A HISTORY

OF

BRITISH BIRDS,

WITH COLOURED ILLUSTRATIONS

OF THEIR

EGGS.

BY

HENRY SEEBOHM.

PLATES.

LONDON:
PUBLISHED FOR THE AUTHOR BY
R. H. PORTER, 6 TENTERDEN STREET, W.,
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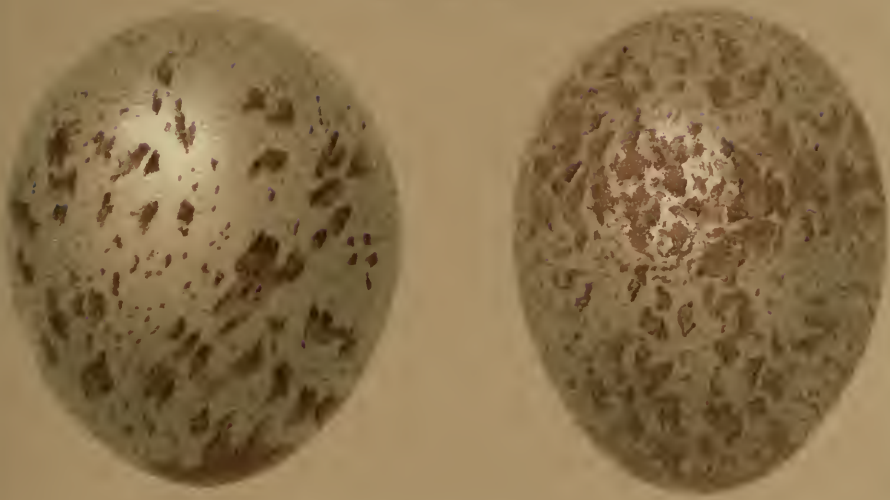
1885.

GRIFFON VULTURE.

EGYPTIAN VULTURE.

Printed by Lemercier Paris.

GOLDEN EAGLE.



SPOTTED EAGLE.

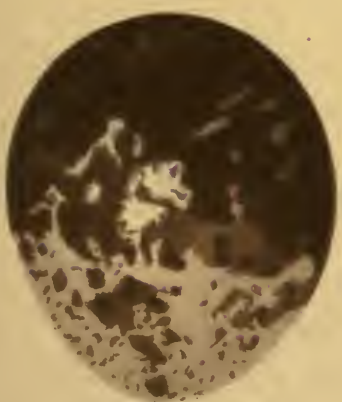
WHITE-TAILED EAGLE.

OSPREY.

OSPREY.

ICELAND FALCON.

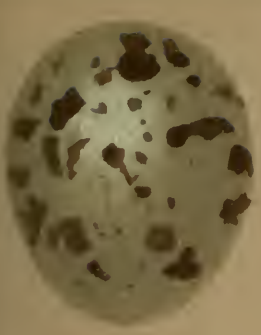
GREENLAND FALCON.

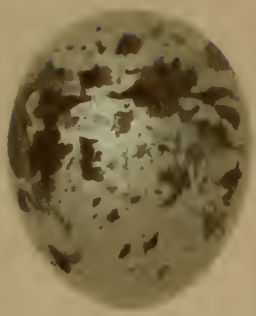


HONEY BUZZARD

PEREGRINE

Printed by Lemercier Paris



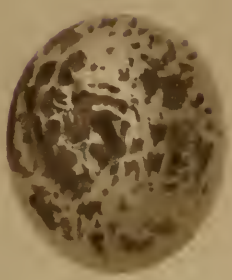


SPARROW HAWK.

KESTREL.

KESTREL.

R. F. FALCON.



LESSER KESTREL.

MERLIN.

HOBBY.

HOBBY.

GOSHAWK

KITE.

C. BUZZARD.

BLACK KITE.

ROUGH-L. BUZZARD.

BLACK KITE.

Printed by Lemercier, Paris.

SWALLOW-TAILED KITE.

SWALLOW-TAILED KITE.

MONTAGU'S HARRIER.

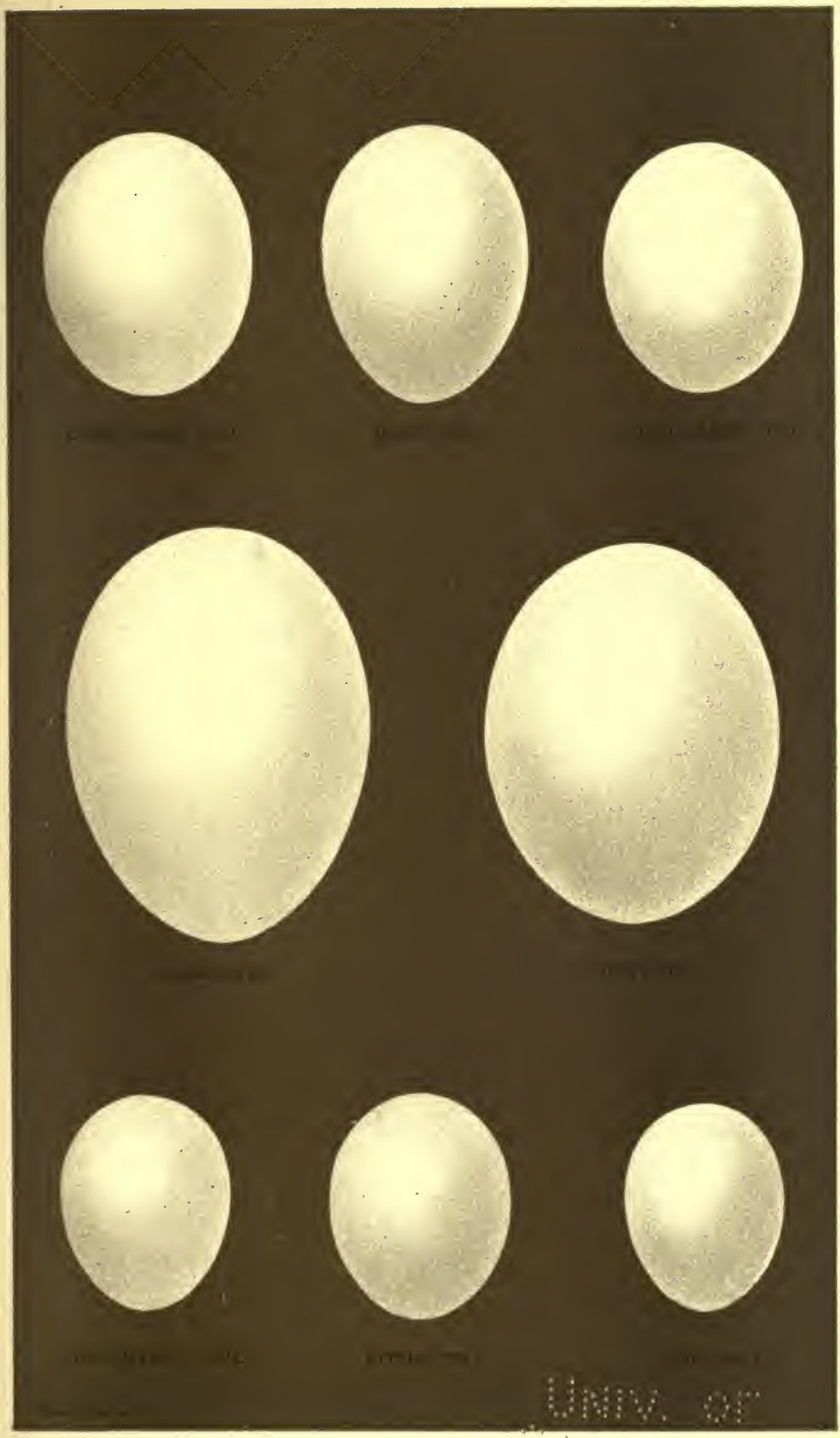
HEN HARRIER.

MONTAGU'S HARRIER.

MARSH HARRIER.

TAWNY OWL.

Printed by Lemercier Paris.



BLACKBIRD.

BLACKBIRD.

WHITE'S THRUSH.

FIELDFARE.

FIELDFARE.

RING-OUSEL.

SONG THRUSH.

SONG THRUSH.

MISSEL-THRUSH.

REDWING.

REDWING.

ROCK THRUSH.

Printed by Lemaire Frères

W.-S. BLUETHROAT.

BLUETHROAT.

NIGHTINGALE.

ROBIN.

S. FLYCATCHER.

R-B. FLYCATCHER.

P. FLYCATCHER.

B. REDSTART

REDSTART.

WHEATEAR.

B.-T. WHEATEAR.

D. WHEATEAR.

STONECHAT

WHINCHAT.

GREAT TIT.

CRESTED TIT.

MARSH TIT.

COAL TIT.

BLUE TIT.

L.-T. TIT.

Printed by Lemercier Paris.

BARRED W.

GARDEN W.

BLACKCAP W.

ORPHEAN W.

WHITETHROAT.

L. WHITETHROAT

DARTFORD W.

RUFOUS W.

YELLOW-B. W.

WILLOW W.

CHIFFCHAFF W.

WOOD W.

ICTERINE W.

GREAT REED W.

MARSH W.

REED W.

SEDGE W.

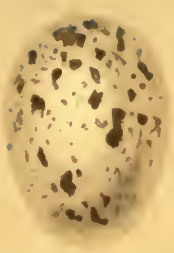
AQUATIC W.

GRASSHOPPER W.

SAVI'S W.

Printed by Lemercier Paris.

ORIOLE.



MEADOW STARLING.

STARLING.

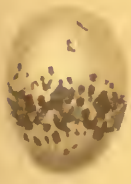
R.-C. PASTOR

LESSER G. SHRIKE.

LESSER G. SHRIKE.

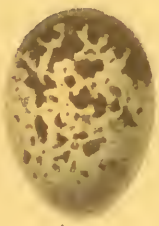
WOODCHAT SHRIKE.

WOODCHAT SHRIKE.



RED-B. SHRIKE.

RED-B. SHRIKE.



GREAT GRAY SHRIKE.

DIPPER.

WAXWING.

WAXWING.

RUSTY GRAKLE.

R. W. STARLING.

CREEPER.

WREN.

FIRECREST.

GOLDCREST.

Printed by Lemercier Paris

ALPINE ACCENTOR.

HEDGE-SPARROW.

NUTHATCH.

NUTHATCH.

ROSY BULLFINCH.

BEARDED TIT.

BULLFINCH.

BULLFINCH.

PINE GROSBEAK.

PINE GROSBEAK.

M. REDPOLL.

M. REDPOLL.

GREENLAND R.

LESSER R.

GOLDFINCH

GOLDFINCH

SERIN FINCH.

SISKIN.

GREENFINCH.

GREENFINCH.

Printed by Lemercier Paris

COMMON BUNTING.

COMMON BUNTING.

CIRL BUNTING.

CIRL BUNTING.

YELLOW BUNTING.

YELLOW BUNTING.

HAWFINCH.

HAWFINCH.

BRAMBLING.

TREE SPARROW

TREE SPARROW

HOUSE SPARROW.

HOUSE SPARROW.

HOUSE SPARROW.

CHAFFINCH

CHAFFINCH

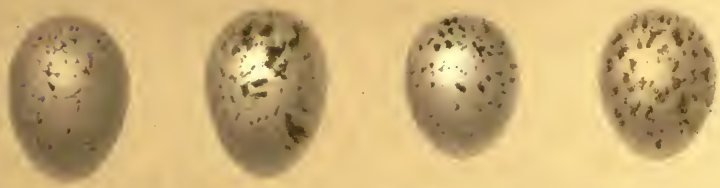
LINNET.

TWITE.

PARROT CROSSBILL.

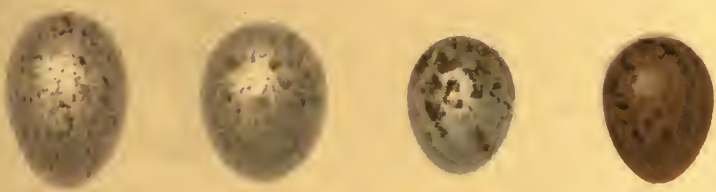
COM. CROSSBILL.

Printed by Lemercier Paris.



PIED WAGTAIL. PIED WAGTAIL. WHITE WAGTAIL. WHITE WAGTAIL.

BLUE-HD. WAGTAIL. GREY WAGTAIL. YELLOW WAGTAIL. RED-T. PIPIT.



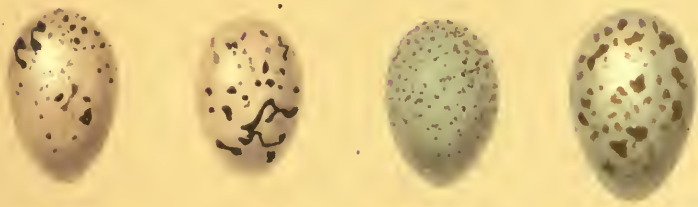
ROCK PIPIT. WATER PIPIT. RED-T. PIPIT. RED-T. PIPIT.

MEADOW PIPIT. TAWNY PIPIT. RICHARD'S PIPIT. AMERICAN PIPIT.

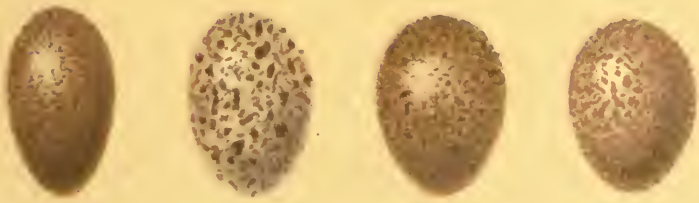
TREE PIPIT. TREE PIPIT. TREE PIPIT. TREE PIPIT.

