Negro	San Carlos de Bariloche
Rivas-Fuenzalida et al. 2016	*Buteo ventralis*	Nestling stage	1	16	12	2007	Argentina	Río Negro	San Carlos de Bariloche
Rivas-Fuenzalida et al. 2016	*Buteo ventralis*	Nestling stage	1	11	1	2015	Argentina	Río Negro	San Carlos de Bariloche
Saggese & De Lucca 2001	*Geranoaetus melanoleucus*	Incubating	1		9	1987	Argentina	Santa Cruz	Deseado
Saggese & De Lucca 2001	*Geranoaetus melanoleucus*	Incubating	1		10	1987	Argentina	Santa Cruz	Deseado
Saggese & De Lucca 2001	*Geranoaetus melanoleucus*	Incubating	1		11	1987	Argentina	Santa Cruz	Deseado
Saggese & De Lucca 2001	*Geranoaetus melanoleucus*	Incubating	1		9	1987	Argentina	Santa Cruz	Deseado
Saggese & De Lucca 2001	*Geranoaetus melanoleucus*	Incubating	1		10	1987	Argentina	Santa Cruz	Deseado
Saggese & De Lucca 2001	*Geranoaetus melanoleucus*	Incubating	1		11	1987	Argentina	Santa Cruz	Deseado
Saggese & De Lucca 2001	*Geranoaetus melanoleucus*	Active nest(s)	1		12	1987	Argentina	Santa Cruz	Deseado
Saggese & De Lucca 2001	*Geranoaetus melanoleucus*	Active nest(s)	1		1	1988	Argentina	Santa Cruz	Deseado
Salvador-Jr & Silva 2009	*Buteo brachyurus*	Fledgling stage	1		10	2005	Brazil	Minas Gerais	
Salvador-Jr. et al. 2008	*Geranoaetus melanoleucus*	Incubating	1		7	2005	Brazil	Minas Gerais	Belo Horizonte
Salvador-Jr. et al. 2008	*Geranoaetus melanoleucus*	Incubating	1		8	2005	Brazil	Minas Gerais	Belo Horizonte
Salvador-Jr. et al. 2008	*Geranoaetus melanoleucus*	Active nest(s)	1		9	2005	Brazil	Minas Gerais	Belo Horizonte
Salvador-Jr. et al. 2008	*Geranoaetus melanoleucus*	Active nest(s)	1		10	2005	Brazil	Minas Gerais	Belo Horizonte
Salvador-Jr. et al. 2008	*Geranoaetus melanoleucus*	Active nest(s)	1		11	2005	Brazil	Minas Gerais	Belo Horizonte
Salvador-Jr. et al. 2008	*Geranoaetus melanoleucus*	Active nest(s)	1		12	2005	Brazil	Minas Gerais	Belo Horizonte
Sandoval 2009	*Buteo plagiatus*	Sitting	1	21	3	2008	Costa Rica	Heredia	Getsemaní
Santana & Temple 1988	*Buteo jamaicensis*	Laying	19		1	1982-1983	USA	Puerto Rico	
Santana & Temple 1988	*Buteo jamaicensis*	Laying	2		12	1981-1982	USA	Puerto Rico	
Santana & Temple 1988	*Buteo jamaicensis*	Laying	2		1	1982-1983	USA	Puerto Rico	
Santana & Temple 1988	*Buteo jamaicensis*	Laying	1		2	1982-1983	USA	Puerto Rico	
Santana & Temple 1988	*Buteo jamaicensis*	Laying	1		3	1982-1983	USA	Puerto Rico	
Santana & Temple 1988	*Buteo jamaicensis*	Laying	1		4	1982-1983	USA	Puerto Rico	
Santana & Temple 1988	*Buteo jamaicensis*	Egg(s)	1		5	1982-1983	USA	Puerto Rico	
Santana & Temple 1988	*Buteo jamaicensis*	Active nest(s)	4		12	1981-1982	USA	Puerto Rico	
Santana & Temple 1988	*Buteo jamaicensis*	Active nest(s)	4		1	1982-1983	USA	Puerto Rico	
Santana & Temple 1988	*Buteo jamaicensis*	Active nest(s)	4		2	1982-1983	USA	Puerto Rico	
Santana & Temple 1988	*Buteo jamaicensis*	Active nest(s)	4		3	1982-1983	USA	Puerto Rico	
Santana & Temple 1988	*Buteo jamaicensis*	Active nest(s)	3		4	1982-1983	USA	Puerto Rico	

Santana & Temple 1988	*Buteo jamaicensis*	Active nest(s)	3		5	1982-1983	USA	Puerto Rico	
Santos & Rosado 2009	*Rupornis magnirostris*	Active nest(s)	1		10	2008	Brazil	Paraná	Peabiru
Santos et al. 2009	*Rupornis magnirostris*	YAN	1		11	2006	Brazil	Paraná	Peabiru
Santos et al. 2009	*Rupornis magnirostris*	Nestling stage	1		10	2006	Brazil	Paraná	Peabiru
Santos et al. 2009	*Rupornis magnirostris*	Egg(s)	1		9	2006	Brazil	Paraná	Peabiru
Sarasola et al. 2010	*Buteogallus coronatus*	Nestling stage	1	15	12	2007	Argentina	La Pampa	
Sarasola et al. 2010	*Buteogallus coronatus*	Nestling stage	1	15	2	2008	Argentina	La Pampa	
Schlatter 1979	*Geranoaetus polyosoma*	Fledgling stage	1		9		Chile		
Seavy & Gerhardt 1998	*Buteogallus urubitinga*	Laying	1	16	4	1991	Guatemala		
Seavy & Gerhardt 1998	*Buteogallus urubitinga*	Laying	1	4	5	1994	Guatemala		
Seavy & Gerhardt 1998	*Buteogallus urubitinga*	Laying	1	25	3	1994	Guatemala		
Seavy & Gerhardt 1998	*Buteogallus urubitinga*	Hatching	1	6	5	1994	Guatemala		
Seavy & Gerhardt 1998	*Buteogallus urubitinga*	Nestling stage	1	27	7	1991	Guatemala		
Seminario et al. 2011	*Buteogallus solitarius*	Fledgling stage	1		7	2009	Belize	Cayo	
Silva & Olmos 1997	*Parabuteo unicinctus*	Egg(s)	1	19	7	1996	Brazil	São Paulo	Santos
Sousa 1999	*Geranoaetus melanoleucus*	Egg(s)	1		6	1994	Brazil	Sergipe	
Sousa 1999	*Geranoaetus melanoleucus*	Egg(s)	1		7	1994	Brazil	Sergipe	
Sousa 1999	*Geranoaetus melanoleucus*	Egg(s)	1		8	1997	Brazil	Sergipe	
Thorstrom et al. 2005	*Buteo ridgwayi*	YAN	1		2	2002	Dominican Republic		
Thorstrom et al. 2005	*Buteo ridgwayi*	YAN	1		3	2002	Dominican Republic		
Thorstrom et al. 2005	*Buteo ridgwayi*	YAN	1		4	2002	Dominican Republic		
Thorstrom et al. 2005	*Buteo ridgwayi*	YAN	1		5	2002	Dominican Republic		
Thorstrom et al. 2005	*Buteo ridgwayi*	YAN	1		6	2002	Dominican Republic		
Thorstrom et al. 2005	*Buteo ridgwayi*	YAN	1		7	2002	Dominican Republic		
