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RECONSTRUÇÃO 3D E INTERPRETAÇÕES PALEOECOLÓGICAS DA CAVIDADE ENDOCRANIAL DE *BAURUSUCHUS* SP. (CROCODYLIFORMES, MESOEUCROCODYLIA)

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Reconstrução 3D e interpretações paleoecológicas da cavidade endocranial de *Baurusuchus* sp. (Crocodyliformes, Mesoeucrocodylia)

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Orientador: Prof. Dr. Rodrigo Miloni Santucci

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“Cara mia...”

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RESUMO

A popularização das técnicas de tomografia computadorizada tem contribuído para grandes avanços em paleoneurologia. Entretanto, o conhecimento sobre a paleoneurologia de crocodiliformes ainda é incipiente. O presente trabalho busca contribuir com o campo de conhecimento através da descrição detalhada da cavidade endocranial, labirinto endósseo e nervos cranianos de *Baurusuchus* sp. a partir de imagens tomográficas, levando em consideração fatores ontogenéticos e diagenéticos. A partir da descrição, através da comparação com espécies fósseis e atuais, uma série de inferências sensoriais e ecológicas são realizadas. São analisados o tamanho cerebral relativo, olfato, sensibilidade facial, postura de alerta da cabeça e frequências auditivas. O tamanho cerebral relativo em vertebrados fósseis é tradicionalmente comparado através de coeficientes de encefalização. Estes são baseados em regressões lineares obtidas através das relações alométricas observadas em grupos viventes. Entretanto, além de problemas no método escolhido para realizar as regressões lineares, existem diferentes alometrias entre tamanho cerebral e corporal em grupos viventes. Para examinar como isso pode afetar o estudo do tamanho cerebral relativo em espécies fósseis reuniu-se um banco de dados de massa cerebral e corporal de várias espécies de diápsidos, realizando recortes e comparações entre grupos de clados diferentes e de planos corporais distintos, utilizando métodos filogenéticos comparativos. Os resultados indicam que o uso de coeficientes de encefalização desenvolvidos com base em um grupo frequentemente é inadequado para ser aplicado a outro, pois não consegue eliminar o efeito da massa corporal no tamanho cerebral esperado. Como solução foram criados diferentes coeficientes de encefalização, para serem utilizados em comparações considerando as diferentes relações alométricas existentes em diápsidos. As inferências em paleoneurologia de crocodiliformes, bem como de outros grupos de répteis, esbarra no problema da relativa falta de conhecimento neurológico sobre seus representantes atuais. Estudos que busquem preencher esta lacuna são fundamentais para o aprimoramento das inferências paleoneurológicas.

Palavras-chave: *Baurusuchus*, *endocast*, nervos cranianos, paleoneurologia, ontogenia, coeficiente de encefalização.

ABSTRACT

Popularization of computed tomography techniques is contributing for great advances in paleoneurology. However, the knowledge on crocodyliform paleoneurology is still incipient. This work aims to contribute with the field of knowledge by giving a detailed description of the endocranial cavity, endosseous labyrinth, and cranial nerves of *Baurusuchus* sp. using tomography-generated images, considering ontogenetic and diagenetic factors. Based on the description and comparison with fossil and recent species, a series of sensorial and ecological inferences are made. Relative brain size, olfaction, facial sensitivity, alert head posture, and hearing frequencies are analyzed. Relative brain size in fossil vertebrates is traditionally compared using encephalization quotients. These are based on linear regressions generated from the allometric relations observed in living groups. However, in addition to issues regarding the methods chosen to perform linear regressions, there are different allometries among living groups. In order to examine how this can affect the study of relative brain size in fossil species, a database of brain and body mass from several diapsid species was constructed and comparisons among different groups and distinct bauplans were made, using comparative phylogenetic methods. The results indicates that the use of encephalization quotients based on one group is frequently inadequate to be applied in another group, since it cannot eliminate the effect of body mass in expected brain size. As a solution, different encephalization quotients are created to be used in comparisons considering the existing differences among diapsid allometric relationships. Inferences on crocodyliform paleoneurology, as well as other reptile groups, are limited by the relative lack of neurological knowledge about its modern representatives. Studies looking to fill that gap are fundamental to the enhancement of paleoneurological inferences.

Key words: *Baurusuchus*, endocast, cranial nerves, paleoneurology, ontogeny, encephalization quotient.

Sumário

Apresentação

A tese a seguir é apresentada no formato de artigos científicos, conforme o Art. 35 do Regulamento do Programa de Pós-graduação em Geologia, Instituto de Geociências, Universidade de Brasília.

O presente volume é composto por três capítulos. O capítulo 1 reúne uma revisão bibliográfica sobre métodos em paleoneurologia, a fim de embasar escolhas metodológicas realizadas para o restante do trabalho. Além de trazer os objetivos do projeto.

O capítulo 2 contém um artigo escrito na língua inglesa que traz a descrição neuroanatômica de *Baurusuchus* sp. e inferências neurosensoriais, seguindo padrões das revistas internacionais, contém resumo, introdução, materiais e métodos, resultados, discussão, conclusões e referências bibliográficas.

O capítulo 3, contém um artigo escrito na língua inglesa que discute o uso de coeficientes de encefalização em diápsidos viventes e fósseis, seguindo padrões das revistas internacionais, contém resumo, introdução, materiais e métodos, resultados, discussão, conclusões e referências bibliográficas.

Capítulo 1 – Introdução Geral

Fossilização, tecidos moles e paleoneurologia

Durante o processo de fossilização há a alteração do material biológico original, sendo que, na maioria dos casos, a preservação da forma e estrutura acontece através da substituição dos componentes biológicos originais por componentes da matriz mineral que cerca o fóssil em formação (HOLZ & SIMÕES, 2002; CARVALHO, 2004). Esse processo é demorado e o grau de substituição dos componentes dependerá, dentre outros fatores, da idade do fóssil, sendo o mais antigo também geralmente o mais substituído. Dessa forma, a preservação de estruturas anatômicas em fósseis tende a ser uma representação mineralizada dos restos mortais e não a preservação da estrutura anatômica em si (HOLZ & SIMÕES, 2002; CARVALHO, 2004).

O processo de fossilização é seletivo. Dada a natureza dos diferentes tecidos dos vertebrados, sua preservação em fósseis ocorre de diferentes formas. Os tecidos mineralizados são muito mais facilmente preservados dada sua resistência e dureza, sendo mais difíceis de serem decompostos antes de serem preservados do que tecidos não mineralizados. Dessa forma, tecidos moles como os que compõem o cérebro, nervos e vasos sanguíneos normalmente não são preservados em fósseis, com raríssimas exceções (HOLZ & SIMÕES, 2002; CARVALHO, 2004).

O estudo do cérebro e sistema nervoso de fósseis, denominado paleoneurologia, tem como objetivo determinar como as estruturas neurais evoluíram em um grupo particular e entender aspectos paleoecológicos dos animais estudados (HOPSON, 1979; BUCHHOLTZ & SEYFARTH, 1999; WITMER *et al*., 2008; WALSH *et al*., 2009; ZELENITSKY *et al*., 2009, 2011; GEORGE & HOLLIDAY, 2013; HURLBURT *et al*., 2013). Em vertebrados fósseis, evidências sobre hábitos e comportamento geralmente são obtidas a partir de osteologia comparada (WALSH & KNOLL, 2011). Nesse sentido, a paleoneurologia se apresenta como uma linha de evidência separada, que pode revelar informações que a osteologia falha em conseguir sozinha, como habilidades cognitivas e sensoriais (WITMER *et al*., 2008; WALSH *et al*., 2009; ZELENITSKY *et al*., 2009, 2011; GEORGE & HOLLIDAY, 2013; HURLBURT *et al*., 2013).

Por ser um tecido mole, o tecido nervoso raramente é preservado. A preservação de estruturas esqueletais em fósseis de vertebrados permite o entendimento da anatomia

óssea, que é historicamente o principal foco da paleontologia de vertebrados. Entretanto, os ossos não existem sozinhos no organismo. Possuem protuberâncias, côndilos, tuberosidades, forames e diversas outras estruturas que interagem com outros órgãos e tecidos (HILDEBRAND & GOSLOW JR., 2006), permitindo que o estudo dos vertebrados fósseis se estenda além da osteologia. O sistema esquelético interage intimamente com o sistema muscular para sustentação e locomoção dos vertebrados. Alguns músculos ancoram-se aos ossos através de tendões, essas regiões de interface entre músculo e osso tendem a ser proporcionais ao tamanho do músculo e das forças que ele é capaz de realizar. Além disso, os ossos do crânio envolvem intimamente o encéfalo, promovendo sua proteção e possuem forames por onde passam nervos e vasos sanguíneos (HILDEBRAND & GOSLOW JR., 2006).

Para a paleoneurologia, o estudo dos ossos que formam a caixa craniana e se encontravam em contato próximo ao cérebro do animal em vida são de vital importância para recuperar a anatomia cerebral (FRANZOSA, 2004; WALSH & KNOLL, 2011). Comumente, um molde da cavidade endocranial é formado durante a fossilização de um crânio. Nesse processo, a matriz rochosa preenche a cavidade onde o cérebro se localiza e forma um molde natural que se assemelha anatomicamente ao encéfalo em vida, em maior ou menor proporção, comumente referido como um *endocast* cerebral (HOPSON, 1979). Entretanto, o *endocast* normalmente está cercado pelos ossos que compõem a caixa craniana, dificultando a recuperação da anatomia encefálica.

Em alguns casos, a matriz rochosa é mais resistente que o fóssil e o *endocast* criado resiste ao desgaste do tempo enquanto os ossos fossilizados se desgastam, expondo o *endocast* natural (NEWTON, 1888; EDINGER, 1938, 1941; GAFFNEY, 1977). Em outros casos, a matriz rochosa pode ser removida da cavidade endocranial e um *endocast* artificial de látex pode ser criado (RADINSKY 1968; JERISON 1973; HOPSON, 1979), entretanto esta técnica é potencialmente destrutiva e não aplicável à espécimes frágeis (WITMER *et al*., 2008). Ao longo da maior parte de sua história, a evolução do conhecimento paleoneurológico dependeu ou de achados extraordinários, ou de métodos potencialmente destrutivos. Além da remoção agressiva da matriz rochosa e criação de *endocasts* artificiais de látex (GALTON, 1989, 2001), outras técnicas destrutivas empregadas em estudos paleoneurológicos incluem seccionar o crânio com uma serra (OSBORN 1912) e desgastar o fóssil, seccionando-o em fatias finas (STENSIÖ, 1963). Mais recentemente, o desenvolvimento da Tomografia Computadorizada, que utiliza raios-X de alta resolução, permitiu o estudo do interior dos crânios dos vertebrados,

viventes e fósseis, sem a necessidade de destruir o material, sendo um método confiável e não destrutivo (ROWE, 1997; 1999; TYKOSKI *et al*., 2002; WITMER *et al*., 2003). Assim é possível estudar os ossos em grande detalhe, mas também os forames, canais e outras estruturas antes dificilmente acessíveis em material fóssil (FRANZOSA, 2004).

Tamanho cerebral relativo

O tamanho cerebral relativo pode ser definido como o tamanho do cérebro comparado ao tamanho corporal total. O tamanho corporal normalmente é expressado pela massa. Já o tamanho cerebral pode ser expressado em massa ou volume, já que a densidade relativa do cérebro é muito próxima de 1 (JERISON, 1973; HURLBURT, 1982). As duas medidas, tamanho corporal e tamanho cerebral, estão altamente correlacionadas nos vertebrados. Nesse grupo o tamanho relativo do cérebro é menor à medida que o tamanho corporal aumenta (HURLBURT *et al.*, 2013). O tamanho relativo do cérebro tem sido utilizado para inferir as capacidades cognitivas e o modo termorregulatório em vertebrados extintos (JERISON, 1973; HOPSON, 1977) e associado a comportamentos cognitivos complexos em aves e mamíferos (LEFEBVRE *et al.*, 2002; MARINO, 2002).

Partindo das relações encontradas entre a massa corporal e cerebral, o conceito de Coeficiente de Encefalização, abreviado como EQ em inglês (Encephalization Quotient), foi cunhado por Jerison (1973). Ele é expressado como o coeficiente entre a massa cerebral do espécime e a massa cerebral esperada para a massa corporal do espécime, utilizando equações de regressão para grupos de referência ao qual o espécime pertence. Desde então o termo tem sido aplicado em diversos estudos e tornou-se uma das medidas mais comuns de tamanho cerebral relativo (HURLBURT *et al*., 2013).

Equações de regressão entre tamanho cerebral e corporal para diferentes grupos de vertebrados são utilizadas e o grupo é comumente referido por uma inicial antes da abreviação “EQ”. Jerison (1973), por exemplo, cunhou o termo LVEQ, referindo-se ao coeficiente de encefalização calculado para os “vertebrados inferiores” (lower vertebrates). Posteriormente, Hurlburt (1996) desenvolveu o coeficiente de encefalização em répteis não avianos (REQ) e aves (BEQ) a partir de equações de tamanho corporal-cerebral em cada grupo.

Diferentes grupos de vertebrados possuem grau de encefalização diferente. Equações de regressão entre tamanho cerebral e corporal para diferentes grupos de vertebrados são utilizadas para examinar o tamanho relativo do cérebro entre táxons semelhantes. Com base nas relações encontradas em répteis não avianos atuais (N = 62) pode-se expressar essa relação na forma da equação abaixo (HURLBURT *et al.*, 2013).

$\log MBr = -1{,}810 + (0{,}553 \times \log MBd)$

Onde MBr é a massa cerebral e MBd é a massa corporal. Desta forma o EQ de répteis (REQ) pode ser expressado por:

$REQ = MBr/(0{,}0155 \times MBd^{0{,}553})$

Embora tamanho corporal e cerebral estejam fortemente correlacionados, há também, ao menos em *A. missisipiensis*, uma correlação negativa entre o REQ e o comprimento total, onde tamanho cerebral observado varia significativamente do esperado a partir da equação de regressão de massa cerebral e massa corporal obtida para a espécie, amostrando seis indivíduos selvagens e seis em cativeiro (HURLBURT *et al.*, 2013). Em outras palavras, o tamanho cerebral relativo é muito maior que o esperado em animais adultos menores (165% do valor esperado no menor espécime – 1,61m de comprimento) e torna-se muito menor que o esperado à medida que o animal cresce (67% do valor esperado no maior espécime – 3,81m de comprimento). O que dificulta comparações entre espécies diferentes de répteis. Apesar do uso do REQ para comparar a encefalização de diferentes grupos de répteis na literatura (*e.g.* HURLBURT *et al.* 2013; LAUTERS *et al.* 2013; TROTTEYN & PAULINA-CARABAJAL, 2016; PAULINA-CARABAJAL & CURRIE, 2017), este uso é potencialmente problemático tanto entre crocodilianos modernos quanto em outros grupos, como dinossauros, cujos REQs parecem decrescer em função da massa corporal (*e.g.* HURLBURT *et al.* 2013; PAULINA-CARABAJAL & CURRIE, 2017).

Estimativas de massa cerebral

Em aves, mamíferos e provavelmente em terópodes maniraptoriformes, o cérebro preenche toda a cavidade endocranial (CURRIE, 1995; LARSSON *et al.*, 2000; ZELENITSKY *et al.*, 2009, 2011) o que não ocorre em répteis, como os crocodilomorfos e outros grupos de dinossauros terópodes. Tradicionalmente, assume-se que os cérebros dos répteis ocupam uma proporção de 50% da cavidade endocranial. Essa proporção é

assumida com base no cérebro de *Sphenodon* e de um espécime de *Iguana* (DENDY, 1910; JERISON, 1973). Entretanto, o volume ocupado pelo cérebro dentro da cavidade endocranial varia decrescentemente com a massa corporal. Podendo ocupar quase a totalidade do volume em embriões e em animais muito jovens ou ocupar valores entre quase 70% e 30% em indivíduos adultos (HURLBURT *et al.*, 2013; JIRAK & JANACEK, 2017). Entretanto, embora estes valores variem ao longo da ontogenia, os volumes cerebral e da cavidade endocranial estão fortemente correlacionados (WATANABE *et al*., 2019).

Hurlburt *et al.* (2013) encontraram uma diferença significativa na relação entre volume cerebral e massa corporal entre machos e fêmeas de *A. mississipienis*. Os maiores machos, de tamanho corporal maior, possuem cérebros que ocupam proporcionalmente menos a cavidade endocranial (33%) do que as maiores fêmeas (42%). Apesar da atribuição dessa variação ao dimorfismo sexual, é importante ressaltar que o tamanho corporal entre machos e fêmeas é bem diferente nessa espécie, onde os machos são maiores. Portanto, não está claro se a diferença significativa encontrada é realmente ligada ao sexo ou somente ao tamanho corporal.

Estimativas de massa corporal

Diferentes estratégias têm sido utilizadas para estimar a massa corporal de arcossauros fósseis. Dada a natureza fragmentar da maioria dos achados fósseis, há a necessidade de esses métodos conseguirem estimar a massa corporal a partir de ossos isolados ou do crânio. As principais medidas utilizadas para as estimativas em Mesoeucrocodylia são o comprimento do crânio ou o comprimento máximo do fêmur (FARLOW *et al.*, 2005; COTTS *et al.*, 2017). Entretanto, existem certas limitações no uso de equações de regressão para essas estimativas. A relação entre comprimento total, e consequentemente massa corporal, e comprimento do crânio entre os crocodilianos atuais é ligeiramente diferente. Alligatoridae, por exemplo, possuem um crânio proporcionalmente mais curto que Crocodylidae (SERENO *et al.*, 2001).

Apesar do uso do comprimento craniano e femoral serem considerados métodos que podem dar boas estimativas, existem algumas limitações para sua aplicação que devem ser consideradas. A proporção entre a massa corporal e o comprimento do crânio e fêmur não são constantes entre as espécies. No espécime de *Stratiotosuchus maxhetchi*

DGM 1477-R o comprimento do crânio é de 470 mm e do fêmur 347 mm (RIFF & KELLNER 2011; COTTS *et al*. 2017), um comprimento craniano cerca de 35% maior que o femoral. Já no espécime SMNS 9808 de *Cricosaurus suevicus* o comprimento craniano é mais de três vezes maior que o femoral (YOUNG *et al*. 2011). Portanto, medidas de um mesmo exemplar que possua crânio e fêmur preservados podem dar estimativas de massa corporal bastante diferentes. Por exemplo, a massa corporal estimada para *S. maxhetchi* (DGM 1447-R), utilizando as equações em Farlow *et al*. (2005), pelo comprimento do crânio é de 213,3 Kg, já pelo comprimento do fêmur é de 548,7 Kg.

Ao plotar os dados da literatura (SERENO *et al.*, 2001; FARLOW *et al.*, 2005; TURNER, 2006; RIFF & KELLNER 2011; YOUNG *et al*. 2011; GODOY *et* al., 2016; COTTS *et al*. 2017), a relação entre o comprimento total e os comprimentos do fêmur e crânio em *S. maxhetchi* e *Baurusuchus* indicam um comprimento proporcional craniano ligeiramente menor e um comprimento femoral proporcionalmente maior em relação ao comprimento total (fig. 1), quando comparados com o encontrado em *A. mississippiensis*. Além disso, pode-se observar uma tendência a possuir um crânio relativamente maior que o fêmur em espécies marinhas e o contrário em espécies terrestres (fig. 2). Dessa forma, ao utilizar as equações calculadas para *A. mississippiensis*, as estimativas obtidas com base em comprimento craniano podem estar subestimando ligeiramente a massa corporal de baurusuquídeos, enquanto as estimativas com base no fêmur a superestimam consideravelmente. Já que a medida considerada mais segura para estimar a massa seria o comprimento total (FARLOW *et al.*, 2005).

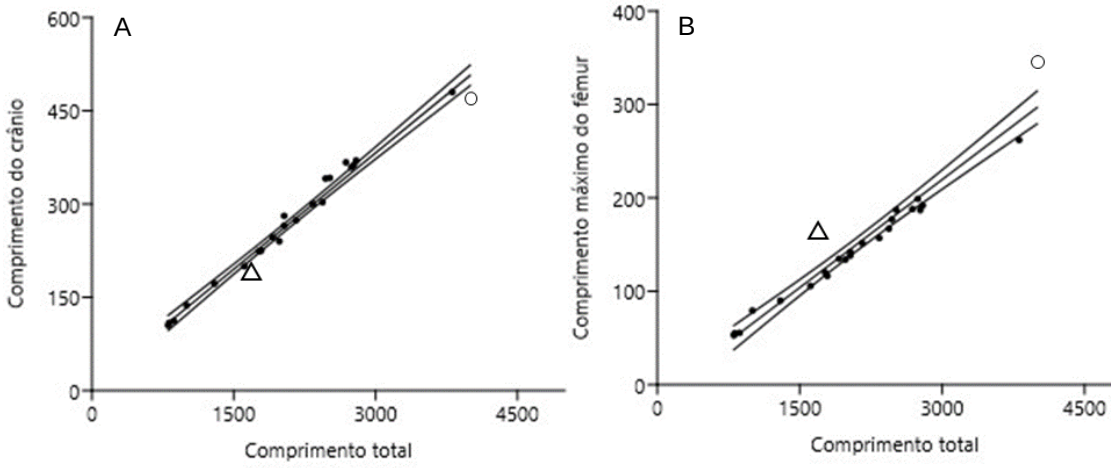

Figura 1. Relações entre comprimento total e comprimento do crânio (A) e fêmur (B). Pontos pretos – *Alligator mississippiensis*; Triângulo branco – *Baurusuchus* FUP; Círculo branco – *Stratiotosuchus maxhechti* DGM 1447-R.

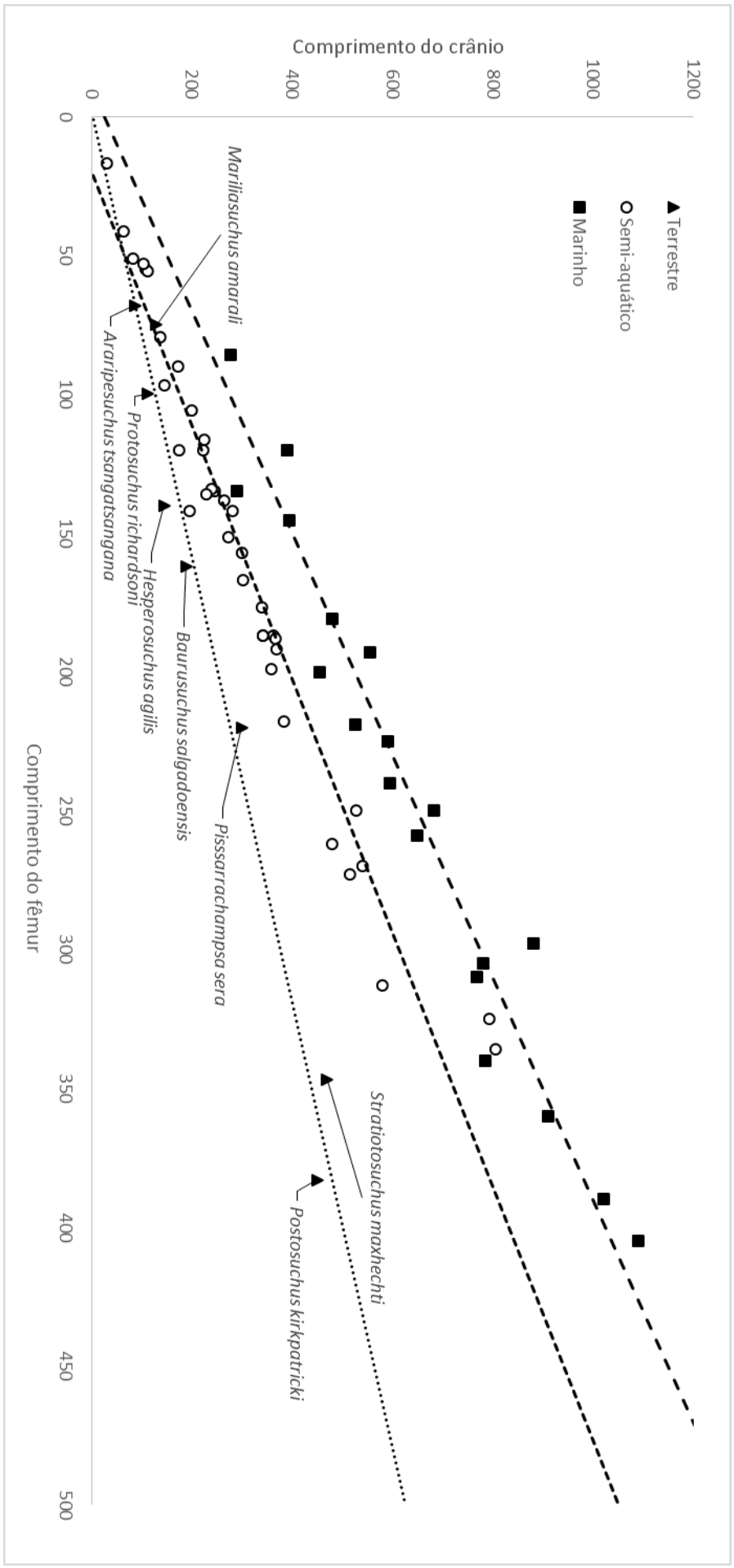

Figura 2 Relações entre comprimento do crânio e do fêmur entre Crurotarsi terrestres, semiaquáticos e marinhos. Medidas em mm.

Coeficiente olfatório

Os bulbos olfatórios são estruturas que se projetam rostralmente e ventralmente do encéfalo dos vertebrados, são fundamentais para o processamento de informações olfativas e seu tamanho relativo tem sido utilizado como indicador da acuidade olfatória em aves e dinossauros terópodes (fig. 3) (VASSAR *et al*., 1994; PURVES *et al*., 2001; ZELENITSKY *et al*., 2011).

A ligação de moléculas odoríferas aos receptores no epitélio olfatório dispara os neurônios que propagam o sinal através dos nervos olfatórios até os bulbos olfatórios (VASSAR *et al*., 1994; PURVES *et al*., 2001). Os lobos olfatórios coletam e processam essas informações, transmitindo-as para centros de processamento superiores através do trato olfatório (MORI *et al*., 1999; PURVES *et al*., 2001).

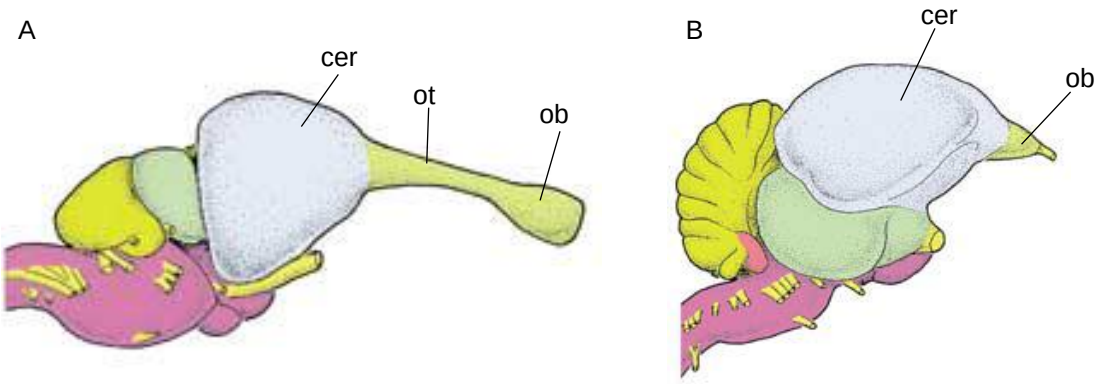

Figura 3. Ilustração de cérebros de Archosauria viventes com suas partes destacadas. A – Cérebro de aligátor (*Alligator mississippiensis*) em vista lateral direita. B – Cérebro de pombo (*Collumba livia*). Abreviações: cer – hemisfério cerebral, ot – trato olfatório (extremamente reduzido e frequentemente anatomicamente indistinguível em aves), ob – bulbo olfatório. Retirado de Witmer *et al.* (2003).

O tamanho relativo de partes do cérebro está positivamente correlacionado com a importância da função que desempenha (BANG & COBB, 1968; HEALY & GUILFORD, 1990; ZELENITSKY *et al*., 2011). Essa hipótese tem sido corroborada para os bulbos olfatórios em aves e bulbos olfatórios proporcionalmente maiores estão correlacionados em aves com uma variedade maior de receptores olfatórios, portanto sendo capazes de detectar uma gama maior de moléculas odoríferas (NOTTEBOHM *et al*., 1981; KREBS *et al*., 1989; WENZEL & MEISAMI, 1987; NIIMURA & NEI, 2006; STEIGER *et al*., 2008). O coeficiente olfatório pode ser definido como a maior medida linear do bulbo olfatório dividida pela maior medida linear do hemisfério cerebral

correspondente (COBB, 1960; BANG & COBB, 1968; ZELENITSKY *et al*., 2009; ZELENITSKY *et al*., 2011).

Os trabalhos que tratam do coeficiente olfatório assumem que a proporção volumétrica entre os componentes cerebrais e as porções endocraniais que as abrigam são muito pouco diferentes (LARSSON *et al*., 2000; ZELENITSKY *et al*. 2009, 2011). Dessa forma, quando o *endocast*, natural ou digital, de um fóssil preserva a região do bulbo olfatório, pode-se ter uma ideia de suas dimensões e da acuidade olfatória do animal. Portanto, o coeficiente olfatório poderia ser calculado com acurácia considerável mesmo para répteis, onde o cérebro não preenche completamente a cavidade endocranial. Entretanto, mais recentemente, descobriu-se que a proporção entre o volume endocranial e o volume cerebral não é constante ao longo do encéfalo de crocodilianos e essas diferenças regionais se alteram ao longo da ontogenia (JIRAK & JANACEK, 2017). Além disso, trata-se de uma medida relativa, onde o mesmo resultado pode ser obtido através de processos evolutivos distintos. Um valor pequeno de coeficiente olfatório, por exemplo, pode ser consequência tanto da redução do tamanho dos bulbos olfatórios quanto do aumento do tamanho dos hemisférios cerebrais em uma linhagem. Isso não impossibilita a utilização do coeficiente olfatório como estimativa de capacidade olfatória, mas é necessário discutir os possíveis efeitos das limitações do método, em especial para comparações entre grupos taxonômicos distintos, com diferentes relações entre volume cerebral e endocranial.

Labirinto endósseo.

O labirinto endósseo corresponde à porção mais interna do sistema auditivo dos vertebrados. É composto pelo sistema vestibular, responsável por coletar informações ambientais fundamentais para o equilíbrio e orientação espacial do animal, e pela cóclea, responsável pela recepção de estímulos auditivos (fig. 4) (BAIRD, 1970; HILDEBRAND & GOSLOW JR., 2006).

Da mesma forma que a cavidade endocranial, o contramolde do labirinto endósseo com frequência está preservado em espécimes fósseis, mas mesmo com o desenvolvimento das técnicas de tomografia computadorizada sua visualização era difícil e pouco precisa, dado o pequeno tamanho das estruturas. Com o avanço da tecnologia de

microtomografia computadorizada (MicroCT), que possui resolução muito superior à tomografia tradicional, a anatomia do labirinto endósseo de vários vertebrados fósseis passou a poder ser inteiramente reconstruída de forma confiável (*e.g.* WITMER *et al*., 2003; ALONSO *et al*. 2004; SANDERS & SMITH 2005; SAMPSON & WITMER 2007; SERENO *et al*. 2007; WITMER *et al*., 2008; MILNER & WALSH, 2009).

Nos vertebrados gnatostomados a região dorsal de cada labirinto é sempre composta de três canais semicirculares, geralmente orientados em três planos aproximadamente ortogonais que sentem a aceleração angular e movimentos de virada da cabeça. Canais semicirculares maiores estão associados a uma agilidade maior em aves e primatas e essa relação tem sido utilizada como indicadora de agilidade em espécies fósseis (SPOOR & ZONNEVELD, 1998; SPOOR, 2003; SPOOR *et al.* 2007).

Medidas lineares da cóclea, em particular de seu comprimento máximo, são consideradas preditivas da capacidade auditiva e potencialmente do grau de sociabilidade do animal, tanto em espécies viventes quanto fósseis (WALSH *et al.*, 2009). Como a papila basilar, estrutura que contém células ciliadas responsáveis pela conversão de ondas mecânicas em sinais nervosos (BAIRD, 1970), está localizada dentro do ducto coclear endósseo, suas dimensões podem ser estimadas em material fóssil (GLEICH *et al.*, 2005). Dimensões estas que estão fortemente correlacionadas com a sensibilidade auditiva, em particular com a faixa de frequência do som que pode ser decodificado pelo animal, em vários vertebrados viventes (MANLEY, 1972).

Por sua vez, estimativas da frequência audível de um animal podem ser indicativas de seu comportamento e ecologia. Por exemplo: a vocalização em vertebrados, quando presente, geralmente é produzida na faixa de frequência que o animal é capaz de escutar (KONISHI, 1970; BROWN &WASER, 1984; ENDLER, 1992; NARINS *et al*., 2004); uma complexidade maior da vocalização está associada com sociabilidade maior e comportamento gregário (EVANS 1936; BLUMSTEIN 1997); espécies que vivem em ambientes mais fechados (*e.g.* florestas) onde a comunicação visual não é efetiva tendem a possuir vocalizações mais complexas ou com frequências mais baixas que as espécies que vivem em outros ambientes (*e.g.* desertos) (GARRICK & LANG 1977; BROWN & WASER 1984), o que pode ser especialmente informativo para o caso das localidades de ocorrência de baurusuquídeos que preservaram pouca informação sobre sua paleoflora.

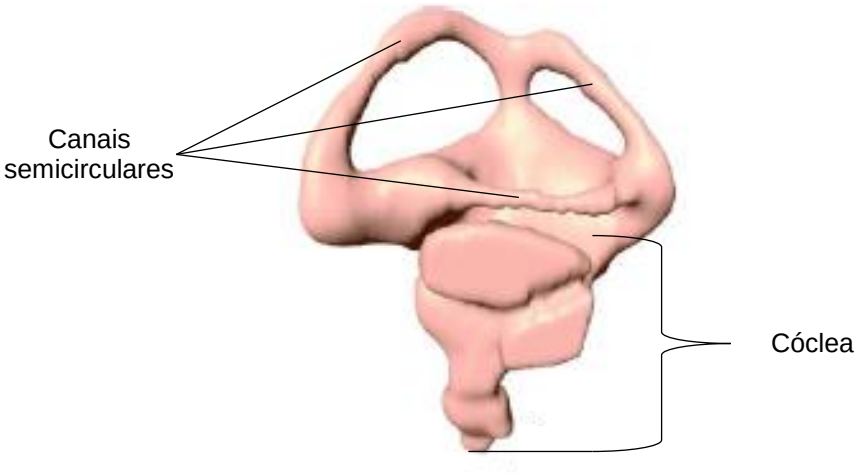

Figura 4. Vista lateral esquerda do labirinto endósseo de *A. mississippiensis*, evidenciando os canais semicirculares, região ligada ao equilíbrio, e cóclea, região auditiva (retirado de BRUSATTE *et al.*, 2016).

Contexto Geológico.

A Formação Adamantina, Cretáceo Superior, é uma das unidades do Grupo Bauru (fig. 5), que aflora em parte das regiões Sul, Sudeste e Centro-Oeste do Brasil, em uma área com cerca de 370000 Km^2 (FERNANDES & COIMBRA, 2017). Não existe consenso a respeito da divisão estratigráfica das unidades geológicas do Grupo Bauru (SOARES *et al.*, 1980; FERNANDES & COIMBRA, 1996; MILANI & ZALAN, 1999, DIAS-BRITO *et al.*, 2001). Para a Formação Adamantina também não há consenso de nomenclatura. A existência de variações regionais consideráveis levou alguns autores a dividirem a Formação Adamantina nas formações Vale do Rio do Peixe, São José do Rio Preto e Presidente Prudente (FERNANDES, 1998; FERNANDES & COIMBRA, 2017). Entretanto, considera-se aqui a nomenclatura original, em acordo com outros autores que a utilizam e que entendem as variações como uma característica típica da unidade (BATEZELLI, 2003; PAULA E SILVA, 2003; GARCIA *et al*., 2005).

Os sedimentos da Formação Adamantina são representados por arenitos finos a muito finos, podendo possuir cimentação e nódulos carbonáticos. Também estão presentes lentes de siltitos arenosos e argilitos. Os sedimentos apresentam grande variedade de estruturas sedimentares, com estratificações plano-paralela e cruzada de pequeno porte, com variações regionais, caracterizando sistemas deposicionais fluviais

do tipo entrelaçado (BATEZELLI, 2003; PAULA E SILVA, 2003; GARCIA *et al.*, 2005).

Nos depósitos da Formação Adamantina são comuns os fósseis de crocodilomorfos, principalmente da família Baurusuchidae, a qual apresenta restos bem preservados incluindo material craniano (PRICE, 1945; RIFF & KELLNER, 2001; VASCONCELLOS *et al.*, 2007; VASCONCELLOS & CARVALHO, 2007; NASCIMENTO & ZAHER, 2012; MONTEFELTRO *et al.*, 2011).

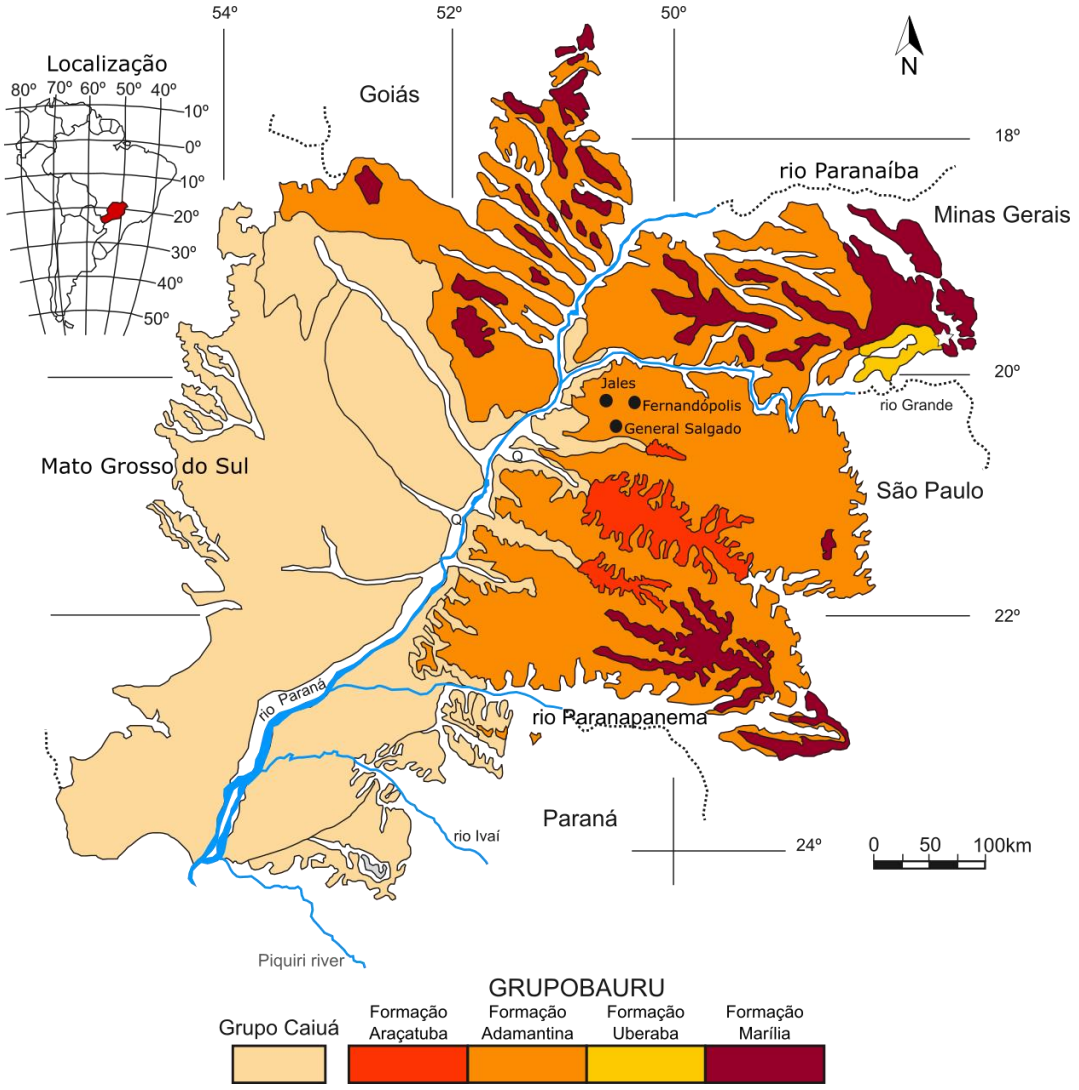

Figura 5. Mapa geológico da Bacia Bauru compilado de Fernandes (2004) e Fernandes & Coimbra (1996).

O gênero *Baurusuchus*: Filogenia e paleoecologia.

Baurusuchus (fig. 6.A) é um gênero de crocodilomorfos pertencente à família Baurusuchidae, encontrado na Formação Adamantina. Os Baurusuchidae eram animais de porte médio e morfologia muito divergente em comparação a outros crocodilomorfos. Eles possuem crânios altos e comprimidos lateralmente, número de dentes reduzido, com carenas serrilhadas, restritos à porção anterior do rostro. Além disso, alguns dos dentes são hipertrofiados (PRICE, 1945; RIFF & KELLNER, 2001; VASCONCELLOS *et al*., 2007; VASCONCELLOS & CARVALHO, 2007; NASCIMENTO & ZAHER, 2012; MONTEFELTRO *et al*., 2011).

A filogenia da família (fig. 6.B) ainda não está bem esclarecida, sendo representantes dela, suportados por análise filogenética, as espécies *Cynodontosuchus rothi* e *Wargosuchus australis*, ambas provenientes do Cretáceo Superior da Argentina. *Baurusuchus pachecoi*, *Baurusuchus salgadoensis*, *Baurusuchus albertoi*, *Stratiotosuchus maxhechti*, *Campinasuchus dinizi*, *Pissarrachampsa sera*, *Gondwanasuchus scabrosus* e *Aplestosuchus sordidus*. Todas elas encontradas no Cretáceo Superior da Bacia Bauru, Brasil (MONTEFELTRO *et al.*, 2011; GODOY *et al.*, 2014). Além destas, *Pabwehshi pakistanensis*, do Cretáceo do Paquistão também é incluído como membro da família por algumas análises (TURNER & CALVO, 2005; NASCIMENTO & ZAHER, 2012), mas esse status não é consensual (LARSON & SUES, 2007).

Os crocodilomorfos atuais estão distribuídos nos ambientes tropicais e subtropicais de todos os continentes, com exceção da Antártica. Apresentando uma grande adaptação e dependência com os ambientes aquáticos, em especial de água doce que pode ser visualizada em sua anatomia. Os órgãos sensoriais estão localizados no topo da cabeça e a cauda é robusta e tem forma de remo (POUGH *et al*., 2008). Com base em sua anatomia óssea, o gênero *Baurusuchus* é interpretado como um crocodiliano terrestre predador, adaptado a climas quentes e áridos (RIFF & KELLNER, 2001; CARVALHO *et al*., 2010). A morfologia craniana, com órbitas laterais, ao invés de apicais, e abertura das narinas na extremidade frontal, indica o hábito terrestre. A morfologia dos membros, proporcionalmente mais compridos, com postura ereta, indica um hábito ambulatorial, ou até mesmo cursorial, em ambientes terrestres para o grupo (VASCONCELLOS *et al*., 2007; VASCONCELLOS & CARVALHO, 2007; NASCIMENTO & ZAHER, 2010; GODOY *et al*., 2016).

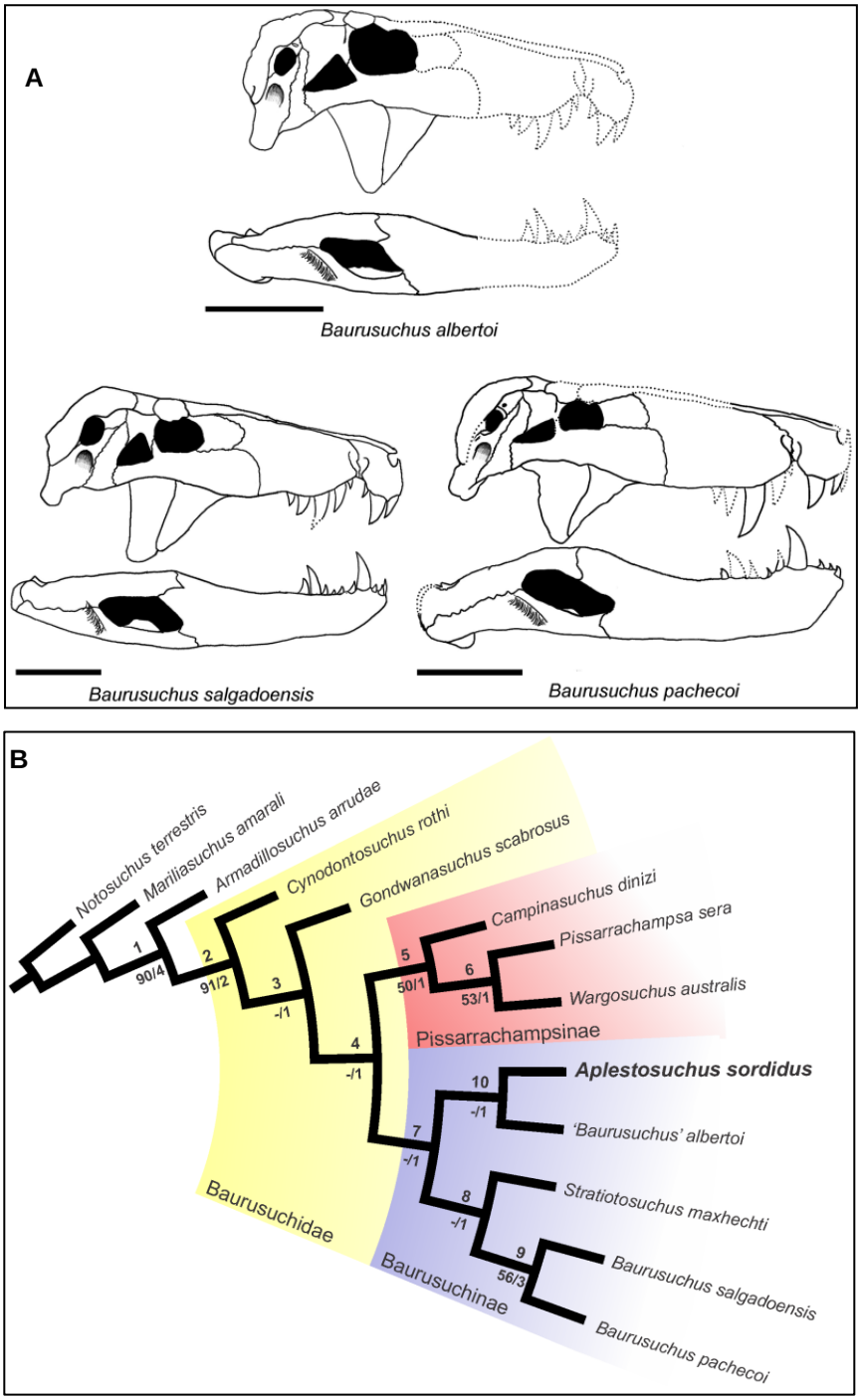

Figura 6. O gênero *Baurusuchus*. **A:** Crânios reconstruídos das três espécies de *Baurusuchus*, *B. albertoi*, *B. salgadoensis* e *B. pachecoi* (retirado de NASCIMENTO & ZAHER, 2012). **B:** Filogenia da família Baurusuchidae (retirado de GODOY *et al.*, 2014)

Por possuir morfologia osteológica bastante diferente dos crocodilianos viventes é de se esperar que a morfologia de outros sistemas em *Baurusuchus* também seja diferente. No sistema nervoso, o encéfalo e os nervos cranianos estão adaptados para

cumprir suas funções específicas em cada grupo animal. Por exemplo, se um vertebrado tem o olfato como sentido muito importante ele possuirá estruturas neurais compatíveis, como um lobo olfatório bem desenvolvido, bem irrigado, e grande aporte de nervos sensitivos para a região quimiorreceptora (BUTLER & HODOS, 2005). Como resultado disso, ao se estudar a estrutura do encéfalo e nervos cranianos de um vertebrado fóssil pode-se inferir sobre sua paleoecologia (por exemplo, principais sentidos, possíveis hábitos, capacidade motora). Embora haja outros estudos paleoecológicos sobre o gênero *Baurusuchus*, nenhum deles descreve ou analisa a neuroanatomia do animal (RIFF & KELLNER, 2001; VASCONCELLOS *et al*., 2007; VASCONCELLOS & CARVALHO, 2007; CARVALHO *et al*., 2010).

Objetivos

Descrever a neuroanatomia de *Baurusuchus*, a partir de espécimes fósseis, utilizando-se de técnicas de tomografia computadorizada e reconstrução 3D.

Comparar a neuroanatomia de *Baurusuchus* com a de crocodilianos atuais e pretéritos, além de outros vertebrados que possuam neuroanatomia semelhantes e, possivelmente, auxiliar a compreensão filogenética da família.

Inferir dados paleoecológicos do gênero a partir da neuroanatomia (principais sentidos, possíveis hábitos, capacidade motora), comparando-os com dados provenientes de outras fontes (anatomia, osteologia, bioestratigrafia).

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Capítulo 2 – Paleoneurologia de *Baurusuchus* sp.

Paleoneurology of *Baurusuchus* (Crocodyliformes: Baurusuchidae), ontogenetic variation, brain size, and sensorial implications

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Abstract

Knowledge on crocodyliform paleoneurology has significantly improved with development of computed tomography. However, so far studies have been able to reconstruct brain endocasts based only on single specimens for each taxon. Here, for the first time, we reconstructed brain endocasts for four fossil specimens of the same crocodyliform taxon (*Baurusuchus*), consisting of complete skulls of one large adult, a late juvenile and two medium sized specimens. In addition, we were able to reconstruct the inner ear anatomy of a fragmentary skull using microtomography. Moreover, we present estimates of brain size using simple models, based on modern Crocodylia, able to adapt brain to endocranial cavity ratios to expected ontogenetic variation instead of using fixed ratios. We also analyzed relative brain sizes, olfactory ratios, facial sensation, alert head posture, best hearing frequencies and hearing range. Endocranial volumes recovered showed that they can be greatly altered by taphonomic processes, altering both total and partial endocranial volumes. Recovered endocasts are compatible with different degrees of occupation along the endocranial cavity and some of their characteristics might be useful as phylogenetic characters. Either the relative brain size or the brain to endocasts ratio of *Baurusuchus* were not compatible with modern crocodilians. Sensorial abilities

were somewhat similar to modern crocodilians, hearing ranges and best mean frequencies capabilities are remarkably similar to modern crocodilians and olfactory ratio values are a little higher. Differing from its modern relatives, *Baurusuchus* retrieved head posture is compatible with a carnivorous terrestrial habit.

Key words: *Baurusuchus* endocast brain nerves paleoneurology ontogeny

Introduction

Paleoneurology is the study of the nervous systems of fossil organisms (Edinger, 1938; Hopson, 1979; Buchholtz and Seyfarth, 1999) and provides insight on vertebrate evolution and paleoecology (e.g., Witmer et al., 2008; Walsh et al., 2009; Zelenitsky et al., 2009, 2011; George and Holliday, 2013; Hurlburt et al., 2013). In extinct vertebrates, evidence for behavior comes mainly from comparative osteology (Walsh and Knoll, 2011). In this sense, paleoneurology is an independent line of evidence for behavior that yields information that osteology alone fails to reveal, such as sensory and cognitive abilities (Witmer et al., 2008; Walsh et al., 2009; Zelenitsky et al., 2009, 2011; George and Holliday, 2013; Hurlburt et al., 2013; Hoffmann et al, 2019).

For much of its history, paleoneurology was dependent on either fortuitous findings or potentially destructive methods (Newton, 1888; Osborn 1912; Edinger, 1938, 1941, 1975; Stensiö, 1963; Radinsky 1968; Jerison 1973; Edinger 1975; Gaffney, 1977; Hopson, 1979; Galton 1989, 2001; Buchholtz and Seyfarth 1999). Recently, technological advances in computed tomography scanning (CT) have fomented a huge increase in paleoneurological knowledge. For instance, pre-CT technology studies of crocodyliform paleoneurology are scarce (e.g., Edinger, 1938; Colbert, 1946) in comparison to studies based on CT scans (e.g., Tykoski et al., 2002; Kley et al., 2010; Fernández et al., 2011; Holliday and Gardner, 2012; Bona et al., 2013; George and Holliday, 2013; Herrera et al., 2013; Sertich and O'Connor, 2014; Blanco et al., 2015; Brusatte et al., 2016; Bona et al., 2017; Pierce et al., 2017; Serrano-Martínez et al., 2019; Fonseca et al., 2020). These recent studies led to a great advance in crocodyliform paleoneurological knowledge. However, these studies still represent only a small fraction of known crocodyliform taxa (Serrano-Martínez et al., 2019).

Despite the advances regarding crocodyliform paleoneurology, some important investigations are yet to be conducted. Probably, mainly due to the nature of the fossil

record, paleoneurological evidence in the literature for any crocodyliform taxa is based on single specimens (e.g., Edinger, 1938; Colbert, 1946; Tykoski et al., 2002; Kley et al., 2010; Fernández et al., 2011; Holliday and Gardner, 2012; Bona et al., 2013; George and Holliday, 2013; Herrera et al., 2013; Sertich and O'Connor, 2014; Blanco et al., 2015; Brusatte et al., 2016; Bona et al., 2017; Pierce et al., 2017; Serrano-Martínez et al., 2019; Fonseca et al., 2020). This impairs our capacity to understand both the effects of deformation in retrieved endocast volumes, ontogenetic variation regarding brain size and shape, and intraspecific variability.

Fossil crocodyliforms are common in Adamantina Formation deposits, especially baurusuchids, represented by well-preserved cranial and post-cranial materials (Price, 1945; Riff and Kellner, 2001; Vasconcellos et al., 2007; Vasconcellos and Carvalho, 2007; Nascimento and Zaher, 2010; Montefeltro et al., 2011). The Upper Cretaceous Adamantina Formation (Bauru Group) crops out in central and Southern regions of Brazil (Fernandes and Coimbra, 2017). There is no consensus regarding the stratigraphic division of the Bauru Group (Soares et al., 1980; Fernandes and Coimbra, 1996; Milani and Zalan, 1999; Dias-Brito et al., 2001) and this also holds true for the Adamantina Formation. Some authors divide it into Vale do Rio do Peixe, São José do Rio Preto, and Presidente Prudente formations due to regional variations (Fernandes, 1998; Fernandes and Coimbra, 2017). However, we use the original designation (Adamantina Formation), described by other works that take into account lithologic variations as a typical characteristic of the unit (Batezelli, 2003; Silva, 2003; Garcia et al., 2005). There is a dispute between a Campanian-Maastrichtian and Turonian-Santonian age for Adamantina Formation (Gobbo-Rodrigues et al., 1999; Dias-Brito et al., 2001; Santucci and Bertini, 2001). However, accumulated evidences so far seem to give a better support the Campanian-Maastrichtian age (Tamrat et al., 2002; Batezelli et al., 2003; Granot et al., 2012; Batezelli, 2017; Castro et al., 2018).

Baurusuchus Price, 1945, from the Adamantina Formation, is the type genus of the Baurusuchidae Price, 1945. This is a group of medium to large-sized, terrestrial, predatory crocodyliforms from the Cretaceous of South America and possibly Pakistan. They have tall, laterally compressed skulls and reduced number of teeth, which are serrated and, some of them, hypertrophied (Price, 1945; Riff and Kellner, 2001; Vasconcellos et al., 2007; Vasconcellos and Carvalho, 2007; Carvalho et al., 2010; Nascimento and Zaher, 2011; Montefeltro et al., 2011). Their phylogenetic relations are still disputed; the Pakistani species Pabwehshi pakistanensis Wilson et al., 2001 is

included in the family by some cladograms (Turner and Calvo, 2005; Nascimento and Zaher, 2011; Pol and Powell, 2011) but excluded in other (Larson and Sues, 2007). Baurusuchids were cursorial predators with a series of convergences with carnivorous theropod dinosaurs, being among the top predators of South American Late Cretaceous faunas (Price, 1945; Riff and Kellner, 2001, 2011; Vasconcellos and Carvalho, 2007 Godoy et al., 2014).

Although there are works regarding Baurusuchus anatomy and paleoecology, none of them describes its neuroanatomy (Riff and Kellner, 2001; Vasconcellos et al., 2007; Vasconcellos and Carvalho, 2007; Carvalho et al., 2010). Despite being an important component of Brazilian Cretaceous fauna, knowledge on Baurusuchidae neuroanatomy is still scarce. The only work on baurusuchid neuroanatomy so far is Fonseca et al. (2020) on Campinasuchus dinizi Carvalho et al., 2011, from the Adamantina Formation, Brazil. Despite being able to reconstruct endocranial endocast and head sinuses, they were unable to reconstruct cranial nerves. In addition, their reconstructed inner ear is incomplete due to poor preservation.

The relative abundance of Baurusuchus skull materials makes it possible to study its neuroanatomy, as well as factors that can influence recovered neuroanatomy in fossil taxa, such as deformation and ontogenetic stage. In living crocodyliforms, the central nervous system grows continually with the endocranial cavity growing faster than the brain, making brain to endocast ratios and morphological correspondence to vary even among adult individuals of different sizes (Ngwenya et al., 2013; Hurlburt et al., 2013; Jirak and Janacek, 2017; Watanabe et al., 2019). In this sense, our study aims to describe Baurusuchus neuroanatomy in detail using CT scans from specimens of different ontogenetic stages, with different deformation degrees, discussing variation among specimens. Based on recovered neuroanatomy, we discuss the relative brain size and sensorial implications for olfaction, alert head posture, hearing and facial sensitivity.

Anatomical Abbreviations

For nomenclature of anatomical features, we follow Witmer et al. (2008) and Iordansky (1973). Anatomical Abbreviations - **blty**, tympanic bulla; **c**, cochlea; **car**, cerebral carotid artery canal; **cer**, cerebral hemisphere; **crc**, crus communis; **csc**, caudal (posterior vertical) semicircular canal; **dc**, dorsal contour; **dls**, dorsal longitudinal sinus; **eo**, exoccipital; **fc**, fenestra cochleae (= round window); **fv**, fenestra vestibuli (= oval window); **II - XII**, cranial nerve canal number; **lsc**, lateral (horizontal) semicircular canal;

hyp, hypophysis; **ob**, olfactory bulb; **ot**, olfactory tract; **p**, parietal; **pot**, prootic; **rsc**, rostral (anterior vertical) semicircular canal; **rsca**, ampulla of rostral semicircular canal; **so**, supraoccipital; **V1**, ophthalmic nerve canal; **V2**–**3**, maxillomandibular nerve canal; **V2-so**, canal for supraorbital branch of maxillary nerve; **Vgang**, trigeminal (Gasserian) ganglion; **vls**, ventral longitudinal sinus; **Vtym**, tympanic branch of trigeminal nerve canal.

Institutional Abbreviations

FEF-PV, Fernandópolis Educational Foundation, São Paulo; **FUP**, University of Brasília, campus Planaltina, Federal District; **IFSP-VTP**, Federal Institute of Education, Science and Technology of São Paulo (Votuporanga, São Paulo, Brazil).

Materials and Methods

Fossil specimens

Five fossil specimens attributed to the genus *Baurusuchus* were used in this study (Fig. 1), all collected from deposits of the Adamantina Formation in São Paulo State, in the cities of Fernandópolis and Jales. Specimen IFSP-VTP/PALEO-0003 is an almost complete late juvenile individual, lacking the entire tail, except for the first two caudal vertebrae and their respective haemal arches, from Fernandópolis, found in dorsoventral position, with the skull roof slightly damaged. In IFSP-VTP/PALEO-0003 the epiphyses of long bones are not fully ossified, neural arches and vertebral centra are incompletely fused, and dermal plates are very thin, indicating the earlier ontogenetic stage. All other specimens are adult individuals, represented only by their skulls and partial postcrania. The specimen IFSP-VTP/PALEO-0002, from Fernandópolis, was found in dorsoventral position and is considerably deformed dorsoventrally. Specimens FUP-Pv 000020 (complete skull without mandible) and FEF-PV-R-1/9 (complete skull with mandible and part of postcranium) were found in Jales laying in lateral position and are slightly laterally deformed. All complete skulls, including the late juvenile, share synapomorphies for the genus, the jugal antorbital region is more expanded than the infraorbital, major surface of pterygoid wing is latero-ventrally oriented and the surangular-angular lateral surface has a marked depression for insertion of musculus pterygoideous posterior (Montefeltro et al., 2011). Specimen FUP-Pv 000021 is a fragmentary skull from Jales comprising the

right otic capsule and fragments of adjacent bones and, as far as comparisons can be made, with features identical to the other studied specimens.

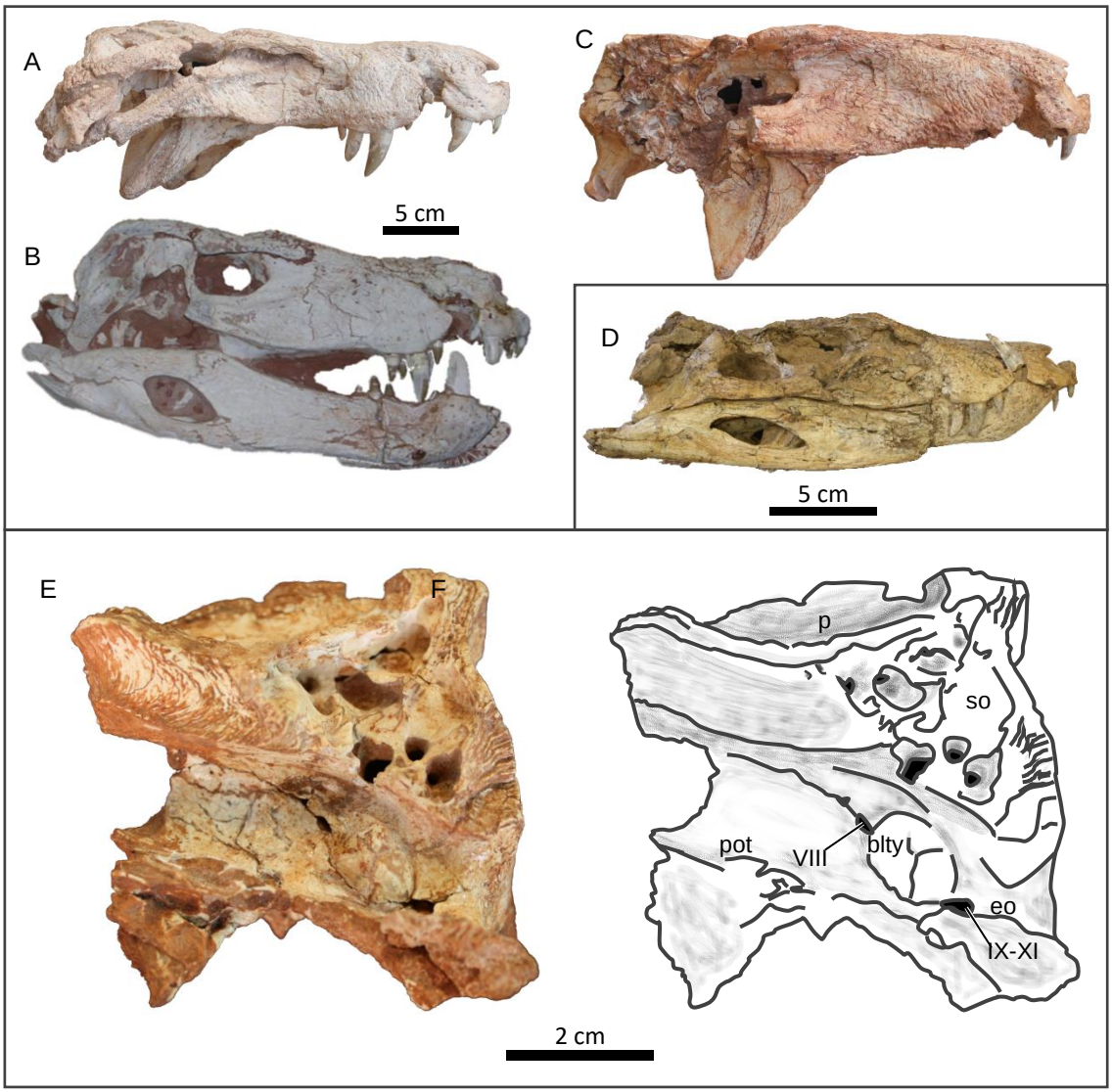

Fig. 1. Specimens used in this study. Adult skulls right lateral views IFSP-VTP/PALEO-0002 (A), FEF-PV-R-1/9 (B), FUP-Pv 000020 (C); late juvenile skull right lateral view IFSP-VTP/PALEO-0003 (D); fragmentary skull left medial view FUP-Pv 000021 (E, F). btly, tympanic bulla; eo, exoccipital; p, parietal; pot, prootic; so, supraoccipital; VIII-IX, cranial nerve canal number. Scale bars A-D: 5 cm; E, F: 2 cm.

CT scan

All specimens were mechanically prepared before image acquisition. The specimen FEF-PV-R-1/9 was scanned in a CT scan model Biograph 16 Siemens kV in

Santa Casa de Votuporanga-SP, resulting in 600 slices of 0.75 mm each, with resolution of 768 x 768 pixels, 120 kV, and 200 mA. Specimens IFSP-VTP/PALEO-0003, IFSP-VTP/PALEO-0002, and FUP-Pv 000020 were scanned in a CT scan model Revolution EVO in IMEB (Imagens Médicas de Brasília-DF) resulting in 392, 593, and 692 slices, respectively of 0.50 mm each, with resolution of 512 x 512 pixels, 140 kV, and 240 mA. Specimen FUP-Pv 000021 was scanned in a microCT scanner model Skyscan1076, in Laboratório de Nanobiotecnologia, Instituto de Biologia from University of Brasília, which provided 2640 slices, with pixel resolution of 9,0 µm, 100 kV, and 100 µA. Tridimensional reconstructions and segmentations were made in the free software InVesalius (Amorim et al., 2011).

Calculating body and brain mass

Estimates of body mass for fossil mesoeucrocodylians are typically done using linear measurements, such as skull and femur length, and body mass linear regression equations of living Mesoeucrocodylia (Farlow et al., 2005; Cotts et al., 2017). Therefore, body masses were estimated using the regression equation relating skull length (SL) and body mass (MBr) for modern Crocodylia: log MBd = (log SL x 3.48) – 6.97 in Farlow et al. (2005), obtained by direct measurement of both skull length and body masses for a series of *Alligator mississipiensis* individuals.

Cranial endocasts can be used to accurately estimate brain size in both birds and mammals because their brains fill the endocranial space almost completely, differing from other vertebrate groups (Currie, 1995; Larsson et al., 2000). Initially, reptile brains were thought to occupy about 50% of endocranial volume, based on *Sphenodon* and *Iguana* specimens (Dendy, 1910; Jerison, 1973). More recently, it has been shown that this occupation ratio is more complex, varying not only among species but also throughout ontogeny (Hurlburt et al., 2013; Jirak and Janacek, 2017; Watanabe et al. 2019).

In crocodilians, brain and endocast volumes are highly correlated if proper estimation is applied (Hurlburt et al., 2013; Jirak and Janacek, 2017; Watanabe et al. 2019). In other words, endocranial volumes are a proxy of brain size, but approaches that use constant brain to endocast ratios are likely to return inaccurate results. This is because the ratio of brain occupation varies from nearly 100% in embryos and hatchlings, to about 67% in small adults to 30% in large adults of larger species (e.g.: *Alligator mississipiensis*,

Crocodylus niloticus). In non-avian Archosauriformes this problem has been addressed by returning brain size estimates with more than one ratio, typically 37% and 50% unless there is evidence of higher brain occupancy (e.g.: Hurlburt et al. 2013; Lauters et al. 2013; Trotteyn and Paulina-Carabajal, 2016; Paulina-Carabajal and Currie, 2017). This kind of approach narrows the possibilities for estimated brain mass, but still gives a large range of possible values. More recently, Serrano-Martínez et al. (2019) used data from living Crocodylia to obtain a regression formula relating endocranial and brain volumes, a more appropriate method to deal with the varying brain to endocranial ratio.

In this sense, we estimated brain masses using two separate approaches: linear regression and partial brain volumes from model organisms. Since the specific gravity of the brain is close to 1 (Jerison, 1973), we consider calculated brain volumes in ml to be equivalent to brain masses in g. For the linear equation, crocodilian brain and endocranial volumes were gathered from the literature (Hurlburt et al. 2013; Jirak and Janacek, 2017; Watanabe et al. 2019) and subsequently log transformed and plotted in software PAST, where a least squares regression was performed for two datasets: one containing only *Alligator mississipiensis* and other containing all crocodilian data. For the partial brain volumes approach, a living individual of similar endocranial volume, or two living individuals which endocranial volumes range overlaps fossil specimen endocranial volume were chosen from published partial volumes data (Jirak and Janacek, 2017). Partial brain to endocast ratio in the living organisms were used to estimate fossil specimens brain size. When two living individuals were used, the brain volume were calculated twice and presented as an average. Partial endocranial volumes were also measured and compared with modern crocodilians (Jirak and Janacek, 2017).

In vertebrates, brain and body size are highly correlated, where the brain tends to be relatively smaller in large bodied taxa (Hurlburt et al., 2013). Relative brain size has been used to infer cognition and thermoregulatory mechanisms of extinct vertebrates based on living vertebrate species (Jerison, 1973; Hopson, 1977; Lefebvre et al., 2002; Marino, 2002). Traditionally, observed brain size is divided by an expected brain size for a given body mass using regression equations for the appropriate vertebrate group (Jerison, 1973; Hurlburt, 1996; Hurlburt et al., 2013). This approach is known as encephalization quotient (EQ), and the group used to calculate expected brain mass is represented in front of the name (e.g.: reptile encephalization quotient standard (REQ), bird encephalization quotient standard (BEQ), and so on; Jerison, 1973; Hurlburt, 1996; Hurlburt et al., 2013). Unfortunately, the use of REQs is problematic when studying

modern Mesoeucrocodylia, since their REQs decrease throughout ontogeny even when only adult individuals are taken into account (Hurlburt et al., 2013). Luckily, brain and body mass data for living crocodilians is available in literature for a few taxa (e.g.: Crile and Quiring, 1940; Platel, 1979; Gans, 1980; Chentanez et al., 1983; Ngwenya et al., 2013; Hurlburt et al., 2013; Jirak and Janacek, 2017), allowing direct comparisons.

Olfaction and olfactory ratio

Olfactory bulbs are responsible for processing sensory input from the olfactory nerve (CN I), since the contact between odor particles and olfactory epithelium in the nasal cavity fires neurons that transmit the neural signal to olfactory bulbs via CN I (Vassar et al., 1994; Purves et al., 2001). Olfactory bulbs collect and process these stimuli and sends signal to higher processing centers of the brain through the olfactory tract (Mori et al., 1999; Purves et al., 2001). Relatively larger olfactory bulbs and wider variability of olfactory receptors are positively correlated, enabling detection of a larger array of odor molecules (Bang and Cobb, 1968; Nottebohm et al., 1981; Wenzel and Meisami, 1987; Krebs et al., 1989; Healy and Guilford, 1990; Clark and Bean, 1993; Vassar et al., 1994; Purves et al., 2001; Hammock, 2005; Niimura and Nei, 2006; Buschhüter et al., 2008; Steiger et al., 2008). Modern crocodilians have a keen sense of smell and large olfactory bulbs, using olfaction to navigate, locate food sources, and for intraspecific communication (Weldon and Ferguson, 1993; Scott and Weldon, 1990; Schwenk, 2008; Zelenitsky et al., 2009; Zelenitsky et al., 2011).

The olfactory ratio is a method of measuring the relative size of olfactory bulbs, widely employed for inferring olfactory capabilities in living and fossil archosaurs (Cobb, 1960; Bang and Cobb, 1968; Zelenitsky et al., 2009, 2011; Serrano-Martínez et al., 2019). The olfactory ratio is the quotient between the largest linear measurement of both olfactory bulb and cerebral hemispheres, regardless of orientation (Cobb, 1960; Bang and Cobb, 1968; Zelenitsky et al., 2009; Zelenitsky et al., 2011). Olfactory ratios are indicative of olfactory capability and have been associated to a series of ecological factors in birds (see Zelenitsky et al., 2009 and references therein). As expected for their keen sense of smell and large olfactory bulbs, crocodilians have high olfactory ratios (Zelenitsky et al., 2009; Serrano-Martínez et al., 2019). Since olfactory ratios and ecological factors are related, the values for all Crocodylia sampled so far might be similar due to their similar ecologies (Grigg and Kirshner, 2015).

Inner ear, alert head posture, and hearing

In gnathostomates, the inner ear typically consists of two main components: the semicircular canals, sensing angular accelerations, and the cochlea (lagena) sensing mechanical waves (sound) (Baird, 1970; Spoor and Zonneveld, 1998; Spoor, 2003; Spoor et al., 2007). Since the bones of the otic capsule encase both, their gross anatomy can be reconstructed even when only skeletal elements are available, such as in fossil vertebrates (Gleich et al., 2005; Witmer et al., 2008; Walsh et al., 2009).

There is a strong correlation between cochlear linear measurements with hearing range and mean hearing frequency (Manley, 1972; Walsh et al., 2009). Vocalization in vertebrates is generally produced within the species hearing range (Konishi, 1970; Brown and Waser, 1984; Endler, 1992; Narins et al., 2004) and its complexity is related to ecological factors such as sociability and gregarism (Evans 1936; Blumstein 1997). In addition, species living in environments where visual communication is limited tend either to have vocalizations that are more complex or use lower frequencies than species living in open environments (Garrick and Lang 1977; Brown and Waser 1984). Best mean hearing frequencies and hearing ranges were estimated using log transformed endosseous cochlear duct length scaled to basicranial axis length (Walsh et al., 2009).

Orientation of lateral semicircular canal is used in some studies as the head posture proxy (e.g. Witmer et al., 2003, 2008) based on literature covering mammals, birds, and crocodilians (e.g. Blanks et al.,1972; Erichsen et al., 1989; Witmer et al., 2008). However, other studies claim that lateral semicircular canal should not be used as a reference for head posture (e.g. Taylor et al., 2009; Marugán-Lobón et al., 2013). Among the reasons, they point that semicircular canals tend to be misaligned with Earth's axes (Graf et al., 1995; Spoor and Zonneveld, 1998; Hullar, 2006). This misalignment is regarded as physiologically advantageous for vestibular reflexes, since the misalignment between the lateral semicircular canal and the horizontal plane makes all three semicircular canals sensitive to horizontal acceleration, improving sensorial input (Cohen and Raphan, 2004). In addition, Duijm (1951) found highly variable inclination values for 33 bird species, despite the average inclination of all species being close to horizontal (0°) the inclination varied from 30° anterodorsally to 20° anteroventrally. Alternatively, these studies propose other proxies for inferring head alert posture such as aligning to the horizontal plane either the maxillary tooth (Marugán-Lobón et al., 2013) or the endocranial surface of braincase and bony palate (Kley et al., 2010; von Baczko et al., 2018). Therefore, we used three different anatomical proxies for fossil vertebrates to infer alert head posture:

the lateral semicircular canal (but see head posture in the discussions) (Witmer et al., 2003, 2008); maxillary tooth row (Marugán-Lobón et al., 2013); and the endocranial surface of braincase and bony palate (Kley et al., 2010; von Baczko et al., 2018). In order to discuss how the alert head posture would affect stereoscopic view we grossly estimate total and stereoscopic planar field of views using the orbits central point as reference.

Trigeminal fossa and facial sensitivity

In mesoeucrocodylians the trigeminal nerve exits the endocranial cavity through the trigeminal foramen into the trigeminal fossa (Vfossa), which houses the trigeminal ganglion (Vgang) (Holliday and Witmer, 2009; George and Holliday, 2013). From the trigeminal ganglion, the trigeminal ophthalmic branch exits anteriorly via ophthalmic nerve foramen while the trigeminal maxillary and mandibular branches exits together through the maxillomandibular foramen (mmf) (Holliday and Witmer, 2009; George and Holliday, 2013). Living and fossil Crocodylia have relatively large Vfossa and mmf, while other mesoeucrocodylians have relatively small ones (Holliday and Witmer, 2009; George and Holliday, 2013). The presence of unique trigeminal-innervated highly sensitive mechanoreceptors system in the crocodilian face (dome pressure receptors – DPR) is likely the reason for this Vgang enlargement (George and Holliday, 2013). This sensory system is important for crocodilians of semi-aquatic lifestyle as it can detect pressure changes in surrounding water (von During, 1973, 1974; von During and Miller, 1979). Therefore, a large Vfossa and mmf would imply the presence of a large Vgang and the presence of enhanced face sensitivity, which is only known in semi-aquatic taxa (George and Holliday, 2013). In this sense, we infer relative facial sensitivity via trigeminal fossa volume and maxilomandibular foramen maximum diameter (George and Holliday, 2013).

Results

Anatomical description

With exception of a small region below the olfactory tracts, bones enclosed the brain completely, enabling relatively accurate endocranial volume reconstructions. The endocasts are similar in form with exception of IFSP-VTP/PALEO-0002, which has the largest degree of deformation (Fig. 2). Adult endocast lengths from the tip of olfactory bulbs to the end of the medulla oblongata vary from 111 to 115 mm long, while the

juvenile is approximately 74 mm long. They all reach their largest width at the cerebral hemispheres. Total endocast volumes range from 9.8 to 18.8 cm^3 in the adult specimens and is 5.2 cm^3 in the juvenile (Table 1). Partial endocast volumes (PEVs) are close but not completely similar to those of modern Crocodylia (Table 1). The olfactory PEVs fall within or slightly above living Crocodylia values. On the other hand, prosencephalic PEVs are within or below the values for extant Crocodylia, where the PEV of IFSP-VTP/PALEO-0002 is remarkably lower, probably due to its higher degree of dorso-ventral deformation in this region. Mesencephalic and rhombencephalic PEVs fall within modern Crocodylia known limits with exception of the rombencephalic value from IFSP-VTP/PALEO-0002, where its higher value is also likely to be due to its severe deformation in the prosencephalic region.

Along the endocast general brain morphology seem to be reflected in different degrees. The correspondent region of the forebrain is more similar to the brain anatomy of living Crocodylia than the midbrain and hindbrain regions. The cerebral and pontine flexures are present but not well developed in the adults, giving the brain endocast a general horizontal, but slightly sigmoid profile, in lateral view. In the juvenile, they are less evident and the endocast is more uniformly horizontal in lateral view, except for the slightly ventrally arched olfactory bulbs.

The bones forming the endocranial cavity are the same found in modern Crocodylia. The olfactory bulb region is limited dorsally by the frontal and laterally and ventrally by the prefrontal. The olfactory tract is limited only dorsally and laterally by the frontal. Ventrally, it is only partially limited by the frontal and there is no bone enclosing the middle portion of the olfactory tract. The rest of the forebrain is limited dorsally by the parietal, laterally by the laterosphenoid, and ventrally by the basisphenoid. The anterior end of the midbrain is covered dorsally by the parietal and laterally by the laterosphenoid, while the posterior end is dorsally and laterally covered by the prootic. Ventrally, the midbrain is entirely covered by the basisphenoid. The anterior tip of the hindbrain is enclosed dorsally and laterally by the prootic and ventrally by the basisphenoid. The posterior tip of hindbrain is delimited dorsally and laterally by the exoccipital and ventrally by the basioccipital.

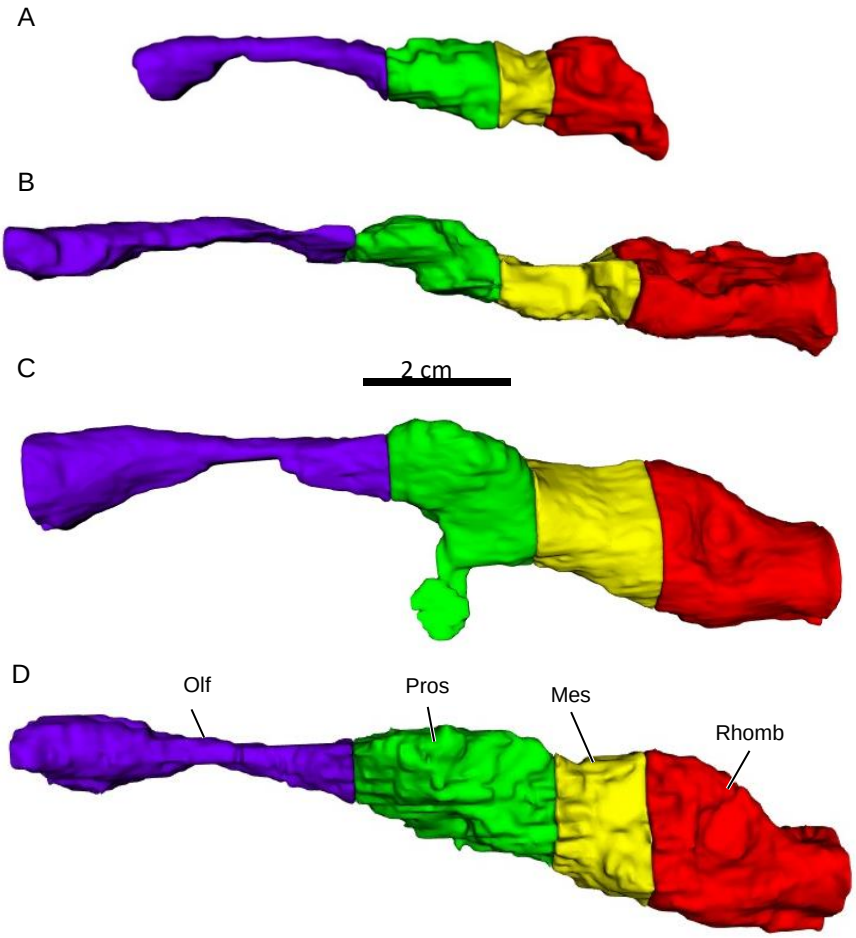

Fig. 2. Left lateral views of brain endocast reconstructions of studied specimens divided into four major brain sectors. Late juvenile IFSP-VTP/PALEO-0003 (A), adult IFSP-VTP/PALEO-0002 (B), adult FEF-PV-R-1/9 (C), large adult FUP-Pv 000020 (D). Brain portions: olfactory (Olf) – purple, prosencephalic (Pros) – green, mesencephalic (Mes) – yellow, rhombencephalic (Rhomb) – red. Scale bar: 2 cm.