SNOW BUNTING. SNOW BUNTING. REED BUNTING. REED BUNTING.

LAPLAND BUNTING. LITTLE BUNTING. LITTLE BUNTING. RUSTIC BUNTING.



ORTOLAN BUNTING. ORTOLAN BUNTING. BLACK-HD. BUNTING. BLACK-HD. BUNTING.



SHORE-LARK. CRESTED LARK. CRESTED LARK. WOOD-LARK.

SKY-LARK. SHORT-TOED LARK. WHITE-WINGED LARK. HOOPOE

Printed by Emeric Rex

RING DOVE.

STOCK DOVE.

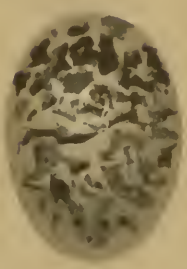
ROCK DOVE.

TURTLE DOVE.

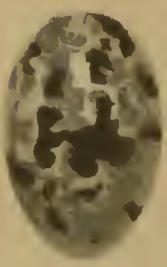
PASSENGER PIGEON.

R. N.-NIGHTJAR.

R.-N. NIGHTJAR.



NIGHTJAR.



NIGHTJAR.

SAND MARTIN.

HOUSE MARTIN.

SWALLOW.

SWALLOW.

Printed by Lemercier Paris

WHITE-WINGED GROSSBILL.

CUCKOO 1

CUCKOO 2.

CUCKOO 3.

CUCKOO 4.

CUCKOO 5.

CUCKOO 6.

CUCKOO 7.

CUCKOO 8.

CUCKOO 9.

CUCKOO 10.

CUCKOO 11.

CUCKOO 12.

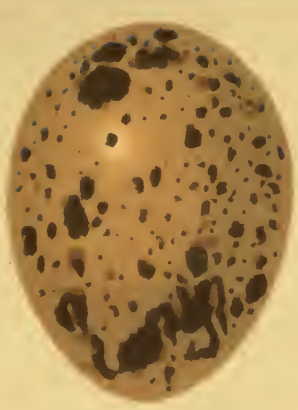
CUCKOO 13.

CUCKOO 14.

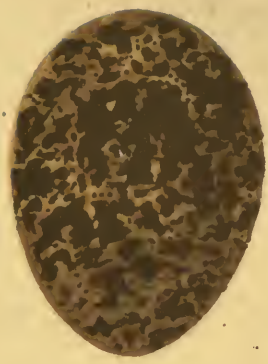
CUCKOO 15.

Printed by Emeran Paris.

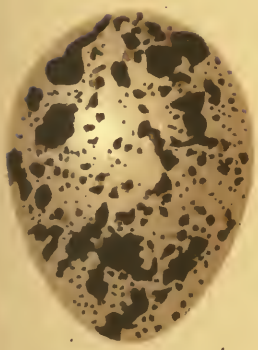
RED GROUSE.



BLACK GROUSE.

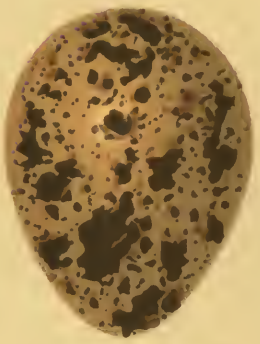


RED GROUSE.



PTARMIGAN.

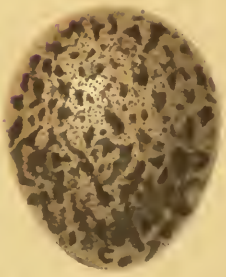
BLACK GROUSE.



PTARMIGAN.

R. L. PARTRIDGE.

HEMIPODE.



COURSER.

QUAIL.

SAND GROUSE.

QUAIL.

Printed by Lemercier Paris.

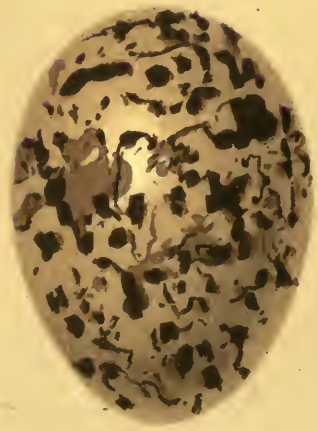
MACQUEENS BUSTARD.

CAPERCAILZIE

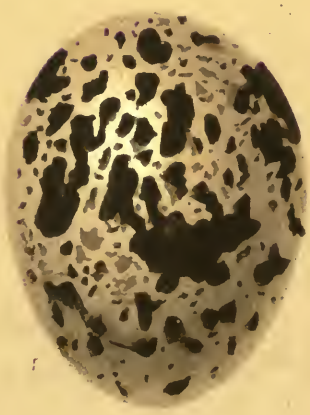
PARTRIDGE.

PHEASANT.

VIRGINIAN COLIN.



THICK-KNEE.



THICK-KNEE.

Printed by Lemercier Paris

GREAT BUSTARD

LITTLE BUSTARD

LITTLE BUSTARD

GREAT BUSTARD

Printed by Lowman Pars

SPOTTED CRAKE.

COOT.

SPOTTED CRAKE.

WATER HEN.

WATER HEN.

WATER HEN.

WATER RAIL.

WATER RAIL.

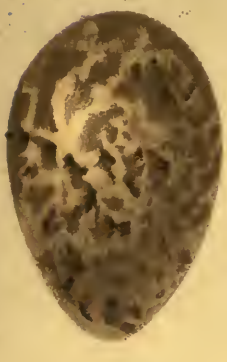
CORN CRAKE.

BAILLON'S CRAKE.

CORN CRAKE.

LITTLE CRAKE.

Printed by Lowrance Bros.



TURNSTONE.

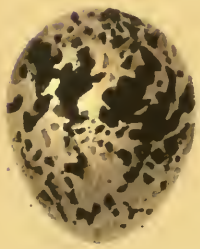
AVOCET.

TURNSTONE.

BLACK-W. STILT.

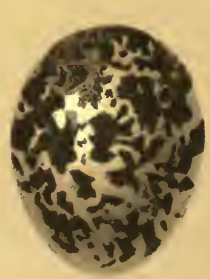
AVOCET.

BLACK-W. STILT.



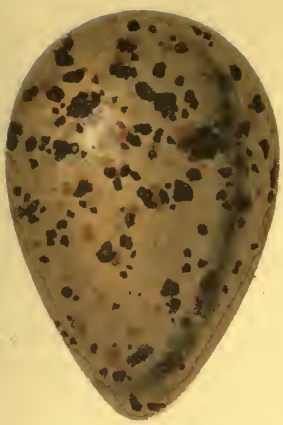
PRATINCOLE.

OYSTERCATCHER.



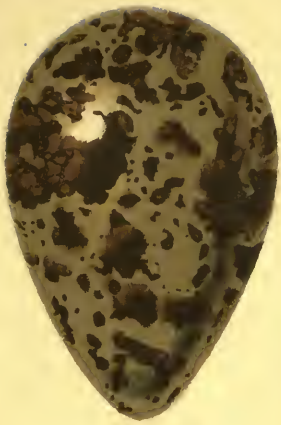
PRATINCOLE.

Printed by Lemercier Paris.



GOLDEN PLOVER.

GOLDEN PLOVER.



GOLDEN PLOVER.

VIRGINIAN G. PLOVER.

ASIATIC G. PLOVER.

GREY PLOVER.

GREY PLOVER.

GREY PLOVER.

GREY PLOVER.

Printed by Lemercier Paris.

DOTTEREL.

DOTTEREL.

DOTTEREL.

KILLDEER PLOVER.

RINGED PLOVER.

RINGED PLOVER.

KENTISH PLOVER.

LITTLE R. PLOVER.

KENTISH PLOVER.

Printed by Lemercier Paris.

LAPWING.

LAPWING.

LAPWING.

RED NECKED PHALAROPE.

LAPWING.

RED NECKED PHALAROPE.

GREY PHALAROPE.

SANDERLING.

GREY PHALAROPE.

BROAD-B. SANDPIPER.

BROAD-B. SANDPIPER.

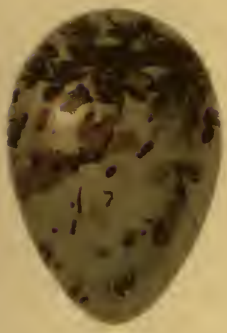
BROAD-B. SANDPIPER.

Printed by Lemercier, Paris.

GREAT SNIPE.

WOODCOCK.

GREAT SNIPE.



COMMON SNIPE.

WOODCOCK.

COMMON SNIPE.

JACK SNIPE.

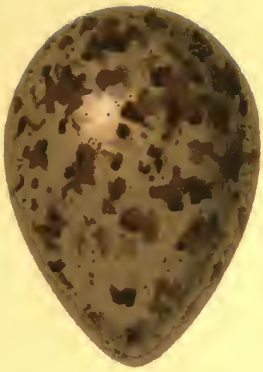
COMMON SNIPE.

JACK SNIPE.

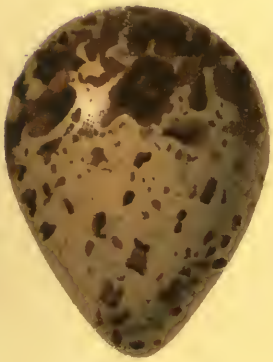
Printed by Lemercier Paris

GREENSHANK.

BLACK-T. GODWIT.



GREENSHANK.



GREENSHANK.

BLACK-T. GODWIT.

RUFF.

RUFF.

BAR-T. GODWIT.

RUFF.

Printed by Lemercier Paris.

GREEN SANDPIPER.

GREEN SANDPIPER.

GREEN SANDPIPER.

WOOD SANDPIPER.

WOOD SANDPIPER.

WOOD SANDPIPER.

COMM. SANDPIPER.

COMM. SANDPIPER.

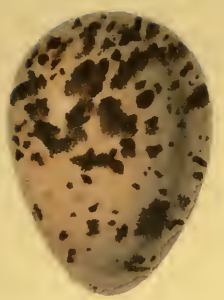
COMM. SANDPIPER.

SPOTTED SANDPIPER.

SPOTTED SANDPIPER.

SPOTTED SANDPIPER.

Printed by Lemercier Paris



PURPLE SANDPIPER.

PURPLE SANDPIPER.

BUFF-BREASTED SANDPIPER.

BONAPARTES SANDPIPER.

AMERICAN STINT.

DUNLIN.

TEMMINCK'S STINT.

TEMMINCK'S STINT.

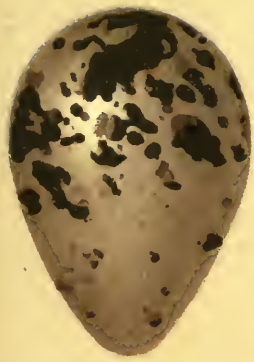
DUNLIN.

LITTLE STINT.

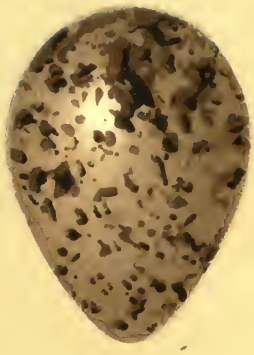
LITTLE STINT.

LITTLE STINT.

Printed by Lemercier Paris.



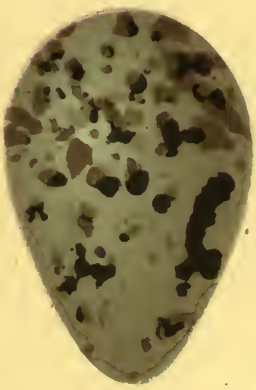
REDSHANK.



REDSHANK.

REDSHANK.

SPOTTED REDSHANK.



SPOTTED REDSHANK.

SPOTTED REDSHANK.

BARTRAM'S SANDPIPER.

YELLOWSHANK.

BARTRAM'S SANDPIPER.

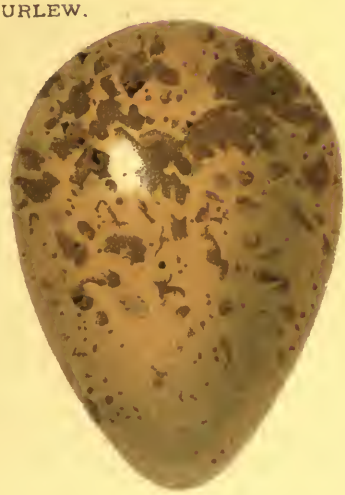
Printed by Lemercier Paris

CURLEW.

CURLEW.

ESQUIMAUX CURLEW.

WHIMBREL.



WHIMBREL.

WHITE PELICAN.

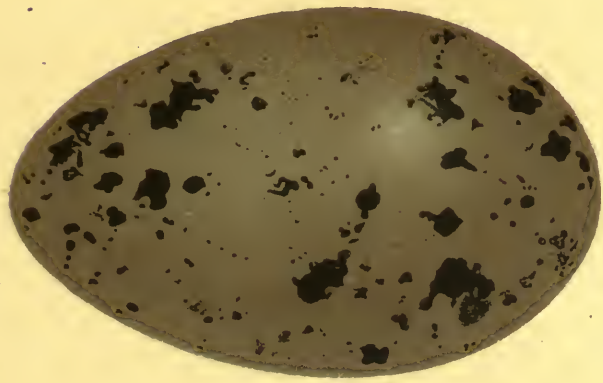
GANNET.

SHAG.