Thorstrom et al. 2005	*Buteo ridgwayi*	YAN	1		8	2002	Dominican Republic		
Thorstrom et al. 2005	*Buteo ridgwayi*	YAN	1		9	2002	Dominican Republic		
Thorstrom et al. 2005	*Buteo ridgwayi*	YAN	1		10	2002	Dominican Republic		
Thorstrom et al. 2005	*Buteo ridgwayi*	YAN	1		11	2002	Dominican Republic		
Thorstrom et al. 2005	*Buteo ridgwayi*	Nestling stage	4		3	2003	Dominican Republic		
Thorstrom et al. 2005	*Buteo ridgwayi*	Nestling stage	4		4	2003	Dominican Republic		
Thorstrom et al. 2005	*Buteo ridgwayi*	Nestling stage	4		5	2003	Dominican Republic		
Thorstrom et al. 2005	*Buteo ridgwayi*	Nestling stage	4		6	2003	Dominican Republic		
Thorstrom et al. 2005	*Buteo ridgwayi*	Nestling stage	4		7	2003	Dominican Republic		
Thorstrom et al. 2005	*Buteo ridgwayi*	Nestling stage	4		8	2003	Dominican Republic		
Thorstrom et al. 2005	*Buteo ridgwayi*	Nestling stage	3		9	2003	Dominican Republic		
Thorstrom et al. 2005	*Buteo ridgwayi*	Nestling stage	3		10	2003	Dominican Republic		
Thorstrom et al. 2005	*Buteo ridgwayi*	Active nest(s)	1		2	2002-2003	Dominican Republic		
Thorstrom et al. 2005	*Buteo ridgwayi*	Active nest(s)	1		11	2002-2003	Dominican Republic		
Thorstrom et al. 2007	*Buteo ridgwayi*	Nestling stage	11		3	2004	Dominican Republic		
Thorstrom et al. 2007	*Buteo ridgwayi*	Nestling stage	11		4	2004	Dominican Republic		

Thorstrom et al. 2007		*Buteo ridgwayi*	Nestling stage	11		5	2004	Dominican Republic		
Thorstrom et al. 2007		*Buteo ridgwayi*	Nestling stage	11		6	2004	Dominican Republic		
Thorstrom et al. 2007		*Buteo ridgwayi*	Nestling stage	10		7	2004	Dominican Republic		
Thorstrom et al. 2007		*Buteo ridgwayi*	YAN	9		3	2005	Dominican Republic		
Thorstrom et al. 2007		*Buteo ridgwayi*	YAN	9		4	2005	Dominican Republic		
Thorstrom et al. 2007		*Buteo ridgwayi*	YAN	9		5	2005	Dominican Republic		
Thorstrom et al. 2007		*Buteo ridgwayi*	YAN	9		6	2005	Dominican Republic		
Thorstrom et al. 2007		*Buteo ridgwayi*	YAN	9		7	2005	Dominican Republic		
Todd & Carriker 1922		*Rupornis magnirostris*	Egg(s)	1	13	4	1898	Colombia	Magdalena	Bonda
Todd & Carriker 1922		*Rupornis magnirostris*	Egg(s)	1	18	4	1898	Colombia	Magdalena	Bonda
Trejo et al. 2001		*Buteo albigula*	Fledgling stage	1	20	1	2001	Argentina		
Trejo et al. 2001		*Buteo albigula*	Active nest(s)	1		2	2001	Argentina		
Trejo et al. 2001		*Buteo albigula*	Active nest(s)	1		9	2000	Argentina		
Trejo et al. 2001		*Buteo albigula*	Active nest(s)	1		10	2000	Argentina		
Trejo et al. 2001		*Buteo albigula*	Active nest(s)	1		11	2000	Argentina		
Trejo et al. 2001		*Buteo albigula*	Active nest(s)	1		12	2000	Argentina		
Trejo et al. 2001		*Buteo albigula*	Active nest(s)	1		3	2003	Argentina		
Trejo et al. 2004		*Buteo albigula*	Hatching	2	16	12	2001	Argentina		Bariloche
Trejo et al. 2004		*Buteo albigula*	YAN	3		12	2000	Argentina		Bariloche
Trejo et al. 2004		*Buteo albigula*	YAN	3		1	2001	Argentina		Bariloche
Trejo et al. 2004		*Buteo albigula*	YAN	2		2	2001	Argentina		Bariloche
Trejo et al. 2004		*Buteo albigula*	Active nest(s)	1		10	1998-2001	Argentina		Bariloche
Trejo et al. 2004		*Buteo albigula*	Active nest(s)	1		10	1998-2001	Argentina		Bariloche
Trejo et al. 2004		*Buteo albigula*	Active nest(s)	1		3	1999-2002	Argentina		Bariloche
Trejo et al. 2006b		*Geranoaetus melanoleucus*	Active nest(s)	1		9	2002	Argentina	Río Negro	
Trejo et al. 2006b		*Geranoaetus melanoleucus*	Active nest(s)	1		10	2002	Argentina	Río Negro	
Trejo et al. 2006b		*Geranoaetus melanoleucus*	Active nest(s)	1		11	2002	Argentina	Río Negro	
Trejo et al. 2006b		*Geranoaetus melanoleucus*	Active nest(s)	1		12	2002	Argentina	Río Negro	
Trejo et al. 2006b		*Geranoaetus melanoleucus*	Active nest(s)	1		1	2003	Argentina	Río Negro	
Trejo et al. 2006b		*Geranoaetus melanoleucus*	Active nest(s)	1		2	2003	Argentina	Río Negro	
Trejo et al. 2006b		*Geranoaetus melanoleucus*	Active nest(s)	1		9	2003	Argentina	Río Negro	
Trejo et al. 2006b		*Geranoaetus melanoleucus*	Active nest(s)	1		10	2002	Argentina	Río Negro	
Trejo et al. 2006b		*Geranoaetus melanoleucus*	Active nest(s)	1		11	2002	Argentina	Río Negro	
Trejo et al. 2006b		*Geranoaetus melanoleucus*	Active nest(s)	1		12	2002	Argentina	Río Negro	
Trejo et al. 2006b		*Geranoaetus melanoleucus*	Active nest(s)	1		1	2003	Argentina	Río Negro	
Trejo et al. 2006b		*Geranoaetus melanoleucus*	Active nest(s)	1		2	2003	Argentina	Río Negro	
Urios et al. 2014		*Buteogallus coronatus*	Hatching	1		12	2006	Argentina	La Pampa	
USNM	B41077	*Rupornis magnirostris*	Egg(s)	1	26	10	1919	Brazil	Rio Grande Do Sul	
USNM	B41232	*Buteogallus aequinoctialis*	Egg(s)	1	5	3	1936	Venezuela		
USNM	B41236	*Buteogallus aequinoctialis*	Egg(s)	1	14	3	1936	Venezuela		

USNM	B41229	*Buteogallus aequinoctialis*	Egg(s)	1	27	4	1936	Venezuela		
USNM	B41230	*Buteogallus aequinoctialis*	Egg(s)	1	27	4	1936	Venezuela		
USNM	B41231	*Buteogallus aequinoctialis*	Egg(s)	1	27	4	1936	Venezuela		