Table 1. Total endocranial volume (EV) and partial endocranial volumes for each brain portion in *Baurusuchus*. Olfactory (Olf), prosencephalic (Pros), mesencephalic (Mes), rhombencephalic (Rhomb)

Specimen	Total volume (cm^3)	Portion volume ratio			
		Olf	Pros	Mes	Rhomb
IFSP-VTP/PALEO-0003	5.21	0.20	0.31	0.14	0.35
IFSP-VTP/PALEO-0002	9.85	0.14	0.18	0.16	0.52
FEF-PV-R-1/9	14.51	0.20	0.28	0.20	0.32
FUP-Pv 000020	18.76	0.15	0.42	0.14	0.28
Living Crocodylia along ontogeny*	-	0.05 - 0.19	0.33 - 0.56	0.11 - 0.20	0.25 - 0.37

* Data from Jirak & Janacek (2017)

The regions correspondent to the olfactory bulb, olfactory tract, and cerebral hemispheres are well marked and easily identifiable, suggesting the brain infilled the endocranial cavity largely in the forebrain portion (Figs. 3-6). The olfactory bulbs are large and a dorsal longitudinal sulcus extends along the olfactory bulbs entirely, while the olfactory tracts are slender, without any sulcus (Fig. 3C, 4B, 5C, and 6B). These conditions are seen even in the juvenile specimen. Olfactory ratios are high and remarkably similar among specimens (ranging from 75.1 to 76.4). The combination of the expanded olfactory bulbs and their dorsal longitudinal sulcus marks the limit between the olfactory bulb and the olfactory tract very clearly. The limit between olfactory tracts and cerebral hemispheres is not so well marked, mainly because the lateral expansion of the cerebral hemispheres tapers more gradually than the expansion of the olfactory bulbs. However, the anterior limit of the cerebral hemispheres can be located in dorsal view. Posteriorly, the angle between forebrain and midbrain marks the hemispheres limit.

Seemingly, the midbrain anatomy is not well defined, probably by the presence of large dural dorsal venous sinus. In dorsal view, the midbrain region becomes narrower posteriorly, evidencing the probable passage of a dorsal longitudinal sinus (dls) (Fig. 3C, 5C, 6B). The narrowing ceases in the hindbrain and the endocasts widen to encase the cerebellum. Posteriorly, the otic capsules compress the endocast without any floccular recess. This evidences either a small or absent flocculus and/or a lower brain volume to endocast volume ratio in the hindbrain. There is also evidence of a ventral longitudinal sinus (vls), further obscuring hindbrain ventral anatomy (Fig. 5D, 6C).

In summary, the olfactory bulbs and cerebral hemispheres seemed to occupy most of their surrounding endocranial volume, while venous sinus or interstitial space largely surrounded the olfactory tracts, midbrain, and hindbrain.

Inside the otic capsule lies the inner ear. However, there is not enough contrast in the obtained CT scans to reconstruct complete inner ear anatomy of specimens. The microCT, however, made possible to reconstruct the fragmented specimen (FUP-Pv 000021) inner ear anatomy in detail (Fig. 7). Regular CT scans only allowed to partially reconstruct the inner ear of IFSP-VTP/PALEO-0003 (the juvenile specimen, both left and right) and the left inner ear of FUP-Pv 000020 (Figs. 3, 6). General inner ear morphology is similar to modern Crocodylia, with similar height and semicircular canals placed nearly orthogonally among each other. However, the inner ear is anteroposteriorly shorter than in modern crocodilians, making it slenderer and tall in comparison. The rostral

semicircular canal (rsc) is slightly larger than the caudal semicircular canal (csc), which has the shortest maximum diameter (rsc – 8.0 mm, csc – 6.3 mm, lsc – 6.7 mm). The lateral semicircular canal (lsc) is also almost orthogonal to the medially slightly arched endosseous cochlear duct (ecd). Recovered ecds had similar lengths for FUP-Pv 000020 and FUP-Pv 000021 (9.2 and 10.0 mm, respectively). In IFSP-VTP/PALEO-0003 it is not possible to accurately recover the ecd distal end and its length seems to be slightly longer than what could be measured (4.0 mm). Basicranial axis and ecd scaled/transformed measurements returned a mean best mean hearing of 1062 Hz, ranging from 283-1841 Hz, for FUP-Pv 000020 and of 552 Hz, ranging from 243-861 Hz, for IFSP-VTP/PALEO-0003.

Only in FEF-PV-R-1/9 the hypophisis (hyp) could be reconstructed (Fig. 5). It expands ventrally in an elliptical shape without any evident anterior or posterior flexure. Unfortunately, it is laterally deformed and its width cannot be accurately determined. In dorsal view, all endocasts are slightly asymmetric, due to fossildiagenetic processes.

It was also possible to reconstruct the cranial nerves (CN) II, III, IV, V, VI, VII, VIII, IX-XI (via metotic foramen), and XII (Figs. 3, 5, 6). Their position relative to the recognized portions of the endocast is similar to the general pattern of Crocodylomorpha. CN II and III exit the endocranial cavity through the anterior border of the laterosphenoid. CN IV passes through the middle portion of laterosphenoid. CN V is located anterior to the CN VII and cerebellum, with its foramen marking the border between the laterosphenoid and prootic. CN VI exits the endocranial cavity ventrally, through the basisphenoid. CN VII remains anterior to the otic capsule and its cochlear branch near otic capsule, shortly after reaching the ecd. The CNs IX-XI exit the endocranial cavity posterior to the otic capsule dorsally, and CN XII is located in the posterior end of the endocranial cavity, more ventrally, with both foramina being located in the exoccipital. It is noteworthy that CN II and III seem to exit the endocranial cavity through a single large opening, instead of CN III having a separate lateral foramen (Fig. 5).

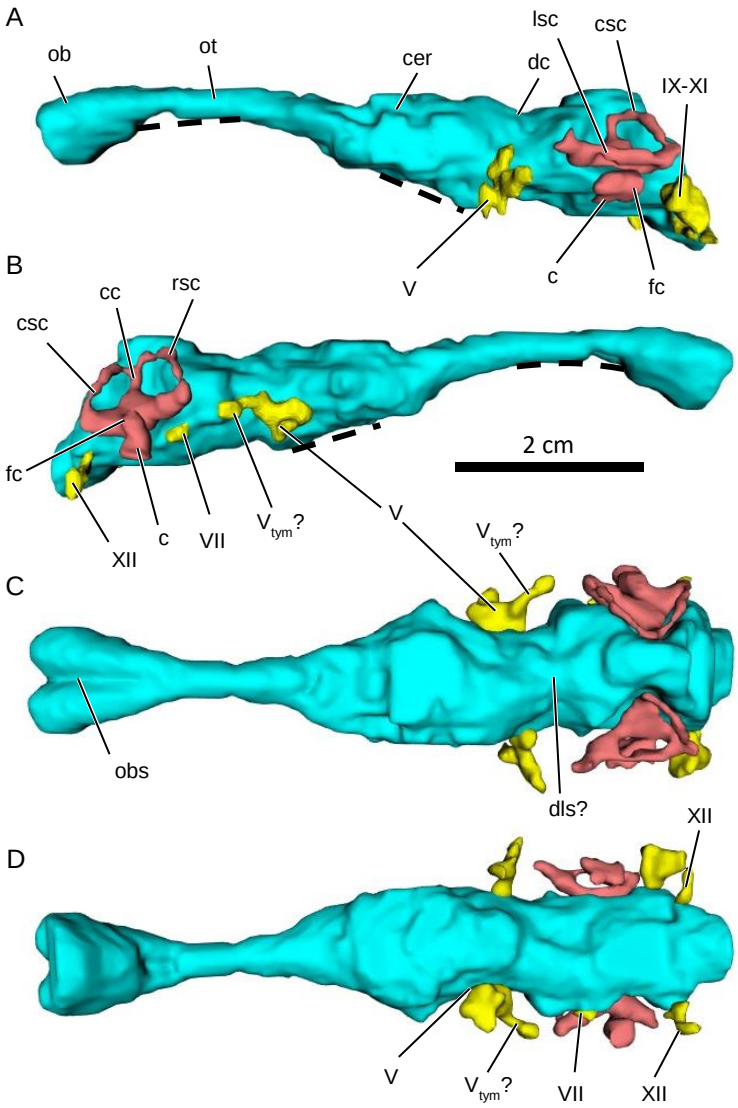

Fig. 3. Brain endocast, cranial nerves and inner ear of late juvenile specimen IFSP-VTP/PALEO-0003. Left lateral view (A), right lateral view (B), dorsal view (C), ventral view (D). V - XII, cranial nerve canal number; rsc, rostral semicircular canal; c, cochlea; cc, crus communis; cer, cerebral hemisphere; dc, dorsal contour; dls, dorsal longitudinal sinus, fc, fenestra cochleae (= round window); lsc, lateral semicircular canal; ob, olfactory bulb; obs, olfactory bulb sulcus; ot, olfactory tract; csc, caudal semicircular canal. Dashed line represents space not limited by bones. Scale bar – 2 cm.

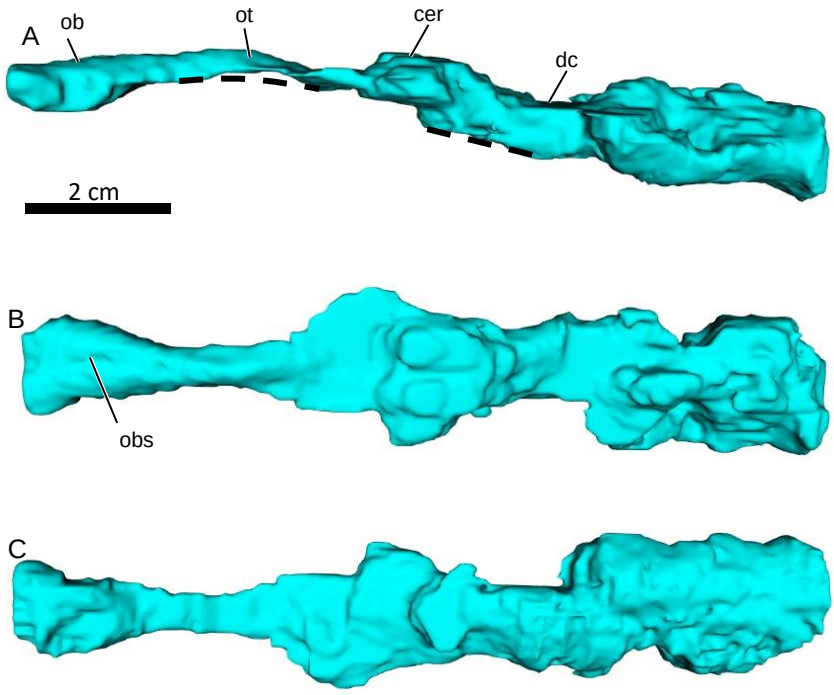

Fig. 4. Brain endocast of adult specimen IFSP-VTP/PALEO-0002. Left lateral view (A), dorsal view (B), ventral view (C). cer, cerebral hemisphere; dc, dorsal contour; ob, olfactory bulb; obs, olfactory bulb sulcus; ot, olfactory tract. Dashed line represents space not limited by bones. Scale bar – 2 cm.

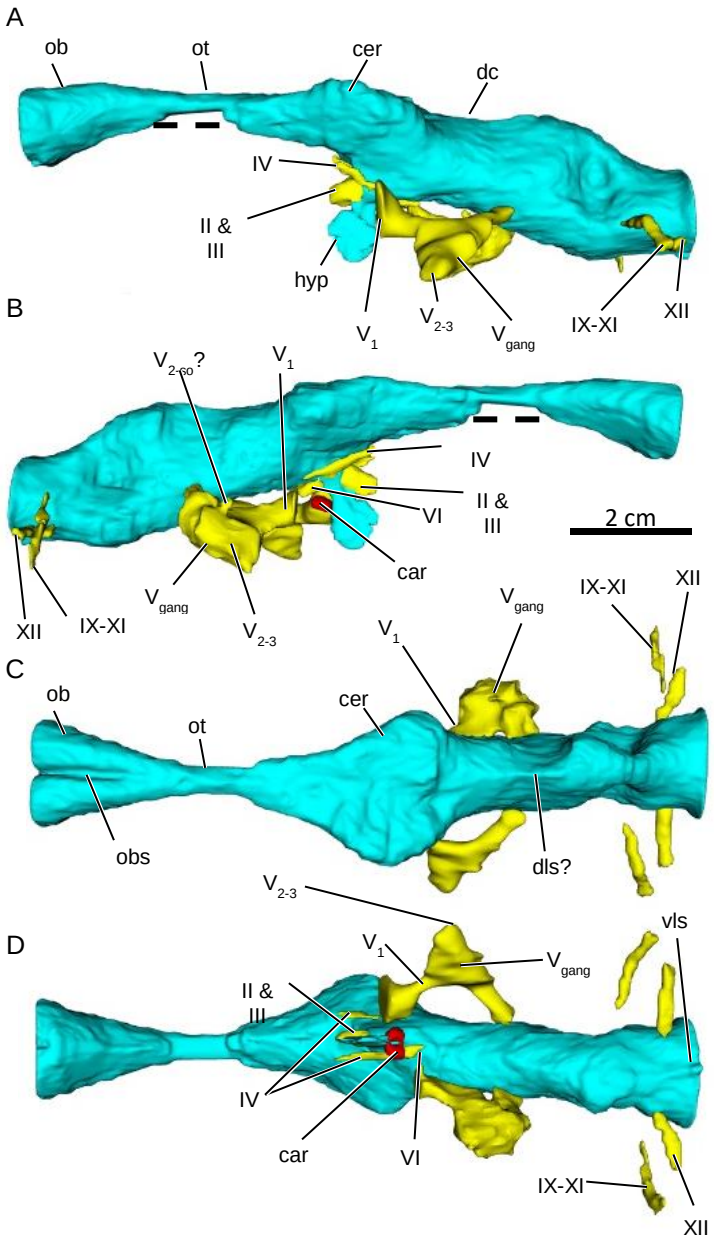

Fig. 5. Brain endocasts and cranial nerves of adult specimen FEF-PV-R-1/9. Left lateral view (A), right lateral view (B), dorsal view (C), ventral view (D). II - XII, cranial nerve canal number; car, cerebral carotid artery canal cer, cerebral hemisphere; dc, dorsal contour; dls, dorsal longitudinal sinus; hyp, hypophysis; ob, olfactory bulb; obs, olfactory bulb sulcus; ot, olfactory tract; vls, ventral longitudinal sinus. Dashed line represents space not limited by bones. Scale bar – 2 cm.

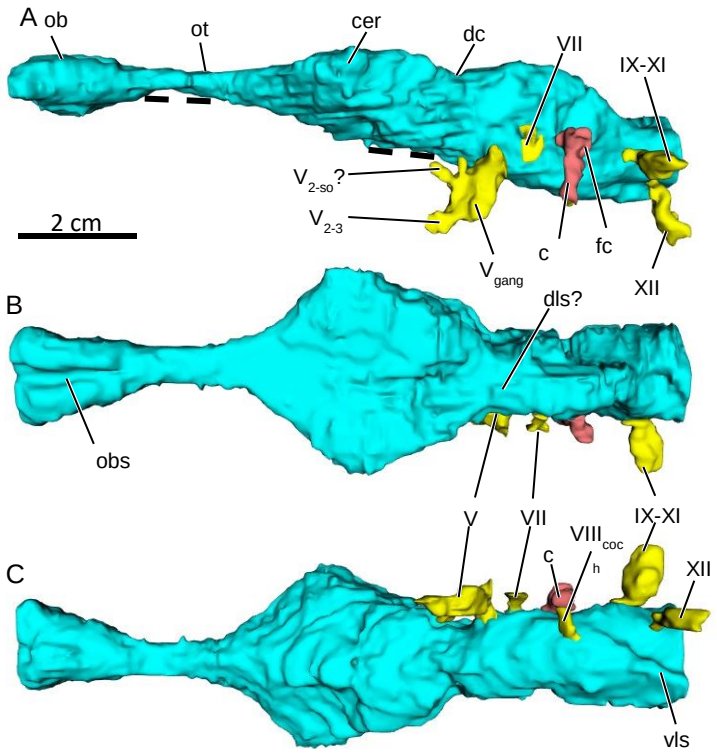

Fig. 6. Brain endocast, cranial nerves, and inner ear of large adult specimen FUP-Pv 000020. Left lateral view (A), dorsal view (B), ventral view (C). V - XII, cranial nerve canal number; c, cochlea; cer, cerebral hemisphere; dc, dorsal contour; dls, dorsal longitudinal sinus, fc, fenestra cochleae (= round window); ob, olfactory bulb; obs, olfactory bulb sulcus; ot, olfactory tract; vls, ventral longitudinal sinus. Scale bar – 2 cm.

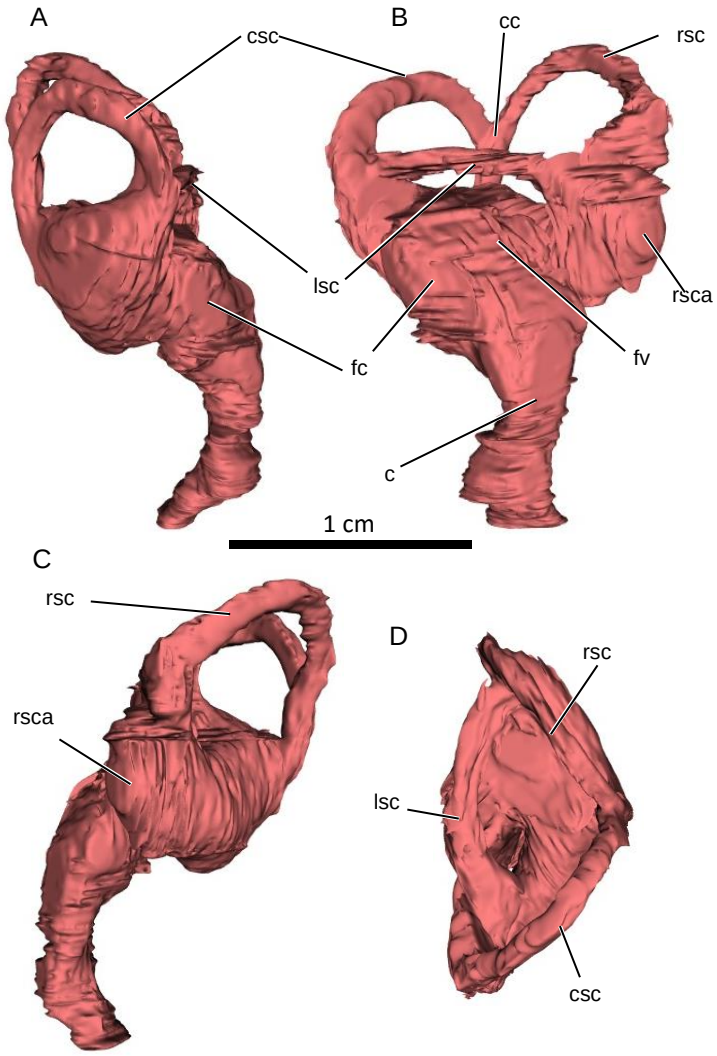

Fig. 7. FUP-Pv 000021 right inner ear in posterior (A), lateral (B), anterior (C), and dorsal (D) views. Scale bar – 1 cm. aa, ampulla of rostral semicircular canal; rsc, rostral semicircular canal; c, cochlea; cc, crus; fc, fenestra cochleae (= round window); fv, fenestra vestibuli (= oval window); lsc, lateral semicircular canal; csc, caudal semicircular canal.

Relative brain size

Resulting linear regression equations (using either linear regressions or partial brain volumes method) from endocranial cavity and brain volumes were very similar (equation using *A. mississipiensis*: a = 0.743, b = 0.705; equation using all crocodilians: a = 0.728, b = 0.756), with high correlation and statistical significance values (r^2 = 0.977 - 0.978, p = 0.0001) (Table 2). Therefore, calculated brain volume from both equations did return similar values regardless of the method or source data (*A. mississipiensis*, "all" crocodilians) (Table 3).

Brain masses calculated using the partial volumes (PV) are almost equal or slightly lower than the ones obtained from the linear regression method (LR, above), with the exception of IFSP-VTP/PALEO-0002 (Table 3), which is considerably lower. In this case, the obtained MBr using PV is only 75% of the value obtained using LR. Estimated body mass ranged from 12.1 kg, for the juvenile individual, to 113.4 kg, for the largest one (see Table 3).

Plotted log transformed body mass (MBd) and brain mass (MBr) reveals a small relative brain size for *Baurusuchus* when compared to modern crocodilians, even throughout ontogeny (Fig. 8). *Baurusuchus*, which is considered to be of terrestrial habits (e.g. Montefeltro et al., 2011; Cotts et al., 2017; Fonseca et al., 2020), clearly has a distinct relative brain size in comparison to modern crocodilians. In contrast, living Crocodylia relative brain sizes are not clearly distinct among species, in all cases their convex hull overlaps with the convex hull of at least one other species. The ontogenetic allometry of *Baurusuchus* seems to have a slope similar to modern crocodilians, but shows a lower intercept (Fig. 8). However, the data for *Baurusuchus* is still scarce, with reasonably reliable data for only three individuals, since the brain endocast of IFSP-VTP/PALEO-0002 is highly deformed.

Table 2. Linear regression equations for log transformed endocranial (EV) and brain volumes (BV) for living crocodilians.

Taxa	Equation	p	r^2	n (specimens)
Alligator	Log EV = (Log BV x 0.74275) + 0.70453	0.0001	0.97665	15
Crocodylia	Log EV = (Log BV x 0.7279) + 0.75624	0.0001	0.97841	20

Table 3. Calculated body mass and brain volumes (BV) for studied specimens of *Baurusuchus*.

Specimen	Body mass (kg)	Linear Crocodylia		Linear *Alligator*		Partial Volumes	
		BV mm^3	BV/EV	BV mm^3	BV/EV	BV mm^3	BV/EV
IFSP-VTP/PALEO-0003	12.0	2897	56%	2921	56%	2603	50%
IFSP-VTP/PALEO-0002	72.7	4603	47%	4684	48%	3481	35%
FEF-PV-R-1/9	78.8	6103	42%	6246	43%	5358	37%
FUP-Pv 000020	113.4	7359	39%	7560	40%	7374	39%

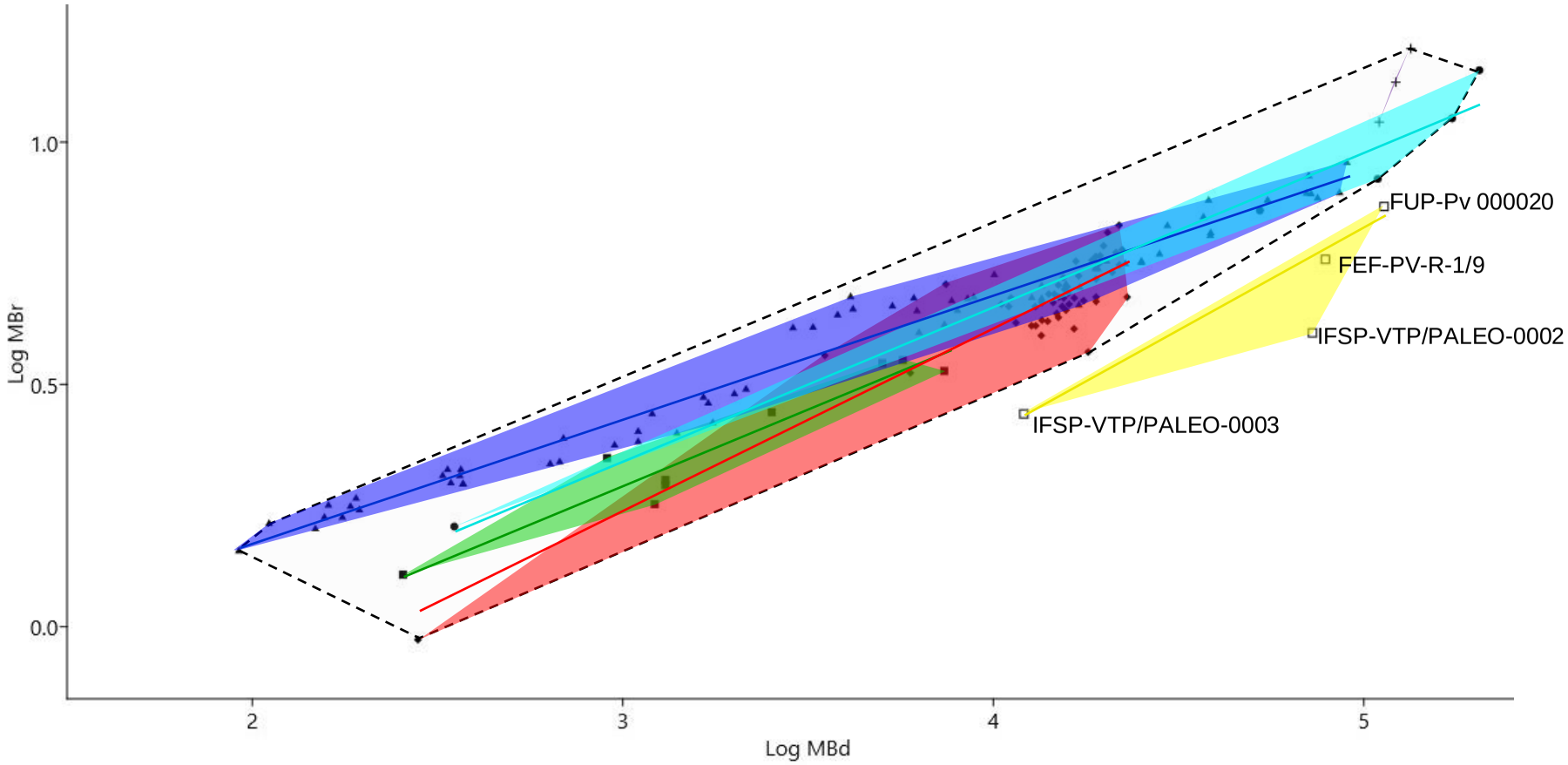

Fig. 8. Plotted log transformed body and brain mass for crocodyliform taxa with convex hulls and ontogenetic regression lines. *Alligator mississipiensis* – filled circles, light blue convex hull; *Caiman crocodylus* – filled squares, green convex hull; *Crocodylus acutus* – plus, purple convex hull (no available data for ontogenetic regression); *Crocodylus niloticus* – filled triangles, dark blue convex hull; *Crocodylus siamensis* – filled diamonds, red convex hull; *Baurusuchus* – open squares, yellow convex hull (regression excluding highly deformed specimen); Dashed line – modern Crocodylia convex hull

Trigeminal fossa and facial sensitivity

The relative size of the trigeminal fossa both in respect to the skull length and to the endocast volume is similar to that of living crocodilians for all three reconstructed adult trigeminal fossa (Fig. 9). The only trigeminal fossa ratio available in literature from a terrestrial taxon is reported for the peirosaurid *Hamadasuchus rebouli*, which had a relatively smaller one. However, in *Baurusuchus* the mmf maximum diameter is small in relation to the large trigeminal fossa (Table 4).

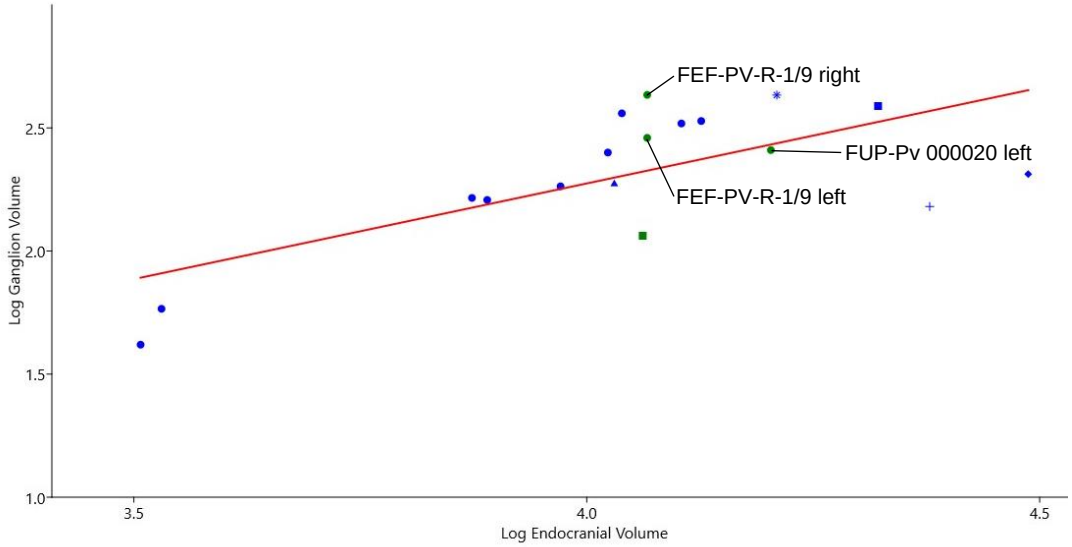

Fig. 9. Plotted log transformed endocranial volume and trigeminal ganglion volume in several crocodyliform taxa. Blue – aquatic/semiaquatic taxa: *Alligator mississipiensis* – filled circles, *Crocodylus johnstoni* – filled triangle, *Crocodylus niloticus* – filled diamond, *Leidyosuchus canadensis* – asterisk, *Melanosuchus niger* – filled square, cf. *Rhabdognathus* – plus. Green – terrestrial taxa: *Baurusuchus* – filled circles, *Hamadasuchus rebouli* – filled square.

Table 4. Measured trigeminal fossa volume and maxilomandibular foramen diameter in *Baurusuchus*, compared to expected maxilomandibular foramen diameter.

Specimen	V fossa volume (mm^3)	Maxillomandibular foramen maximum diameter (mm)	
		Measured	Expected
FEF-PV-R-1/9 right	431	6.0	9.5
FEF-PV-R-1/9 left	288	5.0	8.6
FUP-Pv 000020 left	257	4.7	8.3

Discussion

Taphonomic deformation

Taphonomic deformation can significantly alter recovered endocranial volumes. Despite IFSP-VTP/PALEO-0002 and FEF-PV-R-1/9 having similar skull and endocast lengths they have hugely different endocast volumes, with IFSP-VTP/PALEO-0002 showing only 68% of the values presented by FEF-PV-R-1/9. This result calls for extra attention when reconstructing and evaluating cranial endocasts when only one specimen is available for CT scanning. In this particular case, deformation seems to have occurred in different degrees along the IFSP-VTP/PALEO-0002 endocast. The comparison of PEVs among studied fossil specimens and living representatives of the same clade shows that IFSP-VTP/PALEO-0002 is not uniformly deformed. While rhombencephalic PEV values for this specimen are compatible with the other two adult specimens (111% of FEF-PV-R-1/9 and 96% of FUP-Pv 000020 rhomb PEVs), all other regions have values ranging from 23% to 57% of the values in the other two adult specimens. This makes the rhombencephalic PEV to account for more than half of the total endocranial volume (Tab. 1). In this sense, PEV comparison among related taxa might be a proxy for the degree of deformation when only one specimen is available.

Despite among adult specimens the dorsoventral deformation is, by far, more evident, the disposition of the deformation axis does not seem to be the reason for the higher degree of alteration in the calculated volumes. The juvenile specimen is also dorsoventrally deformed, but its PEV values, as well as calculated relative brain mass, are compatible with the laterally deformed adult specimens (FEF-PV-R-1/9 and FUP-Pv 000020). However, the disposition of the main deformation axis seems to have some impact in the lateral profile of the endocast. In modern crocodilians, the endocasts of specimens representing earlier ontogenetic stages are more dorsoventrally flexed while in later ontogenetic stages they are more horizontal (Jirak and Janacek, 2017). This was not the case for studied specimens, where the juvenile endocast is flatter than the mildly deformed adults are (Fig. 2). However, disposition of their deformation axis are different.

The dorsoventral deformation in the juvenile specimen is bound to have a flattening effect to the endocranial cavity, which would give the endocast a more horizontal profile. Additionally, it should be kept in mind that both FEF-PV-R-1/9 and FUP-Pv 000020 were found laying on one of their sides, which implies that any deformation effect would mostly distort/compress the skull laterally. Thus, it seems likely

that the general more horizontal profile of the juvenile is a diagenetic artifact, a feature also found in the dorsoventrally flattened adult specimen IFSP-VTP/PALEO-0002, instead of an ontogenetic process, while the flat shape seem in adult specimens can be considered as an actual feature of this taxon and similar to modern crocodilians.

In addition, the juvenile specimen has a markedly arched olfactory region while in adult specimens it is either only slightly arched, or not arched at all. In fact, only in the larger adult FUP-Pv 000020 the olfactory region is not arched (Fig. 2). This follows the pattern found in modern crocodilian ontogeny (Jirak and Janacek, 2017) supporting the idea that *Baurusuchus* brain ontogeny was similar to living Crocodylia and that the flattened lateral profile of the juvenile is more likely to be a diagenetic artifact.

Anatomy

Recovered general endocast morphologies are similar to modern crocodilian endocasts, with different degrees of brain occupancy along the endocranial cavity (Jirak and Janacek, 2017). However, the olfactory region seems to have different degrees of occupation in the olfactory bulbs and tracts. Unfortunately, the few studies on crocodilian brain and endocranial volumes (BV/EV) neither treated brain/endocast regions separately (Hurlburt et al. 2013; Watanabe et al. 2019), nor treated olfactory bulbs and tracts as separate regions (Jirak and Janacek, 2017). This may be of interest since the olfactory region is the one that reaches the lowest correspondence of BV/EV earlier during ontogeny (Jirak and Janacek, 2017), but in the endocasts recovered here the olfactory bulbs seem to largely occupy the endocranial cavity. Olfactory bulbs and tracts have different functions in olfaction: the bulbs are responsible for the initial processing of olfactory signals; the tracts are responsible only for the transmission of those signals to other processing centers in the brain (Mori et al., 1999; Purves et al., 2001). Relative size of brain region and its function are positively correlated (Bang and Cobb, 1968; Healy and Guilford, 1990; Zelenitsky et al., 2011) so, theoretically, as they have different functions in olfaction, olfactory bulbs and tracts will not necessarily have similar BV/EV ratios. Investigating the BV/EV ratios of olfactory bulbs and tracts separately could potentially refine both total brain volume and olfactory capacity estimations for extinct taxa.

The presence of a sulcus between the olfactory bulbs is not new for crocodyliform endocasts. For instance, they occur in *Campinasuchus dinizi*, *Notosuchus terrestris*, *Sebecus icaeorhinus*, *Simosuchus clarki*, *Uberabasuchus terrificus*, and *Wargosuchus*

australis (Colbert, 1946; Martinelli and Pais, 2008; Kley et al., 2010; Fonseca et al., 2020). It also might be present, although shallow, in the peirosaurid *Rukwasuchus yajabalijekundu* (Sertich and O'Connor, 2014) but, unfortunately, part of the olfactory bulbs is missing in the available endocast reconstruction. However, this sulcus seems to be deeper in *Baurusuchus* and *C. dinizi* than in any other available crocodyliform taxa. The sulcus is absent in available modern crocodilian endocasts (Witmer et al., 2008; Dufeau and Witmer, 2015; Jirak and Janacek, 2017). Considering the known distribution of this trait (present in peirosaurids, notosuchids, and baurusuchids but absent in neosuchids), it might be a potentially important phylogenetic character.

Cranial nerves II and III foramina are variable among modern crocodilians. For instance, *Caiman crocodilus, Crocodylus acutus, Osteolaemus tetraspis, Tomistoma schlegelii*, illustrated by Iordanski (1973), do not show a complete separation between CN II and III, although there is a constriction between them. The lack of a distinction between CN II and III might be due to a preservation issue, since this region was only anatomically informative in one of the four *Baurusuchus* specimens herein studied.

The baurusuchid *Campinasuchus dinizi* is reported to have a caudal semicircular canal more developed than the rostral semicircular canal (Fonseca et al., 2020) and so far was the only available reconstruction of baurusuchid inner ear. Our reconstructions did not yield the same result, since *Baurusuchus* follows the more common pattern within crocodyliforms, with a rostral semicircular canal larger than the posterior one, as in the notosuchid *Simosuchus clarki* (Kley et al., 2010), modern crocodilians (Brusatte et al., 2016), the non-crocodyliform crocodilomorph *Almadasuchus figarii* (Leardi et al., 2020), and most archosaurs (Witmer et al., 2008; Sobral and Müller, 2016). The condition reported for *C. dinizi* is known among Archosauromorpha only in the basal eusuchian *Lohuecosuchus megadontos* (Serrano-Martínez et al., 2019). It is important to note that *C. dinizi* labyrinth reconstruction is actually an estimation, since the authors could not recover the entire extent of semicircular canals due to poor preservation (Fonseca et al., 2020). Considering the close relationship between *Baurusuchus* and *C. dinizi*, the poor preservation of *C. dinizi* inner ear, and the reported condition being rare in crocodyliforms, we advise to be wary when taking the estimated semicircular canals (as truly having a larger posterior canal than rostral one) in *C. dinizi*. In this sense, we consider that baurusuchids and closely related forms (e.g. *S. clarki*) are likely to follow the arcosauromorph pattern in having the rsc larger than the csc. Furthermore, the tall and slender inner ear of *Baurusuchus*, with rsc larger than psc is compatible with terrestrial

crocodylomorph taxa (Schwab et al., 2020), in contrast with the short looking reconstructed inner ear of *C. dinizi*.

Olfaction and relative brain size

Reported olfactory ratios for *Alligator mississipiensis* are 49.8, 54.3, and 55.1 for three individuals, being lower in the largest and highest in the smallest measured individuals (Zelenitsky et al., 2009). Therefore, in *Alligator*, the relative volume of olfactory region decrease as the individual grows. In addition, log transformed olfactory ratios for modern crocodilians range from 1.70 to 1.82 (Serrano-Martínez et al., 2019). These values are considerably lower than the ones found in *Baurusuchus* (raw values ranging from 75.1 to 76.4, log transformed varying from 1.876 to 1.883) and, as far as we could detect, there is no decreasing tendency along different ontogenetic stages. Deformation does not seem to alter olfactory ratios, probably because the largest measurement of both olfactory bulbs and cerebral hemispheres is their length, however, more intense deformation can preclude locating landmarks for measurements. Higher PEV values corroborate the high olfactory ratios, which might indicate that *Baurusuchus* was more reliant on olfaction than its modern relatives are. However, both olfactory ratios and PEVs are relative measurements. Either a smaller cerebral hemisphere or a larger olfactory bulb would yield higher olfactory ratios and PEVs. Therefore, this discussion would be incomplete without a general relative brain size analysis.

Calculated brain masses (MBr) were generally similar for both methods used here. This is probably due to similar partial endocranial volumes by cerebral region among *Baurusuchus* and living crocodilians. However, our results are generally slightly lower when the PEV method is used. Since the BV/EV ratio is not similar along brain regions (Jirak and Janacek, 2017), further brain volume estimations for fossil reptilian taxa should also investigate if PEVs yields results similar or slightly different from other methods. Traditionally, brain volume estimates for fossil reptilian taxa assume a similar degree of brain to endocast correspondence along different brain regions, and uses a series of fixed values of endocranial brain occupancy (e.g. Zhou et al. 2007; Knoll and Scwharz-Wings, 2009; Hurlburt et al., 2013; Lauters et al., 2013; Trotteyn and Paulina-Carabajal, 2016; Paulina-Carabajal and Currie, 2017). Results achieved in these studies might not be as accurate as if they were able to consider different regional BV/EV ratios and a more dynamic BV/EV ratio among different sized specimens.

Estimated brain and body masses revealed a relatively small brain for *Baurusuchus* in all cases (Fig. 8). Since encephalization in fossil taxa has to use estimates instead of direct measurements, there is always the possibility of the resulting encephalization estimation be an artifact. As a relative measurement, either an underestimation of MBr or an overestimation of MBd would yield an artificially lower encephalization degree. Overestimation of MBd for *Baurusuchus* seems unlikely. Mesoeucrocodylians can have their masses estimated by different skeletal measurements, including total length, skull length, and femur length (Farlow, 2005). For the almost complete specimens of *Baurusuchus* we used in this study, IFSP-VTP/PALEO-0003 and IFSP-VTP/PALEO-0004, skull length derived MBds yields the lowest values. Underestimation of MBr is more complex. Considering estimated MBds, it would require an MBr at least 20% larger than obtained. Estimated values of *Baurusuchus* specimens fall within the lower range of modern crocodilians relative brain size. This MBr would represent a BV/EV of 63% in the juvenile specimen and of 47% in the large adult. These values are compatible with the range observed for *A. mississipiensis* (Hurlburt, 2013). However, they would still place *Baurusuchus* among the less encephalized crocodyliforms. To *Baurusuchus* specimens fall within typical crocodyliform values, their MBr should be at least 50% higher than estimated values, with BV/EV ratios ranging from 59–80%. Despite not being able to completely rule out the possibility of having an underestimated MBr, if so, *Baurusuchus* would have much higher BV/EV ratios than modern crocodyliforms and there is yet little to no evidence to support this claim. Considering the likely lower encephalization degree and PEVs, it seems that *Baurusuchus* did not have proportionally larger olfactory bulbs, but rather proportionally smaller cerebral hemispheres relative to the olfactory bulbs.

Head posture and hearing capabilities

We were not able to reconstruct lateral semicircular canals accurately for the specimens with complete skulls to infer head posture. However, the almost orthogonal orientation between lsc and endosseous cochlear duct evident in the MicroCT of FUP-Pv 000021 make it possible to estimate lsc orientation when only ecd anatomy is available. In this sense, head posture when lsc is in complete horizontal position is slightly anteroventrally inclined (Fig. 10). When orienting the juvenile IFSP-VTP/PALEO-0003 skull using lsc, the head sits in an angle of about 8° anteroventrally in relation to the horizontal plane. The large adult FUP-Pv 000020 provides an inclination of 16°. When

using the palate to orient skulls the inclination is the same for lsc in the juvenile, but a little steeper in the large adult (21° anteroventrally), with the lsc 6° anteroventrally inclined. Maxillary tooth row yielded the least steep head inclination, with the skull 3° anteroventrally inclined in the juvenile (with the lsc 5° anterodorsally inclined) and 8° anteroventrally inclined in the large adult (with the lsc 7° anterodorsally inclined). The inferred alert head posture for *Baurusuchus* in all cases is slightly anteroventrally inclined (3º to 8º in the juvenile, 8° to 21° in the large adult).

Among the three different methods of inferring head posture, our results varied very little in the juvenile, with lsc and palate even yielding the same skull angle. The large adult head posture varied more but it still has a small variation range (13°). In all cases, obtained lsc angle lies within the known range for archosaurs (Duijm, 1951; Erichsen et al., 1989; Witmer et al., 2003, 2008) and are either aligned to the horizontal plane or slightly inclined (0° to 5° anterodorsally in the juvenile, 6º anteroventrally to 7º anterodorsally in the large adult). The similar values obtained by the different methods of inferring head posture are concordant with the findings for other notosuchians, as in *Simosuchus clarki*, *Campinasuchus dinizi*, and *Uberabasuchus terrificus* (Fonseca et al., 2020), as well as for the aetosaur *Neoaetosauroides engaeus* (see von Baczko et al., 2018). In *S. clarki*, *C. dinizi*, *U. terrificus*, and *N. engaeus* the difference in head posture between palate and lateral semicircular canal methods is of 11°, 10°, 5°, and 3°, respectively (Kley et al., 2010; von Baczko et al., 2018; Fonseca et al., 2020), while in *Baurusuchus* there is no difference for the juvenile and differs 6° for the large adult. This little to no difference between lsc and palate methods seems to be a trend among terrestrial pseudosuchians. Maxillary tooth row alignment is only available for *N. engaeus* and yielded an antinatural anterodorsal inclination, which is not compatible with articulation of osteoderms (von Baczko et al., 2018). This contrasts with our results for *Baurusuchus* that were slightly anteroventrally inclined and compatible with head-neck articulation.

It is important to note that Fonseca et al. (2020) present different angles between palate and lateral semicircular canal. Since *Campinasuchus dinizi* skull sits anteroventrally in a 35° angle when aligned by lsc and in a 25° when aligned by the palate, the difference between lsc and palate orientation would be 10°. However, when aligned by the palate, lsc is reported to be 20° inclined in relation to the ground, instead of 10°. The 20° lsc inclination is within known range for archosaurs (Duijm, 1951), despite being much higher than what is inferred for other notosuchids and modern crocodilians, which ranges from 6° anteroventrally in *Baurusuchus* to 11° anterodorsally in *Simosuchus clarki*

(Witmer et al., 2008; Kley et al., 2010; Fonseca et al., 2020). Furthermore, inner ear anatomy of *C. dinizi* is based on a poorly preserved inner ear and the presented structures in CT reconstruction for *C. dinizi* seem to be misidentified in Fonseca et al. (2020). When estimating lateral semicircular canal anatomy, the authors connected what seems to be part of the ampulla of rostral semicircular canal to what looks to be the fenestra cochleae (Fonseca et al., 2020 Fig. 8). This results in an anteroposteriorly short lsc, that does not meet the base of the caudal semicircular canal and it is much smaller than both other semicircular canals. In comparison, *Baurusuchus*, as well as living crocodilians, have proportionally longer lsc, which ends near to the base of csc and has the same or larger diameter than csc (Fig. 7; Brusatte et al., 2016 Fig. 8; Serrano-Martínez et al., 2019 Appendix tables). So far, the anatomy of *C. dinizi* would be unique among mesoeucrocodylians. Therefore, considering the poor preservation of the inner ear of *C. dinizi*, we prefer to consider the present data as uncertain, as well as the inferred head posture using lsc.

Head alert posture in living crocodilians is relatively homogeneous with the head held horizontally (Witmer et al., 2008). The difference found in baurusuchids could be due to different ecologies. Baurusuchids were terrestrial taxa (e.g., Price, 1945; Gasparini et al., 1993; Riff and Kellner, 2001; Vasconcellos and Carvalho, 2007; Nascimento and Zaher, 2010; Montefeltro et al., 2011) while modern crocodilians are all semiaquatic (Grigg and Kirshner, 2015). Modern crocodilians often float almost completely submerged, leaving just eyes, nostrils, and ears above water (Grigg and Kirshner, 2015). To hold this position crocodilians must stay with their heads fully horizontally to the water surface, although their bodies are commonly inclined downward (Grigg and Kirshner, 2015). Curiously, occipital condyle articulation surface is in a similar position in both *Baurusuchus* and modern crocodilians, favoring an inclined articulation between the skull and atlas. It seems that modern crocodilians hold their heads parallel to the horizontal plane with their bodies inclined, while baurusuchids held their bodies parallel to the horizontal plane with their heads inclined. Terrestrial taxa, such as baurusuchids, probably would not hold their heads horizontally to the ground, since there is no need to rise sense organs above water level. Instead, it is likely that baurusuchids would need their sense organs to be in different heights. In the adult individuals, if the head is parallel to the ground, the nostrils are about six centimeters higher than the height inferred for alert head posture, sitting farther from the ground, where chemically signaling molecules tend to concentrate (Crimaldi et al., 2002). The nostrils would also stand in the way of

stereoscopic vision, which would occur much more easily in the inferred alert head posture (Fig. 11). In addition, holding the head higher is probably energetically costly for terrestrial taxa since it would have to sustain head weight completely without the aid of a water column.

The juvenile individual alert head posture is considerably less inclined than the large adult is. A few factors may influence this, including head weight, ecological niche occupancy, stereoscopic vision, and the distance between nostrils and the ground. Throughout ontogeny, the cost to maintain a higher alert posture is expected to proportionally increase. There are two reasons for this. The first is that the skull mass increases in a higher rate than the muscular strength, because the latter increases with muscular transectional area (i.e., to the square), whereas the mass increases with head volume (i.e., to the cube). The second reason is because the rostrum seems to get proportionally longer as the individual grows. In addition, it is likely that ecological niches shifted throughout *Baurusuchus* life, as in modern crocodilians, where hatchlings and juvenile individuals are vulnerable to a wide array of predators while adults are often top predators (Somaweera et al., 2013; Grigg and Kirshner, 2015). Therefore, alert head posture in the juvenile might be more related with avoiding predators while adults would be only concerned in tracking and hunting for food. This seems to add up with apparent field of view for the studied specimens. Adult field of view seems to be well adapted to stereoscopic vision, but being very limited dorsally (Fig. 11). On the other hand, the juvenile field of view seems to be wider, permitting a stereoscopic view, but without the dorsal limitation of the adults (Fig. 12).

Recovered mean hearing frequencies and hearing ranges have higher values in the adult probably because we could not be able of accurately recover ecd length for the juvenile. However, obtained values are compatible with extant crocodilian hearing capabilities (Walsh et al., 2009 and references therein) and with their vocalization frequencies (Vergne et al., 2009 and references therein). In this sense, *Baurusuchus* hearing and possible vocalizations would be constituted predominantly of mid to low frequencies (<2000 Hz).

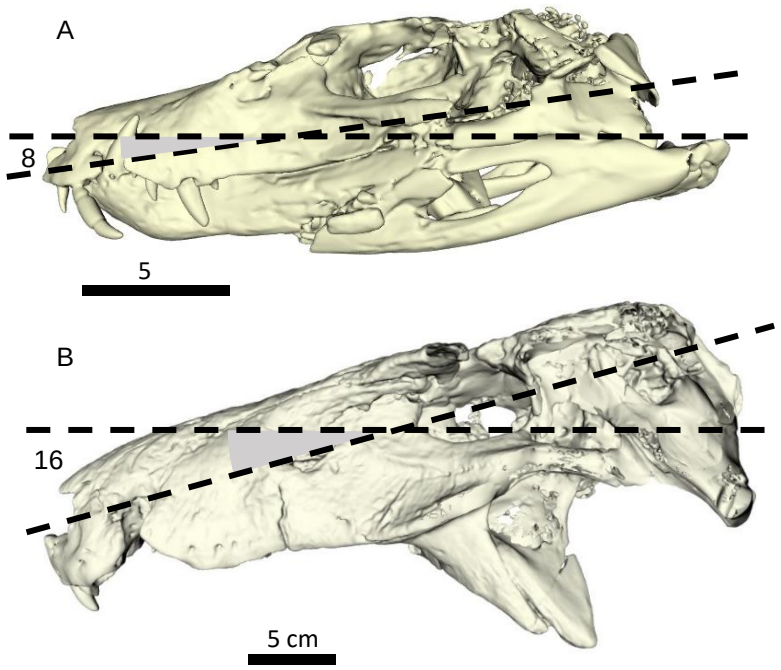

Fig. 10. Head posture with lateral semicircular canal aligned to the horizontal plane. Late juvenile IFSP-VTP/PALEO-0003 (A), large adult FUP-Pv 000020 (B). Scale bar – 5 cm.

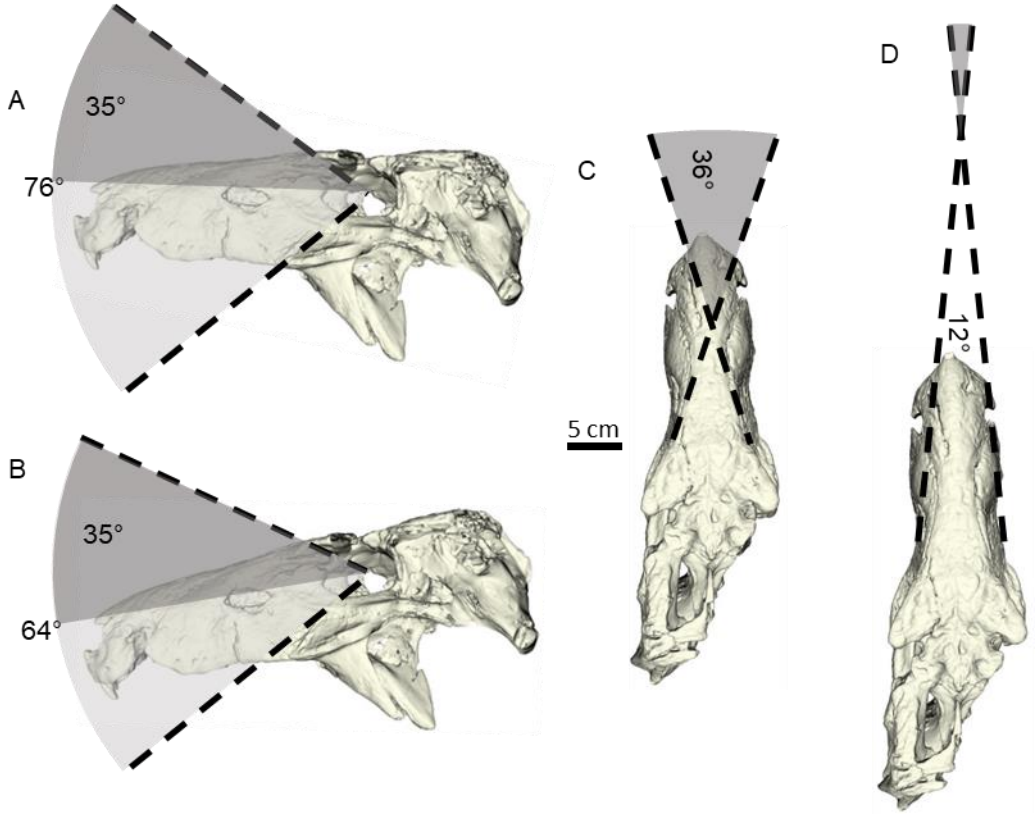

Fig. 11. Inferred total field of view and stereoscopic field of view (dark grey) for different head postures in the large adult FUP-Pv 000020. Head aligned to horizontal plane in left lateral (A) and dorsal (C) views; alert head posture using lsc in left lateral (B) and dorsal (D) views. Scale bar – 5 cm.

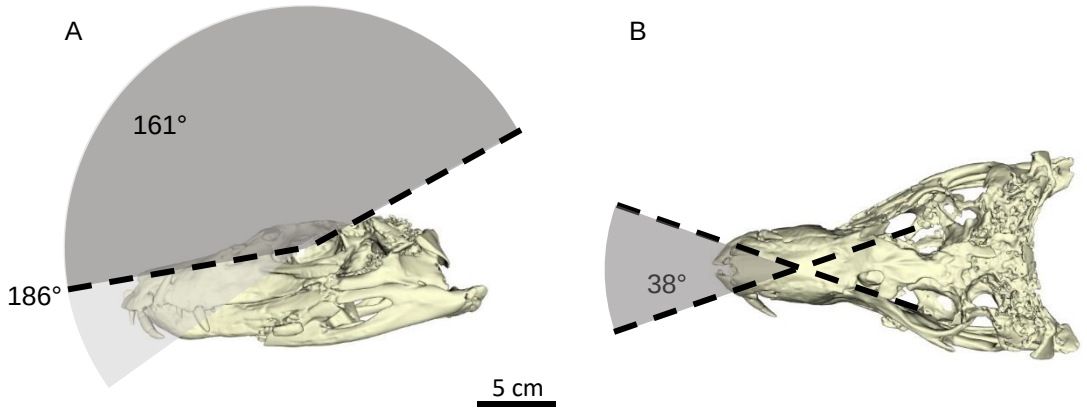

Fig. 12. Inferred total field of view and stereoscopic field of view (dark grey) for alert head posture in the juvenile IFSP-VTP/PALEO-0003. Left lateral view (A), dorsal view (B). Scale bar – 5 cm.

Facial sensitivity

A feature regarded as possibly indicative of habit is the relative size of the trigeminal fossa. George and Holliday (2013) reported that relative large trigeminal fossa are exclusive of semi-aquatic taxa. To date, *Baurusuchus* is the only terrestrial taxon with relatively large trigeminal fossa. Before concluding that this is an indicative of enhanced facial sensation, it is important to remember that George and Holliday (2013) approach is a relative measurement of the fossa to the endocranial volume. In this sense, *Baurusuchus* could have a relatively large trigeminal fossa not because of an enhanced facial sensation, but due to a small endocranial volume. As previously discussed, it already seems likely that *Baurusuchus* have had small relative brain size. This would add to the small endocranial volume hypothesis. In addition, the variable directly linked to axon count number, and therefore facial sensation, is the maxilomandibular foramen maximum diameter (George and Holliday, 2013) and not trigeminal fossa volume. In this way, *Baurusuchus* does not have a maxilomandibular foramen diameter compatible with its large fossa. Therefore, we recommend caution in interpreting the large trigeminal fossa as indicative of enhanced facial sensitivity. This topic needs further evaluation before a more conclusive paleobiological inference.

Conclusions

When dealing with fossils the concern about the deformation degree is always present. Here we showed that recovered endocranial volumes from CT scans could be highly affected by taphonomic processes. Comparing partial endocranial volumes with related taxa might be a proxy for deformation degree determination in brain endocasts.

Recovered *Baurusuchus* endocast morphology is compatible with different degrees of brain occupancy along the endocranial cavity, as reported in the literature. However, there are no sufficiently detailed studies to date to provide accurate information on olfactory region partial brain volume. Apparently, the anatomy of olfactory bulbs and tracts is reflected in different degrees in *Baurusuchus* brain endocasts. Characteristics of brain endocasts might be useful as phylogenetic characters. For example, the presence of a large sulcus between the olfactory bulbs found in *Baurusuchus* is shared with other closely related taxa: baurusuchids (*Campinasuchus dinizi* and *Wargosuchus australis*) and sebecids (*Sebecus icaeorhinus*) and other notosuchians (*Simosuchus clarki*, *Notosuchus terrestris*, and *Uberabasuchus terrificus*).

Both methods for calculating brain mass yielded similar results and emerge as a potentially more appropriate way of calculating brain mass in crocodyliforms. The endocranial cavity to brain allometry was taken in consideration to estimate fossil taxa brain mass resulting in different BV/EV ratios along ontogeny. Estimated relative brain size revealed that *Baurusuchus* probably had proportionally smaller brains than modern crocodilians, with smaller cerebral hemispheres. In the light of this information, it seems that the larger olfactory ratio values obtained were not due to a keener sense of smell, but due to the smaller cerebral hemispheres. If *Baurusuchus* relative brain size were similar to that of the living crocodilians, their brains would have to fill the endocranial cavity in much higher ratios than their modern relatives brains do. In summary, either relative brain size or BV/EV ratios were different among *Baurusuchus* and Crocodylia.

Alert head posture for *Baurusuchus* seem to reflect its terrestrial habits. The slightly anteroventrally inclined head position differs from the horizontal position present in modern day aquatic crocodilians. On the other hand, mean hearing frequencies and hearing ranges values are similar to modern day crocodilians.

In addition, we reported for the first time a terrestrial crocodyliform taxon with a relatively large trigeminal fossa. Despite the link between trigeminal fossa size and facial sensitivity, the large fossa of *Baurusuchus* does not have a compatible maxilomandibular foramen diameter. We recommend caution in interpreting the large trigeminal fossa as

indicative of enhanced facial sensitivity. However, the relative size of the trigeminal fossa might become another important endocranial phylogenetic character.

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Capítulo 3 – Coeficientes de encefalização em diápsidos

Encephalization Quotients in Living Diapsids and Non-Avian Dinosaurs

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Abstract

Encephalization quotients (EQs) are largely used for comparing relative brain size of living and fossil vertebrates. They can be useful in eliminating allometric bias when taxa of different body masses are compared. However, there are several issues with EQs currently used, such as sampling and linear regression methodology. Here we used body and brain mass data from the literature to analyze these biases. The evaluation of different log transformed body and brain masses for different diapsid groups shows that allometric relationships between body and brain masses differ considerably among groups. Derived EQs are able to remove body mass bias only when brain-body allometry is similar among analyzed taxa. The use of adequate EQs shows that modern reptiles have different brain-body allometries. The EQ of living groups applied in non-avian dinosaurs are highly affected by body mass in all cases except for crocodilians and flightless palaeognathans. Previous approaches using other EQs in non-avian dinosaurs are biased towards body mass, overestimating the EQ values for small taxa and underestimating for large ones. The results of removing the effect of body mass in EQs challenges the current understanding of dinosaur encephalization. Sampled Maniraptoriformes and non-Maniraptoriformes theropods have similar relative brain sizes despite their huge differences in body mass. The evolution of relatively larger brains seems to be common along the Mesozoic, and seems to be acquired independently in hadrosauriforms, non-avian-theropods, and birds.

Key words: encephalization quotient, relative brain size, Crocodylia, non-avian dinosaurs, Diapsida.

Introduction

Body mass (MBd) and brain mass (MBr) are highly correlated among vertebrates (e.g., Jerison, 1973; Hurlburt, 1996. Hurlburt et al. 2013). In living vertebrates, larger relative brain sizes are correlated with more complex cognitive behavior and higher metabolism (Armstrong & Bergeron, 1985; Armstrong, 1990; Lefebvre et al. 2002; Marino 2002). For that reason, relative brain size is used as a proxy of cognitive capacities and thermoregulation in fossil vertebrates (e.g., Jerison 1973; Hopson 1977, 1980; Gaetano et al., 2017; Zotin, 2018).

A common approach in the study of relative brain size in fossil taxa is to estimate MBr and MBd for the chosen fossil taxa and compare the obtained MBr to the expected MBr from an organism of similar MBd. The equation relating expected MBr for a determined MBd is derived from large set of data on modern groups by plotting log transformed MBd x MBr values and using a linear regression to determine expected MBr for any given MBd (Jerison, 1973; Hurlburt, 1996; Hurlburt et al., 2013). Jerison (1973) first proposed this method of estimating relative brain size, which is called the "Encephalization Quotient" (EQ). Posteriorly, Hurlburt (1996) used the same method to develop two group specific EQs, the "Reptile Encephalization Quotient" (REQ) and "Bird Encephalization Quotient" (BEQ).

Currently non-avian dinosaur relative brain sizes are determined by using both reptile and bird encephalization quotients presented by Hurlburt et al. (2013), where the authors used log transformed brain and body masses to perform reduced major axis linear regressions (RMA). However, RMA regressions are not an adequate method for estimating evolutionary regression slopes when biological variation is present, such as in brain-body allometry (Hansen & Bartoszek, 2012; Kilmer & Rodríguez, 2017). RMA regressions make no distinction between observational error and biological variation, correcting for both and recovering unreliable slopes, especially when biological variation is moderate to high (Hansen & Bartoszek, 2012; Kilmer & Rodríguez, 2017). In addition, Hurlburt et al. (2013) did not consider phylogenetic relatedness, ignoring the non-independence of species data points (Felsenstein, 1985; Harvey & Pagel, 1991; Symonds & Blomberg, 2014). Because of that, phylogenetic generalized least squares regressions (PGLS) would be a more adequate method to test for phylogenetic signal and correcting for phylogenetic relatedness among taxa. (Grafen, 1989; Martins & Hansen, 1997; Pagel, 1997, 1999; Rohlf, 2001; Symonds & Blomberg, 2014).

There are at least two non-avian reptile brain-body equations obtained employing PGLS in the literature (Tsuboi et al., 2018; Font et al., 2019). However, both PGLS, as well as the RMA, reptile brain-body regressions come from brain and body datasets composed mostly of non-archosaur reptiles (Hurlburt et al., 2013; Tsuboi et al., 2018; Font et al., 2019). All three datasets are composed mostly of lizards (55-84%), followed by snakes (9-26%), and turtles (5-16%), with crocodilians being represented by only two species (1-3%).Thus, in these equations, archosaurs (represented only by crocodylomorphs) correspond to less than 5% of the data. Regression log transformed MBd x MBr equations have different slopes and intercepts among vertebrate clades (e.g. Tsuboi et al., 2018; Ksepka et al., 2020). These differences are compatible with variation of other factors among clades that can affect MBd, such as body density and bauplan (Font et al., 2019). For instance, among non-avian reptiles, turtles have relative smaller brain size/body mass ratios when compared with brain size/body volume values, which is likely related to their unique bauplan (Font et al., 2019). Therefore, a non-avian reptile regression might neither represent brain-body allometry for all clades and nor bauplans within "Reptilia". If brain-body allometries among non-avian reptiles are truly different, overrepresented lizards are likely to bias obtained non-avian reptiles regression towards the lizard slope and intercept.

Relative brain size is especially hard to investigate in fossil taxa, since direct measurements are not available. To evaluate it, one must work with estimations of brain and body masses. Estimations of both brain and body masses for fossil taxa generally implies in the use of a range of possible values, adding uncertainty to the study of relative brain size and EQ calculations (Jerison, 1973; Hopson, 1977; Hurlburt, 1996; Mazzeta et al., 2004; Christiansen & Fariña, 2004; Sampson & Witmer, 2007; Hurlburt et al., 2013; Paulina-Carabajal & Currie, 2017). Estimated body mass for a given fossil taxon can vary greatly, for instance, *Brachiosaurus* body mass estimates varies from 40,000 to 78,300 kg (Bakker, 1975; Hurlburt 1996), and *Tyrannosaurus* brain mass estimates varies from 141 to 202 g for the same specimen (Hurlburt et al., 2013). This uncertainty probably led the study of fossil taxa brain-body allometry to rely on linear regressions based solely on living taxa, where direct measurements are possible. However, these differences are much smaller in the logarithmic scale used in linear regressions (*Brachiosaurus* log body mass: 7.60 to 7.89, *Tyrannosaurus* log brain mass: 2.15 to 2.31).

To date, there are no linear regressions performed for non-avian dinosaurs in the literature. There is a log transformed MBd x MBr PGLS regression for 12 non-avian

theropods in Ksepka et al. (2020). However, this regression seems to use total endocranial volume for all theropods, instead of their brain mass (Ksepka et al., 2020, supplementary data). While the brain mass for the smaller theropods in Ksepka et al. (2020) is likely to be close to total endocranial volume, this is not true for the larger theropods, such as *Acrocanthosaurus* and *Tyrannosaurus*, since brain to endocranial volume ratios differ among theropod species of different body masses (Hurlburt et al., 2013). Thus, the linear regression in Ksepka et al. (2020) seems to not truly represent brain-body allometry but endocranial volume-body allometry. It is noteworthy that Ksepka et al. (2020) regression has a slope of 0.499, which is a considerably smaller value than the slope recovered for all reptile regression slopes in the literature (ranging from 0.553 to 0.579) (Hurlburt et al., 2013; Tsuboi et al., 2018; Font et al., 2019). Since brain volume was considerably smaller than endocranial volume in the larger non-avian theropods (Hurlburt et al., 2013), and its specific gravity is close to one (Jerison, 1973), the brain-body PGLS equation presented by Ksepka et al. (2020) for non-avian theropod would probably have an even smaller slope value.

In this context, one of our objectives is to obtain more adequate encephalization quotients for both living and fossil reptile taxa, analyzing different reptile clades and bauplans with comparative phylogenetic methods. Another objective is to test if the use of EQs based on one reptile group is adequately applicable for the study of encephalization within another reptile group, as currently done for non-avian dinosaurs.

Materials and methods

Body mass (MBd) and brain mass (MBr) data from 1700 living bird, 75 living reptile and 28 non-avian dinosaur species were compiled from the literature (Supplementary Information - S1) (Crile & Quiring, 1940; Portmann 1946, 1947 in Hurlburt, 1996; Colbert, 1962; Jerison, 1973; Bakker, 1975; Platel, 1979; Gans, 1980; Chentanez et al., 1983; Alexander, 1991; De Speroni & Pirlot, 1987; Hopson, 1977; Alexander, 1985; Hurlburt, 1996; Iwaniuk & Nelson, 2003; Christiansen & Fariña, 2004; Mazzeta et al., 2004; Sampson & Witmer, 2007; Ashwell & Scofield, 2008; Hurlburt et al., 2013; Ngwenya et al., 2013; Sayol et al, 2016; Jirak & Janacek, 2017; Paulina-Carabajal & Currie, 2017; Tsuboi et al, 2018; Serrano-Martínez et al., 2019; Ksepka et al., 2020).

In order to estimate phylogenetic signal influence (Grafen 1989, Martins and Hansen 1997, Pagel 1997,1999, Rohlf 2001, Freckleton et al. 2002) we used Phylogenetic Generalised Least Squares (PGLS) regressions, implemented in RStudio (RStudio Team, 2020). PGLS regression analyses were conducted for log transformed values of MBd x MBr for each of the following groups: Aves, flying Aves, flightless Aves, flightless Palaeognathae (Aves), Sphenisciformes (Aves), Crocodylia, Squamata, legged Squamata, legless Squamata, Testudines, living "Reptilia", non-avian Dinosauria, and non-avian Theropoda. We also conducted log transformed MBd x endocranial volume (EV) for non-avian dinosaurs and non-avian theropods.

Initially, we obtained cladograms for the main analyzed groups from Anquetin (2012), Ferreira et al. (2018), Guillon et al. (2012), Crawford et al. (2015) e Zhou et al. (2012) for Testudines; Oaks (2011), Pol et al. (2014), Groh et al. (2020) for Crocodylomorpha; Figueroa et al. (2016), Pyron et al. (2013) e Simões et al. (2017) for Squamata; Butler et al. (2008), Wilson (2002), and Lee et al. (2014) for Dinosauria; and Prum et al. (2015) for Aves. In some cases, especially with Aves, we used one or a few works as a framework for more inclusive monophyletic taxonomic groups (e.g. monophyletic orders and families). Then we used papers that are more specific in order to enhance detail within these groups to construct a cladogram for the whole group (supplementary information: S1).

Whenever possible, we kept fossil taxa, as well as living taxa without MBd and MBr information, in the cladograms in order to enhance tree calibration before pruning the trees. Calibration used timePaleoPhy (Bapst 2012, 2013) package with bin_ timePaleoPhy routine to account for the temporal uncertainty among fossil species. In this methodology, temporal ranges for each taxon are treated as stratigraphic uncertainty instead of true ranges. Living species were constrained to the present time (without true time interval) (Bapst 2012, 2013, 2020 personal information). Chronostratigraphic intervals attributed to each fossil species were transformed into age ranges (in Ma) by using the latest updated version of the Chronostratigraphic International Chart (Cohen et al. 2013 updated), 2020/01 version. We used the function minimum branch length (MBL) in order to avoid creation of zero-length branches to calibrate the trees. To check for the stratigraphic range attributed to fossil taxa causes significant effects in the analysis, 20 different calibrated trees were generated for each studied group. After calibration, trees were pruned to keep only the taxa with available MBr and MBd values.

We plotted log-transformed MBd, MBr, and EV as an ordinary least squares (OLS) regression, which assumes data points are independent. Furthermore, from the same datasets, PGLS regressions were implemented, which considers that variation in residual values of analyzed taxa is conditioned by their phylogenetic relationships. Strength of phylogenetic influence was defined by the λ parameter (Pagel, 1999), under Brownian motion, automatically adjusted according to a maximum likelihood function. We defined the best data fit between OLS and PGLS functions with Akaike Information Criterion (AIC) (Akaike, 1973).

One main issue with MBd and MBr data for fossil taxa is that they are estimations rather than direct measurements, thus increasing observational error. They are frequently a range of possible values (e.g. Christiansen & Fariña, 2004; Hurlburt et al., 2013). To address this problem, we used mean values for these estimates and also examined how different the fossil log transformed MBd x MBr equations could be. When the log MBd value for a given fossil taxa is lower than the midpoint for the sampled MBds, the highest possible value for MBd and the lowest possible MBr value increase the regression slope. On the other hand, for taxa with log MBd higher than sampled MBds midpoint, the opposite is true. By using these extreme values, we are able to estimate the steepest and the least steep possible equations for our dataset.

The encephalization quotients (EQs) were derived from each regression equation and each species had its EQs calculated using all obtained EQs. To test possible influence of MBd on obtained EQs, the EQs of each group were plotted against log MBd and tested for statistical significance (p value) and correlation (r^2). Then, we compared our data for significant differences in encephalization using different EQs in order to test how much they are reliable.

Results

Log MBd x log MBr equations

For all regressions considered, the best Akaike information criterion (AIC) values for log transformed MBd x MBr species equations were yielded by PGLS regression (Tables 1 and 2), indicating some degree of phylogenetic signal in the original dataset. However, among groups, the slopes obtained with both ordinary least squares (OLS) and phylogenetic generalized least squares (PGLS) are strikingly similar, with the larger

difference between Squamata equations (PGLS slope is 0.0944 higher). The same is true for the log transformed MBd x EV equations for non-avian dinosaurs (Table 3).

Slope values (Table 2) for each group varied from 0.3806 (in Crocodylia) to 0.5945 (in Squamata). The Squamata slope value is similar to Aves and Testudines slope values (0.5911 and 0.5756, respectively). Intercept value for Aves is clearly higher (-1.0254) than Squamata and Testudines, with the first being slightly higher than the latter (-1.7944 and -1.8898, respectively). For the non-avian dinosaurs, the slope of the MBr equation is close to the value for Crocodylia (0.3664 and 0.3806, respectively) and the EV equation is steeper (0.4593). Interestingly, the living Reptilia equation has a slope similar to Squamata and Testudines, but quite different from Crocodylia and non-avian Dinosauria (0.5720, Table 2). Figure 1 shows log MBd x log MBr plot for all taxa.

Table 1. OLS equations for log MBd (body mass) x log MBr (brain mass) of different groups used in this study.

Group	AIC	Intercept	Std. Error	Slope	Std. Error	multiple r^2	adjusted r^2	p
Aves	-1463.3160	-0.8581	0.0109	0.5638	0.0051	0.8772	0.8771	<0.0001
Aves - Flightless	-20.2060	-0.6889	0.1267	0.4935	0.0352	0.9076	0.9030	<0.0001
Aves - Flightless Palaeognathae	-5.6943	-0.2546	0.3443	0.3630	0.0818	0.7974	0.7569	0.0068
Aves - Flying	-1447.2330	-0.8581	0.0109	0.5638	0.0051	0.8772	0.8771	<0.0001
Aves - Sphenisciformes	-21.1468	-0.4763	0.1155	0.4698	0.0312	0.9784	0.9741	<0.0001
Crocodylia	-16.3076	-0.9336	0.3349	0.3806	0.0695	0.8334	0.8057	0.0015
Living Reptilia	-38.2750	-1.7816	0.0392	0.5413	0.0152	0.9452	0.9445	<0.0001
Non-avian Dinosauria*	0.3877	-0.1826	0.2381	0.3140	0.0408	0.6953	0.6836	<0.0001
Non-avian Theropoda*	-5.6525	-0.3915	0.2321	0.3634	0.0424	0.8209	0.8097	<0.0001
Squamata	-20.7929	-1.7277	0.0508	0.5001	0.0274	0.8585	0.8560	<0.0001
Squamata - Legged	-45.1950	-1.7804	0.0379	0.6100	0.0251	0.9409	0.9393	<0.0001
Squamata - Legless	-24.4837	-2.0496	0.0815	0.5584	0.0334	0.9459	0.9425	<0.0001
Testudines	-4.7978	-1.8898	0.2347	0.5756	0.0686	0.8980	0.8852	<0.0001

*Equation obtained using fossil taxa.

Table 2. PGLS equations for log MBd (body mass) x log MBr (brain mass) of different groups used in this study.

Group	AIC	Intercept	Std. Error	Slope	Std. Error	multiple r^2	adjusted r^2	p
Aves	-4277.1810	-1.0254	0.0517	0.5911	0.0054	0.8767	0.8766	<0.0001
Aves - Flightless	-45.4019	-0.4866	0.1216	0.4430	0.0272	0.9301	0.9266	<0.0001
Aves - Flightless Palaeognathae	-7.6943	-0.2546	0.3443	0.3630	0.0818	0.7974	0.7569	0.0068
Aves - Flying	-4242.4780	-1.0438	0.0512	0.5971	0.0055	0.8741	0.8740	<0.0001
Aves - Sphenisciformes	-23.1468	-0.4763	0.1155	0.4698	0.0312	0.9784	0.9741	<0.0001
Crocodylia	-18.3076	-0.9336	0.3349	0.3806	0.0695	0.8334	0.8057	0.0015
Living Reptilia	-75.4892	-1.8177	0.1066	0.5720	0.0200	0.9181	0.9170	<0.0001
Non-avian Dinosauria*	-1.9340	-0.6144	0.3311	0.3664	0.0508	0.6666	0.6538	<0.0001
Non-avian Theropoda*	-6.6932	-0.3862	0.2374	0.3568	0.0425	0.8153	0.8038	<0.0001
Squamata	-61.7368	-1.7944	0.1021	0.5945	0.0230	0.9241	0.9227	<0.0001
Squamata - Legged	-60.0757	-1.7103	0.0580	0.5972	0.0210	0.9563	0.9551	<0.0001
Squamata - Legless	-26.4837	-2.0496	0.0814	0.5584	0.0334	0.9459	0.9425	<0.0001
Testudines	-6.7978	-1.8898	0.2347	0.5756	0.0686	0.8980	0.8852	<0.0001

*Equation obtained using fossil taxa.

Table 3. PGLS equations for log MBd (body mass) x log EV (endocranial volume) of the fossil groups used in this study.

Group	AIC	Intercept	Std. Error	Slope	Std. Error	multiple r^2	adjusted r^2	p
Non-avian Dinosauria EV (OLS)	0.3329	-0.6542	0.2379	0.4319	0.0407	0.8122	0.8050	<0.0001
Non-avian Dinosauria EV (PGLS)	-2.9500	-0.9376	0.3354	0.4593	0.0513	0.7554	0.7460	<0.0001
Non-avian Theropoda EV (OLS)	-12.7150	-1.0601	0.1908	0.5177	0.0349	0.9323	0.9281	<0.0001
Non-avian Theropoda EV (PGLS)	-14.0393	-1.0650	0.1936	0.5150	0.0346	0.9326	0.9284	<0.0001

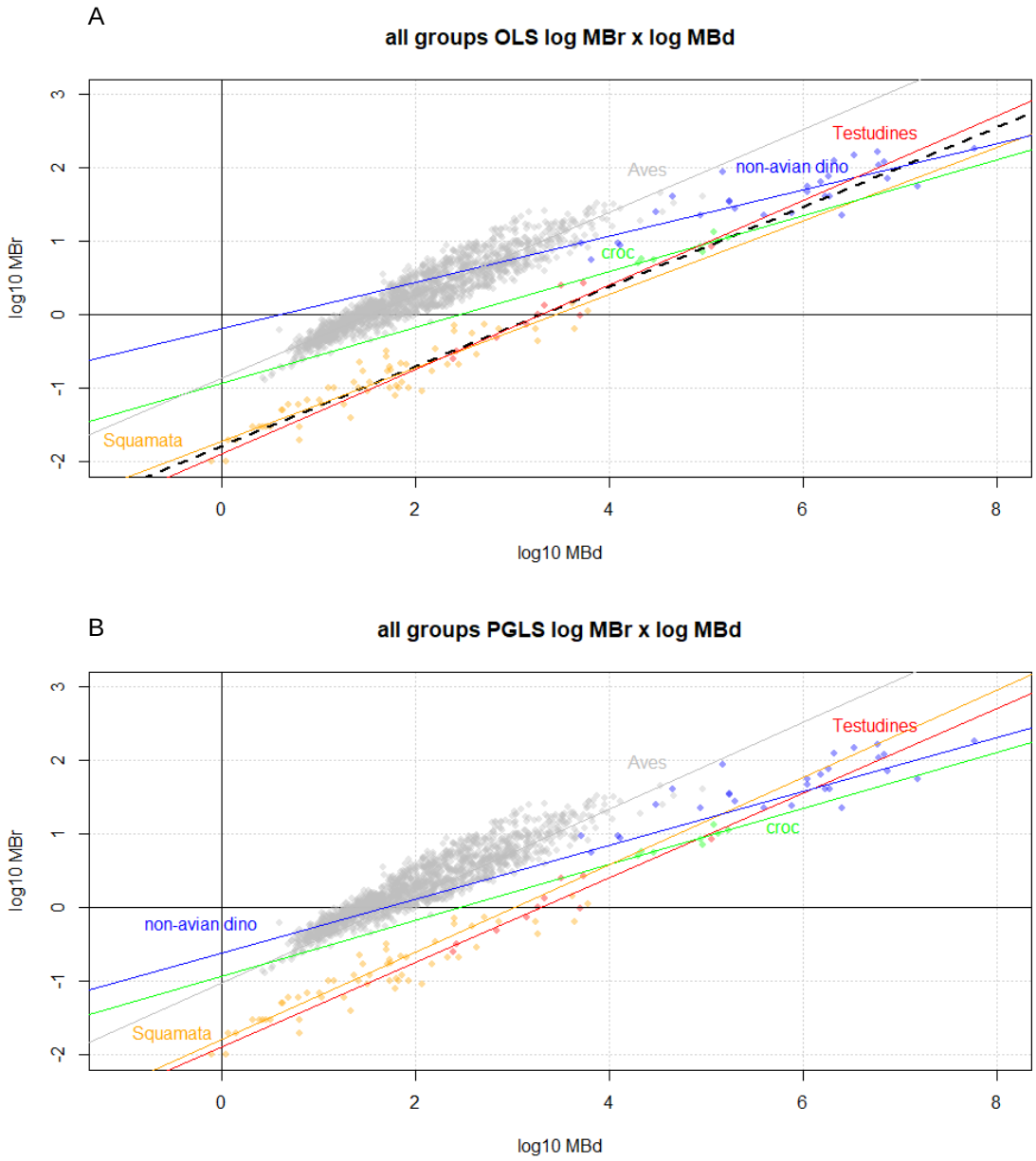

Figure 1. OLS (A) and PGLS (B) log MBd x log MBr plot and regression lines of all studied species. Aves – grey line and dots; Crocodylia – green line and dots; non-avian dinosaurs – blue line and dots; Squamata – yellow line and dots; Testudines – red line and dots; living Reptilia – dashed black line.