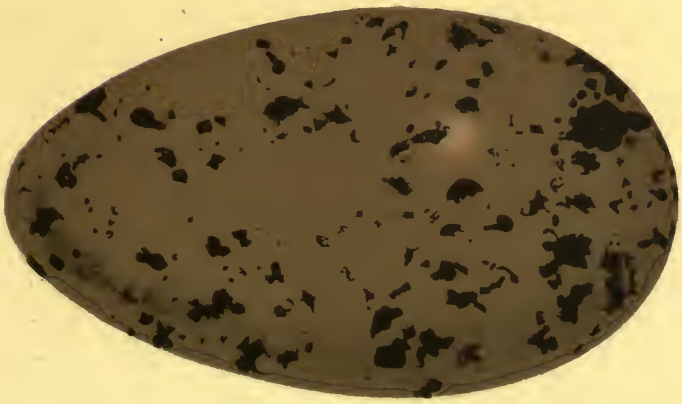
CORMORANT.

Printed by Lemercier Paris.

GREAT NORTHERN DIVER.

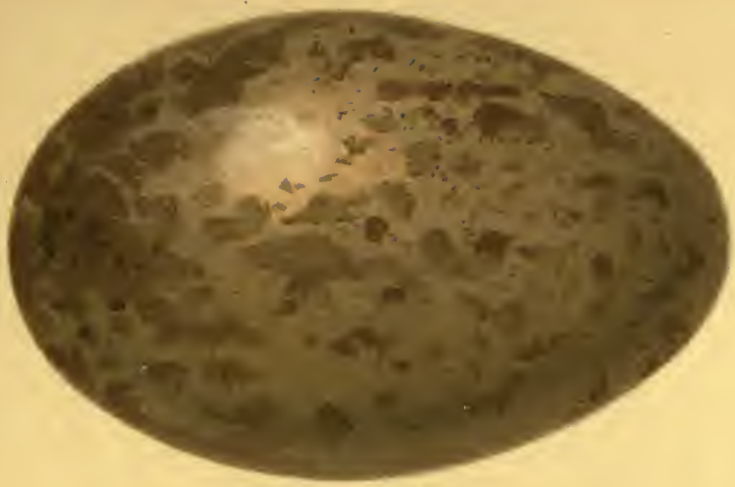


RED-THROATED DIVER.



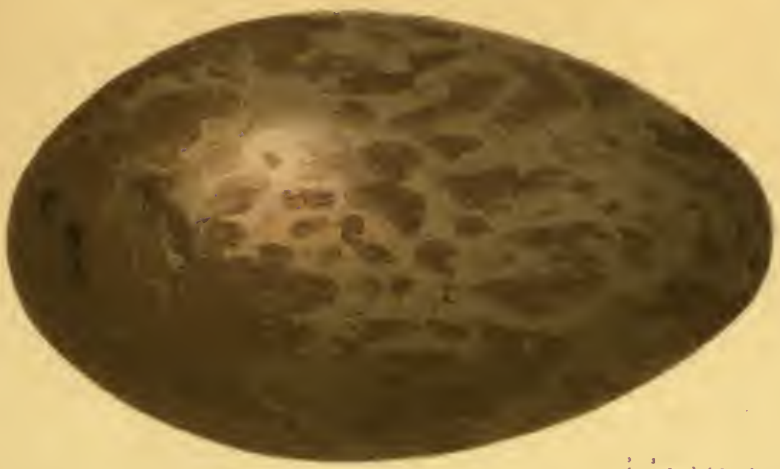
BLACK-THROATED DIVER.

Printed by Lemercier, Paris.



CRANE.

DEMOISELLE CRANE.



CRANE.

Printed by Lemercier, Paris

BLACK STORK.

SPOONBILL.

SPOONBILL.

WHITE STORK.

Printed by Lemercier Paris.

IBIS.

SQUACCO HERON.

NIGHT HERON.

BUFF-BACKED HERON.

PURPLE HERON.

LITTLE EGRET.

GREAT WHITE EGRET.

LITTLE BITTERN.

COMMON HERON.

Printed by Emerson Bros.

GREAT CRESTED GREBE.

RED-NECKED GREBE.

SCLAVONIAN GREBE.

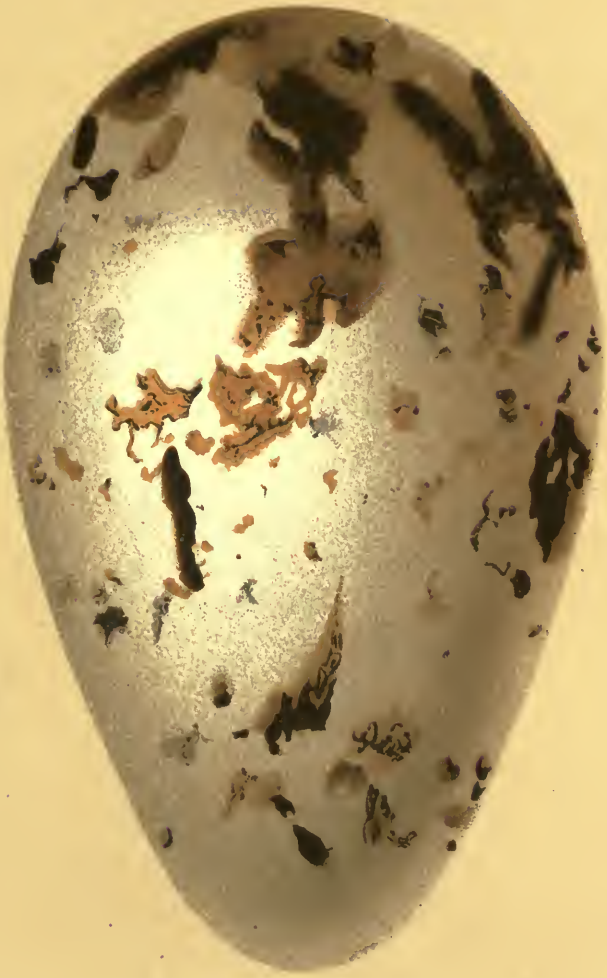
LITTLE GREBE.

EARED GREBE.

COMMON BITTERN.

AMERICAN BITTERN.

Printed by Lemercier Paris



GREAT AUK

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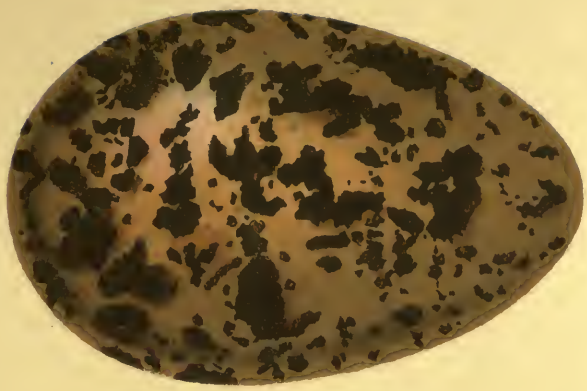
GREAT AUK.



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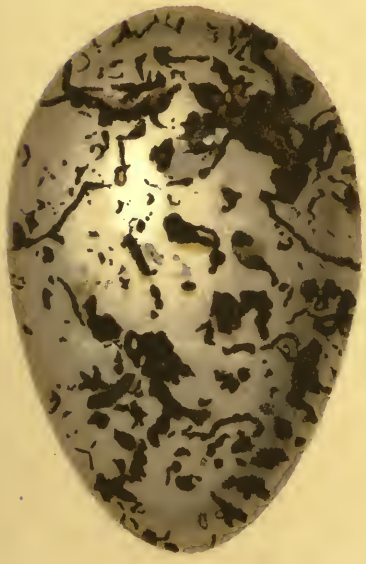


RAZORBILL.

RAZORBILL.

RAZORBILL.

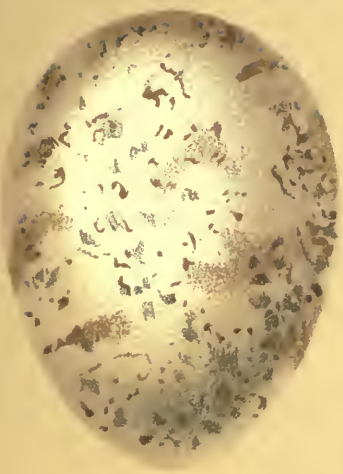
Printed by Lemercier Paris

GUILLEMOT.

Printed by Lemercier Paris.

GUILLEMOT.

Printed by Lemercier Paris



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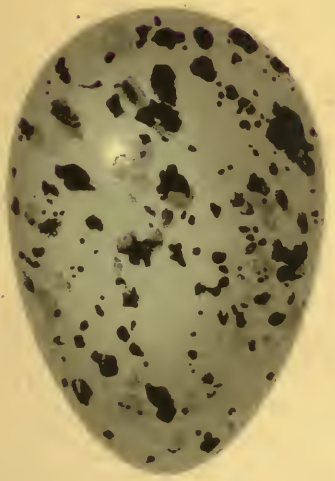
PUFFIN.

LITTLE AUK.



BLACK GUILLEMOT.

BLACK GUILLEMOT.

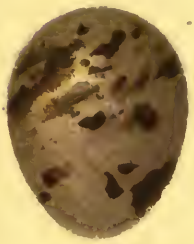
Printed by Lemercier Paris

COMMON TERN.

LESSER TERN.

COMMON TERN.

ARCTIC TERN.



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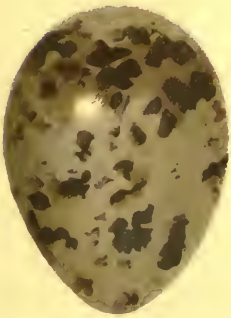

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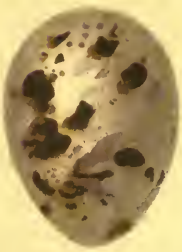
ROSEATE TERN.



LESSER TERN.

ROSEATE TERN.

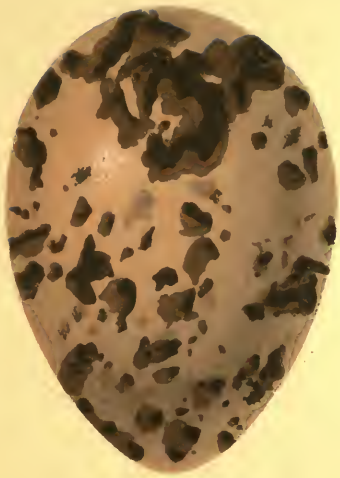
COMMON TERN.

LESSER TERN.

ARCTIC TERN.

Printed by Lemercier Paris

RÜPPELL'S TERN.



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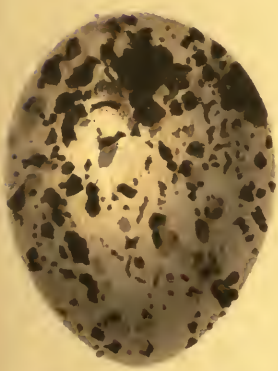

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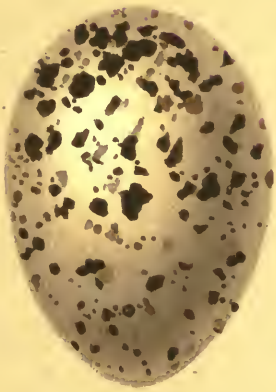

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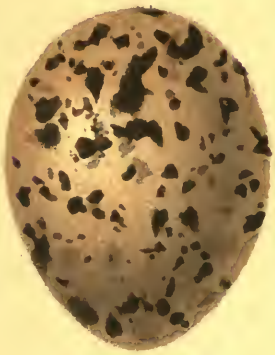

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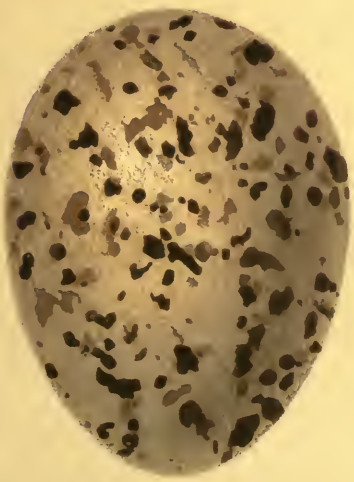
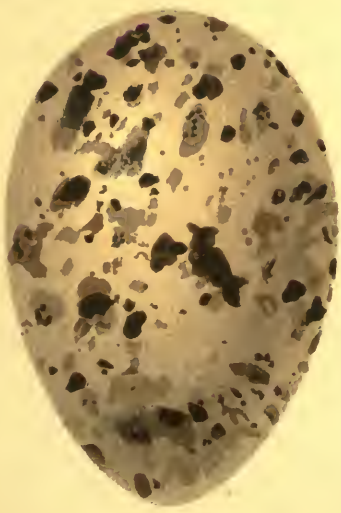
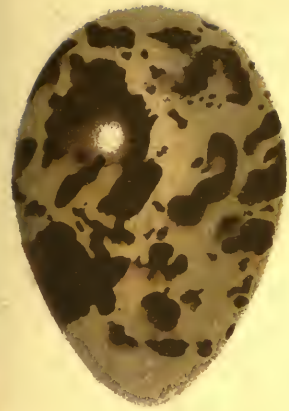


CASPIAN TERN



CASPIAN TERN.

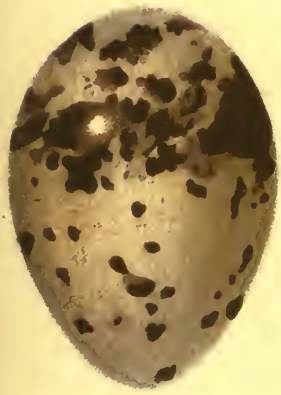
Printed by Lemercier Paris.



SANDWICH TERN.

SANDWICH TERN.

SANDWICH TERN.