USNM	B41233	*Buteogallus aequinoctialis*	Egg(s)	1	27	4	1936	Venezuela		
USNM	B41234	*Buteogallus aequinoctialis*	Egg(s)	1	27	4	1936	Venezuela		
USNM	B41227	*Buteogallus anthracinus*	Egg(s)	1	8	5	1932	Trinidad and Tobago	Trinidad	
Verea et al. 2009		*Rupornis magnirostris*	Active nest(s)	1		2	1992-2005	Venezuela		
Verea et al. 2009		*Rupornis magnirostris*	Active nest(s)	1		3	1992-2005	Venezuela		
Verea et al. 2009		*Rupornis magnirostris*	Active nest(s)	1		4	1992-2005	Venezuela		
Vilella & Hengstenberg 2006		*Buteo platypterus*	YAN	1		5	2001	USA	Puerto Rico	Ceiba
Walter 1990		*Buteo jamaicensis*	Active nest(s)	3	17-29	2	1990	Mexico	Baja California	Revillagigedo Islands
Walter 1990		*Buteo jamaicensis*	YAN	1		5	1990	Mexico	Baja California	Revillagigedo Islands
Walter 1990		*Buteo jamaicensis*	Egg(s)	1		5	1990	Mexico	Baja California	Revillagigedo Islands
Wetmore 1965		*Rupornis magnirostris*	Active nest(s)	1	21	1	1956	Panama		Isla Coiba
Wetmore 1965		*Buteogallus meridionalis*	Egg(s)	1	15	4	1941	Colombia		
Wetmore 1965		*Buteogallus urubitinga*	YAN	1	17	3	1948	Panama	Herrera	París
Wetmore 1965		*Buteogallus urubitinga*	YAN	1	21	4	1949	Panama		
Wetmore 1965		*Buteogallus anthracinus*	Active nest(s)	1	25	1	1963	Panama	Coclé	Aguadulce
WFVZ	16459	*Buteo albonotatus*	E+L	1	27	4	1937	Trinidad and Tobago	Trinidad	
WFVZ	124257	*Buteo albonotatus*	Egg(s)	1	19	5	1907	Honduras	Belize River	
WFVZ	16458	*Buteo albonotatus*	E+L	1	10	4	1937	Trinidad and Tobago	Trinidad	
WFVZ	16399	*Buteo brachyurus*	Egg(s)	1	30?	5	1938	Trinidad and Tobago	Trinidad	Sangre Grande
WFVZ	145392	*Buteo brachyurus*	Laying	1	25	3	1970	Mexico	Veracruz	Tampico
WFVZ	86347	*Buteo brachyurus*	E+L	1	7	4	1959	Mexico	Veracruz	Tampico
WFVZ	16401	*Buteo brachyurus*	Egg(s)	1	10	4	1963	Mexico	Veracruz	Tampico
WFVZ	86349	*Buteo brachyurus*	Egg(s)	1	10	5	1966	Mexico	Veracruz	
WFVZ	83450	*Buteo brachyurus*	Egg(s)	1	20	4	1964	Mexico	Veracruz	
WFVZ	86348	*Buteo brachyurus*	Egg(s)	1	16	4	1965	Mexico	Veracruz	
WFVZ	16400	*Buteo brachyurus*	Egg(s)	1	12	2	1911	Mexico	Veracruz	
WFVZ	209743	*Buteo brachyurus*	Egg(s)	1	10	4	1963	Mexico	Veracruz	
WFVZ	53324	*Buteo galapagoensis*	Egg(s)	1	20	6	1899	Ecuador	Galapagos Islands	Isla Marchena
WFVZ	54854	*Buteo jamaicensis*	Egg(s)	1	5	3	1928	Mexico	Baja California	
WFVZ	98405	*Buteo jamaicensis*	Egg(s)	1	24	3	1921	Mexico	Baja California	
WFVZ	98652	*Buteo jamaicensis*	Egg(s)	1	18	3	1923	Mexico	Baja California	
WFVZ	97815	*Buteo jamaicensis*	Egg(s)	1	17	3	1923	Mexico	Baja California	
WFVZ	157603	*Buteo jamaicensis*	Egg(s)	1	17	3	1923	Mexico	Baja California	
WFVZ	144947	*Buteo jamaicensis*	E+L	1	12	2	1920	Costa Rica	Cartago	
WFVZ	16570	*Buteo platypterus*	Egg(s)	1	12	5	1940	Dominican Republic		
WFVZ	16567	*Buteo platypterus*	Egg(s)	1	29	3	1938	Dominican Republic		
WFVZ	16568	*Buteo platypterus*	E+L	1	29	3	1939	Dominican Republic		

WFVZ	16569	*Buteo platypterus*	Egg(s)	1	14	4	1939	Dominican Republic		
WFVZ	16572	*Buteo platypterus*	Egg(s)	1	3	3	1940	Trinidad and Tobago	Tobago?	
WFVZ	16573	*Buteo platypterus*	Egg(s)	1	9	5	1938	Trinidad and Tobago	Tobago?	
WFVZ	16571	*Buteo platypterus*	E+L	1	28	4	1927	Saint Vincent	Saint Vincent	St. George
WFVZ	16781	*Geranoaetus albicaudatus*	Egg(s)	1	26	3	1931	Trinidad and Tobago	Trinidad	
WFVZ	98809	*Geranoaetus albicaudatus*	E+L	1	17	3	1919	Colombia	Magdalena	
WFVZ	16780	*Geranoaetus albicaudatus*	Egg(s)	1	15	6	1952	Trinidad and Tobago	Trinidad	
WFVZ	16779	*Geranoaetus albicaudatus*	Egg(s)	1	24	3	1936	Trinidad and Tobago	Trinidad	
WFVZ	16755	*Geranoaetus albicaudatus*	Laying	1	20	8	1937	Paraguay		La Victoria
WFVZ	16754	*Geranoaetus albicaudatus*	E+L	1	3	9	1940	Paraguay		La Victoria
WFVZ	179004	*Geranoaetus albicaudatus*	Egg(s)	1	6	5	1977	Mexico	Campeche	
WFVZ	209611	*Geranoaetus albicaudatus*	Egg(s)	1	20	4	1956	Mexico	Tamaulipas	
WFVZ	53678	*Geranoaetus melanoleucus*	Egg(s)	1	27	10	1940	Chile	Santiago	
WFVZ	147739	*Geranoaetus melanoleucus*	Egg(s)	1	27	10	1940	Chile	Santiago	
WFVZ	16749	*Geranoaetus melanoleucus*	Egg(s)	1	28	9	1940	Chile	Santiago	
WFVZ	53682	*Geranoaetus melanoleucus*	Egg(s)	1	24	10	1936	Chile	Santiago	
WFVZ	53680	*Geranoaetus melanoleucus*	Egg(s)	1		10	1941	Chile	Aconcagua	
WFVZ	53681	*Geranoaetus melanoleucus*	Egg(s)	1	27	10	1940	Chile	Santiago	
WFVZ	16750	*Geranoaetus melanoleucus*	E+L	1	26	11	1940	Chile	Atacama	
WFVZ	21911	*Geranoaetus melanoleucus*	Egg(s)	1	30	9	1940	Chile	Atacama	
WFVZ	16748	*Geranoaetus melanoleucus*	E+L	1	20	11	1938	Chile		
WFVZ	52957	*Geranoaetus melanoleucus*	E+L	1	3	11	1940	Chile	Santiago	
WFVZ	53679	*Geranoaetus melanoleucus*	Egg(s)	1	12	10	1939	Chile	Santiago	
WFVZ	53677	*Geranoaetus melanoleucus*	Egg(s)	1	28	8	1934	Chile	Santiago	
WFVZ	15049	*Geranoaetus melanoleucus*	Egg(s)	1	28	10	1911	Argentina	Rio Negro	
WFVZ	15050	*Geranoaetus melanoleucus*	Hatching	1	16	11	1911	Argentina	Rio Negro	
