**SUPPORTING INFORMATION**

**Appendix 1 : Supplementary methods**

*Species data : geographic ranges*

For almost 120 species, we found strong divergences between the online distribution ranges and the ranges in reference bird handbooks (del Hoyo et al. 2018). As it is likely that the online maps were incorrectly coded, we used the maps from the reference books and corrected the online maps. See below the list of species for which maps were corrected :

Acrocephalus dumetorum

Aphrodroma brevirostris

Ardenna bulleri

Ardenna carneipes

Ardenna creatopus

Ardenna gravis

Ardenna grisea

Ardenna pacifica

Ardenna tenuirostris

Bulweria bulwerii

Bulweria fallax

Calonectris diomedea

Calonectris edwardsii

Calonectris leucomelas

Carduelis uropygialis

Daption capense

Diomedea amsterdamensis

Diomedea antipodensis

Diomedea exulans

Elaenia strepera

Epthianura tricolor

Fregata ariel

Fregetta grallaria

Fregetta maoriana

Fulmarus glacialis

Fulmarus glacialoides

Garrodia nereis

Geositta antarctica

Halobaena caerulea

Hippolais caligata

Hirundo spilodera

Hydrobates castro

Hydrobates furcatus

Hydrobates homochroa

Hydrobates leucorhous

Hydrobates markhami

Hydrobates microsoma

Hydrobates monorhis

Hydrobates monteiroi

Hydrobates pelagicus

Hydrobates tethys

Hydrobates tristrami

Hymenops perspicillatus

Luscinia pectoralis

Macronectes giganteus

Macronectes halli

Morus bassanus

Myiagra cyanoleuca

Nesofregetta fuliginosa

Oceanites gracilis

Pachyptila belcheri

Pachyptila crassirostris

Pachyptila desolata

Pachyptila salvini

Pachyptila turtur

Pachyptila vittata

Pagodroma nivea

Pelagodroma marina

Pelecanoides garnotii

Pelecanoides georgicus

Pelecanoides magellani

Pelecanoides urinatrix

Phalacrocorax chalconotus

Phalacrocorax punctatus

Phoebastria albatrus

Phoebastria immutabilis

Phoebastria irrorata

Phoebastria nigripes

Phoebetria palpebrata

Phylloscopus subviridis

Procellaria aequinoctialis

Procellaria cinerea

Procellaria conspicillata

Procellaria parkinsoni

Procellaria westlandica

Pseudobulweria aterrima

Pseudobulweria becki

Pseudobulweria macgillivrayi

Pseudobulweria rostrata

Pterodroma alba

Pterodroma arminjoniana

Pterodroma atrata

Pterodroma axillaris

Pterodroma baraui

Pterodroma brevipes

Pterodroma cahow

Pterodroma cervicalis

Pterodroma cookii

Pterodroma defilippiana

Pterodroma externa

Pterodroma feae

Pterodroma hasitata

Pterodroma heraldica

Pterodroma hypoleuca

Pterodroma incerta

Pterodroma inexpectata

Pterodroma lessonii

Pterodroma leucoptera

Pterodroma longirostris

Pterodroma macroptera

Pterodroma madeira

Pterodroma magentae

Pterodroma mollis

Pterodroma neglecta

Pterodroma nigripennis

Pterodroma phaeopygia

Pterodroma pycrofti

Pterodroma sandwichensis

Pterodroma solandri

Pterodroma ultima

Sula dactylatra

Sula granti

Sula nebouxii

Sula sula

Sylvia deserticola

Sylvia melanothorax

Thalassarche bulleri

Thalassarche cauta

Thalassarche chrysostoma

Thalassarche impavida

Thalassarche melanophris

Thalassarche steadi

Thalassoica antarctica

Tyrannus albogularis

*Species data : species omitted*

As the climatic niche of a single cell may not reflect the climate experienced by narrow-ranging species, we removed species with distributional range smaller than the size of a grid cell. We also removed species without wintering distribution and species considered as possibly extinct. In total, we considered 9819 species out of the 9993 species recognized in Jetz et al. (2012). See below the list of species omitted from the analysis :