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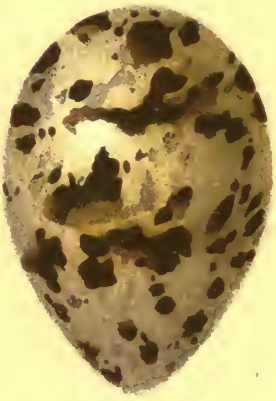

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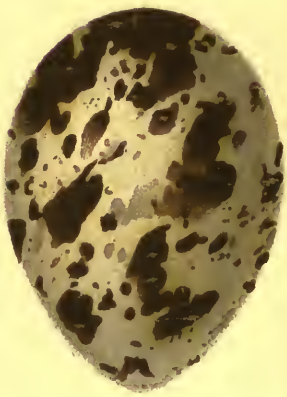

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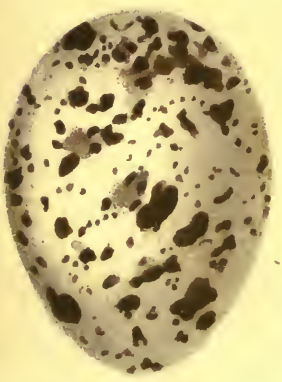
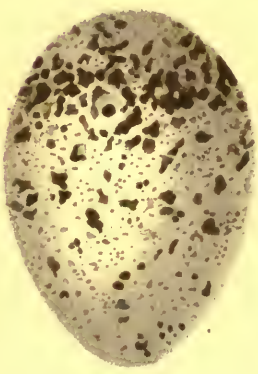


SOOTY TERN.



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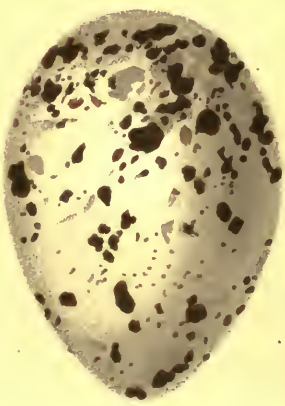


SOOTY TERN.

Printed by Lemercier Paris

BLACK TERN.

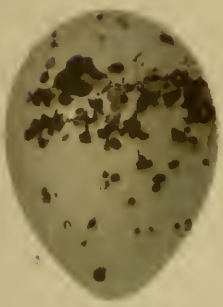
NODDY.

BLACK TERN.

WHITE-W. BLACK TERN.

NODDY.

WHITE-W. BLACK TERN.



WHISKERED TERN.

WHISKERED TERN.

WHISKERED TERN.

Printed by Somerset Press.

GLAUCOUS GULL.

GLAUCOUS GULL.

KITTIWAKE.

KITTIWAKE.

KITTIWAKE.

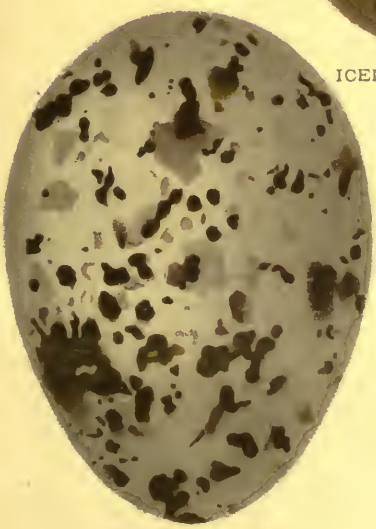
IVORY GULL.

Printed by Lemercier Paris

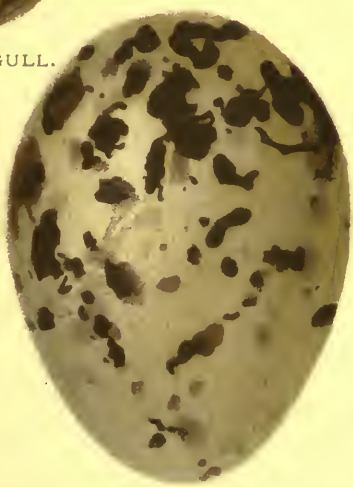
HERRING GULL.

HERRING GULL.

ICELAND GULL.



LESSER B. B. GULL.



LESSER B. B. GULL.

Printed by Lemercier, Paris.

COMMON GULL.

COMMON GULL.

GREATER B. B. GULL.

GREATER B. B. GULL.

LAUGHING GULL.

LAUGHING GULL.

Printed by Lemercier Paris.

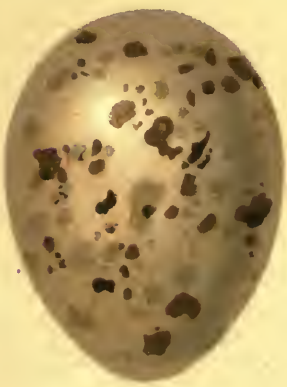
BLACK-HEADED GULL.

BLACK-HEADED GULL.

GREAT BLACK-HD. GULL.

GREAT BLACK-HD. GULL.

ADRIATIC GULL.



ADRIATIC GULL.

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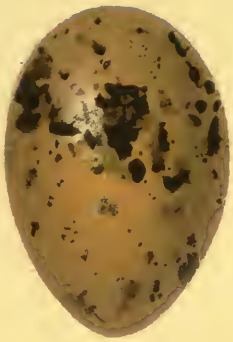


LITTLE GULL.

LITTLE GULL.

LITTLE GULL.

BONAPARTE'S GULL.

SABINE'S GULL

Printed by Lemercier Paris

RICHARDSON'S SKUA.

RICHARDSON'S SKUA.

GREAT SKUA.

GREAT SKUA.

BUFFON'S SKUA.

POMARINE SKUA.

Printed by Lemercier Paris.

FULMAR

GREAT SHEARWATER

STORMY PETREL

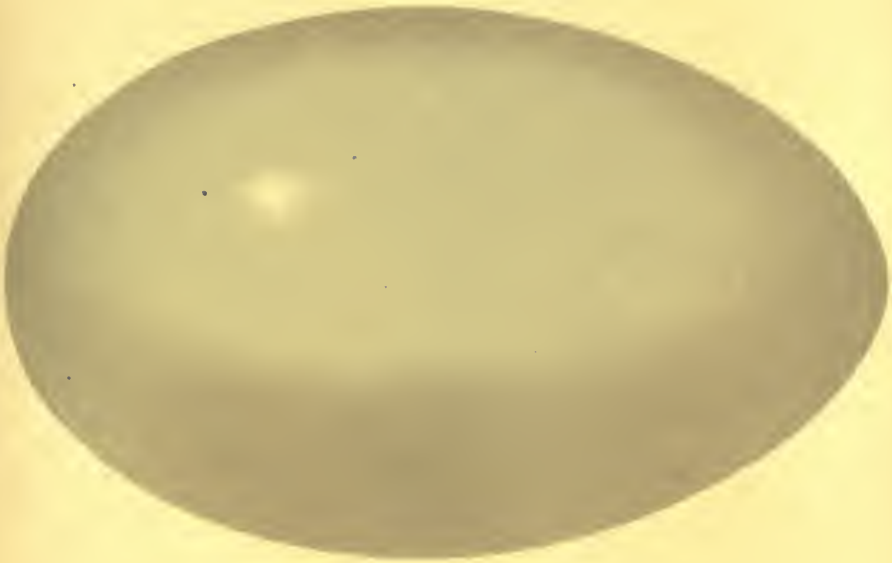
BULWER'S PETREL

FORK-TAILED PETREL

MANX SHEARWATER

DUSKY SHEARWATER

Printed by Lowerison Pure



MUTE SWAN.

WHOOPER SWAN.

Printed by Lemercier Paris.

BEAN GOOSE

BEWICK'S SWAN

GREY LAG GOOSE

Printed by Lemercier Paris

EIDER DUCK.

EIDER DUCK.

KING EIDER.

STELLER'S DUCK.

Printed by Lemercier Paris.

PINK FOOTED GOOSE

WHITE-FRONTED GOOSE

BRENT GOOSE

BARNACLE GOOSE

Printed by Lemercier Paris

RED-BREASTED GOOSE

FLAMINGO

SNOW GOOSE

Printed by Lemercier Paris

EGYPTIAN GOOSE

CANADA GOOSE

L. WHITE-FRONTED GOOSE

Printed by Lemercier Paris

GOLDEN-EYE.

SHOVELLER.

AMER. WIGEON.

WIGEON.

MALLARD.

PINTAIL.

Printed by Lemercier Paris

TUFTED DUCK

SCAUP

GADWALL

WHITE-EYED POCHARD

POCHARD

RED-CRESTED POCHARD

BLACK SCOTER

HARLEQUIN DUCK

VELVET SCOTER

SURF SCOTER

Printed by Lemercier Paris

TEAL.

GARGANEY.

LONG-T-DUCK.

RUDDY SHELDRAKE.

COM. SHELDRAKE.

Printed by Lemercier Paris

SMEW

HOODED MERGANSER

GOOSANDER

RED-B. MERGANSER

Printed by Lemercier Paris

PECTORAL SANDPIPER.

RED-BREASTED SNIPE.

GREAT S. CUCKOO.

RUSTIC BUNTING.

GREAT S. CUCKOO.

YELLOW-B. CUCKOO.

BLACK-B. CUCKOO.

Printed by Lemercier Paris

CLASSIFICATION OF BIRDS;

AN ATTEMPT TO DIAGNOSE THE SUBCLASSES, ORDERS, SUBORDERS, AND FAMILIES OF EXISTING BIRDS

By HENRY SEEBOHM

PREFACE

FIVE years ago I published a short essay on the Classification of Birds. Since then, in addition to original research, I have had an opportunity of studying various collections of facts bearing upon the question, of which the most important are Fürbringer's "Morphologie und Systematik der Vögel," Lydekker's "Catalogue of the Fossil Birds in the British Museum," and Gadow's "Thier-Reichs."

The result has been that I have discovered many blunders in my original essay, which require correction, and have modified my views in various ways, so that it no longer expresses my present opinions.

I trust that my readers will regard this supplementary essay as a step in the right direction, and will assist me to the utmost of their power in the arduous task of eliminating the errors, both of facts and of deduction from facts, which still obscure our attempts to discover the natural Classification of Birds.

LONDON, 1895.

CLASS **AVES.**

Subclass I. **SPHÆNISCOMORPHÆ.**

Order I. SPHÆNISCIFORMES.

Suborder 1. IMPENNES.

Family *Sphæniscidæ.*

Subclass II. **PELARGOMORPHÆ.**

Order II. CICONIIFORMES.

Suborder 2. ANSERES.

Families *Palamedeidæ, Anatidæ, Phœnicopteridæ.*

Suborder 3. HERODIONES.

Families *Ibididæ, Scopidæ, Ardeidæ, Ciconiidæ.*

Suborder 4. STEGANOPODES.

Families *Phaetontidæ, Pelecanidæ, Fregatidæ, Sulidæ, Phalacrocoracidæ.*

Order III. FALCONIFORMES.

Suborder 5. PSITTACI.

Families *Psittacidæ, Trichoglossidæ.*

Suborder 6. ACCIPITRES.

Families *Gypogeranidæ, Falconidæ, Pandionidæ.*

Suborder 7. STRIGES.

Family *Strigidæ.*

Suborder 18. PICARIÆ.

Families *Cypselidæ*, *Alcedinidæ*, *Todidæ*, *Momotidæ*, *Coraciidæ*, *Meropidæ*, *Coliidæ*, *Bucerotidæ*.

Order VIII. TROGONIFORMES.

Suborder 19. TROGONES.

Family *Trogonidæ*.

Order IX. PICIFORMES.

Suborder 20. SCANSORES.

Families *Capitonidæ*, *Galbulidæ*, *Picidæ*, *Rhamphastidæ*.

Subclass IV. **ÆGITHOMORPHÆ**.

Order X. CUCULIFORMES.

Suborder 21. UPUPÆ.

Family *Upupidæ*.

Suborder 22. CUCULI.

Families *Cuculidæ*, *Musophagidæ*.

Order XI. PASSERIFORMES.

Suborder 23. TROCHILI.

Family *Trochilidæ*.

Suborder 24. PASSERES.

Families *Eurylæmidæ*, *Menuridæ*, *Passeridæ*, *Tyrannidæ*.

Order XII. TURNICIFORMES.

Suborder 25. TURNICES.

Family *Turnicidæ*.

Suborder 26. EURYPYGÆ.

Families *Mesitidæ*, *Eurypygidæ*, *Rhinochetidæ*.

Suborder 27. CRYPTURI.

Family *Tinamidæ*.

Order XIII. GALLIFORMES.

Suborder 28. PSOPHIÆ.

Families *Cariamidæ*, *Psophiidæ*, *Opisthocomidæ*, *Podicidæ*.

Suborder 29. GALLI.

Families *Cracidæ*, *Phasianidæ*, *Megapodiidæ*.

Subclass V. **DROMÆOMORPHÆ.**

Order XIV. APTERYGIFORMES.

Suborder 30. APTERYGES.

Family *Apterygidæ*.

Order XV. STRUTHIONIFORMES.

Suborder 31. STRUTHIONES.

Families *Rheidæ*, *Casuariidæ*, *Struthionidæ*.