In birds, the ability to fly seem to be a major factor determining the slope, since its value is 0.4430 in the flightless Aves equation and 0.5971 in the flying Aves. The flightless Palaeognathae and penguins (Sphenisciformes) equations also have lower slope values (0.3630 and 0.4698, respectively). Non-avian Theropoda equation has a

remarkably similar slope to the non-avian Dinosauria equation (0.3568, 0.3664, respectively), but clearly different intercept values (-0.3862, -0.6144, respectively). However, the Theropoda EV equation has a higher slope than the Dinosauria EV equation (0.5150, 0.4593, respectively) and more similar intercepts (-1.0650, -0.9376, respectively). In Squamata, the presence/absence of limbs seem to affect the equation. The Squamata and legged Squamata equations have similar slopes (0.5945 and 0.5972, respectively), whereas the legless Squamata equation slope value is lower (0.5584). In addition, the intercept of legged Squamata is higher than the intercept of legless Squamata (-1.7103 and -2.0496, respectively).

All fossil-based equations varied little when forced for their most extreme scenarios (Table 4; Figure 2). The largest difference is seen between the least and steeper regressions of non-avian Dinosauria (0.3283 to 0.3983, respectively) and the smallest difference was for the non-avian Theropoda EV least steep and steeper equations (0.5013 to 0.5286, respectively).

Table 4. PGLS equations for log MBd (body mass) x log MBr (brain mass) and log MBd (body mass) x log EV (endocranial volume) of the fossil groups used in this study forcing for extreme slopes (steepest and least steep).

Group	AIC	Intercept	Std. Error	Slope	Std. Error	multiple r^2	adjusted r^2	p
Non-avian Dinosauria least steep	-0.4460	-0.3977	0.3220	0.3283	0.0495	0.6282	0.6139	<0.0001
Non-avian Dinosauria steepest	-2.6956	-0.7782	0.3395	0.3983	0.0524	0.6895	0.6775	<0.0001
Non-avian Dinosauria EV least steep	-1.3909	-0.8299	0.3373	0.4392	0.0511	0.7393	0.7292	<0.0001
Non-avian Dinosauria EV steepest	-4.1039	-1.0523	0.3326	0.4815	0.0512	0.7725	0.7638	<0.0001
Non-avian Theropoda least steep	-4.4423	-0.3406	0.3175	0.3313	0.0532	0.7082	0.6900	<0.0001
Non-avian Theropoda steepest	-7.6271	-0.5590	0.2325	0.3956	0.0417	0.8489	0.8395	<0.0001
Non-avian Theropoda EV least steep	-13.8555	-1.0015	0.1919	0.5013	0.0342	0.9307	0.9264	<0.0001
Non-avian Theropoda EV steepest	-12.6864	-1.1281	0.2031	0.5286	0.0364	0.9293	0.9249	<0.0001

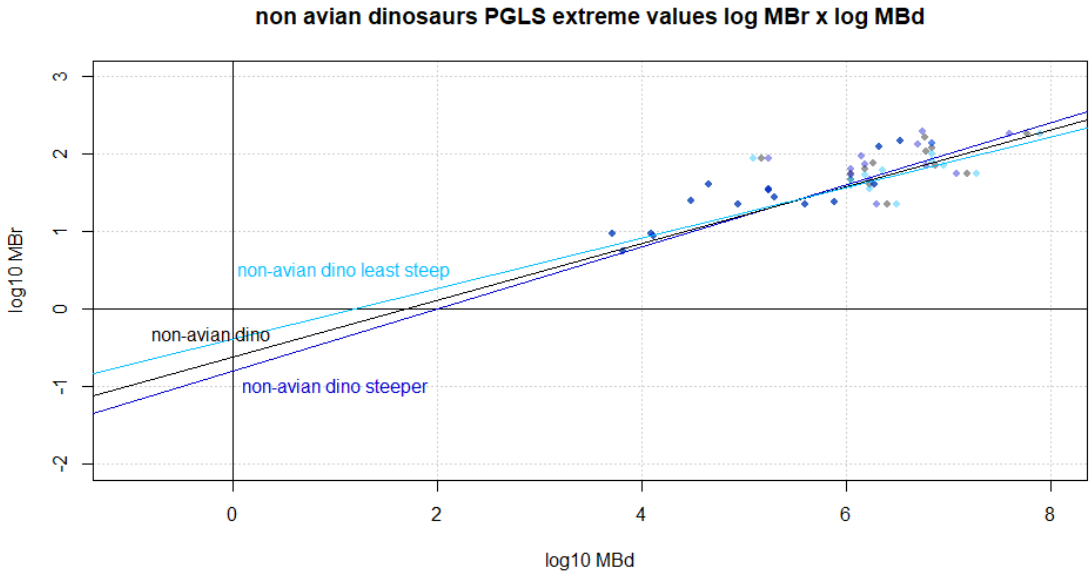

Figure 2. Log MBd x log MBr plot and comparison among PGLS regression lines for non-avian dinosaurs using different values for MBd and MBr; black line, grey dots - mean values; dark blue line and dots - extreme values for steepest slope; light blue line and dots - extreme values for least steep slope.

Encephalization quotient equations x log MBd

Encephalization quotients (EQs; Table 5) were capable of eliminating the effects of MBd in MBr, allowing relative brain size comparisons among individuals of various sizes within any group analyzed. However, EQs did not worked properly for any grouping used. When selecting subgroups inside a larger group, or using the EQ equation in a different group from which it was derived, the results are frequently affected by log MBd ($p < 0.05$, $r^2 > 0.1$; Tables 6 and 7). For non-avian dinosaurs, the EQs not significantly affected by log MBd were the ones obtained for the flightless Palaeognathae (BEQfsp), crocodilians (CEQ), non-avian dinosaurs (DinoEQ), and non-avian theropods (DinoEQt). All other equations yielded significant log MBd influence on EQ for the non-avian dinosaurs. In addition, REQ equation is moderately correlated with log MBd in non-avian dinosaurs ($p = 0.001$, $r^2 = 0.4868$).

Table 5. Encephalization quotient equations based in each group used in this study. Expected brain mass (MBr) for a given body mass (MBd).

Reference group	n (brain-body equation)	EQ Equation
Aves	1700	$BEQ = MBr/(0.0943 \times MBd^{0.5911})$
Aves - Flightless	22	$BEQfs = MBr/(0.3262 \times MBd^{0.4430})$
Aves - Flightless Palaeognathae	7	$BEQfsp = MBr/(0.5564 \times MBd^{0.3630})$
Aves - Flying	1678	$BEQfy = MBr/(0.0904 \times MBd^{0.5971})$
Aves - Sphenisciformes	7	$BEQsph = MBr/(0.3339 \times MBd^{0.4698})$
Crocodylia	8	$CEQ = MBr/(0.1165 \times MBd^{0.3806})$
Living Reptilia	75	$REQ = MBr/(0.0152 \times MBd^{0.5720})$
Non-avian Dinosauria	28	$DinoEQ = MBr/(0.2430 \times MBd^{0.3664})$
Non-avian Theropoda	18	$DinoEQt = MBr/(0.4109 \times MBd^{0.3568})$
Squamata	57	$SEQ = MBr/(0.0161 \times MBd^{0.5945})$
Squamata - Legged	39	$SEQlg = MBr/(0.0195 \times MBd^{0.5972})$
Squamata - Legless	18	$SEQls = MBr/(0.0089 \times MBd^{0.5584})$
Testudines	10	$TEQ = MBr/(0.0129 \times MBd^{0.5756})$

Table 6. Values of p for log MBd x EQ regression for each sampled group and EQ equation (nonsignificant values in bold).

Group	BEQ	BEQfs	BEQfsp	BEQfy	BEQsph	CEQ	DinoEQ	DinoEQt	REQ	SEQ	SEQlg	SEQls	TEQ
Aves	**0.0749**	0.0001	0.0001	0.0051	0.0001	0.0001	0.0001	0.0001	**0.1403**	0.0188	0.0053	0.0004	**0.3913**
Aves - Flightless	**0.0502**	**0.3529**	0.0172	0.0426	**0.6719**	0.0345	0.0185	0.0129	0.1176	0.0438	0.0339	**0.1828**	**0.0954**
Aves - Flightless Palaeognathae	0.0027	**0.0798**	**0.5997**	0.0028	0.0345	**0.9480**	**0.6741**	**0.4728**	0.0042	0.0036	0.0034	0.0042	0.0035
Aves - Flying	**0.3427**	0.0001	0.0001	**0.0521**	0.0001	0.0001	0.0001	0.0001	0.0238	**0.1328**	0.0477	0.0001	**0.1019**
Aves - Sphenisciformes	0.0064	**0.4307**	0.0169	0.0072	**0.9951**	0.0313	0.0173	0.0143	0.0148	0.0055	0.0070	0.0292	0.0114
Crocodylia	0.0417	**0.4535**	**0.8334**	0.0436	**0.2726**	**0.9755**	**0.8615**	**0.7858**	**0.0655**	0.0446	0.0415	**0.0818**	**0.0572**
Dinosauria - non avian	0.0001	0.0123	**0.3149**	0.0001	0.0038	**0.1808**	**0.2824**	**0.7391**	0.0001	0.0002	0.0001	0.0001	0.0001
Dinosauria - non avian Theropoda	0.0015	**0.1570**	**0.8411**	0.0018	**0.0752**	**0.6414**	**0.8042**	**0.8155**	0.0027	0.0014	0.0008	0.0046	0.0015
Reptilia - Living	0.0046	0.0001	0.0001	0.0009	0.0001	0.0001	0.0001	0.0001	**0.0672**	0.0011	0.0017	**0.3130**	0.0418
Squamata	0.0224	0.0392	0.0001	0.0136	**0.1739**	0.0005	0.0002	0.0001	**0.0845**	0.0161	0.0134	**0.1915**	**0.0741**
Squamata - Legged	**0.2736**	0.0001	0.0001	**0.3585**	0.0001	0.0001	0.0001	0.0001	**0.0822**	**0.3147**	**0.3613**	0.0314	**0.1028**
Squamata – Legless	**0.4699**	0.0085	0.0001	**0.3816**	0.0349	0.0009	0.0002	0.0002	**0.8121**	**0.4151**	**0.3835**	**0.9128**	**0.7407**

Testudines	**0.9815**	**0.1155**	0.0107	**0.9267**	**0.1940**	0.0204	0.0001	0.0095	**0.8420**	**0.9468**	**0.9256**	**0.7178**	**0.8769**

Table 7. Values of r^2 for log MBd x EQ regression for each sampled group and EQ equation.

Group	BEQ	BEQfs	BEQfsp	BEQfy	BEQsph	CEQ	DinoEQ	DinoEQt	REQ	SEQ	SEQlg	SEQls	TEQ
Aves	0.0019	0.0226	0.4029	0.0047	0.1620	0.3677	0.3963	0.4146	0.0013	0.0033	0.0005	0.0082	0.0004
Aves - Flightless	0.1763	0.0445	0.2610	0.1951	0.0089	0.2052	0.2501	0.2809	0.1205	0.1869	0.1954	0.0856	0.1305
Aves - Flightless Palaeognathae	0.9103	0.5241	0.0573	0.9134	0.6894	0.0009	0.0363	0.1047	0.0898	0.9121	0.9135	0.8872	0.9008
Aves - Flying	0.0005	0.2308	0.3985	0.0023	0.1688	0.3655	0.3923	0.4095	0.0030	0.0014	0.0023	0.0119	0.1615
Aves - Sphenisciformes	0.7428	0.1298	0.7042	0.7597	0.0000	0.6253	0.6909	0.7266	0.6754	0.4526	0.4600	0.6120	0.6899
Crocodylia	0.6006	0.0946	0.0114	0.6156	0.1854	0.0003	0.0081	0.0191	0.5491	0.6092	0.6158	0.5085	0.5595
Dinosauria - non avian	0.5186	0.2061	0.0394	0.5280	0.2709	0.0685	0.0445	0.0045	0.4868	0.5239	0.5281	0.4624	0.4930
Dinosauria - non avian Theropoda	0.4458	0.1151	0.0026	0.4575	0.1744	0.0145	0.0044	0.0038	0.4071	0.4524	0.4577	0.3782	0.4146
Reptilia - Living	0.1108	0.4066	0.6582	0.1345	0.2641	0.6255	0.6527	0.6674	0.0457	0.1241	0.1349	0.0140	0.0564
Squamata	0.0910	0.0775	0.2697	0.1048	0.0324	0.2245	0.2610	0.2855	0.0524	0.0987	0.1050	0.0307	0.0590
Squamata - Legged	0.0331	0.5144	0.6959	0.0224	0.4318	0.6642	0.6902	0.7060	0.0786	0.0268	0.0223	0.1194	0.0689
Squamata – Legless	0.0334	0.3477	0.5873	0.0485	0.2462	0.5449	0.5801	0.6018	0.0035	0.0416	0.0488	0.0008	0.0069
Testudines	0.0001	0.2821	0.5297	0.0010	0.2003	0.4784	0.5202	0.5471	0.0046	0.0005	0.0010	0.0149	0.0029

Relative brain size

Comparing diapsids using REQs (reptilian encephalization quotient), Testudines and Crocodylia are the ones with lower median and mean REQs (0.81 – 0.92 and 0.91 – 0.93, respectively; Table 8). In this scenario, squamates have intermediate REQ median and mean (1.04, both) and Aves have the highest values (8.75 – 9.39). Non-avian dinosaurs have a REQ range that partially or completely overlaps with all ranges (0.29 – 6.33), with median and mean values higher than any other reptile group considered, but lower than birds (1.37 – 1.94). Interestingly, *Archaeopteryx* has a REQ only compatible with non-avian dinosaurs and birds (3.28, Tables 8 and 9), being higher than the maximum value for any living reptile (2.30). REQ values are normally distributed only in crocodilians and turtles (Table 10). Differences among median REQs are statistically significant, with birds being different from all other groups in addition to dinosaurs being different from squamates (Table 11).

Table 8. Reptile encephalization quotients (REQ) for each group.

Group	Median	Mean	Min.	Max.	Range
Aves	8,75	9,39	3,02	27,19	24,17
Crocodylia	0,91	0,93	0,67	1,24	0,57
Non-avian Dinosauria	1,37	1,94	0,29	6,33	6,04
Squamata	1,04	1,04	0,35	2,30	1,95

Testudines	0,81	0,92	0,49	1,61	1,12	

Table 9. EQs and EVQs of interest for sampled non-avian dinosaurs and for fossil taxa not used in regressions.

Genus	BEQfsp	CEQ	DinoEQ	DinoEQt	REQ	DinoEVQ	DinoEVQt
Allosaurus	0.74	2.74	1.61	1.10	1.33	2.05	1.23
Anatosaurus	1.15	4.21	2.50	1.71	1.81	2.60	1.51
*Archaeopteryx**	0.32	1.39	0.73	0.46	3.28	0.21	0.80
*Bambiraptor**	1.03	4.23	2.30	1.48	6.03	2.14	1.76
Brachiosaurus	0.50	1.76	1.09	0.76	0.44	0.72	0.36
Camptosaurus	0.38	1.46	0.84	0.56	0.95	1.07	0.70
Carcharodontosaurus	0.68	2.46	1.47	1.01	0.95	1.63	0.91
Citipati	0.65	2.54	1.43	0.94	2.20	1.05	0.74
Conchoraptor	0.76	3.11	1.68	1.08	4.63	1.60	1.33
Diplodocus	0.25	0.90	0.54	0.38	0.29	0.43	0.23
Erlikosaurus	0.77	2.97	1.69	1.12	2.26	1.16	0.79
Euoplocephalus	0.39	1.43	0.84	0.57	0.69	0.93	0.56
Giganotosaurus	0.70	2.55	1.53	1.05	0.96	1.71	0.95
Gorgosaurus	0.64	2.41	1.41	0.95	1.29	1.87	1.15
Iguanodon	1.14	4.21	2.48	1.69	1.99	2.70	1.61
Incisivosaurus	0.41	1.66	0.90	0.58	2.37	0.84	0.69
Kentrosaurus	0.31	1.18	0.69	0.46	0.67	0.82	0.52
Khaan	0.51	2.05	1.12	0.73	2.56	0.98	0.78
Majungasaurus	0.53	1.97	1.15	0.78	1.05	1.53	0.94
Murusraptor	0.66	2.44	1.43	0.97	1.22	1.84	1.12
*Nanotyrannus**	1.11	4.26	2.44	1.62	3.00	3.14	2.10
Ornithomimus	2.09	8.08	4.59	3.04	6.33	3.19	2.20
Protoceratops	0.60	2.31	1.32	0.88	1.71	1.78	1.21
Sinraptor	0.41	1.51	0.89	0.60	0.74	1.13	0.68
Stegosaurus	0.19	0.70	0.42	0.28	0.32	0.45	0.26
Struthiomimus	0.79	3.04	1.73	1.15	2.31	1.19	0.81
Triceratops	0.41	1.50	0.90	0.62	0.55	0.87	0.48
Troodon	1.51	5.96	3.33	2.18	5.88	2.59	1.91
Tsaagan	0.56	2.28	1.25	0.81	2.88	1.10	0.87
Tyranossaurus	1.01	3.67	2.20	1.51	1.42	2.50	1.40
Zanabazar	1.07	4.25	2.36	1.54	4.51	1.90	1.44

*not used on regressions

Table 10. Shapiro-Wilk normality test for REQ values (significant values in bold).

	Aves	Crocodylia	Non-avian Dinosauria	Squamata	Testudines
N	1700	8	28	57	10
W	0.9130	0.8852	0.8251	0.9460	0.9056

p (normal)	<0.0001	**0.2111**	0.0003	0.0130	**0.2519**

Table 11. Raw p values - Mann-Whitney pairwise test for significant median differences among group REQs (significant values in bold).

	Aves	Crocodylia	Non-avian Dinosauria	Squamata	Testudines
Aves	-	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**
Crocodylia	**<0.0001**	-	0.0979	0.7268	0.7558
Non-avian Dinosauria	**<0.0001**	0.0979	-	**0.0111**	0.0566
Squamata	**<0.0001**	0.7268	**0.0111**	-	0.6410
Testudines	**<0.0001**	0.7558	0.0566	0.6410	-

Table 12. p values - Shapiro-Wilk normality test for EQs of interest in different non-avian dinosaur groups (significant values for normal distribution in bold).

Non-avian dinosaur group	n	BEQfsp	CEQ	DinoEQ	DinoEQt	REQ	DinoEVQ	DinoEVQt
Non-Theropoda	10	0.0148	0.0141	0.0147	0.0151	0.0462	0.0267	**0.0532**
Theropoda	18	0.0004	0.0004	0.0004	0.0005	0.0058	**0.1488**	0.0110
Non-Maniraptoriformes	8	**0.5030**	**0.4487**	**0.4951**	**0.5135**	**0.7361**	**0.9329**	**0.9467**
Maniraptoriformes	10	0.0316	0.0314	0.0309	0.0329	0.0213	0.0287	0.0190
Coelurosauria	12	0.0204	0.0154	0.0192	0.0227	**0.0652**	**0.1107**	**0.0527**
Allosauroidea	5	**0.0512**	**0.0554**	**0.0525**	0.0484	**0.6838**	**0.6401**	**0.8998**
Jurassic	7	**0.5658**	**0.4726**	**0.5531**	**0.5825**	**0.5244**	**0.1708**	**0.2611**
Cretaceous	21	0.0016	0.0011	0.0015	0.0018	0.0036	**0.0881**	**0.2366**

Table 13. p values of Mann-Whitney (MW) test for equal medians (non-parametric data) and t-test for equal means (parametric data) between group EQs in non-avian dinosaurs (significant values in bold).

Group	BEQfsp	CEQ	DinoEQ	DinoEQt	REQ	DinoEVQ	DinoEVQt
non-Theropoda x Theropoda (MW)	**0,0201**	**0,0118**	**0,0176**	**0,0228**	**0,0020**	0,0582	**0,0370**
Maniraptoriformes x non-Maniraptoriformes Theropoda (MW)	0,3069	0,1976	0,2667	0,4501	**0,0004**	0,2303	0,8242
Coelurosauria x Allosauroidea (MW)	0,3166	0,2254	0,2684	0,4292	**0,0027**	-	-
Coelurosauria x Allosauroidea (t-test)	-	-	-	-	**0,0130**	0,9832	0,4077
Jurassic x Cretaceous (MW)	**0,0025**	**0,0035**	**0,0025**	**0,0042**	**0,0012**	-	-
Jurassic x Cretaceous (t-test)	-	-	-	-	-	**0,0161**	**0,0065**

Table 14. Difference along time (Jurassic to Cretaceous) between mean EQs of various non-avian dinosaur groups.

Clade	BEQfsp	CEQ	DinoEQ	DinoEQt	REQ
Allosauroidea	+0.11	+0.36	+0.23	+0.16	+0.01
Ornithopoda	+0.76	+2.75	+1.65	+1.14	+0.96
Theropoda	+0.26	+1.09	+0.58	+0.37	+1.64
Thyreophora	+0.14	+0.49	+0.29	+0.20	+0.19
Non-avian Dinosauria	+0.41	+1.64	+0.91	+0.59	+1.68

Discussion

Brain-body allometry and encephalization quotient equations

It is clear that there are different MBd x MBr allometric relations within Diapsida. Birds are known to have much larger relative brain sizes (Jerison, 1969, 1973; Butler & Hodos, 2005; Balanoff et al. 2013; Hurlburt et al. 2013), here evidenced by their higher EQs (Table 8). In addition, crocodilians, flightless ratites, penguins, and non-avian dinosaurs have strikingly different brain-body allometry, evidenced by their less steep slopes (Table 2; Figure 1). The existence of such different allometric patterns makes relative brain size comparison among diapsids a complex task.

When the log MBd x log MBr equations have similar slopes between analyzed groups the log MBd x EQ relationship is not statistically significant. For instance, log MBd x log MBr equations of Squamata and Aves have similar slopes (0.59), so the encephalization quotient derived from each equation can be used for both groups without significant bias related to log MBd ($p > 0.5$ and $r^2 < 0.01$ in both cases; Tables 6 and 7). When the slopes are different, log MBd affects calculated EQ values significantly. If the slope of the sampled group is less steep than the slope that originated the EQ equation, small-bodied species have their EQs overestimated, while EQs of large-bodied ones are underestimated (Figure 3). If the slope is steeper, the pattern shifts, and the overestimation occurs in the large-bodied taxa while the underestimation occurs in the small-bodied ones.

Log MBd affects non-avian dinosaur EQs when REQs are used. Since they have a less inclined log MBd x log MBr slope than reptiles, their EQs are distorted in such way that smaller species have their EQs overestimated, while the EQ of larger species are underestimated. If only non-avian Theropoda are analyzed, the same pattern is found.

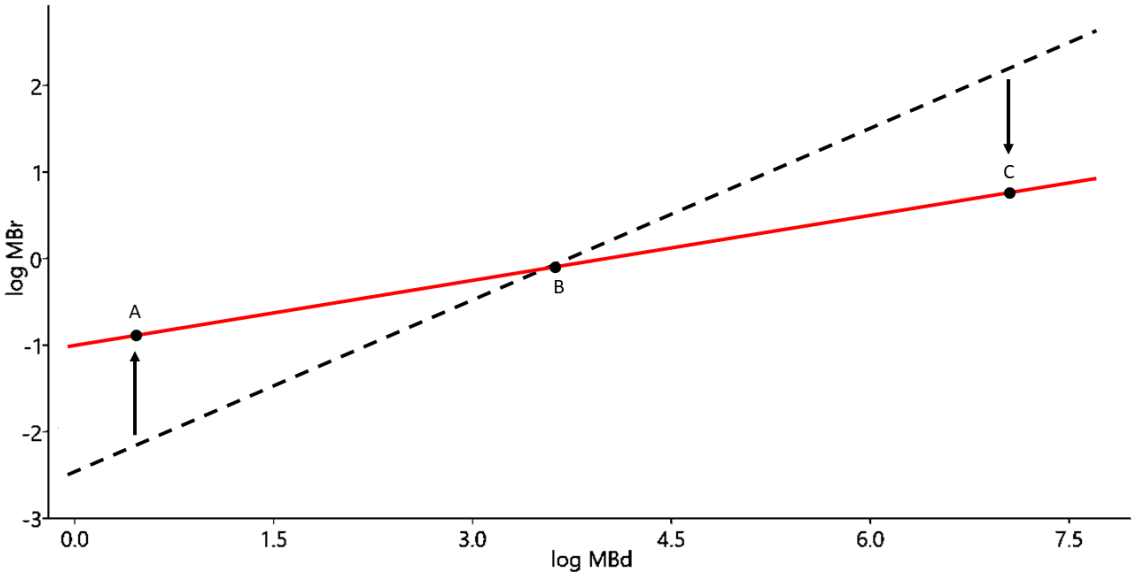

Figure 3. Log MBd x log MBr hypothetic regression lines with different slopes and hypothetic species. All species A, B, and C have EQs approaching 1.00 when compared with a group with less steep slope (red line). However, species A has a higher EQ than B and species C has a lower EQ than B, if compared with a steeper slope derived from other group (dashed black line). This artificially increases the range of obtained EQ values for the group.

The difference between Aves and other diapsids encephalization quotients have been addressed by the development of a Bird Encephalization Quotient (BEQ) and a Reptile Encephalization Quotient (REQ) (Hurlburt, 1996) and they have been used to infer and compare encephalization quotients of living and fossil taxa (e.g.: Witmer et al. 2003; Franzosa, 2004; Evans, 2005; Sampson & Witmer, 2007; Zhou et al. 2007; Knoll & Scwharz-Wings, 2009; Hurlburt et al. 2013; Lauters et al. 2013; Trotteyn & Paulina-Carabajal, 2016; Paulina-Carabajal & Currie, 2017). However, the original REQ equation (n = 62) was obtained mainly from Squamata and Testudines taxa, with crocodilians being represented by only four specimens. Therefore, the REQ equation is a mostly non-Archosauria diapsid equation, derived from the equation in Hurlburt (1996)

Log MBr = (Log MBd x 0.553) - 1.810

Both the slope and the intercept of Hurlburt (1996) equation are close to our results for living reptile groups, except for Crocodylia (Table 2). In contrast, crocodilian brain-body slope seem to be closer to flightless birds and non-avian dinosaurs.

It is possible to pinpoint where obtained values are overestimated or underestimated by equaling equations of interest. This yields the MBd where both regression lines predict the same expected MBr. Therefore, observing REQs, which are significantly affected by MBd in non-avian dinosaurs, it is possible to see that the overestimation of predicted brain size occurs when MBds are larger than 710.4 kg. Among non-avian dinosaurs, 12 sampled species are smaller than 710.4 kg and among these 11 have a REQ value above one (91.7%). However, among the 16 larger ones seven have REQs above one (43.8%). This for sure increases obtained REQ ranges, however these extreme values are biased and do not necessarily have an ecological or physiological meaning.

The use of REQ as an indicator of encephalization in crocodilians and non-avian dinosaurs can lead to erroneous conclusions. For instance, REQ results show no significant difference between the two groups (Table 11). However, this might seem not be true, since looking at their log MBd x MBr equations it is clear there are major differences in encephalization quotients (Table 2). They both have similar slopes, but their intercepts difference is 0.3192, which is close to the difference between the flightless palaeognathans and non-avian dinosaurs (0.3598). Testing CEQs instead of REQs for the three groups shows statistically significant differences among all of them (Tables 15 and 16). Incorrect results can also arise from REQ comparisons among non-avian dinosaurs. The results show significant differences between non-Maniraptoriformes Theropoda and Maniraptoriformes, and between Coelurosauria and Allosauroidea that are not found by EQs not influenced by log MBd (Table 13). These differences are actually in log MBd and not in relative brain sizes, as evidenced by other EQs (Table 13).

The currently used BEQ equation, also developed by Hulrburt (1996), faces similar issues for comparing non-avian dinosaur taxa. Our slope for Aves (0.591) is close to the original BEQ slope (0.590). In the same way that REQs are not useful for comparing within some reptile subgroups, BEQs are not useful within all bird subgroups because they can have different brain-body allometries. The ability to fly seems to be a major factor defining bird slopes, probably because flight requires a larger brain, with neural networks able to deal with the complexities of powered flight, and a lighter body, in order to decrease the amount of energy expended needed to fly. Flightless bird groupings slopes range from 0.3630 in flightless Palaeognathae to 0.4698 in Sphenisciformes. Using the equation of all flightless birds (slope 0.4430), the point where it touches the equation with all birds is for a body mass of 4.3 kg. Among the 12 species

below this mass, nine (75%) have BEQs higher than one, among the other 10, four (40%) have BEQs higher than one. Comparing BEQ with DinoEQ, the overestimation on expected brain sizes for non-avian dinosaurs BEQ occurs with body masses larger than 67.4 g. All sampled non-avian dinosaurs have higher body masses and none of them has a BEQ above one.

Table 15. Shapiro-Wilk normality test for CEQ values (significant values in bold).

	Crocodylia	Flightless Palaeognathae	Non-avian Dinosauria
N	8	7	28
W	0.8778	0.9149	0.8471
p (normal)	**0.1794**	**0.4310**	0.0008

Table 16. Raw p values - Mann-Whitney pairwise test for significant median differences among group CEQs (significant values in bold).

	Crocodylia	Flightless Palaeognathae	Non-avian Dinosauria
Crocodylia	**-**	**0,0015**	**0,0002**
Flightless Palaeognathae	**0,0015**	**-**	**0,0016**
Non-avian Dinosauria	**0,0002**	**0,0016**	**-**

It becomes clear that the REQ and BEQ are not suited to compare non-avian dinosaurs. Since they are both largely affected by body mass. In fact, for any group it is essential to examine their brain-body allometry in order to use an appropriate EQ, otherwise the results can be misleading. The bias is especially important for non-avian dinosaurs because of their extreme MBd variation. The existence of different allometric relations between MBd and MBr among diapsids explains, at least partially, why sauropod dinosaurs have such low REQ values.

Presented EQs leave a few options to compare non-avian dinosaur encephalization without the influence of MBd. Among living groups, the brain-body allometry slopes that seem to be closer to non-avian dinosaurs are the slopes for the flightless palaeognathans and crocodilians. The problem with these equations is the small sample number. We could only sample eight crocodilian species and seven fligthless palaeognathans. However, our sampling represents all crocodilian families with 30% of all living species (Grigg & Kirshner, 2015) and all flightless Palaeognathae genera (Dyke & Leonard, 2012). Other possible choices are the brain-body equations based on fossil taxa (DinoEQ and DinoEQt). The sample sizes are slightly larger than the other options (28 and 18,

respectively). Accuracy of MBd and MBr data is not the same, since they are estimations rather than direct measurements with a range of possible values. However, when considering these ranges, extreme slopes varied little from the slope using mean values (Tables 3 and 4, Figure 2). In addition, the logarithmic scale used on regressions greatly reduces how much a data point can vary and results for significant median differences are similar for either CEQ, BEQfsp, DinoEQ, or DinoEQt.

Both non-avian dinosaurs and non-avian theropods MBr extreme equations slopes varied more than the EV slopes (Table 4), as expected. Equations for fossil relative endocranial volume size should be less prone to variation than MBr equations since endocranial volumes are direct measurements. Our slope for the non-avian theropods EV equation (0.515) is close to the one recovered by Ksepka et al. (2020) non-avian Theropoda MBd x MBr (0.499). This corroborates that the latter equation is actually an EV and not an MBr equation.

Relative endocranial volume might be useful to better quantify endocranial volumes in association with paleoneurological information. For instance, *Brachiosaurus* has cerebellar and venous marks inside a relatively small head and brain cavity (Knoll & Scwharz-Wings, 2009). These are arguments in favor of a larger brain occupancy of endocranial cavity. Our results quantify and corroborate the reported small brain cavity, with a DinoEVQ of 0.72. Although less specific than relative brain size, relative endocranial volume is more accurate, since brain to endocranial ratio varies among vertebrates (Hurlburt et al., 2013; Jirak and Janacek, 2017; Watanabe et al. 2019).

Relative brain size

Groups with similar slope values are relatively easy to compare by using their intercept values. Among flying birds, turtles, legged and legless squamates, birds clearly have the largest relative brain sizes, followed by legged squamates. On the other hand, legless squamates have the smallest relative brain sizes, followed by turtles. Our results also show that non-avian dinosaurs have larger relative brain sizes than crocodilians, but smaller than flightless palaeognathans. In addition, among non-avian dinosaurs, Theropoda and Hadrosauriformes have the largest relative brain sizes, some with BEQfsp values above one. However, it is important not to carelessly draw ecological or physiological conclusions, since their bauplan clearly influences these differences. For example, in the same sense we could say that legless lizards have proportionally smaller brains we could say they have proportionally larger bodies.

Although birds are definitively the most encephalized diapsids, *Archaeopteryx lithographica* has a low DinoEQ for a non-avian dinosaur and its BEQ is considerably low for a bird (Tables 8 and 9). The DinoEQ low value is likely to be due to an allometric change towards a more birdlike MBd x MBr allometry. In this case, MBd influences the bird DinoEQs and the low values are an artifact instead of a true small relative brain size. In addition, for non-avian dinosaurs, MBd affects BEQ values (Tables 6 and 7) in a way that taxa with more than 534 g have their expected MBr overestimated, giving artificially low values for all sampled non-avian dinosaurs. Even being artificially low, five non-avian dinosaurs have higher BEQs than *A. lithographica* (Table 9). Therefore, regardless of using DinoEQ or BEQ, it seems that encephalization increased independently in birds and in non-avian dinosaurs. This could explain why *A. lithographica* intermediate position between non-avian dinosaurs and modern birds is not unique (Balanoff et al. 2013). This would not be the only case where higher encephalization occurs independently, since it is shown here that it is likely to have happened in other non-avian dinosaurs (Tables 9 and 14).

Conclusions

There is variation in allometric relationships between MBd and MBr among Diapsida, making encephalization quotient comparisons a complex task. Each comparison should be made according to the groups being analyzed and accounting for possible different allometric patterns. Inferred log MBd x log MBr of non-avian dinosaur equation seems to have a slope similar to living crocodilians and flightless palaeognathans. Unlike other EQs, log MBd does not affect obtained BEQfsp, CEQs, DinoEQs, and DinoEQts in non-avian dinosaurs, making them suitable choices for comparing relative brain sizes within a group with such a wide range of body masses. Linear log MBd x MBr or EV regressions derived from fossil groups yield a small range of variation between extreme slopes, being less affected by different brain and body size estimates than one might expect. The effect of MBd in previously used EQs also misleads the interpretation of some small sized non-avian theropoda (Maniraptoriformes) as having bigger relative brain sizes than some large ones. Even among living reptiles, the reptile encephalization quotient is biased, not taking into account different allometries. Crocodilians, for instance, have a unique slope among living reptiles. To compare among

crocodilians and closely related taxa proper quotients should be used, like CEQ. Different body plans have different slopes and/or intercepts. An increase in encephalization seems to have happened independently in non-avian theropods, hadrosauriforms, and birds. However, robust datasets for reptiles (i.e. with larger species n) are key to understand diapsid encephalization. We strongly encourage future works to obtain and share MBd and MBr data in order to construct large comprehensive databases.

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Considerações finais

Após a popularização da tomografia computadorizada, uma grande quantidade de dados tem sido gerada em paleoneurologia. Entretanto, esses dados ainda estão em fase de sistematização. Apesar de cada vez mais comuns, as descrições de *endocasts* de crocodilomorfos frequentemente deixam de trazer informações que podem ser úteis na construção de bases de dados para estudos ecológicos e evolutivos, como o volume da cavidade endocranial e coeficiente olfatório.

Necessariamente a paleoneurologia precisa se basear em animais viventes para construir e testar hipóteses. Apesar do crescente número de trabalhos em paleoneurologia de crocodilomorfos, seus representantes atuais não são bem estudados. O entendimento, por exemplo, das relações de forma e volume entre a cavidade endocranial e cérebro são baseadas em poucas espécies. Além disso, as informações disponíveis para séries verdadeiramente ontogenéticas só existem para *Alligator mississipiensis*.

Há uma diferença marcante entre estudos sobre encefalização em aves e outros diápsidos. Enquanto dados para massa cerebral e corporal em aves disponíveis na literatura existem ao menos para 1700 espécies, entre répteis esse número ainda é muito pequeno. Adicionalmente, entre répteis esses dados são majoritariamente de escamados, tornando as conclusões e inferências enviesadas. Crocodilianos são pouco representados, mas existem dados para ao menos uma espécie de cada família. Os dados de Testudines talvez se encontrem na pior situação, entre as duas grandes subdivisões do grupo todos os dados são de Cryptodira, sequer um Pleurodira está representado.

O campo da paleoneurologia está se expandindo rapidamente. Para que se possa fazer sentido e tirar melhor proveito das informações que surgem é necessário um olhar mais crítico. A disponibilização de dados importantes em trabalhos futuros deve ser observada, explorando melhor o potencial das informações paleoneurológicas. Além disso, estudos em neurociências, em especial sobre diápsidos não-avianos, são fortemente encorajados por este trabalho.

Anexo I – Informações suplementares do capítulo 2

S1 - Supplementary table 1. Endocranial and brain volumes for crocodilian individuals of different species in the literature.

Species	Endocranial volume mm³	Brain volume mm³	Reference
A. mississipiensis	742	520	Watanabe et al. 2019
A. mississipiensis	761	658	Watanabe et al. 2019
A. mississipiensis	814	784	Watanabe et al. 2019
A. mississipiensis	964	964	Watanabe et al. 2019
A. mississipiensis	1394	1157	Watanabe et al. 2019
A. mississipiensis	2508	1332	Watanabe et al. 2019
A. mississipiensis	1768	1545	Watanabe et al. 2019
A. mississipiensis	2148	1650	Watanabe et al. 2019
A. mississipiensis	4154	2164	Watanabe et al. 2019
A. mississipiensis	3679	2389	Watanabe et al. 2019
A. mississipiensis	4628	2630	Watanabe et al. 2019
A. mississipiensis	6574	4470	Hurlburt et al. 2013
A. mississipiensis	19029	8000	Hurlburt et al. 2013
A. mississipiensis	28202	9820	Hurlburt et al. 2013
A. mississipiensis	33805	10510	Hurlburt et al. 2013
Ca. crocodilus	1974	1717	Jirak & Janacek 2017
Ca. crocodilus	4403	2388	Jirak & Janacek 2017
Ca. crocodilus	11874	5648	Jirak & Janacek 2017
Cr. acutus	593	578	Jirak & Janacek 2017
Cr. niloticus	28984	8538	Jirak & Janacek 2017

S2 - Supplementary table 2. Body and brain masses for crocodilian individuals of different species in the literature.

Species	Specimen	Gender	Body mass (g)	Brain mass (g)	Reference
A. mississipiensis	1191	M	351.00	1.61	Crile & Quiring, 1940
A. mississipiensis	628	F	52400.00	7.23	Crile & Quiring, 1940
A. mississipiensis	218	M	109000.00	8.40	Crile & Quiring, 1940
A. mississipiensis	71	M	173000.00	11.20	Crile & Quiring, 1940
A. mississipiensis	1251	M	205000.00	14.08	Crile & Quiring, 1940
Ca. crocodylus	G	?	255.00	1.28	Gans, 1980
Ca. crocodylus	J	?	907.00	2.23	Gans, 1980
Ca. crocodylus	D	?	1219.00	1.79	Gans, 1980
Ca. crocodylus	F	?	1304.00	2.01	Gans, 1980
Ca. crocodylus	K	?	1304.00	1.96	Gans, 1980
Ca. crocodylus	I	?	2523.00	2.77	Gans, 1980
Ca. crocodylus	B	?	5018.00	3.50	Gans, 1980

Ca. crocodylus	C	?	5698.00	3.55	Gans, 1980
Ca. crocodylus	A	?	7371.00	3.37	Gans, 1980
Cr. acutus	RC04	?	110000	11	Platel, 1979
Cr. acutus	RC03	?	134000	15.6	Crile & Quiring, 1940
Cr. niloticus	1	M	92.00	1.440	Ngwenya et al., 2013
Cr. niloticus	2	F	111.00	1.640	Ngwenya et al., 2013
Cr. niloticus	3	M	148.00	1.600	Ngwenya et al., 2013
Cr. niloticus	4	M	156.50	1.690	Ngwenya et al., 2013
Cr. niloticus	5	F	160.50	1.790	Ngwenya et al., 2013
Cr. niloticus	6	M	175.00	1.690	Ngwenya et al., 2013
Cr. niloticus	7	F	184.00	1.780	Ngwenya et al., 2013
Cr. niloticus	8	M	190.50	1.850	Ngwenya et al., 2013
Cr. niloticus	9	M	194.50	1.750	Ngwenya et al., 2013
Cr. niloticus	10	M	326.50	2.060	Ngwenya et al., 2013
Cr. niloticus	11	M	336.50	2.120	Ngwenya et al., 2013
Cr. niloticus	12	F	343.50	1.990	Ngwenya et al., 2013
Cr. niloticus	13	M	363.00	2.060	Ngwenya et al., 2013
Cr. niloticus	14	F	365.50	2.120	Ngwenya et al., 2013
Cr. niloticus	15	F	370.00	1.980	Ngwenya et al., 2013
Cr. niloticus	16	M	371.00	1.980	Ngwenya et al., 2013
Cr. niloticus	17	F	636.50	2.180	Ngwenya et al., 2013
Cr. niloticus	18	F	675.50	2.200	Ngwenya et al., 2013
Cr. niloticus	19	F	691.50	2.460	Ngwenya et al., 2013
Cr. niloticus	20	M	950.00	2.382	Ngwenya et al., 2013
Cr. niloticus	21	M	1100.00	2.422	Ngwenya et al., 2013
Cr. niloticus	22	F	1100.00	2.542	Ngwenya et al., 2013
Cr. niloticus	23	M	1200.00	2.763	Ngwenya et al., 2013
Cr. niloticus	24	M	1400.00	2.520	Ngwenya et al., 2013
Cr. niloticus	25	F	1650.00	2.990	Ngwenya et al., 2013
Cr. niloticus	26	F	1700.00	2.908	Ngwenya et al., 2013
Cr. niloticus	27	F	1750.00	2.648	Ngwenya et al., 2013
Cr. niloticus	28	F	2000.00	3.039	Ngwenya et al., 2013
Cr. niloticus	29	F	2150.00	3.108	Ngwenya et al., 2013
Cr. niloticus	30	M	2880.00	4.159	Ngwenya et al., 2013
Cr. niloticus	31	M	3260.00	4.168	Ngwenya et al., 2013
Cr. niloticus	32	F	3800.00	4.421	Ngwenya et al., 2013
Cr. niloticus	33	M	4120.00	4.820	Ngwenya et al., 2013
Cr. niloticus	34	F	4180.00	4.547	Ngwenya et al., 2013
Cr. niloticus	35	F	5340.00	4.611	Ngwenya et al., 2013
Cr. niloticus	36	F	6100.00	4.788	Ngwenya et al., 2013
Cr. niloticus	37	F	6220.00	4.509	Ngwenya et al., 2013
Cr. niloticus	38	M	6300.00	4.066	Ngwenya et al., 2013
Cr. niloticus	39	F	7380.00	4.223	Ngwenya et al., 2013
Cr. niloticus	40	M	7720.00	4.728	Ngwenya et al., 2013

Cr. niloticus	41	F	8000.00	4.516	Ngwenya et al., 2013
Cr. niloticus	42	M	8520.00	4.780	Ngwenya et al., 2013
Cr. niloticus	43	F	8860.00	4.807	Ngwenya et al., 2013
Cr. niloticus	44	M	10060.00	5.355	Ngwenya et al., 2013
Cr. niloticus	45	F	12700.00	4.800	Ngwenya et al., 2013
Cr. niloticus	46	M	13500.00	4.783	Ngwenya et al., 2013
Cr. niloticus	47	M	13500.00	5.077	Ngwenya et al., 2013
Cr. niloticus	48	M	15700.00	5.117	Ngwenya et al., 2013
Cr. niloticus	49	M	17020.00	4.635	Ngwenya et al., 2013
Cr. niloticus	50	F	17100.00	5.044	Ngwenya et al., 2013
Cr. niloticus	51	F	18840.00	5.514	Ngwenya et al., 2013
Cr. niloticus	52	M	19140.00	5.508	Ngwenya et al., 2013
Cr. niloticus	53	M	20200.00	5.706	Ngwenya et al., 2013
Cr. niloticus	54	F	22700.00	5.643	Ngwenya et al., 2013
Cr. niloticus	55	M	25090.00	5.675	Ngwenya et al., 2013
Cr. niloticus	56	F	25100.00	5.708	Ngwenya et al., 2013
Cr. niloticus	57	M	28080.00	5.908	Ngwenya et al., 2013
Cr. niloticus	58	M	29500.00	6.757	Ngwenya et al., 2013
Cr. niloticus	59	M	36900.00	7.041	Ngwenya et al., 2013
Cr. niloticus	60	M	38100.00	7.625	Ngwenya et al., 2013
Cr. niloticus	61	M	38500.00	6.450	Ngwenya et al., 2013
Cr. niloticus	62	F	38600.00	6.530	Ngwenya et al., 2013
Cr. niloticus	63	M	55000.00	7.614	Ngwenya et al., 2013
Cr. niloticus	64	M	55000.00	7.621	Ngwenya et al., 2013
Cr. niloticus	65	F	70000.00	7.886	Ngwenya et al., 2013
Cr. niloticus	66	M	71000.00	8.565	Ngwenya et al., 2013
Cr. niloticus	67	M	72000.00	7.862	Ngwenya et al., 2013
Cr. niloticus	68	F	75000.00	7.705	Ngwenya et al., 2013
Cr. niloticus	69	M	86000.00	7.902	Ngwenya et al., 2013
Cr. niloticus	70	M	90000.00	9.114	Ngwenya et al., 2013
Cr. siamensis	27	?	280.00	0.94	Chentanez et al., 1983
Cr. siamensis	1	F	3510.00	3.63	Chentanez et al., 1983
Cr. siamensis	2	F	5970.00	3.34	Chentanez et al., 1983
Cr. siamensis	28	M	7450.00	5.09	Chentanez et al., 1983
Cr. siamensis	29	M	10520.00	4.63	Chentanez et al., 1983
Cr. siamensis	30	M	11010.00	4.58	Chentanez et al., 1983
Cr. siamensis	3	F	11160.00	4.77	Chentanez et al., 1983
Cr. siamensis	31	M	11510.00	4.24	Chentanez et al., 1983
Cr. siamensis	4	F	12680.00	4.18	Chentanez et al., 1983
Cr. siamensis	32	M	12980.00	4.58	Chentanez et al., 1983
Cr. siamensis	5	F	13020.00	4.18	Chentanez et al., 1983
Cr. siamensis	6	F	13480.00	3.99	Chentanez et al., 1983
Cr. siamensis	7	F	13520.00	4.29	Chentanez et al., 1983
Cr. siamensis	8	F	13520.00	4.67	Chentanez et al., 1983

Cr. siamensis	33	M	14010.00	4.27	Chentanez et al., 1983
Cr. siamensis	34	M	14120.00	4.86	Chentanez et al., 1983
Cr. siamensis	9	F	14500.00	4.67	Chentanez et al., 1983
Cr. siamensis	10	F	14610.00	4.86	Chentanez et al., 1983
Cr. siamensis	11	F	14840.00	4.43	Chentanez et al., 1983
Cr. siamensis	12	F	14990.00	4.35	Chentanez et al., 1983
Cr. siamensis	14	F	14990.00	5.07	Chentanez et al., 1983
Cr. siamensis	13	F	15030.00	4.79	Chentanez et al., 1983
Cr. siamensis	15	F	15340.00	4.58	Chentanez et al., 1983
Cr. siamensis	35	M	15450.00	5.26	Chentanez et al., 1983
Cr. siamensis	16	F	15490.00	4.77	Chentanez et al., 1983
Cr. siamensis	36	M	15560.00	4.97	Chentanez et al., 1983
Cr. siamensis	17	F	15710.00	4.50	Chentanez et al., 1983
Cr. siamensis	18	F	15830.00	5.03	Chentanez et al., 1983
Cr. siamensis	19	F	15940.00	4.88	Chentanez et al., 1983
Cr. siamensis	37	M	16020.00	4.63	Chentanez et al., 1983
Cr. siamensis	38	M	16510.00	4.12	Chentanez et al., 1983
Cr. siamensis	39	M	16550.00	4.77	Chentanez et al., 1983
Cr. siamensis	20	F	16700.00	5.68	Chentanez et al., 1983
Cr. siamensis	21	F	17000.00	5.30	Chentanez et al., 1983
Cr. siamensis	40	M	17530.00	4.71	Chentanez et al., 1983
Cr. siamensis	22	F	18030.00	3.69	Chentanez et al., 1983
Cr. siamensis	41	M	18440.00	5.70	Chentanez et al., 1983
Cr. siamensis	42	M	18900.00	5.81	Chentanez et al., 1983
Cr. siamensis	43	M	18940.00	4.69	Chentanez et al., 1983
Cr. siamensis	44	M	18940.00	4.79	Chentanez et al., 1983
Cr. siamensis	45	M	18940.00	5.22	Chentanez et al., 1983
Cr. siamensis	46	M	19280.00	5.62	Chentanez et al., 1983
Cr. siamensis	47	M	19430.00	5.83	Chentanez et al., 1983
Cr. siamensis	48	M	19850.00	6.11	Chentanez et al., 1983
Cr. siamensis	23	F	20340.00	6.51	Chentanez et al., 1983
Cr. siamensis	24	F	20950.00	5.39	Chentanez et al., 1983
Cr. siamensis	49	M	21440.00	5.92	Chentanez et al., 1983
Cr. siamensis	26	F	21860.00	6.74	Chentanez et al., 1983
Cr. siamensis	25	F	21890.00	5.58	Chentanez et al., 1983
Cr. siamensis	50	M	22270.00	6.00	Chentanez et al., 1983
Cr. siamensis	51	M	22960.00	4.79	Chentanez et al., 1983

Anexo II – Informações suplementares do capítulo 3

S1 - Supplementary references

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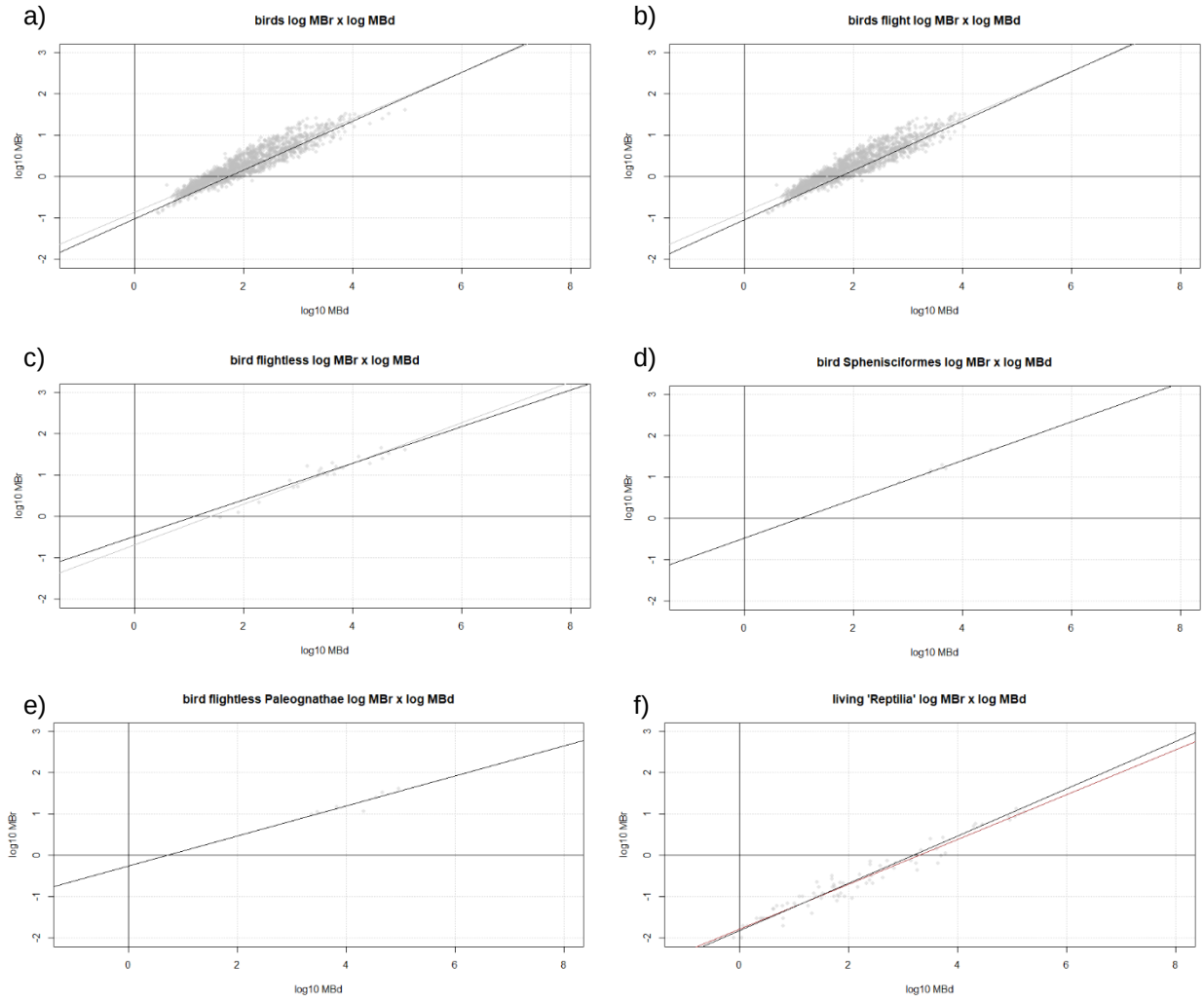
S2 - Supplementary figure 1. OLS and PGLS log MBd x log MBr plot and regression lines of all studied groups (a – n) and log MBd x log EV of studied fossil groups (o – t). **a** – Aves (all); **b** – flying Aves; **c** – flightless Aves; **d** - Sphenisciformes; **e** – flightless Palaeognathae; **f** – living Reptilia; **g** – Squamata (all); **h** – legged Squamata; **i** – legless Squamata; **j** - Testudines; **k** - Crocodylia; **l** – non-avian Theropods (MBr); **m** – steepest non-avian Theropods (MBr); **n** – least steep non-avian Theropods (MBr); **o** – non-avian Theropoda (EV); **p** – steepest non-avian Theropoda (EV); **q** – least steep non-avian Theropoda (EV); **r** – non-avian Dinosauria (EV); **s** – steepest non-avian Dinosauria (EV); **t** – least steep non-avian Dinosauria (EV).



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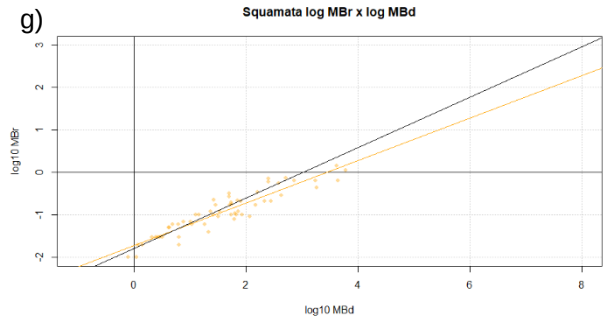
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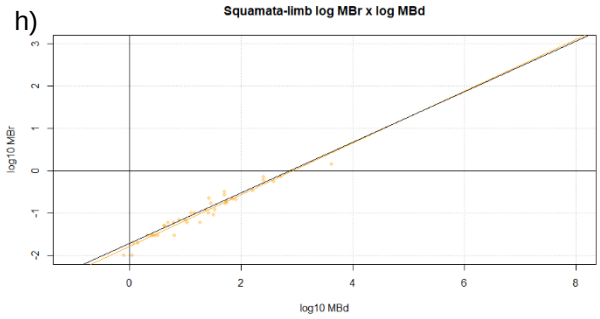
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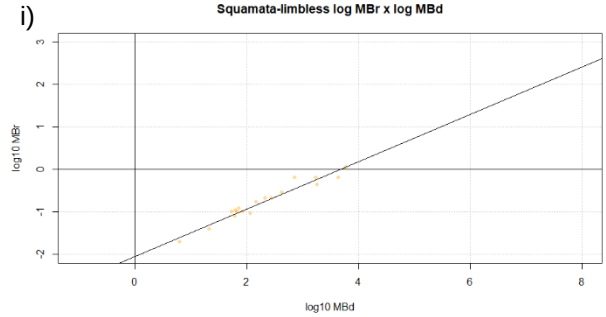
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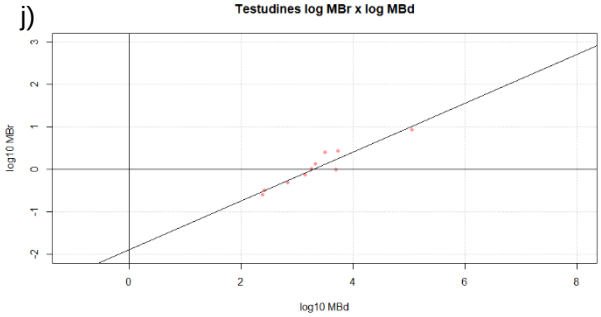
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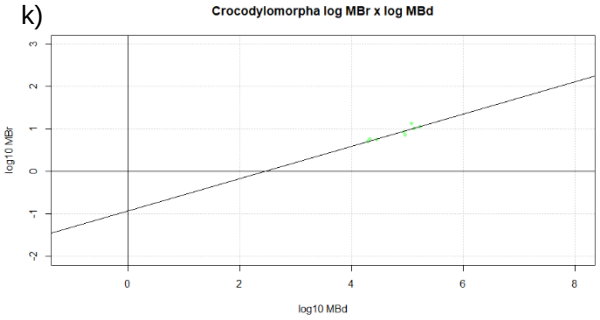
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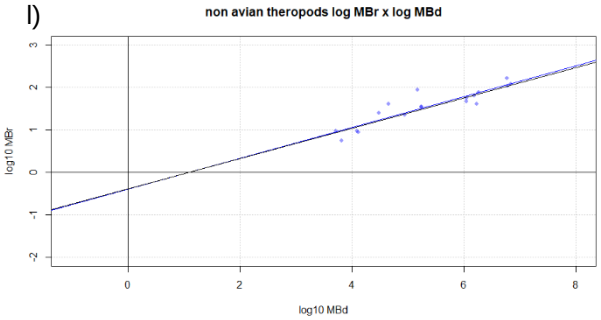
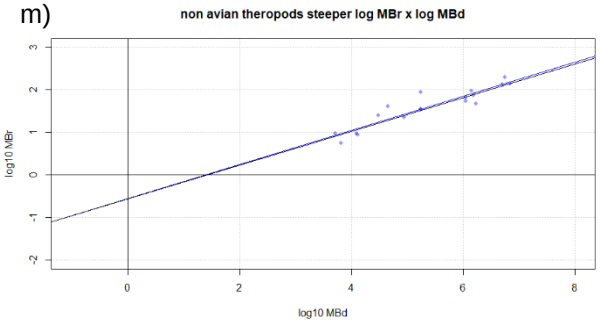
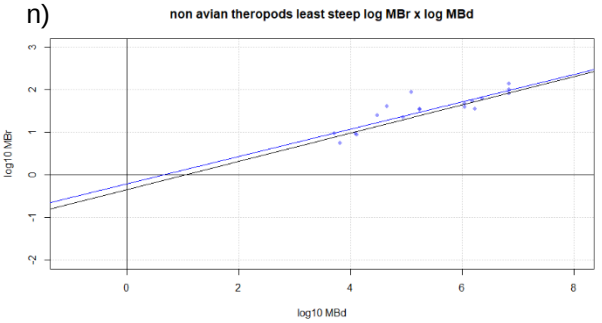

non avian theropods log MBr x log MBd
log10 MBr
log10 MBd

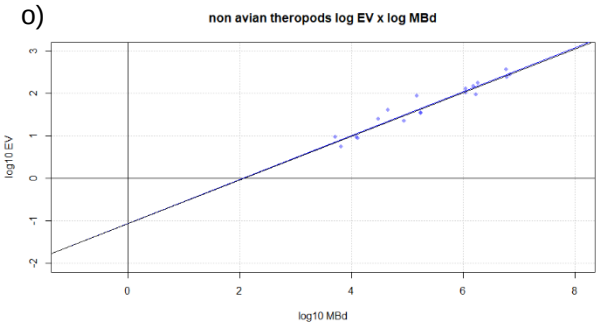
m)


non avian theropods steeper log MBr x log MBd
log10 MBr
log10 MBd

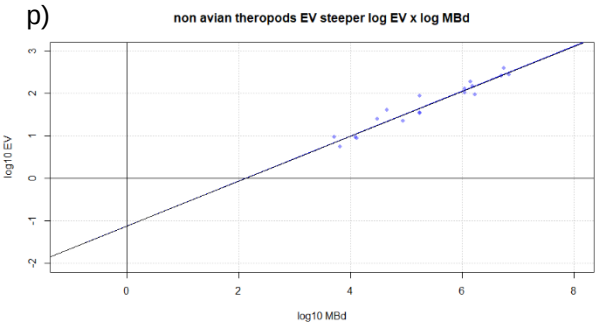
n)

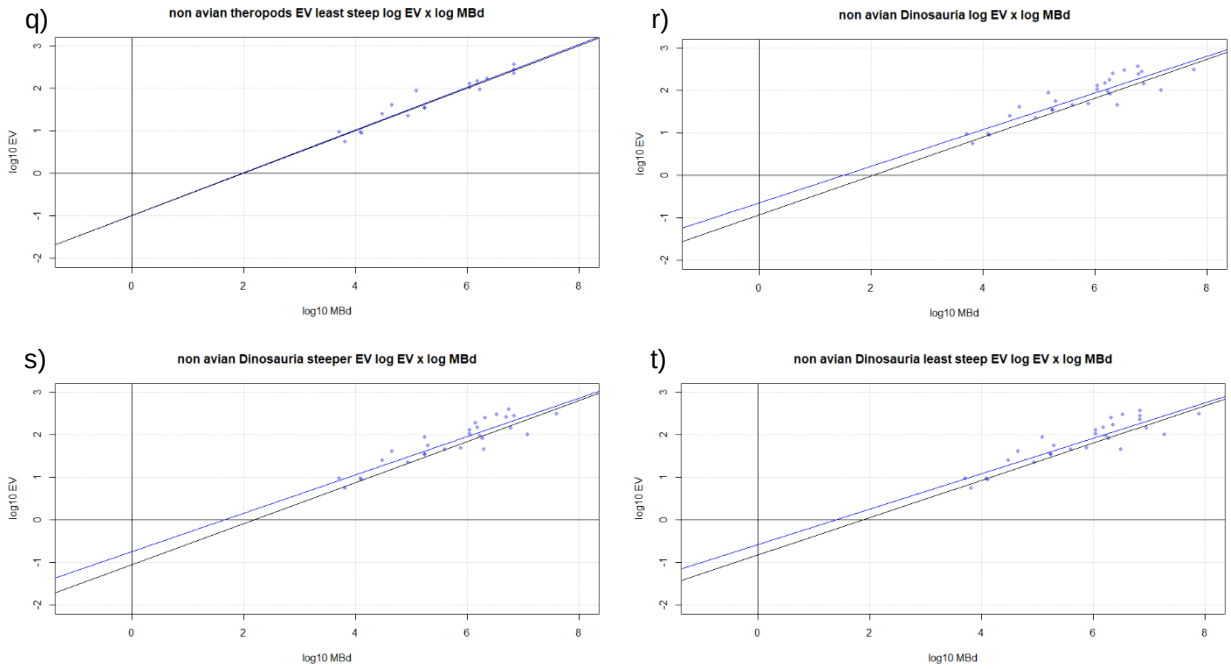

non avian theropods least steep log MBr x log MBd
log10 MBr
log10 MBd

o)


non avian theropods log EV x log MBd
log10 EV
log10 MBd

p)


non avian theropods EV steeper log EV x log MBd
log10 EV
log10 MBd



S3 - Supplementary table 1. Raw brain and body mass data for living species gathered from the literature.

Clade	Species	Specimens	Body mass (g)	Brain mass (g)	Reference	Remarks
Crocodylia	*Alligator mississipiensis*	1	52400.00	7.23	Crile & Quiring, 1940	
Crocodylia	*Alligator mississipiensis*	1	109000.00	8.40	Crile & Quiring, 1940	
Crocodylia	*Alligator mississipiensis*	1	173000.00	11.20	Crile & Quiring, 1940	
Crocodylia	*Alligator mississipiensis*	1	205000.00	14.08	Crile & Quiring, 1940	
Crocodylia	*Caiman crocodylus*	1	28970.90*	5.65	Jirak & Janacek, 2017; *Estimated from log transformed MBr x MBd equation derived from C. Crocodylus specimens in Gans, 1980	
Crocodylia	*Crocodylus acutus*	1	110000	11	Platel, 1979	
Crocodylia	*Crocodylus acutus*	1	134000.00	15.60	Crile & Quiring, 1940	
Crocodylia	*Crocodylus niloticus*	1	86000.00	7.902	Ngwenya et al., 2013	
Crocodylia	*Crocodylus niloticus*	1	90000.00	9.114	Ngwenya et al., 2013	
Crocodylia	*Crocodylus niloticus*	1	151389.3	8.38	Serrano-Martínez et al., 2019	
Crocodylia	*Crocodylus siamensis*	1	20950.00	5.39	Chentanez et al., 1983	
Crocodylia	*Crocodylus siamensis*	1	21440.00	5.92	Chentanez et al., 1983	
Crocodylia	*Crocodylus siamensis*	1	21860.00	6.74	Chentanez et al., 1983	
Crocodylia	*Crocodylus siamensis*	1	21890.00	5.58	Chentanez et al., 1983	
Crocodylia	*Crocodylus siamensis*	1	22270.00	6.00	Chentanez et al., 1983	
Crocodylia	*Crocodylus siamensis*	1	22960.00	4.79	Chentanez et al., 1983	
Crocodylia	*Osteolaemus tetraspis*	1	20228.39	4.96	Serrano-Martínez et al., 2019	
Crocodylia	*Gavialis gangeticus*	1	170000	11.32	Serrano-Martínez et al., 2019	
Crocodylia	*Tomistoma schlegelii*	1	93619.6	7.08	Serrano-Martínez et al., 2019	
Neognathae	*Accipiter cirrocephalus*	11	169.90	2.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Accipiter cooperii*	8	323.20	4.70	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Accipiter fasciatus*	11	402.50	4.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Accipiter gentilis*	21	872.50	7.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Accipiter griseogularis*	10	510.00	4.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Accipiter haplochrous*	7	204.50	3.91	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Accipiter nisus*	1	260.00	3.08	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Accipiter novaehollandiae*	6	591.90	4.74	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Accipiter striatus*	20	118.00	2.23	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aegypius monachus*	1	9000.00	24.81	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Aegypius tracheliotus*	3	6200.00	27.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aquila audax*	7	3350.00	16.24	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aquila chrysaetos*	33	3991.50	17.19	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aquila fasciatus*	3	2000.00	10.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aquila rapax*	3	2250.00	13.31	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aviceda subcristata*	5	358.60	4.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Busarellus nigricollis*	2	804.50	8.75	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Buteo buteo*	10	875.00	7.94	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Buteo jamaicensis*	27	1053.90	9.18	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Buteo lagopus*	17	961.90	9.20	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Buteo lineatus*	10	606.90	7.19	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Buteo magnirostris*	11	334.60	4.56	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Buteo platypterus*	10	397.00	5.12	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Buteo polysoma*	3	950.00	8.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Buteo regalis*	7	1469.50	9.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Buteo swainsoni*	27	899.00	7.36	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Buteogallus anthracinus*	8	923.80	7.17	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Buteogallus urabatinga*	5	1141.10	10.17	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Circus aeruginosus*	unespecified	568.50	5.30	Sayol et al, 2016	Fly
Neognathae	*Circus cyaneus*	11	337.00	4.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Coragyps atratus*	7	2080.50	11.99	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Elanus axillaris*	8	234.00	3.37	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gypohierax angolensis*	2	1500.00	10.13	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gyps africanus*	4	5500.00	18.25	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gyps africanus*	1	5270.00	19.60	Crile & Quiring, 1940	Fly
Neognathae	*Haliaeetus leucocephalus*	13	4418.90	18.04	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Haliaeetus leucogaster*	10	3004.00	12.63	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Haliaeetus vocifer*	3	2806.00	12.19	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Haliastur indus*	10	530.00	6.10	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Haliastur sphenurus*	8	920.20	6.61	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Harpagus bidentatus*	4	187.80	3.83	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Heterospizias meridionalis*	3	808.00	7.84	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Hieraaetus morphnoides*	5	1425.00	7.81	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ictinia mississippiensis*	3	278.00	3.69	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Kaupifalco monogrammicus*	7	311.50	4.03	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Leucopternis albicollis*	unespecified	609.72	8.15	Sayol et al, 2016	Fly
Neognathae	*Lophaetus occipitalis*	3	1292.50	9.15	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melierax canorus*	2	684.00	6.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Milvus migrans*	10	595.50	5.82	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pandion haliaetus*	11	1485.50	9.38	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Parabuteo unicinctus*	5	863.20	7.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Polyboroides typus*	2	796.00	8.00	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Rostrhamus sociabilis*	5	420.00	5.09	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Stephanoaetus coronatus*	3	3640.00	14.06	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Terathopius ecaudatus*	3	2438.50	14.69	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aix galericulata*	8	495.00	4.22	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aix sponsa*	10	673.00	4.25	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Alopochen aegyptiacus*	9	1938.00	6.93	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Alopochen aegyptica*	1	1935.00	7.64	Crile & Quiring, 1940	Fly
Neognathae	*Amazonetta brasiliensis*	3	590.00	3.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anas acuta*	10	844.00	4.72	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anas americana*	10	734.10	4.05	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anas carolinensis*	10	320.80	2.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anas castanea*	8	601.00	3.73	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anas clypeata*	10	542.90	3.56	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anas crecca*	unespecified	320.86	2.63	Sayol et al, 2016	Fly
Neognathae	*Anas cyanoptera*	10	377.50	3.26	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anas discors*	10	366.60	2.93	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anas eatoni*	unespecified	454.86	3.40	Sayol et al, 2016	Fly
Neognathae	*Anas flavirostris*	4	429.50	3.56	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anas gracilis*	10	450.50	3.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anas hottentota*	5	238.50	3.01	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anas laysanensis*	7	459.50	3.55	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anas penelope*	1	700.00	4.05	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Anas platalea*	3	542.50	3.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anas platyrhynchos*	10	1110.50	5.44	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anas rhynchotis*	8	620.00	3.54	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anas smithii*	5	833.50	3.77	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anas strepera*	10	889.50	3.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anas superciliosa*	10	1043.00	5.33	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anas veriscolor*	3	397.50	3.63	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anas wyvilliana*	9	515.10	4.54	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anser albifrons*	8	3120.00	9.09	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anser anser*	1	3250.00	11.32	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Anser caerulescens*	10	2292.40	10.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anser caerulescens*	unespecified	2026.37	10.58	Sayol et al, 2016	Fly
Neognathae	*Anser fabalis*	3	2397.50	10.65	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anser rossii*	4	1424.00	6.85	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Anser rossii*	unespecified	2036.52	6.60	Sayol et al, 2016	Fly
Neognathae	*Anseranas semipalmata*	9	2283.40	8.80	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aythya affinis*	11	755.50	4.18	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aythya americana*	10	1055.00	5.46	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aythya australis*	5	870.00	4.89	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aythya collaris*	10	717.30	5.38	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aythya marila*	1	787.00	4.80	Crile & Quiring, 1940	Fly
Neognathae	*Aythya valisineria*	10	1203.00	6.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Biziura lobata*	9	1971.30	8.72	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Branta bernicla*	10	1420.40	6.10	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Branta canadensis*	9	1645.00	6.47	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Branta canadensis*	10	3665.00	11.53	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Bucephala albeola*	10	347.30	4.10	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Bucephala clangula*	10	888.70	5.95	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Bucephala islandica*	4	915.00	5.83	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cairina moschata*	3	2625.00	7.35	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calonetta leucophrys*	2	264.30	3.25	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cereopsis novaehollandiae*	9	4530.00	8.83	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chauna chavaria*	3	4400.00	8.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chenonetta jubata*	10	775.00	4.08	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chloephaga hybrida*	9	2691.20	7.61	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chloephaga poliocephala*	4	2233.50	5.80	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Clangula hyemalis*	10	730.00	4.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Coscoroba coscoroba*	7	4400.00	9.16	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cygnus atratus*	12	5685.00	12.15	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cygnus buccinator*	8	10863.00	20.29	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cygnus columbianus*	10	6750.00	17.35	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cygnus cygnus*	3	9450.00	19.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cygnus olor*	1	11000.00	16.00	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Dendrocygna arcuata*	7	730.00	4.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dendrocygna eytoni*	12	746.00	4.56	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Histrionicus histrionicus*	5	611.30	4.86	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lophodytes cucullatus*	10	610.00	4.61	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lophonetta specularoides*	5	926.70	4.84	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Malacorhynchus membranaceus*	11	363.60	2.85	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melanitta deglandi*	9	1545.60	6.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melanitta fusca*	unespecified	1545.34	6.67	Sayol et al, 2016	Fly
Neognathae	*Melanitta nigra*	6	1001.10	5.85	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melanitta perspicillata*	8	992.30	5.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Mergus merganser*	9	1393.60	4.86	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Mergus serrator*	11	1041.00	4.83	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Mergus serrator*	1	900.00	5.03	Portmann 1946, 1947 in Hurlburt, 1996	Fly

Neognathae	*Neochen jubata*	4	1333.00	5.80	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Netta rufina*	7	1051.00	5.36	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Nettapus pulchellus*	10	372.50	2.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Oxyura australis*	7	832.00	4.02	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Oxyura jamaicensis*	10	532.70	3.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Oxyura maccoa*	2	862.50	4.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Plectropterus gambensis*	5	5400.00	12.13	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Polysticta stelleri*	8	869.50	5.28	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pteronetta hartlaubi*	2	870.00	5.73	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sarkidornis melanotos*	6	1776.30	6.99	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Somateria mollissima*	1	2050.00	8.72	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Somateria mollissima*	10	2550.00	8.32	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Somateria spectabilis*	10	1660.30	7.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Speculanas specularis*	unespecified	1216.82	6.10	Sayol et al, 2016	Fly
Neognathae	*Stictonetta naevosa*	10	886.90	4.41	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tachyeres leucocephalus*	unespecified	3501.69	10.20	Sayol et al, 2016	Flightless
Neognathae	*Tachyeres patachonicus*	2	2780.00	9.08	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tachyeres pteneres*	3	4725.00	10.63	Iwaniuk & Nelson, 2003	Flightless
Neognathae	*Tadorna radjah*	6	887.00	5.18	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tadorna tadorna*	5	1001.70	5.33	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tadorna tadornoides*	7	1425.00	5.83	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tadorna variegata*	4	1549.50	5.96	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aeronautes saxatilis*	9	31.20	0.67	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Apus apus*	6	37.60	0.67	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Apus pallidus*	10	41.90	0.72	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chaetura pelagica*	8	23.60	0.46	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Collocalia esculenta*	7	5.30	0.20	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Collocalia spodiopygia*	10	6.80	0.24	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cypsiurus parvus*	2	13.60	0.30	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eulampis holosericeus*	unespecified	5.65	0.24	Sayol et al, 2016	Fly
Neognathae	*Glaucis hirsutus*	4	7.20	0.25	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Hemiprocne mystacea*	4	74.50	1.10	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Hirundapus caudacutus*	10	93.50	1.29	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Streptoprocne zonaris*	2	98.10	1.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tachornis phoenicobia*	6	9.90	0.28	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tachymarptis melba*	1	90.00	1.11	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Aceros leucocephalus*	3	1086.00	12.81	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aceros plicatus*	6	1720.00	15.42	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aceros undulatus*	3	2232.50	18.25	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anthracoceros coronatus*	2	300.00	7.93	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Berenicornis albocristatus*	2	1415.00	4.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Buceros bicornis*	4	2798.50	18.25	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Buceros hydrocorax*	unespecified	1399.68	17.00	Sayol et al, 2016	Fly
Neognathae	*Buceros rhinoceros*	3	2380.00	17.38	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Bucorvus abyssinicus*	5	3767.50	23.75	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Bycanistes cylindricus*	2	1105.50	10.13	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Penelopides panini*	2	473.50	6.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phoeniculus purpureus*	unespecified	78.02	2.05	Sayol et al, 2016	Fly
Neognathae	*Tockus deckeni*	6	169.50	3.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tockus erythrorhynchus*	6	139.00	3.53	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tockus flavirostris*	4	237.80	4.25	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tockus nasutus*	2	156.50	4.05	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aegotheles cristatus*	8	41.00	1.42	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Caprimulgus carolinensis*	9	108.90	1.36	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Caprimulgus europaeus*	10	67.00	0.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Caprimulgus macrurus*	9	78.00	1.01	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Caprimulgus vexillarius*	6	66.10	0.87	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Caprimulgus vociferus*	10	50.80	0.82	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chordeiles minor*	10	79.30	0.85	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chordeiles nacunda*	3	213.30	1.29	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eurostopodus argus*	unespecified	72.02	0.98	Sayol et al, 2016	Fly
Neognathae	*Eurostopodus macrotis*	5	168.80	1.46	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eurostopodus mystacialis*	2	170.00	1.33	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Nyctibius griseus*	5	257.40	1.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Nyctidromus albicollis*	8	53.00	0.91	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Nyctiphrynus ocellatus*	3	39.00	0.74	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Nyctiprogne leucopyga*	4	23.00	0.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Podargus strigoides*	15	387.30	4.86	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Actitis hypoleucos*	5	51.70	0.86	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Actitis macularius*	6	45.40	0.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aethia pusilla*	10	84.60	1.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Alca torda*	10	719.00	5.38	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Alle alle*	10	167.30	2.10	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anous cerulea*	10	50.60	1.12	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anous stolidus*	10	172.50	2.23	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Arenaria interpres*	10	92.50	1.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Arenaria melanocephala*	unespecified	121.88	1.54	Sayol et al, 2016	Fly
Neognathae	*Bartramia longicauda*	12	159.00	1.30	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Brachyramphus marmoratum*	9	233.40	2.35	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Burhinus bistriatus*	4	787.00	4.66	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Burhinus grallarius*	3	732.50	4.31	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calidris acuminata*	10	81.60	0.99	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calidris alba*	10	57.00	1.01	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calidris alpina*	10	57.00	1.00	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calidris bairdii*	unespecified	38.09	0.71	Sayol et al, 2016	Fly