Sporophila\_caerulescens

Ramphocelus\_icteronotus

Dacnis\_egregia

Hemispingus\_ochraceus

Hemispingus\_piurae

Hemispingus\_auricularis

Camarhynchus\_pauper

Pinaroloxias\_inornata

Nesospiza\_questi

Nesospiza\_wilkinsi

Calyptophilus\_tertius

Piranga\_lutea

Piranga\_hepatica

Chlorothraupis\_frenata

Amaurospiza\_carrizalensis

Atlapetes\_pallidiceps

Spizella\_pallida

Molothrus\_armenti

Cacicus\_microrhynchus

Cacicus\_leucoramphus

Leucopeza\_semperi

Vermivora\_bachmanii

Melamprosops\_phaeosoma

Carduelis\_hornemanni

Leucosticte\_australis

Psittirostra\_psittacea

Carpodacus\_rodopeplus

Hemignathus\_lucidus

Loxops\_caeruleirostris

Telespiza\_ultima

Paroreomyza\_maculata

Anthus\_longicaudatus

Lagonosticta\_umbrinodorsalis

Pytilia\_lineata

Estrilda\_kandti

Estrilda\_quartinia

Vidua\_orientalis

Foudia\_flavicans

Nectarinia\_tsavoensis

Nectarinia\_stuhlmanni

Nectarinia\_ludovicensis

Dicaeum\_quadricolor

Phoenicurus\_caeruleocephala

Luscinia\_obscura

Luscinia\_ruficeps

Myadestes\_lanaiensis

Stizorhina\_finschi

Speculipastor\_bicolor

Onychognathus\_neumanni

Troglodytes\_tanneri

Malacocincla\_perspicillata

Zosterops\_murphyi

Zosterops\_albogularis

Zosterops\_rotensis

Zosterops\_nehrkorni

Zosterops\_tenuirostris

Rukia\_ruki

Zosterops\_griseovirescens

Apalis\_argentea

Apalis\_alticola

Eremomela\_canescens

Phyllastrephus\_lorenzi

Phylloscopus\_amoenus

Phylloscopus\_emeiensis

Phylloscopus\_nitidus

Phylloscopus\_proregulus

Phylloscopus\_kansuensis

Phylloscopus\_orientalis

Megalurulus\_llaneae

Acrocephalus\_rehsei

Acrocephalus\_rimatarae

Acrocephalus\_familiaris

Acrocephalus\_baeticatus

Acrocephalus\_sorghophilus

Acrocephalus\_rodericanus

Hirundo\_perdita

Hirundo\_striolata

Progne\_sinaloae

Progne\_dominicensis

Progne\_cryptoleuca

Tachycineta\_albiventer

Pseudochelidon\_eurystomina

Eurochelidon\_sirintarae

Alauda\_razae

Heteromirafra\_sidamoensis

Parus\_teneriffae

Parus\_carpi

Mayrornis\_versicolor

Pomarea\_nigra

Pomarea\_dimidiata

Monarcha\_boanensis

Eutrichomyias\_rowleyi

Rhipidura\_malaitae

Corvus\_hawaiiensis

Pica\_hudsonia

Lanius\_meridionalis

Dicrurus\_modestus

Vireo\_caribaeus

Vireo\_gracilirostris

Oriolus\_traillii

Colluricincla\_tenebrosa

Colluricincla\_sanghirensis

Prionops\_rufiventris

Coracina\_newtoni

Xanthomyza\_phrygia

Philemon\_kisserensis

Myzomela\_cineracea

Myzomela\_chermesina

Gerygone\_modesta

Gerygone\_hypoxantha

Cinclodes\_comechingonus

Xenops\_milleri

Dendrocincla\_turdina

Deconychura\_stictolaema

Formicarius\_moniliger

Pithys\_castaneus

Herpsilochmus\_parkeri

Frederickena\_unduligera

Myrmotherula\_fluminensis

Nesotriccus\_ridgwayi

Elaenia\_strepera

Elaenia\_ridleyana

Pachyramphus\_xanthogenys

Cephalopterus\_glabricollis

Charmosyna\_diadema

Cyanoramphus\_forbesi

Cyanopsitta\_spixii

Rhynchopsitta\_pachyrhyncha

Campephilus\_principalis

Campephilus\_imperialis

Todiramphus\_cinnamominus

Otus\_moheliensis

Otus\_insularis

Sterna\_bernsteini

Catharacta\_maccormicki

Numenius\_borealis

Lophornis\_brachylophus

Discosura\_letitiae

Eriocnemis\_godini

Collocalia\_sawtelli

Cypseloides\_cherriei

Aegotheles\_savesi

Caprimulgus\_centralasicus

Caprimulgus\_maculosus

Chordeiles\_gundlachii

Phalacrocorax\_carunculatus

Fregata\_aquila

Pseudobulweria\_aterrima

Puffinus\_huttoni

Pseudobulweria\_macgillivrayi

Puffinus\_bulleri

Procellaria\_westlandica

Procellaria\_conspicillata

Pterodroma\_caribbaea

Pterodroma\_incerta

Oceanites\_maorianus

Oceanites\_oceanicus

Oceanites\_gracilis

Thalassarche\_salvini

Thalassarche\_eremita

Diomedea\_amsterdamensis

Diomedea\_epomophora

Oceanodroma\_hornbyi

Oceanodroma\_monteiroi

Megadyptes\_antipodes

Spheniscus\_demersus

Aptenodytes\_forsteri

Gallinula\_silvestris

Gallirallus\_owstoni

Coccyzus\_ferrugineus

Ptilinopus\_chalcurus

Ducula\_aurorae

Zenaida\_graysoni

Mitu\_mitu

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**Figure**  Quantitative estimation of species’ migration distances from their distribution maps. (a) Schematic representation of the computation method : 5000 points were randomly chosen within the breeding and wintering ranges of each species, allowing to compute 5000x5000 distances between breeding and wintering locations. (b) An example of distribution map from BirdLife International, here the Red-throated Pipit’ *Anthus cervinus* map. For worldwide distributed species only, the Nearctic migration system was separated to the rest of the world considered as an another migration system, and worldwide distributed species known for not following these systems were treated like the others (Newton, 2007) (c) From the obtained distribution of potential migrations distances, we computed the median value as an estimation of median distance of migration for each species (here 7922 kilometers for the Red-throated Pipit). (d) Boxplots comparing the calculated distance of migration with our manually coded distance classes (short, variable, long).