WFVZ	15038	*Geranoaetus polyosoma*	E+L	1	25	10	1911	Argentina	Rio Negro	
WFVZ	16797	*Geranoaetus polyosoma*	Egg(s)	1		11	1945	Chile	Aconcagua	
WFVZ	21887	*Geranoaetus polyosoma*	Egg(s)	1		11	1938	Chile		
WFVZ	16795	*Geranoaetus polyosoma*	E+L	1	3	11	1940	Chile	Valparaiso	
WFVZ	16794	*Geranoaetus polyosoma*	E+L	1		10	1938	Chile		
WFVZ	16789	*Geranoaetus polyosoma*	E+L	1	21	10	1943	Chile	Atacama	
WFVZ	16796	*Geranoaetus polyosoma*	E+L	1	5	11	1940	Chile	Atacama	
WFVZ	53675	*Geranoaetus polyosoma*	Egg(s)	1	20	11	1940	Chile	Aconcagua	
WFVZ	53674	*Geranoaetus polyosoma*	Egg(s)	1	25	11	1935	Chile	Aconcagua	
WFVZ	53676	*Geranoaetus polyosoma*	Egg(s)	1	3	11	1935	Chile	Aconcagua	
WFVZ	53673	*Geranoaetus polyosoma*	Egg(s)	1	11	11	1935	Chile	Aconcagua	
WFVZ	53672	*Geranoaetus polyosoma*	Egg(s)	1	2	11	1935	Chile	Aconcagua	
WFVZ	53671	*Geranoaetus polyosoma*	Egg(s)	1	20	11	1935	Chile	Aconcagua	
WFVZ	15034	*Geranoaetus polyosoma*	E+L	1	16	10	1911	Argentina	Rio Negro	

WFVZ	15035	*Geranoaetus polyosoma*	Egg(s)	1	14	10	1911	Argentina	Rio Negro	
WFVZ	15033	*Geranoaetus polyosoma*	E+L	1	13	10	1911	Argentina	Rio Negro	
WFVZ	15039	*Geranoaetus polyosoma*	Hatching	1	27	11	1911	Argentina	Rio Negro	
WFVZ	16799	*Geranoaetus polyosoma*	Egg(s)	1	27	10	1940	Chile	Santiago	
WFVZ	53670	*Geranoaetus polyosoma*	Egg(s)	1	10	9	1913	Chile	Tarapacá	
WFVZ	15921	*Pseudastur albicollis*	Egg(s)	1	18	4	1936	Trinidad and Tobago	Trinidad	
WFVZ	159370	*Buteo plagiatus*	Egg(s)	1	22	4	1964	Mexico	Sinaloa	
WFVZ	15935 'a'	*Buteo nitidus*	Egg(s)	1	9	5	1936	Trinidad and Tobago	Trinidad	
WFVZ	15935 'b'	*Buteo nitidus*	Egg(s)	1	30	4	1936	Trinidad and Tobago		
WFVZ	15934	*Buteo nitidus*	Laying	1	20	3	1933	Trinidad and Tobago	Trinidad	
WFVZ	66315	*Buteo plagiatus*	E+L	1	5	4	1965	Mexico	Veracruz	
WFVZ	15930	*Buteo plagiatus*	Laying	1	31	3	1963	Mexico	Veracruz	
WFVZ	87485	*Buteo plagiatus*	Egg(s)	1	8	4	1959	Mexico	Veracruz	
WFVZ	87491	*Buteo plagiatus*	Egg(s)	1	11	3	1958	Mexico	Veracruz	
WFVZ	87489	*Buteo plagiatus*	Egg(s)	1	9	4	1958	Mexico	Veracruz	
WFVZ	87487	*Buteo plagiatus*	Egg(s)	1	1	4	1958	Mexico	Veracruz	
WFVZ	87494	*Buteo plagiatus*	Egg(s)	1	7	4	1959	Mexico	Veracruz	
WFVZ	87496	*Buteo plagiatus*	Egg(s)	1	11	4	1957	Mexico	Veracruz	
WFVZ	87490	*Buteo plagiatus*	Egg(s)	1	29	3	1958	Mexico	Veracruz	
WFVZ	87495	*Buteo plagiatus*	Egg(s)	1	1	4	1966	Mexico	Veracruz	
WFVZ	15932	*Buteo plagiatus*	Egg(s)	1	5	4	1961	Mexico	Veracruz	
WFVZ	16394	*Buteo plagiatus*	Egg(s)	1	2	4	1963	Mexico	Veracruz	Tampico
WFVZ	145390	*Buteo plagiatus*	Egg(s)	1	14	4	1970	Mexico	Veracruz	Tampico
WFVZ	123650	*Buteo plagiatus*	Laying	1	21	3	1963	Mexico	Campeche	
WFVZ	66430	*Buteo plagiatus*	E+L	1	31	3	1965	Mexico	Tabasco	
WFVZ	21279	*Buteo plagiatus*	E+L	1	9	4	1966	Mexico	Oaxaca	
WFVZ	107595	*Buteo plagiatus*	Egg(s)	1	15	4	1960	Mexico	Veracruz	
WFVZ	87492	*Buteo plagiatus*	Egg(s)	1	6	4	1959	Mexico	Veracruz	
WFVZ	87493	*Buteo plagiatus*	Egg(s)	1	2	4	1959	Mexico	San Luis Potosi	
WFVZ	16396	*Buteo plagiatus*	Laying	1	7	4	1955	Mexico	San Luis Potosi	
WFVZ	87488	*Buteo plagiatus*	Egg(s)	1	16	4	1954	Mexico	San Luis Potosi	
WFVZ	16395	*Buteo plagiatus*	Hatching	1	3	4	1953	Mexico	Tamaulipas	
WFVZ	16397	*Buteo plagiatus*	Laying	1	3	4	1957	Mexico	Veracruz	
WFVZ	87486	*Buteo plagiatus*	Egg(s)	1	10	4	1957	Mexico	Veracruz	
WFVZ	209767	*Buteo plagiatus*	Egg(s)	1	9	4	1961	Mexico	Veracruz	
WFVZ	209768	*Buteo plagiatus*	Egg(s)	1	12	4	1960	Mexico	Veracruz	
WFVZ	209776	*Buteo plagiatus*	Egg(s)	1	28	4	1960	Mexico	Veracruz	
WFVZ	209775	*Buteo plagiatus*	E+L	1	19	5	1961	Mexico	Veracruz	
WFVZ	209774	*Buteo plagiatus*	Egg(s)	1	21	5	1961	Mexico	Veracruz	
WFVZ	209771	*Buteo plagiatus*	Egg(s)	1	2	5	1961	Mexico	Veracruz	

WFVZ	209766	*Buteo plagiatus*	Egg(s)	1	5	4	1961	Mexico	Veracruz	
WFVZ	209769	*Buteo plagiatus*	Egg(s)	1	2	4	1963	Mexico	Veracruz	
WFVZ	209770	*Buteo plagiatus*	Egg(s)	1	12	4	1960	Mexico	Veracruz	
WFVZ	209772	*Buteo plagiatus*	Egg(s)	1	9	4	1958	Mexico	Veracruz	
WFVZ	209773	*Buteo plagiatus*	Egg(s)	1	17	4	1960	Mexico	Veracruz	
WFVZ	87853	*Buteogallus anthracinus*	Egg(s)	1	4	4	1964	Mexico	Veracruz	
WFVZ	87861	*Buteogallus anthracinus*	Egg(s)	1	4	4	1963	Mexico	Veracruz	
WFVZ	87860	*Buteogallus anthracinus*	Egg(s)	1	4	4	1963	Mexico	Veracruz	
WFVZ	87864	*Buteogallus anthracinus*	Egg(s)	1	11	4	1961	Mexico	Veracruz	
WFVZ	87851	*Buteogallus anthracinus*	Egg(s)	1	10	4	1961	Mexico	Veracruz	
WFVZ	87866	*Buteogallus anthracinus*	Egg(s)	1	10	4	1961	Mexico	Veracruz	
WFVZ	15941	*Buteogallus anthracinus*	Laying	1	7	4	1961	Mexico	Veracruz	
WFVZ	15937	*Buteogallus anthracinus*	Laying	1	2	4	1961	Mexico	Veracruz	
WFVZ	87871	*Buteogallus anthracinus*	Egg(s)	1	12	4	1956	Mexico	Veracruz	
WFVZ	87877	*Buteogallus anthracinus*	Egg(s)	1	12	4	1956	Mexico	Veracruz	
WFVZ	87857	*Buteogallus anthracinus*	Egg(s)	1	10	4	1959	Mexico	Veracruz	