Neognathae	*Calidris canutus*	10	137.00	1.32	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calidris falcinellus*	6	34.20	0.72	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calidris ferruginea*	11	60.30	0.99	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calidris fuscicollis*	10	40.70	0.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calidris himantopus*	unespecified	69.20	0.96	Sayol et al, 2016	Fly
Neognathae	*Calidris himantopus*	10	57.30	0.92	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calidris mauri*	unespecified	26.02	0.63	Sayol et al, 2016	Fly
Neognathae	*Calidris melanotos*	10	72.90	1.02	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calidris minuta*	10	23.00	0.53	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calidris minutilla*	10	25.20	0.55	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calidris pugnax*	10	137.50	1.56	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calidris pusilla*	11	27.50	0.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calidris ruficollis*	10	29.60	0.66	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calidris subminuta*	2	30.20	0.59	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calidris subruficollis*	6	75.60	1.03	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calidris tenuirostris*	6	147.50	1.54	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cepphus grylle*	10	405.00	3.61	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cerorhinca monocerata*	7	487.50	4.63	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Charadrius alexandrinus*	unespecified	36.97	0.89	Sayol et al, 2016	Fly
Neognathae	*Charadrius australis*	unespecified	80.96	1.15	Sayol et al, 2016	Fly
Neognathae	*Charadrius bicinctus*	8	62.60	1.11	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Charadrius falklandicus*	unespecified	70.53	1.17	Sayol et al, 2016	Fly
Neognathae	*Charadrius leschenaultii*	10	68.50	1.26	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Charadrius melodus*	unespecified	51.32	0.96	Sayol et al, 2016	Fly
Neognathae	*Charadrius modestus*	unespecified	77.63	1.24	Sayol et al, 2016	Fly
Neognathae	*Charadrius mongolus*	7	63.70	1.13	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Charadrius pecuaurius*	6	34.00	0.82	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Charadrius ruficapillus*	3	46.20	0.82	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Charadrius semipalmatus*	10	47.00	0.96	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Charadrius tricollaris*	unespecified	147.97	0.80	Sayol et al, 2016	Fly
Neognathae	*Charadrius vociferus*	14	85.50	1.12	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Charadrius wilsonia*	unespecified	65.76	1.03	Sayol et al, 2016	Fly
Neognathae	*Chionis albus*	6	400.00	3.97	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chionis minor*	unespecified	509.79	3.40	Sayol et al, 2016	Fly
Neognathae	*Chlidonias hybrida*	4	88.20	1.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cladorhynchus leucocephalus*	4	213.00	1.61	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cursorius cursor*	3	138.00	1.44	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Elseyornis melanops*	3	30.00	0.84	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Erythrogonys cinctus*	unespecified	50.00	1.05	Sayol et al, 2016	Fly
Neognathae	*Esacus giganteus*	unespecified	1005.26	5.51	Sayol et al, 2016	Fly
Neognathae	*Esacus magnirostris*	3	1000.00	5.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Esacus neglectus*	2	995.00	5.35	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Fratercula arctica*	9	483.50	4.05	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Fratercula corniculata*	11	641.10	5.19	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gallinago gallinago*	10	74.20	1.41	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gallinago hardwickii*	4	156.00	1.99	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gallinago nobilis*	unespecified	175.91	2.20	Sayol et al, 2016	Fly
Neognathae	*Gallinago undulata*	unespecified	284.86	2.89	Sayol et al, 2016	Fly
Neognathae	*Glareola nuchalis*	2	47.50	0.85	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gygis alba*	10	109.90	1.93	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Haematopus ater*	unespecified	825.51	5.15	Sayol et al, 2016	Fly
Neognathae	*Haematopus bachmani*	5	554.90	4.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Haematopus leucopodus*	unespecified	659.18	4.55	Sayol et al, 2016	Fly
Neognathae	*Haematopus longirostris*	unespecified	588.16	4.30	Sayol et al, 2016	Fly
Neognathae	*Haematopus ostralegus*	unespecified	514.40	4.35	Sayol et al, 2016	Fly
Neognathae	*Haematopus palliatus*	8	602.50	4.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Himantopus mexicanus*	9	168.90	1.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Hydrophasianus chirurgus*	7	178.50	1.40	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Irediparra gallinacea*	4	102.60	1.13	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Jacana spinosa*	9	118.00	1.38	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Larus argentatus*	9	1085.00	6.69	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Larus atricilla*	unespecified	327.01	3.15	Sayol et al, 2016	Fly
Neognathae	*Larus californicus*	unespecified	692.98	5.07	Sayol et al, 2016	Fly
Neognathae	*Larus canus*	unespecified	382.22	4.25	Sayol et al, 2016	Fly
Neognathae	*Larus delawarensis*	10	508.20	4.44	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Larus dominicanus*	7	968.00	6.61	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Larus fuscus*	unespecified	824.68	5.88	Sayol et al, 2016	Fly
Neognathae	*Larus glaucescens*	15	1408.90	7.62	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Larus hartlaubii*	unespecified	271.51	3.07	Sayol et al, 2016	Fly
Neognathae	*Larus maculipennis*	unespecified	304.90	3.30	Sayol et al, 2016	Fly
Neognathae	*Larus marinua*	1	1670.00	7.78	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Larus minutus*	unespecified	119.46	1.70	Sayol et al, 2016	Fly
Neognathae	*Larus novaehollandiae*	12	291.90	3.12	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Larus philadelphia*	unespecified	233.69	2.30	Sayol et al, 2016	Fly
Neognathae	*Larus pipixcan*	unespecified	302.48	2.52	Sayol et al, 2016	Fly
Neognathae	*Larus ridibundus*	1	250.00	2.81	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Larus ridibundus*	10	276.90	3.05	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Larus scoresbii*	3	520.00	4.64	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Larus thayeri*	unespecified	995.26	6.30	Sayol et al, 2016	Fly
Neognathae	*Limnodromus griseus*	10	109.40	1.38	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Limnodromus scolopaceus*	11	91.80	1.37	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Limosa fedoa*	13	343.00	2.73	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Limosa haemastica*	unespecified	245.43	2.31	Sayol et al, 2016	Fly
Neognathae	*Limosa lapponica*	10	313.30	2.77	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Numenius americanus*	12	510.20	3.80	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Numenius madagascariensis*	5	792.00	4.70	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Numenius phaeopus*	6	379.50	3.13	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pagophila eburnea*	10	529.50	4.83	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pedionomus torquatus*	3	51.50	0.77	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phaetusa simplex*	2	232.00	3.00	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phalaropus fulicaria*	2	49.40	0.56	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phalaropus lobatus*	10	35.30	0.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phalaropus tricolor*	12	61.00	0.65	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phalaropus tricolor*	unespecified	61.01	0.65	Sayol et al, 2016	Fly
Neognathae	*Pluvialis apricaria*	6	212.90	2.23	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pluvialis dominica*	11	158.70	1.82	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pluvialis fulva*	unespecified	145.04	1.65	Sayol et al, 2016	Fly
Neognathae	*Pluvialis squatarola*	8	214.00	2.56	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ptychoramphus aleutica*	10	191.80	2.06	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Recurvirostra americana*	17	325.70	2.10	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Recurvirostra avosetta*	unespecified	154.47	1.75	Sayol et al, 2016	Fly
Neognathae	*Recurvirostra novaehollandiae*	6	273.80	1.99	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Rhodostethia rusea*	5	223.40	2.15	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Rissa tridactyla*	10	475.40	4.31	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Rostratula benghalensis*	8	121.00	1.42	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Rynchops niger*	8	312.70	2.64	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Rynchops niger*	unespecified	235.80	2.50	Sayol et al, 2016	Fly
Neognathae	*Scolopax minor*	10	197.50	2.02	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Stercorarius maccormicki*	7	1156.00	6.79	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Stercorarius parasiticus*	9	470.30	3.89	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Stercorarius pomarinus*	5	705.10	4.79	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sterna albifrons*	unespecified	48.38	1.03	Sayol et al, 2016	Fly
Neognathae	*Sterna aleutica*	unespecified	132.42	1.74	Sayol et al, 2016	Fly
Neognathae	*Sterna bergii*	6	342.00	3.36	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sterna caspia*	unespecified	565.10	4.55	Sayol et al, 2016	Fly
Neognathae	*Sterna forsteri*	unespecified	130.84	2.13	Sayol et al, 2016	Fly
Neognathae	*Sterna fuscata*	10	185.50	2.32	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sterna hirundo*	1	120.00	1.49	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Sterna hirundo*	10	120.00	1.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sterna maxima*	unespecified	438.34	3.81	Sayol et al, 2016	Fly
Neognathae	*Sterna trudeaui*	unespecified	158.54	2.13	Sayol et al, 2016	Fly
Neognathae	*Stiltia isabella*	10	63.80	1.05	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Synthliboramphus antiquus*	4	206.00	2.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tringa brevipes*	unespecified	126.22	1.32	Sayol et al, 2016	Fly
Neognathae	*Tringa brevipes*	8	107.00	1.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tringa cinerea*	2	72.00	1.03	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tringa flavipes*	12	82.40	1.07	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tringa glareola*	5	67.50	1.04	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tringa incana*	unespecified	116.16	1.29	Sayol et al, 2016	Fly

Neognathae	*Tringa incana*	7	109.00	1.29	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tringa melanoleuca*	10	189.90	1.79	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tringa nebularia*	unespecified	157.43	1.90	Sayol et al, 2016	Fly
Neognathae	*Tringa semipalmatus*	16	249.50	2.33	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tringa solitaria*	11	52.10	0.82	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tringa stagnatilis*	3	72.50	1.02	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Uria aalge*	10	970.30	5.73	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Uria lomvia*	10	990.20	5.30	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Vanellus armatus*	unespecified	165.84	1.94	Sayol et al, 2016	Fly
Neognathae	*Vanellus cayanus*	unespecified	88.77	1.63	Sayol et al, 2016	Fly
Neognathae	*Vanellus coronatus*	unespecified	195.98	2.23	Sayol et al, 2016	Fly
Neognathae	*Vanellus miles*	10	334.60	2.85	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Vanellus senegallus*	unespecified	264.54	2.47	Sayol et al, 2016	Fly
Neognathae	*Vanellus tricolor*	8	270.80	2.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Vanellus vanellus*	unespecified	180.37	2.15	Sayol et al, 2016	Fly
Neognathae	*Xema sabini*	3	190.20	2.21	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Xenus cinereus*	unespecified	66.02	1.03	Sayol et al, 2016	Fly
Neognathae	*Anastomus lamelligerus*	3	1120.00	10.28	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ardea alba*	10	873.50	5.04	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ardea alba*	1	1000.00	5.30	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Ardea cinerea*	1	1500.00	7.87	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Ardea herodias*	10	2295.00	8.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ardea intermedia*	5	500.00	4.15	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ardea sumatrana*	3	2600.00	8.73	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Bostrychia hagadesh*	4	1168.00	10.18	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Botaurus lentiginosus*	8	706.00	4.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Botaurus poiciloptilus*	4	1110.40	5.80	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Botaurus stellaris*	1	900.00	5.21	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Bubulcus ibis*	10	365.80	3.81	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Butorides striata*	11	212.00	2.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cathartes aura*	7	1733.30	9.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ciconia abdimi*	1	950.00	7.30	Crile & Quiring, 1940	Fly
Neognathae	*Ciconia ciconia*	6	3473.00	14.67	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ciconia ciconia*	1	3500.00	14.68	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Cochlearius cochlearis*	4	657.00	5.83	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Egretta garzetta*	1	500.00	3.47	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Egretta novaehollandiae*	10	560.20	3.91	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eudocimus albus*	5	900.00	6.36	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ixobrychus exilis*	8	80.40	1.28	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Jabiru mycteria*	4	6054.50	23.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Leptoptilos crumeniferus*	2	6165.00	30.73	Crile & Quiring, 1940; Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Leptoptilos crumeniferus*	6	6325.00	27.17	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Leptoptilos dubius*	unespecified	7457.68	33.52	Sayol et al, 2016	Fly
Neognathae	*Mesembrinibis cayennensis*	5	741.30	6.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Mycteria americana*	3	2505.00	14.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Nyctanassa violacea*	8	682.50	5.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Nycticorax caledonicus*	7	912.00	5.55	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Nycticorax nycticorax*	10	876.10	6.66	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Platalea flavipes*	8	1747.50	11.12	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Plegadis chihi*	5	612.50	5.04	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Plegadis falcinellus*	9	612.90	5.12	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sarcoramphus papa*	5	3325.00	18.56	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Scopus umbretta*	1	317.50	3.93	Crile & Quiring, 1940	Fly
Neognathae	*Scopus umbretta*	2	422.50	4.25	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Syrigma sibilatrix*	8	476.00	4.61	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Theristictus caerulescens*	2	1500.00	8.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Threskiornis aethiopica*	9	1498.00	10.24	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Threskiornis molucca*	13	1914.40	9.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Threskiornis spinicollis*	4	1662.50	8.41	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tigrisoma lineatum*	5	860.00	6.86	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Vultur gryphus*	3	11125.00	31.56	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Colius striatus*	9	56.40	1.14	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Urocolius indicus*	4	55.50	1.07	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Urocolius macrourus*	4	48.40	1.00	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Caloenas nicobarica*	11	530.00	3.06	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chalcophaps indica*	10	136.30	1.25	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chalcophaps stephani*	unespecified	107.02	1.05	Sayol et al, 2016	Fly
Neognathae	*Claravis pretiosa*	5	66.30	0.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Columba arquatrix*	unespecified	500.20	2.40	Sayol et al, 2016	Fly
Neognathae	*Columba guinea*	unespecified	375.03	2.00	Sayol et al, 2016	Fly
Neognathae	*Columba leucomela*	7	398.20	2.29	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Columba livia*	1	300.00	2.31	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Columba palumbus*	1	450.00	2.40	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Columba speciosa*	4	243.50	1.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Columba vitiensis*	unespecified	379.93	2.23	Sayol et al, 2016	Fly
Neognathae	*Columbina inca*	unespecified	42.52	0.75	Sayol et al, 2016	Fly
Neognathae	*Columbina inca*	10	42.50	0.73	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Columbina minuta*	unespecified	29.73	0.57	Sayol et al, 2016	Fly
Neognathae	*Columbina passerina*	10	33.30	0.64	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Columbina picui*	unespecified	51.62	0.75	Sayol et al, 2016	Fly
Neognathae	*Columbina talpacoti*	10	47.10	0.72	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ducula aenea*	9	560.00	3.06	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ducula bicolor*	11	456.10	3.05	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ducula goliath*	unespecified	779.77	3.37	Sayol et al, 2016	Fly
Neognathae	*Ducula melanochroa*	unespecified	744.71	3.80	Sayol et al, 2016	Fly
Neognathae	*Ducula pacifica*	unespecified	401.02	2.40	Sayol et al, 2016	Fly

Neognathae	*Gallicolumba beccarii*	unespecified	90.02	1.05	Sayol et al, 2016	Fly
Neognathae	*Gallicolumba luzonica*	7	164.50	1.37	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Geopelia cuneata*	7	47.60	0.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Geopelia humeralis*	7	121.70	1.26	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Geopelia placida*	8	47.00	0.79	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Geopelia striata*	unespecified	46.95	0.79	Sayol et al, 2016	Fly
Neognathae	*Geophaps plumifera*	9	101.30	1.18	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Geophaps smithii*	3	153.50	1.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Geotrygon chrysia*	unespecified	118.04	1.35	Sayol et al, 2016	Fly
Neognathae	*Geotrygon costaricensis*	unespecified	215.08	1.90	Sayol et al, 2016	Fly
Neognathae	*Geotrygon montana*	10	135.40	1.14	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Goura coronota*	1	1500.00	5.28	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Goura victoria*	6	2384.00	5.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gymnophaps albertisii*	3	254.50	2.10	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Hemiphaga novaeseelandiae*	6	622.50	2.97	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Henicophaps albifrons*	unespecified	260.08	2.10	Sayol et al, 2016	Fly
Neognathae	*Leptotila cassini*	unespecified	193.06	1.30	Sayol et al, 2016	Fly
Neognathae	*Leptotila jamaicensis*	unespecified	165.17	1.36	Sayol et al, 2016	Fly
Neognathae	*Leptotila plumbeiceps*	unespecified	145.04	1.26	Sayol et al, 2016	Fly
Neognathae	*Leptotila rufaxilla*	unespecified	140.47	1.28	Sayol et al, 2016	Fly
Neognathae	*Leptotila verreauxi*	10	127.70	1.42	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Leucosarcia melanoleuca*	6	457.50	2.41	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lopholaimus antarcticus*	3	518.00	2.71	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Macropygia amboinensis*	10	211.10	1.49	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Macropygia phasianella*	unespecified	145.18	1.41	Sayol et al, 2016	Fly
Neognathae	*Ocyphaps lophotes*	10	205.00	1.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Oena capensis*	7	40.60	0.61	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Patagioenas cayennensis*	unespecified	231.60	1.77	Sayol et al, 2016	Fly
Neognathae	*Patagioenas fasciata*	10	353.10	2.12	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Patagioenas fasciata*	unespecified	324.08	2.20	Sayol et al, 2016	Fly
Neognathae	*Patagioenas leucocephala*	10	236.50	1.74	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Patagioenas leucocephala*	unespecified	236.51	1.74	Sayol et al, 2016	Fly
Neognathae	*Patagioenas maculosa*	unespecified	318.62	2.03	Sayol et al, 2016	Fly
Neognathae	*Patagioenas picazuro*	unespecified	405.05	2.50	Sayol et al, 2016	Fly
Neognathae	*Patagioenas squamosa*	unespecified	310.44	1.85	Sayol et al, 2016	Fly
Neognathae	*Phapitreron amethystinus*	10	135.00	1.29	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phapitreron leucotis*	10	134.50	1.13	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phaps chalcoptera*	10	322.30	1.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phaps elegans*	9	204.80	1.65	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phaps histrionica*	7	240.00	1.65	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ptilinopus insularis*	unespecified	102.51	1.07	Sayol et al, 2016	Fly

Neognathae	*Ptilinopus leclancheri*	unespecified	189.43	1.59	Sayol et al, 2016	Fly
Neognathae	*Ptilinopus magnificus*	11	357.50	2.17	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ptilinopus monacha*	9	85.90	0.91	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ptilinopus occipitalis*	unespecified	209.98	2.10	Sayol et al, 2016	Fly
Neognathae	*Ptilinopus ornatus*	unespecified	148.56	1.70	Sayol et al, 2016	Fly
Neognathae	*Ptilinopus porphyraceus*	unespecified	118.99	1.30	Sayol et al, 2016	Fly
Neognathae	*Ptilinopus pulchellus*	3	70.00	0.99	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ptilinopus regina*	9	99.70	1.21	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ptilinopus rivoli*	3	149.00	1.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ptilinopus superbus*	10	103.50	1.09	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Reinwardtoena browni*	unespecified	315.13	2.10	Sayol et al, 2016	Fly
Neognathae	*Spilopelia chinensis*	unespecified	161.42	1.34	Sayol et al, 2016	Fly
Neognathae	*Spilopelia chinensis*	9	161.50	1.35	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Streptopelia orientalis*	unespecified	199.94	1.40	Sayol et al, 2016	Fly
Neognathae	*Streptopelia risoria*	1	143.00	1.22	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Streptopelia senegalensis*	10	101.00	1.24	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Streptopelia turtur*	10	145.10	1.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Treron curvirostra*	unespecified	154.93	1.35	Sayol et al, 2016	Fly
Neognathae	*Treron formosae*	unespecified	303.08	1.55	Sayol et al, 2016	Fly
Neognathae	*Treron fulvicollis*	unespecified	163.04	1.30	Sayol et al, 2016	Fly
Neognathae	*Treron pompadora*	6	234.00	1.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Treron vernans*	8	132.50	1.25	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Turtur brehmeri*	unespecified	128.00	1.32	Sayol et al, 2016	Fly
Neognathae	*Turtur chalcopsilos*	6	60.60	0.92	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Turtur tympanistria*	unespecified	89.03	1.02	Sayol et al, 2016	Fly
Neognathae	*Zenaida asiatica*	unespecified	126.98	1.55	Sayol et al, 2016	Fly
Neognathae	*Zenaida auriculata*	unespecified	90.47	1.10	Sayol et al, 2016	Fly
Neognathae	*Zenaida aurita*	10	150.20	1.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Zenaida macroura*	10	126.50	1.19	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Alcedo atthis*	10	28.30	0.74	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Alcedo azurea*	9	34.60	0.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Baryphthengus ruficapillus*	8	175.00	2.65	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Bucorvus cafer*	1	2150.00	26.25	Crile & Quiring, 1940	Fly
Neognathae	*Ceryle rudis*	5	84.40	1.59	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ceyx lepidus*	9	19.30	0.56	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chloroceryle amazona*	6	119.30	1.95	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chloroceryle americana*	10	37.50	0.92	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Coracias caudata*	5	108.00	2.06	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Coracias garrulus*	7	146.00	2.32	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dacelo leachii*	6	309.20	4.23	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dacelo novaeguineae*	10	334.50	4.31	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eurystomus orientalis*	9	131.00	1.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Halcyon leucocephala*	5	41.40	1.08	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Halcyon senegalensis*	4	58.60	1.45	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Halcyon smyrensis*	6	85.30	1.84	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ispidina picta*	7	11.40	0.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Megaceryle alcyon*	10	147.60	2.46	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Megaceryle torquata*	8	317.00	3.57	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Merops apiaster*	1	60.00	0.88	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Merops apiaster*	10	56.60	0.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Merops orientalis*	7	14.80	0.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Merops ornatus*	9	26.90	0.62	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Merops pusillus*	5	13.20	0.41	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Momotus momota*	8	133.00	2.19	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pelargopsis capensis*	6	170.00	2.82	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Syma torotoro*	unespecified	34.99	1.11	Sayol et al, 2016	Fly
Neognathae	*Tanysiptera galatea*	11	50.00	1.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tanysiptera sylvia*	5	48.80	1.14	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Todiramphus chloris*	10	67.90	1.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Todiramphus chloris*	unespecified	67.90	1.39	Sayol et al, 2016	Fly
Neognathae	*Todiramphus macleayii*	unespecified	35.06	1.06	Sayol et al, 2016	Fly
Neognathae	*Todiramphus macleayii*	10	35.30	1.07	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Todiramphus pyrrhopygia*	9	51.70	1.13	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Todiramphus pyrrhopygius*	unespecified	58.50	1.15	Sayol et al, 2016	Fly
Neognathae	*Todiramphus sanctus*	unespecified	38.28	1.03	Sayol et al, 2016	Fly
Neognathae	*Todiramphus sanctus*	10	38.30	1.03	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Todus mexicanus*	5	5.80	0.40	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Todus subulatus*	9	7.90	0.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Todus todus*	10	6.50	0.41	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Upupa epops*	1	55.00	1.23	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Alectura lathami*	7	1855.70	5.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Crax rubra*	6	4133.00	9.56	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Leipoa ocellata*	7	1917.00	4.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Megapodius eremita*	6	604.80	3.21	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Megapodius freycinet*	10	857.50	3.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ortalis vetula*	5	545.50	3.23	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Penelope purpurascens*	7	2060.00	6.25	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pipile pipile*	2	1350.00	5.30	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cacomantis castaneiventris*	unespecified	31.00	0.95	Sayol et al, 2016	Fly
Neognathae	*Cacomantis flabelliformis*	3	49.90	1.09	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cacomantis variolosus*	unespecified	34.88	1.07	Sayol et al, 2016	Fly
Neognathae	*Centropus bengalensis*	9	117.10	2.27	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Centropus phasianinus*	10	518.80	4.12	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ceuthmochares aereus*	3	63.80	1.33	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chrysococcyx basalis*	8	22.60	0.62	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chrysococcyx caprius*	5	32.00	0.77	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Chrysococcyx lucidus*	11	22.20	0.69	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chrysococcyx minutillus*	unespecified	15.50	0.58	Sayol et al, 2016	Fly
Neognathae	*Chrysococcyx osculans*	unespecified	27.99	0.73	Sayol et al, 2016	Fly
Neognathae	*Clamator glandarius*	5	153.50	1.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Coccyzus americanus*	10	64.00	1.17	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Coccyzus erythropthalmus*	6	50.50	1.01	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Coccyzus vetula*	unespecified	99.29	2.01	Sayol et al, 2016	Fly
Neognathae	*Coccyzus vetula*	10	99.30	2.00	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Corythaixoides concolor*	1	300.00	3.30	Hurlburt, 1996	Fly
Neognathae	*Crotophaga ani*	10	100.20	1.56	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cuculus canorus*	10	113.00	1.57	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cuculus pallidus*	5	81.60	1.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cuculus saturatus*	6	99.90	1.58	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eudynamys scolopaceus*	7	232.70	2.46	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eudynamys taitensis*	2	117.30	2.00	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Geococcyx californianus*	9	302.70	3.49	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Guira guira*	5	146.60	1.92	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Opisthocomus hoazin*	4	855.00	3.89	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phaenicophaeus curvirostris*	4	126.00	2.92	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phaenicophaeus superciliosus*	3	102.30	2.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phaenicophaeus superciliosus*	unespecified	102.21	2.51	Sayol et al, 2016	Fly
Neognathae	*Phaenicophaeus tristis*	3	124.00	2.30	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Piaya cayana*	8	104.00	1.84	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Scythrops novaehollandiae*	unespecified	765.09	5.35	Sayol et al, 2016	Fly
Neognathae	*Caracara cheriway*	7	893.50	9.26	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Caracara plancus*	6	1031.00	10.06	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Daptrius ater*	3	363.30	5.28	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Falco berigora*	12	561.80	6.24	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Falco cenchroides*	11	183.30	3.14	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Falco columbarius*	18	157.40	3.09	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Falco eleonorae*	3	385.00	4.04	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Falco longipennis*	12	226.10	3.35	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Falco mexicanus*	10	638.40	6.86	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Falco moluccensis*	4	220.00	3.49	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Falco naumanni*	7	151.50	2.71	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Falco peregrinus*	11	736.10	6.19	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Falco rufigularis*	2	168.80	3.18	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Falco sparverius*	23	92.00	2.49	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Falco subbuteo*	3	211.00	3.59	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Falco subniger*	4	707.50	6.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Falco tinnunculus*	16	214.00	3.87	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Falco vespertinus*	2	158.00	2.70	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Herpetotheres cachinnans*	4	621.00	6.55	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Microhierax erythrogenys*	3	48.90	1.40	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Milvago chimango*	3	294.50	4.59	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phalcoboenus australis*	4	1848.00	10.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Polihierax semitorquatus*	5	51.20	1.47	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sagittarius serpentarius*	2	3285.00	15.00	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chelidoptera tenebrosa*	8	41.60	0.85	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Galbula albirostris*	6	19.70	0.61	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Jacamerops aureus*	3	65.20	1.11	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Malacoptila panamensis*	3	42.60	1.15	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Monasa nigrifrons*	7	80.70	1.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Notharchus macrorhynchos*	2	95.90	1.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Acryllium vulturinum*	4	1390.00	4.55	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Alectoris chukar*	10	558.50	2.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Argusianus argus*	6	1994.00	5.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Bambusicola thoracicus*	6	270.00	1.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Bonasa umbellus*	10	545.80	2.46	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Callipepla californica*	8	174.20	1.33	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Callipepla gambelii*	9	169.20	1.32	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Centrocercus urophasianus*	8	2195.90	4.00	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chrysolophus amherstiae*	7	738.30	3.76	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chrysolophus pictus*	10	625.00	3.32	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Colinus virginianus*	10	171.50	1.30	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Coturnix coturnix*	10	96.50	0.94	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Coturnix pectoralis*	9	109.50	0.96	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Crossoptilon crossoptilon*	4	2137.50	5.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cyrtonyx montezumae*	6	185.60	1.46	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dendragapus canadensis*	10	520.80	2.44	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dendragapus obscurus*	5	1009.60	3.07	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Excalfactoria chinensis*	unespecified	24.90	0.59	Sayol et al, 2016	Fly
Neognathae	*Excalfactoria chinensis*	1	31.00	0.50	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Francolinus leucoscepus*	5	245.00	3.20	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Francolinus sephaena*	3	649.00	2.25	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gallus gallus*	1	550.00	2.68	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Guttera edouardi*	3	1149.00	4.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ithaginis cruentus*	8	537.50	3.18	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lagopus lagopus*	9	580.40	2.38	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lagopus muta*	4	526.70	2.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lophophorus impejanus*	2	2315.00	6.20	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Lophura nycthemera*	1	1250.00	4.68	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Lophura nycthemera*	7	1490.00	4.74	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lophura swinhoii*	5	1100.00	4.25	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melanoperdix nigra*	3	260.00	1.91	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Meleagris gallopavo*	10	6062.50	8.21	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Meleagris ocellata*	5	5525.00	5.84	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Numida meleagris*	8	1299.00	4.08	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Numida meleagris*	1	1620.00	4.20	Crile & Quiring, 1940	Fly
Neognathae	*Oreortyx pictus*	5	239.20	1.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pavo cristatus*	8	4088.60	6.86	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pavo cristatus*	1	3500.00	7.24	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Perdix perdix*	1	370.00	1.75	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Phasianus colchicus*	10	1111.00	3.86	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Rollulus rouloul*	10	217.00	1.85	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Syrmaticus reevesi*	8	1239.00	4.38	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tetrao tetrix*	1	1250.00	3.90	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Tetrao urogallus*	1	2750.00	5.70	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Tetrao urogallus*	3	2950.00	6.14	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tragopan temminckii*	2	1184.00	4.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tympanuchus phasianellus*	10	847.80	2.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gavia immer*	10	3093.80	10.10	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gavia stellata*	10	1758.50	5.54	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amaurolimnas concolor*	unespecified	95.01	1.72	Sayol et al, 2016	Fly
Neognathae	*Amaurornis flavirostra*	9	88.80	1.47	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amaurornis olivacea*	2	150.00	2.16	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amaurornis phoenicurus*	10	236.80	2.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Antigone antigone*	5	8863.00	20.06	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Antigone antigone*	1	7500.00	20.02	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Aramides cajanea*	9	400.40	3.99	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aramides ypecaha*	3	612.50	4.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aramus guarauna*	4	1080.00	6.62	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ardeotis australis*	9	4450.00	11.65	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Balearica pavonina*	4	3590.00	12.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Balearica pavonina*	1	3250.00	14.41	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Burhinus oedicnemus*	1	440.00	3.54	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Cariama cristata*	2	1400.00	11.15	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Coturnicops noveboracensis*	4	55.70	0.74	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Crex crex*	10	155.30	1.38	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eupodotis denhami*	2	7240.00	12.25	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eurypyga helias*	3	222.00	2.48	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Fratercula arctica*	1	330.00	4.43	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Fulica americana*	10	651.00	2.93	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Fulica atra*	10	526.50	2.85	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gallicrex cinerea*	7	451.00	2.56	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gallinula chloropus*	1	100.00	1.26	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Gallinula chloropus*	10	305.00	2.40	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gallinula melanops*	5	154.00	1.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gallinula tenebrosa*	8	587.60	2.71	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gallinula ventralis*	7	387.00	2.77	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gallirallus australis*	8	841.20	5.11	Iwaniuk & Nelson, 2003	Flightless
Neognathae	*Gallirallus owstoni*	unespecified	214.01	2.15	Sayol et al, 2016	Flightless
Neognathae	*Gallirallus owstoni*	6	194.40	2.15	Iwaniuk & Nelson, 2003	Flightless
Neognathae	*Gallirallus philippensis*	unespecified	194.03	1.98	Sayol et al, 2016	Fly
Neognathae	*Grus canadensis*	7	3901.10	14.82	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Grus rubicunda*	3	6250.50	17.69	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Grus virgo*	9	2308.00	10.23	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Grus virgo*	unespecified	2199.53	10.40	Sayol et al, 2016	Fly
Neognathae	*Habroptila wallacii*	4	1000.00	5.19	Iwaniuk & Nelson, 2003	Flightless
Neognathae	*Laterallus albigularis*	5	41.80	1.04	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lewinia pectoralis*	unespecified	76.86	1.31	Sayol et al, 2016	Fly
Neognathae	*Lewinia pectoralis*	7	78.10	1.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Limnocryptes minimus*	1	60.00	0.93	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Numenius arquatus*	1	650.00	4.09	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Pardirallus maculatus*	7	129.50	1.89	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Porphyrio martinica*	10	218.30	2.47	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Porphyrio porphyrio*	10	999.40	4.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Porzana atra*	3	82.50	1.27	Iwaniuk & Nelson, 2003	Flightless
Neognathae	*Porzana carolina*	10	80.80	1.16	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Porzana fluminea*	3	54.00	1.03	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Porzana palmeri*	4	37.50	0.93	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Porzana porzana*	1	80.00	1.16	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Psophia crepitans*	4	1050.00	5.85	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Rallina eurizonoides*	3	110.00	1.71	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Rallus aquaticus*	6	95.30	1.73	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Rallus longirostris*	10	314.60	2.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Rallus phillipensis*	8	194.00	1.97	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Scolopax rusticola*	1	290.00	2.59	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Corythaixoides concolor*	unespecified	227.92	3.70	Sayol et al, 2016	Fly
Neognathae	*Crinifer piscator*	2	527.00	4.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tauraco hartlaubi*	2	224.00	3.35	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tauraco leucotis*	4	265.00	3.35	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tauraco persa*	3	297.00	3.25	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Abroscopus albogularis*	5	5.00	0.32	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Acanthagenys rufogularis*	8	50.20	1.16	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Acanthiza chrysorrhoa*	5	10.00	0.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Acanthiza ewingii*	unespecified	4.00	0.63	Sayol et al, 2016	Fly
Neognathae	*Acanthiza inornata*	unespecified	8.50	0.44	Sayol et al, 2016	Fly
Neognathae	*Acanthiza lineata*	5	6.40	0.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Acanthiza nana*	unespecified	7.25	0.37	Sayol et al, 2016	Fly
Neognathae	*Acanthiza pusilla*	6	6.00	0.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Acanthiza reguloides*	2	7.50	0.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Acanthiza uropygialis*	7	6.50	0.36	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Acanthorhynchus tenuirostris*	9	11.20	0.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Acridotheres tristis*	6	115.60	2.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Acrocephalus arundinaceus*	10	21.90	0.91	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Acrocephalus schoenobaenus*	7	10.80	0.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Acrocephalus scirpaceus*	1	14.00	0.48	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Aegithalos caudatus*	1	7.50	0.46	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Aegithalos concinnus*	2	6.10	0.37	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aegithina tiphia*	10	12.30	0.67	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aethopyga nipalensis*	2	6.00	0.33	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Agelaioides badius*	unespecified	39.69	1.55	Sayol et al, 2016	Fly
Neognathae	*Agelaioides badius*	5	44.50	1.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Agelaius phoeniceus*	10	65.50	1.69	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ailuroedus crassirostris*	8	204.00	4.01	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ailuroedus melanotis*	unespecified	165.01	4.40	Sayol et al, 2016	Fly
Neognathae	*Aimophila cassinii*	4	18.10	0.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Alauda arvensis*	8	35.10	0.96	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Alcippe nipalensis*	5	15.80	0.93	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Alethe diademata*	3	33.60	1.04	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amadina fasciata*	8	15.40	0.59	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amalocichla incerta*	unespecified	26.50	1.10	Sayol et al, 2016	Fly
Neognathae	*Amandava amandava*	10	9.60	0.38	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amblycercus holosericeus*	7	66.90	2.21	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amblyornis macgregoriae*	2	123.50	3.58	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amblyramphus holosericeus*	2	69.00	2.33	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ammodramus sandwichensis*	9	20.10	0.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ammodramus savannarum*	7	17.00	0.65	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amphispiza bilineata*	7	13.80	0.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amytornis goyderi*	2	16.70	0.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anisognathus flavinuchus*	5	42.00	1.49	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Anthochaera carunculata*	11	108.50	2.20	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anthochaera chrysoptera*	8	66.30	1.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anthochaera phrygia*	unespecified	33.52	1.03	Sayol et al, 2016	Fly
Neognathae	*Anthreptes malacensis*	6	11.90	0.58	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anthus novaeseelandiae*	8	27.90	0.84	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anthus pratensis*	1	16.00	0.53	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Anthus trivialis*	9	18.40	0.60	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anumbius annumbi*	3	41.50	1.18	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aphelocephala leucopsis*	9	12.90	0.54	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aphelocephala nigricincta*	5	12.70	0.47	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aphelocoma coerulescens*	10	76.00	2.85	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aphelocoma ultramarina*	10	128.40	3.61	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aphrastura spinicauda*	10	11.50	0.81	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aplonis metallica*	10	61.00	1.58	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Arachnothera longirostra*	6	11.70	0.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Arremon aurantiirostris*	10	34.50	1.08	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Arremon brunneinucha*	unespecified	44.75	1.55	Sayol et al, 2016	Fly
Neognathae	*Arremon brunneinucha*	5	46.60	1.54	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Arremonops conirostris*	7	37.30	1.29	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Arses telescophthalmus*	unespecified	14.00	0.62	Sayol et al, 2016	Fly
Neognathae	*Artamus cinereus*	8	38.00	0.92	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Artamus cyanopterus*	8	35.50	1.00	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Artamus leucorhynchus*	6	45.60	1.08	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Artamus maximus*	unespecified	66.02	1.65	Sayol et al, 2016	Fly
Neognathae	*Artamus minor*	unespecified	15.00	0.51	Sayol et al, 2016	Fly
Neognathae	*Artamus personatus*	4	36.50	1.03	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Artamus superciliosus*	9	39.20	1.04	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ashbyia lovensis*	2	17.50	0.67	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Attila spadiceus*	6	33.20	1.18	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Auriparus flaviceps*	5	6.60	0.44	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Automolus infuscatus*	6	33.10	1.13	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Automolus ochrolaemus*	6	40.20	1.14	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Baeolophus bicolor*	10	21.60	1.01	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Basileuterus culcivorus*	7	8.90	0.58	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Batis capensis*	3	12.80	0.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Bias musicus*	6	21.70	0.84	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Bombycilla cedorum*	10	33.70	0.89	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Bombycilla garrulus*	6	56.40	1.16	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Brachypteryx montana*	6	18.00	0.83	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Bubalornis albirostris*	2	64.50	2.13	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cacicus cela*	7	91.50	2.43	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Calamanthus fuliginosus*	unespecified	13.00	0.70	Sayol et al, 2016	Fly
Neognathae	*Calamospiza melanocorys*	9	37.80	1.18	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calandrella cinerea*	8	19.60	0.67	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calcarius lapponica*	11	27.50	0.87	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Campephaga phoenicea*	4	28.50	1.05	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Camptostoma obsoletum*	6	8.00	0.36	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Campylorhamphus pusillus*	3	43.30	1.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Campylorhynchus bruneicapillus*	10	38.90	1.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Campylorhynchus griseus*	4	42.40	1.31	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cardellina rubrifrons*	6	9.80	0.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cardinalis cardinalis*	11	44.10	1.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Carduelis carduelis*	9	15.60	0.65	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Carduelis flammea*	5	13.70	0.59	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Carduelis pinus*	10	14.60	0.57	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Carduelis spinus*	1	11.50	0.55	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Carduelis tristis*	9	12.90	0.54	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Carpodacus mexicanus*	10	20.40	0.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Carpodacus purpureus*	10	25.60	0.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Caryothraustes poliogaster*	2	37.50	1.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Catharus fuscescens*	7	41.50	0.92	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cercomacra nigrescens*	5	15.30	0.84	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cercomacra tyrannina*	6	16.60	0.74	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cercotrichas coryphaeus*	unespecified	23.06	0.72	Sayol et al, 2016	Fly
Neognathae	*Cercotrichas coryphaeus*	5	23.10	0.72	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Certhia familiaris*	7	9.00	0.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Certhiaxis cinnamomea*	10	14.80	0.69	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Certhionyx niger*	unespecified	10.90	0.41	Sayol et al, 2016	Fly
Neognathae	*Certhionyx variegatus*	unespecified	23.50	0.98	Sayol et al, 2016	Fly
Neognathae	*Chamaea fasciata*	2	14.70	0.77	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cheramoeca leucosterna*	unespecified	12.00	0.44	Sayol et al, 2016	Fly
Neognathae	*Chersomanes albofasciata*	2	30.00	0.94	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chiroxiphia caudata*	4	25.60	0.80	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chiroxiphia linearis*	3	18.50	0.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chlamydera maculata*	unespecified	142.59	3.95	Sayol et al, 2016	Fly
Neognathae	*Chlamydera nuchalis*	4	199.50	5.01	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chlorocichla flavicollis*	4	45.30	1.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chlorophonia cyanea*	4	14.00	0.61	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chloropsis palawanensis*	7	30.50	1.05	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Chlorospingus ophthalmicus*	6	19.00	0.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chlorospingus pileatus*	unespecified	19.81	1.11	Sayol et al, 2016	Fly
Neognathae	*Chlorothraupis carmioli*	2	39.00	1.30	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cicinnurus regius*	6	52.00	1.74	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cinclidium leucurum*	9	25.80	0.89	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cinclodes fuscus*	2	24.70	0.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cinclodes patagonicus*	8	53.20	1.24	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cincloramphus cruralis*	7	43.00	1.12	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cincloramphus mathewsi*	5	25.00	0.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cinclosoma cinnamomeum*	2	58.60	1.47	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cinclosoma punctatum*	unespecified	100.89	2.07	Sayol et al, 2016	Fly
Neognathae	*Cinclus cinclus*	1	60.00	1.45	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Cinclus mexicanus*	2	57.80	1.40	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cinnyricinclus leucogaster*	3	42.50	1.18	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cissa chinensis*	6	126.80	3.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cissopis leverianus*	4	76.00	1.71	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cisticola cherina*	2	10.00	0.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cisticola exilis*	2	7.10	0.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cisticola fulvicapilla*	3	10.30	0.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cistothorus palustris*	8	10.00	0.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Climacteris melanurus*	unespecified	33.52	0.83	Sayol et al, 2016	Fly
Neognathae	*Climacteris picumnus*	10	30.30	1.00	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Climacteris rufus*	2	33.30	1.03	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Clytorhynchus pachycephaloides*	unespecified	41.51	1.05	Sayol et al, 2016	Fly
Neognathae	*Cnemotriccus fuscatus*	2	13.50	0.46	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Coccothraustes vespertinus*	10	57.20	1.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Coereba flaveola*	10	8.50	0.44	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Colluricincla harmonica*	7	63.30	2.00	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Colluricincla megarhyncha*	7	36.00	1.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Colonia colonus*	6	16.80	0.47	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Conopophaga lineata*	3	21.80	0.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Conopophila albogularis*	unespecified	10.50	0.56	Sayol et al, 2016	Fly
Neognathae	*Conopophila rufogularis*	2	10.80	0.44	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Contopus cooperi*	3	32.80	0.64	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Contopus latirostris*	7	10.60	0.38	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Contopus virens*	6	14.20	0.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Copsychus saularis*	10	33.20	1.10	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Coracina caledonica*	10	145.30	2.99	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Coracina maxima*	unespecified	134.69	2.20	Sayol et al, 2016	Fly
Neognathae	*Coracina novaehollandiae*	10	127.70	2.40	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Coracina papuensis*	5	80.00	2.03	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Coracina tenuirostris*	unespecified	58.73	1.71	Sayol et al, 2016	Fly
Neognathae	*Corcorax melanorhamphos*	7	349.10	5.20	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cormobates leucophaea*	7	22.40	0.81	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Corvus albus*	10	584.10	8.75	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Corvus bennetti*	3	379.00	6.44	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Corvus brachyrhynchos*	10	438.50	7.17	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Corvus caurinus*	10	384.00	7.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Corvus corax*	10	1051.90	14.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Corvus corone*	10	536.50	8.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Corvus coronoides*	7	675.00	9.83	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Corvus cryptoleucus*	10	534.00	8.95	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Corvus dauuricus*	9	123.00	4.75	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Corvus frugilegus*	5	488.00	7.61	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Corvus mellori*	10	300.00	8.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Corvus monedula*	7	246.00	5.15	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Corvus monedula*	1	200.00	4.76	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Corvus moneduloides*	9	267.50	7.23	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Corvus orru*	8	522.20	8.91	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Corvus ossifragus*	6	285.00	5.99	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Corydon sumatranus*	2	140.00	2.40	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Coryphistera alaudina*	2	34.30	0.94	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Coryphospingus cucullatus*	10	14.60	0.67	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cossypha caffra*	5	28.50	1.02	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cracticus nigrogularis*	2	156.00	3.02	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cracticus quoyi*	unespecified	180.01	3.55	Sayol et al, 2016	Fly
Neognathae	*Cracticus torquatus*	8	104.10	2.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Crateroscelis nigrorufa*	unespecified	15.50	0.80	Sayol et al, 2016	Fly
Neognathae	*Criniger pallidus*	3	46.00	1.24	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Culicicapa helianthea*	3	7.50	0.31	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Curaeus curaeus*	8	90.00	2.47	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cyanerpes cyaneus*	8	14.00	0.55	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cyanocitta cristata*	10	89.10	2.92	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cyanocitta stelleri*	10	128.00	3.54	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cyanocorax affinis*	unespecified	203.98	4.52	Sayol et al, 2016	Fly
Neognathae	*Cyclarhis gujanensis*	5	28.80	1.26	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cymbilaimus lineatus*	6	28.70	1.22	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cyornis rubeculoides*	unespecified	12.26	0.56	Sayol et al, 2016	Fly
Neognathae	*Cyornis rubeculoides*	4	12.30	0.55	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cyphorhinus arada*	5	18.70	0.91	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dacnis cayana*	3	13.00	0.55	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Daphoenositta chrysoptera*	unespecified	13.50	0.54	Sayol et al, 2016	Fly
Neognathae	*Dasyornis brachypterus*	unespecified	43.99	1.45	Sayol et al, 2016	Fly
Neognathae	*Dasyornis broadbenti*	2	83.30	1.88	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Delichon urbica*	1	15.00	0.44	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Delichon urbica*	9	14.50	0.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dendrocincla fuliginosa*	10	39.40	1.06	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dendrocolaptes certhia*	3	66.70	1.74	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dendroplex picus*	unespecified	34.57	1.26	Sayol et al, 2016	Fly
Neognathae	*Dendroplex picus*	5	34.60	1.30	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dicaeum aeruginosum*	6	11.80	0.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dicaeum hirundinaceum*	4	8.00	0.37	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dicrurus hottentotus*	11	66.30	1.96	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Diuca diuca*	4	31.00	1.28	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dives dives*	4	96.20	2.20	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dolichonyx oryzivorus*	8	38.70	1.07	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Donacobius atricapillus*	2	34.80	1.15	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Drymodes brunneopygia*	4	38.70	0.95	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dryoscopus cubla*	5	26.40	1.13	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dulus dominicus*	10	47.60	1.27	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dumetella carolinensis*	10	37.80	1.14	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dysithamnus mentalis*	unespecified	11.21	0.70	Sayol et al, 2016	Fly
Neognathae	*Dysithamnus mentalis*	7	11.20	0.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Elaenia frantzii*	5	19.40	0.61	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Elaenia martinica*	10	18.60	0.65	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Emberiza hortulana*	10	23.80	0.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Emberiza spodocephala*	4	18.00	0.93	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Empidonax minimus*	3	10.50	0.37	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Empidonax virescens*	10	12.90	0.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Enicurus scouleri*	3	14.00	0.76	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Entomyzon cyanotis*	3	106.50	2.23	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eopsaltria australis*	6	19.60	0.86	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eopsaltria georgiana*	4	19.80	0.75	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eopsaltria griseogularis*	3	21.10	0.83	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Epinecrophylla fulviventris*	unespecified	10.22	0.48	Sayol et al, 2016	Fly
Neognathae	*Epinecrophylla fulviventris*	6	10.20	0.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Epthianura aurifrons*	6	10.30	0.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Epthianura tricolor*	7	10.70	0.44	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eremophila alpestris*	10	34.80	0.89	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Erithacus megarhyncha*	10	19.40	0.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Erithacus rubecula*	1	16.20	0.61	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Erithacus rubecula*	8	18.20	0.64	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Erythrura gouldiae*	11	10.00	0.53	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Erythrura trichroa*	3	14.40	0.58	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Estrilda caerulescens*	9	8.40	0.41	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Estrilda melpoda*	10	7.60	0.38	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Euneornis campestris*	10	16.20	0.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Euphagus carolinus*	10	55.70	1.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Euphagus cyanocephalus*	7	68.50	1.44	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Euphonia jamaica*	10	16.10	0.65	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Euplectes orix*	9	16.30	0.76	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Falcunculus frontatus*	4	26.10	1.24	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ficedula albicollis*	10	10.30	0.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Formicarius analis*	7	54.20	1.30	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Formicarius colma*	3	45.30	1.08	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Formicivora grisea*	4	9.30	0.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Foudia madagascariensis*	6	16.00	0.75	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Fringilla coelebs*	8	21.40	0.81	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Furnarius rufus*	10	56.50	1.33	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Galerida cristata*	10	30.30	1.17	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Garrulus glandarius*	1	160.00	4.10	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Geositta cuncicularia*	3	30.00	0.97	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Geothlypis trichas*	10	9.80	0.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gerygone flavolateralis*	3	6.40	0.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gerygone hypoxantha*	unespecified	6.50	0.42	Sayol et al, 2016	Fly
Neognathae	*Glyphorynchus spirurus*	10	14.80	0.62	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gnorimopsar chopi*	2	79.50	1.80	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gracula religiosa*	7	192.00	3.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Grallaria quitensis*	3	79.50	2.05	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Grallina bruijni*	unespecified	33.52	1.00	Sayol et al, 2016	Fly
Neognathae	*Grallina cyanoleuca*	3	89.00	1.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Grantiella picta*	unespecified	22.99	0.70	Sayol et al, 2016	Fly
Neognathae	*Gymnocichla nudipes*	2	32.80	1.06	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gymnoderus foetidus*	3	275.00	3.53	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gymnopithys leucaspis*	3	31.10	0.76	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gymnorhina tibicen*	20	314.00	4.65	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Gymnorhinus cyanocephalus*	10	103.00	3.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Habia fuscicauda*	10	39.70	1.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Helmitheros vermivorus*	10	14.20	0.59	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Hemithraupis guira*	3	12.00	0.57	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Hemitriccus margaritaceiventer*	unespecified	7.72	0.45	Sayol et al, 2016	Fly
Neognathae	*Hemitriccus margaritaceiventer*	2	7.70	0.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Henicorhina leucosticta*	6	13.90	0.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Heteromyias albispecularis*	unespecified	38.51	1.05	Sayol et al, 2016	Fly
Neognathae	*Heterophasia melanoleuca*	3	32.60	1.16	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Himatione sanguinea*	3	14.80	0.67	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Hippolais icterina*	10	14.60	0.47	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Hirundo ariel*	4	11.20	0.36	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Hirundo neoxena*	10	13.30	0.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Hirundo nigricans*	5	17.10	0.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Hirundo rustica*	10	18.60	0.55	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Hylacola pyrrhopygia*	unespecified	19.91	1.03	Sayol et al, 2016	Fly
Neognathae	*Hylocichla mustelina*	10	47.40	1.25	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Hylocichla mustelina*	unespecified	39.21	1.28	Sayol et al, 2016	Fly
Neognathae	*Hylophylax naevius*	4	12.50	0.59	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Hylophylax poecilonota*	9	16.60	0.64	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Hymenops perspicillatus*	4	23.10	0.76	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Hypocnemis cantator*	6	10.00	0.63	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Hypothymis azurea*	9	10.20	0.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Hypsipetes phillipinus*	10	36.90	1.12	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Icteria virens*	8	24.90	0.91	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Icterus galbula*	10	33.30	1.13	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Icterus spurius*	6	20.40	0.86	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ifrita kowaldi*	unespecified	27.99	1.25	Sayol et al, 2016	Fly
Neognathae	*Illadopsis fulvescens*	4	24.40	1.19	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Irena puella*	10	66.40	1.36	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Iridosornis rufivertex*	4	22.30	1.33	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ixoreus naevius*	6	77.60	1.71	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ixos philippinus*	unespecified	36.89	1.12	Sayol et al, 2016	Fly
Neognathae	*Junco hyemalis*	10	19.00	0.83	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lagonosticta senegala*	8	8.30	0.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lalage sueurii*	6	18.90	0.87	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lamprotornis purpureus*	10	115.50	2.12	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Laniarius erythrogaster*	5	45.80	1.56	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lanius collurio*	10	29.90	0.96	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lanius cristatus*	8	29.70	1.05	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lanius ludovicianus*	10	47.40	1.53	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lanius senator*	10	27.80	1.07	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Legatus leucophaius*	3	24.40	0.66	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Leiothrix lutea*	6	21.80	0.92	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lepidocolaptes affinis*	6	29.00	1.13	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lepidocolaptes souleyetii*	7	25.70	1.04	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Leucosticte arctoa*	6	25.60	1.31	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lichenostomus chrysops*	9	17.50	0.72	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lichenostomus cratitus*	5	20.60	0.92	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lichenostomus flavescens*	5	12.60	0.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lichenostomus flavus*	3	21.10	0.71	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lichenostomus frenatus*	unespecified	29.99	1.04	Sayol et al, 2016	Fly
Neognathae	*Lichenostomus hindwoodi*	unespecified	24.66	0.89	Sayol et al, 2016	Fly

Neognathae	*Lichenostomus keartlandi*	2	15.30	0.69	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lichenostomus leucotis*	8	22.10	0.89	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lichenostomus melanops*	6	19.80	0.92	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lichenostomus ornatus*	8	19.80	0.75	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lichenostomus penicillatus*	9	19.20	0.83	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lichenostomus unicolor*	unespecified	29.99	0.81	Sayol et al, 2016	Fly
Neognathae	*Lichenostomus virescens*	8	33.30	0.92	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lichmera indistincta*	5	11.40	0.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Limnothlypis swainsonii*	10	14.00	0.67	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Linaria cannabina*	1	18.00	0.64	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Lipaugus vociferans*	2	82.20	1.63	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Locustella luscinioides*	7	15.00	0.55	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lonchura cucullata*	10	9.20	0.38	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lonchura malacca*	10	12.60	0.60	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lophorina superba*	2	78.00	2.60	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Loxia curvirostra*	10	34.30	1.42	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Loxia leucoptera*	8	31.80	1.38	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Loxigilla violacea*	10	28.00	1.16	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Loxipasser anoxanthus*	10	11.30	0.57	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Luscinia megarhynchos*	unespecified	18.80	0.69	Sayol et al, 2016	Fly
Neognathae	*Lycocorax pyrrhopterus*	9	259.50	4.79	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Machetornis rixosus*	3	33.40	0.96	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Macronus gularis*	8	13.50	0.65	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Malaconotus cruentus*	3	72.00	2.28	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Malurus alboscapulatus*	unespecified	8.00	0.47	Sayol et al, 2016	Fly
Neognathae	*Malurus coronatus*	unespecified	9.00	0.48	Sayol et al, 2016	Fly
Neognathae	*Malurus cyaneus*	9	8.30	0.47	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Malurus elegans*	3	10.10	0.57	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Malurus lamberti*	10	9.20	0.46	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Malurus leucopterus*	10	8.00	0.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Malurus melanocephalus*	4	7.00	0.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Malurus pulcherrimus*	3	9.80	0.42	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Malurus splendens*	5	11.40	0.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Manacus candei*	6	17.60	0.57	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Manacus manacus*	7	19.00	0.59	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Manacus vitellinus*	11	18.20	0.62	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Manorina flavigula*	7	59.80	1.37	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Manorina melanocephala*	9	60.90	1.86	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Manorina melanophrys*	11	25.50	1.14	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Margarops fuscatus*	10	109.40	2.35	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Margarops fuscus*	10	70.80	1.54	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Mecocerculus leucophrys*	4	13.90	0.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Megalurus gramineus*	unespecified	12.19	0.57	Sayol et al, 2016	Fly
Neognathae	*Megalurus palustris*	4	33.30	1.14	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Megarynchus pitangua*	5	73.50	1.17	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melaenornis silens*	3	28.30	1.00	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melaenornis silens*	unespecified	28.30	1.01	Sayol et al, 2016	Fly
Neognathae	*Melanocharis nigra*	unespecified	11.50	0.54	Sayol et al, 2016	Fly
Neognathae	*Melanocharis striativentris*	unespecified	18.30	0.68	Sayol et al, 2016	Fly
Neognathae	*Melanocorypha calandra*	1	55.00	1.36	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Melanodryas cucullatus*	7	24.30	0.80	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melanodryas vittata*	3	20.00	1.00	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melanoptila glabirostris*	5	35.00	1.20	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melilestes megarhynchus*	unespecified	47.23	1.35	Sayol et al, 2016	Fly
Neognathae	*Meliphaga gracilis*	unespecified	15.00	0.65	Sayol et al, 2016	Fly
Neognathae	*Meliphaga lewinii*	5	36.20	1.17	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Meliphaga notata*	5	26.40	0.87	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melithreptus albogularis*	3	11.10	0.63	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melithreptus brevirostris*	5	14.30	0.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melithreptus lunatus*	6	14.10	0.60	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melopyrrha nigra*	7	10.90	0.84	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melospiza georgiana*	10	17.60	0.81	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melospiza melodia*	1	21.00	1.10	Crile & Quiring, 1940	Fly
Neognathae	*Menura novaehollandiae*	5	644.40	10.72	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Microeca fascinans*	unespecified	11.36	0.55	Sayol et al, 2016	Fly
Neognathae	*Microeca flavigaster*	4	12.70	0.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Microeca leucophaea*	5	11.40	0.54	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Microeca papuana*	unespecified	12.26	0.58	Sayol et al, 2016	Fly
Neognathae	*Mimus polyglottus*	10	45.20	1.38	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Minla ignotincta*	5	14.30	0.71	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Mionectes oleagineus*	8	13.20	0.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Mirafra javanica*	3	23.00	0.73	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Mitrephanes phaeocercus*	2	8.60	0.32	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Mitrospingus cassinii*	3	40.40	1.31	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Mniotilta varia*	9	12.00	0.44	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Molothrus ater*	10	41.70	1.15	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Molothrus oryzivorus*	10	190.50	3.14	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Molothrus oryzivorus*	unespecified	190.57	3.10	Sayol et al, 2016	Fly
Neognathae	*Monachella muelleriana*	unespecified	22.00	0.75	Sayol et al, 2016	Fly
Neognathae	*Monarcha guttula*	4	15.50	0.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Monarcha melanopsis*	5	20.20	0.92	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Monarcha trivirgatus*	8	13.50	0.63	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Monticola saxatilis*	10	48.50	1.29	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Montifringilla nivalis*	1	45.00	1.09	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Motacilla alba*	10	24.40	0.60	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Motacilla alba*	1	23.00	0.63	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Motacilla flava*	10	14.40	0.55	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Muscicapa striata*	10	15.40	0.49	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Muscisaxicola alpinus*	2	22.80	0.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myadestes genibarbis*	6	27.10	0.92	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myadestes townsendi*	3	32.50	1.01	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myiagra alecto*	10	24.00	0.73	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myiagra caledonica*	6	11.00	0.59	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myiagra cyanoleuca*	unespecified	14.81	0.63	Sayol et al, 2016	Fly
Neognathae	*Myiagra inquieta*	5	14.30	0.76	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myiagra rubecula*	unespecified	15.00	0.54	Sayol et al, 2016	Fly
Neognathae	*Myiarchus cinerascens*	10	28.80	0.77	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myiarchus stolidus*	7	19.30	0.65	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myiarchus tuberculifer*	9	18.70	0.66	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myiarchus tyrannulus*	8	35.30	0.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myiarchus validus*	unespecified	40.98	1.20	Sayol et al, 2016	Fly
Neognathae	*Myiobius barbatus*	4	11.90	0.35	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myioborus pictus*	3	9.80	0.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myiodynastes maculatus*	6	45.90	1.13	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myiopagis cotta*	3	13.00	0.42	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myiophobus fasciatus*	3	9.90	0.37	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myiothlypis fulvicauda*	4	14.90	0.56	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myiozetetes similis*	9	27.80	0.82	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myrmeciza exsul*	10	26.10	1.03	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myrmeciza ferruginea*	2	26.60	0.82	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myrmelastes leucostigma*	4	23.20	0.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myrmelastes leucostigma*	unespecified	23.20	0.98	Sayol et al, 2016	Fly
Neognathae	*Myrmotherula axillaris*	10	7.40	0.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myzomela obscura*	6	11.90	0.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Myzomela sanguinolenta*	4	7.80	0.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Nectarinia calcostetha*	8	8.60	0.41	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Nectarinia jugularis*	10	8.70	0.40	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Nectarinia olivacea*	unespecified	9.70	0.55	Sayol et al, 2016	Fly
Neognathae	*Nectarinia violacea*	6	8.90	0.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Neochmia phaethon*	7	10.00	0.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Neochmia temporalis*	8	10.90	0.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Nesospingus speculiferus*	10	36.20	1.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Nicator chloris*	6	38.20	1.28	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Notiochelidon cyanoleuca*	5	9.70	0.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Oedistoma iliolophum*	4	12.90	0.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Oenanthe oenanthe*	10	23.50	0.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Onychorhynchus coronatus*	4	14.00	0.47	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Onycognathus salvadorii*	3	147.30	2.44	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Oreocharis arfaki*	unespecified	19.49	0.69	Sayol et al, 2016	Fly
Neognathae	*Oreoica gutturalis*	3	62.00	1.67	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Origma solitaria*	unespecified	13.00	0.85	Sayol et al, 2016	Fly
Neognathae	*Oriolus flavocinctus*	unespecified	89.03	2.10	Sayol et al, 2016	Fly
Neognathae	*Oriolus oriolus*	1	72.00	1.50	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Oriolus sagittatus*	5	97.40	1.96	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Orthonyx temminckii*	4	62.30	1.76	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Oryzoborus angolensis*	10	11.80	0.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pachycephala olivacea*	unespecified	44.26	1.48	Sayol et al, 2016	Fly
Neognathae	*Pachycephala pectoralis*	8	26.00	1.12	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pachycephala rufiventris*	7	21.40	1.03	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pachycephala rufogularis*	unespecified	36.05	1.09	Sayol et al, 2016	Fly
Neognathae	*Pachycephala simplex*	unespecified	18.99	0.83	Sayol et al, 2016	Fly
Neognathae	*Pachycephalopsis poliosoma*	4	38.30	1.06	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pachyramphus cinnamomeus*	2	20.30	0.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pachyramphus niger*	unespecified	38.90	1.30	Sayol et al, 2016	Fly
Neognathae	*Pachyramphus polychopterus*	4	20.30	0.74	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Padda oryzivora*	9	24.50	0.85	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pardalotus punctatus*	9	9.20	0.40	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pardalotus striatus*	8	11.60	0.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Paroaria coronata*	10	43.00	1.23	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Parotia lawesii*	3	156.50	4.01	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Parula americana*	6	8.00	0.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Parus caeruleus*	1	11.00	0.68	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Parus major*	1	17.50	0.91	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Passer domesticus*	12	27.70	0.97	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Passer hispaniolensis*	10	24.20	0.97	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Passerina cyanea*	9	12.20	0.65	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pastor roseus*	1	55.21	1.48	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Peneothello cyanus*	unespecified	27.06	0.96	Sayol et al, 2016	Fly
Neognathae	*Pericrocotus ethologus*	5	18.00	0.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Perisoreus canadensis*	10	69.00	2.53	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Perissocephalus tricolor*	2	339.50	4.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Petrochelidon fulva*	10	15.50	0.50	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Petroica goodenovii*	11	8.70	0.37	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Petroica multicolor*	8	9.60	0.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Petroica phoenicea*	6	13.30	0.49	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Petroica rodinogaster*	2	9.70	0.49	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Petroica rosea*	unespecified	10.70	0.50	Sayol et al, 2016	Fly
Neognathae	*Phacellodomus ruber*	3	39.30	1.11	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phaenicophilus palmarum*	10	29.20	1.13	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phaenostictus macleannani*	2	51.10	1.07	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phaeomyias murina*	7	10.00	0.37	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phainopepla nitens*	10	22.40	0.79	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pheucticus ludovicianus*	7	45.60	1.32	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Philemon argenticeps*	unespecified	99.98	1.70	Sayol et al, 2016	Fly
Neognathae	*Philemon buceroides*	5	121.00	2.15	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Philemon citreogularis*	unespecified	62.18	1.57	Sayol et al, 2016	Fly
Neognathae	*Philemon corniculatus*	3	105.80	1.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Philemon diemenensis*	10	67.00	1.55	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Philydor guttulatus*	4	34.80	1.19	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phleocryptes melanops*	3	14.20	0.69	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phoenicurus phoenicurus*	10	12.10	0.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phrygilus gramineus*	10	22.70	1.02	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phrygilus patagonicus*	unespecified	22.74	1.02	Sayol et al, 2016	Fly
Neognathae	*Phylidonyris albifrons*	4	17.10	0.72	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phylidonyris melanops*	3	18.30	0.62	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phylidonyris niger*	unespecified	15.39	0.80	Sayol et al, 2016	Fly
Neognathae	*Phylidonyris novaehollandiae*	9	19.40	0.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phyllastrephus terrestris*	3	31.70	1.03	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phylloscopus bonelli*	8	7.40	0.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phylloscopus sibilatrix*	10	7.20	0.36	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phytotoma rutila*	unespecified	36.02	0.73	Sayol et al, 2016	Fly
Neognathae	*Pica pica*	10	188.10	4.67	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pinicola enucleator*	10	65.70	1.58	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pipilo erythrophthalmus*	10	39.20	1.36	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pipra erythrocephala*	10	13.60	0.49	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pipra fasciicauda*	9	14.30	0.62	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pipra mentalis*	8	15.20	0.59	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pipra pipra*	unespecified	11.93	0.50	Sayol et al, 2016	Fly
Neognathae	*Piranga ludoviciana*	9	30.00	0.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Piranga rubra*	11	29.50	1.02	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pitangus sulphuratus*	10	71.50	1.35	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pithys albifrons*	8	19.70	0.62	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pitohui dichrous*	unespecified	71.66	1.88	Sayol et al, 2016	Fly
Neognathae	*Pitohui ferrugineus*	3	94.00	2.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pitta brachyura*	3	55.50	1.39	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Pitta maxima*	5	189.00	2.53	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pitta sordida*	7	63.60	1.31	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pitta versicolor*	7	107.70	1.87	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Platyrinchus cancrominus*	3	9.70	0.49	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Platyrinchus mystaceus*	8	9.10	0.40	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Platysteira cyanea*	4	13.40	0.79	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Plectrophenax nivalis*	9	34.80	1.02	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Plocepasser mahali*	2	43.30	1.23	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ploceus cucullatus*	9	40.90	1.37	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Podoces hendersoni*	2	149.00	3.28	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Poecile atricapillus*	unespecified	11.40	0.77	Sayol et al, 2016	Fly
Neognathae	*Poecile atricapillus*	7	12.00	0.76	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Poecile carolinensis*	4	10.20	0.60	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Poecile gambeli*	unespecified	11.43	0.73	Sayol et al, 2016	Fly
Neognathae	*Poecile gambeli*	6	11.30	0.75	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Poecile hudsonicus*	unespecified	11.01	0.71	Sayol et al, 2016	Fly
Neognathae	*Poecile hudsonicus*	6	11.00	0.71	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Poecilodryas albonotata*	unespecified	38.02	1.30	Sayol et al, 2016	Fly
Neognathae	*Poecilodryas cerviniventris*	unespecified	17.00	0.72	Sayol et al, 2016	Fly
Neognathae	*Poecilodryas placens*	unespecified	26.60	0.98	Sayol et al, 2016	Fly
Neognathae	*Poecilodryas superciliosa*	unespecified	20.01	0.92	Sayol et al, 2016	Fly
Neognathae	*Poeoptera lugubris*	2	38.00	0.99	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Poephila acuticauda*	10	14.00	0.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Poephila cincta*	8	16.10	0.47	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Poephila personata*	3	11.80	0.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Polioptila caerulea*	2	6.00	0.30	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pomatorhinus ruficollis*	4	31.70	1.53	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pomatostomus halli*	3	37.50	1.60	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pomatostomus isidorei*	2	64.00	2.18	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pomatostomus ruficeps*	10	56.00	2.35	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pomatostomus superciliosus*	11	35.00	1.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pomatostomus temporalis*	2	75.00	1.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pooecetes gramineus*	8	25.70	0.81	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Poospiza nigrorufa*	5	17.40	0.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Prinia leucopogon*	3	13.80	0.59	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Prionochilus plateni*	4	7.90	0.40	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Prionops plumatus*	3	35.50	1.16	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Progne subis*	10	50.70	1.03	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Protonotaria citrea*	9	15.50	0.59	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Prunella modularis*	4	19.70	0.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Psaltriparus minimus*	3	5.30	0.35	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Psarocolius montezuma*	10	376.50	5.89	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Pseudocolopteryx flaviventris*	2	7.40	0.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pseudoleistes virescens*	5	70.40	2.01	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pseudotriccus pelzelni*	2	10.90	0.64	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Psilorhinus morio*	10	204.00	4.80	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Psophodes cristatus*	unespecified	38.51	1.40	Sayol et al, 2016	Fly
Neognathae	*Psophodes occidentalis*	2	42.00	1.33	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Psophodes olivaceus*	unespecified	62.74	2.18	Sayol et al, 2016	Fly
Neognathae	*Pteruthius flaviscapis*	3	39.00	1.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ptilonorhynchus violaceus*	6	217.00	4.72	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ptiloprora guisei*	unespecified	22.69	0.91	Sayol et al, 2016	Fly
Neognathae	*Ptiloris magnificus*	unespecified	163.04	2.80	Sayol et al, 2016	Fly
Neognathae	*Ptiloris paradiseus*	2	125.50	2.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ptiloris victoriae*	4	92.00	2.54	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pycnonotus jocosus*	10	27.40	0.93	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pycnonotus tricolor*	10	43.00	1.16	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pycnoptilus floccosus*	unespecified	31.19	1.18	Sayol et al, 2016	Fly
Neognathae	*Pyriglena leuconota*	7	32.80	0.93	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pyrocephalus rubinus*	7	12.70	0.46	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pyrrhocorax pyrrhocorax*	4	324.00	6.38	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pyrrhocorax pyrrhocorax*	1	356.00	6.49	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Pyrrholaemus brunneus*	unespecified	11.50	0.55	Sayol et al, 2016	Fly
Neognathae	*Pyrrholaemus sagittatus*	unespecified	13.50	0.60	Sayol et al, 2016	Fly
Neognathae	*Pytilia melba*	3	13.50	0.57	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Querula purpurata*	4	101.80	2.13	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Quiscalus major*	8	158.80	2.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Quiscalus mexicanus*	8	168.70	2.96	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Quiscalus quiscula*	10	110.20	2.59	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ramphocaenus melanurus*	7	9.80	0.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ramphocelus flammigerus*	10	30.70	1.19	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ramsayornis modestus*	3	10.60	0.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Regulus calendula*	6	6.60	0.31	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Regulus regulus*	1	5.40	0.36	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Regulus satrapa*	9	6.20	0.36	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Rhinocrypta lanceolata*	2	63.60	1.40	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Rhipidura atra*	unespecified	10.50	0.57	Sayol et al, 2016	Fly
Neognathae	*Rhipidura fuliginosa*	4	8.00	0.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Rhipidura leucophrys*	9	27.70	0.58	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Rhipidura rufifrons*	7	10.20	0.36	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Rhipidura rufiventris*	4	15.60	0.55	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Rhodinocichla rosea*	5	46.70	1.35	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Rhodospingus cruentus*	10	10.80	0.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Riparia riparia*	8	13.80	0.41	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Rupicola peruviana*	5	243.50	3.36	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sakesphorus luctuosus*	3	31.00	1.15	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Salpinctes obsoletus*	7	16.00	0.75	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Saltator maximus*	10	46.60	1.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sarcops calvus*	6	142.00	2.80	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Saxicola torquatus*	7	15.30	0.61	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sayornis nigricans*	3	18.60	0.49	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sayornis phoebe*	8	18.30	0.59	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sayornis phoebe*	1	17.80	0.77	Crile & Quiring, 1940	Fly
Neognathae	*Sayornis saya*	5	21.70	0.61	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Scenopoeetes dentirostris*	unespecified	146.06	3.50	Sayol et al, 2016	Fly
Neognathae	*Schiffornis turdina*	5	30.80	1.07	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Schistochlamys melanopis*	10	33.00	1.22	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sclerurus mexicanus*	3	21.10	0.79	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Scytalopus unicolor*	unespecified	17.50	0.90	Sayol et al, 2016	Fly
Neognathae	*Seiurus aurocapilla*	10	22.10	0.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Seleucidis melanoleuca*	4	178.00	3.41	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sericornis citreogularis*	4	16.60	0.79	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sericornis frontalis*	unespecified	13.20	0.80	Sayol et al, 2016	Fly
Neognathae	*Sericornis magnirostra*	7	8.50	0.60	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sericornis perspicillatus*	unespecified	8.50	0.55	Sayol et al, 2016	Fly
Neognathae	*Sericulus chrysocephalus*	8	100.50	3.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Serinus canaris*	1	8.00	0.45	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Serinus flaviventris*	5	16.30	0.72	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Setophaga caerulescens*	10	9.40	0.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Setophaga citrina*	10	10.70	0.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Setophaga coronata*	10	12.60	0.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Setophaga petechia*	10	9.80	0.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Setophaga ruticilla*	10	7.80	0.36	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sialia mexicana*	8	26.40	0.84	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sialia sialis*	10	29.70	0.99	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sicalis flaveola*	6	19.70	0.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sitta canadensis*	6	10.50	0.57	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sitta carolinensis*	9	17.80	0.86	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sitta europaea*	1	23.00	1.06	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Sitta pygmaea*	8	10.40	0.55	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sittasomus griseicapillus*	6	14.00	0.55	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Smicrornis brevirostris*	unespecified	6.60	0.29	Sayol et al, 2016	Fly
Neognathae	*Smithornis capensis*	2	25.50	0.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Spermophaga haematina*	3	22.30	0.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sphecotheres viridis*	9	132.40	2.24	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Spindalis zena*	10	42.50	1.31	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Spiza americana*	7	27.00	0.91	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Spizella arborea*	7	12.40	0.74	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sporophila americana*	10	10.70	0.60	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Stachyris whiteheadi*	8	19.10	0.82	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Stagonopleura guttata*	4	19.00	0.63	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Stelgidopteryx ruficollis*	10	15.20	0.53	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Strepera fuliginosa*	2	300.00	5.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Strepera graculina*	10	278.50	5.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Strepera versicolor*	5	353.00	5.97	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Struthidea cinerea*	8	134.30	2.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sturnella neglecta*	9	103.50	1.94	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sturnus vulgaris*	10	83.80	1.97	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sylvia atricapilla*	10	18.10	0.65	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sylvia borin*	10	17.60	0.62	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Synallaxis brachyura*	4	18.30	0.86	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Syndactyla guttulata*	unespecified	34.85	1.19	Sayol et al, 2016	Fly
Neognathae	*Tachycineta bicolor*	7	20.10	0.55	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tachycineta thalassina*	10	15.10	0.46	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tachyphonus delatrii*	10	16.80	0.74	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Taeniopygia bichenovii*	4	10.50	0.40	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Taeniopygia guttata*	14	12.00	0.44	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tangara cyanicollis*	9	17.00	0.64	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Taraba major*	10	67.50	1.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tchagra australis*	7	36.30	1.23	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Telophorus zeylonus*	3	62.70	1.91	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tephrodornis pondicerianus*	6	19.50	0.89	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Terpsiphone atrocaudata*	9	16.50	0.65	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tersina viridis*	3	29.00	0.93	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Thamnomanes caesius*	10	14.20	0.61	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Thamnophilus caerulescens*	8	20.00	0.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Thamnophilus punctatus*	10	22.40	0.94	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Thraupis episcopus*	9	31.10	1.11	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Thryomanes bewickii*	6	9.80	0.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Thryothorus ludovicianus*	10	18.70	0.85	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Thryothorus nigricapillus*	10	27.90	1.06	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tiaris olivaceus*	10	8.50	0.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tityra cayana*	6	73.90	1.61	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tityra semifasciata*	6	79.30	1.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Todirostrum cinereum*	4	6.40	0.31	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tolmomyias sulphurescens*	5	14.90	0.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Toxorhamphus poliopterus*	5	11.40	0.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Toxostoma curvirostre*	10	78.40	2.13	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Toxostoma rufum*	8	70.30	2.00	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tregellasia capito*	unespecified	14.17	0.77	Sayol et al, 2016	Fly
Neognathae	*Tregellasia leucops*	5	16.00	0.59	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tregellasia leucops*	unespecified	16.02	0.61	Sayol et al, 2016	Fly
Neognathae	*Trichodere cockerelli*	unespecified	18.60	0.65	Sayol et al, 2016	Fly
Neognathae	*Trichothraupis melanops*	9	21.60	0.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Troglodytes aedon*	8	11.00	0.53	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Troglodytes troglodytes*	1	9.50	0.50	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Turdoides jardineii*	unespecified	78.02	2.00	Sayol et al, 2016	Fly
Neognathae	*Turdus ericetorium*	1	67.00	1.46	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Turdus lherminieri*	7	100.00	2.20	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Turdus lherminieri*	unespecified	110.72	2.17	Sayol et al, 2016	Fly
Neognathae	*Turdus merula*	15	113.00	1.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Turdus migratorius*	10	80.20	1.64	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Turdus philomelos*	11	67.80	1.63	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tyrannus dominicensis*	10	46.30	1.00	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tyrannus forficata*	3	39.30	0.86	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tyrannus savana*	8	28.60	0.73	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tyrannus tyrannus*	10	39.50	0.95	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tyrannus verticalis*	7	40.70	0.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Uraeginthus bengalus*	9	10.30	0.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Vauriella gularis*	2	18.00	1.05	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Vermivora peregrina*	8	9.50	0.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Vidua paradisaea*	11	22.20	0.64	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Vireo altiloquus*	10	19.50	0.75	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Vireo griseus*	8	11.90	0.58	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Vireo magister*	4	15.90	0.72	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Vireo olivaceus*	10	20.30	0.61	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Volatinia jacarina*	7	12.50	0.49	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Willisornis poecilinotus*	unespecified	16.59	0.63	Sayol et al, 2016	Fly
Neognathae	*Xanthocephalus xanthocephalus*	10	76.60	1.65	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Xanthotis flaviventer*	4	33.60	1.05	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Xanthotis macleayanus*	unespecified	32.49	0.90	Sayol et al, 2016	Fly
Neognathae	*Xenops minutus*	8	11.70	0.49	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Xiphorhynchus guttatus*	10	46.40	1.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Xolmis irupero*	3	29.80	0.82	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Xolmis pyrope*	3	42.80	1.28	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Yuhina diademata*	3	12.00	0.77	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Zonotrichia albicollis*	10	27.40	1.05	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Zonotrichia leucophrys*	10	26.40	0.97	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Zoothera heinei*	unespecified	72.97	1.80	Sayol et al, 2016	Fly
Neognathae	*Zoothera lunulata*	6	104.00	2.16	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Zoothera naevia*	unespecified	70.74	1.74	Sayol et al, 2016	Fly
Neognathae	*Zosterops japonicus*	10	10.20	0.54	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Zosterops lateralis*	9	10.60	0.47	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anhinga melanogaster*	9	1608.30	4.56	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ardea intermedia*	unespecified	409.94	4.40	Sayol et al, 2016	Fly
Neognathae	*Ardea pacifica*	unespecified	858.34	5.17	Sayol et al, 2016	Fly
Neognathae	*Balaeniceps rex*	2	5984.00	22.38	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Fregata aquila*	1	1405.00	9.45	Crile & Quiring, 1940	Fly
Neognathae	*Fregata minor*	10	1193.80	9.23	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ixobrychus minutus*	unespecified	57.97	1.65	Sayol et al, 2016	Fly
Neognathae	*Morus serrator*	5	1003.90	4.83	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pelecanus conspicillatus*	6	5850.00	24.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pelecanus erythrorhynchus*	6	7000.00	24.25	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pelecanus occidentalis*	1	3290.00	17.45	Crile & Quiring, 1940	Fly
Neognathae	*Pelecanus onocrotalus*	1	9000.00	30.57	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Phaethon rubricauda*	10	672.00	4.52	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phalacrocorax africanus*	8	617.50	4.53	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phalacrocorax carbo*	10	2475.00	10.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phalacrocorax fuscescens*	6	1700.00	8.89	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phalacrocorax melanoleucos*	10	695.90	5.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phalacrocorax sulcirostris*	10	1030.50	5.64	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phalacrocorax urile*	10	2181.40	8.22	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phalacrocorax varius*	8	1965.00	9.21	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Platalea alba*	unespecified	1824.39	12.26	Sayol et al, 2016	Fly
Neognathae	*Platalea regia*	unespecified	1788.26	11.05	Sayol et al, 2016	Fly
Neognathae	*Sula leucogaster*	8	1237.50	9.04	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phoenicopterus roseus*	unespecified	2599.31	10.45	Sayol et al, 2016	Fly
Neognathae	*Phoenicopterus ruber*	1	3000.00	11.06	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Phoenicopterus ruber*	10	3035.00	10.80	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Andigena hypoglauca*	unespecified	297.97	5.20	Sayol et al, 2016	Fly
Neognathae	*Aulacorhynchus sulcatus*	7	173.00	2.74	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Brachygalba lugubris*	unespecified	17.25	0.43	Sayol et al, 2016	Fly
Neognathae	*Calorhamphus fuliginosus*	3	42.20	1.10	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Campephilus guatemalensis*	8	240.70	5.94	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Campethera nivosa*	4	34.80	1.58	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Capito niger*	3	54.80	1.35	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Celeus castaneus*	4	109.00	2.11	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chrysocolaptes lucidus*	unespecified	119.94	4.60	Sayol et al, 2016	Fly
Neognathae	*Colaptes auratus*	11	152.80	3.06	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dendrocopos major*	1	80.00	2.70	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Dendrocopos medius*	1	58.00	2.06	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Dendropicos fuscescens*	5	26.00	1.22	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Dinopium javanense*	8	78.50	2.67	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Dryocopus pileatus*	10	282.80	6.80	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Jynx torquilla*	10	27.60	0.94	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lybius torquatus*	3	60.00	1.16	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melanerpes carolinus*	11	68.50	2.16	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melanerpes erythrocephalus*	7	71.60	1.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melanerpes formicivorus*	10	79.00	1.99	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melanerpes lewis*	10	103.90	2.22	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melanerpes striatus*	10	74.90	2.04	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Mulleripicus fulvus*	2	200.00	4.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Picoides arcticus*	4	72.40	3.15	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Picoides borealis*	3	47.90	1.66	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Picoides pubescens*	8	25.30	1.21	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Picoides scalaris*	10	33.00	1.38	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Picoides tridactylus*	5	55.20	2.63	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Picoides villosus*	10	82.80	2.95	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Piculus flavigula*	3	61.50	1.63	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Picumnus temminckii*	2	11.00	0.60	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Picus canus*	8	150.40	3.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Picus viridus*	1	200.00	4.38	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Pogoniulus scolopaceus*	4	15.50	0.44	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Psilopogon lineatus*	4	160.50	2.01	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Psilopogon pyrolophus*	5	129.00	2.21	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Psilopogon zeylanicus*	3	105.80	1.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pteroglossus aracari*	7	232.00	3.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pteroglossus bailloni*	3	139.00	2.94	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pteroglossus castanotis*	5	310.00	3.77	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pteroglossus inscriptus*	5	126.00	2.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pteroglossus torquatus*	10	224.90	3.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ramphastos sulfuratus*	12	425.00	4.86	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ramphastos tucanus*	7	530.00	5.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ramphastos vitellinus*	12	361.50	4.81	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sasia abnormis*	2	8.10	0.58	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Selenidera maculirostris*	8	138.50	2.91	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Semnornis ramphestinus*	5	97.50	1.91	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sphyrapicus nuchalis*	5	45.60	1.27	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Sphyrapicus varius*	10	49.90	1.30	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Trachyphonus vaillanti*	3	73.00	1.63	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tricholaema leucomelas*	3	35.00	0.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Veniliornis passerinus*	2	31.40	1.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Podiceps cristatus*	1	1050.00	3.76	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Podiceps ruficollis*	1	160.00	1.72	Portmann 1946, 1947 in Hurlburt, 1996	Fly