THE CLASSIFICATION OF BIRDS

The following attempt at a natural classification of Birds is based upon the theory of Evolution. It assumes that all Birds are descended from one original species, whose early history is lost in the imperfection of the geological record, but which had become differentiated into many widely varying species as long ago as the Cretaceous Period. It is not necessary to adopt any particular theory of Evolution. The fashionable opinion at the present moment appears to be in favour of Weismann's hypothesis that the sole machinery of Evolution is the Natural Selection, by means of the Survival of the Fittest, of those individuals who are fortunate enough to be born with some fortuitous variation which is advantageous to themselves and can be transmitted to their offspring. More conservative ornithologists are disposed to narrow rather than widen the part played by Natural Selection, and to agree with the great author of the "Origin of Species" when he wrote to Moritz Wagner: "In my opinion the greatest error which I have committed has been not allowing sufficient weight to the direct action of the environment—*i.e.*, food, climate, &c.—independently of Natural Selection" ("Life and Letters of Charles Darwin," iii. p. 159). The hypothesis that the tendency of organisms to develop in a definite direction is a primitive character with which Life was already endowed when it first made its appearance in the dead world of Matter and Force, which reigned supreme on our planet for countless ages, is still the only plausible explanation of many of the facts of Evolution.

The theory of Evolution in general, or the hypothesis of Natural Selection in particular, makes a large demand upon our faith. It crumbles away if it be approached in an agnostic spirit. It satisfactorily explains a great many facts, but it leaves a great

many unexplained, and we are driven to the unsatisfactory method of argument by analogy. We are forced to assume that it is merely our ignorance that prevents us from recognising the satisfactory nature of the explanation. It may be that many birds have changed their environment, possibly several times; that in many cases the environments themselves have changed, either temporarily or permanently; and that each change has left its mark upon the species, until the characters have been so entangled together that the attempt to unravel the mystery of their genealogy is almost hopeless.

When Darwin had convinced the scientific world that the theory of Evolution was a reasonable hypothesis, and not the wild dream that nearly all learned men at that time supposed it to be, it was assumed that a natural classification of animals and plants was a problem of comparatively easy solution. It was taken for granted that the key had at length been discovered which was to unlock the mysteries of affinity and analogy. All that was necessary to produce a natural classification was to arrange animals and plants according to their genetic affinities. It was supposed that an examination of fossil animals and plants would throw a flood of light upon the relationship of recent organisms, and that the descent of important characters could be easily traced back to their origin from common ancestors. So far as Ornithology is concerned, the result has been very disappointing. The geological record has been found to be extremely imperfect. Very few species have been found in a fossil state. In very few cases have any but osteological characters been preserved, and even these are for the most part very fragmentary. It is of course obvious that if all birds have descended from common ancestors, and if we had access to examples of all the intermediate forms which have connected existing birds with their common ancestors, no classification would be possible, for every species would be connected with every other species by an unbroken series of intermediate forms gradually and insensibly leading from one to the other. It is of course a subject of profound scientific interest to discover any trace in the geological past of the missing links that fill up the gaps between the various families of existing birds, but so far the fragments of knowledge that have been acquired by a study of Palæontology have thrown little or no light upon the vexed question of the classification of Birds; and for the present at least it seems to be impossible to include fossil birds, except those of very

recent origin, in any scheme in which it is attempted to arrange Birds in natural groups. I propose, therefore, to confine my attention to the inquiry, how far it is possible to classify existing birds in a natural manner—that is to say, to arrange them in groups which may be diagnosed by the possession of certain characters which have probably been inherited from common ancestors, and which, there is every reason to believe, have not been acquired by some species in the group independently of other species in the same group. This assumption, however, does not exclude the possibility of the same character, or a very similar character, having been independently acquired by species in other groups.

Much has been published respecting the classification of Birds since Huxley's celebrated paper on the bones of the palate astonished the ornithological world by proving at least that the existing systems of classification had no scientific basis.

A great deal of scientific work has been done in various departments of Ornithology since then, but little or no progress has been made towards a true classification of Birds. Every one admits that the ideal system of classification must be based upon genetic affinity, and it is further admitted by most ornithologists that the only clue to genetic affinity between any two birds is the discovery that they both possess a certain character or characters which they have presumably inherited from common ancestors.

An ideal classification would, if it could be discovered, arrange birds in groups so constituted that each character could be traced to its origin. Every attempt to discover this ideal classification has hitherto been an absolute failure; and it can almost be proved that it involves a mathematical impossibility, unless we admit that a primitive character may be independently modified in a special direction by two distantly related families under the influence of similar causes, and also that the influence of other causes may afterwards produce a reversion to the primitive character in some of the descendants. This admission is almost tantamount to a confession that the attempt to arrive at finality in the classification of Birds is hopeless.

We seem to be compelled to assume the truth of one or both of the following hypotheses: Identical characters in different species may in some cases have been independently acquired; or, having been acquired, they may be subsequently lost by one or more groups of descendants.

It is manifest that if either of these propositions be accepted the true classification of Birds becomes a matter of opinion, incapable of proof, and that we can only accept the system as least likely to be wrong which involves the independent acquirement, or the acquirement and subsequent loss, of very few or very unimportant characters. It is easy to count the number of characters; it is very difficult to say which are easy and which are difficult to acquire or to lose.

It is a disputed point amongst biologists whether characters acquired after birth are or are not transmitted to offspring. Very little satisfactory evidence has been produced on either side, but much discussion has arisen, and the question appears to be one that will give occasion for much difference of opinion for years to come. The subject is of great importance in its relation to the origin of species, but it has no bearing upon their classification. The extent to which characters can be independently acquired is an entirely different question, and is one which lies at the root of all attempts at classification. It is a difficult problem. The mass of evidence is overwhelming—so enormous that it is almost impossible adequately to grapple with it. It cannot be too emphatically asserted that characters derived from inheritance are all-important as bases of classification, whilst characters independently acquired are absolutely valueless.

All attempts to find a natural classification of Birds must be based upon the laws of heredity. It is a universal law that, in an overwhelming majority of cases, parents transmit their characters to their offspring; but were this law absolute the development of new species would be impossible, and the assumption that all existing species had been specially created would be inevitable. It is unquestionably true that the characters of an individual may be slightly changed by use or disuse, or by other effects of environment; but it is an open question whether these slight changes of character can or cannot be transmitted to offspring. The theory of Natural Selection assumes that the transmission of characters is not absolute, but is subject to slight variation; and inasmuch as the laws which govern these variations are absolutely unknown, the variations are provisionally called fortuitous variations. It further assumes that the possession of even a very slight change of character in a direction favourable to longevity may give to the possessor the opportunity of producing more offspring than the very slightly less favoured individuals. It still further assumes

that these very slight variations (fortuitous, so-called) are hereditary, and that consequently the group of individuals within range of each other, so far as interbreeding is concerned, gradually develop in a direction favourable to their special mode of life by the combined action of the longevity of the individuals possessing any slightly beneficial modification, and of the early removal by death of those possessing any slightly injurious modification. The effect of these causes are supposed to be intensified by the fierceness of the struggle for existence to which some individuals are exposed, and to be almost inoperative where the struggle for existence is very slight; so that whilst some species may develop rapidly, others may show scarcely any change for long periods.

The development of a species is one thing, but the creation of a new species is quite another. So long as the individuals of a species live in the same area they habitually interbreed, and by inheritance the favourable modifications become common property; but if a part of a species emigrate to a district isolated from the rest, the slight differences of environment may make it to the advantage of the species in the two localities to develop on slightly different lines, and the accumulated slight differences may in the course of a great number of generations produce so wide a divergence that, should circumstances occur by which the two parties should again occupy the same area, the wish or the power to interbreed would be absent, and the two parties would be regarded as specifically distinct. It is thus obvious that the two great factors in the multiplication of species are variation and isolation. It is, however, outside the scope of the study of classification to inquire into the *modus operandi* of the differentiation of species; it is enough to recognise the fact that species have become differentiated, without deviating into the endless maze whither an inquiry into the cause of the differentiation must inevitably lead the student. Suffice it to say that there seems to be a consensus of opinion amongst the followers of Lamarck, Darwin, and Weismann that the variations of the species are advantageous, whether those of the individuals be accidental, controlled by natural selection, or the effects, direct or indirect, of environment, or the result of some unknown teleological law.

The convert to the law of heredity naturally assumes that every important character has been derived from inheritance, and consequently expects that by grouping together species which possess common characters a natural classification of Birds can

easily be made; but in this expectation he is doomed to absolute disappointment. It is very easy to group genera into families, it is not very difficult to arrange families into suborders, but to take a retrospect of the history of Birds so far back as to discover the genealogy of the suborders, and arrange them into orders and subclasses, is an unsolved problem. Most writers on classification have attempted to determine the limits of the higher groups, a few have attempted roughly to define the orders, but, so far as I know, no one has been rash enough to diagnose the subclasses of birds except myself. My first attempts were very imperfect, and no one is more conscious of the imperfections of my last attempt than I am; but it seems to me that every attempt that shows the independent development of characters to be fewer in number or smaller in importance than previous classifications demand is a step in the right direction.

Perfection appears to be unattainable, possibly because we are not yet working on the right lines. Shuffle the cards as we may, we soon find that no possible combination of families can be made without placing some of them in such a position that makes it imperative to assume the independent development of apparently very important characters in very distantly related orders. Indeed so constantly do we find characters which seem to be most difficult of acquirement, but which must have been independently acquired under every possible arrangement, that we are forced to the conclusion that it is not, as might naturally be supposed, a rare exception to find a character which has been independently acquired by two or more groups; but that, on the contrary, it is very exceptional to find any character other than those which are common to all Birds which has not been acquired by two or more groups independently of each other.

It must be constantly borne in mind that no character which has not been derived from inheritance has the smallest taxonomic value. Those characters which have been independently acquired are perfectly useless for purposes of classification; they throw no light whatever, not even the smallest ray, upon the genetic affinity of the groups which possess them: no one of them, nor any number of them, must be allowed for one moment to influence the judgment; they must be totally ignored. The pre-Darwinian naturalists recognised this fact, and admitted that some similarities of character were marks of affinity, whilst others were only marks of analogy.

Unfortunately, in too many cases it is impossible to decide which of two characters is to be ascribed to analogy and which to affinity, and thus the classification of Birds becomes to a considerable extent a matter of guess-work. All that can be done is to go on guessing and to finally accept the combination which presents the fewest in number and the least important in character of instances of the independent acquisition of any modification.

In most recent attempts to make a natural classification of Birds, the families have been arranged so as to place the most highly developed Birds (presumably the Passeres) at one end of the series, and the least highly developed (possibly the Struthiones) at the other. This arrangement appears to me to be artificial, and has probably done much to make a natural classification impossible. Of the half-dozen (more or less) subclasses into which the surviving species of Birds may be grouped, most of them, if not all, may contain families in various stages of development, which we in our ignorance may be pleased to term highly developed or otherwise. In many cases the apparently archaic forms may be very highly specialised for some peculiar niche in the organic world into which they have been squeezed during the struggle for existence, and which they exactly fit.

The fact that all Birds have feathers is some argument for the assumption that the ancestors of all Birds once possessed the power of flight, otherwise their feathers would be of little use to them. It is difficult to imagine how the power of flight could have been acquired except by some animal which lived in a tree and began by jumping from bough to bough; hence it seems a reasonable assumption that the adaptation of the wing of the Penguin to serve as a paddle under water is not an archaic character which has been retained. It may be the partial resumption of an archaic character which has been independently reproduced, but is probably more correctly described as a highly specialised modification of later date adapted to special ends. The same may be said of the apparent degradation by disuse of the wing of the Ostrich.

Birds having been originally perchers in trees, we may accept the Passerine foot as well as the Passerine wing as the normal avian type. In the struggle for existence it is not surprising that Birds should have adapted themselves, or should have been adapted by surrounding circumstances, to other modes of life; and we consequently find that Birds may be classified into various

groups according to their mode of life, such as (*a*) Perchers in trees, (*b*) Runners on land, (*c*) Waders in water, and (*d*) Swimmers on water. This was the basis of the earlier attempts at classification; but recent writers have (doubtless correctly) assumed that of the half-dozen (more or less) subclasses into which the surviving species of Birds may be grouped, several of them may contain families whose ancestors succeeded in establishing themselves in other modes of life than the ancestral tree-perching business, and did it so effectually that in spite of the struggle for existence they contain species which have survived the perils aforesaid in more than one, if not in all, of the avian modes of life. Consequently in the attempt to make a natural classification of Birds it is probably wisest not only entirely to disregard the supposed height of development which has been attained, or the assumed depth of degradation which has been reached, but also to view without alarm the association of runners with swimmers or perchers with waders.

This point, that the primary divisions of the Class Aves may each contain families of Birds which are typically aërial in their habits, and consequently appear to be very highly developed, as well as others that have been driven in the struggle for existence to adopt aquatic or terrestrial habits, and consequently appear to be very archaic in their development, is the point upon which I am anxious especially to insist in the present essay. In arranging the sequence of the Families, it must always be remembered that with each Order a fresh series commences, with probably a wide gap between the two. These gaps are not blemishes to be concealed, but facts to be welcomed, and rudely represent the age of the original isolation of the groups. The attempt to make a linear series with the smallest possible gaps between the families is a mistake.

The result of our investigations may possibly be very far from a discovery of the true system of classification, but it will at least provide us with a workable system—a system which, so far as we know, contains no group, small or large, that cannot be diagnosed.

The diagnosis of a genus, a family, or an order is a list of the characters which are possessed by every species contained in it, but which form a combination not found in any species outside its limits. These characters have presumably been inherited, and the greater the number of them which can be found in any group, the stronger is the diagnosis of that group.

Some writers have attempted to explain away the recurrence of discarded characters by ascribing the fact to a mysterious tendency, to which the name of Atavism has been given. There can be no doubt that archaic characters do sometimes recur, but they are probably produced by the ordinary laws of adaptation, whatever they may be, Natural Selection, or some other force. The similarity between a present character and an ancient one is probably only accidental. The recurrence of a discarded character is probably unconnected with its previous existence, the new character being independently acquired. If this theory be correct, it is unscientific to speak of the reptilian affinities of so-called archaic species such as *Opisthocomus*, *Chauna*, or *Struthio*. They do show reptilian analogies, but the characters which are presumably reptilian have not been inherited from reptilian ancestors, but have been independently acquired, because there happened to be a vacant space in the economy of Nature in which birds possessing those characters were able to hold their own.