WFVZ	87870	*Buteogallus anthracinus*	Egg(s)	1	9	4	1959	Mexico	Veracruz	
WFVZ	87869	*Buteogallus anthracinus*	Egg(s)	1	9	4	1959	Mexico	Veracruz	
WFVZ	87856	*Buteogallus anthracinus*	Egg(s)	1	9	4	1959	Mexico	Veracruz	
WFVZ	87854	*Buteogallus anthracinus*	Egg(s)	1	23	3	1964	Mexico	Veracruz	
WFVZ	107587	*Buteogallus anthracinus*	Egg(s)	1	14	4	1956	Mexico	Veracruz	
WFVZ	87726	*Buteogallus anthracinus*	Egg(s)	1	5	4	1964	Mexico	Veracruz	
WFVZ	107593	*Buteogallus anthracinus*	Egg(s)	1	10	4	1956	Mexico	Veracruz	
WFVZ	87731	*Buteogallus anthracinus*	E+L	1	10	4	1956	Mexico	Veracruz	
WFVZ	87728	*Buteogallus anthracinus*	Egg(s)	1	24	3	1964	Mexico	Veracruz	
WFVZ	87855	*Buteogallus anthracinus*	Egg(s)	1	21	3	1964	Mexico	Veracruz	
WFVZ	87730	*Buteogallus anthracinus*	Egg(s)	1	21	3	1964	Mexico	Veracruz	
WFVZ	15947	*Buteogallus anthracinus*	Egg(s)	1	15	4	1932	Trinidad and Tobago	Trinidad	
WFVZ	15944	*Buteogallus anthracinus*	Egg(s)	1	23	5	1932	Trinidad and Tobago	Trinidad	
WFVZ	15943	*Buteogallus anthracinus*	Egg(s)	1	15	6	1932	Trinidad and Tobago	Trinidad	
WFVZ	15945	*Buteogallus anthracinus*	E+L	1	21	5	1932	Trinidad and Tobago	Trinidad	
WFVZ	15946	*Buteogallus anthracinus*	E+L	1	28	4	1927	St. Vincent & The Grenadines	St. Vincent	
WFVZ	21943	*Buteogallus anthracinus*	Egg(s)	1	13	3	1907	Belize		Belize
WFVZ	107591	*Buteogallus anthracinus*	Egg(s)	1	14	4	1958	Mexico	Veracruz	
WFVZ	107590	*Buteogallus anthracinus*	Egg(s)	1	14	4	1958	Mexico	Veracruz	
WFVZ	107589	*Buteogallus anthracinus*	Egg(s)	1	14	4	1958	Mexico	Veracruz	
WFVZ	87865	*Buteogallus anthracinus*	Egg(s)	1	14	4	1958	Mexico	Veracruz	
WFVZ	87873	*Buteogallus anthracinus*	Egg(s)	1	4	4	1963	Mexico	Veracruz	
WFVZ	144958	*Buteogallus anthracinus*	Egg(s)	1	4	4	1963	Mexico	Veracruz	

WFVZ	87863	*Buteogallus anthracinus*	Egg(s)	1	28	3	1965	Mexico	Veracruz
WFVZ	87862	*Buteogallus anthracinus*	Egg(s)	1	28	3	1965	Mexico	Veracruz
WFVZ	87881	*Buteogallus anthracinus*	Egg(s)	1	26	3	1964	Mexico	Tabasco
WFVZ	15940	*Buteogallus anthracinus*	Egg(s)	1	13	4	1952	Mexico	San Luis Potosi
WFVZ	24379	*Buteogallus anthracinus*	Egg(s)	1	6	4	1964	Mexico	Oaxaca
WFVZ	24378	*Buteogallus anthracinus*	E+L	1	12	3	1964	Mexico	Oaxaca
WFVZ	21285	*Buteogallus anthracinus*	Egg(s)	1	31	3	1967	Mexico	Oaxaca
WFVZ	21284	*Buteogallus anthracinus*	Egg(s)	1	8	4	1966	Mexico	Oaxaca
WFVZ	87876	*Buteogallus anthracinus*	Egg(s)	1	10	4	1966	Mexico	Veracruz
WFVZ	87880	*Buteogallus anthracinus*	Egg(s)	1	6	4	1964	Mexico	Veracruz
WFVZ	66314	*Buteogallus anthracinus*	Egg(s)	1	6	4	1964	Mexico	Veracruz
WFVZ	87850	*Buteogallus anthracinus*	Egg(s)	1	6	4	1964	Mexico	Veracruz
WFVZ	87879	*Buteogallus anthracinus*	E+L	1	31	3	1963	Mexico	Veracruz
WFVZ	87852	*Buteogallus anthracinus*	Egg(s)	1	31	3	1963	Mexico	Veracruz
WFVZ	66313	*Buteogallus anthracinus*	Egg(s)	1	2	5	1963	Mexico	Veracruz
WFVZ	87595	*Buteogallus anthracinus*	Egg(s)	1	11	4	1960	Mexico	Veracruz
WFVZ	87868	*Buteogallus anthracinus*	E+L	1	11	4	1960	Mexico	Veracruz
WFVZ	87859	*Buteogallus anthracinus*	E+L	1	15	4	1959	Mexico	Veracruz
WFVZ	87878	*Buteogallus anthracinus*	Egg(s)	1	9	4	1963	Mexico	Veracruz
WFVZ	87732	*Buteogallus anthracinus*	Egg(s)	1	3	4	1959	Mexico	Veracruz
WFVZ	87733	*Buteogallus anthracinus*	Egg(s)	1	3	4	1959	Mexico	Veracruz
WFVZ	87872	*Buteogallus anthracinus*	Egg(s)	1	3	4	1959	Mexico	Veracruz
WFVZ	107592	*Buteogallus anthracinus*	E+L	1	19	4	1958	Mexico	Veracruz
WFVZ	87874	*Buteogallus anthracinus*	E+L	1	8	4	1958	Mexico	Veracruz
WFVZ	87867	*Buteogallus anthracinus*	Egg(s)	1	19	4	1954	Mexico	Veracruz
WFVZ	15942	*Buteogallus anthracinus*	Laying	1	9	4	1955	Mexico	Veracruz
WFVZ	87729	*Buteogallus anthracinus*	Egg(s)	1	3	4	1964	Mexico	Veracruz
WFVZ	87727	*Buteogallus anthracinus*	Egg(s)	1	3	4	1964	Mexico	Veracruz
WFVZ	107588	*Buteogallus anthracinus*	Egg(s)	1	14	4	1958	Mexico	Veracruz
WFVZ	145384	*Buteogallus anthracinus*	E+L	1	12	3	1969	Mexico	Veracruz
WFVZ	145385	*Buteogallus anthracinus*	Egg(s)	1	29	3	1970	Mexico	Veracruz
WFVZ	87858	*Buteogallus anthracinus*	Egg(s)	1	13	4	1957	Mexico	Veracruz
WFVZ	87875	*Buteogallus anthracinus*	Egg(s)	1	10	4	1958	Mexico	Veracruz
WFVZ	85965	*Buteogallus anthracinus*	Egg(s)	1	2	4	1967	Mexico	Veracruz
WFVZ	135637	*Buteogallus anthracinus*	Laying	1	2	4	1957	Mexico	Veracruz
WFVZ	173261	*Buteogallus anthracinus*	E+L	1	20	4	1896	Mexico	Tamaulipas
WFVZ	15939	*Buteogallus anthracinus*	Laying	1	26	3	1953	Mexico	Tamaulipas
WFVZ	209757	*Buteogallus anthracinus*	Egg(s)	1	4	4	1963	Mexico	Veracruz
WFVZ	209753	*Buteogallus anthracinus*	Egg(s)	1	7	4	1961	Mexico	Veracruz
WFVZ	209754	*Buteogallus anthracinus*	Egg(s)	1	8	4	1963	Mexico	Veracruz

WFVZ	209744	*Buteogallus anthracinus*	E+L	1	17	4	1954	Mexico	Tamaulipas	
WFVZ	209745	*Buteogallus anthracinus*	Egg(s)	1	13	4	1960	Mexico	Veracruz	
WFVZ	209749	*Buteogallus anthracinus*	Egg(s)	1	9	4	1961	Mexico	Veracruz	
WFVZ	209750	*Buteogallus anthracinus*	Egg(s)	1	9	4	1961	Mexico	Veracruz	