Neognathae	*Aechmophorus occidentalis*	10	1147.70	3.71	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Podiceps auritus*	10	441.70	2.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Podiceps cristatus*	12	729.70	3.11	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Podiceps grisegena*	10	1115.00	4.04	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Podiceps nigricollis*	10	292.00	1.69	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Podilymbus podiceps*	10	442.00	3.16	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Poliocephalus poliocephalus*	11	223.40	1.72	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Rollandia rolland*	2	248.50	1.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tachybaptus novaehollandiae*	6	152.30	1.66	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Bulweria bulwerii*	10	99.00	1.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calonectris diomedea*	8	571.80	4.92	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Daption capense*	10	428.00	5.02	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Diomedea cauta*	9	4100.00	19.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Diomedea chrysostoma*	4	3507.50	19.15	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Diomedea exulans*	1	4763.00	31.00	Hurlburt, 1996	Fly
Neognathae	*Diomedea exulans*	3	7650.00	28.25	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Diomedea melanophrys*	5	3387.50	17.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Diomedea nigripes*	7	3148.00	15.80	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Fregetta grallaria*	7	46.00	0.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Fulmarus glacialis*	10	544.00	6.33	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Fulmarus glacialoides*	10	1000.00	7.46	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Halobaena caerulea*	7	173.20	2.77	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Macronectes giganteus*	7	4567.00	17.94	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Nesofregetta albigularis*	6	64.60	0.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Oceanites oceanicus*	10	33.70	0.71	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Oceanodroma leucorrhoa*	10	39.60	0.89	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Oceanodroma microsoma*	8	19.70	0.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Oceanodroma tethys*	10	26.90	0.60	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pachyptila belcherii*	9	92.60	2.00	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pachyptila desolata*	8	151.50	2.10	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pachyptila salvinii*	7	164.00	2.06	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pachyptila turtur*	8	80.60	2.00	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pagodroma nivea*	10	314.00	4.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pelecanoides georgicus*	10	114.20	1.47	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pelecanoides urinatrix*	10	134.60	1.69	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phoebetria palpebrata*	3	2785.00	16.94	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Procellaria aequinoctialis*	8	1271.70	8.99	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Procellaria cinerea*	3	1131.00	8.49	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pterodroma brevirostris*	10	297.50	4.26	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pterodroma lessonii*	7	457.70	5.87	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pterodroma leucoptera*	10	164.50	2.48	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Pterodroma macroptera*	5	321.00	4.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Puffinus gavia*	8	191.80	2.92	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Puffinus griseus*	1	268.00	3.01	Crile & Quiring, 1940	Fly
Neognathae	*Puffinus griseus*	10	770.00	5.31	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Puffinus pacificus*	10	383.40	3.97	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Puffinus tenuirostris*	32	556.70	4.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Thalassoica antarctica*	10	754.50	6.68	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Agapornis cana*	7	26.50	1.15	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Agapornis fischeri*	7	48.30	1.95	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Agapornis lilianae*	8	40.50	1.53	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Agapornis personatus*	9	52.50	1.87	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Agapornis pullaria*	8	43.00	1.44	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Agapornis roseicollis*	9	45.80	1.86	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Agapornis swinderiana*	2	40.00	1.53	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Agapornis taranta*	4	57.50	1.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Alisterus scapularis*	16	160.40	4.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amazona aestiva*	4	400.00	8.24	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amazona albifrons*	7	218.00	5.28	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amazona amazonica*	11	338.00	8.29	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amazona auropalliata*	5	433.00	9.57	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amazona autumnalis*	5	399.50	8.13	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amazona farinosa*	10	610.00	10.14	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amazona leucocephala*	8	277.00	5.63	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amazona ochrocephala*	7	510.00	8.64	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amazona oratrix*	7	433.00	8.62	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amazona ventralis*	5	300.00	5.97	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amazona versicolor*	1	400.00	7.82	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Amazona vinacea*	3	411.70	7.46	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amazona viridigenalis*	6	316.00	6.89	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Amazona vittata*	unespecified	229.06	5.85	Sayol et al, 2016	Fly
Neognathae	*Anodorhynchus hyacinthus*	5	1500.00	24.73	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aprosmictus erythropterus*	9	138.30	3.85	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ara ararauna*	10	1125.00	18.08	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ara ararauna*	1	850.00	18.69	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Ara chloroptera*	4	1185.00	20.88	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ara chloroptera*	1	1430.00	24.34	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Ara macao*	13	1015.00	17.93	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ara militaris*	4	1134.00	18.83	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aratinga aurea*	4	84.00	3.23	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aratinga canicularis*	3	75.20	3.26	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aratinga finschii*	4	236.00	5.28	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aratinga holochlora*	3	232.00	5.23	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Aratinga leucopthalmus*	4	155.00	5.58	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aratinga nana*	10	79.00	4.01	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aratinga pertinax*	5	89.00	3.49	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aratinga solstitialis*	unespecified	86.23	4.50	Sayol et al, 2016	Fly
Neognathae	*Aratinga weddellii*	4	108.00	4.01	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Barnardius barnardius*	9	162.60	3.62	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Barnardius zonarius*	7	139.60	3.91	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Bolbopsittacus lunulatus*	unespecified	67.02	2.65	Sayol et al, 2016	Fly
Neognathae	*Bolborhynchus lineola*	2	53.60	2.08	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Brotogeris chrysopterus*	10	72.00	2.08	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Brotogeris jugularis*	10	63.30	2.12	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Brotogeris versicolurus*	7	60.40	2.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cacatua alba*	6	631.00	14.16	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cacatua galerita*	22	765.00	14.24	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cacatua haematuropygia*	unespecified	209.98	8.80	Sayol et al, 2016	Fly
Neognathae	*Cacatua leadbeateri*	5	460.00	8.47	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cacatua moluccensis*	5	850.00	15.63	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cacatua pastinator*	4	643.20	10.99	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cacatua roseicapilla*	23	351.00	6.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cacatua sanguinea*	10	437.50	8.91	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cacatua sulphurea*	6	344.00	9.62	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cacatua sulphurea*	1	450.00	8.72	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Cacatua tenuirostris*	22	523.60	10.64	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Callocephalon fimbriatum*	11	256.60	7.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calyptorhynchus banksii*	5	772.00	11.95	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calyptorhynchus baudinii*	4	683.30	14.63	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calyptorhynchus funereus*	9	766.00	15.08	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calyptorhynchus lathamii*	4	430.00	9.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Calyptorhynchus latirostris*	9	676.30	14.25	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Charmosyna papou*	6	98.00	3.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Charmosyna pulchella*	3	29.10	1.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cyanoramphus auriceps*	2	48.20	2.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cyanoramphus novaezelandiae*	unespecified	59.03	2.25	Sayol et al, 2016	Fly
Neognathae	*Cyanoramphus unicolor*	4	150.10	4.03	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Cyclopsitta diophthalma*	unespecified	33.02	1.70	Sayol et al, 2016	Fly
Neognathae	*Cyclopsitta gulielmitertii*	unespecified	29.49	1.53	Sayol et al, 2016	Fly
Neognathae	*Deroptyus accipitrinus*	4	251.40	7.74	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Diopsittaca nobilis*	3	136.00	5.84	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eclectus roratus*	12	428.00	7.36	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Enicognathus ferrugineus*	unespecified	183.83	5.30	Sayol et al, 2016	Fly
Neognathae	*Eos bornea*	4	120.00	4.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eos cyanogenia*	3	120.00	4.85	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eos squamata*	6	100.00	3.83	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eunymphicus cornutus*	2	130.00	3.33	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eunymphicus uvaeensis*	unespecified	93.97	3.00	Sayol et al, 2016	Fly
Neognathae	*Forpus coelestis*	10	26.20	1.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Forpus passerinus*	6	24.00	1.10	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Geoffroyus geoffroyi*	9	131.50	4.26	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Glossopsitta concinna*	15	75.80	2.87	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Glossopsitta porphyrocephala*	12	45.70	1.89	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Glossopsitta pusilla*	4	36.10	1.59	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Guaruba guarouba*	2	194.30	7.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lathamus discolor*	9	64.00	2.37	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Loriculus amabilis*	4	20.00	1.14	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Loriculus galgulus*	6	28.50	1.49	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Loriculus phillipensis*	2	36.00	1.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lorius garrulus*	7	211.50	5.17	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Lorius lory*	11	233.00	5.12	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Melopsittacus undulatus*	25	35.00	1.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Micropsitta pusio*	unespecified	14.50	0.98	Sayol et al, 2016	Fly
Neognathae	*Nannopsittaca panychlora*	2	38.80	1.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Neophema chrysostoma*	unespecified	57.97	1.70	Sayol et al, 2016	Fly
Neognathae	*Neophema elegans*	5	37.30	1.28	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Neophema pulchella*	9	32.30	1.29	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Neophema splendida*	8	32.30	1.28	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Neopsephotus bourkii*	10	44.00	1.25	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Neopsittacus musschenbroekii*	unespecified	57.00	2.45	Sayol et al, 2016	Fly
Neognathae	*Nestor notabilis*	6	956.00	14.40	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Northiella haematogaster*	9	76.40	2.40	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Nymphicus hollandicus*	22	83.00	2.39	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ognorhynchus icterotis*	2	285.00	8.85	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Oreopsittacus arfaki*	2	19.50	1.15	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Orthopsittaca manilata*	unespecified	354.96	8.15	Sayol et al, 2016	Fly
Neognathae	*Pezoporus wallicus*	unespecified	76.55	2.72	Sayol et al, 2016	Fly
Neognathae	*Pionites leucogaster*	6	155.00	5.20	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pionites melanocephalus*	8	136.40	5.18	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pionus menstruus*	8	247.00	5.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pionus senilis*	unespecified	209.98	6.00	Sayol et al, 2016	Fly
Neognathae	*Platycercus adscitus*	4	89.80	3.06	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Platycercus caledonicus*	7	122.70	3.63	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Platycercus elegans*	21	128.60	3.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Platycercus elegans*	7	109.90	3.24	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Platycercus eximius*	14	103.50	3.01	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Platycercus icterotis*	6	53.90	2.38	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Platycercus venustus*	3	78.50	2.56	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Poicephalus gulielmi*	2	213.50	5.80	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Poicephalus meyeri*	6	117.50	4.41	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Poicephalus robustus*	5	350.00	8.21	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Poicephalus senegalus*	9	155.00	4.71	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Polytelis alexandrae*	6	73.00	2.58	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Polytelis anthopeplus*	9	176.80	3.85	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Polytelis swainsonii*	11	142.60	3.35	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Primolius auricollis*	3	250.00	7.53	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Prioniturus platurus*	3	140.00	4.76	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Probosciger aterrimus*	4	1050.00	20.50	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Psephotus chrysopterygius*	2	37.20	1.40	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Psephotus dissimilis*	3	30.00	1.74	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Psephotus haematonotus*	17	59.20	1.97	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Psephotus varius*	9	56.70	1.79	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Psittacula alexandri*	3	156.00	4.20	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Psittacula columboides*	2	90.00	3.43	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Psittacula cyanocephala*	unespecified	59.98	2.65	Sayol et al, 2016	Fly
Neognathae	*Psittacula eupatria*	6	214.00	5.54	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Psittacula eupatria*	1	96.00	4.09	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Psittacula krameri*	12	137.00	3.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Psittaculirostris edwardsii*	4	90.70	3.25	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Psittacus erithacus*	11	405.50	9.18	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Psittacus erithacus*	1	450.00	9.50	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Psitteuteles versicolor*	3	56.50	2.00	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Purpureicephalus varius*	4	99.70	3.49	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pyrilia caica*	unespecified	135.78	3.35	Sayol et al, 2016	Fly
Neognathae	*Pyrilia haematotis*	unespecified	146.50	3.70	Sayol et al, 2016	Fly
Neognathae	*Pyrrhura frontalis*	6	80.10	2.81	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pyrrhura melanura*	2	83.00	3.28	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pyrrhura perlata*	2	87.00	2.90	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pyrrhura picta*	2	62.00	2.45	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Strigops habroptilus*	3	1500.00	16.50	Iwaniuk & Nelson, 2003	Flightless
Neognathae	*Tanygnathus lucionensis*	6	210.00	5.71	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tanygnathus megalorhynchus*	2	316.20	6.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Touit dilectissimus*	unespecified	62.99	2.60	Sayol et al, 2016	Fly
Neognathae	*Touit purpuratus*	unespecified	68.37	2.40	Sayol et al, 2016	Fly

Neognathae	*Trichoglossus chlorolepidotus*	7	77.20	3.05	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Trichoglossus haematodus*	18	116.00	3.66	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Trichoglossus novaehollandiae*	1	136.00	2.75	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Trichoglossus ornatus*	7	120.00	3.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Trichoglossus rubritorquatus*	4	125.00	3.35	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Vini stepheni*	3	49.10	2.08	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pterocles bicinctus*	4	237.00	1.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Pterocles decoratus*	4	188.00	1.31	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aptenodytes forsteri*	7	34000.00	46.19	Iwaniuk & Nelson, 2003	Flightless
Neognathae	*Aptenodytes patagonicus*	5	13220.00	27.90	Iwaniuk & Nelson, 2003	Flightless
Neognathae	*Eudyptes chrysocome*	5	2500.00	12.42	Iwaniuk & Nelson, 2003	Flightless
Neognathae	*Eudyptula minor*	9	715.10	7.36	Iwaniuk & Nelson, 2003	Flightless
Neognathae	*Pygoscelis adeliae*	10	4375.00	19.66	Iwaniuk & Nelson, 2003	Flightless
Neognathae	*Spheniscus demersus*	1	2700.00	14.45	Portmann 1946, 1947 in Hurlburt, 1996	Flightless
Neognathae	*Spheniscus humboldti*	7	5000.00	15.98	Iwaniuk & Nelson, 2003	Flightless
Neognathae	*Aegolius acadicus*	9	104.30	3.36	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Aegolius funereus*	6	91.20	4.02	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Asio capensis*	5	310.00	5.98	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Asio flammeus*	37	309.80	5.30	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Asio otus*	12	214.70	5.31	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Athene cunicularia*	10	152.80	3.78	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Athene noctua*	5	164.00	3.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Athene noctua*	1	165.00	3.92	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Bubo africanus*	4	635.00	8.60	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Bubo bubo*	1	2000.00	16.89	Portmann 1946, 1947 in Hurlburt, 1996	Fly
Neognathae	*Bubo bubo*	5	2686.00	17.09	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Bubo scandiacus*	10	1894.00	15.87	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Bubo virginianus*	40	1415.80	14.73	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Glaucidium brasilianum*	5	69.10	2.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Glaucidium gnoma*	unespecified	46.99	3.60	Sayol et al, 2016	Fly
Neognathae	*Glaucidium passerinum*	6	58.50	2.59	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Megascops asio*	unespecified	134.69	3.92	Sayol et al, 2016	Fly
Neognathae	*Megascops asio*	9	180.00	4.91	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Megascops choliba*	unespecified	107.66	3.41	Sayol et al, 2016	Fly
Neognathae	*Megascops choliba*	3	121.50	3.41	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Megascops nudipes*	unespecified	142.45	3.80	Sayol et al, 2016	Fly
Neognathae	*Megascops nudipes*	4	142.50	3.71	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Micrathene whitneyi*	unespecified	33.21	1.40	Sayol et al, 2016	Fly
Neognathae	*Ninox boobook*	12	231.40	5.53	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Ninox connivens*	unespecified	699.94	6.40	Sayol et al, 2016	Fly
Neognathae	*Ninox jacquinoti*	3	175.70	4.38	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Ninox squamipila*	unespecified	130.06	4.40	Sayol et al, 2016	Fly
Neognathae	*Ninox strenua*	3	1359.90	11.44	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Otus bakkamoena*	5	139.10	4.04	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Otus magicus*	3	165.00	3.76	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Otus scops*	12	77.10	2.49	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Strix aluco*	unespecified	379.93	9.25	Sayol et al, 2016	Fly
Neognathae	*Strix nebulosa*	11	1078.80	14.66	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Strix nigrolineata*	5	527.50	7.40	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Strix uralensis*	5	784.50	11.21	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Strix varia*	10	734.10	12.55	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Strix virgata*	4	329.50	6.10	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Surnia ulula*	5	320.50	7.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tyto alba*	10	354.70	6.51	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tyto capensis*	3	419.00	5.23	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tyto longimembris*	unespecified	478.19	5.25	Sayol et al, 2016	Fly
Neognathae	*Tyto novaehollandiae*	9	765.60	8.47	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Tyto tenebricosa*	3	671.50	12.70	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phalacrocorax atriceps*	unespecified	3050.31	14.13	Sayol et al, 2016	Fly
Neognathae	*Amazilia tzacatl*	4	5.30	0.22	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Anthracothorax dominicus*	4	5.80	0.23	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Archilochus colubris*	3	3.30	0.15	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Campylopterus largipennis*	4	8.30	0.31	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Chlorostilbon ricordii*	4	2.80	0.13	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eulampis holosericeus*	4	5.70	0.24	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Eulampis jugularis*	4	10.20	0.32	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Florisuga mellivora*	4	7.00	0.26	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Orthorhynchus cristatus*	4	2.70	0.14	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Phaethornis superciliosus*	4	5.80	0.26	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Selasphorus rufus*	3	3.40	0.16	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Thalurania furcata*	4	4.10	0.20	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Threnetes ruckeri*	4	5.90	0.27	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Trochilus polytmus*	4	4.30	0.19	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Harpactes ardens*	4	96.30	1.77	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Harpactes erythrocephalus*	unespecified	74.51	1.83	Sayol et al, 2016	Fly
Neognathae	*Pharomachrus mocinno*	10	206.00	2.34	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Priotelus roseigaster*	4	74.00	1.31	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Priotelus temnurus*	6	58.00	1.16	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Trogon citreolus*	6	83.10	1.48	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Trogon massena*	4	150.80	2.13	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Trogon melanurus*	7	119.00	1.86	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Trogon violaceus*	6	57.70	1.41	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Trogon viridis*	9	88.00	1.79	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Turnix pyrrhothorax*	5	41.60	0.57	Iwaniuk & Nelson, 2003	Fly

Neognathae	*Turnix suscitator*	3	56.30	0.71	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Turnix varius*	9	88.00	1.04	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Turnix velox*	8	41.00	0.67	Iwaniuk & Nelson, 2003	Fly
Neognathae	*Upupa epops*	11	61.40	1.35	Iwaniuk & Nelson, 2003	Fly
Palaeognathae	*Apteryx australis*	1	1900.00	9.00	Hurlburt, 1996	Flightless
Palaeognathae	*Apteryx australis*	3	3302.48	11.78	Ashwell & Scofield, 2008	Flightless
Palaeognathae	*Apteryx haastii*	3	2332.14	9.78	Ashwell & Scofield, 2008	Flightless
Palaeognathae	*Apteryx owenii*	10	1119.92	6.98	Ashwell & Scofield, 2008	Flightless
Palaeognathae	*Casuarius casuarius*	3	40533.00	31.28	Ashwell & Scofield, 2008	Flightless
Palaeognathae	*Casuarius casuarius*	1	68040.00	34.00	Hurlburt, 1996	Flightless
Palaeognathae	*Casuarius casuarius*	2	44000.00	36.35	Iwaniuk & Nelson, 2003	Flightless
Palaeognathae	*Dromaius novaehollandiae*	6	37782.45	21.98	Ashwell & Scofield, 2008	Flightless
Palaeognathae	*Dromaius novaehollandiae*	1	40500.00	26.56	Portmann 1946, 1947 in Hurlburt, 1996	Flightless
Palaeognathae	*Dromaius novaehollandiae*	4	31160.00	28.88	Iwaniuk & Nelson, 2003	Flightless
Palaeognathae	*Rhea americana*	3	19061.29	18.38	Ashwell & Scofield, 2008	Flightless
Palaeognathae	*Rhea americana*	2	23000.00	18.88	Iwaniuk & Nelson, 2003	Flightless
Palaeognathae	*Rhea americana*	1	25000.00	19.90	De Speroni & Pirlot, 1987	Flightless
Palaeognathae	*Rhea pennata*	1	3544.91	11.00	Ashwell & Scofield, 2008	Flightless
Palaeognathae	*Rhea pennata*	1	10000.00	18.50	Hurlburt, 1996	Flightless
Palaeognathae	*Struthio camelus*	1	90000.00	41.05	Portmann 1946, 1947 in Hurlburt, 1996	Flightless
Palaeognathae	*Struthio camelus*	4	86522.95	41.48	Ashwell & Scofield, 2008	Flightless
Palaeognathae	*Struthio camelus*	1	123000.00	42.11	Crile & Quiring, 1940	Flightless
Palaeognathae	*Crypturellus boucardi*	1	460.00	2.75	Hurlburt, 1996	Fly
Palaeognathae	*Crypturellus soui*	3	216.50	1.49	Iwaniuk & Nelson, 2003	Fly
Palaeognathae	*Crypturellus tataupa*	1	225.00	1.64	De Speroni & Pirlot, 1987	Fly
Palaeognathae	*Eudromia elegans*	10	578.50	2.49	Iwaniuk & Nelson, 2003	Fly
Palaeognathae	*Nothoprocta ornata*	3	624.50	2.85	Iwaniuk & Nelson, 2003	Fly
Palaeognathae	*Nothura maculosa*	10	242.30	1.58	Iwaniuk & Nelson, 2003	Fly
Palaeognathae	*Rhynchotus rufescens*	4	900.00	3.66	Iwaniuk & Nelson, 2003	Fly
Palaeognathae	*Tinamus major*	4	1052.00	2.89	Iwaniuk & Nelson, 2003	Fly
Squamata	*Agama agama*	1	29.30	0.17	Platel, 1979	Legged
Squamata	*Agama inermis*	1	12.90	0.10	Platel, 1979	Legged
Squamata	*Calotes versicolor*	1	14.60	0.10	Platel, 1979	Legged
Squamata	*Uromastyx acanthinurus*	1	164.00	0.34	Platel, 1979	Legged
Squamata	*Anguis fragilis*	1	22.00	0.04	Platel, 1979	Legless
Squamata	*Boa constrictor*	1	4460.00	0.65	Platel, 1979	Legless
Squamata	*Boa imperator*	1	1829.00	0.44	Crile & Quiring, 1940	Legless
Squamata	*Chamaleo lateralis*	1	10.90	0.06	Platel, 1979	Legged
Squamata	*Coluber constrictor*	1	286.00	0.30	Crile & Quiring, 1940	Legless
Squamata	*Coluber constrictor*	1	417.00	0.30	Crile & Quiring, 1940	Legless
Squamata	*Coluber constrictor*	1	590.00	0.27	Crile & Quiring, 1940	Legless
Squamata	*Coluber constrictor*	1	431.00	0.29	Crile & Quiring, 1940	Legless
Squamata	*Coluber viridiflavus*	1	285.10	0.21	Platel, 1979	Legless
Squamata	*Coronella girondica*	1	117.00	0.09	Platel, 1979	Legless

Squamata	*Elaphe longissima*	1	148.20	0.17	Platel, 1979	Legless
Squamata	*Natrix maura*	1	86.00	0.10	Platel, 1979	Legless
Squamata	*Natrix natrix*	1	74.10	0.12	Platel, 1979	Legless
Squamata	*Thamnophis sirtalis*	1	52.00	0.08	Crile & Quiring, 1940	Legless
Squamata	*Thamnophis sirtalis*	1	57.00	0.12	Crile & Quiring, 1940	Legless
Squamata	*Zamenis viridis*	1	220.00	0.21	Crile & Quiring, 1940	Legless
Squamata	*Cordylus cordylus*	1	56.50	0.18	Platel, 1979	Legged
Squamata	*Zonosaurus maximus*	1	386.40	0.57	Platel, 1979	Legged
Squamata	*Zonosaurus quadrilineatus*	1	82.70	0.21	Platel, 1979	Legged
Squamata	*Naja melanoleuca*	1	1770.00	0.65	Platel, 1979	Legless
Squamata	*Gekko gekko*	1	54.80	0.20	Platel, 1979	Legged
Squamata	*Hemidactylus frenatus*	1	2.68	0.03	Tsuboi et al, 2018	Legged
Squamata	*Hemidactylus mabouia*	1	2.50	0.03	Platel, 1979	Legged
Squamata	*Lepidodactylus orientalis*	1	1.19	0.02	Tsuboi et al, 2018	Legged
Squamata	*Phelsuma cepedia*	1	5.00	0.06	Platel, 1979	Legged
Squamata	*Tarentola mauritanica*	1	7.80	0.07	Platel, 1979	Legged
Squamata	*Heloderma suspectum*	1	514.00	0.73	Crile & Quiring, 1940	Legged
Squamata	*Amblyrhyncus cristatus*	1	4190.00	1.44	Crile & Quiring, 1940	Legged
Squamata	*Ameiva sp.*	1	27.10	0.23	Platel, 1979	Legged
Squamata	*Anolis auratus*	1	10.50	0.07	Platel, 1979	Legged
Squamata	*Chalarodon madagascariensis*	1	6.30	0.06	Platel, 1979	Legged
Squamata	*Hoplurus sebae*	1	51.00	0.27	Platel, 1979	Legged
Squamata	*Iguana iguana*	1	253.50	0.61	Platel, 1979	Legged
Squamata	*Liolaemus chilensis*	1	26.00	0.10	Platel, 1979	Legged
Squamata	*Lacerta lepida*	1	70.80	0.22	Platel, 1979	Legged
Squamata	*Lacerta muralis*	1	4.20	0.05	Platel, 1979	Legged
Squamata	*Lacerta viridis*	1	26.00	0.13	Crile & Quiring, 1940	Legged
Squamata	*Lacerta viridis*	1	21.20	0.11	Platel, 1979	Legged
Squamata	*Lacerta vivipara*	1	3.20	0.03	Platel, 1979	Legged
Squamata	*Psammodromus algiris*	1	4.30	0.05	Platel, 1979	Legged
Squamata	*Psammodromus hispanicus*	1	2.10	0.03	Platel, 1979	Legged
Squamata	*Python molurus*	1	6140.00	1.12	Crile & Quiring, 1940	Legless
Squamata	*Carlia bicarinata*	1	1.43	0.02	Tsuboi et al, 2018	Legged
Squamata	*Chalcides chalcides*	1	18.80	0.06	Platel, 1979	Legged
Squamata	*Chalcides mionecton*	1	6.40	0.03	Platel, 1979	Legged
Squamata	*Chalcides ocellatus*	1	32.00	0.09	Platel, 1979	Legged
Squamata	*Cryptoblepharus virgatus*	1	0.80	0.01	Tsuboi et al, 2018	Legged
Squamata	*Emoia pallidiceps*	1	2.94	0.03	Tsuboi et al, 2018	Legged
Squamata	*Eumeces schneiderii*	1	51.70	0.17	Platel, 1979	Legged
Squamata	*Scincus scincus*	1	34.10	0.12	Platel, 1979	Legged
Squamata	*Sphenomorphus fragilis*	1	1.13	0.01	Tsuboi et al, 2018	Legged
Squamata	*Callopistes maculatus*	1	50.30	0.32	Platel, 1979	Legged
Squamata	*Trogonophis wiegmanni*	1	6.50	0.02	Platel, 1979	Legless

Squamata	*Varanus griseus*	1	254.20	0.72	Platel, 1979	Legged
Squamata	*Agkistrodon piscovoris*	1	728.00	0.64	Crile & Quiring, 1940	Legless
Squamata	*Cerastes vipera*	1	62.10	0.08	Platel, 1979	Legless
Squamata	*Vipera aspis*	1	68.70	0.10	Platel, 1979	Legless
Squamata	*Vipera berus*	1	64.20	0.11	Platel, 1979	Legless
Testudines	*Caretta caretta*	1	5443.00	2.70	Platel, 1979	
Testudines	*Chelonia mydas*	1	114300.00	8.60	Crile & Quiring, 1940	
Testudines	*Chelydra serpentina*	1	5125.00	0.98	Platel, 1979	
Testudines	*Macrochelys lacertina*	1	1848.00	1.01	Crile & Quiring, 1940	
Testudines	*Macroclemys temminckii*	1	1848.00	1.01	Crile & Quiring, 1940	
Testudines	*Clemmys guttata*	1	2163.00	1.36	Platel, 1979	
Testudines	*Emys orbicularis*	1	250.00	0.25	Crile & Quiring, 1940	
Testudines	*Pseudemys scripta*	1	1418.00	0.74	Platel, 1979	
Testudines	*Testudo graeca*	1	267.50	0.32	Platel, 1979	
Testudines	*Testudo hermanni*	1	693.40	0.48	Platel, 1979	
Testudines	*Trionyx ferox*	1	3253.00	2.50	Crile & Quiring, 1940	

S4 - Supplementary table 2. Raw endocranial volumes and estimated brain and body mass data for fossil species gathered from the literature.

Genus	Specimen	EV (ml)	BV/EV	Body mass (g)	Brain mass (g)	Reference
Allosaurus	UUVP 294	187.89	0.37	1400000.00	69.52	Hurlburt et al., 2013
Allosaurus	UUVP 294	187.89	0.37	2300000.00	69.52	Hurlburt et al., 2013
Allosaurus	UUVP 294	169.00	0.37	1400000.00	62.53	Hurlburt et al., 2013
Allosaurus	UUVP 294	187.90	0.50	1400000.00	93.95	Hurlburt et al., 2013
Allosaurus	UUVP 294	187.90	0.50	2300000.00	93.95	Hurlburt et al., 2013
Allosaurus	UUVP 294	169.00	0.50	1400000.00	84.50	Hurlburt et al., 2013
Anatosaurus	-	300.00	0.50	3400000.00	150.00	Brain - Jerison, 1973; Body mass - Colbert, 1962
Archaeopteryx	BMNH 37001	1.76	1.00	468.00	1.76	Hurlburt et al., 2013
Archaeopteryx	BMNH 37001	1.60	1.00	468.00	1.60	Hurlburt et al., 2013
Bambiraptor	KUVP 129737 (juvenile)	14.00	1.00	2240.00	14.00	Hurlburt et al., 2013
Bambiraptor	KUVP 129737 (adult estimation)	14.00	1.00	6581.96	14.00	Hurlburt et al., 2013
Brachiosaurus	Brain - S66 Janensch (1935-36)	310.00	0.60	78300000.00	186.00	Hurlburt, 1996
Brachiosaurus	Brain - S66 Janensch (1935-36)	310.00	0.60	40000000.00	186.00	Brain - Hurlburt 1996; Body mass - Bakker, 1975
Camptosaurus	-	46.00	0.50	400000.00	23.00	Brain - Jerison, 1973; Body mass - Colbert, 1962
Carcharodontosaurus	SGM Din-1	263.68	0.37	5000000.00	97.56	Hurlburt et al., 2013
Carcharodontosaurus	SGM Din-1	263.68	0.37	7000000.00	97.56	Hurlburt et al., 2013
Carcharodontosaurus	SGM Din-1	224.00	0.37	5000000.00	82.88	Hurlburt et al., 2013
Carcharodontosaurus	SGM Din-1	263.60	0.50	5000000.00	131.80	Hurlburt et al., 2013
Carcharodontosaurus	SGM Din-1	263.60	0.50	7000000.00	131.80	Hurlburt et al., 2013
Carcharodontosaurus	SGM Din-1	224.00	0.50	5000000.00	112.00	Hurlburt et al., 2013
Citipati	IGM 100/978	22.62	1.00	88800	22.62	Ksepka et al., 2020
Conchoraptor	IGM 100/3006	9.44	1.00	5250	9.44	Ksepka et al., 2020

Diplodocus	-	100.00	0.57	12000000.00	57.00	Brain - Jerison, 1973 in Hurlburt, 1996; body mass Alexander, 1991 in Hurlburt, 1996
Diplodocus	-	100.00	0.57	19000000.00	57.00	Brain - Jerison, 1973 in Hurlburt, 1996; body mass Alexander, 1991 in Hurlburt, 1996
Erlikosaurus	IGM 100/111	34.12	1.00	173700	34.12	Ksepka et al., 2020
Euoplocephalus	-	82.00	0.50	1900000.00	41.00	Hopson, 1977
Giganotosaurus	MUCPv-CH-1	275.00	0.50	7000000.00	137.50	Brain - Paulina-Carabajal & Currie, 2017; Body mass - Mazzeta et al., 2004
Giganotosaurus	MUCPv-CH-1	274.86	0.37	7000000.00	101.70	Brain - Paulina-Carabajal & Currie, 2017; Body mass - Mazzeta et al., 2004
Gorgosaurus	ROM 1247	128.92	0.37	1110000.00	47.70	Hurlburt et al., 2013
Gorgosaurus	ROM 1247	128.94	0.50	1110000.00	64.47	Hurlburt et al., 2013
Iguanodon	-	250.00	0.50	2100000.00	125.00	Brain - Jerison, 1973; Body mass - Colbert, 1962
Incisivosaurus	IVPP V 13326	5.52	1.00	6619.5	5.52	Ksepka et al., 2020
Kentrosaurus	-	48.00	0.50	780000.00	24.00	Hopson, 1977
Khaan	IGM 100/973	8.83	1.00	13150	8.83	Ksepka et al., 2020
Majungasaurus	FMNH PR 2100	106.49	0.37	1130000.00	39.40	Brain Paulina-Carabajal & Currie, 2017 - Sampson & Witmer, 2007
Majungasaurus	FMNH PR 2100	106.40	0.50	1130000.00	53.20	Sampson & Witmer, 2007
Murusraptor	MCF-PVPH 411	148.20	0.50	1551000.00	74.10	Paulina-Carabajal & Currie, 2017
Murusraptor	MCF-PVPH 411	148.11	0.37	1551000.00	54.80	Paulina-Carabajal & Currie, 2017
Nanotyrannus	CMNH 7541	111.19	0.37	240000.00	41.14	Hurlburt et al., 2013
Nanotyrannus	CMNH 7541	111.19	0.37	280000.00	41.14	Hurlburt et al., 2013
Nanotyrannus	CMNH 7541	111.18	0.50	240000.00	55.59	Hurlburt et al., 2013
Nanotyrannus	CMNH 7541	111.18	0.50	240000.00	55.59	Hurlburt et al., 2013
Nanotyrannus	CMNH 7541	111.18	0.67	280000.00	74.49	Hurlburt et al., 2013
Nanotyrannus	CMNH 7541	111.18	0.67	280000.00	74.49	Hurlburt et al., 2013
Ornithomimus	NMC 12228	87.90	1.00	125000.00	87.90	Hurlburt et al., 2013
Ornithomimus	NMC 12228	87.90	1.00	175000.00	87.90	Hurlburt et al., 2013
Protoceratops	-	56.00	0.50	200000.00	28.00	Brain - Jerison, 1973; Body mass - Colbert, 1962
Sinraptor dongi	IVPP V 10600	95.00	0.50	1700000.00	47.50	Brain - Paulina-Carabajal & Currie, 2017; Body mass - Christiansen & Fariña, 2004
Sinraptor dongi	IVPP V 10600	94.86	0.37	1700000.00	35.10	Brain - Paulina-Carabajal & Currie, 2017; Body mass - Christiansen & Fariña, 2004
Stegosaurus	-	45.00	0.50	3100000.00	22.50	Brain - Hurlburt 1996; Body mass - Alexander, 1985
Stegosaurus	-	45.00	0.50	2000000.00	22.50	Brain - Hurlburt 1996; Body mass - Colbert, 1962

Struthiomimus	TMP 90-26-01	35.06	1.00	175000	35.06	Ksepka et al., 2020
Triceratops	-	144.40	0.50	9000000.00	72.20	Brain - Jerison, 1973; Body mass - Alexander 1991
Triceratops	-	144.40	0.50	6000000.00	72.20	Brain - Jerison, 1973; Body mass - Alexander 1991
Troodon	RTMP 86.36.457 and RTMP 79.8.1	41.00	1.00	45000.00	41.00	Hurlburt et al., 2013
Tsaagan	IGM 100/1015	9.62	1.00	12420	9.62	Ksepka et al., 2020
Tyranossaurus	AMNH 5029	381.76	0.37	5000000.00	141.25	Hurlburt et al., 2013
Tyranossaurus	AMNH 5029	381.80	0.50	5000000.00	190.90	Hurlburt et al., 2013
Tyranossaurus	AMNH 5029	381.76	0.37	7000000.00	141.25	Hurlburt et al., 2013
Tyranossaurus	AMNH 5029	381.80	0.50	7000000.00	190.90	Hurlburt et al., 2013
Tyranossaurus	AMNH 5029	404.00	0.37	5000000.00	149.48	Hurlburt et al., 2013
Tyranossaurus	AMNH 5029	404.00	0.50	5000000.00	202.00	Hurlburt et al., 2013
Tyranossaurus	AMNH 5117	313.65	0.37	4312000.00	116.05	Hurlburt et al., 2013
Tyranossaurus	AMNH 5117	313.65	0.37	7000000.00	116.05	Hurlburt et al., 2013
Tyranossaurus	AMNH 5117	313.60	0.50	4312000.00	156.80	Hurlburt et al., 2013
Tyranossaurus	AMNH 5117	313.60	0.50	7000000.00	156.80	Hurlburt et al., 2013
Tyranossaurus	FMNH PR 2081	414.19	0.37	5654000.00	153.25	Hurlburt et al., 2013
Tyranossaurus	FMNH PR 2081	414.19	0.37	7000000.00	153.25	Hurlburt et al., 2013
Tyranossaurus	FMNH PR 2081	414.20	0.50	5654000.00	207.10	Hurlburt et al., 2013
Tyranossaurus	FMNH PR 2081	414.20	0.50	7000000.00	207.10	Hurlburt et al., 2013
Zanabazar	IGM 100/1	25.14	1.00	30360	25.14	Ksepka et al., 2020

S5 - Supplementary table 3. Mean brain and body mass data for living species gathered from the literature.

Clade	Species	Specimens	Body mass (g)	Brain mass (g)	Remarks
Alligatoridae	*Alligator mississipiensis*	4	134850.00	10.23	
Alligatoridae	*Caiman crocodylus*	1	28970	5.65	Estimated MBd
Crocodylidae	*Crocodylus acutus*	4	125000	13.875	
Crocodylidae	*Crocodylus niloticus*	2	109129.77	8.465	
Crocodylidae	*Crocodylus siamensis*	6	21895.00	5.73	
Crocodylidae	*Osteolaemus tetraspis*	1	20228.392	4.96	
Gavialidae	*Gavialis gangeticus*	1	170000	11.32	
Gavialidae	*Tomistoma schlegelii*	1	93619.603	7.08	
Accipitriformes	*Accipiter cirrocephalus*	11	169.90	2.39	Fly
Accipitriformes	*Accipiter cooperii*	8	323.20	4.70	Fly
Accipitriformes	*Accipiter gentilis*	21	872.50	7.88	Fly
Accipitriformes	*Accipiter haplochrous*	7	204.50	3.91	Fly
Accipitriformes	*Accipiter nisus*	1	260.00	3.08	Fly
Accipitriformes	*Accipiter novaehollandiae*	6	591.90	4.74	Fly
Accipitriformes	*Accipiter striatus*	20	118.00	2.23	Fly
Accipitriformes	*Aegypius monachus*	1	9000.00	24.81	Fly
Accipitriformes	*Aegypius tracheliotus*	3	6200.00	27.88	Fly
Accipitriformes	*Aquila audax*	7	3350.00	16.24	Fly
Accipitriformes	*Aquila chrysaetos*	33	3991.50	17.19	Fly
Accipitriformes	*Aquila fasciatus*	3	2000.00	10.50	Fly
Accipitriformes	*Aquila rapax*	3	2250.00	13.31	Fly
Accipitriformes	*Aviceda subcristata*	5	358.60	4.70	Fly
Accipitriformes	*Busarellus nigricollis*	2	804.50	8.75	Fly

Accipitriformes	*Buteo buteo*	10	875.00	7.94	Fly
Accipitriformes	*Buteo jamaicensis*	27	1053.90	9.18	Fly
Accipitriformes	*Buteo lagopus*	17	961.90	9.20	Fly
Accipitriformes	*Buteo lineatus*	10	606.90	7.19	Fly
Accipitriformes	*Buteo magnirostris*	11	334.60	4.56	Fly
Accipitriformes	*Buteo platypterus*	10	397.00	5.12	Fly
Accipitriformes	*Buteo polysoma*	3	950.00	8.78	Fly
Accipitriformes	*Buteo regalis*	7	1469.50	9.50	Fly
Accipitriformes	*Buteo swainsoni*	27	899.00	7.36	Fly
Accipitriformes	*Buteogallus anthracinus*	8	923.80	7.17	Fly
Accipitriformes	*Buteogallus urabatinga*	5	1141.10	10.17	Fly
Accipitriformes	*Circus aeruginosus*	unespecified	568.50	5.30	Fly
Accipitriformes	*Circus cyaneus*	11	337.00	4.78	Fly
Accipitriformes	*Elanus axillaris*	8	234.00	3.37	Fly
Accipitriformes	*Gypohierax angolensis*	2	1500.00	10.13	Fly
Accipitriformes	*Gyps africanus*	5	5454.00	18.52	Fly
Accipitriformes	*Haliaeetus leucocephalus*	13	4418.90	18.04	Fly
Accipitriformes	*Haliaeetus leucogaster*	10	3004.00	12.63	Fly
Accipitriformes	*Haliaeetus vocifer*	3	2806.00	12.19	Fly
Accipitriformes	*Haliastur indus*	10	530.00	6.10	Fly
Accipitriformes	*Haliastur sphenurus*	8	920.20	6.61	Fly
Accipitriformes	*Harpagus bidentatus*	4	187.80	3.83	Fly
Accipitriformes	*Heterospizias meridionalis*	3	808.00	7.84	Fly
Accipitriformes	*Hieraaetus morphnoides*	5	1425.00	7.81	Fly
Accipitriformes	*Ictinia mississippiensis*	3	278.00	3.69	Fly
Accipitriformes	*Kaupifalco monogrammicus*	7	311.50	4.03	Fly
Accipitriformes	*Leucopternis albicollis*	unespecified	609.72	8.15	Fly
Accipitriformes	*Lophaetus occipitalis*	3	1292.50	9.15	Fly
Accipitriformes	*Melierax canorus*	2	684.00	6.88	Fly
Accipitriformes	*Milvus migrans*	10	595.50	5.82	Fly
Accipitriformes	*Pandion haliaetus*	11	1485.50	9.38	Fly
Accipitriformes	*Parabuteo unicinctus*	5	863.20	7.98	Fly
Accipitriformes	*Polyboroides typus*	2	796.00	8.00	Fly
Accipitriformes	*Rostrhamus sociabilis*	5	420.00	5.09	Fly
Accipitriformes	*Sagittarius serpentarius*	2	3285.00	15.00	Fly
Accipitriformes	*Stephanoaetus coronatus*	3	3640.00	14.06	Fly
Accipitriformes	*Terathopius ecaudatus*	3	2438.50	14.69	Fly
Anseriformes	*Aix galericulata*	8	495.00	4.22	Fly
Anseriformes	*Aix sponsa*	10	673.00	4.25	Fly
Anseriformes	*Alopochen aegyptiacus*	9	1938.00	6.93	Fly
Anseriformes	*Amazonetta brasiliensis*	3	590.00	3.90	Fly
Anseriformes	*Anas acuta*	10	844.00	4.72	Fly
Anseriformes	*Anas americana*	10	734.10	4.05	Fly
Anseriformes	*Anas carolinensis*	10	320.80	2.70	Fly
Anseriformes	*Anas castanea*	8	601.00	3.73	Fly
Anseriformes	*Anas clypeata*	10	542.90	3.56	Fly
Anseriformes	*Anas crecca*	unespecified	320.86	2.63	Fly
Anseriformes	*Anas cyanoptera*	10	377.50	3.26	Fly
Anseriformes	*Anas discors*	10	366.60	2.93	Fly
Anseriformes	*Anas flavirostris*	4	429.50	3.56	Fly
Anseriformes	*Anas hottentota*	5	238.50	3.01	Fly
Anseriformes	*Anas laysanensis*	7	459.50	3.55	Fly
Anseriformes	*Anas penelope*	1	700.00	4.05	Fly
Anseriformes	*Anas platalea*	3	542.50	3.50	Fly
Anseriformes	*Anas platyrhynchos*	10	1110.50	5.44	Fly
Anseriformes	*Anas rhynchotis*	8	620.00	3.54	Fly
Anseriformes	*Anas smithii*	5	833.50	3.77	Fly
Anseriformes	*Anas strepera*	10	889.50	3.90	Fly
Anseriformes	*Anas superciliosa*	10	1043.00	5.33	Fly
Anseriformes	*Anas veriscolor*	3	397.50	3.63	Fly
Anseriformes	*Anser albifrons*	8	3120.00	9.09	Fly
Anseriformes	*Anser anser*	1	3250.00	11.32	Fly

Anseriformes	*Anser fabalis*	3	2397.50	10.65	Fly
Anseriformes	*Anser rossii*	4	1424.00	6.85	Fly
Anseriformes	*Anseranas semipalmata*	9	2283.40	8.80	Fly
Anseriformes	*Aythya affinis*	11	755.50	4.18	Fly
Anseriformes	*Aythya americana*	10	1055.00	5.46	Fly
Anseriformes	*Aythya australis*	5	870.00	4.89	Fly
Anseriformes	*Aythya marila*	1	787.00	4.80	Fly
Anseriformes	*Biziura lobata*	9	1971.30	8.72	Fly
Anseriformes	*Branta bernicla*	10	1420.40	6.10	Fly
Anseriformes	*Branta canadensis*	19	2708.16	9.13	Fly
Anseriformes	*Bucephala albeola*	10	347.30	4.10	Fly
Anseriformes	*Bucephala clangula*	10	888.70	5.95	Fly
Anseriformes	*Bucephala islandica*	4	915.00	5.83	Fly
Anseriformes	*Cairina moschata*	3	2625.00	7.35	Fly
Anseriformes	*Calonetta leucophrys*	2	264.30	3.25	Fly
Anseriformes	*Cereopsis novaehollandiae*	9	4530.00	8.83	Fly
Anseriformes	*Chauna chavaria*	3	4400.00	8.51	Fly
Anseriformes	*Chenonetta jubata*	10	775.00	4.08	Fly
Anseriformes	*Chloephaga poliocephala*	4	2233.50	5.80	Fly
Anseriformes	*Clangula hyemalis*	10	730.00	4.88	Fly
Anseriformes	*Coscoroba coscoroba*	7	4400.00	9.16	Fly
Anseriformes	*Cygnus atratus*	12	5685.00	12.15	Fly
Anseriformes	*Cygnus columbianus*	10	6750.00	17.35	Fly
Anseriformes	*Cygnus cygnus*	3	9450.00	19.50	Fly
Anseriformes	*Cygnus olor*	1	11000.00	16.00	Fly
Anseriformes	*Dendrocygna arcuata*	7	730.00	4.51	Fly
Anseriformes	*Dendrocygna eytoni*	12	746.00	4.56	Fly
Anseriformes	*Lophodytes cucullatus*	10	610.00	4.61	Fly
Anseriformes	*Lophonetta specularoides*	5	926.70	4.84	Fly
Anseriformes	*Malacorhynchus membranaceus*	11	363.60	2.85	Fly
Anseriformes	*Melanitta deglandi*	9	1545.60	6.68	Fly
Anseriformes	*Melanitta fusca*	unespecified	1545.34	6.67	Fly
Anseriformes	*Melanitta nigra*	6	1001.10	5.85	Fly
Anseriformes	*Mergus merganser*	9	1393.60	4.86	Fly
Anseriformes	*Mergus serrator*	12	1029.25	4.85	Fly
Anseriformes	*Neochen jubata*	4	1333.00	5.80	Fly
Anseriformes	*Netta rufina*	7	1051.00	5.36	Fly
Anseriformes	*Oxyura australis*	7	832.00	4.02	Fly
Anseriformes	*Oxyura jamaicensis*	10	532.70	3.52	Fly
Anseriformes	*Oxyura maccoa*	2	862.50	4.68	Fly
Anseriformes	*Pteronetta hartlaubi*	2	870.00	5.73	Fly
Anseriformes	*Sarkidornis melanotos*	6	1776.30	6.99	Fly
Anseriformes	*Somateria mollissima*	11	2504.55	8.36	Fly
Anseriformes	*Somateria spectabilis*	10	1660.30	7.39	Fly
Anseriformes	*Speculanas specularis*	unespecified	1216.82	6.10	Fly
Anseriformes	*Tachyeres leucocephalus*	unespecified	3501.69	10.20	Flightless
Anseriformes	*Tachyeres pteneres*	3	4725.00	10.63	Flightless
Anseriformes	*Tadorna radjah*	6	887.00	5.18	Fly
Anseriformes	*Tadorna tadorna*	5	1001.70	5.33	Fly
Anseriformes	*Tadorna tadornoides*	7	1425.00	5.83	Fly
Apodiformes	*Aeronautes saxatilis*	9	31.20	0.67	Fly
Apodiformes	*Apus apus*	6	37.60	0.67	Fly
Apodiformes	*Apus pallidus*	10	41.90	0.72	Fly
Apodiformes	*Chaetura pelagica*	8	23.60	0.46	Fly
Apodiformes	*Collocalia esculenta*	7	5.30	0.20	Fly
Apodiformes	*Collocalia spodiopygia*	10	6.80	0.24	Fly
Apodiformes	*Cypsiurus parvus*	2	13.60	0.30	Fly
Apodiformes	*Glaucis hirsutus*	4	7.20	0.25	Fly
Apodiformes	*Hemiprocne mystacea*	4	74.50	1.10	Fly
Apodiformes	*Hirundapus caudacutus*	10	93.50	1.29	Fly
Apodiformes	*Streptoprocne zonaris*	2	98.10	1.48	Fly
Apodiformes	*Tachornis phoenicobia*	6	9.90	0.28	Fly

Apodiformes	*Tachymarptis melba*	1	90.00	1.11	Fly
Bucerotiformes	*Aceros leucocephalus*	3	1086.00	12.81	Fly
Bucerotiformes	*Aceros plicatus*	6	1720.00	15.42	Fly
Bucerotiformes	*Aceros undulatus*	3	2232.50	18.25	Fly
Bucerotiformes	*Anthracoceros coronatus*	2	300.00	7.93	Fly
Bucerotiformes	*Berenicornis albocristatus*	2	1415.00	4.88	Fly
Bucerotiformes	*Buceros bicornis*	4	2798.50	18.25	Fly
Bucerotiformes	*Buceros hydrocorax*	unespecified	1399.68	17.00	Fly
Bucerotiformes	*Buceros rhinoceros*	3	2380.00	17.38	Fly
Bucerotiformes	*Bucorvus abyssinicus*	5	3767.50	23.75	Fly
Bucerotiformes	*Bucorvus leadbeateri*	1	2150.00	26.25	Fly
Bucerotiformes	*Bycanistes cylindricus*	2	1105.50	10.13	Fly
Bucerotiformes	*Penelopides panini*	2	473.50	6.88	Fly
Bucerotiformes	*Phoeniculus purpureus*	unespecified	78.02	2.05	Fly
Bucerotiformes	*Tockus deckeni*	6	169.50	3.45	Fly
Bucerotiformes	*Tockus erythrorhynchus*	6	139.00	3.53	Fly
Bucerotiformes	*Tockus flavirostris*	4	237.80	4.25	Fly
Bucerotiformes	*Tockus nasutus*	2	156.50	4.05	Fly
Caprimulgiformes	*Aegotheles cristatus*	8	41.00	1.42	Fly
Caprimulgiformes	*Caprimulgus carolinensis*	9	108.90	1.36	Fly
Caprimulgiformes	*Caprimulgus europaeus*	10	67.00	0.88	Fly
Caprimulgiformes	*Caprimulgus macrurus*	9	78.00	1.01	Fly
Caprimulgiformes	*Caprimulgus vexillarius*	6	66.10	0.87	Fly
Caprimulgiformes	*Caprimulgus vociferus*	10	50.80	0.82	Fly
Caprimulgiformes	*Chordeiles minor*	10	79.30	0.85	Fly
Caprimulgiformes	*Chordeiles nacunda*	3	213.30	1.29	Fly
Caprimulgiformes	*Eurostopodus argus*	unespecified	72.02	0.98	Fly
Caprimulgiformes	*Eurostopodus macrotis*	5	168.80	1.46	Fly
Caprimulgiformes	*Eurostopodus mystacialis*	2	170.00	1.33	Fly
Caprimulgiformes	*Nyctibius griseus*	5	257.40	1.98	Fly
Caprimulgiformes	*Nyctidromus albicollis*	8	53.00	0.91	Fly
Caprimulgiformes	*Nyctiphrynus ocellatus*	3	39.00	0.74	Fly
Caprimulgiformes	*Nyctiprogne leucopyga*	4	23.00	0.51	Fly
Caprimulgiformes	*Podargus strigoides*	15	387.30	4.86	Fly
Cariamiformes	*Cariama cristata*	2	1400.00	11.15	Fly
Cathartiformes	*Cathartes aura*	7	1733.30	9.98	Fly
Cathartiformes	*Coragyps atratus*	7	2080.50	11.99	Fly
Cathartiformes	*Sarcoramphus papa*	5	3325.00	18.56	Fly
Cathartiformes	*Vultur gryphus*	3	11125.00	31.56	Fly
Charadriiformes	*Actitis hypoleucos*	5	51.70	0.86	Fly
Charadriiformes	*Actitis macularius*	6	45.40	0.68	Fly
Charadriiformes	*Aethia pusilla*	10	84.60	1.48	Fly
Charadriiformes	*Alca torda*	10	719.00	5.38	Fly
Charadriiformes	*Alle alle*	10	167.30	2.10	Fly
Charadriiformes	*Anous cerulea*	10	50.60	1.12	Fly
Charadriiformes	*Anous stolidus*	10	172.50	2.23	Fly
Charadriiformes	*Arenaria interpres*	10	92.50	1.34	Fly
Charadriiformes	*Arenaria melanocephala*	unespecified	121.88	1.54	Fly
Charadriiformes	*Bartramia longicauda*	12	159.00	1.30	Fly
Charadriiformes	*Brachyramphus marmoratum*	9	233.40	2.35	Fly
Charadriiformes	*Burhinus bistriatus*	4	787.00	4.66	Fly
Charadriiformes	*Burhinus grallarius*	3	732.50	4.31	Fly
Charadriiformes	*Calidris acuminata*	10	81.60	0.99	Fly
Charadriiformes	*Calidris alba*	10	57.00	1.01	Fly
Charadriiformes	*Calidris alpina*	10	57.00	1.00	Fly
Charadriiformes	*Calidris bairdii*	unespecified	38.09	0.71	Fly
Charadriiformes	*Calidris canutus*	10	137.00	1.32	Fly
Charadriiformes	*Calidris falcinellus*	6	34.20	0.72	Fly
Charadriiformes	*Calidris ferruginea*	11	60.30	0.99	Fly
Charadriiformes	*Calidris fuscicollis*	10	40.70	0.78	Fly
Charadriiformes	*Calidris himantopus*	10	57.30	0.92	Fly
Charadriiformes	*Calidris mauri*	unespecified	26.02	0.63	Fly

Charadriiformes	*Calidris melanotos*	10	72.90	1.02	Fly
Charadriiformes	*Calidris minuta*	10	23.00	0.53	Fly
Charadriiformes	*Calidris minutilla*	10	25.20	0.55	Fly
Charadriiformes	*Calidris pugnax*	10	137.50	1.56	Fly
Charadriiformes	*Calidris pusilla*	11	27.50	0.51	Fly
Charadriiformes	*Calidris ruficollis*	10	29.60	0.66	Fly
Charadriiformes	*Calidris subminuta*	2	30.20	0.59	Fly
Charadriiformes	*Calidris subruficollis*	6	75.60	1.03	Fly
Charadriiformes	*Calidris tenuirostris*	6	147.50	1.54	Fly
Charadriiformes	*Cepphus grylle*	10	405.00	3.61	Fly
Charadriiformes	*Cerorhinca monocerata*	7	487.50	4.63	Fly
Charadriiformes	*Charadrius alexandrinus*	unespecified	36.97	0.89	Fly
Charadriiformes	*Charadrius australis*	unespecified	80.96	1.15	Fly
Charadriiformes	*Charadrius bicinctus*	8	62.60	1.11	Fly
Charadriiformes	*Charadrius falklandicus*	unespecified	70.53	1.17	Fly
Charadriiformes	*Charadrius leschenaultii*	10	68.50	1.26	Fly
Charadriiformes	*Charadrius melodus*	unespecified	51.32	0.96	Fly
Charadriiformes	*Charadrius modestus*	unespecified	77.63	1.24	Fly
Charadriiformes	*Charadrius mongolus*	7	63.70	1.13	Fly
Charadriiformes	*Charadrius pecuaurius*	6	34.00	0.82	Fly
Charadriiformes	*Charadrius ruficapillus*	3	46.20	0.82	Fly
Charadriiformes	*Charadrius semipalmatus*	10	47.00	0.96	Fly
Charadriiformes	*Charadrius tricollaris*	unespecified	147.97	0.80	Fly
Charadriiformes	*Charadrius vociferus*	14	85.50	1.12	Fly
Charadriiformes	*Charadrius wilsonia*	unespecified	65.76	1.03	Fly
Charadriiformes	*Chionis albus*	6	400.00	3.97	Fly
Charadriiformes	*Chionis minor*	unespecified	509.79	3.40	Fly
Charadriiformes	*Chlidonias hybrida*	4	88.20	1.48	Fly
Charadriiformes	*Cladorhynchus leucocephalus*	4	213.00	1.61	Fly
Charadriiformes	*Cursorius cursor*	3	138.00	1.44	Fly
Charadriiformes	*Elseyornis melanops*	3	30.00	0.84	Fly
Charadriiformes	*Erythrogonys cinctus*	unespecified	50.00	1.05	Fly
Charadriiformes	*Esacus magnirostris*	3	1000.00	5.90	Fly
Charadriiformes	*Fratercula arctica*	10	468.15	4.09	Fly
Charadriiformes	*Fratercula corniculata*	11	641.10	5.19	Fly
Charadriiformes	*Gallinago gallinago*	10	74.20	1.41	Fly
Charadriiformes	*Gallinago hardwickii*	4	156.00	1.99	Fly
Charadriiformes	*Gallinago nobilis*	unespecified	175.91	2.20	Fly
Charadriiformes	*Gallinago undulata*	unespecified	284.86	2.89	Fly
Charadriiformes	*Glareola nuchalis*	2	47.50	0.85	Fly
Charadriiformes	*Gygis alba*	10	109.90	1.93	Fly
Charadriiformes	*Haematopus ater*	unespecified	825.51	5.15	Fly
Charadriiformes	*Haematopus bachmani*	5	554.90	4.52	Fly
Charadriiformes	*Haematopus leucopodus*	unespecified	659.18	4.55	Fly
Charadriiformes	*Haematopus longirostris*	unespecified	588.16	4.30	Fly
Charadriiformes	*Haematopus ostralegus*	unespecified	514.40	4.35	Fly
Charadriiformes	*Haematopus palliatus*	8	602.50	4.52	Fly
Charadriiformes	*Himantopus mexicanus*	9	168.90	1.90	Fly
Charadriiformes	*Hydrophasianus chirurgus*	7	178.50	1.40	Fly
Charadriiformes	*Irediparra gallinacea*	4	102.60	1.13	Fly
Charadriiformes	*Jacana spinosa*	9	118.00	1.38	Fly
Charadriiformes	*Larus argentatus*	9	1085.00	6.69	Fly
Charadriiformes	*Larus atricilla*	unespecified	327.01	3.15	Fly
Charadriiformes	*Larus californicus*	unespecified	692.98	5.07	Fly
Charadriiformes	*Larus canus*	unespecified	382.22	4.25	Fly
Charadriiformes	*Larus delawarensis*	10	508.20	4.44	Fly
Charadriiformes	*Larus dominicanus*	7	968.00	6.61	Fly
Charadriiformes	*Larus fuscus*	unespecified	824.68	5.88	Fly
Charadriiformes	*Larus glaucescens*	15	1408.90	7.62	Fly
Charadriiformes	*Larus hartlaubii*	unespecified	271.51	3.07	Fly
Charadriiformes	*Larus maculipennis*	unespecified	304.90	3.30	Fly
Charadriiformes	*Larus marinua*	1	1670.00	7.78	Fly

Charadriiformes	*Larus minutus*	unespecified	119.46	1.70	Fly
Charadriiformes	*Larus novaehollandiae*	12	291.90	3.12	Fly
Charadriiformes	*Larus philadelphia*	unespecified	233.69	2.30	Fly
Charadriiformes	*Larus pipixcan*	unespecified	302.48	2.52	Fly
Charadriiformes	*Larus ridibundus*	11	274.45	3.03	Fly
Charadriiformes	*Larus scoresbii*	3	520.00	4.64	Fly
Charadriiformes	*Larus thayeri*	unespecified	995.26	6.30	Fly
Charadriiformes	*Limnodromus griseus*	10	109.40	1.38	Fly
Charadriiformes	*Limnodromus scolopaceus*	11	91.80	1.37	Fly
Charadriiformes	*Limosa fedoa*	13	343.00	2.73	Fly
Charadriiformes	*Limosa haemastica*	unespecified	245.43	2.31	Fly
Charadriiformes	*Limosa lapponica*	10	313.30	2.77	Fly
Charadriiformes	*Numenius americanus*	12	510.20	3.80	Fly
Charadriiformes	*Numenius madagascariensis*	5	792.00	4.70	Fly
Charadriiformes	*Numenius phaeopus*	6	379.50	3.13	Fly
Charadriiformes	*Pagophila eburnea*	10	529.50	4.83	Fly
Charadriiformes	*Pedionomus torquatus*	3	51.50	0.77	Fly
Charadriiformes	*Phaetusa simplex*	2	232.00	3.00	Fly
Charadriiformes	*Phalaropus fulicaria*	2	49.40	0.56	Fly
Charadriiformes	*Phalaropus lobatus*	10	35.30	0.45	Fly
Charadriiformes	*Phalaropus tricolor*	12	61.00	0.65	Fly
Charadriiformes	*Pluvialis apricaria*	6	212.90	2.23	Fly
Charadriiformes	*Pluvialis dominica*	11	158.70	1.82	Fly
Charadriiformes	*Pluvialis fulva*	unespecified	145.04	1.65	Fly
Charadriiformes	*Pluvialis squatarola*	8	214.00	2.56	Fly
Charadriiformes	*Ptychoramphus aleutica*	10	191.80	2.06	Fly
Charadriiformes	*Recurvirostra americana*	17	325.70	2.10	Fly
Charadriiformes	*Recurvirostra avosetta*	unespecified	154.47	1.75	Fly
Charadriiformes	*Recurvirostra novaehollandiae*	6	273.80	1.99	Fly
Charadriiformes	*Rhodostethia rusea*	5	223.40	2.15	Fly
Charadriiformes	*Rissa tridactyla*	10	475.40	4.31	Fly
Charadriiformes	*Rostratula benghalensis*	8	121.00	1.42	Fly
Charadriiformes	*Rynchops niger*	8	312.70	2.64	Fly
Charadriiformes	*Scolopax minor*	10	197.50	2.02	Fly
Charadriiformes	*Stercorarius maccormicki*	7	1156.00	6.79	Fly
Charadriiformes	*Stercorarius parasiticus*	9	470.30	3.89	Fly
Charadriiformes	*Stercorarius pomarinus*	5	705.10	4.79	Fly
Charadriiformes	*Sterna albifrons*	unespecified	48.38	1.03	Fly
Charadriiformes	*Sterna aleutica*	unespecified	132.42	1.74	Fly
Charadriiformes	*Sterna bergii*	6	342.00	3.36	Fly
Charadriiformes	*Sterna caspia*	unespecified	565.10	4.55	Fly
Charadriiformes	*Sterna forsteri*	unespecified	130.84	2.13	Fly
Charadriiformes	*Sterna fuscata*	10	185.50	2.32	Fly
Charadriiformes	*Sterna hirundo*	11	120.00	1.84	Fly
Charadriiformes	*Sterna maxima*	unespecified	438.34	3.81	Fly
Charadriiformes	*Sterna trudeaui*	unespecified	158.54	2.13	Fly
Charadriiformes	*Stiltia isabella*	10	63.80	1.05	Fly
Charadriiformes	*Synthliboramphus antiquus*	4	206.00	2.43	Fly
Charadriiformes	*Tringa brevipes*	8	107.00	1.34	Fly
Charadriiformes	*Tringa cinerea*	2	72.00	1.03	Fly
Charadriiformes	*Tringa flavipes*	12	82.40	1.07	Fly
Charadriiformes	*Tringa glareola*	5	67.50	1.04	Fly
Charadriiformes	*Tringa incana*	7	109.00	1.29	Fly
Charadriiformes	*Tringa melanoleuca*	10	189.90	1.79	Fly
Charadriiformes	*Tringa nebularia*	unespecified	157.43	1.90	Fly
Charadriiformes	*Tringa semipalmatus*	16	249.50	2.33	Fly
Charadriiformes	*Tringa solitaria*	11	52.10	0.82	Fly
Charadriiformes	*Tringa stagnatilis*	3	72.50	1.02	Fly
Charadriiformes	*Turnix pyrrhothorax*	5	41.60	0.57	Fly
Charadriiformes	*Turnix suscitator*	3	56.30	0.71	Fly
Charadriiformes	*Turnix varius*	9	88.00	1.04	Fly
Charadriiformes	*Turnix velox*	8	41.00	0.67	Fly

Charadriiformes	*Uria aalge*	10	970.30	5.73	Fly
Charadriiformes	*Uria lomvia*	10	990.20	5.30	Fly
Charadriiformes	*Vanellus armatus*	unespecified	165.84	1.94	Fly
Charadriiformes	*Vanellus cayanus*	unespecified	88.77	1.63	Fly
Charadriiformes	*Vanellus coronatus*	unespecified	195.98	2.23	Fly
Charadriiformes	*Vanellus miles*	10	334.60	2.85	Fly
Charadriiformes	*Vanellus senegallus*	unespecified	264.54	2.47	Fly
Charadriiformes	*Vanellus tricolor*	8	270.80	2.39	Fly
Charadriiformes	*Vanellus vanellus*	unespecified	180.37	2.15	Fly
Charadriiformes	*Xema sabini*	3	190.20	2.21	Fly
Ciconiiformes	*Anastomus lamelligerus*	3	1120.00	10.28	Fly
Ciconiiformes	*Ciconia abdimi*	1	950.00	7.30	Fly
Ciconiiformes	*Ciconia ciconia*	7	3476.86	14.67	Fly
Ciconiiformes	*Jabiru mycteria*	4	6054.50	23.50	Fly
Ciconiiformes	*Leptoptilos crumeniferus*	8	6285.00	28.06	Fly
Ciconiiformes	*Leptoptilos dubius*	unespecified	7457.68	33.52	Fly
Ciconiiformes	*Mycteria americana*	3	2505.00	14.88	Fly
Coliiformes	*Colius striatus*	9	56.40	1.14	Fly
Coliiformes	*Urocolius indicus*	4	55.50	1.07	Fly
Coliiformes	*Urocolius macrourus*	4	48.40	1.00	Fly
Columbiformes	*Caloenas nicobarica*	11	530.00	3.06	Fly
Columbiformes	*Chalcophaps indica*	10	136.30	1.25	Fly
Columbiformes	*Chalcophaps stephani*	unespecified	107.02	1.05	Fly
Columbiformes	*Claravis pretiosa*	5	66.30	0.90	Fly
Columbiformes	*Columba arquatrix*	unespecified	500.20	2.40	Fly
Columbiformes	*Columba guinea*	unespecified	375.03	2.00	Fly
Columbiformes	*Columba leucomela*	7	398.20	2.29	Fly
Columbiformes	*Columba livia*	1	300.00	2.31	Fly
Columbiformes	*Columba palumbus*	1	450.00	2.40	Fly
Columbiformes	*Columba speciosa*	4	243.50	1.98	Fly
Columbiformes	*Columba vitiensis*	unespecified	379.93	2.23	Fly
Columbiformes	*Columbina inca*	10	42.50	0.73	Fly
Columbiformes	*Columbina minuta*	unespecified	29.73	0.57	Fly
Columbiformes	*Columbina passerina*	10	33.30	0.64	Fly
Columbiformes	*Columbina picui*	unespecified	51.62	0.75	Fly
Columbiformes	*Columbina talpacoti*	10	47.10	0.72	Fly
Columbiformes	*Ducula aenea*	9	560.00	3.06	Fly
Columbiformes	*Ducula bicolor*	11	456.10	3.05	Fly
Columbiformes	*Ducula goliath*	unespecified	779.77	3.37	Fly
Columbiformes	*Ducula melanochroa*	unespecified	744.71	3.80	Fly
Columbiformes	*Ducula pacifica*	unespecified	401.02	2.40	Fly
Columbiformes	*Gallicolumba beccarii*	unespecified	90.02	1.05	Fly
Columbiformes	*Gallicolumba luzonica*	7	164.50	1.37	Fly
Columbiformes	*Geopelia cuneata*	7	47.60	0.78	Fly
Columbiformes	*Geopelia humeralis*	7	121.70	1.26	Fly
Columbiformes	*Geopelia placida*	8	47.00	0.79	Fly
Columbiformes	*Geopelia striata*	unespecified	46.95	0.79	Fly
Columbiformes	*Geophaps plumifera*	9	101.30	1.18	Fly
Columbiformes	*Geophaps smithii*	3	153.50	1.39	Fly
Columbiformes	*Geotrygon chrysia*	unespecified	118.04	1.35	Fly
Columbiformes	*Geotrygon costaricensis*	unespecified	215.08	1.90	Fly
Columbiformes	*Geotrygon montana*	10	135.40	1.14	Fly
Columbiformes	*Goura coronota*	1	1500.00	5.28	Fly
Columbiformes	*Goura victoria*	6	2384.00	5.43	Fly
Columbiformes	*Gymnophaps albertisii*	3	254.50	2.10	Fly
Columbiformes	*Hemiphaga novaeseelandiae*	6	622.50	2.97	Fly
Columbiformes	*Henicophaps albifrons*	unespecified	260.08	2.10	Fly
Columbiformes	*Leptotila cassini*	unespecified	193.06	1.30	Fly
Columbiformes	*Leptotila jamaicensis*	unespecified	165.17	1.36	Fly
Columbiformes	*Leptotila plumbeiceps*	unespecified	145.04	1.26	Fly
Columbiformes	*Leptotila rufaxilla*	unespecified	140.47	1.28	Fly
Columbiformes	*Leptotila verreauxi*	10	127.70	1.42	Fly

Columbiformes	*Leucosarcia melanoleuca*	6	457.50	2.41	Fly
Columbiformes	*Lopholaimus antarcticus*	3	518.00	2.71	Fly
Columbiformes	*Macropygia amboinensis*	10	211.10	1.49	Fly
Columbiformes	*Macropygia phasianella*	unespecified	145.18	1.41	Fly
Columbiformes	*Ocyphaps lophotes*	10	205.00	1.70	Fly
Columbiformes	*Oena capensis*	7	40.60	0.61	Fly
Columbiformes	*Patagioenas cayennensis*	unespecified	231.60	1.77	Fly
Columbiformes	*Patagioenas fasciata*	10	353.10	2.12	Fly
Columbiformes	*Patagioenas leucocephala*	10	236.50	1.74	Fly
Columbiformes	*Patagioenas maculosa*	unespecified	318.62	2.03	Fly
Columbiformes	*Patagioenas picazuro*	unespecified	405.05	2.50	Fly
Columbiformes	*Patagioenas squamosa*	unespecified	310.44	1.85	Fly
Columbiformes	*Phapitreron amethystinus*	10	135.00	1.29	Fly
Columbiformes	*Phapitreron leucotis*	10	134.50	1.13	Fly
Columbiformes	*Phaps chalcoptera*	10	322.30	1.78	Fly
Columbiformes	*Phaps elegans*	9	204.80	1.65	Fly
Columbiformes	*Phaps histrionica*	7	240.00	1.65	Fly
Columbiformes	*Ptilinopus insularis*	unespecified	102.51	1.07	Fly
Columbiformes	*Ptilinopus leclancheri*	unespecified	189.43	1.59	Fly
Columbiformes	*Ptilinopus magnificus*	11	357.50	2.17	Fly
Columbiformes	*Ptilinopus monacha*	9	85.90	0.91	Fly
Columbiformes	*Ptilinopus occipitalis*	unespecified	209.98	2.10	Fly
Columbiformes	*Ptilinopus ornatus*	unespecified	148.56	1.70	Fly
Columbiformes	*Ptilinopus porphyraceus*	unespecified	118.99	1.30	Fly
Columbiformes	*Ptilinopus pulchellus*	3	70.00	0.99	Fly
Columbiformes	*Ptilinopus regina*	9	99.70	1.21	Fly
Columbiformes	*Ptilinopus rivoli*	3	149.00	1.45	Fly
Columbiformes	*Ptilinopus superbus*	10	103.50	1.09	Fly
Columbiformes	*Reinwardtoena browni*	unespecified	315.13	2.10	Fly
Columbiformes	*Spilopelia chinensis*	9	161.50	1.35	Fly
Columbiformes	*Streptopelia orientalis*	unespecified	199.94	1.40	Fly
Columbiformes	*Streptopelia risoria*	1	143.00	1.22	Fly
Columbiformes	*Streptopelia senegalensis*	10	101.00	1.24	Fly
Columbiformes	*Streptopelia turtur*	10	145.10	1.39	Fly
Columbiformes	*Treron curvirostra*	unespecified	154.93	1.35	Fly
Columbiformes	*Treron formosae*	unespecified	303.08	1.55	Fly
Columbiformes	*Treron fulvicollis*	unespecified	163.04	1.30	Fly
Columbiformes	*Treron pompadora*	6	234.00	1.39	Fly
Columbiformes	*Treron vernans*	8	132.50	1.25	Fly
Columbiformes	*Turtur brehmeri*	unespecified	128.00	1.32	Fly
Columbiformes	*Turtur chalcopsilos*	6	60.60	0.92	Fly
Columbiformes	*Turtur tympanistria*	unespecified	89.03	1.02	Fly
Columbiformes	*Zenaida asiatica*	unespecified	126.98	1.55	Fly
Columbiformes	*Zenaida auriculata*	unespecified	90.47	1.10	Fly
Columbiformes	*Zenaida aurita*	10	150.20	1.45	Fly
Columbiformes	*Zenaida macroura*	10	126.50	1.19	Fly
Coraciiformes	*Alcedo atthis*	10	28.30	0.74	Fly
Coraciiformes	*Alcedo azurea*	9	34.60	0.98	Fly
Coraciiformes	*Baryphthengus ruficapillus*	8	175.00	2.65	Fly
Coraciiformes	*Ceryle rudis*	5	84.40	1.59	Fly
Coraciiformes	*Ceyx lepidus*	9	19.30	0.56	Fly
Coraciiformes	*Chloroceryle amazona*	6	119.30	1.95	Fly
Coraciiformes	*Chloroceryle americana*	10	37.50	0.92	Fly
Coraciiformes	*Coracias caudata*	5	108.00	2.06	Fly
Coraciiformes	*Coracias garrulus*	7	146.00	2.32	Fly
Coraciiformes	*Dacelo leachii*	6	309.20	4.23	Fly
Coraciiformes	*Dacelo novaeguineae*	10	334.50	4.31	Fly
Coraciiformes	*Eurystomus orientalis*	9	131.00	1.98	Fly
Coraciiformes	*Halcyon leucocephala*	5	41.40	1.08	Fly
Coraciiformes	*Halcyon senegalensis*	4	58.60	1.45	Fly
Coraciiformes	*Halcyon smyrensis*	6	85.30	1.84	Fly
Coraciiformes	*Ispidina picta*	7	11.40	0.43	Fly

Coraciiformes	*Megaceryle alcyon*	10	147.60	2.46	Fly
Coraciiformes	*Megaceryle torquata*	8	317.00	3.57	Fly
Coraciiformes	*Merops apiaster*	11	56.91	0.88	Fly
Coraciiformes	*Merops orientalis*	7	14.80	0.48	Fly
Coraciiformes	*Merops ornatus*	9	26.90	0.62	Fly
Coraciiformes	*Merops pusillus*	5	13.20	0.41	Fly
Coraciiformes	*Momotus momota*	8	133.00	2.19	Fly
Coraciiformes	*Pelargopsis capensis*	6	170.00	2.82	Fly
Coraciiformes	*Syma torotoro*	unespecified	34.99	1.11	Fly
Coraciiformes	*Tanysiptera galatea*	11	50.00	1.43	Fly
Coraciiformes	*Tanysiptera sylvia*	5	48.80	1.14	Fly
Coraciiformes	*Todiramphus chloris*	10	67.90	1.34	Fly
Coraciiformes	*Todiramphus macleayii*	10	35.30	1.07	Fly
Coraciiformes	*Todiramphus pyrrhopygia*	9	51.70	1.13	Fly
Coraciiformes	*Todiramphus sanctus*	10	38.30	1.03	Fly
Coraciiformes	*Todus mexicanus*	5	5.80	0.40	Fly
Coraciiformes	*Todus subulatus*	9	7.90	0.43	Fly
Coraciiformes	*Todus todus*	10	6.50	0.41	Fly
Cuculiformes	*Cacomantis castaneiventris*	unespecified	31.00	0.95	Fly
Cuculiformes	*Cacomantis flabelliformis*	3	49.90	1.09	Fly
Cuculiformes	*Cacomantis variolosus*	unespecified	34.88	1.07	Fly
Cuculiformes	*Centropus bengalensis*	9	117.10	2.27	Fly
Cuculiformes	*Centropus phasianinus*	10	518.80	4.12	Fly
Cuculiformes	*Ceuthmochares aereus*	3	63.80	1.33	Fly
Cuculiformes	*Chrysococcyx basalis*	8	22.60	0.62	Fly
Cuculiformes	*Chrysococcyx caprius*	5	32.00	0.77	Fly
Cuculiformes	*Chrysococcyx lucidus*	11	22.20	0.69	Fly
Cuculiformes	*Chrysococcyx minutillus*	unespecified	15.50	0.58	Fly
Cuculiformes	*Chrysococcyx osculans*	unespecified	27.99	0.73	Fly
Cuculiformes	*Clamator glandarius*	5	153.50	1.90	Fly
Cuculiformes	*Coccyzus americanus*	10	64.00	1.17	Fly
Cuculiformes	*Coccyzus erythropthalmus*	6	50.50	1.01	Fly
Cuculiformes	*Coccyzus vetula*	10	99.30	2.00	Fly
Cuculiformes	*Crotophaga ani*	10	100.20	1.56	Fly
Cuculiformes	*Cuculus canorus*	10	113.00	1.57	Fly
Cuculiformes	*Cuculus pallidus*	5	81.60	1.43	Fly
Cuculiformes	*Cuculus saturatus*	6	99.90	1.58	Fly
Cuculiformes	*Eudynamys scolopaceus*	7	232.70	2.46	Fly
Cuculiformes	*Eudynamys taitensis*	2	117.30	2.00	Fly
Cuculiformes	*Geococcyx californianus*	9	302.70	3.49	Fly
Cuculiformes	*Guira guira*	5	146.60	1.92	Fly
Cuculiformes	*Phaenicophaeus curvirostris*	4	126.00	2.92	Fly
Cuculiformes	*Phaenicophaeus superciliosus*	3	102.30	2.51	Fly
Cuculiformes	*Phaenicophaeus tristis*	3	124.00	2.30	Fly
Cuculiformes	*Piaya cayana*	8	104.00	1.84	Fly
Cuculiformes	*Scythrops novaehollandiae*	unespecified	765.09	5.35	Fly
Eurypygiformes	*Eurypyga helias*	3	222.00	2.48	Fly
Falconiformes	*Caracara cheriway*	7	893.50	9.26	Fly
Falconiformes	*Caracara plancus*	6	1031.00	10.06	Fly
Falconiformes	*Daptrius ater*	3	363.30	5.28	Fly
Falconiformes	*Falco berigora*	12	561.80	6.24	Fly
Falconiformes	*Falco cenchroides*	11	183.30	3.14	Fly
Falconiformes	*Falco columbarius*	18	157.40	3.09	Fly
Falconiformes	*Falco eleonorae*	3	385.00	4.04	Fly
Falconiformes	*Falco longipennis*	12	226.10	3.35	Fly
Falconiformes	*Falco mexicanus*	10	638.40	6.86	Fly
Falconiformes	*Falco moluccensis*	4	220.00	3.49	Fly
Falconiformes	*Falco naumanni*	7	151.50	2.71	Fly
Falconiformes	*Falco peregrinus*	11	736.10	6.19	Fly
Falconiformes	*Falco rufigularis*	2	168.80	3.18	Fly
Falconiformes	*Falco sparverius*	23	92.00	2.49	Fly
Falconiformes	*Falco subbuteo*	3	211.00	3.59	Fly

Falconiformes	*Falco subniger*	4	707.50	6.50	Fly
Falconiformes	*Falco tinnunculus*	16	214.00	3.87	Fly
Falconiformes	*Falco vespertinus*	2	158.00	2.70	Fly
Falconiformes	*Herpetotheres cachinnans*	4	621.00	6.55	Fly
Falconiformes	*Microhierax erythrogenys*	3	48.90	1.40	Fly
Falconiformes	*Milvago chimango*	3	294.50	4.59	Fly
Falconiformes	*Phalcoboenus australis*	4	1848.00	10.50	Fly
Falconiformes	*Polihierax semitorquatus*	5	51.20	1.47	Fly
Galliformes	*Acryllium vulturinum*	4	1390.00	4.55	Fly
Galliformes	*Alectoris chukar*	10	558.50	2.48	Fly
Galliformes	*Alectura lathami*	7	1855.70	5.68	Fly
Galliformes	*Argusianus argus*	6	1994.00	5.68	Fly
Galliformes	*Bambusicola thoracicus*	6	270.00	1.78	Fly
Galliformes	*Bonasa umbellus*	10	545.80	2.46	Fly
Galliformes	*Callipepla californica*	8	174.20	1.33	Fly
Galliformes	*Callipepla gambelii*	9	169.20	1.32	Fly
Galliformes	*Centrocercus urophasianus*	8	2195.90	4.00	Fly
Galliformes	*Chrysolophus amherstiae*	7	738.30	3.76	Fly
Galliformes	*Chrysolophus pictus*	10	625.00	3.32	Fly
Galliformes	*Colinus virginianus*	10	171.50	1.30	Fly
Galliformes	*Coturnix coturnix*	10	96.50	0.94	Fly
Galliformes	*Crax rubra*	6	4133.00	9.56	Fly
Galliformes	*Crossoptilon crossoptilon*	4	2137.50	5.88	Fly
Galliformes	*Cyrtonyx montezumae*	6	185.60	1.46	Fly
Galliformes	*Dendragapus canadensis*	10	520.80	2.44	Fly
Galliformes	*Dendragapus obscurus*	5	1009.60	3.07	Fly
Galliformes	*Excalfactoria chinensis*	1	31.00	0.50	Fly
Galliformes	*Francolinus leucoscepus*	5	245.00	3.20	Fly
Galliformes	*Francolinus sephaena*	3	649.00	2.25	Fly
Galliformes	*Gallus gallus*	1	550.00	2.68	Fly
Galliformes	*Guttera edouardi*	3	1149.00	4.90	Fly
Galliformes	*Ithaginis cruentus*	8	537.50	3.18	Fly
Galliformes	*Lagopus lagopus*	9	580.40	2.38	Fly
Galliformes	*Lagopus muta*	4	526.70	2.50	Fly
Galliformes	*Leipoa ocellata*	7	1917.00	4.50	Fly
Galliformes	*Lophophorus impejanus*	2	2315.00	6.20	Fly
Galliformes	*Lophura nycthemera*	8	1460.00	4.73	Fly
Galliformes	*Lophura swinhoii*	5	1100.00	4.25	Fly
Galliformes	*Megapodius eremita*	6	604.80	3.21	Fly
Galliformes	*Megapodius freycinet*	10	857.50	3.78	Fly
Galliformes	*Meleagris gallopavo*	10	6062.50	8.21	Fly
Galliformes	*Numida meleagris*	9	1334.67	4.09	Fly
Galliformes	*Oreortyx pictus*	5	239.20	1.68	Fly
Galliformes	*Ortalis vetula*	5	545.50	3.23	Fly
Galliformes	*Pavo cristatus*	9	4023.20	6.90	Fly
Galliformes	*Penelope purpurascens*	7	2060.00	6.25	Fly
Galliformes	*Perdix perdix*	1	370.00	1.75	Fly
Galliformes	*Phasianus colchicus*	10	1111.00	3.86	Fly
Galliformes	*Pipile pipile*	2	1350.00	5.30	Fly
Galliformes	*Rollulus rouloul*	10	217.00	1.85	Fly
Galliformes	*Syrmaticus reevesi*	8	1239.00	4.38	Fly
Galliformes	*Tetrao tetrix*	1	1250.00	3.90	Fly
Galliformes	*Tetrao urogallus*	4	2900.00	6.03	Fly
Galliformes	*Tragopan temminckii*	2	1184.00	4.68	Fly
Galliformes	*Tympanuchus phasianellus*	10	847.80	2.88	Fly
Gaviiformes	*Gavia immer*	10	3093.80	10.10	Fly
Gaviiformes	*Gavia stellata*	10	1758.50	5.54	Fly
Gruiformes	*Amaurolimnas concolor*	unespecified	95.01	1.72	Fly
Gruiformes	*Amaurornis flavirostra*	9	88.80	1.47	Fly
Gruiformes	*Amaurornis olivacea*	2	150.00	2.16	Fly
Gruiformes	*Amaurornis phoenicurus*	10	236.80	2.34	Fly
Gruiformes	*Antigone antigone*	6	8635.83	20.05	Fly