The oldest fossil birds that have yet been discovered possessed teeth. Possibly in those early geological ages all birds had teeth, and have since independently lost them in every group; but the number of fossil birds known to us of that horizon is so very small, that it is equally probable that the few toothed birds of which any trace has been discovered may represent a small section of the then existing avian fauna whose descendants subsequently lost their teeth or became extinct. It must be admitted that *Archæopteryx*, *Hesperornis*, and *Ichthyornis* differ so very widely from each other, that they must be regarded as a somewhat distant development of the original avian type. It is very easy to suppose that teeth were independently lost by each group of Birds at various epochs, but to imagine that any Order of Birds having once lost their reptilian legacy of teeth should afterwards re-acquire them is difficult to reconcile with our experience of the modes of evolution.

Without, therefore, attempting to guess at the characters which the original avian type possessed, we may hazard the conjecture that the Sphæniscomorphæ and the Pelargomorphæ became aquatic in their habits, acquired webbed feet to enable them to swim, and that the ancestors of the Pelargomorphæ (and possibly those also of the Sphæniscomorphæ) lost their fifth secondary for some inscrutable reason of which we cannot make any guess.

Be that as it may, no quincubital bird has a webbed foot. If

the Ægithomorphæ and the Coraciomorphæ be regarded as descended from arboreal birds, the Pelargomorphæ and the Sphæniscomorphæ may be regarded as descended from aquatic birds. It were, perhaps, idle to speculate upon the precise sequence of events, but on the principle that it is very much easier independently to lose a character than independently to acquire one, we may hazard the guess that the Sphæniscomorphæ and the Pelargomorphæ acquired webbed feet before they were isolated from each other, and that the webbed feet of the Anseres, the Tubinares, the Pygopodes, and the Gaviæ date back prior to the isolation of the ancestors of the Ciconiiformes, the Falconiformes, the Ralliformes, and the Charadriiformes from each other.

The Class Aves may be divided into five Subclasses, each of which is supposed to represent the surviving descendants of an ancestral species from which the various species contained in it have inherited certain characters by which they may be collectively diagnosed. There were probably other contemporary species, whose descendants were unsuccessful in the struggle for life, whose numbers gradually decreased until they became extinct.

The five subclasses of existing Birds may be diagnosed in a fairly satisfactory manner.

There are two very small groups of Birds which have already been mentioned that possess so many unique characters that it seems probable that their isolation dates far enough back to entitle them to rank as subclasses. The Penguins and the Ostrich and its allies can be diagnosed by so many characters that we may venture to place them at the two extremes of our classification—the former under the name of Sphæniscomorphæ and the latter under that of Dromæomorphæ. It is quite true that the *Sphæniscidæ* and the *Alcidæ* have very many characters in common, and that in some remarkable points the Struthiones resemble the Crypturi; but some of the characters in which one group resembles the other may in both cases have been acquired by inheritance from very remote ancestors, whilst others may have been independently acquired by the influence, direct or indirect, of almost identical environments.

Having thus disposed of the Sphæniscomorphæ and the Dromæomorphæ, the rest of existing birds may be divided into three subclasses which may possibly be more nearly allied to each other than they are to the two subclasses which we have already mentioned. Be that as it may, they are at least more simple in

their diagnosis. No one of these three subclasses appears to possess as many diagnostic characters or combinations of characters as the two other subclasses; but perhaps it ought to be a matter of congratulation that they are capable of being diagnosed at all. Though the characters are only two in number, they appear to be extremely difficult of independent acquirement. They are the loss of the fifth secondary and the abnormal arrangement of the deep plantar tendons.

In regarding the arrangement of the deep plantar tendons from a taxonomic point of view, the *flexor longus hallucis* may be passed over as of little importance. The hallux is so often absent or has ceased to be functional, that its muscles may vary in closely allied genera, whilst the *flexor perforans digitorum* is constant in every family which has been examined.*

What possible advantage could be gained by disturbing the normal arrangement of the plantars, or by what possible method the change from the normal condition was arranged, are problems so utterly insoluble that it requires an abnormal amount of faith in the theory of Natural Selection to suppose that no other cause for the evolution was operating.

The loss of the fifth secondary is a character which appears to be of greater taxonomic importance than an abnormal arrangement of the deep plantar tendons. No suggestion of any

* The *flexor perforans digitorum* is modified in four different ways, which may be remembered most easily by numbering them according to the number of digits to which the muscle leads.

Variation No. 1: the Picine modification is the most simple arrangement, as the front plantar leads to one digit only (the third). It is peculiar to the Scansores, a small group of birds composed of the families *Picidæ*, *Capitonidæ*, *Galbu'idæ*, and *Rhamphastidæ*.

Variation No. 2: the Trogonine arrangement characterises the few birds in which the front plantar leads to two digits only (third and fourth), and is believed to be peculiar to the *Trogonidæ*.

Variation No. 3: the Passerine arrangement is the normal one. The front plantar leads to three digits (the second, third, and fourth), except of course in the very rare instances where one of the front digits is absent.

Variation No. 4: the Picarian modification is perhaps the most abnormal, the front plantar leading to all four digits, and the hallux, which is always present, being unconnected with the *flexor longus hallucis*. This arrangement is found only in the *Coliidæ*, *Alcedinidæ*, *Momotidæ*, *Todidæ*, *Cypselidæ*, *Caprimulgidæ*, *Podargidæ*, *Bucerotidæ*, *Steatornithidæ*, *Coraciidæ*, and *Meropidæ*.

Variation No. 5: the Pseudo-Gryphine modification is unique. The front plantar leads to three digits (the first, second, and third), whilst the hind plantar leads sometimes to three digits (the second, third, and fourth), and sometimes to only two (third and fourth). So far as I know, this arrangement is peculiar to the *Cathartidæ*.

advantage to be derived from such loss appears possible. No instance of the loss of any other secondary except the fifth is known, nor is any case of partial loss of a secondary to be found except in the family *Phasianidæ*, all the species of which have the first secondary reduced in size. That the fifth secondary should have been lost independently in different groups of birds, or that, having been lost, it should have been re-acquired by the majority of species in one or more groups, is very remarkable. The only other hypothesis capable of explaining the facts is that for some unknown reason the coverts of the fifth secondary have been also lost in some species, and that thus the sole evidence of its ever having been there has been destroyed. Whatever may be the explanation, the fact is undisputed that amongst the birds which have abnormal plantars both quincubital and aquincubital species are to be found, though the latter are comparatively few in number.

Based upon these characters, the simplest diagnosis of the five Subclasses of Birds is as follows:—

SPHÆNISCOMORPHÆ.—Aves with none of the feathers of the wing differentiated into quills, and the bones of the forearm all flattened.

PELARGOMORPHÆ.—Aves with normal plantar tendons, but with the fifth secondary absent.

CORACIOMORPHÆ.—Aves with abnormal plantar tendons, and, as regards the young, altrices.*

* Recent investigations, though some of them are based upon the observation of birds in confinement, seem to suggest that the condition of the young at birth is a character that may vary in not very distantly related groups. It seems to be a remarkably constant character on the whole, but there are several cases of the apparently independent acquirement of one or other condition.

If the earliest birds were arboreal in their habits, it is most likely that they built in trees, and laid their eggs in places where it would be dangerous or difficult for young birds to leave the nest until they were able to fly, so that it was manifestly advantageous to them to be altrices. Assuming this condition of the young to be the primitive one, the following groups have acquired the habit of remaining in the egg until they are sufficiently developed to run about in pursuit of food or in avoidance of danger:—

Anseres.

Ralliformes (with the possible exception of the *Heliornithidæ*).

All the Charadriiformes except the *Alcidæ* and *Columbidæ*.

Turnices and Crypturi.

All the Galliformes, with the probable exception of the *Podicipidæ* and *Opisthocomidæ*.

Dromæomorphæ.

ÆGITHOMORPHÆ.—Aves with normal plantar tendons, and with the fifth secondary present.

DROMÆOMORPHÆ.—Aves with the palatines articulating with the pterygoids, and not with the rostrum of the basisphenoid. Keel of the sternum obsolete. Coracoids fused with the clavicles.

The order in which these five subclasses may be placed is a matter of no importance whatever, except so far as any evidence may exist to show that any two of them are more nearly related to each other than they are to the rest. Thus it is possible that the Dromæomorphæ, which are supposed to be quincubital, are more nearly allied to the Ægithomorphæ than they are to the Pelargomorphæ. The Coraciomorphæ contain both quincubital and aquincubital species, and may consequently be placed between the aquincubital Pelargomorphæ and the quincubital Ægithomorphæ. On the other hand, the diagnosis of the three central groups may be regarded as weak, whilst those of the two external ones are exceptionally strong.

It is very unlikely that the ancestors of the five subclasses of birds were isolated from each other contemporaneously. At what particular date the isolation of the Penguins took place it is impossible to determine. There is no evidence to suggest specially near relationship to any other group, though isomorphisms can be traced in abundance. It must be assumed that the Penguins are descended from birds which were able to fly, but whether they were isolated after the aquincubital birds were developed, and if so, to which party they belonged, it were idle to guess, inasmuch as all traces of primaries or secondaries have disappeared from the wing of the Penguin. The Penguins occupy a position amongst Birds analogous to that of the Whales amongst Mammals. They are the most highly specialised amongst birds, the aim of their specialisation being to adapt them to an aquatic life, and to enable them to get their food by diving. To give them time to metamorphose their wing into paddles so completely as they have done, it must be assumed that their isolation occurred at a very early date, sufficiently early to warrant us in regarding the Penguins as the survivors of a group of birds whose isolation dates back far enough to entitle them to hold rank as a subclass.

SPHÆNISCOMORPHÆ.

The Penguins are very highly specialised Birds, but possess some peculiarities which may be archaic. In addition to the character that none of the feathers of the wing are differentiated into quills, they possess other characters which are equally diagnostic. The first digit of the manus is fused with the second in adult birds; the bones of the forearm are all flattened; the scapula is very broad, not differing very much in size from the keel of the sternum.

1. Impennes.

The Penguins are entirely confined to the Southern Hemisphere only reaching the Equator on the Galapagos Islands, having apparently followed the cold Peruvian current, which flows from the Antarctic Ocean along the west coast of South America. They all belong to the *Sphæniscidæ*.

PELARGOMORPHÆ.

The Pelargomorphæ comprise all the aquincubital Birds with normal deep plantar tendons. They may be subdivided in various ways; but the following division appears to possess the merit of demanding the fewest instances of the independent acquirement of important characters, whilst each division is capable of being diagnosed with ease. These subdivisions are four in number, and may be diagnosed as follows:—

Charadriiformes. — Pelargomorphæ with schizognathous palate* and schizorhinal nasals.†

* The arrangement of the bones of the palate, with which Huxley's name is specially associated, is admitted to be of considerable taxonomic importance, though in some cases the change from one type to another has unquestionably been independently made and occasionally imperfectly completed. The main points are in the shape of the vomer and the coalescence of the maxillo-palatines. The vomer may be broad and truncated (Passeres), narrow and more or less pointed (Limicolæ), or a combination of the two (Trochili). It may be absent (*Alcedinidæ*), or split into more than one (*Picidæ*). It may also be expanded behind so as to prevent the palatines from articulating with the rostrum of the basisphenoid (Struthiones). The maxillo-palatines may coalesce with each other across the middle line (Anseres), or be united by an ossified nasal septum (*Falconidæ*), or be free from each other (*Charadriidæ*).

If wideness of distribution be an argument in favour of ancientness of origin,

RALLIFORMES.—Pelargomorphæ with schizognathous palate, holorhinal nasals, more or less vestigial hallux, and bill unfurnished with a cere.

FALCONIFORMES.—Pelargomorphæ with holorhinal nasals; bill furnished with a cere; hallux well developed and situated on the same plane as the other digits; spinal feather-tract well defined on the neck; and young hatched in a helpless condition.

CICONIIFORMES.—Pelargomorphæ with desmognathous palate, and with spinal feather-tract not defined on the neck.

The Pelargomorphæ appear to have been very successful in the struggle for existence. The Columbæ, the Psittaci, the Accipitres, and the Striges still perch in trees; whilst most of the Gaviæ, the Pygopodes, the Steganopodes, the Anseres, and the Tubinares are swimmers or divers. The Limicolæ, the Grues, and the Herodiones are many of them waders, and are half land and half water birds.

CICONIIFORMES.

Probably few persons will object to the association of the Steganopodes with the Herodiones and the Anseres. They are all desmognathous, and in none of them is the spinal feather-

we may suppose that free maxillo-palatines are a primitive character; but desmognathous palates are found in all the Ciconiiformes, in the Psittaci, and Accipitres amongst the Falconiformes, in more than half the families of the Coraciomorphæ, and in all the Cuculiformes. Further evidence that free maxillo-palatines are a primitive character is to be found in the fact that in newly-hatched examples of many desmognathous birds the maxillo-palatines have not yet coalesced.

† Garrod and Forbes attached great importance to the bifurcation of the nasal bone, of which they recognised two modifications:—

Holorhinal.—Angle of bifurcation rounded off and placed forwards, so that a line drawn across the skull at a tangent to the two curves falls in front of the lachrymals and the termination of the nasal processes of the premaxillary.

Schizorhinal.—Angle of bifurcation in most cases very acute, but occasionally rounded; always placed backwards so that the apex extends as far back as the posterior terminations of the nasal processes of the premaxillary between the centres of the lachrymals.