WFVZ	209752	*Buteogallus anthracinus*	Egg(s)	1	9	4	1961	Mexico	Veracruz	
WFVZ	209751	*Buteogallus anthracinus*	Egg(s)	1	4	4	1963	Mexico	Veracruz	
WFVZ	189614	*Buteogallus anthracinus*	Egg(s)	1		6	1951	Mexico	Veracruz	
WFVZ	154693	*Buteogallus anthracinus*	E+L	1	8	3	1986	Costa Rica	Guanacaste	
WFVZ	15955	*Buteogallus urubitinga*	E+L	1	10	9	1927	Argentina	Tucuman	
WFVZ	15956	*Buteogallus urubitinga*	Egg(s)	1	5	10	1926	Argentina	Tucuman	
WFVZ	15957	*Buteogallus urubitinga*	Egg(s)	1	17	10	1919	Argentina	Tucuman	
WFVZ	15958	*Buteogallus urubitinga*	Egg(s)	1	20	11	1923	Argentina	Tucuman	Famaillá
WFVZ	21940	*Buteogallus urubitinga*	Egg(s)	1	6	10	1921	Argentina	Tucuman	Famaillá
WFVZ	15954	*Buteogallus urubitinga*	E+L	1	8	5	1932	Trinidad and Tobago	Trinidad	
WFVZ	15953	*Buteogallus urubitinga*	E+L	1	12	4	1939	Trinidad and Tobago	Trinidad	
WFVZ	15961	*Buteogallus aequinoctialis*	E+L	1	21	5	1936	Venezuela		
WFVZ	15960	*Buteogallus aequinoctialis*	E+L	1	5	3	1936	Venezuela		
WFVZ	15963	*Buteogallus aequinoctialis*	Egg(s)	1	3	4	1937	Venezuela		Guarico
WFVZ	15964	*Buteogallus aequinoctialis*	Egg(s)	1	21	6	1900	Suriname		
WFVZ	15959	*Buteogallus aequinoctialis*	Egg(s)	1	14	3	1930	British Guiana		
WFVZ	16752	*Buteogallus meridionalis*	E+L	1	21	9	1951	Colombia		
WFVZ	16751	*Buteogallus meridionalis*	E+L	1	8	10	1955	Brazil	Amapa	
WFVZ	16767	*Buteogallus meridionalis*	E+L	1	15	10	1904	Brazil	Minas Gerais	Arcos
WFVZ	16768	*Buteogallus meridionalis*	Egg(s)	1		10	1900	Brazil	Minas Gerais	Arcos
WFVZ	16769	*Buteogallus meridionalis*	Laying	1	18	11	1933	Trinidad and Tobago	Trinidad	
WFVZ	16771	*Buteogallus meridionalis*	Egg(s)	1	6	10	1935	Paraguay	Concepcion	
WFVZ	16770	*Buteogallus meridionalis*	Laying	1	15	10	1956	Paraguay		
WFVZ	16766	*Buteogallus meridionalis*	Egg(s)	1	13	10	1927	Argentina	Tucuman	
WFVZ	16765	*Buteogallus meridionalis*	Egg(s)	1	20	9	1923	Argentina	Tucuman	
WFVZ	16763	*Buteogallus meridionalis*	Egg(s)	1	24	9	1923	Argentina	Tucuman	
WFVZ	16764	*Buteogallus meridionalis*	Egg(s)	1	8	10	1927	Argentina	Tucuman	
WFVZ	16402	*Parabuteo leucorrhous*	E+L	1	28	10	1954	Brazil		
WFVZ	16403	*Parabuteo leucorrhous*	E+L	1	4	10	1948	Brazil		
WFVZ	16404	*Parabuteo leucorrhous*	E+L	1	9	9	1918	Brazil	Minas Gerais	Arcos
WFVZ	53685	*Parabuteo unicinctus*	E+L	1	19	9	1933	Chile	Santiago	
WFVZ	15925	*Parabuteo unicinctus*	Laying	1	19	3	1953	Mexico	San Luis Potosi	
WFVZ	85949	*Parabuteo unicinctus*	Egg(s)	1	11	3	1956	Mexico	Morelos	
WFVZ	15926	*Parabuteo unicinctus*	Laying	1	24	3	1957	Mexico	Veracruz	
WFVZ	26129	*Parabuteo unicinctus*	Egg(s)	1	17	5	1933	Mexico	Baja California	
WFVZ	52958	*Parabuteo unicinctus*	Egg(s)	1	20	10	1940	Chile	Santiago	

WFVZ	53683	*Parabuteo unicinctus*	E+L	1	7	10	1964	Chile	Santiago	
WFVZ	53684	*Parabuteo unicinctus*	E+L	1	6	10	1940	Chile	Santiago	
WFVZ	53686	*Parabuteo unicinctus*	Egg(s)	1	27	10	1939	Chile	Santiago	
WFVZ	129172	*Parabuteo unicinctus*	E+L	1	13	2	1979	Chile	Santiago	
WFVZ	15919	*Parabuteo unicinctus*	Egg(s)	1	15	9	1946	Chile	Valparaiso	
WFVZ	15920	*Parabuteo unicinctus*	E+L	1	19	9	1939	Chile	Valparaiso	
WFVZ	91123	*Parabuteo unicinctus*	Egg(s)	1	2	5	1933	Mexico	Baja California	
WFVZ	208486	*Parabuteo unicinctus*	Egg(s)	1	1	4	1958	Mexico	Baja California	
WFVZ	97205	*Rupornis magnirostris*	E+L	1	16	4	1958	Mexico	Veracruz	
WFVZ	98033	*Rupornis magnirostris*	Egg(s)	1	18	4	1958	Mexico	Veracruz	
WFVZ	159430	*Rupornis magnirostris*	Laying	1	1	4	1963	Mexico	Veracruz	
WFVZ	16376	*Rupornis magnirostris*	Laying	1	31	3	1964	Mexico	Veracruz	
WFVZ	98056	*Rupornis magnirostris*	Egg(s)	1	3	4	1964	Mexico	Veracruz	
WFVZ	98037	*Rupornis magnirostris*	Egg(s)	1	12	4	1958	Mexico	Veracruz	
WFVZ	87722	*Rupornis magnirostris*	Egg(s)	1	4	4	1955	Mexico	Veracruz	
WFVZ	87843	*Rupornis magnirostris*	Egg(s)	1	15	4	1956	Mexico	Veracruz	
WFVZ	87842	*Rupornis magnirostris*	Egg(s)	1	16	4	1956	Mexico	Veracruz	
WFVZ	123651	*Rupornis magnirostris*	Laying	1	28	3	1963	Mexico	Veracruz	
WFVZ	98034	*Rupornis magnirostris*	E+L	1	12	4	1963	Mexico	Veracruz	
WFVZ	98031	*Rupornis magnirostris*	Egg(s)	1	17	4	1958	Mexico	Veracruz	
WFVZ	110553	*Rupornis magnirostris*	Egg(s)	1	8	4	1958	Mexico	Veracruz	La Laja
WFVZ	87721	*Rupornis magnirostris*	Egg(s)	1	12	4	1958	Mexico	Veracruz	
WFVZ	20747	*Rupornis magnirostris*	Egg(s)	1	31	5	1966	Mexico	Oaxaca	
WFVZ	21281	*Rupornis magnirostris*	E+L	1	16	4	1967	Mexico	Oaxaca	
WFVZ	21283	*Rupornis magnirostris*	Egg(s)	1	21	5	1966	Mexico	Oaxaca	
WFVZ	21282	*Rupornis magnirostris*	Egg(s)	1	21	5	1966	Mexico	Oaxaca	
WFVZ	21280	*Rupornis magnirostris*	Egg(s)	1	9	4	1966	Mexico	Oaxaca	
WFVZ	158881	*Rupornis magnirostris*	Egg(s)	1	11	4	1988	Costa Rica	Alajuela	
WFVZ	144956	*Rupornis magnirostris*	Egg(s)	1	5	4	1964	Mexico	Veracruz	
WFVZ	16586	*Rupornis magnirostris*	Egg(s)	1	1	4	1957	Mexico	Veracruz	
WFVZ	110551	*Rupornis magnirostris*	E+L	1	16	4	1958	Mexico	Veracruz	