Gruiformes	*Aramides cajanea*	9	400.40	3.99	Fly
Gruiformes	*Aramides ypecaha*	3	612.50	4.90	Fly
Gruiformes	*Aramus guarauna*	4	1080.00	6.62	Fly
Gruiformes	*Balearica pavonina*	5	3522.00	13.19	Fly
Gruiformes	*Coturnicops noveboracensis*	4	55.70	0.74	Fly
Gruiformes	*Crex crex*	10	155.30	1.38	Fly
Gruiformes	*Fulica americana*	10	651.00	2.93	Fly
Gruiformes	*Fulica atra*	10	526.50	2.85	Fly
Gruiformes	*Gallicrex cinerea*	7	451.00	2.56	Fly
Gruiformes	*Gallinula chloropus*	11	286.36	2.30	Fly
Gruiformes	*Gallinula melanops*	5	154.00	1.52	Fly
Gruiformes	*Gallinula tenebrosa*	8	587.60	2.71	Fly
Gruiformes	*Gallinula ventralis*	7	387.00	2.77	Fly
Gruiformes	*Gallirallus australis*	8	841.20	5.11	Flightless
Gruiformes	*Gallirallus owstoni*	6	194.40	2.15	Flightless
Gruiformes	*Gallirallus phillipensis*	8	194.00	1.97	Fly
Gruiformes	*Grus canadensis*	7	3901.10	14.82	Fly
Gruiformes	*Grus rubicunda*	3	6250.50	17.69	Fly
Gruiformes	*Grus virgo*	9	2308.00	10.23	Fly
Gruiformes	*Habroptila wallacii*	4	1000.00	5.19	Flightless
Gruiformes	*Laterallus albigularis*	5	41.80	1.04	Fly
Gruiformes	*Lewinia pectoralis*	7	78.10	1.34	Fly
Gruiformes	*Pardirallus maculatus*	7	129.50	1.89	Fly
Gruiformes	*Porphyrio martinica*	10	218.30	2.47	Fly
Gruiformes	*Porphyrio porphyrio*	10	999.40	4.70	Fly
Gruiformes	*Porzana atra*	3	82.50	1.27	Flightless
Gruiformes	*Porzana carolina*	10	80.80	1.16	Fly
Gruiformes	*Porzana fluminea*	3	54.00	1.03	Fly
Gruiformes	*Porzana palmeri*	4	37.50	0.93	Flightless
Gruiformes	*Porzana porzana*	1	80.00	1.16	Fly
Gruiformes	*Psophia crepitans*	4	1050.00	5.85	Fly
Gruiformes	*Rallina eurizonoides*	3	110.00	1.71	Fly
Gruiformes	*Rallus aquaticus*	6	95.30	1.73	Fly
Gruiformes	*Rallus longirostris*	10	314.60	2.39	Fly
Musophagiformes	*Corythaixoides concolor*	1	300.00	3.30	Fly
Musophagiformes	*Crinifer piscator*	2	527.00	4.70	Fly
Musophagiformes	*Tauraco hartlaubi*	2	224.00	3.35	Fly
Musophagiformes	*Tauraco leucotis*	4	265.00	3.35	Fly
Musophagiformes	*Tauraco persa*	3	297.00	3.25	Fly
Opisthocomiformes	*Opisthocomus hoazin*	4	855.00	3.89	Fly
Otidiformes	*Ardeotis australis*	9	4450.00	11.65	Fly
Otidiformes	*Eupodotis denhami*	2	7240.00	12.25	Fly
Passeriformes	*Abroscopus albogularis*	5	5.00	0.32	Fly
Passeriformes	*Acanthagenys rufogularis*	8	50.20	1.16	Fly
Passeriformes	*Acanthiza chrysorrhoa*	5	10.00	0.43	Fly
Passeriformes	*Acanthiza ewingii*	unespecified	4.00	0.63	Fly
Passeriformes	*Acanthiza inornata*	unespecified	8.50	0.44	Fly
Passeriformes	*Acanthiza lineata*	5	6.40	0.51	Fly
Passeriformes	*Acanthiza nana*	unespecified	7.25	0.37	Fly
Passeriformes	*Acanthiza pusilla*	6	6.00	0.45	Fly
Passeriformes	*Acanthiza reguloides*	2	7.50	0.39	Fly
Passeriformes	*Acanthiza uropygialis*	7	6.50	0.36	Fly
Passeriformes	*Acanthorhynchus tenuirostris*	9	11.20	0.48	Fly
Passeriformes	*Acridotheres tristis*	6	115.60	2.48	Fly
Passeriformes	*Acrocephalus arundinaceus*	10	21.90	0.91	Fly
Passeriformes	*Acrocephalus schoenobaenus*	7	10.80	0.45	Fly
Passeriformes	*Acrocephalus scirpaceus*	1	14.00	0.48	Fly
Passeriformes	*Aegithalos caudatus*	1	7.50	0.46	Fly
Passeriformes	*Aegithalos concinnus*	2	6.10	0.37	Fly
Passeriformes	*Aegithina tiphia*	10	12.30	0.67	Fly
Passeriformes	*Aethopyga nipalensis*	2	6.00	0.33	Fly
Passeriformes	*Agelaioides badius*	5	44.50	1.48	Fly

Passeriformes	*Agelaius phoeniceus*	10	65.50	1.69	Fly
Passeriformes	*Ailuroedus crassirostris*	8	204.00	4.01	Fly
Passeriformes	*Ailuroedus melanotis*	unespecified	165.01	4.40	Fly
Passeriformes	*Aimophila cassinii*	4	18.10	0.78	Fly
Passeriformes	*Alauda arvensis*	8	35.10	0.96	Fly
Passeriformes	*Alcippe nipalensis*	5	15.80	0.93	Fly
Passeriformes	*Alethe diademata*	3	33.60	1.04	Fly
Passeriformes	*Amadina fasciata*	8	15.40	0.59	Fly
Passeriformes	*Amalocichla incerta*	unespecified	26.50	1.10	Fly
Passeriformes	*Amandava amandava*	10	9.60	0.38	Fly
Passeriformes	*Amblycercus holosericeus*	7	66.90	2.21	Fly
Passeriformes	*Amblyornis macgregoriae*	2	123.50	3.58	Fly
Passeriformes	*Amblyramphus holosericeus*	2	69.00	2.33	Fly
Passeriformes	*Ammodramus sandwichensis*	9	20.10	0.68	Fly
Passeriformes	*Ammodramus savannarum*	7	17.00	0.65	Fly
Passeriformes	*Amphispiza bilineata*	7	13.80	0.68	Fly
Passeriformes	*Amytornis goyderi*	2	16.70	0.78	Fly
Passeriformes	*Anisognathus flavinuchus*	5	42.00	1.49	Fly
Passeriformes	*Anthochaera carunculata*	11	108.50	2.20	Fly
Passeriformes	*Anthochaera chrysoptera*	8	66.30	1.70	Fly
Passeriformes	*Anthochaera phrygia*	unespecified	33.52	1.03	Fly
Passeriformes	*Anthreptes malacensis*	6	11.90	0.58	Fly
Passeriformes	*Anthus novaeseelandiae*	8	27.90	0.84	Fly
Passeriformes	*Anthus pratensis*	1	16.00	0.53	Fly
Passeriformes	*Anthus trivialis*	9	18.40	0.60	Fly
Passeriformes	*Anumbius annumbi*	3	41.50	1.18	Fly
Passeriformes	*Aphelocephala leucopsis*	9	12.90	0.54	Fly
Passeriformes	*Aphelocephala nigricincta*	5	12.70	0.47	Fly
Passeriformes	*Aphelocoma coerulescens*	10	76.00	2.85	Fly
Passeriformes	*Aphelocoma ultramarina*	10	128.40	3.61	Fly
Passeriformes	*Aphrastura spinicauda*	10	11.50	0.81	Fly
Passeriformes	*Aplonis metallica*	10	61.00	1.58	Fly
Passeriformes	*Arachnothera longirostra*	6	11.70	0.52	Fly
Passeriformes	*Arremon aurantiirostris*	10	34.50	1.08	Fly
Passeriformes	*Arremon brunneinucha*	5	46.60	1.54	Fly
Passeriformes	*Arremonops conirostris*	7	37.30	1.29	Fly
Passeriformes	*Arses telescophthalmus*	unespecified	14.00	0.62	Fly
Passeriformes	*Artamus cinereus*	8	38.00	0.92	Fly
Passeriformes	*Artamus cyanopterus*	8	35.50	1.00	Fly
Passeriformes	*Artamus leucorhynchus*	6	45.60	1.08	Fly
Passeriformes	*Artamus maximus*	unespecified	66.02	1.65	Fly
Passeriformes	*Artamus minor*	unespecified	15.00	0.51	Fly
Passeriformes	*Artamus personatus*	4	36.50	1.03	Fly
Passeriformes	*Artamus superciliosus*	9	39.20	1.04	Fly
Passeriformes	*Ashbyia lovensis*	2	17.50	0.67	Fly
Passeriformes	*Attila spadiceus*	6	33.20	1.18	Fly
Passeriformes	*Auriparus flaviceps*	5	6.60	0.44	Fly
Passeriformes	*Automolus infuscatus*	6	33.10	1.13	Fly
Passeriformes	*Automolus ochrolaemus*	6	40.20	1.14	Fly
Passeriformes	*Baeolophus bicolor*	10	21.60	1.01	Fly
Passeriformes	*Basileuterus culcivorus*	7	8.90	0.58	Fly
Passeriformes	*Batis capensis*	3	12.80	0.68	Fly
Passeriformes	*Bias musicus*	6	21.70	0.84	Fly
Passeriformes	*Bombycilla cedorum*	10	33.70	0.89	Fly
Passeriformes	*Bombycilla garrulus*	6	56.40	1.16	Fly
Passeriformes	*Brachypteryx montana*	6	18.00	0.83	Fly
Passeriformes	*Bubalornis albirostris*	2	64.50	2.13	Fly
Passeriformes	*Cacicus cela*	7	91.50	2.43	Fly
Passeriformes	*Calamanthus fuliginosus*	unespecified	13.00	0.70	Fly
Passeriformes	*Calamospiza melanocorys*	9	37.80	1.18	Fly
Passeriformes	*Calandrella cinerea*	8	19.60	0.67	Fly
Passeriformes	*Calcarius lapponica*	11	27.50	0.87	Fly

Passeriformes	*Campephaga phoenicea*	4	28.50	1.05	Fly
Passeriformes	*Camptostoma obsoletum*	6	8.00	0.36	Fly
Passeriformes	*Campylorhamphus pusillus*	3	43.30	1.34	Fly
Passeriformes	*Campylorhynchus bruneicapillus*	10	38.90	1.34	Fly
Passeriformes	*Campylorhynchus griseus*	4	42.40	1.31	Fly
Passeriformes	*Cardellina rubrifrons*	6	9.80	0.43	Fly
Passeriformes	*Cardinalis cardinalis*	11	44.10	1.52	Fly
Passeriformes	*Carduelis carduelis*	9	15.60	0.65	Fly
Passeriformes	*Carduelis flammea*	5	13.70	0.59	Fly
Passeriformes	*Carduelis pinus*	10	14.60	0.57	Fly
Passeriformes	*Carduelis spinus*	1	11.50	0.55	Fly
Passeriformes	*Carduelis tristis*	9	12.90	0.54	Fly
Passeriformes	*Carpodacus mexicanus*	10	20.40	0.78	Fly
Passeriformes	*Carpodacus purpureus*	10	25.60	0.90	Fly
Passeriformes	*Caryothraustes poliogaster*	2	37.50	1.43	Fly
Passeriformes	*Catharus fuscescens*	7	41.50	0.92	Fly
Passeriformes	*Cercomacra nigrescens*	5	15.30	0.84	Fly
Passeriformes	*Cercomacra tyrannina*	6	16.60	0.74	Fly
Passeriformes	*Cercotrichas coryphaeus*	5	23.10	0.72	Fly
Passeriformes	*Certhia familiaris*	7	9.00	0.39	Fly
Passeriformes	*Certhiaxis cinnamomea*	10	14.80	0.69	Fly
Passeriformes	*Certhionyx niger*	unespecified	10.90	0.41	Fly
Passeriformes	*Certhionyx variegatus*	unespecified	23.50	0.98	Fly
Passeriformes	*Chamaea fasciata*	2	14.70	0.77	Fly
Passeriformes	*Cheramoeca leucosterna*	unespecified	12.00	0.44	Fly
Passeriformes	*Chersomanes albofasciata*	2	30.00	0.94	Fly
Passeriformes	*Chiroxiphia caudata*	4	25.60	0.80	Fly
Passeriformes	*Chiroxiphia linearis*	3	18.50	0.68	Fly
Passeriformes	*Chlamydera maculata*	unespecified	142.59	3.95	Fly
Passeriformes	*Chlamydera nuchalis*	4	199.50	5.01	Fly
Passeriformes	*Chlorocichla flavicollis*	4	45.30	1.48	Fly
Passeriformes	*Chlorophonia cyanea*	4	14.00	0.61	Fly
Passeriformes	*Chloropsis palawanensis*	7	30.50	1.05	Fly
Passeriformes	*Chlorospingus ophthalmicus*	6	19.00	0.98	Fly
Passeriformes	*Chlorospingus pileatus*	unespecified	19.81	1.11	Fly
Passeriformes	*Chlorothraupis carmioli*	2	39.00	1.30	Fly
Passeriformes	*Cicinnurus regius*	6	52.00	1.74	Fly
Passeriformes	*Cinclidium leucurum*	9	25.80	0.89	Fly
Passeriformes	*Cinclodes fuscus*	2	24.70	0.88	Fly
Passeriformes	*Cinclodes patagonicus*	8	53.20	1.24	Fly
Passeriformes	*Cincloramphus cruralis*	7	43.00	1.12	Fly
Passeriformes	*Cincloramphus mathewsi*	5	25.00	0.90	Fly
Passeriformes	*Cinclosoma cinnamomeum*	2	58.60	1.47	Fly
Passeriformes	*Cinclosoma punctatum*	unespecified	100.89	2.07	Fly
Passeriformes	*Cinclus cinclus*	1	60.00	1.45	Fly
Passeriformes	*Cinclus mexicanus*	2	57.80	1.40	Fly
Passeriformes	*Cinnyricinclus leucogaster*	3	42.50	1.18	Fly
Passeriformes	*Cissa chinensis*	6	126.80	3.45	Fly
Passeriformes	*Cissopis leverianus*	4	76.00	1.71	Fly
Passeriformes	*Cisticola cherina*	2	10.00	0.43	Fly
Passeriformes	*Cisticola exilis*	2	7.10	0.39	Fly
Passeriformes	*Cisticola fulvicapilla*	3	10.30	0.51	Fly
Passeriformes	*Cistothorus palustris*	8	10.00	0.52	Fly
Passeriformes	*Climacteris melanurus*	unespecified	33.52	0.83	Fly
Passeriformes	*Climacteris picumnus*	10	30.30	1.00	Fly
Passeriformes	*Climacteris rufus*	2	33.30	1.03	Fly
Passeriformes	*Clytorhynchus pachycephaloides*	unespecified	41.51	1.05	Fly
Passeriformes	*Cnemotriccus fuscatus*	2	13.50	0.46	Fly
Passeriformes	*Coccothraustes vespertinus*	10	57.20	1.70	Fly
Passeriformes	*Coereba flaveola*	10	8.50	0.44	Fly
Passeriformes	*Colluricincla harmonica*	7	63.30	2.00	Fly
Passeriformes	*Colluricincla megarhyncha*	7	36.00	1.34	Fly

Passeriformes	*Colonia colonus*	6	16.80	0.47	Fly
Passeriformes	*Conopophaga lineata*	3	21.80	0.70	Fly
Passeriformes	*Conopophila albogularis*	unespecified	10.50	0.56	Fly
Passeriformes	*Conopophila rufogularis*	2	10.80	0.44	Fly
Passeriformes	*Contopus cooperi*	3	32.80	0.64	Fly
Passeriformes	*Contopus latirostris*	7	10.60	0.38	Fly
Passeriformes	*Contopus virens*	6	14.20	0.45	Fly
Passeriformes	*Copsychus saularis*	10	33.20	1.10	Fly
Passeriformes	*Coracina caledonica*	10	145.30	2.99	Fly
Passeriformes	*Coracina maxima*	unespecified	134.69	2.20	Fly
Passeriformes	*Coracina novaehollandiae*	10	127.70	2.40	Fly
Passeriformes	*Coracina papuensis*	5	80.00	2.03	Fly
Passeriformes	*Coracina tenuirostris*	unespecified	58.73	1.71	Fly
Passeriformes	*Corcorax melanorhamphos*	7	349.10	5.20	Fly
Passeriformes	*Cormobates leucophaea*	7	22.40	0.81	Fly
Passeriformes	*Corvus albus*	10	584.10	8.75	Fly
Passeriformes	*Corvus bennetti*	3	379.00	6.44	Fly
Passeriformes	*Corvus brachyrhynchos*	10	438.50	7.17	Fly
Passeriformes	*Corvus caurinus*	10	384.00	7.43	Fly
Passeriformes	*Corvus corax*	10	1051.90	14.45	Fly
Passeriformes	*Corvus corone*	10	536.50	8.51	Fly
Passeriformes	*Corvus coronoides*	7	675.00	9.83	Fly
Passeriformes	*Corvus cryptoleucus*	10	534.00	8.95	Fly
Passeriformes	*Corvus dauuricus*	9	123.00	4.75	Fly
Passeriformes	*Corvus frugilegus*	5	488.00	7.61	Fly
Passeriformes	*Corvus mellori*	10	300.00	8.50	Fly
Passeriformes	*Corvus monedula*	8	240.25	5.10	Fly
Passeriformes	*Corvus moneduloides*	9	267.50	7.23	Fly
Passeriformes	*Corvus orru*	8	522.20	8.91	Fly
Passeriformes	*Corvus ossifragus*	6	285.00	5.99	Fly
Passeriformes	*Corydon sumatranus*	2	140.00	2.40	Fly
Passeriformes	*Coryphistera alaudina*	2	34.30	0.94	Fly
Passeriformes	*Coryphospingus cucullatus*	10	14.60	0.67	Fly
Passeriformes	*Cossypha caffra*	5	28.50	1.02	Fly
Passeriformes	*Cracticus nigrogularis*	2	156.00	3.02	Fly
Passeriformes	*Cracticus quoyi*	unespecified	180.01	3.55	Fly
Passeriformes	*Cracticus torquatus*	8	104.10	2.78	Fly
Passeriformes	*Crateroscelis nigrorufa*	unespecified	15.50	0.80	Fly
Passeriformes	*Criniger pallidus*	3	46.00	1.24	Fly
Passeriformes	*Culicicapa helianthea*	3	7.50	0.31	Fly
Passeriformes	*Curaeus curaeus*	8	90.00	2.47	Fly
Passeriformes	*Cyanerpes cyaneus*	8	14.00	0.55	Fly
Passeriformes	*Cyanocitta cristata*	10	89.10	2.92	Fly
Passeriformes	*Cyanocitta stelleri*	10	128.00	3.54	Fly
Passeriformes	*Cyanocorax affinis*	unespecified	203.98	4.52	Fly
Passeriformes	*Cyclarhis gujanensis*	5	28.80	1.26	Fly
Passeriformes	*Cymbilaimus lineatus*	6	28.70	1.22	Fly
Passeriformes	*Cyornis rubeculoides*	4	12.30	0.55	Fly
Passeriformes	*Cyphorhinus arada*	5	18.70	0.91	Fly
Passeriformes	*Dacnis cayana*	3	13.00	0.55	Fly
Passeriformes	*Daphoenositta chrysoptera*	unespecified	13.50	0.54	Fly
Passeriformes	*Dasyornis brachypterus*	unespecified	43.99	1.45	Fly
Passeriformes	*Dasyornis broadbenti*	2	83.30	1.88	Fly
Passeriformes	*Delichon urbica*	10	14.55	0.48	Fly
Passeriformes	*Dendrocincla fuliginosa*	10	39.40	1.06	Fly
Passeriformes	*Dendrocolaptes certhia*	3	66.70	1.74	Fly
Passeriformes	*Dendroplex picus*	5	34.60	1.30	Fly
Passeriformes	*Dicaeum aeruginosum*	6	11.80	0.50	Fly
Passeriformes	*Dicaeum hirundinaceum*	4	8.00	0.37	Fly
Passeriformes	*Dicrurus hottentotus*	11	66.30	1.96	Fly
Passeriformes	*Diuca diuca*	4	31.00	1.28	Fly
Passeriformes	*Dives dives*	4	96.20	2.20	Fly

Passeriformes	*Dolichonyx oryzivorus*	8	38.70	1.07	Fly
Passeriformes	*Donacobius atricapillus*	2	34.80	1.15	Fly
Passeriformes	*Drymodes brunneopygia*	4	38.70	0.95	Fly
Passeriformes	*Dryoscopus cubla*	5	26.40	1.13	Fly
Passeriformes	*Dulus dominicus*	10	47.60	1.27	Fly
Passeriformes	*Dumetella carolinensis*	10	37.80	1.14	Fly
Passeriformes	*Dysithamnus mentalis*	7	11.20	0.70	Fly
Passeriformes	*Elaenia frantzii*	5	19.40	0.61	Fly
Passeriformes	*Elaenia martinica*	10	18.60	0.65	Fly
Passeriformes	*Emberiza hortulana*	10	23.80	0.70	Fly
Passeriformes	*Emberiza spodocephala*	4	18.00	0.93	Fly
Passeriformes	*Empidonax minimus*	3	10.50	0.37	Fly
Passeriformes	*Empidonax virescens*	10	12.90	0.43	Fly
Passeriformes	*Enicurus scouleri*	3	14.00	0.76	Fly
Passeriformes	*Entomyzon cyanotis*	3	106.50	2.23	Fly
Passeriformes	*Eopsaltria australis*	6	19.60	0.86	Fly
Passeriformes	*Eopsaltria georgiana*	4	19.80	0.75	Fly
Passeriformes	*Eopsaltria griseogularis*	3	21.10	0.83	Fly
Passeriformes	*Epinecrophylla fulviventris*	6	10.20	0.48	Fly
Passeriformes	*Epthianura aurifrons*	6	10.30	0.43	Fly
Passeriformes	*Epthianura tricolor*	7	10.70	0.44	Fly
Passeriformes	*Eremophila alpestris*	10	34.80	0.89	Fly
Passeriformes	*Erithacus megarhyncha*	10	19.40	0.70	Fly
Passeriformes	*Erithacus rubecula*	9	17.98	0.64	Fly
Passeriformes	*Erythrura gouldiae*	11	10.00	0.53	Fly
Passeriformes	*Erythrura trichroa*	3	14.40	0.58	Fly
Passeriformes	*Estrilda caerulescens*	9	8.40	0.41	Fly
Passeriformes	*Estrilda melpoda*	10	7.60	0.38	Fly
Passeriformes	*Euneornis campestris*	10	16.20	0.70	Fly
Passeriformes	*Euphagus carolinus*	10	55.70	1.51	Fly
Passeriformes	*Euphagus cyanocephalus*	7	68.50	1.44	Fly
Passeriformes	*Euphonia jamaica*	10	16.10	0.65	Fly
Passeriformes	*Euplectes orix*	9	16.30	0.76	Fly
Passeriformes	*Falcunculus frontatus*	4	26.10	1.24	Fly
Passeriformes	*Ficedula albicollis*	10	10.30	0.45	Fly
Passeriformes	*Formicarius analis*	7	54.20	1.30	Fly
Passeriformes	*Formicarius colma*	3	45.30	1.08	Fly
Passeriformes	*Formicivora grisea*	4	9.30	0.45	Fly
Passeriformes	*Foudia madagascariensis*	6	16.00	0.75	Fly
Passeriformes	*Fringilla coelebs*	8	21.40	0.81	Fly
Passeriformes	*Furnarius rufus*	10	56.50	1.33	Fly
Passeriformes	*Galerida cristata*	10	30.30	1.17	Fly
Passeriformes	*Garrulus glandarius*	1	160.00	4.10	Fly
Passeriformes	*Geositta cunicularia*	3	30.00	0.97	Fly
Passeriformes	*Geothlypis trichas*	10	9.80	0.52	Fly
Passeriformes	*Gerygone flavolateralis*	3	6.40	0.34	Fly
Passeriformes	*Gerygone hypoxantha*	unespecified	6.50	0.42	Fly
Passeriformes	*Glyphorynchus spirurus*	10	14.80	0.62	Fly
Passeriformes	*Gnorimopsar chopi*	2	79.50	1.80	Fly
Passeriformes	*Gracula religiosa*	7	192.00	3.68	Fly
Passeriformes	*Grallaria quitensis*	3	79.50	2.05	Fly
Passeriformes	*Grallina bruijni*	unespecified	33.52	1.00	Fly
Passeriformes	*Grallina cyanoleuca*	3	89.00	1.68	Fly
Passeriformes	*Grantiella picta*	unespecified	22.99	0.70	Fly
Passeriformes	*Gymnocichla nudipes*	2	32.80	1.06	Fly
Passeriformes	*Gymnoderus foetidus*	3	275.00	3.53	Fly
Passeriformes	*Gymnopithys leucaspis*	3	31.10	0.76	Fly
Passeriformes	*Gymnorhina tibicen*	20	314.00	4.65	Fly
Passeriformes	*Gymnorhinus cyanocephalus*	10	103.00	3.51	Fly
Passeriformes	*Habia fuscicauda*	10	39.70	1.34	Fly
Passeriformes	*Helmitheros vermivorus*	10	14.20	0.59	Fly
Passeriformes	*Hemithraupis guira*	3	12.00	0.57	Fly

Passeriformes	*Hemitriccus margaritaceiventer*	2	7.70	0.45	Fly
Passeriformes	*Henicorhina leucosticta*	6	13.90	0.78	Fly
Passeriformes	*Heteromyias albispecularis*	unespecified	38.51	1.05	Fly
Passeriformes	*Heterophasia melanoleuca*	3	32.60	1.16	Fly
Passeriformes	*Himatione sanguinea*	3	14.80	0.67	Fly
Passeriformes	*Hippolais icterina*	10	14.60	0.47	Fly
Passeriformes	*Hirundo ariel*	4	11.20	0.36	Fly
Passeriformes	*Hirundo neoxena*	10	13.30	0.48	Fly
Passeriformes	*Hirundo nigricans*	5	17.10	0.52	Fly
Passeriformes	*Hirundo rustica*	10	18.60	0.55	Fly
Passeriformes	*Hylacola pyrrhopygia*	unespecified	19.91	1.03	Fly
Passeriformes	*Hylocichla mustelina*	10	47.40	1.25	Fly
Passeriformes	*Hylophylax naevius*	4	12.50	0.59	Fly
Passeriformes	*Hylophylax poecilonota*	9	16.60	0.64	Fly
Passeriformes	*Hymenops perspicillatus*	4	23.10	0.76	Fly
Passeriformes	*Hypocnemis cantator*	6	10.00	0.63	Fly
Passeriformes	*Hypothymis azurea*	9	10.20	0.52	Fly
Passeriformes	*Hypsipetes phillipinus*	10	36.90	1.12	Fly
Passeriformes	*Icteria virens*	8	24.90	0.91	Fly
Passeriformes	*Icterus galbula*	10	33.30	1.13	Fly
Passeriformes	*Icterus spurius*	6	20.40	0.86	Fly
Passeriformes	*Ifrita kowaldi*	unespecified	27.99	1.25	Fly
Passeriformes	*Illadopsis fulvescens*	4	24.40	1.19	Fly
Passeriformes	*Irena puella*	10	66.40	1.36	Fly
Passeriformes	*Iridosornis rufivertex*	4	22.30	1.33	Fly
Passeriformes	*Ixoreus naevius*	6	77.60	1.71	Fly
Passeriformes	*Ixos philippinus*	unespecified	36.89	1.12	Fly
Passeriformes	*Junco hyemalis*	10	19.00	0.83	Fly
Passeriformes	*Lagonosticta senegala*	8	8.30	0.39	Fly
Passeriformes	*Lalage sueurii*	6	18.90	0.87	Fly
Passeriformes	*Lamprotornis purpureus*	10	115.50	2.12	Fly
Passeriformes	*Laniarius erythrogaster*	5	45.80	1.56	Fly
Passeriformes	*Lanius collurio*	10	29.90	0.96	Fly
Passeriformes	*Lanius cristatus*	8	29.70	1.05	Fly
Passeriformes	*Lanius ludovicianus*	10	47.40	1.53	Fly
Passeriformes	*Lanius senator*	10	27.80	1.07	Fly
Passeriformes	*Legatus leucophaius*	3	24.40	0.66	Fly
Passeriformes	*Leiothrix lutea*	6	21.80	0.92	Fly
Passeriformes	*Lepidocolaptes affinis*	6	29.00	1.13	Fly
Passeriformes	*Lepidocolaptes souleyetii*	7	25.70	1.04	Fly
Passeriformes	*Leucosticte arctoa*	6	25.60	1.31	Fly
Passeriformes	*Lichenostomus chrysops*	9	17.50	0.72	Fly
Passeriformes	*Lichenostomus cratitus*	5	20.60	0.92	Fly
Passeriformes	*Lichenostomus flavescens*	5	12.60	0.52	Fly
Passeriformes	*Lichenostomus flavus*	3	21.10	0.71	Fly
Passeriformes	*Lichenostomus frenatus*	unespecified	29.99	1.04	Fly
Passeriformes	*Lichenostomus hindwoodi*	unespecified	24.66	0.89	Fly
Passeriformes	*Lichenostomus keartlandi*	2	15.30	0.69	Fly
Passeriformes	*Lichenostomus leucotis*	8	22.10	0.89	Fly
Passeriformes	*Lichenostomus melanops*	6	19.80	0.92	Fly
Passeriformes	*Lichenostomus ornatus*	8	19.80	0.75	Fly
Passeriformes	*Lichenostomus penicillatus*	9	19.20	0.83	Fly
Passeriformes	*Lichenostomus unicolor*	unespecified	29.99	0.81	Fly
Passeriformes	*Lichenostomus virescens*	8	33.30	0.92	Fly
Passeriformes	*Lichmera indistincta*	5	11.40	0.51	Fly
Passeriformes	*Limnothlypis swainsonii*	10	14.00	0.67	Fly
Passeriformes	*Linaria cannabina*	1	18.00	0.64	Fly
Passeriformes	*Lipaugus vociferans*	2	82.20	1.63	Fly
Passeriformes	*Locustella luscinioides*	7	15.00	0.55	Fly
Passeriformes	*Lonchura cucullata*	10	9.20	0.38	Fly
Passeriformes	*Lonchura malacca*	10	12.60	0.60	Fly
Passeriformes	*Lophorina superba*	2	78.00	2.60	Fly

Passeriformes	*Loxia curvirostra*	10	34.30	1.42	Fly
Passeriformes	*Loxia leucoptera*	8	31.80	1.38	Fly
Passeriformes	*Loxigilla violacea*	10	28.00	1.16	Fly
Passeriformes	*Loxipasser anoxanthus*	10	11.30	0.57	Fly
Passeriformes	*Luscinia megarhynchos*	unespecified	18.80	0.69	Fly
Passeriformes	*Lycocorax pyrrhopterus*	9	259.50	4.79	Fly
Passeriformes	*Machetornis rixosus*	3	33.40	0.96	Fly
Passeriformes	*Macronus gularis*	8	13.50	0.65	Fly
Passeriformes	*Malaconotus cruentus*	3	72.00	2.28	Fly
Passeriformes	*Malurus alboscapulatus*	unespecified	8.00	0.47	Fly
Passeriformes	*Malurus coronatus*	unespecified	9.00	0.48	Fly
Passeriformes	*Malurus cyaneus*	9	8.30	0.47	Fly
Passeriformes	*Malurus elegans*	3	10.10	0.57	Fly
Passeriformes	*Malurus lamberti*	10	9.20	0.46	Fly
Passeriformes	*Malurus leucopterus*	10	8.00	0.39	Fly
Passeriformes	*Malurus melanocephalus*	4	7.00	0.45	Fly
Passeriformes	*Malurus pulcherrimus*	3	9.80	0.42	Fly
Passeriformes	*Malurus splendens*	5	11.40	0.45	Fly
Passeriformes	*Manacus candei*	6	17.60	0.57	Fly
Passeriformes	*Manacus manacus*	7	19.00	0.59	Fly
Passeriformes	*Manacus vitellinus*	11	18.20	0.62	Fly
Passeriformes	*Manorina flavigula*	7	59.80	1.37	Fly
Passeriformes	*Manorina melanocephala*	9	60.90	1.86	Fly
Passeriformes	*Manorina melanophrys*	11	25.50	1.14	Fly
Passeriformes	*Margarops fuscatus*	10	109.40	2.35	Fly
Passeriformes	*Margarops fuscus*	10	70.80	1.54	Fly
Passeriformes	*Mecocerculus leucophrys*	4	13.90	0.48	Fly
Passeriformes	*Megalurus gramineus*	unespecified	12.19	0.57	Fly
Passeriformes	*Megalurus palustris*	4	33.30	1.14	Fly
Passeriformes	*Megarynchus pitangua*	5	73.50	1.17	Fly
Passeriformes	*Melaenornis silens*	3	28.30	1.00	Fly
Passeriformes	*Melanocharis striativentris*	unespecified	18.30	0.68	Fly
Passeriformes	*Melanocorypha calandra*	1	55.00	1.36	Fly
Passeriformes	*Melanodryas cucullatus*	7	24.30	0.80	Fly
Passeriformes	*Melanodryas vittata*	3	20.00	1.00	Fly
Passeriformes	*Melanoptila glabirostris*	5	35.00	1.20	Fly
Passeriformes	*Melilestes megarhynchus*	unespecified	47.23	1.35	Fly
Passeriformes	*Meliphaga gracilis*	unespecified	15.00	0.65	Fly
Passeriformes	*Meliphaga lewinii*	5	36.20	1.17	Fly
Passeriformes	*Meliphaga notata*	5	26.40	0.87	Fly
Passeriformes	*Melithreptus albogularis*	3	11.10	0.63	Fly
Passeriformes	*Melithreptus brevirostris*	5	14.30	0.68	Fly
Passeriformes	*Melithreptus lunatus*	6	14.10	0.60	Fly
Passeriformes	*Melopyrrha nigra*	7	10.90	0.84	Fly
Passeriformes	*Melospiza georgiana*	10	17.60	0.81	Fly
Passeriformes	*Melospiza melodia*	1	21.00	1.10	Fly
Passeriformes	*Menura novaehollandiae*	5	644.40	10.72	Fly
Passeriformes	*Microeca fascinans*	unespecified	11.36	0.55	Fly
Passeriformes	*Microeca flavigaster*	4	12.70	0.51	Fly
Passeriformes	*Microeca leucophaea*	5	11.40	0.54	Fly
Passeriformes	*Microeca papuana*	unespecified	12.26	0.58	Fly
Passeriformes	*Mimus polyglottus*	10	45.20	1.38	Fly
Passeriformes	*Minla ignotincta*	5	14.30	0.71	Fly
Passeriformes	*Mionectes oleagineus*	8	13.20	0.45	Fly
Passeriformes	*Mirafra javanica*	3	23.00	0.73	Fly
Passeriformes	*Mitrephanes phaeocercus*	2	8.60	0.32	Fly
Passeriformes	*Mitrospingus cassinii*	3	40.40	1.31	Fly
Passeriformes	*Mniotilta varia*	9	12.00	0.44	Fly
Passeriformes	*Molothrus ater*	10	41.70	1.15	Fly
Passeriformes	*Molothrus oryzivorus*	10	190.50	3.14	Fly
Passeriformes	*Monachella muelleriana*	unespecified	22.00	0.75	Fly
Passeriformes	*Monarcha guttula*	4	15.50	0.68	Fly

Passeriformes	*Monarcha melanopsis*	5	20.20	0.92	Fly
Passeriformes	*Monarcha trivirgatus*	8	13.50	0.63	Fly
Passeriformes	*Monticola saxatilis*	10	48.50	1.29	Fly
Passeriformes	*Montifringilla nivalis*	1	45.00	1.09	Fly
Passeriformes	*Motacilla alba*	11	24.27	0.60	Fly
Passeriformes	*Motacilla flava*	10	14.40	0.55	Fly
Passeriformes	*Muscicapa striata*	10	15.40	0.49	Fly
Passeriformes	*Muscisaxicola alpinus*	2	22.80	0.78	Fly
Passeriformes	*Myadestes genibarbis*	6	27.10	0.92	Fly
Passeriformes	*Myadestes townsendi*	3	32.50	1.01	Fly
Passeriformes	*Myiagra alecto*	10	24.00	0.73	Fly
Passeriformes	*Myiagra caledonica*	6	11.00	0.59	Fly
Passeriformes	*Myiagra cyanoleuca*	unespecified	14.81	0.63	Fly
Passeriformes	*Myiagra inquieta*	5	14.30	0.76	Fly
Passeriformes	*Myiagra rubecula*	unespecified	15.00	0.54	Fly
Passeriformes	*Myiarchus cinerascens*	10	28.80	0.77	Fly
Passeriformes	*Myiarchus stolidus*	7	19.30	0.65	Fly
Passeriformes	*Myiarchus tuberculifer*	9	18.70	0.66	Fly
Passeriformes	*Myiarchus tyrannulus*	8	35.30	0.98	Fly
Passeriformes	*Myiarchus validus*	unespecified	40.98	1.20	Fly
Passeriformes	*Myiobius barbatus*	4	11.90	0.35	Fly
Passeriformes	*Myioborus pictus*	3	9.80	0.39	Fly
Passeriformes	*Myiodynastes maculatus*	6	45.90	1.13	Fly
Passeriformes	*Myiopagis cotta*	3	13.00	0.42	Fly
Passeriformes	*Myiophobus fasciatus*	3	9.90	0.37	Fly
Passeriformes	*Myiothlypis fulvicauda*	4	14.90	0.56	Fly
Passeriformes	*Myiozetetes similis*	9	27.80	0.82	Fly
Passeriformes	*Myrmeciza exsul*	10	26.10	1.03	Fly
Passeriformes	*Myrmeciza ferruginea*	2	26.60	0.82	Fly
Passeriformes	*Myrmelastes leucostigma*	4	23.20	0.98	Fly
Passeriformes	*Myrmotherula axillaris*	10	7.40	0.39	Fly
Passeriformes	*Myzomela obscura*	6	11.90	0.51	Fly
Passeriformes	*Myzomela sanguinolenta*	4	7.80	0.34	Fly
Passeriformes	*Nectarinia calcostetha*	8	8.60	0.41	Fly
Passeriformes	*Nectarinia jugularis*	10	8.70	0.40	Fly
Passeriformes	*Nectarinia olivacea*	unespecified	9.70	0.55	Fly
Passeriformes	*Nectarinia violacea*	6	8.90	0.43	Fly
Passeriformes	*Neochmia phaethon*	7	10.00	0.50	Fly
Passeriformes	*Neochmia temporalis*	8	10.90	0.52	Fly
Passeriformes	*Nesospingus speculiferus*	10	36.20	1.43	Fly
Passeriformes	*Nicator chloris*	6	38.20	1.28	Fly
Passeriformes	*Notiochelidon cyanoleuca*	5	9.70	0.43	Fly
Passeriformes	*Oedistoma iliolophum*	4	12.90	0.48	Fly
Passeriformes	*Oenanthe oenanthe*	10	23.50	0.78	Fly
Passeriformes	*Onychorhynchus coronatus*	4	14.00	0.47	Fly
Passeriformes	*Onycognathus salvadorii*	3	147.30	2.44	Fly
Passeriformes	*Oreocharis arfaki*	unespecified	19.49	0.69	Fly
Passeriformes	*Oreoica gutturalis*	3	62.00	1.67	Fly
Passeriformes	*Origma solitaria*	unespecified	13.00	0.85	Fly
Passeriformes	*Oriolus flavocinctus*	unespecified	89.03	2.10	Fly
Passeriformes	*Oriolus oriolus*	1	72.00	1.50	Fly
Passeriformes	*Oriolus sagittatus*	5	97.40	1.96	Fly
Passeriformes	*Orthonyx temminckii*	4	62.30	1.76	Fly
Passeriformes	*Oryzoborus angolensis*	10	11.80	0.68	Fly
Passeriformes	*Pachycephala olivacea*	unespecified	44.26	1.48	Fly
Passeriformes	*Pachycephala pectoralis*	8	26.00	1.12	Fly
Passeriformes	*Pachycephala rufiventris*	7	21.40	1.03	Fly
Passeriformes	*Pachycephala rufogularis*	unespecified	36.05	1.09	Fly
Passeriformes	*Pachycephala simplex*	unespecified	18.99	0.83	Fly
Passeriformes	*Pachycephalopsis poliosoma*	4	38.30	1.06	Fly
Passeriformes	*Pachyramphus cinnamomeus*	2	20.30	0.88	Fly
Passeriformes	*Pachyramphus niger*	unespecified	38.90	1.30	Fly

Passeriformes	*Pachyramphus polychopterus*	4	20.30	0.74	Fly
Passeriformes	*Padda oryzivora*	9	24.50	0.85	Fly
Passeriformes	*Pardalotus punctatus*	9	9.20	0.40	Fly
Passeriformes	*Pardalotus striatus*	8	11.60	0.52	Fly
Passeriformes	*Paroaria coronata*	10	43.00	1.23	Fly
Passeriformes	*Parotia lawesii*	3	156.50	4.01	Fly
Passeriformes	*Parula americana*	6	8.00	0.39	Fly
Passeriformes	*Parus caeruleus*	1	11.00	0.68	Fly
Passeriformes	*Parus major*	1	17.50	0.91	Fly
Passeriformes	*Passer domesticus*	12	27.70	0.97	Fly
Passeriformes	*Passer hispaniolensis*	10	24.20	0.97	Fly
Passeriformes	*Passerina cyanea*	9	12.20	0.65	Fly
Passeriformes	*Pastor roseus*	1	55.21	1.48	Fly
Passeriformes	*Peneothello cyanus*	unespecified	27.06	0.96	Fly
Passeriformes	*Pericrocotus ethologus*	5	18.00	0.88	Fly
Passeriformes	*Perisoreus canadensis*	10	69.00	2.53	Fly
Passeriformes	*Perissocephalus tricolor*	2	339.50	4.70	Fly
Passeriformes	*Petrochelidon fulva*	10	15.50	0.50	Fly
Passeriformes	*Petroica goodenovii*	11	8.70	0.37	Fly
Passeriformes	*Petroica multicolor*	8	9.60	0.52	Fly
Passeriformes	*Petroica phoenicea*	6	13.30	0.49	Fly
Passeriformes	*Petroica rodinogaster*	2	9.70	0.49	Fly
Passeriformes	*Petroica rosea*	unespecified	10.70	0.50	Fly
Passeriformes	*Phacellodomus ruber*	3	39.30	1.11	Fly
Passeriformes	*Phaenicophilus palmarum*	10	29.20	1.13	Fly
Passeriformes	*Phaenostictus macleannani*	2	51.10	1.07	Fly
Passeriformes	*Phaeomyias murina*	7	10.00	0.37	Fly
Passeriformes	*Phainopepla nitens*	10	22.40	0.79	Fly
Passeriformes	*Pheucticus ludovicianus*	7	45.60	1.32	Fly
Passeriformes	*Philemon argenticeps*	unespecified	99.98	1.70	Fly
Passeriformes	*Philemon buceroides*	5	121.00	2.15	Fly
Passeriformes	*Philemon citreogularis*	unespecified	62.18	1.57	Fly
Passeriformes	*Philemon corniculatus*	3	105.80	1.98	Fly
Passeriformes	*Philemon diemenensis*	10	67.00	1.55	Fly
Passeriformes	*Philydor guttulatus*	4	34.80	1.19	Fly
Passeriformes	*Phleocryptes melanops*	3	14.20	0.69	Fly
Passeriformes	*Phoenicurus phoenicurus*	10	12.10	0.51	Fly
Passeriformes	*Phrygilus gramineus*	10	22.70	1.02	Fly
Passeriformes	*Phrygilus patagonicus*	unespecified	22.74	1.02	Fly
Passeriformes	*Phylidonyris albifrons*	4	17.10	0.72	Fly
Passeriformes	*Phylidonyris melanops*	3	18.30	0.62	Fly
Passeriformes	*Phylidonyris niger*	unespecified	15.39	0.80	Fly
Passeriformes	*Phylidonyris novaehollandiae*	9	19.40	0.90	Fly
Passeriformes	*Phyllastrephus terrestris*	3	31.70	1.03	Fly
Passeriformes	*Phylloscopus bonelli*	8	7.40	0.34	Fly
Passeriformes	*Phylloscopus sibilatrix*	10	7.20	0.36	Fly
Passeriformes	*Phytotoma rutila*	unespecified	36.02	0.73	Fly
Passeriformes	*Pica pica*	10	188.10	4.67	Fly
Passeriformes	*Pinicola enucleator*	10	65.70	1.58	Fly
Passeriformes	*Pipilo erythrophthalmus*	10	39.20	1.36	Fly
Passeriformes	*Pipra erythrocephala*	10	13.60	0.49	Fly
Passeriformes	*Pipra fasciicauda*	9	14.30	0.62	Fly
Passeriformes	*Pipra mentalis*	8	15.20	0.59	Fly
Passeriformes	*Pipra pipra*	unespecified	11.93	0.50	Fly
Passeriformes	*Piranga ludoviciana*	9	30.00	0.98	Fly
Passeriformes	*Piranga rubra*	11	29.50	1.02	Fly
Passeriformes	*Pitangus sulphuratus*	10	71.50	1.35	Fly
Passeriformes	*Pithys albifrons*	8	19.70	0.62	Fly
Passeriformes	*Pitohui dichrous*	unespecified	71.66	1.88	Fly
Passeriformes	*Pitohui ferrugineus*	3	94.00	2.48	Fly
Passeriformes	*Pitta brachyura*	3	55.50	1.39	Fly
Passeriformes	*Pitta maxima*	5	189.00	2.53	Fly

Passeriformes	*Pitta sordida*	7	63.60	1.31	Fly
Passeriformes	*Pitta versicolor*	7	107.70	1.87	Fly
Passeriformes	*Platyrinchus cancrominus*	3	9.70	0.49	Fly
Passeriformes	*Platyrinchus mystaceus*	8	9.10	0.40	Fly
Passeriformes	*Platysteira cyanea*	4	13.40	0.79	Fly
Passeriformes	*Plectrophenax nivalis*	9	34.80	1.02	Fly
Passeriformes	*Plocepasser mahali*	2	43.30	1.23	Fly
Passeriformes	*Ploceus cucullatus*	9	40.90	1.37	Fly
Passeriformes	*Podoces hendersoni*	2	149.00	3.28	Fly
Passeriformes	*Poecile atricapillus*	7	12.00	0.76	Fly
Passeriformes	*Poecile carolinensis*	4	10.20	0.60	Fly
Passeriformes	*Poecile gambeli*	6	11.30	0.75	Fly
Passeriformes	*Poecile hudsonicus*	6	11.00	0.71	Fly
Passeriformes	*Poecilodryas albonotata*	unespecified	38.02	1.30	Fly
Passeriformes	*Poecilodryas cerviniventris*	unespecified	17.00	0.72	Fly
Passeriformes	*Poecilodryas placens*	unespecified	26.60	0.98	Fly
Passeriformes	*Poecilodryas superciliosa*	unespecified	20.01	0.92	Fly
Passeriformes	*Poeoptera lugubris*	2	38.00	0.99	Fly
Passeriformes	*Poephila acuticauda*	10	14.00	0.51	Fly
Passeriformes	*Poephila cincta*	8	16.10	0.47	Fly
Passeriformes	*Poephila personata*	3	11.80	0.50	Fly
Passeriformes	*Polioptila caerulea*	2	6.00	0.30	Fly
Passeriformes	*Pomatorhinus ruficollis*	4	31.70	1.53	Fly
Passeriformes	*Pomatostomus halli*	3	37.50	1.60	Fly
Passeriformes	*Pomatostomus isidorei*	2	64.00	2.18	Fly
Passeriformes	*Pomatostomus ruficeps*	10	56.00	2.35	Fly
Passeriformes	*Pomatostomus superciliosus*	11	35.00	1.52	Fly
Passeriformes	*Pomatostomus temporalis*	2	75.00	1.90	Fly
Passeriformes	*Pooecetes gramineus*	8	25.70	0.81	Fly
Passeriformes	*Poospiza nigrorufa*	5	17.40	0.70	Fly
Passeriformes	*Prinia leucopogon*	3	13.80	0.59	Fly
Passeriformes	*Prionochilus plateni*	4	7.90	0.40	Fly
Passeriformes	*Prionops plumatus*	3	35.50	1.16	Fly
Passeriformes	*Progne subis*	10	50.70	1.03	Fly
Passeriformes	*Protonotaria citrea*	9	15.50	0.59	Fly
Passeriformes	*Prunella modularis*	4	19.70	0.78	Fly
Passeriformes	*Psaltriparus minimus*	3	5.30	0.35	Fly
Passeriformes	*Psarocolius montezuma*	10	376.50	5.89	Fly
Passeriformes	*Pseudocolopteryx flaviventris*	2	7.40	0.34	Fly
Passeriformes	*Pseudoleistes virescens*	5	70.40	2.01	Fly
Passeriformes	*Pseudotriccus pelzelni*	2	10.90	0.64	Fly
Passeriformes	*Psilorhinus morio*	10	204.00	4.80	Fly
Passeriformes	*Psophodes cristatus*	unespecified	38.51	1.40	Fly
Passeriformes	*Psophodes occidentalis*	2	42.00	1.33	Fly
Passeriformes	*Psophodes olivaceus*	unespecified	62.74	2.18	Fly
Passeriformes	*Pteruthius flaviscapis*	3	39.00	1.50	Fly
Passeriformes	*Ptilonorhynchus violaceus*	6	217.00	4.72	Fly
Passeriformes	*Ptiloprora guisei*	unespecified	22.69	0.91	Fly
Passeriformes	*Ptiloris magnificus*	unespecified	163.04	2.80	Fly
Passeriformes	*Ptiloris paradiseus*	2	125.50	2.78	Fly
Passeriformes	*Ptiloris victoriae*	4	92.00	2.54	Fly
Passeriformes	*Pycnonotus jocosus*	10	27.40	0.93	Fly
Passeriformes	*Pycnonotus tricolor*	10	43.00	1.16	Fly
Passeriformes	*Pycnoptilus floccosus*	unespecified	31.19	1.18	Fly
Passeriformes	*Pyriglena leuconota*	7	32.80	0.93	Fly
Passeriformes	*Pyrocephalus rubinus*	7	12.70	0.46	Fly
Passeriformes	*Pyrrhocorax pyrrhocorax*	5	330.40	6.40	Fly
Passeriformes	*Pyrrholaemus brunneus*	unespecified	11.50	0.55	Fly
Passeriformes	*Pyrrholaemus sagittatus*	unespecified	13.50	0.60	Fly
Passeriformes	*Pytilia melba*	3	13.50	0.57	Fly
Passeriformes	*Querula purpurata*	4	101.80	2.13	Fly
Passeriformes	*Quiscalus major*	8	158.80	2.78	Fly

Passeriformes	*Quiscalus mexicanus*	8	168.70	2.96	Fly
Passeriformes	*Quiscalus quiscula*	10	110.20	2.59	Fly
Passeriformes	*Ramphocaenus melanurus*	7	9.80	0.51	Fly
Passeriformes	*Ramphocelus flammigerus*	10	30.70	1.19	Fly
Passeriformes	*Ramsayornis modestus*	3	10.60	0.51	Fly
Passeriformes	*Regulus calendula*	6	6.60	0.31	Fly
Passeriformes	*Regulus regulus*	1	5.40	0.36	Fly
Passeriformes	*Regulus satrapa*	9	6.20	0.36	Fly
Passeriformes	*Rhinocrypta lanceolata*	2	63.60	1.40	Fly
Passeriformes	*Rhipidura atra*	unespecified	10.50	0.57	Fly
Passeriformes	*Rhipidura fuliginosa*	4	8.00	0.34	Fly
Passeriformes	*Rhipidura leucophrys*	9	27.70	0.58	Fly
Passeriformes	*Rhipidura rufifrons*	7	10.20	0.36	Fly
Passeriformes	*Rhipidura rufiventris*	4	15.60	0.55	Fly
Passeriformes	*Rhodinocichla rosea*	5	46.70	1.35	Fly
Passeriformes	*Rhodospingus cruentus*	10	10.80	0.52	Fly
Passeriformes	*Riparia riparia*	8	13.80	0.41	Fly
Passeriformes	*Rupicola peruviana*	5	243.50	3.36	Fly
Passeriformes	*Sakesphorus luctuosus*	3	31.00	1.15	Fly
Passeriformes	*Salpinctes obsoletus*	7	16.00	0.75	Fly
Passeriformes	*Saltator maximus*	10	46.60	1.39	Fly
Passeriformes	*Sarcops calvus*	6	142.00	2.80	Fly
Passeriformes	*Saxicola torquatus*	7	15.30	0.61	Fly
Passeriformes	*Sayornis nigricans*	3	18.60	0.49	Fly
Passeriformes	*Sayornis phoebe*	9	18.24	0.61	Fly
Passeriformes	*Sayornis saya*	5	21.70	0.61	Fly
Passeriformes	*Scenopoeetes dentirostris*	unespecified	146.06	3.50	Fly
Passeriformes	*Schiffornis turdina*	5	30.80	1.07	Fly
Passeriformes	*Schistochlamys melanopis*	10	33.00	1.22	Fly
Passeriformes	*Sclerurus mexicanus*	3	21.10	0.79	Fly
Passeriformes	*Scytalopus unicolor*	unespecified	17.50	0.90	Fly
Passeriformes	*Seiurus aurocapilla*	10	22.10	0.70	Fly
Passeriformes	*Seleucidis melanoleuca*	4	178.00	3.41	Fly
Passeriformes	*Sericornis citreogularis*	4	16.60	0.79	Fly
Passeriformes	*Sericornis frontalis*	unespecified	13.20	0.80	Fly
Passeriformes	*Sericornis magnirostra*	7	8.50	0.60	Fly
Passeriformes	*Sericornis perspicillatus*	unespecified	8.50	0.55	Fly
Passeriformes	*Sericulus chrysocephalus*	8	100.50	3.34	Fly
Passeriformes	*Serinus canaris*	1	8.00	0.45	Fly
Passeriformes	*Serinus flaviventris*	5	16.30	0.72	Fly
Passeriformes	*Setophaga caerulescens*	10	9.40	0.43	Fly
Passeriformes	*Setophaga citrina*	10	10.70	0.48	Fly
Passeriformes	*Setophaga coronata*	10	12.60	0.51	Fly
Passeriformes	*Setophaga petechia*	10	9.80	0.52	Fly
Passeriformes	*Setophaga ruticilla*	10	7.80	0.36	Fly
Passeriformes	*Sialia mexicana*	8	26.40	0.84	Fly
Passeriformes	*Sialia sialis*	10	29.70	0.99	Fly
Passeriformes	*Sicalis flaveola*	6	19.70	0.70	Fly
Passeriformes	*Sitta canadensis*	6	10.50	0.57	Fly
Passeriformes	*Sitta carolinensis*	9	17.80	0.86	Fly
Passeriformes	*Sitta europaea*	1	23.00	1.06	Fly
Passeriformes	*Sitta pygmaea*	8	10.40	0.55	Fly
Passeriformes	*Sittasomus griseicapillus*	6	14.00	0.55	Fly
Passeriformes	*Smicrornis brevirostris*	unespecified	6.60	0.29	Fly
Passeriformes	*Smithornis capensis*	2	25.50	0.78	Fly
Passeriformes	*Spermophaga haematina*	3	22.30	0.88	Fly
Passeriformes	*Sphecotheres viridis*	9	132.40	2.24	Fly
Passeriformes	*Spindalis zena*	10	42.50	1.31	Fly
Passeriformes	*Spiza americana*	7	27.00	0.91	Fly
Passeriformes	*Spizella arborea*	7	12.40	0.74	Fly
Passeriformes	*Sporophila americana*	10	10.70	0.60	Fly
Passeriformes	*Stachyris whiteheadi*	8	19.10	0.82	Fly

Passeriformes	*Stagonopleura guttata*	4	19.00	0.63	Fly
Passeriformes	*Stelgidopteryx ruficollis*	10	15.20	0.53	Fly
Passeriformes	*Strepera fuliginosa*	2	300.00	5.70	Fly
Passeriformes	*Strepera graculina*	10	278.50	5.34	Fly
Passeriformes	*Strepera versicolor*	5	353.00	5.97	Fly
Passeriformes	*Struthidea cinerea*	8	134.30	2.98	Fly
Passeriformes	*Sturnella neglecta*	9	103.50	1.94	Fly
Passeriformes	*Sturnus vulgaris*	10	83.80	1.97	Fly
Passeriformes	*Sylvia atricapilla*	10	18.10	0.65	Fly
Passeriformes	*Sylvia borin*	10	17.60	0.62	Fly
Passeriformes	*Synallaxis brachyura*	4	18.30	0.86	Fly
Passeriformes	*Syndactyla guttulata*	unespecified	34.85	1.19	Fly
Passeriformes	*Tachycineta bicolor*	7	20.10	0.55	Fly
Passeriformes	*Tachycineta thalassina*	10	15.10	0.46	Fly
Passeriformes	*Tachyphonus delatrii*	10	16.80	0.74	Fly
Passeriformes	*Taeniopygia bichenovii*	4	10.50	0.40	Fly
Passeriformes	*Taeniopygia guttata*	14	12.00	0.44	Fly
Passeriformes	*Tangara cyanicollis*	9	17.00	0.64	Fly
Passeriformes	*Taraba major*	10	67.50	1.52	Fly
Passeriformes	*Tchagra australis*	7	36.30	1.23	Fly
Passeriformes	*Telophorus zeylonus*	3	62.70	1.91	Fly
Passeriformes	*Tephrodornis pondicerianus*	6	19.50	0.89	Fly
Passeriformes	*Terpsiphone atrocaudata*	9	16.50	0.65	Fly
Passeriformes	*Tersina viridis*	3	29.00	0.93	Fly
Passeriformes	*Thamnomanes caesius*	10	14.20	0.61	Fly
Passeriformes	*Thamnophilus caerulescens*	8	20.00	0.98	Fly
Passeriformes	*Thamnophilus punctatus*	10	22.40	0.94	Fly
Passeriformes	*Thraupis episcopus*	9	31.10	1.11	Fly
Passeriformes	*Thryomanes bewickii*	6	9.80	0.52	Fly
Passeriformes	*Thryothorus ludovicianus*	10	18.70	0.85	Fly
Passeriformes	*Thryothorus nigricapillus*	10	27.90	1.06	Fly
Passeriformes	*Tiaris olivaceus*	10	8.50	0.48	Fly
Passeriformes	*Tityra cayana*	6	73.90	1.61	Fly
Passeriformes	*Tityra semifasciata*	6	79.30	1.88	Fly
Passeriformes	*Todirostrum cinereum*	4	6.40	0.31	Fly
Passeriformes	*Tolmomyias sulphurescens*	5	14.90	0.51	Fly
Passeriformes	*Toxorhamphus poliopterus*	5	11.40	0.43	Fly
Passeriformes	*Toxostoma curvirostre*	10	78.40	2.13	Fly
Passeriformes	*Toxostoma rufum*	8	70.30	2.00	Fly
Passeriformes	*Tregellasia capito*	unespecified	14.17	0.77	Fly
Passeriformes	*Tregellasia leucops*	5	16.00	0.59	Fly
Passeriformes	*Trichodere cockerelli*	unespecified	18.60	0.65	Fly
Passeriformes	*Trichothraupis melanops*	9	21.60	0.90	Fly
Passeriformes	*Troglodytes aedon*	8	11.00	0.53	Fly
Passeriformes	*Troglodytes troglodytes*	1	9.50	0.50	Fly
Passeriformes	*Turdoides jardineii*	unespecified	78.02	2.00	Fly
Passeriformes	*Turdus ericetorium*	1	67.00	1.46	Fly
Passeriformes	*Turdus lherminieri*	7	100.00	2.20	Fly
Passeriformes	*Turdus merula*	15	113.00	1.90	Fly
Passeriformes	*Turdus migratorius*	10	80.20	1.64	Fly
Passeriformes	*Turdus philomelos*	11	67.80	1.63	Fly
Passeriformes	*Tyrannus dominicensis*	10	46.30	1.00	Fly
Passeriformes	*Tyrannus forficata*	3	39.30	0.86	Fly
Passeriformes	*Tyrannus savana*	8	28.60	0.73	Fly
Passeriformes	*Tyrannus tyrannus*	10	39.50	0.95	Fly
Passeriformes	*Tyrannus verticalis*	7	40.70	0.98	Fly
Passeriformes	*Uraeginthus bengalus*	9	10.30	0.43	Fly
Passeriformes	*Vauriella gularis*	2	18.00	1.05	Fly
Passeriformes	*Vermivora peregrina*	8	9.50	0.43	Fly
Passeriformes	*Vidua paradisaea*	11	22.20	0.64	Fly
Passeriformes	*Vireo altiloquus*	10	19.50	0.75	Fly
Passeriformes	*Vireo griseus*	8	11.90	0.58	Fly

Passeriformes	*Vireo magister*	4	15.90	0.72	Fly
Passeriformes	*Vireo olivaceus*	10	20.30	0.61	Fly
Passeriformes	*Volatinia jacarina*	7	12.50	0.49	Fly
Passeriformes	*Willisornis poecilinotus*	unespecified	16.59	0.63	Fly
Passeriformes	*Xanthocephalus xanthocephalus*	10	76.60	1.65	Fly
Passeriformes	*Xanthotis flaviventer*	4	33.60	1.05	Fly
Passeriformes	*Xanthotis macleayanus*	unespecified	32.49	0.90	Fly
Passeriformes	*Xenops minutus*	8	11.70	0.49	Fly
Passeriformes	*Xiphorhynchus guttatus*	10	46.40	1.50	Fly
Passeriformes	*Xolmis irupero*	3	29.80	0.82	Fly
Passeriformes	*Xolmis pyrope*	3	42.80	1.28	Fly
Passeriformes	*Yuhina diademata*	3	12.00	0.77	Fly
Passeriformes	*Zonotrichia albicollis*	10	27.40	1.05	Fly
Passeriformes	*Zonotrichia leucophrys*	10	26.40	0.97	Fly
Passeriformes	*Zoothera heinei*	unespecified	72.97	1.80	Fly
Passeriformes	*Zoothera lunulata*	6	104.00	2.16	Fly
Passeriformes	*Zoothera naevia*	unespecified	70.74	1.74	Fly
Passeriformes	*Zosterops japonicus*	10	10.20	0.54	Fly
Passeriformes	*Zosterops lateralis*	9	10.60	0.47	Fly
Pelecaniformes	*Ardea alba*	11	885.00	5.06	Fly
Pelecaniformes	*Ardea cinerea*	1	1500.00	7.87	Fly
Pelecaniformes	*Ardea intermedia*	5	500.00	4.15	Fly
Pelecaniformes	*Balaeniceps rex*	2	5984.00	22.38	Fly
Pelecaniformes	*Bostrychia hagadesh*	4	1168.00	10.18	Fly
Pelecaniformes	*Botaurus stellaris*	1	900.00	5.21	Fly
Pelecaniformes	*Bubulcus ibis*	10	365.80	3.81	Fly
Pelecaniformes	*Butorides striata*	11	212.00	2.48	Fly
Pelecaniformes	*Egretta garzetta*	1	500.00	3.47	Fly
Pelecaniformes	*Egretta novaehollandiae*	10	560.20	3.91	Fly
Pelecaniformes	*Eudocimus albus*	5	900.00	6.36	Fly
Pelecaniformes	*Nycticorax nycticorax*	10	876.10	6.66	Fly
Pelecaniformes	*Pelecanus conspicillatus*	6	5850.00	24.88	Fly
Pelecaniformes	*Pelecanus erythrorhynchus*	6	7000.00	24.25	Fly
Pelecaniformes	*Pelecanus occidentalis*	1	3290.00	17.45	Fly
Pelecaniformes	*Pelecanus onocrotalus*	1	9000.00	30.57	Fly
Pelecaniformes	*Platalea flavipes*	8	1747.50	11.12	Fly
Pelecaniformes	*Plegadis chihi*	5	612.50	5.04	Fly
Pelecaniformes	*Plegadis falcinellus*	9	612.90	5.12	Fly
Pelecaniformes	*Scopus umbretta*	3	387.50	4.14	Fly
Pelecaniformes	*Theristictus caerulescens*	2	1500.00	8.90	Fly
Pelecaniformes	*Threskiornis aethiopica*	9	1498.00	10.24	Fly
Pelecaniformes	*Threskiornis molucca*	13	1914.40	9.90	Fly
Phaethontiformes	*Phaethon rubricauda*	10	672.00	4.52	Fly
Phoenicopteriformes	*Phoenicopterus roseus*	unespecified	2599.31	10.45	Fly
Phoenicopteriformes	*Phoenicopterus ruber*	11	3031.82	10.82	Fly
Piciformes	*Andigena hypoglauca*	unespecified	297.97	5.20	Fly
Piciformes	*Aulacorhynchus sulcatus*	7	173.00	2.74	Fly
Piciformes	*Brachygalba lugubris*	unespecified	17.25	0.43	Fly
Piciformes	*Calorhamphus fuliginosus*	3	42.20	1.10	Fly
Piciformes	*Campephilus guatemalensis*	8	240.70	5.94	Fly
Piciformes	*Campethera nivosa*	4	34.80	1.58	Fly
Piciformes	*Capito niger*	3	54.80	1.35	Fly
Piciformes	*Celeus castaneus*	4	109.00	2.11	Fly
Piciformes	*Chrysocolaptes lucidus*	unespecified	119.94	4.60	Fly
Piciformes	*Colaptes auratus*	11	152.80	3.06	Fly
Piciformes	*Dendrocopos major*	1	80.00	2.70	Fly
Piciformes	*Dendrocopos medius*	1	58.00	2.06	Fly
Piciformes	*Dendropicos fuscescens*	5	26.00	1.22	Fly
Piciformes	*Dinopium javanense*	8	78.50	2.67	Fly
Piciformes	*Dryocopus pileatus*	10	282.80	6.80	Fly
Piciformes	*Jacamerops aureus*	3	65.20	1.11	Fly
Piciformes	*Jynx torquilla*	10	27.60	0.94	Fly

Piciformes	*Lybius torquatus*	3	60.00	1.16	Fly
Piciformes	*Melanerpes carolinus*	11	68.50	2.16	Fly
Piciformes	*Melanerpes erythrocephalus*	7	71.60	1.78	Fly
Piciformes	*Melanerpes formicivorus*	10	79.00	1.99	Fly
Piciformes	*Melanerpes lewis*	10	103.90	2.22	Fly
Piciformes	*Melanerpes striatus*	10	74.90	2.04	Fly
Piciformes	*Mulleripicus fulvus*	2	200.00	4.43	Fly
Piciformes	*Picoides arcticus*	4	72.40	3.15	Fly
Piciformes	*Picoides borealis*	3	47.90	1.66	Fly
Piciformes	*Picoides pubescens*	8	25.30	1.21	Fly
Piciformes	*Picoides scalaris*	10	33.00	1.38	Fly
Piciformes	*Picoides tridactylus*	5	55.20	2.63	Fly
Piciformes	*Picoides villosus*	10	82.80	2.95	Fly
Piciformes	*Piculus flavigula*	3	61.50	1.63	Fly
Piciformes	*Picumnus temminckii*	2	11.00	0.60	Fly
Piciformes	*Picus canus*	8	150.40	3.68	Fly
Piciformes	*Picus viridus*	1	200.00	4.38	Fly
Piciformes	*Pogoniulus scolopaceus*	4	15.50	0.44	Fly
Piciformes	*Psilopogon lineatus*	4	160.50	2.01	Fly
Piciformes	*Psilopogon pyrolophus*	5	129.00	2.21	Fly
Piciformes	*Psilopogon zeylanicus*	3	105.80	1.90	Fly
Piciformes	*Pteroglossus aracari*	7	232.00	3.48	Fly
Piciformes	*Pteroglossus bailloni*	3	139.00	2.94	Fly
Piciformes	*Pteroglossus castanotis*	5	310.00	3.77	Fly
Piciformes	*Pteroglossus inscriptus*	5	126.00	2.50	Fly
Piciformes	*Pteroglossus torquatus*	10	224.90	3.50	Fly
Piciformes	*Ramphastos sulfuratus*	12	425.00	4.86	Fly
Piciformes	*Ramphastos tucanus*	7	530.00	5.98	Fly
Piciformes	*Ramphastos vitellinus*	12	361.50	4.81	Fly
Piciformes	*Sasia abnormis*	2	8.10	0.58	Fly
Piciformes	*Selenidera maculirostris*	8	138.50	2.91	Fly
Piciformes	*Semnornis ramphestinus*	5	97.50	1.91	Fly
Piciformes	*Sphyrapicus nuchalis*	5	45.60	1.27	Fly
Piciformes	*Sphyrapicus varius*	10	49.90	1.30	Fly
Piciformes	*Trachyphonus vaillanti*	3	73.00	1.63	Fly
Piciformes	*Tricholaema leucomelas*	3	35.00	0.98	Fly
Piciformes	*Veniliornis passerinus*	2	31.40	1.45	Fly
Podicepediformes	*Podiceps ruficollis*	1	160.00	1.72	Fly
Podicipediformes	*Aechmophorus occidentalis*	10	1147.70	3.71	Fly
Podicipediformes	*Podiceps auritus*	10	441.70	2.43	Fly
Podicipediformes	*Podiceps cristatus*	13	754.34	3.16	Fly
Podicipediformes	*Podiceps grisegena*	10	1115.00	4.04	Fly
Podicipediformes	*Podiceps nigricollis*	10	292.00	1.69	Fly
Podicipediformes	*Podilymbus podiceps*	10	442.00	3.16	Fly
Podicipediformes	*Poliocephalus poliocephalus*	11	223.40	1.72	Fly
Podicipediformes	*Rollandia rolland*	2	248.50	1.98	Fly
Podicipediformes	*Tachybaptus novaehollandiae*	6	152.30	1.66	Fly
Procellariiformes	*Bulweria bulwerii*	10	99.00	1.34	Fly
Procellariiformes	*Calonectris diomedea*	8	571.80	4.92	Fly
Procellariiformes	*Daption capense*	10	428.00	5.02	Fly
Procellariiformes	*Diomedea cauta*	9	4100.00	19.34	Fly
Procellariiformes	*Diomedea chrysostoma*	4	3507.50	19.15	Fly
Procellariiformes	*Diomedea exulans*	4	6928.25	28.94	Fly
Procellariiformes	*Diomedea melanophrys*	5	3387.50	17.88	Fly
Procellariiformes	*Diomedea nigripes*	7	3148.00	15.80	Fly
Procellariiformes	*Fregetta grallaria*	7	46.00	0.90	Fly
Procellariiformes	*Fulmarus glacialis*	10	544.00	6.33	Fly
Procellariiformes	*Fulmarus glacialoides*	10	1000.00	7.46	Fly
Procellariiformes	*Halobaena caerulea*	7	173.20	2.77	Fly
Procellariiformes	*Macronectes giganteus*	7	4567.00	17.94	Fly
Procellariiformes	*Oceanites oceanicus*	10	33.70	0.71	Fly
Procellariiformes	*Oceanodroma leucorrhoa*	10	39.60	0.89	Fly

Procellariiformes	*Oceanodroma microsoma*	8	19.70	0.51	Fly
Procellariiformes	*Oceanodroma tethys*	10	26.90	0.60	Fly
Procellariiformes	*Pachyptila belcherii*	9	92.60	2.00	Fly
Procellariiformes	*Pachyptila desolata*	8	151.50	2.10	Fly
Procellariiformes	*Pachyptila salvinii*	7	164.00	2.06	Fly
Procellariiformes	*Pachyptila turtur*	8	80.60	2.00	Fly
Procellariiformes	*Pagodroma nivea*	10	314.00	4.39	Fly
Procellariiformes	*Pelecanoides georgicus*	10	114.20	1.47	Fly
Procellariiformes	*Pelecanoides urinatrix*	10	134.60	1.69	Fly
Procellariiformes	*Phoebetria palpebrata*	3	2785.00	16.94	Fly
Procellariiformes	*Procellaria aequinoctialis*	8	1271.70	8.99	Fly
Procellariiformes	*Procellaria cinerea*	3	1131.00	8.49	Fly
Procellariiformes	*Pterodroma brevirostris*	10	297.50	4.26	Fly
Procellariiformes	*Pterodroma lessonii*	7	457.70	5.87	Fly
Procellariiformes	*Pterodroma macroptera*	5	321.00	4.88	Fly
Procellariiformes	*Puffinus griseus*	11	724.36	5.10	Fly
Procellariiformes	*Puffinus pacificus*	10	383.40	3.97	Fly
Procellariiformes	*Puffinus tenuirostris*	32	556.70	4.50	Fly
Procellariiformes	*Thalassoica antarctica*	10	754.50	6.68	Fly
Psittaciformes	*Agapornis cana*	7	26.50	1.15	Fly
Psittaciformes	*Agapornis fischeri*	7	48.30	1.95	Fly
Psittaciformes	*Agapornis lilianae*	8	40.50	1.53	Fly
Psittaciformes	*Agapornis personatus*	9	52.50	1.87	Fly
Psittaciformes	*Agapornis pullaria*	8	43.00	1.44	Fly
Psittaciformes	*Agapornis roseicollis*	9	45.80	1.86	Fly
Psittaciformes	*Agapornis swinderiana*	2	40.00	1.53	Fly
Psittaciformes	*Agapornis taranta*	4	57.50	1.98	Fly
Psittaciformes	*Alisterus scapularis*	16	160.40	4.48	Fly
Psittaciformes	*Amazona aestiva*	4	400.00	8.24	Fly
Psittaciformes	*Amazona albifrons*	7	218.00	5.28	Fly
Psittaciformes	*Amazona amazonica*	11	338.00	8.29	Fly
Psittaciformes	*Amazona auropalliata*	5	433.00	9.57	Fly
Psittaciformes	*Amazona autumnalis*	5	399.50	8.13	Fly
Psittaciformes	*Amazona farinosa*	10	610.00	10.14	Fly
Psittaciformes	*Amazona leucocephala*	8	277.00	5.63	Fly
Psittaciformes	*Amazona oratrix*	7	433.00	8.62	Fly
Psittaciformes	*Amazona ventralis*	5	300.00	5.97	Fly
Psittaciformes	*Amazona versicolor*	1	400.00	7.82	Fly
Psittaciformes	*Amazona vinacea*	3	411.70	7.46	Fly
Psittaciformes	*Amazona viridigenalis*	6	316.00	6.89	Fly
Psittaciformes	*Amazona vittata*	unespecified	229.06	5.85	Fly
Psittaciformes	*Anodorhynchus hyacinthus*	5	1500.00	24.73	Fly
Psittaciformes	*Aprosmictus erythropterus*	9	138.30	3.85	Fly
Psittaciformes	*Ara ararauna*	11	1100.00	18.14	Fly
Psittaciformes	*Ara chloroptera*	5	1234.00	21.57	Fly
Psittaciformes	*Ara macao*	13	1015.00	17.93	Fly
Psittaciformes	*Ara militaris*	4	1134.00	18.83	Fly
Psittaciformes	*Aratinga aurea*	4	84.00	3.23	Fly
Psittaciformes	*Aratinga canicularis*	3	75.20	3.26	Fly
Psittaciformes	*Aratinga finschii*	4	236.00	5.28	Fly
Psittaciformes	*Aratinga holochlora*	3	232.00	5.23	Fly
Psittaciformes	*Aratinga leucopthalmus*	4	155.00	5.58	Fly
Psittaciformes	*Aratinga nana*	10	79.00	4.01	Fly
Psittaciformes	*Aratinga pertinax*	5	89.00	3.49	Fly
Psittaciformes	*Aratinga solstitialis*	unespecified	86.23	4.50	Fly
Psittaciformes	*Aratinga weddellii*	4	108.00	4.01	Fly
Psittaciformes	*Barnardius zonarius*	7	139.60	3.91	Fly
Psittaciformes	*Bolbopsittacus lunulatus*	unespecified	67.02	2.65	Fly
Psittaciformes	*Bolborhynchus lineola*	2	53.60	2.08	Fly
Psittaciformes	*Brotogeris chrysopterus*	10	72.00	2.08	Fly
Psittaciformes	*Brotogeris jugularis*	10	63.30	2.12	Fly
Psittaciformes	*Brotogeris versicolurus*	7	60.40	2.39	Fly

Psittaciformes	*Cacatua alba*	6	631.00	14.16	Fly
Psittaciformes	*Cacatua galerita*	22	765.00	14.24	Fly
Psittaciformes	*Cacatua haematuropygia*	unespecified	209.98	8.80	Fly
Psittaciformes	*Cacatua leadbeateri*	5	460.00	8.47	Fly
Psittaciformes	*Cacatua moluccensis*	5	850.00	15.63	Fly
Psittaciformes	*Cacatua pastinator*	4	643.20	10.99	Fly
Psittaciformes	*Cacatua roseicapilla*	23	351.00	6.43	Fly
Psittaciformes	*Cacatua sanguinea*	10	437.50	8.91	Fly
Psittaciformes	*Cacatua sulphurea*	7	359.14	9.49	Fly
Psittaciformes	*Callocephalon fimbriatum*	11	256.60	7.48	Fly
Psittaciformes	*Calyptorhynchus banksii*	5	772.00	11.95	Fly
Psittaciformes	*Calyptorhynchus baudinii*	4	683.30	14.63	Fly
Psittaciformes	*Calyptorhynchus funereus*	9	766.00	15.08	Fly
Psittaciformes	*Calyptorhynchus lathamii*	4	430.00	9.78	Fly
Psittaciformes	*Calyptorhynchus latirostris*	9	676.30	14.25	Fly
Psittaciformes	*Charmosyna papou*	6	98.00	3.45	Fly
Psittaciformes	*Charmosyna pulchella*	3	29.10	1.39	Fly
Psittaciformes	*Cyanoramphus auriceps*	2	48.20	2.78	Fly
Psittaciformes	*Cyanoramphus novaezelandiae*	unespecified	59.03	2.25	Fly
Psittaciformes	*Cyanoramphus unicolor*	4	150.10	4.03	Fly
Psittaciformes	*Cyclopsitta diophthalma*	unespecified	33.02	1.70	Fly
Psittaciformes	*Deroptyus accipitrinus*	4	251.40	7.74	Fly
Psittaciformes	*Diopsittaca nobilis*	3	136.00	5.84	Fly
Psittaciformes	*Eclectus roratus*	12	428.00	7.36	Fly
Psittaciformes	*Eos bornea*	4	120.00	4.78	Fly
Psittaciformes	*Eos cyanogenia*	3	120.00	4.85	Fly
Psittaciformes	*Eos squamata*	6	100.00	3.83	Fly
Psittaciformes	*Eunymphicus cornutus*	2	130.00	3.33	Fly
Psittaciformes	*Forpus coelestis*	10	26.20	1.34	Fly
Psittaciformes	*Forpus passerinus*	6	24.00	1.10	Fly
Psittaciformes	*Glossopsitta concinna*	15	75.80	2.87	Fly
Psittaciformes	*Glossopsitta porphyrocephala*	12	45.70	1.89	Fly
Psittaciformes	*Glossopsitta pusilla*	4	36.10	1.59	Fly
Psittaciformes	*Guaruba guarouba*	2	194.30	7.48	Fly
Psittaciformes	*Lathamus discolor*	9	64.00	2.37	Fly
Psittaciformes	*Loriculus galgulus*	6	28.50	1.49	Fly
Psittaciformes	*Loriculus phillipensis*	2	36.00	1.48	Fly
Psittaciformes	*Lorius garrulus*	7	211.50	5.17	Fly
Psittaciformes	*Lorius lory*	11	233.00	5.12	Fly
Psittaciformes	*Melopsittacus undulatus*	25	35.00	1.50	Fly
Psittaciformes	*Micropsitta pusio*	unespecified	14.50	0.98	Fly
Psittaciformes	*Nannopsittaca panychlora*	2	38.80	1.45	Fly
Psittaciformes	*Neophema chrysostoma*	unespecified	57.97	1.70	Fly
Psittaciformes	*Neophema elegans*	5	37.30	1.28	Fly
Psittaciformes	*Neophema pulchella*	9	32.30	1.29	Fly
Psittaciformes	*Neophema splendida*	8	32.30	1.28	Fly
Psittaciformes	*Neopsephotus bourkii*	10	44.00	1.25	Fly
Psittaciformes	*Neopsittacus musschenbroekii*	unespecified	57.00	2.45	Fly
Psittaciformes	*Nestor notabilis*	6	956.00	14.40	Fly
Psittaciformes	*Northiella haematogaster*	9	76.40	2.40	Fly
Psittaciformes	*Nymphicus hollandicus*	22	83.00	2.39	Fly
Psittaciformes	*Oreopsittacus arfaki*	2	19.50	1.15	Fly
Psittaciformes	*Orthopsittaca manilata*	unespecified	354.96	8.15	Fly
Psittaciformes	*Pezoporus wallicus*	unespecified	76.55	2.72	Fly
Psittaciformes	*Pionites leucogaster*	6	155.00	5.20	Fly
Psittaciformes	*Pionites melanocephalus*	8	136.40	5.18	Fly
Psittaciformes	*Pionus menstruus*	8	247.00	5.70	Fly
Psittaciformes	*Pionus senilis*	unespecified	209.98	6.00	Fly
Psittaciformes	*Platycercus adscitus*	4	89.80	3.06	Fly
Psittaciformes	*Platycercus caledonicus*	7	122.70	3.63	Fly
Psittaciformes	*Platycercus elegans*	28	123.93	3.65	Fly
Psittaciformes	*Platycercus eximius*	14	103.50	3.01	Fly