Schizorhinal birds occur both in the Pelargomorphæ and in the Ægithomorphæ. In the former subclass the Charadriiformes are all schizorhinal, and amongst the Ciconiiformes the *Ibididæ*, a small family of Herodiones, appear to have independently acquired the same peculiarity. In the latter subclass the Turniciformes are all schizorhinal, and amongst the Passeriformes it appears that there are half-a-dozen small genera of mesomyodian Passeres which have also independently become schizorhinal (Garrod, "Proceedings of the Zoological Society," 1877, p. 449). All other birds are supposed to be holorhinal.

tract defined on the neck; but a minute inquiry into their characters shows some very remarkable variations from the normal avian type. Some of these variations are so extraordinary that they have been considered of sufficient importance to warrant the placing of their possessors in separate orders. For example, the absence of the uncinate processes of the ribs of the *Palamedeidæ*, though it is a unique character amongst birds, has had an exaggerated taxonomic character attached to it. There is no reason whatever for the supposition that it is an archaic character which has been retained by this family alone. There can scarcely be any doubt that the *Palamedeidæ* once had uncinate processes on their ribs, and that they lost them after having acquired the peculiar characters which they inherited from the ancestors of the *Anatidæ* and *Phœnicopteridæ*, otherwise these peculiar characters must have been independently acquired by one or the other of them. There is, however, a curious instance of the independent acquisition of a remarkable character by a family in the Ciconiiformes. The *Ibididæ* are schizorhinal, like the Charadriiformes.

The twelve families which form the Order CICONIIFORMES may be conveniently grouped in three Suborders, which has every appearance of being a natural arrangement, though some difference of opinion exists as to the nearest affinities of the *Phœnicopteridæ*.

The three Suborders may be diagnosed as follows:—

Herodiones.—Ciconiiformes with altrical young; free hallux; and no basipterygoid processes.

Ansercs.—Ciconiiformes with præcocal young; the mandible much produced and recurved behind its articulation with the quadrate; and holorhinal nasals.

Steganopodes.—Ciconiiformes with the hallux united to the second digit by a web; mandible truncated behind the quadrate.

2. ANSERES.

In spite of the supposed affinity of the Flamingoes with the Storks, the ANSERES are an extremely easy group to diagnose. They are the only desmognathous birds whose young are able to run about a few hours after they are hatched. It is probable that both these characters may have been independently acquired, but other diagnostic combinations of characters can easily be found. In no other birds is the mandible so much produced and recurved

behind its articulation with the quadrate. The Anseres are aquincubital, and have normal plantars, the spinal feather-tract is not defined on the neck, they have a tufted oil-gland and holorhinal nasals, the cæca are well developed, the hallux is elevated, small (occasionally absent) and not united to the second digit by a web, and there is no extraordinary development of the cnemial process of the tibia.

The Anseres comprise three well-marked families. The *Anatidæ* are the only birds except the Galli which have basipterygoid processes placed as far forward as possible. The *Palamedeidæ* * are the only birds which have lost the uncinate processes of the ribs. The *Phœnicopteridæ* differ from the other two families in the Order in various other ways, of which the remarkable length of their legs and the scutellation of the tarsus both in front and at the back are the most conspicuous.

The *Anatidæ* may be regarded as cosmopolitan; the *Phœnicopteridæ* as circumtropical and, to a limited extent, subtropical also; whilst the *Palamedeidæ* are confined to tropical and subtropical South America.

3. Herodiones.

The Herodiones possess many characters in common, though the families which constitute them vary considerably from each other, especially when the *Ibididæ* have been added to the number. This family differs from all the others in the Order in being schizorhinal. In none of the families is the spinal feather-tract defined on the neck, but there is considerable variation in their pterylosis. The *Scopidæ* are peculiar in having lateral bare tracts on the neck, but the spinal feather-tract is replaced by a spinal bare tract. The *Ardeidæ* are peculiar in having an interclavicular process within the angle of the furculum, and in having a large powder-down patch on each side of the breast. The *Ciconiidæ* remain as the typical family, with no powder-down patches † on

* It has been stated that *Palamedea cornuta* is quincubital (Beddard and Mitchell, "Proceedings of the Zoological Society," 1894, p. 536). I venture to think that this is an error; I have examined the relaxed wing of a specimen of this species in the British Museum, and find an extra covert both above and below between the fourth secondary and the one next it.

† The wide distribution of powder-down patches is a remarkable instance of the independent acquirement of a curious and apparently useless character. It is not known that any strictly aquatic bird has any powder-down patches, but in the Herodiones *Balæniceps* has one pair, *Botaurus* two, *Ardea* three, and *Cancroma*

the breast, no lateral bare tracts on the neck, and no interclavicular process, to which must be added holorhinal nasals. The *Scopidæ* and the *Ardeidæ* differ from the *Ibididæ* and the *Ciconiidæ* in having when adult the down confined to the bare spaces instead of extending also over the feather-tracts as in all the other families of the Ciconiiformes.*

The Herodiones may be regarded as almost cosmopolitan, except that their range does not reach the Arctic Regions, and that of the *Scopidæ* is confined to Africa.

four pairs. In the Falconiformes they are found in a few genera of Psittaci and Accipitres, but not in the Striges. In the Coraciiformes they appear in *Podargus* and *Batrachostomus* among the Caprimulgi, and in *Leptosomus* among the Picariæ. In the Passeriformes they are only known in the genus *Artamus;* but in the Turniciformes they appear to be always found in the Eurypygæ (five pairs) and in the Crypturi. They are unknown in the Galliformes, Apterygiformes, Struthioniformes, Sphænisciformes, Ralliformes, Charadriiformes, Cathartiformes, Trogoniformes, Piciformes, or Cuculiformes.

* The difference between a Sparrow, a Cormorant, and a Duck in their immature dress is very remarkable. The young Duckling is hatched with a thick coating of soft down. The Sparrow and the Cormorant come out of the egg as naked as frogs. In a very short time the Cormorant grows a coat of down as thick and soft as that of the young Duckling; but the Sparrow has evidently come to the conclusion that with his snug feather-lined nest and devoted parents always ready to protect him from cold in bad weather, it is not worth his while to acquire a complete dress of down, and is content to wait patiently for his feathers. The amount of down which is acquired before the feathers arrive varies according to the habits of the species, and the same may be said of the amount of down which is retained in the adult plumage. The Sphæniscomorphæ and the Pelargomorphæ have for the most part so far deviated from the primitive or typical bird as to adopt an aquatic life. Apparently, in order to suit themselves to these conditions they have found it "fit" to retain a certain amount of down under their feathers throughout life. The only exceptions in these two subclasses are the following families, which may possibly be reverting towards the primitive type by becoming less aquatic in their habits. The *Scopidæ*, the *Ardeidæ*, the *Strigidæ*, the *Otididæ*, and the *Pteroclidæ* have discarded the down from their feather-tracts, but have retained it on the bare spaces, whilst the *Columbidæ* have "gone one better" by discarding the down from both. In the remaining thirty families there is more or less down distributed both on the feather-tracts and on the bare spaces of the adult.

The Ægithomorphæ, the Coraciomorphæ, and the Dromæomorphæ contrast strikingly in this respect with the Sphæniscomorphæ and the Pelargomorphæ. The Dromæomorphæ lose all their down when adult. The only families in these three subclasses which retain it both on the feather-tracts and bare spaces are the *Cathartidæ*, the *Alcedinidæ*, the *Eurypygidæ*, the *Rhinochetidæ*, the *Cariamidæ*, the *Psophiidæ*, the *Opisthocomidæ*, and possibly the *Mesitidæ*. A few families take an intermediate position, having down more or less sparingly distributed over the bare spaces, but not on the feather-tracts: these are the three families which compose the Caprimulgi, the *Cypselidæ*, the *Cuculidæ*, the *Turnicidæ*, the three families which compose the Galli, and, it is said, some species of the *Passeridæ* and *Tyrannidæ*. In the remaining eighteen families it is not known that the down is retained in any part of the plumage of the adult.

4. Steganopodes.

The Steganopodes differ from all other birds in having the hallux united to the second digit by a web. They agree with the Herodiones in having altrical young, and in having no basipterygoid processes. They may be divided into five families. The *Phaetontidæ* are peculiar in having a large nasal aperture, and in having the palatines not coalesced. The *Phalacrocoracidæ* agree with the *Phaetontidæ*, but differ from the others in having the dorsal vertebræ furnished with ventral processes. The *Fregatidæ* are peculiar in having the feet of the coracoids coalesced with each other. The *Pelecanidæ* agree with the *Phaetontidæ* and differ from the others in having the palatines narrowed for some distance from the pterygoids and expanded for some distance after they separate. The *Sulidæ* scarcely differ from the *Phalacrocoracidæ* in the arrangement of the palatines.

Externally the birds in these five families differ remarkably. The nearly straight bill of the *Phaetontidæ* and the *Sulidæ*, the boldly-hooked bill of the *Fregatidæ*, and the pouched bill of the *Pelecanidæ* are familiar examples of the small taxonomic value that can be attached to the external form of the bill. The range of the *Phaetontidæ* and the *Fregatidæ* is circumtropical, that of the *Pelecanidæ* is also subtropical, and that of the *Phalacrocoracidæ* and *Sulidæ* is also subarctic.

FALCONIFORMES.

The Falconiformes, like the Ralliformes, are aquincubital, holorhinal, and have normal plantars; but the hallux is well-developed and situated on the same plane as the other digits. The nasal septum is ossified, causing the nares to be impervious, and the bill is furnished with a cere. The spinal feather-tract is well defined on the neck by the lateral bare tracts, and is forked between the shoulders. The young are hatched in a helpless condition, and are fed by their parents in the nest for many days. In the arrangement of their palatines they vary somewhat. The Psittaci are directly desmognathous, the maxillo-palatines coalescing across the middle line. The Accipitres are more or less desmognathous, but the ossified nasal septum often has to do duty to make them so. The Striges might almost be regarded as schizog-

nathous, though there is much ossification of the nasal septum. Basipterygoid processes are always present in the Striges, and always absent in the Psittaci; but in the Accipitres they are only present in the *Gypogeranidæ*.

The Falconiformes consist of three sharply defined Suborders, which are supposed by some writers to be more nearly related to other suborders than they are to each other:—

Psittaci.—Feet zygodactyle; dorsal vertebræ opisthocœlous; cæca absent; oil-gland tufted or absent.

Accipitres.—Feet normal or nearly so; dorsal vertebræ heterocœlous; cæca rudimentary; oil-gland tufted.

Striges.—Feet more or less zygodactyle; dorsal vertebræ heterocœlous; cæca large; oil-gland nude.*

5. Psittaci.

The association of the aquincubital Psittaci with the quincubital Cuculi appears to me to be most objectionable. The Psittaci agree with the Accipitres in their pterylosis much nearer than with the Cuculi. The Psittaci and the Accipitres both possess a cere, which is wanting in the Cuculi. On the other hand, the Psittaci agree with the Cuculi in having the fourth digit directed backwards.

* The condition of the oil-gland, though occasionally useful in the diagnosis of minor groups, does not appear to have much taxonomic value. Some birds have no oil-gland, principally birds living in dusty localities, where it is of importance that the plumage should be dry. None of the Struthioniformes have an oil-gland. It is also wanting in the *Otididæ*, in a few American *Psittacidæ*, a few genera of *Columbidæ*, in the genus *Argus* amongst the *Phasianidæ*, and in the *Podargidæ*.

When present, the oil-gland may be either naked or surrounded by a tuft of feathers. The tuft is obviously intended to protect the oil-gland from water, and is chiefly confined to aquatic or semi-aquatic birds.

No web-footed bird has a nude oil-gland. None of the Sphænisciformes or Ciconiiformes have a nude oil-gland. In the Falconiformes, the *Strigidæ* alone have a nude oil-gland. None of the Ralliformes have a nude oil-gland. In the Charadriiformes, the *Columbidæ* and the *Pteroclidæ* alone have a nude oil-gland. The Cathartiformes have a nude oil-gland. Of the Coraciiformes, about half the families have a nude oil-gland: *Caprimulgidæ*, *Steatornithidæ*, *Cypselidæ*, *Coraciidæ*, *Meropidæ*, *Trogonidæ*; and in two of the families, *Momotidæ* and *Galbulidæ*, the oil-gland is nude in some species and tufted in others. In the Cuculiformes, the *Cuculidæ* have a nude oil-gland. All the Passeriformes have a nude oil-gland. In the Turniciformes the *Eurypygæ* have a nude oil-gland, and in the Galliformes the *Cariamidæ*.

The range of the Psittaci may be regarded as circumtropical, but the *Trichoglossidæ* are confined to Australasia.

The Psittaci may possibly be naturally divided into two groups (Salvadori, "Catalogue of the Birds in the British Museum," xx. p. 2). The *Nestorinæ*, the *Loriinæ*, and the *Cyclopsittacinæ* may be associated together to form the family *Trichoglossidæ* (Gadow, "Bronn's Thier-Reichs," ii. p. 222). In this family the ridges on the under-surface of the hook of the mandible are indistinct and longitudinal. The *Cacatuinæ*, the *Psittacinæ*, and the *Stringopinæ* may be united to form the family *Psittacidæ*, with the ridges on the under surface of the hook of the mandible more distinct and more or less transverse or oblique.

6. Accipitres.

The position of the Accipitres in the Systema Avium is a question upon which authorities differ widely. Fürbinger places them between the Steganopodes and the Herodiones, but other writers express different opinions.