WFVZ	144955	*Rupornis magnirostris*	Egg(s)	1	25	4	1962	Mexico	Veracruz	
WFVZ	144954	*Rupornis magnirostris*	E+L	1	28	4	1960	Mexico	Veracruz	
WFVZ	97210	*Rupornis magnirostris*	E+L	1	14	4	1960	Mexico	Veracruz	
WFVZ	161718	*Rupornis magnirostris*	Egg(s)	1	12	3	1969	Mexico	Veracruz	
WFVZ	97213	*Rupornis magnirostris*	Egg(s)	1	5	4	1965	Mexico	Veracruz	
WFVZ	97211	*Rupornis magnirostris*	Egg(s)	1	18	4	1960	Mexico	Veracruz	
WFVZ	16575	*Rupornis magnirostris*	E+L	1	29	4	1960	Mexico	Veracruz	
WFVZ	16590	*Rupornis magnirostris*	Egg(s)	1	13	4	1955	Mexico	Veracruz	
WFVZ	16589	*Rupornis magnirostris*	Laying	1	9	4	1955	Mexico	Veracruz	

WFVZ	16574	*Rupornis magnirostris*	Laying	1	3	4	1961	Mexico	Veracruz	
WFVZ	16576	*Rupornis magnirostris*	Laying	1	9	4	1955	Mexico	Veracruz	
WFVZ	97207	*Rupornis magnirostris*	Egg(s)	1	11	4	1956	Mexico	Veracruz	
WFVZ	87840	*Rupornis magnirostris*	Egg(s)	1	11	4	1956	Mexico	Veracruz	
WFVZ	87847	*Rupornis magnirostris*	Egg(s)	1	10	4	1956	Mexico	Veracruz	
WFVZ	110554	*Rupornis magnirostris*	Egg(s)	1	10	4	1956	Mexico	Veracruz	
WFVZ	69017	*Rupornis magnirostris*	Egg(s)	1	17	4	1961	Mexico	Veracruz	
WFVZ	16579	*Rupornis magnirostris*	E+L	1	14	4	1955	Mexico	Veracruz	
WFVZ	98039	*Rupornis magnirostris*	Egg(s)	1	10	4	1956	Mexico	Veracruz	
WFVZ	87841	*Rupornis magnirostris*	Egg(s)	1	4	4	1959	Mexico	Veracruz	
WFVZ	97206	*Rupornis magnirostris*	E+L	1	10	4	1956	Mexico	Veracruz	
WFVZ	98051	*Rupornis magnirostris*	Egg(s)	1	17	4	1958	Mexico	Veracruz	
WFVZ	98032	*Rupornis magnirostris*	Egg(s)	1	10	4	1958	Mexico	Veracruz	
WFVZ	97212	*Rupornis magnirostris*	Egg(s)	1	9	4	1963	Mexico	Veracruz	
WFVZ	16591	*Rupornis magnirostris*	E+L	1	6	4	1961	Mexico	Veracruz	
WFVZ	16392	*Rupornis magnirostris*	Egg(s)	1	17	3	1963	Mexico	Veracruz	
WFVZ	16578	*Rupornis magnirostris*	Egg(s)	1	9	4	1964	Mexico	Veracruz	
WFVZ	16391	*Rupornis magnirostris*	Egg(s)	1	31	3	1957	Mexico	Veracruz	
WFVZ	87846	*Rupornis magnirostris*	Egg(s)	1	10	4	1956	Mexico	Veracruz	
WFVZ	16588	*Rupornis magnirostris*	Egg(s)	1	4	4	1963	Mexico	Veracruz	
WFVZ	16587	*Rupornis magnirostris*	Laying	1	1	4	1963	Mexico	Veracruz	
WFVZ	87770	*Rupornis magnirostris*	Egg(s)	1	20	4	1962	Mexico	Veracruz	
WFVZ	87848	*Rupornis magnirostris*	Egg(s)	1	9	4	1964	Mexico	Veracruz	
WFVZ	16381	*Rupornis magnirostris*	Egg(s)	1	2	10	1933	Paraguay		
WFVZ	16386	*Rupornis magnirostris*	E+L	1	12	10	1949	Brazil		
WFVZ	16388	*Rupornis magnirostris*	Egg(s)	1	16	10	1918	Brazil	Minas Gerais	Arcos
WFVZ	87724	*Rupornis magnirostris*	Egg(s)	1	25	5	1955	Mexico	Veracruz	
WFVZ	87774	*Rupornis magnirostris*	Egg(s)	1	18	4	1962	Mexico	Veracruz	
WFVZ	87776	*Rupornis magnirostris*	E+L	1	17	4	1962	Mexico	Veracruz	
WFVZ	87839	*Rupornis magnirostris*	Egg(s)	1	7	4	1959	Mexico	Veracruz	
WFVZ	87725	*Rupornis magnirostris*	Egg(s)	1	6	4	1959	Mexico	Veracruz	
WFVZ	98040	*Rupornis magnirostris*	Egg(s)	1	6	4	1959	Mexico	Veracruz	
WFVZ	98041	*Rupornis magnirostris*	Egg(s)	1	7	4	1959	Mexico	Veracruz	
WFVZ	16389	*Rupornis magnirostris*	Egg(s)	1	2	5	1923	Costa Rica	Guanacaste	
WFVZ	87772	*Rupornis magnirostris*	Egg(s)	1	15	5	1953	Mexico	San Luis Potosi	
WFVZ	98057	*Rupornis magnirostris*	Egg(s)	1	1	4	1959	Mexico	San Luis Potosi	
WFVZ	16585	*Rupornis magnirostris*	E+L	1	14	4	1955	Mexico	San Luis Potosi	
WFVZ	16390	*Rupornis magnirostris*	Egg(s)	1	1	4	1953	Mexico	San Luis Potosi	
WFVZ	16393	*Rupornis magnirostris*	Egg(s)	1	13	4	1952	Mexico	San Luis Potosi	
WFVZ	87720	*Rupornis magnirostris*	Egg(s)	1	19	4	1958	Mexico	Veracruz	

WFVZ	98042	*Rupornis magnirostris*	Egg(s)	1	11	4	1956	Mexico	Veracruz	
WFVZ	16584	*Rupornis magnirostris*	Egg(s)	1	14	4	1955	Mexico	San Luis Potosi	
WFVZ	16583	*Rupornis magnirostris*	Laying	1	14	4	1955	Mexico	San Luis Potosi	
WFVZ	16582	*Rupornis magnirostris*	E+L	1	18	4	1955	Mexico	San Luis Potosi	
WFVZ	98045	*Rupornis magnirostris*	Egg(s)	1	18	4	1960	Mexico	Veracruz	
WFVZ	98044	*Rupornis magnirostris*	Egg(s)	1	12	4	1960	Mexico	Veracruz	
WFVZ	98053	*Rupornis magnirostris*	Egg(s)	1	10	4	1956	Mexico	Veracruz	
WFVZ	98052	*Rupornis magnirostris*	Egg(s)	1	10	4	1956	Mexico	Veracruz	
WFVZ	110552	*Rupornis magnirostris*	Egg(s)	1	10	4	1956	Mexico	Veracruz	
WFVZ	97208	*Rupornis magnirostris*	E+L	1	13	4	1960	Mexico	Veracruz	
WFVZ	16384	*Rupornis magnirostris*	Egg(s)	1	16	3	1927	Guyana		
WFVZ	16385	*Rupornis magnirostris*	Egg(s)	1	28	5	1923	Colombia	Santa Marta	
WFVZ	16387	*Rupornis magnirostris*	Egg(s)	1	12	11	1928	Argentina	Entre Rios	
WFVZ	16377	*Rupornis magnirostris*	Laying	1	25	3	1964	Mexico	Tabasco	
WFVZ	16378	*Rupornis magnirostris*	Laying	1	19	3	1964	Mexico	Tabasco	
WFVZ	16380	*Rupornis magnirostris*	Egg(s)	1	14	4	1961	Mexico	Tabasco	
WFVZ	16379	*Rupornis magnirostris*	Laying	1	24	3	1964	Mexico	Tabasco	
WFVZ	16383	*Rupornis magnirostris*	Egg(s)	1	7	10	1934	Paraguay		
WFVZ	16382	*Rupornis magnirostris*	Egg(s)	1	17	10	1933	Paraguay		