Psittaciformes	*Platycercus icterotis*	6	53.90	2.38	Fly
Psittaciformes	*Platycercus venustus*	3	78.50	2.56	Fly
Psittaciformes	*Poicephalus gulielmi*	2	213.50	5.80	Fly
Psittaciformes	*Poicephalus meyeri*	6	117.50	4.41	Fly
Psittaciformes	*Poicephalus robustus*	5	350.00	8.21	Fly
Psittaciformes	*Poicephalus senegalus*	9	155.00	4.71	Fly
Psittaciformes	*Polytelis alexandrae*	6	73.00	2.58	Fly
Psittaciformes	*Polytelis anthopeplus*	9	176.80	3.85	Fly
Psittaciformes	*Primolius auricollis*	3	250.00	7.53	Fly
Psittaciformes	*Prioniturus platurus*	3	140.00	4.76	Fly
Psittaciformes	*Probosciger aterrimus*	4	1050.00	20.50	Fly
Psittaciformes	*Psephotus chrysopterygius*	2	37.20	1.40	Fly
Psittaciformes	*Psephotus dissimilis*	3	30.00	1.74	Fly
Psittaciformes	*Psephotus haematonotus*	17	59.20	1.97	Fly
Psittaciformes	*Psephotus varius*	9	56.70	1.79	Fly
Psittaciformes	*Psittacula alexandri*	3	156.00	4.20	Fly
Psittaciformes	*Psittacula columboides*	2	90.00	3.43	Fly
Psittaciformes	*Psittacula cyanocephala*	unespecified	59.98	2.65	Fly
Psittaciformes	*Psittacula eupatria*	7	197.14	5.33	Fly
Psittaciformes	*Psittacula krameri*	12	137.00	3.90	Fly
Psittaciformes	*Psittaculirostris edwardsii*	4	90.70	3.25	Fly
Psittaciformes	*Psittacus erithacus*	12	409.21	9.21	Fly
Psittaciformes	*Psitteuteles versicolor*	3	56.50	2.00	Fly
Psittaciformes	*Pyrilia caica*	unespecified	135.78	3.35	Fly
Psittaciformes	*Pyrilia haematotis*	unespecified	146.50	3.70	Fly
Psittaciformes	*Pyrrhura frontalis*	6	80.10	2.81	Fly
Psittaciformes	*Pyrrhura melanura*	2	83.00	3.28	Fly
Psittaciformes	*Pyrrhura perlata*	2	87.00	2.90	Fly
Psittaciformes	*Pyrrhura picta*	2	62.00	2.45	Fly
Psittaciformes	*Strigops habroptilus*	3	1500.00	16.50	Flightless
Psittaciformes	*Tanygnathus lucionensis*	6	210.00	5.71	Fly
Psittaciformes	*Tanygnathus megalorhynchus*	2	316.20	6.98	Fly
Psittaciformes	*Touit purpuratus*	unespecified	68.37	2.40	Fly
Psittaciformes	*Trichoglossus chlorolepidotus*	7	77.20	3.05	Fly
Psittaciformes	*Trichoglossus haematodus*	18	116.00	3.66	Fly
Psittaciformes	*Trichoglossus ornatus*	7	120.00	3.51	Fly
Pteroclidiformes	*Pterocles bicinctus*	4	237.00	1.51	Fly
Pteroclidiformes	*Pterocles decoratus*	4	188.00	1.31	Fly
Sphenisciformes	*Aptenodytes forsteri*	7	34000.00	46.19	Flightless
Sphenisciformes	*Aptenodytes patagonicus*	5	13220.00	27.90	Flightless
Sphenisciformes	*Eudyptes chrysocome*	5	2500.00	12.42	Flightless
Sphenisciformes	*Eudyptula minor*	9	715.10	7.36	Flightless
Sphenisciformes	*Pygoscelis adeliae*	10	4375.00	19.66	Flightless
Sphenisciformes	*Spheniscus demersus*	1	2700.00	14.45	Flightless
Sphenisciformes	*Spheniscus humboldti*	7	5000.00	15.98	Flightless
Strigiformes	*Aegolius acadicus*	9	104.30	3.36	Fly
Strigiformes	*Aegolius funereus*	6	91.20	4.02	Fly
Strigiformes	*Asio capensis*	5	310.00	5.98	Fly
Strigiformes	*Asio flammeus*	37	309.80	5.30	Fly
Strigiformes	*Asio otus*	12	214.70	5.31	Fly
Strigiformes	*Athene cunicularia*	10	152.80	3.78	Fly
Strigiformes	*Athene noctua*	6	164.17	3.74	Fly
Strigiformes	*Bubo africanus*	4	635.00	8.60	Fly
Strigiformes	*Bubo bubo*	6	2571.67	17.06	Fly
Strigiformes	*Bubo scandiacus*	10	1894.00	15.87	Fly
Strigiformes	*Bubo virginianus*	40	1415.80	14.73	Fly
Strigiformes	*Glaucidium brasilianum*	5	69.10	2.51	Fly
Strigiformes	*Glaucidium gnoma*	unespecified	46.99	3.60	Fly
Strigiformes	*Glaucidium passerinum*	6	58.50	2.59	Fly
Strigiformes	*Megascops asio*	9	180.00	4.91	Fly
Strigiformes	*Megascops choliba*	3	121.50	3.41	Fly
Strigiformes	*Megascops nudipes*	4	142.50	3.71	Fly

Strigiformes	*Micrathene whitneyi*	unespecified	33.21	1.40	Fly
Strigiformes	*Ninox boobook*	12	231.40	5.53	Fly
Strigiformes	*Ninox connivens*	unespecified	699.94	6.40	Fly
Strigiformes	*Ninox jacquinoti*	3	175.70	4.38	Fly
Strigiformes	*Ninox squamipila*	unespecified	130.06	4.40	Fly
Strigiformes	*Ninox strenua*	3	1359.90	11.44	Fly
Strigiformes	*Otus bakkamoena*	5	139.10	4.04	Fly
Strigiformes	*Otus magicus*	3	165.00	3.76	Fly
Strigiformes	*Otus scops*	12	77.10	2.49	Fly
Strigiformes	*Strix aluco*	unespecified	379.93	9.25	Fly
Strigiformes	*Strix nebulosa*	11	1078.80	14.66	Fly
Strigiformes	*Strix nigrolineata*	5	527.50	7.40	Fly
Strigiformes	*Strix uralensis*	5	784.50	11.21	Fly
Strigiformes	*Strix varia*	10	734.10	12.55	Fly
Strigiformes	*Strix virgata*	4	329.50	6.10	Fly
Strigiformes	*Surnia ulula*	5	320.50	7.48	Fly
Strigiformes	*Tyto alba*	10	354.70	6.51	Fly
Strigiformes	*Tyto capensis*	3	419.00	5.23	Fly
Strigiformes	*Tyto longimembris*	unespecified	478.19	5.25	Fly
Strigiformes	*Tyto novaehollandiae*	9	765.60	8.47	Fly
Strigiformes	*Tyto tenebricosa*	3	671.50	12.70	Fly
Suliformes	*Anhinga melanogaster*	9	1608.30	4.56	Fly
Suliformes	*Fregata aquila*	1	1405.00	9.45	Fly
Suliformes	*Fregata minor*	10	1193.80	9.23	Fly
Suliformes	*Morus serrator*	5	1003.90	4.83	Fly
Suliformes	*Phalacrocorax atriceps*	unespecified	3050.31	14.13	Fly
Suliformes	*Phalacrocorax carbo*	10	2475.00	10.45	Fly
Suliformes	*Phalacrocorax fuscescens*	6	1700.00	8.89	Fly
Suliformes	*Phalacrocorax melanoleucos*	10	695.90	5.34	Fly
Suliformes	*Phalacrocorax sulcirostris*	10	1030.50	5.64	Fly
Suliformes	*Phalacrocorax urile*	10	2181.40	8.22	Fly
Suliformes	*Phalacrocorax varius*	8	1965.00	9.21	Fly
Suliformes	*Sula leucogaster*	8	1237.50	9.04	Fly
Trochiliformes	*Amazilia tzacatl*	4	5.30	0.22	Fly
Trochiliformes	*Anthracothorax dominicus*	4	5.80	0.23	Fly
Trochiliformes	*Archilochus colubris*	3	3.30	0.15	Fly
Trochiliformes	*Campylopterus largipennis*	4	8.30	0.31	Fly
Trochiliformes	*Chlorostilbon ricordii*	4	2.80	0.13	Fly
Trochiliformes	*Eulampis holosericeus*	4	5.70	0.24	Fly
Trochiliformes	*Eulampis jugularis*	4	10.20	0.32	Fly
Trochiliformes	*Florisuga mellivora*	4	7.00	0.26	Fly
Trochiliformes	*Orthorhynchus cristatus*	4	2.70	0.14	Fly
Trochiliformes	*Phaethornis superciliosus*	4	5.80	0.26	Fly
Trochiliformes	*Selasphorus rufus*	3	3.40	0.16	Fly
Trochiliformes	*Thalurania furcata*	4	4.10	0.20	Fly
Trochiliformes	*Threnetes ruckeri*	4	5.90	0.27	Fly
Trochiliformes	*Trochilus polytmus*	4	4.30	0.19	Fly
Trogoniformes	*Harpactes ardens*	4	96.30	1.77	Fly
Trogoniformes	*Harpactes erythrocephalus*	unespecified	74.51	1.83	Fly
Trogoniformes	*Pharomachrus mocinno*	10	206.00	2.34	Fly
Trogoniformes	*Priotelus roseigaster*	4	74.00	1.31	Fly
Trogoniformes	*Priotelus temnurus*	6	58.00	1.16	Fly
Trogoniformes	*Trogon citreolus*	6	83.10	1.48	Fly
Trogoniformes	*Trogon massena*	4	150.80	2.13	Fly
Trogoniformes	*Trogon melanurus*	7	119.00	1.86	Fly
Trogoniformes	*Trogon violaceus*	6	57.70	1.41	Fly
Trogoniformes	*Trogon viridis*	9	88.00	1.79	Fly
Upupiformes	*Upupa epops*	12	60.87	1.34	Fly
Apterygiformes	*Apteryx australis*	4	2951.86	11.09	Flightless
Apterygiformes	*Apteryx haastii*	3	2332.14	9.78	Flightless
Casuariiformes	*Casuarius casuarius*	6	46273.17	33.42	Flightless
Casuariiformes	*Dromaius novaehollandiae*	11	35621.34	24.91	Flightless

Rheiformes	*Rhea americana*	6	21363.98	18.80	Flightless
Rheiformes	*Rhea pennata*	2	6772.45	14.75	Flightless
Struthioniformes	*Struthio camelus*	6	93181.97	41.51	Flightless
Tinamiformes	*Crypturellus boucardi*	1	460.00	2.75	Fly
Tinamiformes	*Crypturellus soui*	3	216.50	1.49	Fly
Tinamiformes	*Crypturellus tataupa*	1	225.00	1.64	Fly
Tinamiformes	*Eudromia elegans*	10	578.50	2.49	Fly
Tinamiformes	*Nothoprocta ornata*	3	624.50	2.85	Fly
Tinamiformes	*Nothura maculosa*	10	242.30	1.58	Fly
Tinamiformes	*Rhynchotus rufescens*	4	900.00	3.66	Fly
Tinamiformes	*Tinamus major*	4	1052.00	2.89	Fly
Agamidae	*Agama agama*	1	29.30	0.17	Legged
Agamidae	*Agama inermis*	1	12.90	0.10	Legged
Agamidae	*Calotes versicolor*	1	14.60	0.10	Legged
Agamidae	*Uromastyx acanthinurus*	1	164.00	0.34	Legged
Anguidae	*Anguis fragilis*	1	22.00	0.04	Legless
Boidae	*Boa constrictor*	1	4460.00	0.65	Legless
Boidae	*Boa imperator*	1	1829.00	0.44	Legless
Chamaleonidae	*Chamaleo lateralis*	1	10.90	0.06	Legged
Colubridae	*Coluber constrictor*	3	431.00	0.29	Legless
Colubridae	*Coluber viridiflavus*	1	285.10	0.21	Legless
Colubridae	*Coronella girondica*	1	117.00	0.09	Legless
Colubridae	*Elaphe longissima*	1	148.20	0.17	Legless
Colubridae	*Natrix maura*	1	86.00	0.10	Legless
Colubridae	*Natrix natrix*	1	74.10	0.12	Legless
Colubridae	*Thamnophis sirtalis*	2	54.50	0.10	Legless
Colubridae cf.	*Zamenis viridis*	1	220.00	0.21	Legless
Cordylidae	*Cordylus cordylus*	1	56.50	0.18	Legged
Cordylidae	*Zonosaurus maximus*	1	386.40	0.57	Legged
Cordylidae	*Zonosaurus quadrilineatus*	1	82.70	0.21	Legged
Elapidae	*Naja melanoleuca*	1	1770.00	0.65	Legless
Gekkonidae	*Gekko gekko*	1	54.80	0.20	Legged
Gekkonidae	*Hemidactylus frenatus*	1	2.68	0.03	Legged
Gekkonidae	*Hemidactylus mabouia*	1	2.50	0.03	Legged
Gekkonidae	*Lepidodactylus orientalis*	1	1.19	0.02	Legged
Gekkonidae	*Phelsuma cepedia*	1	5.00	0.06	Legged
Gekkonidae	*Tarentola mauritanica*	1	7.80	0.07	Legged
Helodermatidae	*Heloderma suspectum*	1	514.00	0.73	Legged
Iguanidae	*Amblyrhyncus cristatus*	1	4190.00	1.44	Legged
Iguanidae	*Ameiva sp.*	1	27.10	0.23	Legged
Iguanidae	*Anolis auratus*	1	10.50	0.07	Legged
Iguanidae	*Chalarodon madagascariensis*	1	6.30	0.06	Legged
Iguanidae	*Hoplurus sebae*	1	51.00	0.27	Legged
Iguanidae	*Iguana iguana*	1	253.50	0.61	Legged
Iguanidae	*Liolaemus chilensis*	1	26.00	0.10	Legged
Lacertidae	*Lacerta lepida*	1	70.80	0.22	Legged
Lacertidae	*Lacerta muralis*	1	4.20	0.05	Legged
Lacertidae	*Lacerta viridis*	2	23.60	0.12	Legged
Lacertidae	*Lacerta vivipara*	1	3.20	0.03	Legged
Lacertidae	*Psammodromus algiris*	1	4.30	0.05	Legged
Lacertidae	*Psammodromus hispanicus*	1	2.10	0.03	Legged
Phytonidae	*Python molurus*	1	6140.00	1.12	Legless
Scincidae	*Carlia bicarinata*	1	1.43	0.02	Legged
Scincidae	*Chalcides chalcides*	1	18.80	0.06	Legged
Scincidae	*Chalcides mionecton*	1	6.40	0.03	Legged
Scincidae	*Chalcides ocellatus*	1	32.00	0.09	Legged
Scincidae	*Cryptoblepharus_virgatus*	1	0.80	0.01	Legged
Scincidae	*Emoia pallidiceps*	1	2.94	0.03	Legged
Scincidae	*Eumeces schneiderii*	1	51.70	0.17	Legged
Scincidae	*Scincus scincus*	1	34.10	0.12	Legged
Scincidae	*Sphenomorphus fragilis*	1	1.13	0.01	Legged
Teidae	*Callopistes maculatus*	1	50.30	0.32	Legged

Trogonophidae	*Trogonophis wiegmanni*	1	6.50	0.02	Legless
Varanidae	*Varanus griseus*	1	254.20	0.72	Legged
Viperidae	*Agkistrodon piscovoris*	1	728.00	0.64	Legless
Viperidae	*Cerastes vipera*	1	62.10	0.08	Legless
Viperidae	*Vipera aspis*	1	68.70	0.10	Legless
Viperidae	*Vipera berus*	1	64.20	0.11	Legless
Cheloniidae	*Caretta caretta*	1	5443.00	2.70	
Cheloniidae	*Chelonia mydas*	1	114300.00	8.60	
Chelydridae	*Chelydra serpentina*	1	5125.00	0.98	
Chelydridae	*Macroclemys temminckii*	1	1848.00	1.01	
Emydidae	*Clemmys guttata*	1	2163.00	1.36	
Emydidae	*Emys orbicularis*	1	250.00	0.25	
Emydidae	*Pseudemys scripta*	1	1418.00	0.74	
Testudinidae	*Testudo graeca*	1	267.50	0.32	
Testudinidae	*Testudo hermanni*	1	693.40	0.48	
Trionychidae	*Trionyx ferox*	1	3253.00	2.50	

S6 - Supplementary table 4. Mean endocranial volumes and estimated brain and body mass data for fossil species gathered from the literature.

Genus	Specimens	EV (ml)	Average BV/EV	Body mass (g)	Brain mass (g)
Archaeopteryx	1	1.7	1.00	468.00	1.68
Allosaurus	1	178.5	0.44	1850000.00	77.63
Bambiraptor	1*	14.0	1.00	6581.96	14.00
Anatosaurus	1	300.0	0.50	3400000.00	150.00
Brachiosaurus	1	310.0	0.60	59150000.00	186.00
Camptosaurus	1	46.0	0.50	400000.00	23.00
Carcharodontosaurus	1	243.8	0.44	6000000.00	108.93
Citipati	1	22.62	1.00	88800	22.62
Conchoraptor	1	9.44	1.00	5250	9.44
Diplodocus	1	100.0	0.57	15500000.00	57.00
Erlikosaurus	1	34.12	1.00	173700	34.12
Euoplocephalus	1	82.0	0.50	1900000.00	41.00
Giganotosaurus	1	274.9	0.44	7000000.00	119.60
Nanotyrannus	1	111.2	0.51	260000.00	57.08
Gorgosaurus	1	128.9	0.44	1110000.00	56.08
Iguanodon	1	250.0	0.50	2100000.00	125.00
Incisivosaurus	1	5.52	1.00	6619.5	5.52
Kentrosaurus	1	48.0	0.50	780000.00	24.00
Khaan	1	8.83	1.00	13150	8.83
Majungasaurus	1	106.4	0.44	1130000.00	46.30
Murusraptor	1	148.2	0.44	1551000.00	64.45
Ornithomimus	1	87.9	1.00	150000.00	87.90
Protoceratops	1	56.0	0.50	200000.00	28.00
Sinraptor	1	94.9	0.44	1700000.00	41.30
Stegosaurus	1	45.0	0.50	2550000.00	22.50
Struthiomimus	1	35.06	1.00	175000	35.06
Triceratops	1	144.4	0.50	7500000.00	72.20
Troodon	1	41.0	1.00	45000.00	41.00
Tsaagan	1	9.62	1.00	12420	9.62
Tyranossaurus	3	373.6	0.44	5994333.33	162.50
Zanabazar	1	25.14	1.00	30360	25.14

S7 – Parenthetical notations of unpruned trees used in PGLS (please see references and S1 for reference used in tree construction).

Testudines

((Sphenodon,(Anolis,Python)),(((Gallus,Tyrannosaurus),Crocodylus),(Odontochelys,(Proganochelys,(Kayentachelys,(Meiolania_platyceps,(((Mesoclemmys,Platemys),((Pelusios,Pelomedusa),(Cambaremys,((Erymnochelys,Turkanemys),(Podocnemis,Cerrejonemys))))),(Solnhofia,((Carettochelys_insculpta,(Lissemys,(Apalone_ferox,(Nilssonia,Pelodiscus)))),(((Platysternon_megacephalum,((Deinochelys,((Chrysemys,Pseudemys_scripta),(Graptemys,Trachemys))),((Terrapene,Clemmys_guttata),Emys_orbicularis))),((Rhinoclemmys,(Cyclemys,Geoemyda)),(Gopherus,(Stigmochelys,(Testudo_graeca,Testudo_hermanni))))),((Toxochelys_moorevillensis,(Dermochelys_coriacea,(Chelonia_mydas,(Caretta_caretta,Lepidochelys)))),((Chelydra_serpentina,Macroclemys_temminckii),(Emarginachelys_cretacea,(Dermatemys_mawii,(Staurotypus,(Sternotherus,Kinosternon)))))))))))))));

Crocodylomorpha

(Protosuchus_richardsoni,(Pelagosaurus_typus,(Steneosaurus_bollensis,((Sebecus_icaeorhinus,(Araripesuchus_gomesi,(Notosuchus_terrestris,Comahuesuchus_brachybuccalis))),((Pholidosaurus_purbeckensis,(Sarcosuchus_imperator,Elosuchus)),((Hyposaurus,Dyrosaurus),(Sunosuchus,((Susisuchus_anatoceps,(Nannosuchus,(Amphicotylus,Goniopholis_simus))),(Bernissartia_fagesii,((Gavialosuchus_antiquus,(Eosuchus,(Rhamphosuchus,(Eogavialis,(Gavialis_gangeticus,Gavialis_lewisi))))),((Isisfordia_duncani,Iharkutosuchus_makadii),(Borealosuchus,((Leidyosuchus,Diplocynodon),(Eoalligator_chunyii,((Navajosuchus_novomexicanus,(Brachychampsa_montana,((Alligator_mefferdi,Alligator_mississippiensis),(Alligator_sinensis,(Paleosuchus_trigonatus,(Caiman_crocodilus,(Caiman_latorostris,Melanosuchus_niger))))))),((Brachyuranochampsa,(Crocodylus_affinis,Crocodylus_elliotti)),((Planocrania,(Kentisuchus_spenceri,(Gavialosuchus_americanus,Tomistoma_schlegelii))),((Crocodylus_siamensis,Asiatosuchus_nanlingensis),((Crocodylus_intermedius,Mecistops_cataphractus),((Crocodylus_porosus,(Crocodylus_rhombifer,Crocodylus_niloticus)),((Crocodylus_novaguineae,(Crocodylus_palustris,(Crocodylus_moreletii,Crocodylus_acutus))),(Crocodylus_sivalensis,(Asiatosuchus_grangeri,(Osteolaemus_tetraspis,Voay_robusturs)))))))))))))))))))));

Squamata

(Gephyrosaurus,(Sphenodon,(((Tarentola_mauritanica,Phyllodactylus),(((Lepidodactylus_orientalis,(Gekko_gekko,Gekko_porosus)),(Cyrtodactylus,(Hemidactylus_frenatus,Hemidactylus_mabouia))),((Pachydactylus,Colopus),(Lygodactylus,Phelsuma_cepedia)))),(((Xantusia,((Zonosaurus_maximus,Zonosaurus_quadrilineatus),(Cordylus_jonesii,Cordylus_cordylus))),(((Eumeces_schneiderii,Scincus_scincus),(Chalcides_chalcides,(Chalcides_mionecton,Chalcides_ocellatus))),(Sphenomorphus_fragilis,(((Cryptoblepharus_virgatus,Emoia_pallidiceps),Carlia_bicarinata),(Oligosoma,Nannoscincus))))),(((Psammodromus_algiris,Psammodromus_hispanicus),(Pedioplanis,(Lacerta_vivipara,(((Lacerta_lepida,Lacerta_viridis),Lacerta_muralis),Darevskia)))),(((Heloderma_suspectum,(Anguis_fragilis,Abronia)),(((Bradypodion,((Calumma,Rhampholeon),(Trioceros,(Chamaleo_lateralis,Chamaeleo_africanus)))),(Uromastyx_acanthinurus,(Ctenophorus,((Trapelus,(Agama_agama,Agama_inermis)),(Calotes_versicolor,Draco))))),((Plica_plica,Tropidurus),((Iguana_iguana,(Amblyrhyncus_cristatus,Ctenosau

ra)),(Petrosaurus,((Chalarodon_madagascariensis,Oplurus_sebae),((Liolaemus_chilensis,Liolaemus_melanops),Anolis_auratus))))))),((((Colobosaura,((Teius,Ameiva_sp.),(Callopistes_maculatus,Tupinambis))),((Myrmecodaptria,Cricosaura),(Paramacellodus,Sphenomorphus))),(Shinisaurus,(Gobiderma,Varanus_griseus))),((Aigialosaurus,(Clidastes,(Tylosaurus,Plotosaurus))),((Sineoamphisbaena,(Dibamus,(Bipes,(Trogonophis_wiegmanni,Geocalamus)))),(Typhlops,((Najash,Dinilysia),((Haasiophis,Pachyrhachis),(((Boa_constrictor,Boa_imperator),Python_molurus),((((Vipera_aspis,Vipera_berus),Cerastes_vipera),(Bothrops,(Lachesis,(Agkistrodon_piscovoris,Crotalus)))),(Naja_melanoleuca,(Ptyas,((Coluber_constrictor,Coluber_viridiflavus),(((Chironius,Sonora),(Zamenis_viridis,(Elaphe_longissima,(Coronella_girondica,(Pituophis,Lampropeltis))))),(Thamnophis_sirtalis,(Natrix_natrix,Natrix_maura))))))))))))));

Non avian Dinosauria

((Pisanosaurus_mertii,((Lesothosaurus,(Scutellosaurus,(Scelidosaurus,((Dacentrurus,(Kentrosaurus,(Tuojiangosaurus,Stegosaurus))),((Minmi,(Gobisaurus,((Ankylosaurus,Euoplocephalus),(Pinacosaurus_grangeri,(Talarurus,Saichania))))),(Antarctopelta,(Tatankacephalus,((Gastonia,Polacanthus),(Nodosaurus,(Panoplosaurus,Edmontonia)))))))))),(Agilisaurus,(((Goyocephale,(Stegoceras,Pachycephalosaurus)),(Yinlong,(Psittacosaurus,((Montanoceratops,Asiaceratops),((Bagaceratops,Protoceratops),((Diabloceratops,(Centrosaurus,Pachyrhinosaurus)),(Chasmosaurus,(Pentaceratops,(Torosaurus,Triceratops)))))))),(((Oryctodromeus,Orodromeus),Thescelosaurus),(Hypsilophodon_foxi,(Gasparinisaura,((Muttaburrasaurus,Mochlodon),(Tenontosaurus,(Camptosaurus,(Iguanodon_bernisartensis,(Ouranosaurus,(Probactrosaurus,(Telmatosaurus,(((Brachylophosaurus,Maiasaura),(Barsboldia,((Kritosaurus_navajovius,(Gryposaurus,Secernosaurus)),(Saurolophus,(Shantungosaurus,Edmontosaurus))))),(Tsintaosaurus,(Parasaurolophus,(Lambeosaurus,(Corythosaurus,Hypacrosaurus))))))))))))))),((Plateosaurus,(Riojasaurus,(Camelotia,(Vulcanodon,(Barapasaurus,((Mamenchisaurus,Omeisaurus),(Jobaria,((Haplocanthosaurus,(Nigersaurus,((Suuwassea,(Amargasaurus,Dicraeosaurus)),((Diplodocus,Barosaurus),Apatosaurus))))),(Camarasaurus,(Tehuelchesaurus,((Europasaurus,(Brachiosaurus,(Cedarosaurus,Venenosaurus))),(Sonorasaurus,(Chubutisaurus,(Andesaurus,(Mendozasaurus,(Epachthosaurus,((Nemegtosaurus,Tapuiasaurus),((Rinconsaurus,(Gondwanatitan,Aeolosaurus)),(Alamosaurus,(Neuquensaurus,Saltasaurus))))))))))))))),(Eoraptor,(Coelophysis,(Dilophosaurus,((Elaphrosaurus,(Ceratosaurus,((Noasaurus,Masiakasaurus),(Rugops,(Abelisaurus,((Majungasaurus,Rajasaurus),((Aucasaurus,Carnotaurus),(Skorpiovenator,Ilokelesia))))))))),(Cryolophosaurus,((Condorraptor,((Spinosaurus,(Suchomimus,Baryonyx)),(Afrovenator,(Torvosaurus,Megalosaurus)))),(((Sinraptor_dongi,Shidaisaurus),(Allosaurus,((Neovenator,((Murusraptor,Aerosteon),(Australovenator,Fukuiraptor))),(Eocarcharia,(Acrocanthosaurus,(Carcharodontosaurus,(Giganotosaurus,Mapusaurus)))))))),((Dilong,(Dryptosaurus,(Gorgosaurus,(Alioramus,(Tarbosaurus,(Nanotyrannus,Tyrannosaurus)))))),((Pelecanimimus,(Gallimimus,(Struthiomimus_altus,Ornithomimus))),((Ornitholestes,Compsognathus),((Patagonykus,(Alvarezsaurus,Shuvuuia)),(Erlikosaurus_andrewsi,((Incisivosaurus_gauthieri,(Caudipteryx,((Microvenator,(Gigantoraptor,Chirostenotes)),((Oviraptor,Citipati_osmolskae),(Khaan_mckennai,(Conchoraptor_gracilis,Ingenia)))))),((((Mei,Sinovenator),(Troodon,(Saurornithoides,Zanabazar_junior))),((Rahonavis,(Buitreraptor,(Unenlagia,Austroraptor))),((Shanag,Microraptor),((Dromaeosaurus,Utahraptor),(Bambiraptor,((Velociraptor,Tsaagan_mangas),Deinonychus))))))))))))))))))));

Aves

(Archaeopteryx,(Jeholornis,(Confuciusornis,((Protopteryx,(Iberomesornis,(Gobipteryx,Concornis))),(Patagopteryx,(Ichthyornis,(Hesperornis,(((Struthio_camelus),((Rhea_pennata,Rhea_americana),((((((Crypturellus_boucardi,Crypturellus_soui),Crypturellus_tataupa),Tinamus_major),(Eudromia_elegans,(Rhynchotus_rufescens,(Nothura_maculosa,Nothoprocta_ornata)))),(Anomalopteryx,Dinornis)),((Casuarius_casuarius,Dromaius_novaehollandiae),((Apteryx_australis,(Apetryx_owenii,Apteryx_haastii)),(Aepyornis,Mullerornis)))))),((((Chauna_chavaria,Anseranas_semipalmata),((Dendrocygna_arcuata,Dendrocygna_eytoni),((Biziura_lobata,((Oxyura_jamaicensis,(Oxyura_australis,Oxyura_maccoa)),(Malacorhynchus_membranaceus,((Cereopsis_novaehollandiae,Coscoroba_coscoroba),(((Cygnus_atratus,Cygnus_olor),(Cygnus_columbianus,Cygnus_cygnus)),((Branta_bernicla,Branta_canadensis),((Anser_albifrons,Anser_fabalis),(Anser_rossii,Anser_anser)))))))),(((Clangula_hyemalis,(Somateria_mollissima,Somateria_spectabilis)),(((Melanitta_nigra,Melanitta_fusca),Melanitta_deglandi),((Bucephala_albeola,(Bucephala_clangula,Bucephala_islandica)),(Lophodytes_cucullatus,(Mergus_merganser,Mergus_serrator))))),((Calonetta_leucophrys,((Cairina_moschata,(Aix_galericulata,Aix_sponsa)),((Neochen_jubata,Chloephaga_poliocephala),(Tadorna_radjah,(Alopochen_aegyptiacus,(Tadorna_tadorna,Tadorna_tadornoides)))))),(((Chenonetta_jubata,Sarkidiornis_melanotos),(Pteronetta_hartlaubi,(Netta_rufina,(Aythya_australis,(Aythya_americana,(Aythya_affinis,Aythya_marila)))))),((((Amazonetta_brasiliensis,Speculanas_specularis),(Lophonetta_specularoides,(Tachyeres_leucocephalus,Tachyeres_pteneres))),((Anas_veriscolor,Anas_hottentota),((Anas_clypeata,(Anas_rhynchotis,Anas_smithii)),(Anas_platalea,(Anas_cyanoptera,Anas_discors))))),((Anas_strepera,(Anas_penelope,Anas_americana)),((Anas_carolinensis,Anas_flavirostris),((Anas_superciliosa,(Anas_laysanensis,Anas_platyrhynchos)),(Anas_crecca,(Anas_castanea,Anas_acuta)))))))))),(((Alectura_lathami,Leipoa_ocellata),(Megapodius_eremita,Megapodius_freycinet)),(((Crax_rubra,Ortalis_vetula),(Penelope_purpurascens,Pipile_pipile)),((Numida_meleagris,(Acryllium_vulturinum,Guttera_edouardi)),((Cyrtonyx_montezumae,(Oreortyx_pictus,(Colinus_virginianus,(Callipepla_californica,Callipepla_gambelii)))),(Rollulus_rouloul,(((Argusianus_argus,Pavo_cristatus),(((Gallus_gallus,Bambusicola_thoracicus),(Francolinus_leucoscepus,Francolinus_sephaena)),(Alectoris_chukar,(Coturnix_coturnix,Excalfactoria_chinensis)))),(Ithaginis_cruentus,((Lophophorus_impejanus,Tragopan_temminckii),((((Meleagris_gallopavo,(Bonasa_umbellus)),((Centrocercus_urophasianus,(Dendragapus_obscurus,Tympanuchus_phasianellus)),((Dendragapus_canadensis,(Tetrao_tetrix,Tetrao_urogallus)),(Lagopus_lagopus,Lagopus_muta)))))),(Perdix_perdix,(Syrmaticus_reevesi,((Chrysolophus_amherstiae,Chrysolophus_pictus),(Phasianus_colchicus,(Crossoptilon_crossoptilon,(Lophura_nycthemera,Lophura_swinhoii)))))))))))))),(((Podargus_strigoides,(Aegotheles_cristatus,(Nyctibius_griseus,((Eurostopodus_argus,(Eurostopodus_macrotis,Eurostopodus_mystacialis)),((Nyctidromus_albicollis,Nyctiphrynus_ocellatus),(((Caprimulgus_europaeus,Caprimulgus_macrurus),Caprimulgus_vociferus),((Caprimulgus_vexillarius,Caprimulgus_carolinensis),(Chordeiles_minor,(Chordeiles_nacunda,Nyctiprogne_leucopyga)))))))),((Florisuga_mellivora,(((Phaethornis_superciliosus,(Glaucis_hirsutus,Threnetes_ruckeri)),(Anthracothorax_dominicus,(Eulampis_holosericeus,Eulampis_jugularis))),((Archilochus_colubris,Selasphorus_rufus),((Chlorostilbon_ricordii,(Orthorhynchus_cristatus,Campylopterus_largipennis)),(Thalurania_furcata,(Trochilus_polytmus,Amazilia_tzacatl)))))),(Streptoprocne_zonaris,(Hemiprocne_mystacea,(Hirundapus_caudacutus,(Chaetura_pelagica,((Aeronautes_saxatilis,Tachornis_phoenicobia),(Collocalia_esculenta,Collocalia_spodiopygia)),(Cypsiurus_parvus,((Apus_apus,Apus_pallidus),Tachymarptis_melba)))))))),(((((Crinifer_piscator,Corythaixoides_concolor),(Tauraco_leucotis,(Tauraco_hartlaubi,Tauraco_persa))),((Ardeotis_australis,Eupodotis_denhami),((Centropus_bengalensis,Centropus_phasianinus),(Geococcyx_californianus,((Crotophaga_ani,Guira_guira),((Ceuthmochares_aereus,(Phaenicophaeus_curvirostris,(Phaenicophaeus_superciliosus,Phaenicophaeus_tristis))),((Clamator_glandarius,(Piaya_cayana,(Coccyzus_americanus,(Coccyzus_vetula,Coccyzus_erythropthalm

us)))),((Scythrops_novaehollandiae,(Eudynamys_scolopaceus,Eudynamys_taitensis)),((Chrysococcyx_caprius,(Chrysococcyx_basalis,((Chrysococcyx_lucidus,Chrysococcyx_minutillus),Chrysococcyx_osculans))),((Cuculus_pallidus,(Cuculus_saturatus,Cuculus_canorus)),((Cacomantis_castaneiventris,Cacomantis_flabelliformis),Cacomantis_variolosus)))))))))),(((Claravis_pretiosa,((Columbina_picui,Columbina_inca),((Columbina_minuta,Columbina_passerina),Columbina_talpacoti))),((((Turtur_brehmeri,Turtur_chalcopsilos),((Chalcophaps_indica,Chalcophaps_stephani),(Oena_capensis,Turtur_tympanistria))),(((((Geophaps_plumifera,Geophaps_smithii),Ocyphaps_lophotes),(Henicophaps_albifrons,(Phaps_chalcoptera,(Phaps_elegans,Phaps_histrionica)))),(Gallicolumba_beccarii,Gallicolumba_luzonica)),((Leucosarcia_melanoleuca,((Geopelia_cuneata,Geopelia_humeralis),(Geopelia_placida,Geopelia_striata))),(((Geotrygon_costaricensis,(Geotrygon_chrysia,Geotrygon_montana)),(((Leptotila_jamaicensis,Leptotila_verreauxi),(Leptotila_rufaxilla,(Leptotila_cassini,Leptotila_plumbeiceps))),(Zenaida_asiatica,(Zenaida_aurita,(Zenaida_auriculata,Zenaida_macroura))))),((Reinwardtoena_browni,(Macropygia_amboinensis,Macropygia_phasianella)),((Patagioenas_cayennensis,((Patagioenas_maculosa,Patagioenas_picazuro),(Patagioenas_fasciata,(Patagioenas_leucocephala,Patagioenas_squamosa)))),(((((Streptopelia_turtur,Streptopelia_orientalis),(Spilopelia_chinensis,Streptopelia_senegalensis)),Streptopelia_risoria),(Columba_leucomela,(Columba_arquatrix,(Columba_palumbus,(Columba_livia,Columba_guinea))))),(Columba_speciosa,Columba_vitiensis))))))))),((Caloenas_nicobarica,((Goura_coronota,Goura_victoria),((Treron_fulvicollis,Treron_pompadora),((Treron_curvirostra,Treron_formosae),Treron_vernans)))),((Phapitreron_amethystinus,Phapitreron_leucotis),((((Ducula_pacifica,Ducula_aenea),Ducula_bicolor),(Ducula_goliath,Ducula_melanochroa)),(((Lopholaimus_antarcticus,Gymnophaps_albertisii),Hemiphaga_novaeseelandiae),(Ptilinopus_magnificus,((Ptilinopus_occipitalis,Ptilinopus_leclancheri),((Ptilinopus_rivoli,Ptilinopus_superbus),(Ptilinopus_ornatus,(Ptilinopus_pulchellus,(Ptilinopus_monacha,(Ptilinopus_regina,(Ptilinopus_insularis,Ptilinopus_porphyraceus)))))))))))),(Pterocles_bicinctus,Pterocles_decoratus))),(((((Rallus_aquaticus,Rallus_longirostris),((Crex_crex,Lewinia_pectoralis),(Habroptila_wallacii,(Gallirallus_australis,(Gallirallus_owstoni,Gallirallus_phillippensis))))),(((Porphyrio_martinica,Porphyrio_porphyrio),((Gallicrex_cinerea,(Amaurornis_olivacea,Amaurornis_phoenicurus)),((Coturnicops_noveboracensis,Laterallus_albigularis),(Rallina_eurizonoides,((Porzana_atra,Porzana_palmeri),Amaurornis_flavirostra))))),((Pardirallus_maculatus,(Amaurolimnas_concolor,(Aramides_cajanea,Aramides_ypecaha))),((Gallinula_ventralis,(Gallinula_melanops,(Porzana_carolina,(Porzana_fluminea,Porzana_porzana)))),((Gallinula_chloropus,Gallinula_tenebrosa),(Fulica_americana,Fulica_atra)))))),(Psophia_crepitans,(Aramus_guarauna,(Balearica_pavonina,(Grus_virgo,(Grus_canadensis,(Grus_rubicunda,Antigone_antigone)))))),(((((((Chionis_albus,Chionis_minor),(Esacus_magnirostris,(Burhinus_bistriatus,Burhinus_grallarius))),(((((Haematopus_leucopodus,Haematopus_palliatus),((Haematopus_longirostris,Haematopus_ostralegus),(Haematopus_ater,Haematopus_bachmani)))),(Himantopus_mexicanus,(Cladorhynchus_leucocephalus,(Recurvirostra_avosetta,(Recurvirostra_americana,Recurvirostra_novaehollandiae)))))),((Pluvialis_squatarola,(Pluvialis_apricaria,(Pluvialis_dominica,Pluvialis_fulva))),((Erythrogonys_cinctus,((Vanellus_vanellus,((((Vanellus_armatus,Vanellus_senegallus),(Vanellus_tricolor,Vanellus_miles)),Vanellus_cayanus),Vanellus_coronatus)))),((Charadrius_modestus,(Elseyornis_melanops,(Charadrius_tricollaris,(Charadrius_vociferus,(Charadrius_melodus,Charadrius_semipalmatus))))),(Charadrius_australis,((Charadrius_leschenaultii,Charadrius_mongolus),(Charadrius_bicinctus,((Charadrius_wilsonia,Charadrius_falklandicus),(Charadrius_pecuaurius,(Charadrius_ruficapillus,Charadrius_alexandrinus)))))))))),(((Pedionomus_torquatus,(Rostratula_benghalensis,(Irediparra_gallinacea,(Hydrophasianus_chirurgus,Jacana_spinosa)))),((Bartramia_longicauda,(Numenius_phaeopus,(Numenius_americanus,Numenius_madagascariensis))),((Limosa_lapponica,(Limosa_fedoa,Limosa_haemastica)),(((Arenaria_interpres,Arenaria_melanocephala),((Calidris_canutus,Calidris_tenuirostris),((Calidris_p

ugnax,(Calidris_acuminata,Calidris_falcinellus)),(((Calidris_ferruginea,Calidris_himantopus),(Calidris_ruficollis,Calidris_subminuta)),((Calidris_alba,Calidris_alpina),(Calidris_bairdii,((Calidris_minuta,(Calidris_fuscicollis,Calidris_minutilla)),(Calidris_subruficollis,(Calidris_melanotos,(Calidris_mauri,Calidris_pusilla)))))))),((((Limnodromus_griseus,Limnodromus_scolopaceus),(Scolopax_minor,((Gallinago_hardwickii,(Gallinago_nobilis,Gallinago_undulata)),Gallinago_gallinago))),((Tringa_cinerea,(Phalaropus_tricolor,(Phalaropus_fulicaria,Phalaropus_lobatus))),((Actitis_hypoleucos,Actitis_macularius),(Tringa_solitaria,((Tringa_brevipes,Tringa_incana),((Tringa_flavipes,Tringa_semipalmatus),((Tringa_glareola,Tringa_stagnatilis),(Tringa_melanoleuca,Tringa_nebularia)))))))))),((Cursorius_cursor,(Glareola_nuchalis,Stiltia_isabella)),(((Fratercula_corniculata,Cerorhinca_monocerata),((Aethia_pusilla,Ptychoramphus_aleutica),((Alle_alle,(Alca_torda,(Uria_aalge,Uria_lomvia))),(Brachyramphus_marmoratum,Cepphus_grylle)))),((Stercorarius_parasiticus,Stercorarius_pomarinus),((((Turnix_pyrrhothorax,Turnix_suscitator),(Turnix_varius,Turnix_velox)),((Stercorarius_maccormicki,(Fratercula_arctica,Synthliboramphus_antiquus)),((Rynchops_niger,((Gygis_alba,((Anous_cerulea,Anous_stolidus),((Phaetusa_simplex,Sterna_albifrons),(((((Sterna_forsteri,Sterna_trudeaui),(Sterna_hirundo,(Sterna_bergii,Sterna_maxima))),Chlidonias_hybrida),Sterna_caspia),(Sterna_aleutica,Sterna_fuscata)))))),(Xema_sabini,((Rhodostethia_rusea,(Larus_minutus,(Larus_philadelphia,((Larus_novaehollandiae,Larus_hartlaubii),(Larus_ridibundus,Larus_maculipennis)))),((Pagophila_eburnea,Rissa_tridactyla),((Larus_scoresbii,(Larus_pipixcan,Larus_atricilla)),((Larus_canus,Larus_delawarensis),(Larus_californicus,((Larus_marinua,(Larus_fuscus,Larus_argentatus)),(Larus_dominicanus,(Larus_glaucescens,Larus_thayeri)))))))))))))),((Phoenicopterus_roseus,Phoenicopterus_ruber),((Poliocephalus_poliocephalus,(Podiceps_ruficollis,Tachybaptus_novaehollandiae)),((Rollandia_rolland,Podilymbus_podiceps),(Podiceps_nigricollis,(Podiceps_auritus,((Podiceps_cristatus,Podiceps_grisegena),Aechmophorus_occidentalis)))))),(((Eurypyga_helias),(Phaethon_rubricauda)),((Gavia_immer,Gavia_stellata),(((((Diomedea_nigripes,Diomedea_exulans),(Phoebetria_palpebrata,(Diomedea_cauta,(Diomedea_melanophrys,Diomedea_chrysostoma)))),((Fregetta_grallaria,Oceanites_oceanicus),((Oceanodroma_leucorrhoa,(Oceanodroma_microsoma,Oceanodroma_tethys)),((Pelecanoides_georgicus,Pelecanoides_urinatrix),(Pterodroma_brevirostris,((Halobaena_caerulea,(Pachyptila_turtur,((Pachyptila_desolata,Pachyptila_belcherii),Pachyptila_salvinii)))),((Bulweria_bulwerii,((Procellaria_aequinoctialis,Procellaria_cinerea),(Calonectris_diomedea,(Puffinus_pacificus,(Puffinus_griseus,Puffinus_tenuirostris))))),((Pterodroma_lessonii,Pterodroma_macroptera),(Pagodroma_nivea,(Thalassoica_antarctica,(Daption_capense,(Macronectes_giganteus,(Fulmarus_glacialis,Fulmarus_glacialoides)))))))))),(Waimanu_tuatahi,(Palaeeudyptes_gunnari,(Pachydyptes_ponderosus,(Kairuku_grebneffi,((Aptenodytes_forsteri,Aptenodytes_patagonicus),(Pygoscelis_adeliae,(Eudyptes_chrysocome,(Eudyptula_minor,(Spheniscus_demersus,Spheniscus_humboldti)))))))))),(((Leptoptilos_crumeniferus,Leptoptilos_dubius),((Ciconia_abdimi,Ciconia_ciconia),(Jabiru_mycteria,(Anastomus_lamelligerus,Mycteria_americana)))),(((Fregata_aquila,Fregata_minor),((Morus_serrator,Sula_leucogaster),(Anhinga_melanogaster,(Phalacrocorax_melanoleucos,(Phalacrocorax_atriceps,(Phalacrocorax_urile,(Phalacrocorax_carbo,(Phalacrocorax_sulcirostris,(Phalacrocorax_fuscescens,Phalacrocorax_varius)))))))),(((Eudocimus_albus,Theristictus_caerulescens),((Bostrychia_hagadesh,((Plegadis_chihi,Plegadis_falcinellus),((Threskiornis_aethiopica,Threskiornis_molucca),Platalea_flavipes)))),((Botaurus_stellaris,((Nycticorax_nycticorax,(Egretta_novaehollandiae,Egretta_garzetta)),(Butorides_striata,(Bubulcus_ibis,(Ardea_cinerea,(Ardea_intermedia,Ardea_alba)))))),(Scopus_umbretta,(Balaeniceps_rex,((Pelecanus_onocrotalus,Pelecanus_conspicillatus),(Pelecanus_erythrorhynchus,Pelecanus_occidentalis)))))))))),((Opisthocomus_hoazin),(((((Cathartes_aura,Coragyps_atratus),(Sarcoramphus_papa,Vultur_gryphus)),(Sagittarius_serpentarius,((Pandion_haliaetus,(((Elanus_axillaris,((Gypohierax_angolensis,Polyboroides_typus),Aviceda_subcristata))),((Terathopius_ecaudatus,((Aegypius_monachus,Aegy

pius_tracheliotus),(Gyps_africanus))),(((((Harpagus_bidentatus,Kaupifalco_monogrammicus),(Melierax_canorus,((Accipiter_novaehollandiae,(Accipiter_haplochrous,Accipiter_cirrocephalus)),(((Accipiter_cooperii,Accipiter_gentilis),(Circus_aeruginosus,Circus_cyaneus)),(Accipiter_striatus,Accipiter_nisus))))),(((Milvus_migrans,(Haliastur_indus,Haliastur_sphenurus)),(Haliaeetus_leucocephalus,(Haliaeetus_leucogaster,Haliaeetus_vocifer))),(Ictinia_mississippiensis,(Busarellus_nigricollis,(Rostrhamus_sociabilis,(((Heterospizias_meridionalis,(Buteogallus_anthracinus,Buteogallus_urabatinga)),(Buteo_magnirostris,(Parabuteo_unicinctus,(Buteo_polysoma,(Leucopternis_albicollis,(Buteo_lineatus,(Buteo_platypterus,(Buteo_jamaicensis,(Buteo_swainsoni,(Buteo_buteo,(Buteo_lagopus,Buteo_regalis)))))))))))))),(Stephanoaetus_coronatus,(Lophaetus_occipitalis,(Aquila_rapax,(Hieraaetus_morphnoides,(Aquila_chrysaetos,(Aquila_audax,Aquila_fasciatus)))))))))),((((((((((Bubo_bubo,Bubo_africanus),(Bubo_scandiacus,Bubo_virginianus)),((((Strix_aluco,Strix_uralensis),Strix_nebulosa),(Strix_varia,Strix_virgata)),Strix_nigrolineata)),((Megascops_asio,Megascops_choliba),Megascops_nudipes)),((Asio_flammeus,Asio_capensis),Asio_otus)),((Otus_bakkamoena,Otus_magicus),Otus_scops)),((Aegolius_acadicus,Aegolius_funereus),((((Glaucidium_brasilianum,Glaucidium_gnoma),Glaucidium_passerinum),Surnia_ulula),(Micrathene_whitneyi,(Athene_cunicularia,Athene_noctua))))),((((Ninox_boobook,Ninox_connivens),Ninox_squamipila),Ninox_strenua),Ninox_jacquinoti)),(Tyto_capensis,(Tyto_alba,(Tyto_longimembris,(Tyto_novaehollandiae,Tyto_tenebricosa))))),((Colius_striatus,(Urocolius_indicus,Urocolius_macrourus)),(((Priotelus_temnurus,Priotelus_roseigaster),(Pharomachrus_mocinno,((Trogon_citreolus,((Trogon_massena,Trogon_melanurus),(Trogon_violaceus,Trogon_viridis))),(Harpactes_ardens,Harpactes_erythrocephalus)))),((((Bucorvus_abyssinicus,Bucorvus_leadbeateri),((Tockus_nasutus,((Tockus_deckeni,Tockus_flavirostris),Tockus_erythrorhynchus)),((Bucorvus_albocristatus,Bycanistes_cylindricus),((Buceros_hydrocorax,(Buceros_bicornis,Buceros_rhinoceros)),(Anthracoceros_coronatus,(Penelopides_panini,(Aceros_leucocephalus,(Aceros_plicatus,Aceros_undulatus)))))))),(Phoeniculus_purpureus,Upupa_epops)),((((Merops_pusillus,(Merops_orientalis,(Merops_apiaster,Merops_ornatus))),(Primobucco,(Miocoracias,(Eurystomus_orientalis,(Coracias_caudata,Coracias_garrulus))))),((Paleotodus,(Todus_todus,(Todus_mexicanus,Todus_subulatus))),((Fossil_momotid,(Baryphthengus_ruficapillus,Momotus_momota)),((Ispidina_picta,(Alcedo_atthis,(Ceyx_lepidus,Alcedo_azurea))),(((Ceryle_rudis,(Chloroceryle_amazona,Chloroceryle_americana)),(Megaceryle_alcyon,Megaceryle_torquata)),((Pelargopsis_capensis,(Halcyon_senegalensis,(Halcyon_smyrensis,Halcyon_leucocephala))),((Tanysiptera_galatea,Tanysiptera_sylvia),((Dacelo_leachii,Dacelo_novaeguineae),(Syma_torotoro,(Todiramphus_pyrrhopygia,(Todiramphus_macleayii,(Todiramphus_chloris,Todiramphus_sanctus)))))))))),((Brachygalba_lugubris,Jacamerops_aureus),((Jynx_torquilla,((Picumnus_temminckii,Sasia_abnormis),((Campephilus_guatemalensis,Chrysocolaptes_lucidus),((((Dryocopus_pileatus,Mulleripicus_fulvus),((Piculus_flavigula,Colaptes_auratus),Celeus_castaneus)),(Dinopium_javanense,(Campethera_nivosa,(Picus_canus,Picus_viridus))))),((((Veniliornis_passerinus,(Dendrocopos_major,Dendrocopos_medius)),Dendropicos_fuscescens),((((Picoides_arcticus,Picoides_tridactylus),Picoides_borealis),Picoides_pubescens),(Picoides_scalaris,Picoides_villosus))),(((Melanerpes_carolinus,Melanerpes_striatus),(Melanerpes_formicivorus,(Melanerpes_erythrocephalus,Melanerpes_lewis))),(Sphyrapicus_nuchalis,Sphyrapicus_varius)))))))),((Calorhamphus_fuliginosus,(Psilopogon_pyrolophus,(Psilopogon_lineatus,Psilopogon_zeylanicus))),((Trachyphonus_vaillanti,(Pogoniulus_scolopaceus,(Lybius_torquatus,Tricholaema_leucomelas))),(Semnornis_ramphestinus,(Capito_niger,(((((Pteroglossus_aracari,Pteroglossus_castanotis),Pteroglossus_torquatus),(Pteroglossus_bailloni,Pteroglossus_inscriptus)),((Andigena_hypoglauca,Selenidera_maculirostris),Aulacorhynchus_sulcatus)),((Ramphastos_sulfuratus,Ramphastos_vitellinus),Ramphastos_tucanus))))))))),((Cariama_cristata),((Herpetotheres_cachinnans,(((Milvago_chimango,Daptrius_ater),Phalcoboenus_australis),((Caracara_cheriway,Caracara_plancus),((Microhierax_erythroge

nys,Polihierax_semitorquatus),(Falco_sparverius,((Falco_vespertinus,((Falco_berigora,(Falco_mexicanus,Falco_peregrinus)),(Falco_columbarius,((Falco_eleonorae,Falco_subbuteo),Falco_longipennis)))),((((Falco_cenchroides,Falco_tinnunculus),Falco_naumanni),(Falco_moluccensis,Falco_rufigularis)),Falco_subniger)))))),(((Nestor_notabilis,Strigops_habroptilus),((Nymphicus_hollandicus,(((Calyptorhynchus_banksii,Calyptorhynchus_lathamii),(Calyptorhynchus_funereus,(Calyptorhynchus_baudinii,Calyptorhynchus_latirostris))),(Probosciger_aterrimus,((Cacatua_roseicapilla,Callocephalon_fimbriatum),(Cacatua_leadbeateri,(((Cacatua_alba,Cacatua_moluccensis),(Cacatua_galerita,Cacatua_sulphurea)),(Cacatua_haematuropygia,(Cacatua_pastinator,Cacatua_sanguinea))))))),(((Poicephalus_robustus,(Psittacus_erithacus,(Poicephalus_gulielmi,(Poicephalus_senegalus,Poicephalus_meyeri)))),((Touit_purpuratus,(Bolborhynchus_lineola,Nannopsittaca_panychlora)),((((Pyrilia_caica,Pyrilia_haematotis),((Pionus_menstruus,Pionus_senilis),(Amazona_vinacea,((Amazona_farinosa,(Amazona_amazonica,(Amazona_autumnalis,Amazona_viridigenalis))),((Amazona_albifrons,(Amazona_leucocephala,(Amazona_ventralis,Amazona_vittata))),(Amazona_versicolor,(Amazona_aestiva,(Amazona_auropalliata,Amazona_oratrix))))))))),(Brotogeris_versicolurus,(Brotogeris_chrysopterus,Brotogeris_jugularis))),((Forpus_coelestis,Forpus_passerinus),((Deroptyus_accipitrinus,(Pionites_leucogaster,Pionites_melanocephalus)),((Pyrrhura_picta,(Pyrrhura_melanura,(Pyrrhura_frontalis,Pyrrhura_perlata))),(Anodorhynchus_hyacinthus,((Diopsittaca_nobilis,Guaruba_guarouba),(((Aratinga_solstitialis,Aratinga_weddellii),(Orthopsittaca_manilata,(Primolius_auricollis,(Ara_ararauna,(Ara_militaris,(Ara_chloroptera,Ara_macao)))))),((Aratinga_pertinax,(Aratinga_canicularis,(Aratinga_aurea,Aratinga_nana))),(Aratinga_leucopthalmus,(Aratinga_finschii,Aratinga_holochlora)))))))))),((Micropsitta_pusio,((Prioniturus_platurus,(Eclectus_roratus,(Psittacula_cyanocephala,((Psittacula_alexandri,(Tanygnathus_lucionensis,Tanygnathus_megalorhynchus)),(Psittacula_columboides,(Psittacula_eupatria,Psittacula_krameri))))))),(Polytelis_alexandrae,(Polytelis_anthopeplus,Alisterus_scapularis,Aprosmictus_erythropterus)))),(((Pezoporus_wallicus,(Neopsephotus_bourkii,((Neophema_pulchella,Neophema_splendida),(Neophema_chrysostoma,Neophema_elegans)))),((Lathamus_discolor,(Eunymphicus_cornutus,(Cyanoramphus_auriceps,(Cyanoramphus_novaezelandiae,Cyanoramphus_unicolor)))),((Barnardius_zonarius,((Platycercus_icterotis,(Platycercus_venustus,(Platycercus_adscitus,Platycercus_eximius))),(Platycercus_caledonicus,Platycercus_elegans))),(Psephotus_haematonotus,(Northiella_haematogaster,(Psephotus_varius,(Psephotus_chrysopterygius,Psephotus_dissimilis)))))))),((Bolbopsittacus_lunulatus,((Loriculus_galgulus,Loriculus_phillipensis),((Agapornis_cana,(Agapornis_pullaria,Agapornis_taranta)),(Agapornis_swinderiana,(Agapornis_roseicollis,(Agapornis_fischeri,(Agapornis_lilianae,Agapornis_personatus)))))),((Cyclopsitta_diophthalma,Psittaculirostris_edwardsii),(Melopsittacus_undulatus,(Oreopsittacus_arfaki,((Charmosyna_papou,Charmosyna_pulchella),(Neopsittacus_musschenbroekii,((Glossopsitta_porphyrocephala,Glossopsitta_pusilla),((Lorius_garrulus,Lorius_lory),(Psitteuteles_versicolor,((Eos_bornea,(Eos_cyanogenia,Eos_squamata)),(Glossopsitta_concinna,(Trichoglossus_ornatus,(Trichoglossus_chlorolepidotus,Trichoglossus_haematodus))))))))))))))),((((Corydon_sumatranus,Smithornis_capensis),(Pitta_brachyura,(Pitta_sordida,(Pitta_maxima,Pitta_versicolor)))),((((Epinecrophylla_fulviventris,((Myrmotherula_axillaris,Formicivora_grisea),(((((((Myrmeciza_exsul,Myrmeciza_ferruginea),Pyriglena_leuconota),(Gymnocichla_nudipes,Gymnopithys_leucaspis)),Myrmelastes_leucostigma),(Hylophylax_naevius,Hylophylax_poecilonota)),(((Cercomacra_nigrescens,Cercomacra_tyrannina),Hypocnemis_cantator),((Phaenostictus_macleannani,Pithys_albifrons),Willisornis_poecilinotus))),(((Dysithamnus_mentalis,(Sakesphorus_luctuosus,(Thamnophilus_caerulescens,Thamnophilus_punctatus))),(Cymbilaimus_lineatus,Taraba_major)),Thamnomanes_caesius)))),Conopophaga_lineata),(Grallaria_quitensis,((Rhinocrypta_lanceolata,Scytalopus_unicolor),((Formicarius_analis,Formicarius_colma),(((Xenops_minutus,((Aphrastura_spinicauda,((Synallaxis_brachyura,Certhiaxis_cinnamomea),((Coryphistera_alaudina,Anumbius_annumbi),Pha

cellodomus_ruber))),(((Syndactyla_guttulata,Philydor_guttulatus),(Automolus_infuscatus,A
utomolus_ochrolaemus)),((Phleocryptes_melanops,Furnarius_rufus),(Cinclodes_fuscus,Cinc
lodes_patagonicus))))),((Glyphorynchus_spirurus,(Dendrocolaptes_certhia,(Xiphorhynchus_
guttatus,(Campylorhamphus_pusillus,(Lepidocolaptes_affinis,Lepidocolaptes_souleyetii)))))
,(Sittasomus_griseicapillus,(Dendroplex_picus,Dendrocincla_fuliginosa)))),(Sclerurus_mexi
canus,Geositta_cunicularia))))))),(((Chiroxiphia_caudata,Chiroxiphia_linearis),((Manacus_c
andei,(Manacus_manacus,Manacus_vitellinus)),(((Pipra_erythrocephala,Pipra_mentalis),Pip
ra_pipra),Pipra_fasciicauda))),(((((Gymnoderus_foetidus,Lipaugus_vociferans),(Querula_pu
rpurata,Perissocephalus_tricolor)),Phytotoma_rutila),Rupicola_peruviana),(((Platyrinchus_c
ancrominus,Platyrinchus_mystaceus),((Tolmomyias_sulphurescens,(Hemitriccus_margarita
ceiventer,Todirostrum_cinereum)),(Mionectes_oleagineus,Pseudotriccus_pelzelni))),((((Myi
archus_tuberculifer,(Myiarchus_validus,(Myiarchus_stolidus,(Myiarchus_cinerascens,Myiar
chus_tyrannulus)))),(Attila_spadiceus,(Legatus_leucophaius,((Machetornis_rixosus,Pitangus
_sulphuratus),(Myiozetetes_similis,((Myiodynastes_maculatus,Megarynchus_pitangua),(Tyr
annus_savana,((Tyrannus_forficata,(Tyrannus_dominicensis,Tyrannus_tyrannus)),Tyrannus
_verticalis))))))),((Colonia_colonus,Pyrocephalus_rubinus),((Myiophobus_fasciatus,((Cne
motriccus_fuscatus,((((Contopus_cooperi,Contopus_latirostris),Contopus_virens),(Empidon
ax_minimus,Empidonax_virescens)),((Sayornis_nigricans,(Sayornis_phoebe,Sayornis_saya)
),Mitrephanes_phaeocercus))))),(Hymenops_perspicillatus,(Muscisaxicola_alpinus,(Xolmis
_irupero,Xolmis_pyrope))))))),((Mecocerculus_leucophrys,Pseudocolopteryx_flaviventris),((
(Elaenia_frantzii,Elaenia_martinica),(Myiopagis_cotta,Phaeomyias_murina)),Camptostoma
_obsoletum))))))),(Menura_novaehollandiae,((((Ailuroedus_crassirostris,Ailuroedus_melan
otis),((Scenopoeetes_dentirostris,Amblyornis_macgregoriae),(Sericulus_chrysocephalus,(Pti
lonorhynchus_violaceus,(Chlamydera_maculata,Chlamydera_nuchalis))))),((Climacteris_me
lanurus,(Climacteris_picumnus,Climacteris_rufus)),Cormobates_leucophaea)),(((Amytornis
_goyderi,(Malurus_coronatus,(((Malurus_alboscapulatus,Malurus_leucopterus),Malurus_me
lanocephalus),((Malurus_cyaneus,Malurus_splendens),((Malurus_lamberti,Malurus_pulcher
rimus),Malurus_elegans))))),((Dasyornis_brachypterus,Dasyornis_broadbenti),((Acanthorhy
nchus_tenuirostris,(Ptiloprora_guisei,(((Melilestes_megarhynchus,((Conopophila_albogulari
s,Conopophila_rufogularis),Ramsayornis_modestus)),(Ashbyia_lovensis,(Epthianura_aurifr
ons,Epthianura_tricolor))),((Certhionyx_niger,Certhionyx_variegatus),((Myzomela_obscura,
Myzomela_sanguinolenta),(((((((Anthochaera_carunculata,Anthochaera_phrygia),Anthocha
era_chrysoptera),Acanthagenys_rufogularis),((Manorina_melanocephala,(Manorina_flavigu
la,Manorina_melanophrys)),((((Lichenostomus_virescens,((Lichenostomus_flavescens,Lich
enostomus_keartlandi),(Lichenostomus_ornatus,Lichenostomus_penicillatus))),((Lichenosto
mus_flavus,Lichenostomus_unicolor),(Lichenostomus_chrysops,(Lichenostomus_melanops,
Lichenostomus_cratitus)))),(Lichenostomus_frenatus,Lichenostomus_hindwoodi)),Lichenos
tomus_leucotis))),(Meliphaga_gracilis,(Meliphaga_lewinii,Meliphaga_notata))),(Entomyzon
_cyanotis,((Melithreptus_albogularis,Melithreptus_brevirostris),Melithreptus_lunatus))),(Li
chmera_indistincta,(Trichodere_cockerelli,((Phylidonyris_melanops,Phylidonyris_albifrons)
,(Phylidonyris_niger,Phylidonyris_novaehollandiae))))),(((((Philemon_argenticeps,Philemo
n_corniculatus),Philemon_buceroides),Philemon_diemenensis),Philemon_citreogularis),((X
anthotis_flaviventer,Xanthotis_macleayanus),Grantiella_picta))))))),(((Gerygone_flavolater
alis,Gerygone_hypoxantha),(((Smicrornis_brevirostris,((((Calamanthus_fuliginosus,Hylacol
a_pyrrhopygia),(Pycnoptilus_floccosus,(Pyrrholaemus_brunneus,Pyrrholaemus_sagittatus)))
),(Origma_solitaria,(Crateroscelis_nigrorufa,(Sericornis_citreogularis,(Sericornis_perspicilla
tus,(Sericornis_magnirostra,Sericornis_frontalis))))))),((Aphelocephala_leucopsis,Apheloce
phala_nigricincta),((Acanthiza_lineata,Acanthiza_nana),(Acanthiza_chrysorrhoa,((Acanthiz
a_ewingii,Acanthiza_pusilla),(Acanthiza_uropygialis,(Acanthiza_reguloides,Acanthiza_inor
nata))))))),(Pardalotus_punctatus,Pardalotus_striatus))))),((Orthonyx_temminckii,(((Pomato

stomus_isidorei,Pomatostomus_temporalis),Pomatostomus_halli),(Pomatostomus_ruficeps,
Pomatostomus_superciliosus))),(((Pericrocotus_ethologus,(Campephaga_phoenicea,((Coraci
na_maxima,(Coracina_novaehollandiae,(Coracina_caledonica,Coracina_papuensis))),(Corac
ina_tenuirostris,Lalage_sueurii)))),(Daphoenositta_chrysoptera,((((Cinclosoma_cinnamome
um,Cinclosoma_punctatum),((Psophodes_cristatus,Psophodes_occidentalis),Psophodes_oliv
aceus)),(Oreoica_gutturalis,(((Pteruthius_flaviscapis,(Cyclarhis_gujanensis,((Vireo_griseus,
Vireo_olivaceus),(Vireo_altiloquus,Vireo_magister)))),Oreocharis_arfaki),((Falcunculus_fr
ontatus,((Pachycephala_olivacea,((Pachycephala_simplex,Pachycephala_pectoralis),(Pachyc
ephala_rufiventris,Pachycephala_rufogularis))),(Colluricincla_harmonica,Colluricincla_meg
arhyncha))),((Sphecotheres_viridis,(Pitohui_dichrous,Pitohui_ferrugineus)),((Oriolus_flavoc
inctus,Oriolus_oriolus),Oriolus_sagittatus))))))),((((Artamus_superciliosus,(Artamus_minor,(
(Artamus_leucorhynchus,Artamus_personatus),(Artamus_maximus,(Artamus_cinereus,Arta
mus_cyanopterus))))),((((Cracticus_nigrogularis,Cracticus_torquatus),Cracticus_quoyi),Gy
mnorhina_tibicen),(Strepera_fuliginosa,(Strepera_graculina,Strepera_versicolor)))),(((Aegit
hina_tiphia,((Malaconotus_cruentus,(Tchagra_australis,Dryoscopus_cubla)),(Telophorus_ze
ylonus,Laniarius_erythrogaster))),(Abroscopus_albogularis,((Aegithalos_caudatus,Aegithal
os_concinnus),Psaltriparus_minimus))),((Batis_capensis,Platysteira_cyanea),(Prionops_plu
matus,(Bias_musicus,Tephrodornis_pondicerianus))))),(((Rhipidura_atra,Rhipidura_rufivent
ris),(Rhipidura_leucophrys,(Rhipidura_rufifrons,Rhipidura_fuliginosa))),(Dicrurus_hottento
tus,(((Hypothymis_azurea,(Terpsiphone_atrocaudata,((Grallina_bruijni,Grallina_cyanoleuca
),((Arses_telescophthalmus,(Myiagra_alecto,(Myiagra_inquieta,(Myiagra_caledonica,(Myia
gra_cyanoleuca,Myiagra_rubecula))))),(Clytorhynchus_pachycephaloides,(Monarcha_guttul
a,(Monarcha_melanopsis,Monarcha_trivirgatus)))))),((Lycocorax_pyrrhopterus,(Parotia_la
wesii,(Cicinnurus_regius,(Seleucidis_melanoleuca,(Lophorina_superba,(Ptiloris_magnificus
,(Ptiloris_paradiseus,Ptiloris_victoriae)))))),Ifrita_kowaldi)),((Corcorax_melanorhamphos,S
truthidea_cinerea),((Pyrrhocorax_pyrrhocorax,(Cissa_chinensis,(Perisoreus_canadensis,(((((
Aphelocoma_coerulescens,Aphelocoma_ultramarina),(Cyanocorax_affinis,Psilorhinus_mori
o)),Gymnorhinus_cyanocephalus),(Cyanocitta_cristata,Cyanocitta_stelleri)),((Podoces_hend
ersoni,Pica_pica),(Garrulus_glandarius,((Corvus_dauuricus,Corvus_monedula),(Corvus_oss
ifragus,(((Corvus_corone,(Corvus_brachyrhynchos,Corvus_caurinus)),(Corvus_moneduloid
es,((Corvus_coronoides,Corvus_mellori),(Corvus_orru,Corvus_bennetti)))),(((Corvus_crypt
oleucus,Corvus_albus),Corvus_corax),Corvus_frugilegus)))))))))),(Lanius_ludovicianus,(La
nius_senator,(Lanius_collurio,Lanius_cristatus)))))))))))),(((Melanocharis_striativentris,Oedi
stoma_iliolophum),Toxorhamphus_poliopterus),(((((Petroica_goodenovii,Petroica_multicol
or),(Petroica_phoenicea,(Petroica_rodinogaster,Petroica_rosea))),(Amalocichla_incerta,Pach
ycephalopsis_poliosoma)),(((((Microeca_fascinans,Microeca_flavigaster),Microeca_leucoph
aea),Microeca_papuana),Monachella_muelleriana),(Drymodes_brunneopygia,(((Poecilodrya
s_albonotata,(Poecilodryas_cerviniventris,Poecilodryas_superciliosa)),Heteromyias_albispe
cularis),(((Melanodryas_cucullatus,Melanodryas_vittata),Peneothello_cyanus),(Poecilodryas
_placens,((Eopsaltria_australis,Eopsaltria_griseogularis),(Eopsaltria_georgiana,(Tregellasia
_capito,Tregellasia_leucops)))))))),((Culicicapa_helianthea,(((((Parus_caeruleus,Parus_maj
or),(((Poecile_atricapillus,Poecile_gambeli),Poecile_hudsonicus),Poecile_carolinensis)),Bae
olophus_bicolor),Auriparus_flaviceps),((Chersomanes_albofasciata,(Mirafra_javanica,((Ala
uda_arvensis,Galerida_cristata),((Calandrella_cinerea,Eremophila_alpestris),Melanocorypha
_calandra)))),(Nicator_chloris,(((Cisticola_exilis,(Cisticola_cherina,Cisticola_fulvicapilla)),
Prinia_leucopogon),(((Acrocephalus_schoenobaenus,(Hippolais_icterina,(Acrocephalus_aru
ndinaceus,Acrocephalus_scirpaceus))),(Donacobius_atricapillus,(Locustella_luscinioides,((
Cincloramphus_cruralis,Cincloramphus_mathewsi),(Megalurus_gramineus,Megalurus_palu
stris))))),((Cheramoeca_leucosterna,((Riparia_riparia,((Tachycineta_bicolor,Tachycineta_th
alassina),(Notiochelidon_cyanoleuca,(Stelgidopteryx_ruficollis,Progne_subis)))),((Delichon

_urbica,(Petrochelidon_fulva,(Hirundo_ariel,Hirundo_nigricans))),(Hirundo_neoxena,Hirundo_rustica)))),((((Chlorocichla_flavicollis,(Criniger_pallidus,Phyllastrephus_terrestris)),((Hypsipetes_phillipinus,Ixos_philippinus),(Pycnonotus_jocosus,Pycnonotus_tricolor))),((Chamaea_fasciata,(Sylvia_atricapilla,Sylvia_borin)),((Yuhina_diademata,(Zosterops_japonicus,Zosterops_lateralis)),(((Myiobius_barbatus,Onychorhynchus_coronatus),((Pomatorhinus_ruficollis,(Macronus_gularis,Stachyris_whiteheadi)),(Schiffornis_turdina,(((Pachyramphus_cinnamomeus,Pachyramphus_polychopterus),Pachyramphus_niger),(Tityra_cayana,Tityra_semifasciata))))),((Alcippe_nipalensis,Illadopsis_fulvescens),((Heterophasia_melanoleuca,(Leiothrix_lutea,Minla_ignotincta)),Turdoides_jardineii))))),(Phylloscopus_bonelli,Phylloscopus_sibilatrix)))))))),(((Dulus_dominicus,(Phainopepla_nitens,(Bombycilla_cedorum,Bombycilla_garrulus))),(((Cinclus_cinclus,Cinclus_mexicanus),(((((Muscicapa_striata,Melaenornis_silens),(Alethe_diademata,(Copsychus_saularis,Cercotrichas_coryphaeus))),((Cyornis_rubeculoides,Vauriella_gularis),(Cossypha_caffra,(Brachypteryx_montana,(((Luscinia_megarhynchos,(Erithacus_megarhyncha,Erithacus_rubecula)),Enicurus_scouleri),(Ficedula_albicollis,(Phoenicurus_phoenicurus,(Monticola_saxatilis,(Oenanthe_oenanthe,(Saxicola_torquatus,Cinclidium_leucurum))))))))),(((Sialia_mexicana,Sialia_sialis),(Myadestes_genibarbis,Myadestes_townsendi)),((((Catharus_fuscescens,Hylocichla_mustelina),Ixoreus_naevius),(Turdus_ericetorium,(Turdus_migratorius,(Turdus_lherminieri,(Turdus_merula,Turdus_philomelos))))),((Zoothera_heinei,Zoothera_lunulata),Zoothera_naevia)))),((((Dumetella_carolinensis,(Margarops_fuscatus,Margarops_fuscus)),Melanoptila_glabirostris),(Mimus_polyglottus,(Toxostoma_curvirostre,Toxostoma_rufum))),((Aplonis_metallica,(Gracula_religiosa,Sarcops_calvus)),((Poeoptera_lugubris,Cinnyricinclus_leucogaster),((Onycognathus_salvadorii,Lamprotornis_purpureus),(Pastor_roseus,(Sturnus_vulgaris,Acridotheres_tristis)))))),((Regulus_calendula,(Regulus_regulus,Regulus_satrapa)),(Certhia_familiaris,(((Campylorhynchus_brunei capillus,Campylorhynchus_griseus),(((Troglodytes_aedon,Troglodytes_troglodytes),Cistothorus_palustris),((Thryomanes_bewickii,Salpinctes_obsoletus),((Cyphorhinus_arada,Henicorhina_leucosticta),(Thryothorus_ludovicianus,Thryothorus_nigricapillus))))),(Polioptila_caerulea,Ramphocaenus_melanurus))))),((((Dicaeum_aeruginosum,Dicaeum_hirundinaceum),Prionochilus_plateni),(Aethopyga_nipalensis,(Anthreptes_malacensis,(Arachnothera_longirostra,(Nectarinia_violacea,(Nectarinia_jugularis,(Nectarinia_calcostetha,Nectarinia_olivacea))))))),((Irena_puella,Chloropsis_palawanensis),(((Plocepasser_mahali,(Bubalornis_albirostris,((Euplectes_orix,Foudia_madagascariensis),Ploceus_cucullatus))),(((((Estrilda_caerulescens,Estrilda_melpoda),((Amadina_fasciata,Amandava_amandava),(Lagonosticta_senegala,(Uraeginthus_bengalus,(Pytilia_melba,Spermophaga_haematina))))),(Erythrura_gouldiae,Erythrura_trichroa)),(((Lonchura_cucullata,Lonchura_malacca),Padda_oryzivora),(Stagonopleura_guttata,((Neochmia_phaethon,Neochmia_temporalis),(((Poephila_acuticauda,Poephila_cincta),Poephila_personata),(Taeniopygia_bichenovii,Taeniopygia_guttata))))))),Vidua_paradisaea)),(Prunella_modularis,((Montifringilla_nivalis,(Passer_domesticus,Passer_hispaniolensis)),(((Anthus_novaeseelandiae,(Anthus_pratensis,Anthus_trivialis)),(Motacilla_alba,Motacilla_flava)),(((Chlorophonia_cyanea,Euphonia_jamaica),(Fringilla_coelebs,(Coccothraustes_vespertinus,((Carpodacus_mexicanus,Carpodacus_purpureus),((Pinicola_enucleator,Leucosticte_arctoa),(Himatione_sanguinea,((Carduelis_carduelis,(((Carduelis_pinus,Carduelis_spinus),Carduelis_tristis),(Serinus_canaris,Serinus_flaviventris))),(Linaria_cannabina,(Carduelis_flammea,(Loxia_curvirostra,Loxia_leucoptera)))))))))),(Rhodinocichla_rosea,(((Calcarius_lapponica,Plectrophenax_nivalis),(Emberiza_hortulana,Emberiza_spodocephala)),(((Pheucticus_ludovicianus,((Passerina_cyanea,Spiza_americana),((Chlorothraupis_carmioli,Habia_fusci cauda),((Cardinalis_cardinalis,Caryothraustes_poliogaster),(Piranga_ludoviciana,Piranga_rubra))))),(((Anisognathus_flavinuchus,Iridosornis_rufivertex),(((Cissopis_leverianus,Schistochlamys_melanopis),(Paroaria_coronata,Diuca_diuca)),((Tangara_cyanicollis,Thraupis_episcopus),((Sicalis_flaveola,(Phrygilus_gramineus,Phrygilus_patagonicus)),((Hemithraupis_guir

a,((Volatinia_jacarina,Trichothraupis_melanops),((Rhodospingus_cruentus,Coryphospingus_cucullatus),(Ramphocelus_flammigerus,Tachyphonus_delatrii)))),((Cyanerpes_cyaneus,(Tersina_viridis,Dacnis_cayana)),((Coereba_flaveola,((Melopyrrha_nigra,Euneornis_campestris),(Loxipasser_anoxanthus,(Loxigilla_violacea,((Sporophila_americana,Oryzoborus_angolensis),Tiaris_olivaceus))))),(Saltator_maximus,Poospiza_nigrorufa)))))))),Mitrospingus_cassinii)),(((Arremonops_conirostris,(Chlorospingus_ophthalmicus,Chlorospingus_pileatus)),((Calamospiza_melanocorys,Amphispiza_bilineata),((Arremon_aurantiirostris,Arremon_brunneinucha),(((Pooecetes_gramineus,((Melospiza_georgiana,Melospiza_melodia),(Ammodramus_sandwichensis,Ammodramus_savannarum))),(Spizella_arborea,(Junco_hyemalis,(Zonotrichia_albicollis,Zonotrichia_leucophrys)))),(Aimophila_cassinii,Pipilo_erythrophthalmus))))),((Nesospingus_speculiferus,(Phaenicophilus_palmarum,((((Sitta_canadensis,Sitta_pygmaea),Sitta_carolinensis),Sitta_europaea),Spindalis_zena))),((Icteria_virens,((Xanthocephalus_xanthocephalus,(Sturnella_neglecta,Dolichonyx_oryzivorus)),((Amblycercus_holosericeus,(Cacicus_cela,Psarocolius_montezuma)),((Icterus_galbula,Icterus_spurius),(Agelaius_phoeniceus,((Molothrus_ater,Molothrus_oryzivorus),((Dives_dives,((Euphagus_carolinus,Euphagus_cyanocephalus),((Quiscalus_major,Quiscalus_mexicanus),Quiscalus_quiscula))),((Amblyramphus_holosericeus,Curaeus_curaeus),(Gnorimopsar_chopi,(Agelaioides_badius,Pseudoleistes_virescens))))))))))),(Seiurus_aurocapilla,(Helmitheros_vermivorus,((Vermivora_peregrina,(Mniotilta_varia,(Protonotaria_citrea,Limnothlypis_swainsonii))),(Geothlypis_trichas,((Setophaga_citrina,(Parula_americana,(Setophaga_ruticilla,(Setophaga_petechia,(Setophaga_caerulescens,Setophaga_coronata))))),(Myiothlypis_fulvicauda,(Basileuterus_culcivorus,(Cardellina_rubrifrons,Myioborus_pictus));

S8 – Data files used in tree calibration.

Time intervals used in timePaleoPhy (First Appearance Datum (FAD) and Last Appearance Datum (LAD) time intervals were based in the Chronostratigraphic International Chart (Cohen et al. 2013 updated), 2020/01 version)

Interval		FAD	LAD
Induan		251.9	251.2
Olenekian	251.2	247.2	
Anisian		247.2	242.0
Ladinian	242.0	237.0	
Carnian		237.0	227.0
Norian		227.0	208.5
Rhaetian	208.5	201.3	
Hettangian	201.3	199.3	
Sinemurian	199.3	190.8	
Pliensbachian		190.8	182.7
Toarcian	182.7	174.1	
Aalenian	174.1	170.3	
Bajocian	170.3	168.3	
Bathonian	168.3	166.1	
Callovian	166.1	163.5	
Oxfordian	163.5	157.3	
Kimmeridgian		157.3	152.1
Tithonian	152.1	145.0	

Berriasian	145.0	139.8	
Valanginian		139.8	132.6
Hauterivian	132.6	129.4	
Barremian	129.4	125.0	
Aptian		125.0	113.0
Albian		113.0	100.5
Cenomanian		100.5	93.9
Turonian	93.9	89.8	
Coniacian	89.8	86.3	
Santonian	86.3	83.6	
Campanian	83.6	72.1	
Maastrichtian		72.1	66.0
Danian		66.0	61.6
Selandian	61.6	59.2	
Thanetian	59.2	56.0	
Ypresian	56.0	47.8	
Lutetian	47.8	41.2	
Bartonian	41.2	37.8	
Priabonian	37.8	33.9	
Rupelian	33.9	27.8	
Chattian	27.8	23.0	
Aquitanian	23.0	20.4	
Burdigalian	20.4	15.9	
Langhian	15.9	13.8	
Serravallian		13.8	11.6
Tortonian	11.6	7.2	
Messinian	7.2	5.3	
Zanclean	5.3	3.6	
Piacenzian	3.6	2.5	
Pleistocene	2.5	1.8	
Holocene	1.8	0.0	
Present		0.0	0.0

Testudines (time interval ranges)

taxon	first_int	last_int
Sphenodon	50	50
Anolis	50	50
Python	50	50
Gallus	50	50
Tyrannosaurus	30	30
Crocodylus	50	50
Mesoclemmys	50	50
Platemys	50	50
Pelusios	50	50
Pelomedusa	50	50
Erymnochelys	50	50
Podocnemis	50	50
Carettochelys_insculpta	50	50

Lissemys	50	50		
Apalone_ferox	50	50		
Nilssonia	50	50		
Pelodiscus	50	50		
Platysternon_megacephalum			50	50
Deinochelys	50	50		
Chrysemys	50	50		
Pseudemys_scripta	50	50		
Graptemys	50	50		
Trachemys	50	50		
Terrapene	50	50		
Clemmys_guttata	50	50		
Emys_orbicularis	50	50		
Rhinoclemmys	50	50		
Cyclemys	50	50		
Geoemyda	50	50		
Gopherus	50	50		
Stigmochelys	50	50		
Testudo_graeca	50	50		
Testudo_hermanni	50	50		
Dermochelys_coriacea			50	50
Chelonia_mydas	50	50		
Caretta_caretta	50	50		
Lepidochelys	50	50		
Chelydra_serpentina			50	50
Macroclemys_temminckii			50	50
Dermatemys_mawii			50	50
Staurotypus	50	50		
Sternotherus	50	50		
Kinosternon	50	50		
Odontochelys	5	6		
Proganochelys	6	7		
Kayentachelys	9	10		
Meiolania_platyceps			49	50
Turkanemys	44	47		
Cerrejonemys	32	32		
Cambaremys	30	30		
Solnhofia	18	18		
Toxochelys_moorevillensis			28	29
Emarginachelys_cretacea			30	30

Crocodylomorpha (time interval ranges)

taxon	first_int	last_int
Protosuchus_richardsoni	8	9
Pelagosaurus_typus	10	10
Steneosaurus_bollensis	10	10
Sebecus_icaeorhinus	35	36
Araripesuchus_gomesi	24	24

Notosuchus_terrestris	28	28
Comahuesuchus_brachybuccalis	28	28
Pholidosaurus_purbeckensis	19	19
Sarcosuchus_imperator	24	24
Elosuchus	25	25
Hyposaurus	30	31
Dyrosaurus	24	37
Sunosuchus	16	18
Susisuchus_anatoceps	24	24
Nannosuchus	19	22
Amphicotylus	17	18
Goniopholis_simus	19	19
Bernissartia_fagesii	19	22
Gavialosuchus_antiquus	39	41
Eosuchus	34	37
Rhamphosuchus	46	47
Eogavialis	38	44
Gavialis_gangeticus	48	50
Gavialis_lewisi	46	47
Isisfordia_duncani	24	24
Iharkutosuchus_makadii	28	28
Borealosuchus	31	31
Leidyosuchus	30	31
Diplocynodon	29	50
Eoalligator_chunyii	32	32
Navajosuchus_novomexicanus	31	31
Brachychampsa_montana	30	30
Alligator_mefferdi	43	43
Alligator_mississippiensis	50	50
Alligator_sinensis	50	50
Paleosuchus_trigonatus	50	50
Caiman_crocodilus	50	50
Caiman_latorostris	50	50
Melanosuchus_niger	50	50
Brachyuranochampsa	28	35
Crocodylus_affinis	34	37
Crocodylus_elliotti	34	34
Planocrania	33	33
Kentisuchus_spenceri	34	34
Gavialosuchus_americanus	38	49
Tomistoma_schlegelii	50	50
Crocodylus_siamensis	50	50
Asiatosuchus_nanlingensis	32	32
Crocodylus_intermedius	50	50
Mecistops_cataphractus	50	50
Crocodylus_porosus	50	50
Crocodylus_rhombifer	50	50
Crocodylus_niloticus	50	50
Crocodylus_novaguineae	50	50
Crocodylus_palustris	50	50

Crocodylus_moreletii	50	50
Crocodylus_acutus	50	50
Crocodylus_sivalensis	44	47
Asiatosuchus_grangeri	35	36
Osteolaemus_tetraspis	50	50
Voay_robusturs	49	50

Non avian Dinosauria (time interval ranges)

taxon	first_int	last_int
Pisanosaurus_mertii	5	6
Lesothosaurus	8	8
Scutellosaurus	9	10
Scelidosaurus	9	10
Dacentrurus	18	18
Kentrosaurus	17	18
Tuojiangosaurus	17	18
Stegosaurus	17	17
Minmi	20	23
Gobisaurus	26	26
Ankylosaurus	30	30
Euoplocephalus	30	30
Pinacosaurus_grangeri	29	29
Talarurus	25	28
Saichania	28	29
Antarctopelta	28	29
Tatankacephalus	24	24
Gastonia	20	22
Polacanthus	22	24
Nodosaurus	25	29
Panoplosaurus	30	30
Edmontonia	30	30
Agilisaurus	16	16
Goyocephale	28	30
Stegoceras	30	30
Pachycephalosaurus	30	30
Yinlong	16	16
Psittacosaurus	23	23
Montanoceratops	30	30
Asiaceratops	25	25
Bagaceratops	29	29
Protoceratops	25	29
Diabloceratops	29	29
Centrosaurus	29	29
Pachyrhinosaurus	30	30
Chasmosaurus	29	29
Pentaceratops	30	30
Torosaurus	30	30
Triceratops	30	30
Oryctodromeus	25	25

Orodromeus	29	30
Thescelosaurus	30	30
Hypsilophodon_foxi	22	22
Gasparinisaura	29	29
Muttaburrasaurus	24	24
Mochlodon	29	30
Tenontosaurus	23	25
Camptosaurus	18	18
Iguanodon_bernisartensis	19	22
Ouranosaurus	24	24
Probactrosaurus	21	24
Telmatosaurus	30	30
Brachylophosaurus	29	29
Maiasaura	29	29
Barsboldia	29	30
Kritosaurus_navajovius	29	29
Gryposaurus	30	30
Secernosaurus	29	30
Saurolophus	30	30
Shantungosaurus	30	30
Edmontosaurus	30	30
Tsintaosaurus	29	29
Parasaurolophus	29	29
Lambeosaurus	29	29
Corythosaurus	29	29
Hypacrosaurus	30	30
Plateosaurus	6	8
Riojasaurus	6	6
Camelotia	7	7
Vulcanodon	9	10
Barapasaurus	9	10
Mamenchisaurus	17	23
Omeisaurus	16	18
Jobaria	15	15
Haplocanthosaurus	17	17
Nigersaurus	23	24
Suuwassea	17	17
Amargasaurus	22	22
Dicraeosaurus	17	18
Diplodocus	18	18
Barosaurus	18	18
Apatosaurus	18	18
Camarasaurus	18	18
Tehuelchesaurus	17	18
Europasaurus	17	17
Brachiosaurus	18	18
Cedarosaurus	20	24
Venenosaurus	21	22
Sonorasaurus	24	25
Chubutisaurus	24	24

Andesaurus	25	25
Mendozasaurus	27	27
Epachthosaurus	25	26
Nemegtosaurus	27	30
Tapuiasaurus	23	23
Rinconsaurus	28	28
Gondwanatitan	29	30
Aeolosaurus	29	30
Alamosaurus	30	30
Neuquensaurus	29	29
Saltasaurus	30	30
Eoraptor	5	6
Coelophysis	7	7
Dilophosaurus	9	9
Elaphrosaurus	18	25
Ceratosaurus	18	18
Noasaurus	30	30
Masiakasaurus	30	30
Rugops	25	25
Abelisaurus	29	29
Majungasaurus	30	30
Rajasaurus	30	30
Aucasaurus	29	29
Carnotaurus	29	30
Skorpiovenator	25	26
Ilokelesia	25	26
Cryolophosaurus	9	10
Condorraptor	11	13
Spinosaurus	24	25
Suchomimus	23	24
Baryonyx	20	22
Afrovenator	13	15
Torvosaurus	18	18
Megalosaurus	14	22
Sinraptor_dongi	16	16
Shidaisaurus	13	13
Allosaurus	18	18
Neovenator	21	22
Murusraptor	29	29
Aerosteon	29	29
Australovenator	25	25
Fukuiraptor	22	22
Eocarcharia	23	24
Acrocanthosaurus	23	23
Carcharodontosaurus	23	25
Giganotosaurus	25	25
Mapusaurus	25	25
Dilong	22	22
Dryptosaurus	30	30
Gorgosaurus	30	30

Alioramus	30	30
Tarbosaurus	30	30
Nanotyrannus	30	30
Tyrannosaurus	30	30
Pelecanimimus	22	22
Gallimimus	29	30
Struthiomimus_altus	30	30
Ornithomimus	30	30
Ornitholestes	17	17
Compsognathus	18	18
Patagonykus	26	27
Alvarezsaurus	28	28
Shuvuuia	29	29
Caudipteryx	22	22
Microvenator	24	24
Gigantoraptor	29	29
Chirostenotes	30	30
Oviraptor	29	29
Citipati_osmolskae	29	29
Khaan_mckennai	29	29
Conchoraptor_gracilis	29	29
Ingenia	30	30
Mei	20	22
Sinovenator	23	23
Troodon	29	30
Saurornithoides	30	30
Rahonavis	30	30
Buitreraptor	25	25
Unenlagia	26	27
Austroraptor	29	30
Shanag	19	24
Microraptor	23	23
Dromaeosaurus	24	30
Utahraptor	20	22
Bambiraptor	29	29
Velociraptor	29	29
Deinonychus	19	23
Erlikosaurus_andrewsi	25	28
Incisivosaurus_gauthieri	23	23
Tsaagan_mangas	29	29
Zanabazar_junior	30	30

Squamata (time interval ranges)

taxon	first_int	last_int
Gephyrosaurus	8	8
Sphenodon	50	50
Tarentola_mauritanica	50	50
Phyllodactylus	50	50
Lepidodactylus_orientalis	50	50
Gekko_gekko	50	50

Gekko_porosus	50	50		
Cyrtodactylus	50	50		
Hemidactylus_frenatus	50	50		
Hemidactylus_mabouia	50	50		
Pachydactylus	50	50		
Colopus	50	50		
Lygodactylus	50	50		
Phelsuma_cepedia	50	50		
Xantusia	50	50		
Zonosaurus_maximus	50	50		
Zonosaurus_quadrilineatus	50	50		
Cordylus_jonesii	50	50		
Cordylus_cordylus	50	50		
Eumeces_schneiderii	50	50		
Scincus_scincus	50	50		
Chalcides_chalcides	50	50		
Chalcides_mionecton	50	50		
Chalcides_ocellatus	50	50		
Sphenomorphus_fragilis	50	50		
Cryptoblepharus_virgatus	50	50		
Emoia_pallidiceps	50	50		
Carlia_bicarinata	50	50		
Oligosoma	50	50		
Nannoscincus	50	50		
Psammodromus_algiris	50	50		
Psammodromus_hispanicus	50	50		
Pedioplanis	50	50		
Lacerta_vivipara	50	50		
Lacerta_lepida	50	50		
Lacerta_viridis	50	50		
Lacerta_muralis	50	50		
Darevskia	50	50		
Heloderma_suspectum	50	50		
Anguis_fragilis	50	50		
Abronia	50	50		
Bradypodion	50	50		
Calumma	50	50		
Rhampholeon	50	50		
Trioceros	50	50		
Chamaleo_lateralis	50	50		
Chamaeleo_africanus	50	50		
Uromastyx_acanthinurus	50	50		
Ctenophorus	50	50		
Trapelus	50	50		
Agama_agama	50	50		
Agama_inermis	50	50		
Calotes_versicolor	50	50		
Draco	50	50		
Plica_plica	50	50		
Tropidurus	50	50		

Iguana_iguana	50	50		
Amblyrhyncus_cristatus	50	50		
Ctenosaura	50	50		
Petrosaurus	50	50		
Chalarodon_madagascariensis	50	50		
Oplurus_sebae	50	50		
Liolaemus_chilensis	50	50		
Liolaemus_melanops	50	50		
Anolis_auratus	50	50		
Colobosaura	50	50		
Teius	50	50		
Ameiva_sp.	50	50		
Callopistes_maculatus	50	50		
Tupinambis	50	50		
Myrmecodaptria	50	50		
Cricosaura	50	50		
Paramacellodus	19	19		
Sphenomorphus	50	50		
Shinisaurus	50	50		
Gobiderma	50	50		
Varanus_griseus	50	50		
Aigialosaurus	25	25		
Clidastes	28	30		
Tylosaurus	27	30		
Plotosaurus	30	30		
Sineoamphisbaena	29	29		
Dibamus	50	50		
Bipes	50	50		
Trogonophis_wiegmanni	50	50		
Geocalamus	50	50		
Typhlops	50	50		
Najash	25	25		
Dinilysia	29	29		
Haasiophis	25	25		
Pachyrhachis	25	25		
Boa_constrictor	50	50		
Boa_imperator	50	50		
Python_molurus	50	50		
Vipera_aspis	50	50		
Vipera_berus	50	50		
Cerastes_vipera	50	50		
Bothrops	50	50		
Lachesis	50	50		
Agkistrodon_piscovoris	50	50		
Crotalus	50	50		
Naja_melanoleuca	50	50		
Ptyas	50	50		
Coluber_constrictor	50	50		
Coluber_viridiflavus	50	50		
Chironius	50	50		

Sonora	50	50
Zamenis_viridis	50	50
Elaphe_longissima	50	50
Coronella_girondica	50	50
Pituophis	50	50
Lampropeltis	50	50
Thamnophis_sirtalis	50	50
Natrix_natrix	50	50
Natrix_maura	50	50

Aves (time interval ranges)

taxon	first_int	last_int
Abroscopus_albogularis	50	50
Acanthagenys_rufogularis	50	50
Acanthiza_chrysorrhoa	50	50
Acanthiza_ewingii	50	50
Acanthiza_inornata	50	50
Acanthiza_lineata	50	50
Acanthiza_nana	50	50
Acanthiza_pusilla	50	50
Acanthiza_reguloides	50	50
Acanthiza_uropygialis	50	50
Acanthorhynchus_tenuirostris	50	50
Accipiter_cirrocephalus	50	50
Accipiter_cooperii	50	50
Accipiter_gentilis	50	50
Accipiter_haplochrous	50	50
Accipiter_nisus	50	50
Accipiter_novaehollandiae	50	50
Accipiter_striatus	50	50
Aceros_leucocephalus	50	50
Aceros_plicatus	50	50
Aceros_undulatus	50	50
Acridotheres_tristis	50	50
Acrocephalus_arundinaceus	50	50
Acrocephalus_schoenobaenus	50	50
Acrocephalus_scirpaceus	50	50
Acryllium_vulturinum	50	50
Actitis_hypoleucos	50	50
Actitis_macularius	50	50
Aechmophorus_occidentalis	50	50
Aegithalos_caudatus	50	50
Aegithalos_concinnus	50	50
Aegithina_tiphia	50	50
Aegolius_acadicus	50	50
Aegolius_funereus	50	50
Aegotheles_cristatus	50	50
Aegypius_monachus	50	50
Aegypius_tracheliotus	50	50

Aeronautes_saxatilis	50	50
Aethia_pusilla	50	50
Aethopyga_nipalensis	50	50
Agapornis_cana	50	50
Agapornis_fischeri	50	50
Agapornis_lilianae	50	50
Agapornis_personatus	50	50
Agapornis_pullaria	50	50
Agapornis_roseicollis	50	50
Agapornis_swinderiana	50	50
Agapornis_taranta	50	50
Agelaioides_badius	50	50
Agelaius_phoeniceus	50	50
Ailuroedus_crassirostris	50	50
Ailuroedus_melanotis	50	50
Aimophila_cassinii	50	50
Aix_galericulata	50	50
Aix_sponsa	50	50
Alauda_arvensis	50	50
Alca_torda	50	50
Alcedo_atthis	50	50
Alcedo_azurea	50	50
Alcippe_nipalensis	50	50
Alectoris_chukar	50	50
Alectura_lathami	50	50
Alethe_diademata	50	50
Alisterus_scapularis	50	50
Alle_alle	50	50
Alopochen_aegyptiacus	50	50
Amadina_fasciata	50	50
Amalocichla_incerta	50	50
Amandava_amandava	50	50
Amaurolimnas_concolor	50	50
Amaurornis_flavirostra	50	50
Amaurornis_olivacea	50	50
Amaurornis_phoenicurus	50	50
Amazilia_tzacatl	50	50
Amazona_aestiva	50	50
Amazona_albifrons	50	50
Amazona_amazonica	50	50
Amazona_auropalliata	50	50
Amazona_autumnalis	50	50
Amazona_farinosa	50	50
Amazona_leucocephala	50	50
Amazona_oratrix	50	50
Amazona_ventralis	50	50
Amazona_versicolor	50	50
Amazona_vinacea	50	50
Amazona_viridigenalis	50	50
Amazona_vittata	50	50

Amazonetta_brasiliensis	50	50		
Amblycercus_holosericeus		50	50	
Amblyornis_macgregoriae		50	50	
Amblyramphus_holosericeus		50	50	
Ammodramus_sandwichensis		50	50	
Ammodramus_savannarum		50	50	
Amphispiza_bilineata	50	50		
Amytornis_goyderi	50	50		
Anas_acuta	50	50		
Anas_americana	50	50		
Anas_carolinensis	50	50		
Anas_castanea	50	50		
Anas_clypeata	50	50		
Anas_crecca	50	50		
Anas_cyanoptera	50	50		
Anas_discors	50	50		
Anas_flavirostris	50	50		
Anas_hottentota	50	50		
Anas_laysanensis	50	50		
Anas_penelope	50	50		
Anas_platalea	50	50		
Anas_platyrhynchos		50	50	
Anas_rhynchotis	50	50		
Anas_smithii	50	50		
Anas_strepera	50	50		
Anas_superciliosa	50	50		
Anas_veriscolor	50	50		
Anastomus_lamelligerus	50	50		
Andigena_hypoglauca	50	50		
Anhinga_melanogaster	50	50		
Anisognathus_flavinuchus		50	50	
Anodorhynchus_hyacinthus		50	50	
Anous_cerulea	50	50		
Anous_stolidus	50	50		
Anser_albifrons	50	50		
Anser_anser	50	50		
Anser_fabalis	50	50		
Anser_rossii	50	50		
Anseranas_semipalmata	50	50		
Anthochaera_carunculata	50	50		
Anthochaera_chrysoptera	50	50		
Anthochaera_phrygia	50	50		
Anthracoceros_coronatus	50	50		
Anthracothorax_dominicus		50	50	
Anthreptes_malacensis	50	50		
Anthus_novaeseelandiae	50	50		
Anthus_pratensis	50	50		
Anthus_trivialis	50	50		
Antigone_antigone	50	50		
Anumbius_annumbi	50	50		

Aphelocephala_leucopsis	50	50	
Aphelocephala_nigricincta		50	50
Aphelocoma_coerulescens		50	50
Aphelocoma_ultramarina	50	50	
Aphrastura_spinicauda	50	50	
Aplonis_metallica	50	50	
Aprosmictus_erythropterus		50	50
Aptenodytes_forsteri	50	50	
Aptenodytes_patagonicus	50	50	
Apteryx_australis	50	50	
Apteryx_haastii	50	50	
Apus_apus	50	50	
Apus_pallidus	50	50	
Aquila_audax	50	50	
Aquila_chrysaetos	50	50	
Aquila_fasciatus	50	50	
Aquila_rapax	50	50	
Ara_ararauna	50	50	
Ara_chloroptera	50	50	
Ara_macao	50	50	
Ara_militaris	50	50	
Arachnothera_longirostra	50	50	
Aramides_cajanea	50	50	
Aramides_ypecaha	50	50	
Aramus_guarauna	50	50	
Aratinga_aurea	50	50	
Aratinga_canicularis		50	50
Aratinga_finschii	50	50	
Aratinga_holochlora		50	50
Aratinga_leucopthalmus		50	50
Aratinga_nana	50	50	
Aratinga_pertinax	50	50	
Aratinga_solstitialis		50	50
Aratinga_weddellii		50	50
Archilochus_colubris		50	50
Ardea_alba	50	50	
Ardea_cinerea	50	50	
Ardea_intermedia	50	50	
Ardeotis_australis	50	50	
Arenaria_interpres	50	50	
Arenaria_melanocephala		50	50
Argusianus_argus	50	50	
Arremon_aurantiirostris		50	50
Arremon_brunneinucha		50	50
Arremonops_conirostris		50	50
Arses_telescophthalmus		50	50
Artamus_cinereus	50	50	
Artamus_cyanopterus		50	50
Artamus_leucorhynchus		50	50
Artamus_maximus	50	50	

Artamus_minor	50	50	
Artamus_personatus	50	50	
Artamus_superciliosus	50	50	
Ashbyia_lovensis	50	50	
Asio_capensis	50	50	
Asio_flammeus	50	50	
Asio_otus	50	50	
Athene_cunicularia	50	50	
Athene_noctua	50	50	
Attila_spadiceus	50	50	
Aulacorhynchus_sulcatus	50	50	
Auriparus_flaviceps	50	50	
Automolus_infuscatus	50	50	
Automolus_ochrolaemus	50	50	
Aviceda_subcristata	50	50	
Aythya_affinis	50	50	
Aythya_americana	50	50	
Aythya_australis	50	50	
Aythya_marila	50	50	
Baeolophus_bicolor	50	50	
Balaeniceps_rex	50	50	
Balearica_pavonina	50	50	
Bambusicola_thoracicus	50	50	
Barnardius_zonarius	50	50	
Bartramia_longicauda	50	50	
Baryphthengus_ruficapillus	50	50	
Basileuterus_culcivorus	50	50	
Batis_capensis	50	50	
Berenicornis_albocristatus	50	50	
Bias_musicus	50	50	
Biziura_lobata	50	50	
Bolbopsittacus_lunulatus	50	50	
Bolborhynchus_lineola	50	50	
Bombycilla_cedorum	50	50	
Bombycilla_garrulus	50	50	
Bonasa_umbellus	50	50	
Bostrychia_hagadesh	50	50	
Botaurus_stellaris	50	50	
Brachygalba_lugubris	50	50	
Jacamerops_aureus	50	50	
Brachypteryx_montana	50	50	
Brachyramphus_marmoratum	50	50	
Branta_bernicla	50	50	
Branta_canadensis	50	50	
Brotogeris_chrysopterus	50	50	
Brotogeris_jugularis	50	50	
Brotogeris_versicolurus	50	50	
Bubalornis_albirostris	50	50	
Bubo_africanus	50	50	
Bubo_bubo	50	50	

Bubo_scandiacus	50	50		
Bubo_virginianus	50	50		
Bubulcus_ibis	50	50		
Bucephala_albeola	50	50		
Bucephala_clangula		50	50	
Bucephala_islandica		50	50	
Buceros_bicornis	50	50		
Buceros_hydrocorax		50	50	
Buceros_rhinoceros		50	50	
Bucorvus_abyssinicus		50	50	
Bucorvus_leadbeateri		50	50	
Bulweria_bulwerii	50	50		
Burhinus_bistriatus		50	50	
Burhinus_grallarius		50	50	
Busarellus_nigricollis		50	50	
Buteo_buteo	50	50		
Buteo_jamaicensis	50	50		
Buteo_lagopus	50	50		
Buteo_lineatus	50	50		
Buteo_magnirostris		50	50	
Buteo_platypterus	50	50		
Buteo_polysoma	50	50		
Buteo_regalis	50	50		
Buteo_swainsoni	50	50		
Buteogallus_anthracinus		50	50	
Buteogallus_urabatinga		50	50	
Butorides_striata	50	50		
Bycanistes_cylindricus		50	50	
Cacatua_alba	50	50		
Cacatua_galerita	50	50		
Cacatua_haematuropygia		50	50	
Cacatua_leadbeateri		50	50	
Cacatua_moluccensis		50	50	
Cacatua_pastinator	50	50		
Cacatua_roseicapilla		50	50	
Cacatua_sanguinea		50	50	
Cacatua_sulphurea	50	50		
Cacicus_cela	50	50		
Cacomantis_castaneiventris			50	50
Cacomantis_flabelliformis			50	50
Cacomantis_variolosus		50	50	
Cairina_moschata	50	50		
Calamanthus_fuliginosus		50	50	
Calamospiza_melanocorys			50	50
Calandrella_cinerea		50	50	
Calcarius_lapponica		50	50	
Calidris_acuminata		50	50	
Calidris_alba	50	50		
Calidris_alpina	50	50		
Calidris_bairdii	50	50		

Calidris_canutus	50	50		
Calidris_falcinellus		50	50	
Calidris_ferruginea		50	50	
Calidris_fuscicollis		50	50	
Calidris_himantopus		50	50	
Calidris_mauri	50	50		
Calidris_melanotos		50	50	
Calidris_minuta	50	50		
Calidris_minutilla	50	50		
Calidris_pugnax	50	50		
Calidris_pusilla	50	50		
Calidris_ruficollis	50	50		
Calidris_subminuta		50	50	
Calidris_subruficollis		50	50	
Calidris_tenuirostris		50	50	
Callipepla_californica		50	50	
Callipepla_gambelii		50	50	
Callocephalon_fimbriatum			50	50
Caloenas_nicobarica		50	50	
Calonectris_diomedea		50	50	
Calonetta_leucophrys		50	50	
Calorhamphus_fuliginosus			50	50
Calyptorhynchus_banksii		50	50	
Calyptorhynchus_baudinii		50	50	
Calyptorhynchus_funereus			50	50
Calyptorhynchus_lathamii		50	50	
Calyptorhynchus_latirostris			50	50
Campephaga_phoenicea		50	50	
Campephilus_guatemalensis			50	50
Campethera_nivosa		50	50	
Camptostoma_obsoletum		50	50	
Campylopterus_largipennis			50	50
Campylorhamphus_pusillus			50	50
Campylorhynchus_bruneicapillus			50	50
Campylorhynchus_griseus			50	50
Capito_niger	50	50		
Caprimulgus_carolinensis		50	50	
Caprimulgus_europaeus		50	50	
Caprimulgus_macrurus		50	50	
Caprimulgus_vexillarius		50	50	
Caprimulgus_vociferus		50	50	
Caracara_cheriway		50	50	
Caracara_plancus	50	50		
Cardellina_rubrifrons		50	50	
Cardinalis_cardinalis		50	50	
Carduelis_carduelis		50	50	
Carduelis_flammea		50	50	
Carduelis_pinus	50	50		
Carduelis_spinus	50	50		
Carduelis_tristis	50	50		

Cariama_cristata	50	50		
Carpodacus_mexicanus	50	50		
Carpodacus_purpureus	50	50		
Caryothraustes_poliogaster		50	50	
Casuarius_casuarius	50	50		
Cathartes_aura	50	50		
Catharus_fuscescens	50	50		
Celeus_castaneus	50	50		
Centrocercus_urophasianus		50	50	
Centropus_bengalensis	50	50		
Centropus_phasianinus	50	50		
Cepphus_grylle	50	50		
Cercomacra_nigrescens	50	50		
Cercomacra_tyrannina	50	50		
Cercotrichas_coryphaeus	50	50		
Cereopsis_novaehollandiae		50	50	
Cerorhinca_monocerata	50	50		
Certhia_familiaris	50	50		
Certhiaxis_cinnamomea	50	50		
Certhionyx_niger	50	50		
Certhionyx_variegatus	50	50		
Ceryle_rudis	50	50		
Ceuthmochares_aereus	50	50		
Ceyx_lepidus	50	50		
Chaetura_pelagica	50	50		
Chalcophaps_indica	50	50		
Chalcophaps_stephani	50	50		
Chamaea_fasciata	50	50		
Charadrius_alexandrinus	50	50		
Charadrius_australis	50	50		
Charadrius_bicinctus	50	50		
Charadrius_falklandicus	50	50		
Charadrius_leschenaultii	50	50		
Charadrius_melodus	50	50		
Charadrius_modestus	50	50		
Charadrius_mongolus	50	50		
Charadrius_pecuaurius	50	50		
Charadrius_ruficapillus	50	50		
Charadrius_semipalmatus	50	50		
Charadrius_tricollaris	50	50		
Charadrius_vociferus	50	50		
Charadrius_wilsonia	50	50		
Charmosyna_papou	50	50		
Charmosyna_pulchella	50	50		
Chauna_chavaria	50	50		
Chenonetta_jubata	50	50		
Cheramoeca_leucosterna	50	50		
Chersomanes_albofasciata		50	50	
Chionis_albus	50	50		
Chionis_minor	50	50		

Chiroxiphia_caudata	50	50	
Chiroxiphia_linearis	50	50	
Chlamydera_maculata	50	50	
Chlamydera_nuchalis	50	50	
Chlidonias_hybrida	50	50	
Chloephaga_poliocephala	50	50	
Chloroceryle_amazona	50	50	
Chloroceryle_americana	50	50	
Chlorocichla_flavicollis	50	50	
Chlorophonia_cyanea	50	50	
Chloropsis_palawanensis	50	50	
Chlorospingus_ophthalmicus	50	50	
Chlorospingus_pileatus	50	50	
Chlorostilbon_ricordii	50	50	
Chlorothraupis_carmioli	50	50	
Chordeiles_minor	50	50	
Chordeiles_nacunda	50	50	
Chrysococcyx_basalis	50	50	
Chrysococcyx_caprius	50	50	
Chrysococcyx_lucidus	50	50	
Chrysococcyx_minutillus	50	50	
Chrysococcyx_osculans	50	50	
Chrysocolaptes_lucidus	50	50	
Chrysolophus_amherstiae	50	50	
Chrysolophus_pictus	50	50	
Cicinnurus_regius	50	50	
Ciconia_abdimi	50	50	
Ciconia_ciconia	50	50	
Cinclidium_leucurum	50	50	
Cinclodes_fuscus	50	50	
Cinclodes_patagonicus	50	50	
Cincloramphus_cruralis	50	50	
Cincloramphus_mathewsi	50	50	
Cinclosoma_cinnamomeum	50	50	
Cinclosoma_punctatum	50	50	
Cinclus_cinclus	50	50	
Cinclus_mexicanus	50	50	
Cinnyricinclus_leucogaster	50	50	
Circus_aeruginosus	50	50	
Circus_cyaneus	50	50	
Cissa_chinensis	50	50	
Cissopis_leverianus	50	50	
Cisticola_cherina	50	50	
Cisticola_exilis	50	50	
Cisticola_fulvicapilla	50	50	
Cistothorus_palustris	50	50	
Cladorhynchus_leucocephalus	50	50	
Clamator_glandarius	50	50	
Clangula_hyemalis	50	50	
Claravis_pretiosa	50	50	

Climacteris_melanurus	50	50	
Climacteris_picumnus	50	50	
Climacteris_rufus	50	50	
Clytorhynchus_pachycephaloides	50	50	
Cnemotriccus_fuscatus	50	50	
Coccothraustes_vespertinus	50	50	
Coccyzus_americanus	50	50	
Coccyzus_erythropthalmus	50	50	
Coccyzus_vetula	50	50	
Coereba_flaveola	50	50	
Colaptes_auratus	50	50	
Colinus_virginianus	50	50	
Colius_striatus	50	50	
Collocalia_esculenta	50	50	
Collocalia_spodiopygia	50	50	
Colluricincla_harmonica	50	50	
Colluricincla_megarhyncha	50	50	
Colonia_colonus	50	50	
Columba_arquatrix	50	50	
Columba_guinea	50	50	
Columba_leucomela	50	50	
Columba_livia	50	50	
Columba_palumbus	50	50	
Columba_speciosa	50	50	
Columba_vitiensis	50	50	
Columbina_inca	50	50	
Columbina_minuta	50	50	
Columbina_passerina	50	50	
Columbina_picui	50	50	
Columbina_talpacoti	50	50	
Conopophaga_lineata	50	50	
Conopophila_albogularis	50	50	
Conopophila_rufogularis	50	50	
Contopus_cooperi	50	50	
Contopus_latirostris	50	50	
Contopus_virens	50	50	
Copsychus_saularis	50	50	
Coracias_caudata	50	50	
Coracias_garrulus	50	50	
Coracina_caledonica	50	50	
Coracina_maxima	50	50	
Coracina_novaehollandiae	50	50	
Coracina_papuensis	50	50	
Coracina_tenuirostris	50	50	
Coragyps_atratus	50	50	
Corcorax_melanorhamphos	50	50	
Cormobates_leucophaea	50	50	
Corvus_albus	50	50	
Corvus_bennetti	50	50	
Corvus_brachyrhynchos	50	50	

Corvus_caurinus	50	50		
Corvus_corax	50	50		
Corvus_corone	50	50		
Corvus_coronoides		50	50	
Corvus_cryptoleucus		50	50	
Corvus_dauuricus	50	50		
Corvus_frugilegus	50	50		
Corvus_mellori	50	50		
Corvus_monedula	50	50		
Corvus_moneduloides		50	50	
Corvus_orru	50	50		
Corvus_ossifragus	50	50		
Corydon_sumatranus		50	50	
Coryphistera_alaudina		50	50	
Coryphospingus_cucullatus			50	50
Corythaixoides_concolor		50	50	
Coscoroba_coscoroba		50	50	
Cossypha_caffra	50	50		
Coturnicops_noveboracensis			50	50
Coturnix_coturnix	50	50		
Cracticus_nigrogularis		50	50	
Cracticus_quoyi	50	50		
Cracticus_torquatus		50	50	
Crateroscelis_nigrorufa		50	50	
Crax_rubra	50	50		
Crex_crex	50	50		
Crinifer_piscator	50	50		
Criniger_pallidus	50	50		
Crossoptilon_crossoptilon		50	50	
Crotophaga_ani	50	50		
Crypturellus_boucardi		50	50	
Crypturellus_soui	50	50		
Crypturellus_tataupa		50	50	
Cuculus_canorus	50	50		
Cuculus_pallidus	50	50		
Cuculus_saturatus	50	50		
Culicicapa_helianthea		50	50	
Curaeus_curaeus	50	50		
Cursorius_cursor	50	50		
Cyanerpes_cyaneus		50	50	
Cyanocitta_cristata		50	50	
Cyanocitta_stelleri	50	50		
Cyanocorax_affinis		50	50	
Cyanoramphus_auriceps	50	50		
Cyanoramphus_novaezelandiae		50	50	
Cyanoramphus_unicolor	50	50		
Cyclarhis_gujanensis		50	50	
Cyclopsitta_diophthalma	50	50		
Cygnus_atratus	50	50		
Cygnus_columbianus		50	50	

Cygnus_cygnus	50	50		
Cygnus_olor	50	50		
Cymbilaimus_lineatus	50	50		
Cyornis_rubeculoides	50	50		
Cyphorhinus_arada	50	50		
Cypsiurus_parvus	50	50		
Cyrtonyx_montezumae	50	50		
Dacelo_leachii	50	50		
Dacelo_novaeguineae	50	50		
Dacnis_cayana	50	50		
Daphoenositta_chrysoptera	50	50		
Daption_capense	50	50		
Daptrius_ater	50	50		
Dasyornis_brachypterus	50	50		
Dasyornis_broadbenti	50	50		
Delichon_urbica	50	50		
Dendragapus_canadensis	50	50		
Dendragapus_obscurus	50	50		
Dendrocincla_fuliginosa	50	50		
Dendrocolaptes_certhia	50	50		
Dendrocopos_major	50	50		
Dendrocopos_medius	50	50		
Dendrocygna_arcuata	50	50		
Dendrocygna_eytoni	50	50		
Dendropicos_fuscescens	50	50		
Dendroplex_picus	50	50		
Deroptyus_accipitrinus	50	50		
Dicaeum_aeruginosum	50	50		
Dicaeum_hirundinaceum	50	50		
Dicrurus_hottentotus	50	50		
Dinopium_javanense	50	50		
Diomedea_cauta	50	50		
Diomedea_chrysostoma	50	50		
Diomedea_exulans	50	50		
Diomedea_melanophrys	50	50		
Diomedea_nigripes	50	50		
Diopsittaca_nobilis	50	50		
Diuca_diuca	50	50		
Dives_dives	50	50		
Dolichonyx_oryzivorus	50	50		
Donacobius_atricapillus	50	50		
Dromaius_novaehollandiae	50	50		
Drymodes_brunneopygia	50	50		
Dryocopus_pileatus	50	50		
Dryoscopus_cubla	50	50		
Ducula_aenea	50	50		
Ducula_bicolor	50	50		
Ducula_goliath	50	50		
Ducula_melanochroa	50	50		
Ducula_pacifica	50	50		

Dulus_dominicus	50	50		
Dumetella_carolinensis	50	50		
Dysithamnus_mentalis	50	50		
Eclectus_roratus	50	50		
Egretta_garzetta	50	50		
Egretta_novaehollandiae	50	50		
Elaenia_frantzii	50	50		
Elaenia_martinica	50	50		
Elanus_axillaris	50	50		
Elseyornis_melanops	50	50		
Emberiza_hortulana	50	50		
Emberiza_spodocephala	50	50		
Empidonax_minimus	50	50		
Empidonax_virescens	50	50		
Enicurus_scouleri	50	50		
Entomyzon_cyanotis	50	50		
Eopsaltria_australis	50	50		
Eopsaltria_georgiana	50	50		
Eopsaltria_griseogularis	50	50		
Eos_bornea	50	50		
Eos_cyanogenia	50	50		
Eos_squamata	50	50		
Epinecrophylla_fulviventris		50	50	
Epthianura_aurifrons	50	50		
Epthianura_tricolor	50	50		
Eremophila_alpestris	50	50		
Erithacus_megarhyncha	50	50		
Erithacus_rubecula	50	50		
Erythrogonys_cinctus	50	50		
Erythrura_gouldiae	50	50		
Erythrura_trichroa	50	50		
Esacus_magnirostris	50	50		
Estrilda_caerulescens	50	50		
Estrilda_melpoda	50	50		
Eudocimus_albus	50	50		
Eudromia_elegans	50	50		
Eudynamys_scolopaceus	50	50		
Eudynamys_taitensis	50	50		
Eudyptes_chrysocome	50	50		
Eudyptula_minor	50	50		
Eulampis_holosericeus	50	50		
Eulampis_jugularis	50	50		
Euneornis_campestris	50	50		
Eunymphicus_cornutus	50	50		
Euphagus_carolinus	50	50		
Euphagus_cyanocephalus	50	50		
Euphonia_jamaica	50	50		
Euplectes_orix	50	50		
Eupodotis_denhami	50	50		
Eurostopodus_argus	50	50		

Eurostopodus_macrotis	50	50
Eurostopodus_mystacialis	50	50
Eurypyga_helias	50	50
Eurystomus_orientalis	50	50
Excalfactoria_chinensis	50	50
Falco_berigora	50	50
Falco_cenchroides	50	50
Falco_columbarius	50	50
Falco_eleonorae	50	50
Falco_longipennis	50	50
Falco_mexicanus	50	50
Falco_moluccensis	50	50
Falco_naumanni	50	50
Falco_peregrinus	50	50
Falco_rufigularis	50	50
Falco_sparverius	50	50
Falco_subbuteo	50	50
Falco_subniger	50	50
Falco_tinnunculus	50	50
Falco_vespertinus	50	50
Falcunculus_frontatus	50	50
Ficedula_albicollis	50	50
Florisuga_mellivora	50	50
Formicarius_analis	50	50
Formicarius_colma	50	50
Formicivora_grisea	50	50
Forpus_coelestis	50	50
Forpus_passerinus	50	50
Foudia_madagascariensis	50	50
Francolinus_leucoscepus	50	50
Francolinus_sephaena	50	50
Fratercula_arctica	50	50
Fratercula_corniculata	50	50
Fregata_aquila	50	50
Fregata_minor	50	50
Fregetta_grallaria	50	50
Fringilla_coelebs	50	50
Fulica_americana	50	50
Fulica_atra	50	50
Fulmarus_glacialis	50	50
Fulmarus_glacialoides	50	50
Furnarius_rufus	50	50
Galerida_cristata	50	50
Gallicolumba_beccarii	50	50
Gallicolumba_luzonica	50	50
Gallicrex_cinerea	50	50
Gallinago_gallinago	50	50
Gallinago_hardwickii	50	50
Gallinago_nobilis	50	50
Gallinago_undulata	50	50

Gallinula_chloropus	50	50	
Gallinula_melanops	50	50	
Gallinula_tenebrosa	50	50	
Gallinula_ventralis	50	50	
Gallirallus_australis	50	50	
Gallirallus_owstoni	50	50	
Gallirallus_phillippensis	50	50	
Gallus_gallus	50	50	
Garrulus_glandarius	50	50	
Gavia_immer	50	50	
Gavia_stellata	50	50	
Geococcyx_californianus	50	50	
Geopelia_cuneata	50	50	
Geopelia_humeralis	50	50	
Geopelia_placida	50	50	
Geopelia_striata	50	50	
Geophaps_plumifera	50	50	
Geophaps_smithii	50	50	
Geositta_cunicularia	50	50	
Geothlypis_trichas	50	50	
Geotrygon_chrysia	50	50	
Geotrygon_costaricensis	50	50	
Geotrygon_montana	50	50	
Gerygone_flavolateralis	50	50	
Gerygone_hypoxantha	50	50	
Glareola_nuchalis	50	50	
Glaucidium_brasilianum	50	50	
Glaucidium_gnoma	50	50	
Glaucidium_passerinum	50	50	
Glaucis_hirsutus	50	50	
Glossopsitta_concinna	50	50	
Glossopsitta_porphyrocephala	50	50	
Glossopsitta_pusilla	50	50	
Glyphorynchus_spirurus	50	50	
Gnorimopsar_chopi	50	50	
Goura_coronota	50	50	
Goura_victoria	50	50	
Gracula_religiosa	50	50	
Grallaria_quitensis	50	50	
Grallina_bruijni	50	50	
Grallina_cyanoleuca	50	50	
Grantiella_picta	50	50	
Grus_canadensis	50	50	
Grus_rubicunda	50	50	
Grus_virgo	50	50	
Guaruba_guarouba	50	50	
Guira_guira	50	50	
Guttera_edouardi	50	50	
Gygis_alba	50	50	
Gymnocichla_nudipes	50	50	

Gymnoderus_foetidus	50	50	
Gymnophaps_albertisii	50	50	
Gymnopithys_leucaspis	50	50	
Gymnorhina_tibicen	50	50	
Gymnorhinus_cyanocephalus	50	50	
Gypohierax_angolensis	50	50	
Gyps_africanus	50	50	
Habia_fuscicauda	50	50	
Habroptila_wallacii	50	50	
Haematopus_ater	50	50	
Haematopus_bachmani	50	50	
Haematopus_leucopodus	50	50	
Haematopus_longirostris	50	50	
Haematopus_ostralegus	50	50	
Haematopus_palliatus	50	50	
Halcyon_leucocephala	50	50	
Halcyon_senegalensis	50	50	
Halcyon_smyrensis	50	50	
Haliaeetus_leucocephalus	50	50	
Haliaeetus_leucogaster	50	50	
Haliaeetus_vocifer	50	50	
Haliastur_indus	50	50	
Haliastur_sphenurus	50	50	
Halobaena_caerulea	50	50	
Harpactes_ardens	50	50	
Harpactes_erythrocephalus	50	50	
Harpagus_bidentatus	50	50	
Helmitheros_vermivorus	50	50	
Hemiphaga_novaeseelandiae	50	50	
Hemiprocne_mystacea	50	50	
Hemithraupis_guira	50	50	
Hemitriccus_margaritaceiventer	50	50	
Henicophaps_albifrons	50	50	
Henicorhina_leucosticta	50	50	
Herpetotheres_cachinnans	50	50	
Heteromyias_albispecularis	50	50	
Heterophasia_melanoleuca	50	50	
Heterospizias_meridionalis	50	50	
Hieraaetus_morphnoides	50	50	
Himantopus_mexicanus	50	50	
Himatione_sanguinea	50	50	
Hippolais_icterina	50	50	
Hirundapus_caudacutus	50	50	
Hirundo_ariel	50	50	
Hirundo_neoxena	50	50	
Hirundo_nigricans	50	50	
Hirundo_rustica	50	50	
Hydrophasianus_chirurgus	50	50	
Hylacola_pyrrhopygia	50	50	
Hylocichla_mustelina	50	50	

Hylophylax_naevius	50	50		
Hylophylax_poecilonota	50	50		
Hymenops_perspicillatus	50	50		
Hypocnemis_cantator	50	50		
Hypothymis_azurea	50	50		
Hypsipetes_phillipinus	50	50		
Icteria_virens	50	50		
Icterus_galbula	50	50		
Icterus_spurius	50	50		
Ictinia_mississippiensis	50	50		
Ifrita_kowaldi	50	50		
Illadopsis_fulvescens	50	50		
Irediparra_gallinacea	50	50		
Irena_puella	50	50		
Iridosornis_rufivertex	50	50		
Ispidina_picta	50	50		
Ithaginis_cruentus	50	50		
Ixoreus_naevius	50	50		
Ixos_philippinus	50	50		
Jabiru_mycteria	50	50		
Jacana_spinosa	50	50		
Junco_hyemalis	50	50		
Jynx_torquilla	50	50		
Kairuku_grebneffi	50	50		
Kaupifalco_monogrammicus	50	50		
Lagonosticta_senegala	50	50		
Lagopus_lagopus	50	50		
Lagopus_muta	50	50		
Lalage_sueurii	50	50		
Lamprotornis_purpureus	50	50		
Laniarius_erythrogaster	50	50		
Lanius_collurio	50	50		
Lanius_cristatus	50	50		
Lanius_ludovicianus	50	50		
Lanius_senator	50	50		
Larus_argentatus	50	50		
Larus_atricilla	50	50		
Larus_californicus	50	50		
Larus_canus	50	50		
Larus_delawarensis	50	50		
Larus_dominicanus	50	50		
Larus_fuscus	50	50		
Larus_glaucescens	50	50		
Larus_hartlaubii	50	50		
Larus_maculipennis	50	50		
Larus_marinua	50	50		
Larus_minutus	50	50		
Larus_novaehollandiae	50	50		
Larus_philadelphia	50	50		
Larus_pipixcan	50	50		

Larus_ridibundus	50	50		
Larus_scoresbii	50	50		
Larus_thayeri	50	50		
Laterallus_albigularis	50	50		
Lathamus_discolor	50	50		
Legatus_leucophaius	50	50		
Leiothrix_lutea	50	50		
Leipoa_ocellata	50	50		
Lepidocolaptes_affinis	50	50		
Lepidocolaptes_souleyetii	50	50		
Leptoptilos_crumeniferus	50	50		
Leptoptilos_dubius	50	50		
Leptotila_cassini	50	50		
Leptotila_jamaicensis	50	50		
Leptotila_plumbeiceps	50	50		
Leptotila_rufaxilla	50	50		
Leptotila_verreauxi	50	50		
Leucopternis_albicollis	50	50		
Leucosarcia_melanoleuca	50	50		
Leucosticte_arctoa	50	50		
Lewinia_pectoralis	50	50		
Lichenostomus_chrysops	50	50		
Lichenostomus_cratitus	50	50		
Lichenostomus_flavescens	50	50		
Lichenostomus_flavus	50	50		
Lichenostomus_frenatus	50	50		
Lichenostomus_hindwoodi	50	50		
Lichenostomus_keartlandi	50	50		
Lichenostomus_leucotis	50	50		
Lichenostomus_melanops	50	50		
Lichenostomus_ornatus	50	50		
Lichenostomus_penicillatus	50	50		
Lichenostomus_unicolor	50	50		
Lichenostomus_virescens	50	50		
Lichmera_indistincta	50	50		
Limnodromus_griseus	50	50		
Limnodromus_scolopaceus	50	50		
Limnothlypis_swainsonii	50	50		
Limosa_fedoa	50	50		
Limosa_haemastica	50	50		
Limosa_lapponica	50	50		
Linaria_cannabina	50	50		
Lipaugus_vociferans	50	50		
Locustella_luscinioides	50	50		
Lonchura_cucullata	50	50		
Lonchura_malacca	50	50		
Lophaetus_occipitalis	50	50		
Lophodytes_cucullatus	50	50		
Lopholaimus_antarcticus	50	50		
Lophonetta_specularoides	50	50		

Lophophorus_impejanus	50	50	
Lophorina_superba	50	50	
Lophura_nycthemera	50	50	
Lophura_swinhoii	50	50	
Loriculus_galgulus	50	50	
Loriculus_phillipensis	50	50	
Lorius_garrulus	50	50	
Lorius_lory	50	50	
Loxia_curvirostra	50	50	
Loxia_leucoptera	50	50	
Loxigilla_violacea	50	50	
Loxipasser_anoxanthus	50	50	
Luscinia_megarhynchos	50	50	
Lybius_torquatus	50	50	
Lycocorax_pyrrhopterus	50	50	
Machetornis_rixosus	50	50	
Macronectes_giganteus	50	50	
Macronus_gularis	50	50	
Macropygia_amboinensis	50	50	
Macropygia_phasianella	50	50	
Malaconotus_cruentus	50	50	
Malacorhynchus_membranaceus	50	50	
Malurus_alboscapulatus	50	50	
Malurus_coronatus	50	50	
Malurus_cyaneus	50	50	
Malurus_elegans	50	50	
Malurus_lamberti	50	50	
Malurus_leucopterus	50	50	
Malurus_melanocephalus	50	50	
Malurus_pulcherrimus	50	50	
Malurus_splendens	50	50	
Manacus_candei	50	50	
Manacus_manacus	50	50	
Manacus_vitellinus	50	50	
Manorina_flavigula	50	50	
Manorina_melanocephala	50	50	
Manorina_melanophrys	50	50	
Margarops_fuscatus	50	50	
Margarops_fuscus	50	50	
Mecocerculus_leucophrys	50	50	
Megaceryle_alcyon	50	50	
Megaceryle_torquata	50	50	
Megalurus_gramineus	50	50	
Megalurus_palustris	50	50	
Megapodius_eremita	50	50	
Megapodius_freycinet	50	50	
Megarynchus_pitangua	50	50	
Megascops_asio	50	50	
Megascops_choliba	50	50	
Megascops_nudipes	50	50	

Melaenornis_silens	50	50	
Melanerpes_carolinus	50	50	
Melanerpes_erythrocephalus		50	50
Melanerpes_formicivorus	50	50	
Melanerpes_lewis	50	50	
Melanerpes_striatus	50	50	
Melanitta_deglandi	50	50	
Melanitta_fusca	50	50	
Melanitta_nigra	50	50	
Melanocharis_striativentris		50	50
Melanocorypha_calandra	50	50	
Melanodryas_cucullatus	50	50	
Melanodryas_vittata	50	50	
Melanoptila_glabirostris	50	50	
Meleagris_gallopavo	50	50	
Melierax_canorus	50	50	
Melilestes_megarhynchus	50	50	
Meliphaga_gracilis	50	50	
Meliphaga_lewinii	50	50	
Meliphaga_notata	50	50	
Melithreptus_albogularis	50	50	
Melithreptus_brevirostris	50	50	
Melithreptus_lunatus	50	50	
Melopsittacus_undulatus	50	50	
Melopyrrha_nigra	50	50	
Melospiza_georgiana	50	50	
Melospiza_melodia	50	50	
Menura_novaehollandiae	50	50	
Mergus_merganser	50	50	
Mergus_serrator	50	50	
Merops_apiaster	50	50	
Merops_orientalis	50	50	
Merops_ornatus	50	50	
Merops_pusillus	50	50	
Micrathene_whitneyi	50	50	
Microeca_fascinans	50	50	
Microeca_flavigaster	50	50	
Microeca_leucophaea	50	50	
Microeca_papuana	50	50	
Microhierax_erythrogenys		50	50
Micropsitta_pusio	50	50	
Milvago_chimango	50	50	
Milvus_migrans	50	50	
Mimus_polyglottus	50	50	
Minla_ignotincta	50	50	
Mionectes_oleagineus	50	50	
Mirafra_javanica	50	50	
Mitrephanes_phaeocercus	50	50	
Mitrospingus_cassinii	50	50	
Mniotilta_varia	50	50	

Molothrus_ater	50	50	
Molothrus_oryzivorus	50	50	
Momotus_momota	50	50	
Monachella_muelleriana	50	50	
Monarcha_guttula	50	50	
Monarcha_melanopsis	50	50	
Monarcha_trivirgatus	50	50	
Monticola_saxatilis	50	50	
Montifringilla_nivalis	50	50	
Morus_serrator	50	50	
Motacilla_alba	50	50	
Motacilla_flava	50	50	
Mulleripicus_fulvus	50	50	
Muscicapa_striata	50	50	
Muscisaxicola_alpinus	50	50	
Myadestes_genibarbis	50	50	
Myadestes_townsendi	50	50	
Mycteria_americana	50	50	
Myiagra_alecto	50	50	
Myiagra_caledonica	50	50	
Myiagra_cyanoleuca	50	50	
Myiagra_inquieta	50	50	
Myiagra_rubecula	50	50	
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Myiarchus_stolidus	50	50	
Myiarchus_tuberculifer	50	50	
Myiarchus_tyrannulus	50	50	
Myiarchus_validus	50	50	
Myiobius_barbatus	50	50	
Myioborus_pictus	50	50	
Myiodynastes_maculatus	50	50	
Myiopagis_cotta	50	50	
Myiophobus_fasciatus	50	50	
Myiothlypis_fulvicauda	50	50	
Myiozetetes_similis	50	50	
Myrmeciza_exsul	50	50	
Myrmeciza_ferruginea	50	50	
Myrmelastes_leucostigma	50	50	
Myrmotherula_axillaris	50	50	
Myzomela_obscura	50	50	
Myzomela_sanguinolenta	50	50	
Nannopsittaca_panychlora	50	50	
Nectarinia_calcostetha	50	50	
Nectarinia_jugularis	50	50	
Nectarinia_olivacea	50	50	
Nectarinia_violacea	50	50	
Neochen_jubata	50	50	
Neochmia_phaethon	50	50	
Neochmia_temporalis	50	50	
Neophema_chrysostoma	50	50	

Neophema_elegans	50	50	
Neophema_pulchella	50	50	
Neophema_splendida	50	50	
Neopsephotus_bourkii	50	50	
Neopsittacus_musschenbroekii	50	50	
Nesospingus_speculiferus	50	50	
Nestor_notabilis	50	50	
Netta_rufina	50	50	
Nicator_chloris	50	50	
Ninox_boobook	50	50	
Ninox_connivens	50	50	
Ninox_jacquinoti	50	50	
Ninox_squamipila	50	50	
Ninox_strenua	50	50	
Northiella_haematogaster	50	50	
Nothoprocta_ornata	50	50	
Nothura_maculosa	50	50	
Notiochelidon_cyanoleuca	50	50	
Numenius_americanus	50	50	
Numenius_madagascariensis	50	50	
Numenius_phaeopus	50	50	
Numida_meleagris	50	50	
Nyctibius_griseus	50	50	
Nycticorax_nycticorax	50	50	
Nyctidromus_albicollis	50	50	
Nyctiphrynus_ocellatus	50	50	
Nyctiprogne_leucopyga	50	50	
Nymphicus_hollandicus	50	50	
Oceanites_oceanicus	50	50	
Oceanodroma_leucorrhoa	50	50	
Oceanodroma_microsoma	50	50	
Oceanodroma_tethys	50	50	
Ocyphaps_lophotes	50	50	
Oedistoma_iliolophum	50	50	
Oena_capensis	50	50	
Oenanthe_oenanthe	50	50	
Onychorhynchus_coronatus	50	50	
Onycognathus_salvadorii	50	50	
Opisthocomus_hoazin	50	50	
Oreocharis_arfaki	50	50	
Oreoica_gutturalis	50	50	
Oreopsittacus_arfaki	50	50	
Oreortyx_pictus	50	50	
Origma_solitaria	50	50	
Oriolus_flavocinctus	50	50	
Oriolus_oriolus	50	50	
Oriolus_sagittatus	50	50	
Ortalis_vetula	50	50	
Orthonyx_temminckii	50	50	
Orthopsittaca_manilata	50	50	

Orthorhynchus_cristatus	50	50		
Oryzoborus_angolensis	50	50		
Otus_bakkamoena	50	50		
Otus_magicus	50	50		
Otus_scops	50	50		
Oxyura_australis	50	50		
Oxyura_jamaicensis	50	50		
Oxyura_maccoa	50	50		
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Pachycephala_pectoralis	50	50		
Pachycephala_rufiventris	50	50		
Pachycephala_rufogularis	50	50		
Pachycephala_simplex	50	50		
Pachycephalopsis_poliosoma	50	50		
Pachydyptes_ponderosus	50	50		
Pachyptila_desolata	50	50		
Pachyptila_belcherii	50	50		
Pachyptila_salvinii	50	50		
Pachyptila_turtur	50	50		
Pachyramphus_cinnamomeus	50	50		
Pachyramphus_niger	50	50		
Pachyramphus_polychopterus	50	50		
Padda_oryzivora	50	50		
Pagodroma_nivea	50	50		
Pagophila_eburnea	50	50		
Pandion_haliaetus	50	50		
Parabuteo_unicinctus	50	50		
Pardalotus_punctatus	50	50		
Pardalotus_striatus	50	50		
Pardirallus_maculatus	50	50		
Paroaria_coronata	50	50		
Parotia_lawesii	50	50		
Parula_americana	50	50		
Parus_caeruleus	50	50		
Parus_major	50	50		
Passer_domesticus	50	50		
Passer_hispaniolensis	50	50		
Passerina_cyanea	50	50		
Pastor_roseus	50	50		
Patagioenas_cayennensis	50	50		
Patagioenas_fasciata	50	50		
Patagioenas_leucocephala	50	50		
Patagioenas_maculosa	50	50		
Patagioenas_picazuro	50	50		
Patagioenas_squamosa	50	50		
Pavo_cristatus	50	50		
Pedionomus_torquatus	50	50		
Pelargopsis_capensis	50	50		
Pelecanoides_georgicus	50	50		
Pelecanoides_urinatrix	50	50		

Pelecanus_conspicillatus	50	50	
Pelecanus_erythrorhynchus		50	50
Pelecanus_occidentalis	50	50	
Pelecanus_onocrotalus	50	50	
Penelope_purpurascens	50	50	
Penelopides_panini	50	50	
Peneothello_cyanus	50	50	
Perdix_perdix	50	50	
Pericrocotus_ethologus	50	50	
Perisoreus_canadensis	50	50	
Perissocephalus_tricolor	50	50	
Petrochelidon_fulva	50	50	
Petroica_goodenovii	50	50	
Petroica_multicolor	50	50	
Petroica_phoenicea	50	50	
Petroica_rodinogaster	50	50	
Petroica_rosea	50	50	
Pezoporus_wallicus	50	50	
Phacellodomus_ruber	50	50	
Phaenicophaeus_curvirostris		50	50
Phaenicophaeus_superciliosus		50	50
Phaenicophaeus_tristis	50	50	
Phaenicophilus_palmarum		50	50
Phaenostictus_macleannani		50	50
Phaeomyias_murina	50	50	
Phaethon_rubricauda	50	50	
Phaethornis_superciliosus	50	50	
Phaetusa_simplex	50	50	
Phainopepla_nitens	50	50	
Phalacrocorax_atriceps	50	50	
Phalacrocorax_carbo	50	50	
Phalacrocorax_fuscescens	50	50	
Phalacrocorax_melanoleucos		50	50
Phalacrocorax_sulcirostris	50	50	
Phalacrocorax_urile	50	50	
Phalacrocorax_varius	50	50	
Phalaropus_fulicaria	50	50	
Phalaropus_lobatus	50	50	
Phalaropus_tricolor	50	50	
Phalcoboenus_australis	50	50	
Phapitreron_amethystinus	50	50	
Phapitreron_leucotis	50	50	
Phaps_chalcoptera	50	50	
Phaps_elegans	50	50	
Phaps_histrionica	50	50	
Pharomachrus_mocinno	50	50	
Phasianus_colchicus	50	50	
Pheucticus_ludovicianus	50	50	
Philemon_argenticeps	50	50	
Philemon_buceroides	50	50	

Philemon_citreogularis	50	50	
Philemon_corniculatus	50	50	
Philemon_diemenensis	50	50	
Philydor_guttulatus	50	50	
Phleocryptes_melanops	50	50	
Phoebetria_palpebrata	50	50	
Phoenicopterus_roseus	50	50	
Phoenicopterus_ruber	50	50	
Phoeniculus_purpureus	50	50	
Phoenicurus_phoenicurus	50	50	
Phrygilus_gramineus	50	50	
Phrygilus_patagonicus	50	50	
Phylidonyris_albifrons	50	50	
Phylidonyris_melanops	50	50	
Phylidonyris_niger	50	50	
Phylidonyris_novaehollandiae	50	50	
Phyllastrephus_terrestris	50	50	
Phylloscopus_bonelli	50	50	
Phylloscopus_sibilatrix	50	50	
Phytotoma_rutila	50	50	
Piaya_cayana	50	50	
Pica_pica	50	50	
Picoides_arcticus	50	50	
Picoides_borealis	50	50	
Picoides_pubescens	50	50	
Picoides_scalaris	50	50	
Picoides_tridactylus	50	50	
Picoides_villosus	50	50	
Piculus_flavigula	50	50	
Picumnus_temminckii	50	50	
Picus_canus	50	50	
Picus_viridus	50	50	
Pinicola_enucleator	50	50	
Pionites_leucogaster	50	50	
Pionites_melanocephalus	50	50	
Pionus_menstruus	50	50	
Pionus_senilis	50	50	
Pipile_pipile	50	50	
Pipilo_erythrophthalmus	50	50	
Pipra_erythrocephala	50	50	
Pipra_fasciicauda	50	50	
Pipra_mentalis	50	50	
Pipra_pipra	50	50	
Piranga_ludoviciana	50	50	
Piranga_rubra	50	50	
Pitangus_sulphuratus	50	50	
Pithys_albifrons	50	50	
Pitohui_dichrous	50	50	
Pitohui_ferrugineus	50	50	
Pitta_brachyura	50	50	

Pitta_maxima	50	50		
Pitta_sordida	50	50		
Pitta_versicolor	50	50		
Platalea_flavipes	50	50		
Platycercus_adscitus		50	50	
Platycercus_caledonicus		50	50	
Platycercus_elegans		50	50	
Platycercus_eximius		50	50	
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Platyrinchus_cancrominus		50	50	
Platyrinchus_mystaceus		50	50	
Platysteira_cyanea	50	50		
Plectrophenax_nivalis		50	50	
Plegadis_chihi	50	50		
Plegadis_falcinellus		50	50	
Plocepasser_mahali		50	50	
Ploceus_cucullatus	50	50		
Pluvialis_apricaria	50	50		
Pluvialis_dominica		50	50	
Pluvialis_fulva	50	50		
Pluvialis_squatarola		50	50	
Podargus_strigoides		50	50	
Podiceps_auritus	50	50		
Podiceps_cristatus	50	50		
Podiceps_grisegena		50	50	
Podiceps_nigricollis		50	50	
Podiceps_ruficollis		50	50	
Podilymbus_podiceps		50	50	
Podoces_hendersoni		50	50	
Poecile_atricapillus		50	50	
Poecile_carolinensis		50	50	
Poecile_gambeli	50	50		
Poecile_hudsonicus		50	50	
Poecilodryas_albonotata		50	50	
Poecilodryas_cerviniventris			50	50
Poecilodryas_placens		50	50	
Poecilodryas_superciliosa		50	50	
Poeoptera_lugubris		50	50	
Poephila_acuticauda		50	50	
Poephila_cincta	50	50		
Poephila_personata		50	50	
Pogoniulus_scolopaceus		50	50	
Poicephalus_gulielmi		50	50	
Poicephalus_meyeri		50	50	
Poicephalus_robustus		50	50	
Poicephalus_senegalus		50	50	
Polihierax_semitorquatus		50	50	
Poliocephalus_poliocephalus			50	50
Polioptila_caerulea		50	50	

Polyboroides_typus	50	50	
Polytelis_alexandrae	50	50	
Polytelis_anthopeplus	50	50	
Pomatorhinus_ruficollis	50	50	
Pomatostomus_halli	50	50	
Pomatostomus_isidorei	50	50	
Pomatostomus_ruficeps	50	50	
Pomatostomus_superciliosus		50	50
Pomatostomus_temporalis	50	50	
Pooecetes_gramineus	50	50	
Poospiza_nigrorufa	50	50	
Porphyrio_martinica	50	50	
Porphyrio_porphyrio	50	50	
Porzana_atra	50	50	
Porzana_carolina	50	50	
Porzana_fluminea	50	50	
Porzana_palmeri	50	50	
Porzana_porzana	50	50	
Primolius_auricollis	50	50	
Prinia_leucopogon	50	50	
Prioniturus_platurus	50	50	
Prionochilus_plateni	50	50	
Prionops_plumatus	50	50	
Priotelus_roseigaster	50	50	
Priotelus_temnurus	50	50	
Probosciger_aterrimus	50	50	
Procellaria_aequinoctialis	50	50	
Procellaria_cinerea	50	50	
Progne_subis	50	50	
Protonotaria_citrea	50	50	
Prunella_modularis	50	50	
Psaltriparus_minimus	50	50	
Psarocolius_montezuma	50	50	
Psephotus_chrysopterygius		50	50
Psephotus_dissimilis	50	50	
Psephotus_haematonotus	50	50	
Psephotus_varius	50	50	
Pseudocolopteryx_flaviventris		50	50
Pseudoleistes_virescens	50	50	
Pseudotriccus_pelzelni	50	50	
Psilopogon_lineatus	50	50	
Psilopogon_pyrolophus	50	50	
Psilopogon_zeylanicus	50	50	
Psilorhinus_morio	50	50	
Psittacula_alexandri	50	50	
Psittacula_columboides	50	50	
Psittacula_cyanocephala	50	50	
Psittacula_eupatria	50	50	
Psittacula_krameri	50	50	
Psittaculirostris_edwardsii	50	50	

Psittacus_erithacus	50	50	
Psitteuteles_versicolor	50	50	
Psophia_crepitans	50	50	
Psophodes_cristatus	50	50	
Psophodes_occidentalis	50	50	
Psophodes_olivaceus	50	50	
Pterocles_bicinctus	50	50	
Pterocles_decoratus	50	50	
Pterodroma_brevirostris	50	50	
Pterodroma_lessonii	50	50	
Pterodroma_macroptera	50	50	
Pteroglossus_aracari	50	50	
Pteroglossus_bailloni	50	50	
Pteroglossus_castanotis	50	50	
Pteroglossus_inscriptus	50	50	
Pteroglossus_torquatus	50	50	
Pteronetta_hartlaubi	50	50	
Pteruthius_flaviscapis	50	50	
Ptilinopus_insularis	50	50	
Ptilinopus_leclancheri	50	50	
Ptilinopus_magnificus	50	50	
Ptilinopus_monacha	50	50	
Ptilinopus_occipitalis	50	50	
Ptilinopus_ornatus	50	50	
Ptilinopus_porphyraceus	50	50	
Ptilinopus_pulchellus	50	50	
Ptilinopus_regina	50	50	
Ptilinopus_rivoli	50	50	
Ptilinopus_superbus	50	50	
Ptilonorhynchus_violaceus	50	50	
Ptiloprora_guisei	50	50	
Ptiloris_magnificus	50	50	
Ptiloris_paradiseus	50	50	
Ptiloris_victoriae	50	50	
Ptychoramphus_aleutica	50	50	
Puffinus_griseus	50	50	
Puffinus_pacificus	50	50	
Puffinus_tenuirostris	50	50	
Pycnonotus_jocosus	50	50	
Pycnonotus_tricolor	50	50	
Pycnoptilus_floccosus	50	50	
Pygoscelis_adeliae	50	50	
Pyriglena_leuconota	50	50	
Pyrilia_caica	50	50	
Pyrilia_haematotis	50	50	
Pyrocephalus_rubinus	50	50	
Pyrrhocorax_pyrrhocorax	50	50	
Pyrrholaemus_brunneus	50	50	
Pyrrholaemus_sagittatus	50	50	
Pyrrhura_frontalis	50	50	

Pyrrhura_melanura		50	50	
Pyrrhura_perlata	50	50		
Pyrrhura_picta	50	50		
Pytilia_melba	50	50		
Querula_purpurata	50	50		
Quiscalus_major	50	50		
Quiscalus_mexicanus		50	50	
Quiscalus_quiscula		50	50	
Rallina_eurizonoides		50	50	
Rallus_aquaticus	50	50		
Rallus_longirostris	50	50		
Ramphastos_sulfuratus		50	50	
Ramphastos_tucanus		50	50	
Ramphastos_vitellinus		50	50	
Ramphocaenus_melanurus			50	50
Ramphocelus_flammigerus			50	50
Ramsayornis_modestus		50	50	
Recurvirostra_americana		50	50	
Recurvirostra_avosetta		50	50	
Recurvirostra_novaehollandiae			50	50
Regulus_calendula	50	50		
Regulus_regulus	50	50		
Regulus_satrapa	50	50		
Reinwardtoena_browni		50	50	
Rhea_americana	50	50		
Rhea_pennata	50	50		
Rhinocrypta_lanceolata		50	50	
Rhipidura_atra	50	50		
Rhipidura_fuliginosa		50	50	
Rhipidura_leucophrys		50	50	
Rhipidura_rufifrons		50	50	
Rhipidura_rufiventris		50	50	
Rhodinocichla_rosea		50	50	
Rhodospingus_cruentus		50	50	
Rhodostethia_rusea		50	50	
Rhynchotus_rufescens		50	50	
Riparia_riparia	50	50		
Rissa_tridactyla	50	50		
Rollandia_rolland	50	50		
Rollulus_rouloul	50	50		
Rostratula_benghalensis		50	50	
Rostrhamus_sociabilis		50	50	
Rupicola_peruviana		50	50	
Rynchops_niger	50	50		
Sagittarius_serpentarius		50	50	
Sakesphorus_luctuosus		50	50	
Salpinctes_obsoletus		50	50	
Saltator_maximus	50	50		
Sarcops_calvus	50	50		
Sarcoramphus_papa		50	50	

Sarkidornis_melanotos	50	50		
Sasia_abnormis	50	50		
Saxicola_torquatus	50	50		
Sayornis_nigricans	50	50		
Sayornis_phoebe	50	50		
Sayornis_saya	50	50		
Scenopoeetes_dentirostris	50	50		
Schiffornis_turdina	50	50		
Schistochlamys_melanopis		50	50	
Sclerurus_mexicanus	50	50		
Scolopax_minor	50	50		
Scopus_umbretta	50	50		
Scytalopus_unicolor	50	50		
Scythrops_novaehollandiae		50	50	
Seiurus_aurocapilla	50	50		
Selasphorus_rufus	50	50		
Selenidera_maculirostris	50	50		
Seleucidis_melanoleuca	50	50		
Semnornis_ramphestinus	50	50		
Sericornis_citreogularis	50	50		
Sericornis_frontalis	50	50		
Sericornis_magnirostra	50	50		
Sericornis_perspicillatus	50	50		
Sericulus_chrysocephalus	50	50		
Serinus_canaris	50	50		
Serinus_flaviventris	50	50		
Setophaga_caerulescens	50	50		
Setophaga_citrina	50	50		
Setophaga_coronata	50	50		
Setophaga_petechia	50	50		
Setophaga_ruticilla	50	50		
Sialia_mexicana	50	50		
Sialia_sialis	50	50		
Sicalis_flaveola	50	50		
Sitta_canadensis	50	50		
Sitta_carolinensis	50	50		
Sitta_europaea	50	50		
Sitta_pygmaea	50	50		
Sittasomus_griseicapillus	50	50		
Smicrornis_brevirostris	50	50		
Smithornis_capensis	50	50		
Somateria_mollissima	50	50		
Somateria_spectabilis	50	50		
Speculanas_specularis	50	50		
Spermophaga_haematina	50	50		
Sphecotheres_viridis	50	50		
Spheniscus_demersus	50	50		
Spheniscus_humboldti	50	50		
Sphyrapicus_nuchalis	50	50		
Sphyrapicus_varius	50	50		

Spilopelia_chinensis		50	50	
Spindalis_zena	50	50		
Spiza_americana	50	50		
Spizella_arborea	50	50		
Sporophila_americana		50	50	
Stachyris_whiteheadi		50	50	
Stagonopleura_guttata		50	50	
Stelgidopteryx_ruficollis		50	50	
Stephanoaetus_coronatus		50	50	
Stercorarius_maccormicki		50	50	
Stercorarius_parasiticus		50	50	
Stercorarius_pomarinus		50	50	
Sterna_albifrons	50	50		
Sterna_aleutica	50	50		
Sterna_bergii	50	50		
Sterna_caspia	50	50		
Sterna_forsteri	50	50		
Sterna_fuscata	50	50		
Sterna_hirundo	50	50		
Sterna_maxima	50	50		
Sterna_trudeaui	50	50		
Stiltia_isabella	50	50		
Strepera_fuliginosa		50	50	
Strepera_graculina	50	50		
Strepera_versicolor		50	50	
Streptopelia_orientalis		50	50	
Streptopelia_risoria		50	50	
Streptopelia_senegalensis		50	50	
Streptopelia_turtur	50	50		
Streptoprocne_zonaris		50	50	
Strigops_habroptilus		50	50	
Strix_aluco	50	50		
Strix_nebulosa	50	50		
Strix_nigrolineata	50	50		
Strix_uralensis	50	50		
Strix_varia	50	50		
Strix_virgata	50	50		
Struthidea_cinerea	50	50		
Struthio_camelus	50	50		
Sturnella_neglecta	50	50		
Sturnus_vulgaris	50	50		
Sula_leucogaster	50	50		
Surnia_ulula	50	50		
Sylvia_atricapilla	50	50		
Sylvia_borin	50	50		
Syma_torotoro	50	50		
Synallaxis_brachyura		50	50	
Syndactyla_guttulata		50	50	
Synthliboramphus_antiquus			50	50
Syrmaticus_reevesi		50	50	

Tachornis_phoenicobia	50	50	
Tachybaptus_novaehollandiae	50	50	
Tachycineta_bicolor	50	50	
Tachycineta_thalassina	50	50	
Tachyeres_leucocephalus	50	50	
Tachyeres_pteneres	50	50	
Tachymarptis_melba	50	50	
Tachyphonus_delatrii	50	50	
Tadorna_radjah	50	50	
Tadorna_tadorna	50	50	
Tadorna_tadornoides	50	50	
Taeniopygia_bichenovii	50	50	
Taeniopygia_guttata	50	50	
Tangara_cyanicollis	50	50	
Tanygnathus_lucionensis	50	50	
Tanygnathus_megalorhynchus	50	50	
Tanysiptera_galatea	50	50	
Tanysiptera_sylvia	50	50	
Taraba_major	50	50	
Tauraco_hartlaubi	50	50	
Tauraco_leucotis	50	50	
Tauraco_persa	50	50	
Tchagra_australis	50	50	
Telophorus_zeylonus	50	50	
Tephrodornis_pondicerianus	50	50	
Terathopius_ecaudatus	50	50	
Terpsiphone_atrocaudata	50	50	
Tersina_viridis	50	50	
Tetrao_tetrix	50	50	
Tetrao_urogallus	50	50	
Thalassoica_antarctica	50	50	
Thalurania_furcata	50	50	
Thamnomanes_caesius	50	50	
Thamnophilus_caerulescens	50	50	
Thamnophilus_punctatus	50	50	
Theristictus_caerulescens	50	50	
Thraupis_episcopus	50	50	
Threnetes_ruckeri	50	50	
Threskiornis_aethiopica	50	50	
Threskiornis_molucca	50	50	
Thryomanes_bewickii	50	50	
Thryothorus_ludovicianus	50	50	
Thryothorus_nigricapillus	50	50	
Tiaris_olivaceus	50	50	
Tinamus_major	50	50	
Tityra_cayana	50	50	
Tityra_semifasciata	50	50	
Tockus_deckeni	50	50	
Tockus_erythrorhynchus	50	50	
Tockus_flavirostris	50	50	

Tockus_nasutus	50	50		
Todiramphus_chloris	50	50		
Todiramphus_macleayii	50	50		
Todiramphus_pyrrhopygia	50	50		
Todiramphus_sanctus	50	50		
Todirostrum_cinereum	50	50		
Todus_mexicanus	50	50		
Todus_subulatus	50	50		
Todus_todus	50	50		
Tolmomyias_sulphurescens	50	50		
Touit_purpuratus	50	50		
Toxorhamphus_poliopterus	50	50		
Toxostoma_curvirostre	50	50		
Toxostoma_rufum	50	50		
Trachyphonus_vaillanti	50	50		
Tragopan_temminckii	50	50		
Tregellasia_capito	50	50		
Tregellasia_leucops	50	50		
Treron_curvirostra	50	50		
Treron_formosae	50	50		
Treron_fulvicollis	50	50		
Treron_pompadora	50	50		
Treron_vernans	50	50		
Trichodere_cockerelli	50	50		
Trichoglossus_chlorolepidotus	50	50		
Trichoglossus_haematodus	50	50		
Trichoglossus_ornatus	50	50		
Tricholaema_leucomelas	50	50		
Trichothraupis_melanops	50	50		
Tringa_brevipes	50	50		
Tringa_cinerea	50	50		
Tringa_flavipes	50	50		
Tringa_glareola	50	50		
Tringa_incana	50	50		
Tringa_melanoleuca	50	50		
Tringa_nebularia	50	50		
Tringa_semipalmatus	50	50		
Tringa_solitaria	50	50		
Tringa_stagnatilis	50	50		
Trochilus_polytmus	50	50		
Troglodytes_aedon	50	50		
Troglodytes_troglodytes	50	50		
Trogon_citreolus	50	50		
Trogon_massena	50	50		
Trogon_melanurus	50	50		
Trogon_violaceus	50	50		
Trogon_viridis	50	50		
Turdoides_jardineii	50	50		
Turdus_ericetorium	50	50		
Turdus_lherminieri	50	50		

Turdus_merula	50	50		
Turdus_migratorius		50	50	
Turdus_philomelos		50	50	
Turnix_pyrrhothorax		50	50	
Turnix_suscitator	50	50		
Turnix_varius	50	50		
Turnix_velox	50	50		
Turtur_brehmeri	50	50		
Turtur_chalcopsilos		50	50	
Turtur_tympanistria		50	50	
Tympanuchus_phasianellus			50	50
Tyrannus_dominicensis		50	50	
Tyrannus_forficata	50	50		
Tyrannus_savana	50	50		
Tyrannus_tyrannus		50	50	
Tyrannus_verticalis		50	50	
Tyto_alba	50	50		
Tyto_capensis	50	50		
Tyto_longimembris		50	50	
Tyto_novaehollandiae		50	50	
Tyto_tenebricosa	50	50		
Upupa_epops	50	50		
Uraeginthus_bengalus		50	50	
Uria_aalge	50	50		
Uria_lomvia	50	50		
Urocolius_indicus	50	50		
Urocolius_macrourus		50	50	
Vanellus_armatus	50	50		
Vanellus_cayanus	50	50		
Vanellus_coronatus		50	50	
Vanellus_miles	50	50		
Vanellus_senegallus		50	50	
Vanellus_tricolor	50	50		
Vanellus_vanellus	50	50		
Vauriella_gularis	50	50		
Veniliornis_passerinus		50	50	
Vermivora_peregrina		50	50	
Vidua_paradisaea	50	50		
Vireo_altiloquus	50	50		
Vireo_griseus	50	50		
Vireo_magister	50	50		
Vireo_olivaceus	50	50		
Volatinia_jacarina	50	50		
Vultur_gryphus	50	50		
Willisornis_poecilinotus		50	50	
Xanthocephalus_xanthocephalus			50	50
Xanthotis_flaviventer		50	50	
Xanthotis_macleayanus		50	50	
Xema_sabini	50	50		
Xenops_minutus	50	50		

Xiphorhynchus_guttatus	50	50	
Xolmis_irupero	50	50	
Xolmis_pyrope	50	50	
Yuhina_diademata	50	50	
Zenaida_asiatica	50	50	
Zenaida_auriculata	50	50	
Zenaida_aurita	50	50	
Zenaida_macroura	50	50	
Zonotrichia_albicollis	50	50	
Zonotrichia_leucophrys	50	50	
Zoothera_heinei	50	50	
Zoothera_lunulata	50	50	
Zoothera_naevia	50	50	
Zosterops_japonicus	50	50	
Zosterops_lateralis	50	50	
Archaeopteryx	18	18	
Jeholornis	23	23	
Confuciusornis	23	23	
Protopteryx	22	22	
Iberomesornis	22	22	
Gobipteryx	28	30	
Concornis	22	22	
Patagopteryx	28	28	
Ichthyornis	27	27	
Hesperornis	29	30	
Aepyornis	50	50	
Anomalopteryx	50	50	
Apetryx_owenii	50	50	
Dinornis	50	50	
Fossil_momotid	41	41	
Miocoracias	40	41	
Mullerornis	50	50	
Paleotodus	38	39	
Palaeeudyptes_gunnari	35	37	
Primobucco	35	36	
Waimanu_tuatahi	32	33	