WFVZ	87723	*Rupornis magnirostris*	E+L	1	6	4	1964	Mexico	Veracruz	
WFVZ	87769	*Rupornis magnirostris*	Egg(s)	1	13	4	1960	Mexico	Veracruz	
WFVZ	55980	*Rupornis magnirostris*	Egg(s)	1	25	4	1962	Mexico	Veracruz	
WFVZ	87775	*Rupornis magnirostris*	E+L	1	13	4	1960	Mexico	Veracruz	
WFVZ	55978	*Rupornis magnirostris*	E+L	1	20	4	1962	Mexico	Veracruz	
WFVZ	87771	*Rupornis magnirostris*	Egg(s)	1	13	4	1960	Mexico	Veracruz	
WFVZ	87585	*Rupornis magnirostris*	Egg(s)	1	8	4	1966	Mexico	Veracruz	
WFVZ	55979	*Rupornis magnirostris*	Egg(s)	1	20	4	1962	Mexico	Veracruz	
WFVZ	145388	*Rupornis magnirostris*	E+L	1	14	3	1969	Mexico	Tabasco	
WFVZ	97209	*Rupornis magnirostris*	Egg(s)	1	14	4	1960	Mexico	Veracruz	
WFVZ	98048	*Rupornis magnirostris*	Egg(s)	1	13	4	1960	Mexico	Veracruz	
WFVZ	98049	*Rupornis magnirostris*	Egg(s)	1	13	4	1960	Mexico	Veracruz	
WFVZ	98046	*Rupornis magnirostris*	Egg(s)	1	11	4	1960	Mexico	Veracruz	
WFVZ	98050	*Rupornis magnirostris*	Egg(s)	1	13	4	1960	Mexico	Veracruz	
WFVZ	110550	*Rupornis magnirostris*	Egg(s)	1	9	4	1958	Mexico	Veracruz	
WFVZ	87768	*Rupornis magnirostris*	Egg(s)	1	12	4	1960	Mexico	Veracruz	
WFVZ	98047	*Rupornis magnirostris*	Egg(s)	1	12	4	1960	Mexico	Veracruz	
WFVZ	87844	*Rupornis magnirostris*	Egg(s)	1	14	4	1960	Mexico	Veracruz	
WFVZ	87773	*Rupornis magnirostris*	Egg(s)	1	12	4	1960	Mexico	Veracruz	
White 2013		*Buteo jamaicensis*	Active nest(s)	1		5	2012	Haiti	La Gonave	
Whiteman & Parker 2004a		*Buteo galapagoensis*	Active nest(s)	1		5	2002	Ecuador	Galapagos Islands	Santiago Island

Whiteman & Parker 2004a	*Buteo galapagoensis*	Active nest(s)	1		6	2002	Ecuador	Galapagos Islands	Santiago Island
Whiteman & Parker 2004a	*Buteo galapagoensis*	Active nest(s)	1		6	2001	Ecuador	Galapagos Islands	Isla Marchena
Wiley & Garrido 2005	*Buteogallus gundlachii*	Egg(s)	7	14-27	5	1996-1998	Cuba	Isla de la Juventud	
Wiley & Garrido 2005	*Buteogallus gundlachii*	Nestling stage	1	14-27	5	1996-1998	Cuba	Isla de la Juventud	
Willis & Eisenmann 1979	*Pseudastur albicollis*	Active nest(s)	1	9	3		Panama		
Woolaver et al. 2013a	*Buteo ridgwayi*	Egg(s)	2		1	2005-2008	Dominican Republic		
Woolaver et al. 2013a	*Buteo ridgwayi*	Egg(s)	2		2	2005-2008	Dominican Republic		
Woolaver et al. 2013a	*Buteo ridgwayi*	Egg(s)	2		3	2005-2008	Dominican Republic		
Woolaver et al. 2013a	*Buteo ridgwayi*	Egg(s)	2		4	2005-2008	Dominican Republic		
Woolaver et al. 2013a	*Buteo ridgwayi*	Egg(s)	2		5	2005-2008	Dominican Republic		
Woolaver et al. 2013a	*Buteo ridgwayi*	Egg(s)	1		6	2005-2008	Dominican Republic		
Woolaver et al. 2013a	*Buteo ridgwayi*	Egg(s)	1		7	2005-2008	Dominican Republic		
Woolaver et al. 2013a	*Buteo ridgwayi*	Egg(s)	8		1	2005-2008	Dominican Republic		
Woolaver et al. 2013a	*Buteo ridgwayi*	Egg(s)	7		2	2005-2008	Dominican Republic		
Woolaver et al. 2013a	*Buteo ridgwayi*	Egg(s)	7		3	2005-2008	Dominican Republic		
Woolaver et al. 2013a	*Buteo ridgwayi*	Egg(s)	7		4	2005-2008	Dominican Republic		
Woolaver et al. 2013a	*Buteo ridgwayi*	Egg(s)	7		5	2005-2008	Dominican Republic		
Woolaver et al. 2013a	*Buteo ridgwayi*	Egg(s)	7		6	2005-2008	Dominican Republic		
Woolaver et al. 2013a	*Buteo ridgwayi*	Egg(s)	7		7	2005-2008	Dominican Republic		
Woolaver et al. 2014	*Buteo ridgwayi*	Egg(s)	6		1	2005-2009	Dominican Republic		
Woolaver et al. 2014	*Buteo ridgwayi*	Egg(s)	5		2	2005-2009	Dominican Republic		
Woolaver et al. 2014	*Buteo ridgwayi*	Egg(s)	5		3	2005-2009	Dominican Republic		
Woolaver et al. 2014	*Buteo ridgwayi*	Egg(s)	5		4	2005-2009	Dominican Republic		
Zilio & Mendonça-Lima 2012	*Parabuteo leucorrhous*	Egg(s)	1		10	2009	Brazil	Santa Catarina	Campo Belo do Sul
Zorzin et al. 2007	*Geranoaetus melanoleucus*	Incubating	1		7	1997, 2000, 2005	Brazil	Minas Gerais	Belo Horizonte
Zorzin et al. 2007	*Geranoaetus melanoleucus*	Incubating	1		8	1997, 2000, 2005	Brazil	Minas Gerais	Belo Horizonte
Zorzin et al. 2007	*Geranoaetus melanoleucus*	Incubating	1		7	1997	Brazil	Minas Gerais	Belo Horizonte
Zorzin et al. 2007	*Geranoaetus melanoleucus*	Incubating	1		7	2000	Brazil	Minas Gerais	Belo Horizonte
Zorzin et al. 2007	*Geranoaetus melanoleucus*	Incubating	1		8	2005	Brazil	Minas Gerais	Belo Horizonte
Zorzin et al. 2007	*Geranoaetus melanoleucus*	Active nest(s)	1		7	1999	Brazil	Minas Gerais	Joaíma
Zorzin et al. 2007	*Geranoaetus melanoleucus*	Active nest(s)	1		8	1999	Brazil	Minas Gerais	Joaíma
Zorzin et al. 2007	*Geranoaetus melanoleucus*	Active nest(s)	1		6	1997	Brazil	Minas Gerais	Belo Horizonte
Zorzin et al. 2007	*Geranoaetus melanoleucus*	Active nest(s)	1		9	2000	Brazil	Minas Gerais	Belo Horizonte
Zorzin et al. 2007	*Geranoaetus melanoleucus*	Active nest(s)	1		10	2005	Brazil	Minas Gerais	Belo Horizonte

Breeding stage/info: Active nest = unknown content; E+L = 'fresh' (recently laid) egg(s); Sitting = parent bird in brooding posture, but nest content unknown; YAN = young(s) at nest (unespecified age)