The Accipitres consist of three families. The *Gypogeranidæ* have long legs like Storks, but differ from them and from the *Falconidæ* and the *Pandionidæ* in having basipterygoid processes, a character in which they agree with the *Striges*. The *Pandionidæ* agree with the *Strigidæ*, and differ from the *Falconidæ* and *Gypogeranidæ*, in having no bony bridge over the extensor groove on the anterior surface of the distal and of the tibio-tarsus, and in having a bony bridge over the extensor groove on the anterior surface of the proximal end of the tarso-metatarsus (Milne-Edwards, *Oiseaux Fossiles de la France*, ii. pp. 413, 419). The *Pandionidæ* also agree with the Striges and the Psittaci, but differ from the *Falconidæ* and *Gypogeranidæ* in having only the second and third digits directed permanently forwards.

The Accipitres are cosmopolitan in their range, but the *Gypogeranidæ* are confined to South Africa.

7. Striges.

The owls are unquestionably the most aberrant group amongst the Falconiformes. They occupy a similar position to that of the Columbæ amongst the Charadriiformes. It is very curious how many characters the Striges have in common with the Caprimulgi.

In both these suborders the oil-gland is nude, and the down in adult birds is restricted to the feather-tracts, and in neither of them is the ambiens muscle present. None of these characters can be regarded as of much taxonomic value; in many other groups instances are to be found of the independent acquirement or loss of all of them. The similarity of the syrinx in the Striges and the Caprimulgi is more important, but appears to me to be far outweighed by the presence of the cere in the Psittaci, Striges, and Accipitres, and the abnormal plantar tendons of the Caprimulgi.

The Striges may be regarded as cosmopolitan.

RALLIFORMES.

The Ralliformes may be briefly diagnosed as aquincubital birds with normal plantars, holorhinal nasals, and schizognathous palatines; the bill is not furnished with a cere; and the hallux is small, elevated above the plane of the other digits, sometimes quite rudimentary, and occasionally absent altogether. The nostrils are said to be always pervious, though in some genera (*Corethrura*, *Thyorhina*) they are furnished with an operculum.

The Ralliformes consist of three sharply defined Suborders, respecting whose relationship to each other some difference of opinion exists:—

Tubinares.—External nostrils produced into tubes.

Pygopodes.—Cnemial process of tibia produced forwards to a remarkable degree. Posterior processes of the ilium approximated to such an extent that the sacrum is almost entirely concealed.

Fulicariæ.—Ralliformes possessing none of the above-mentioned characters.

8. Tubinares.

The association of the Petrels with the Divers and the Rails may at first sight appear somewhat startling. The old school of ornithologists placed the Petrels near the Gulls, but more recently they have been associated with the Pelicans and the Penguins.

The Tubinares frequent the seas of the whole world, and the special modification of their nostrils, a character in which they differ from all other birds, is specially adapted to their aquatic

habits. The front digits are connected together by a web. In one genus (*Pelecanoides*) the hallux is absent; in the *Diomedeidæ* the rudimentary hallux is concealed under the skin, but in all the other Tubinares it is visible though reduced to one phalanx.

The Tubinares may be divided into three families. The *Puffinidæ* differ from the other two families in having basipterygoid processes; the *Diomedeidæ* differ from the other two families in having the nasal tubes separated from each other, leaving the *Procellariidæ* as the typical family of the Order.

9. Pygopodes. 10. Fulicariæ.

These suborders contain only six families, but they all have very wide geographical ranges, and appear to have become differentiated from each other by many and strongly marked characters.

The *Colymbidæ* and the *Podicipidæ* differ from the other four families in having the cnemial process of the tibia produced forwards to a remarkable degree, and in having the posterior processes of the ilium approximated to such an extent that the sacrum is almost entirely concealed.

Of the six families the *Colymbidæ* alone consists of birds with completely webbed feet, but the *Podicipidæ*, the *Heliornithidæ*, and some of the *Rallidæ* have lateral lobes on the digits.

The *Otididæ* and the *Heliornithidæ* agree with the *Colymbidæ* and *Podicipidæ*, and differ from the *Œdicnemidæ* and *Rallidæ*, in having no lateral bare tracts on the neck.

The *Œdicnemidæ* are peculiar in having opisthocœlous dorsal vertebræ, and the *Otididæ* in having no oil-gland. The *Heliornithidæ* are altrices like the Tubinares, but all the other birds in the Order are præcoces. They have also an important interclavicular process which is attached to the keel of the sternum. The *Colymbidæ* and *Podicipidæ* have the external process, but it is not attached to the keel of the sternum. In the other families the interclavicular process is very small and seldom attached to the keel of the sternum.

The hallux is absent in the *Otididæ* and in the *Œdicnemidæ*.

Whether the characters in which the *Colymbidæ* and *Podicipidæ* agree with each other and differ from the others may or may not be regarded as of sufficient importance to warrant the combination of these two families into a Suborder under the name of Pygopodes, leaving the other four associated together under the

name of Fulicariæ, is a not very important question, respecting which there may be differences of opinion.

Of the Ralliformes, the *Heliornithidæ* are tropical; the *Colymbidæ* arctic; the *Podicipidæ* almost cosmopolitan; whilst the range of the other three families does not extend to the Arctic Regions, that of the *Otididæ* is restricted to the Old World, and that of the *Heliornithidæ* * to the New World.

CHARADRIIFORMES.

The Birds which I have associated together to comprise the Order to which the name of Charadriiformes has been given possess the following characters:—

The *flexor perforans digitorum* is connected with the second, third, and fourth digits, but not with the hallux (which is sometimes absent).

The fifth secondary-quill is absent.

The maxillo-palatines are free.

The bifurcation of the nasals is schizorhinal.

The humerus is furnished with a more or less prominent ectepicondylar process.†

The Charadriiformes may be divided into five Suborders, which of course all possess the characters that are diagnostic of the Order, and which may be diagnosed from each other as follows:—

Gaviæ.—Charadriiformes with the spinal feather-tract well-defined on the neck; the dorsal vertebræ opisthocœlous; the basipterygoid processes absent; the oil-gland tufted [and the young generally præcocal except in the *Alcidæ*].

Limicolæ.—Charadriiformes with the spinal feather-tract well defined on the neck; the dorsal vertebræ opisthocœlous; the

* *Heliornis* has always been regarded as the New World representative of the Old World genus *Podica*. The theory that the resemblance is only accidental, and that *Podica* is the Old World representative of the New World *Psophiæ*, is supported by several facts. In spite of statements to the contrary, there can be little doubt that *Podica* is quincubital and belongs to the Galliformes, whilst *Heliornis* is aquincubital and belongs to the Ralliformes. Three specimens (two of them in spirit) of *Podica senegalensis*, and one of *Heliornis fulica*, have been most carefully examined for me by experts at the British Museum.

† This process is not found in the *Œdicnemidæ*, a holorhinal family of the Fulicariæ (Lydekker, "Catalogue of the Fossil Birds in the British Museum," p. 168).

basipterygoid processes * present; the oil-gland tufted; and the young præcocal.

Grues.—Charadriiformes with the spinal feather-tract not defined on the neck; the dorsal vertebræ heterocœlous; [the basipterygoid processes generally absent, but occasionally present;] the young præcocal; and the oil-gland tufted.

Pteroclcs.—Charadriiformes with the spinal feather-tract not defined on the neck; the dorsal vertebræ heterocœlous; the basipterygoid processes present; the oil-gland nude; and the young præcocal.

Columbæ.—Charadriiformes with the spinal feather-tract well defined on the neck; the dorsal vertebræ heterocœlous; the basipterygoid processes present; the young altrical; and no down retained in the adult plumage.

11. Gaviæ. 12. Limicolæ.

The Gaviæ and the Limicolæ have characters in common which are not shared by the three other Orders, and might almost be joined together in one Order. They have opisthocœlous dorsal vertebræ, and the spinal feather-tract is well defined on the neck by the lateral bare tracts.† The spinal feather-tract is also well defined on the neck in the Columbæ, but the lateral bare tracts are confined to the base of the neck in the Pterocles and the Grues. The Pterocles further differ from the Columbæ in

* The presence or absence of basipterygoid processes cannot be regarded as of much taxonomic value. Inasmuch as they are characteristic of Lizards, Snakes, and archaic Reptiles, and are found in the embryos of many Passeres, their presence must be regarded as a primitive character which might easily be independently lost by various groups of birds. There is every reason to believe that they have been thus lost by the majority of birds.

They still survive amongst the Charadriiformes in the Limicolæ, Pterocles, and Columbæ.

Amongst the Ciconiiformes they are only known in the Anseres.

Amongst the Falconiformes they survive in the *Puffinidæ*, *Gypogeranidæ*, and the *Strigidæ*.

Amongst the Coraciomorphæ they are only known in the *Caprimulgidæ*, the *Steatornithidæ*, the *Cathartidæ*, and the *Trogonidæ*.

Amongst the Ægithomorphæ they occur in the Turnices, the Crypturi, and the Gallinæ.

All the Dromæomorphæ possess basipterygoid processes.

† Nitzsch asserted that *Rhynchæa* was exceptional in having no lateral bare tracts on the neck, and later writers have copied his statement. I have examined skins of *Rhynchæa capensis* and they appear to have the same lateral bare tracts on the neck as are found in *Scolopax*.

being præcoces; but in spite of such important differences it has been shown (Gadow, "Proc. Zool. Soc.," 1882, p. 312) that they possess many points in common. The nostrils are impervious, whilst those of the three other Orders of Charadriiformes are pervious. The oil-gland is naked or wanting, whilst it is tufted in the three other Orders. The vomer is vestigial or wanting, but is well developed in the three other Orders.

Of the five families associated together to form this group, the *Charadriidæ* and the *Parridæ* are the only ones that possess basipterygoid processes. The *Parridæ** differ from the *Charadriidæ* in having no lateral occipital fontanelles. The *Alcidæ* are altrices; the other four families are præcoces. I know of no difference between the *Laridæ* and *Cursoriidæ* except that the former have webbed feet, a miserable character on which to found a family.

The *Alcidæ* breed in the Arctic and Subarctic parts of the Northern Hemisphere; the *Laridæ* and the *Charadriidæ* are almost cosmopolitan; the *Parridæ* are circumtropical; whilst of the *Cursoriidæ* the *Cursoriinæ* are confined to the tropical parts of the Old World, the *Chionidinæ* to Arctic South America, and the *Thinocorinæ* to South America generally.

13. Grues.

The almost cosmopolitan Cranes and the American Courlans (*Aramus*) compose the Grues, and cannot be regarded as belonging to different families. They are probably near relatives of the Gavio-Limicolæ. Compared with the *Charadriidæ* the *Gruidæ* have quite lost the opisthocœlous character of their dorsal vertebræ, and all but lost their basipterygoid processes.

14. Pterocles.

The Sand-Grouse appear to form a connecting link between the Limicolæ and the Columbæ. They agree with both in having basipterygoid processes. The Pterocles and the Limicolæ are præcoces, but the Columbæ are altrices. The Pterocles and the Columbæ have the oil-gland nude (when present; it is occasionally

* The statement (Gadow, "Bronn's Thier-Reichs," ii. p. 195) that *Parra* is holorhinal is one of those curious accidents which requires the most careful revision entirely to avoid.

absent in the Columbæ), but in the Limicolæ it is tufted. The Limicolæ have some down distributed all over the surface in the adult: in the Pterocles it is restricted to the feather-tracts, and in the Columbæ it is absent altogether. The nostrils are pervious in the Limicolæ, but impervious in the Pterocles and the Columbæ. On the other hand, the Pterocles differ from both the allied sub-orders in having the plumage of the neck almost continuous.

The Pterocles are confined to the Old World, and to the tropic and subtropic parts of it.

15. Columbæ.

The systematic position of the Pigeons has been a puzzle to ornithologists. They appear to be a very isolated group of birds, and widely different opinions as to their affinities have been expressed. Linnæus regarded the conditions of the newly hatched young and the development of the hallux as very important characters, and placed the Pigeons in his Order Passeres. Pennant established an Order of Columbine Birds, which he placed between his Gallinaceous Birds and his Passerine Birds. Cuvier went a step further and included the Pigeons in his Gallinacés. Now that it has been established that the Pigeons are aquincubital, whilst both the Gallinaceous and Passerine Birds are quincubital, it seems most improbable that any of these opinions can be true. If the choice be restricted to the aquincubital birds with normal plantars, the Pigeons seem to fall naturally into the schizognathous schizorhinal Order, and represent the tree-perching contingent of the Charadriiformes.

The Columbæ may be regarded as almost cosmopolitan; they are only absent from the Arctic and Antarctic Regions.

CORACIOMORPHÆ.

The Coraciomorphæ may be regarded as a central group of families which are easily diagnosed by their abnormal deep plantar tendons. Most unaccountably they contain four aquincubital families, two families which appear to contain both quincubital and aquincubital species, whilst the rest of the families are all quincubital.

The Coraciomorphæ may therefore be looked upon as a middle

and mongrel group separating the aquincubital Pelargomorphæ from the quincubital Ægithomorphæ. There cannot be much doubt that the fifth secondary was lost by the Pelargomorphæ very early in the history of the class. If not as completely developed as the other secondaries, it is always absolutely lost. No instance is known of a rudimentary or vestigial fifth secondary. That *Dendrochelidon* should have no trace of a fifth secondary, whilst *Cypselus* has a fully developed one is a profound mystery. I can offer no guess as to the possible explanation.

The Coraciomorphæ may be divided into four Orders, which may be diagnosed as follows:—

Cathartiformes. — Coraciomorphæ in which the *flexor perforans digitorum* leads to the first, second, and third digits; the fifth secondary is absent; the ambiens muscle is present; and the nostrils are pervious.

Coraciiformes.—Coraciomorphæ in which the *flexor perforans digitorum* leads to all the digits, including the hallux; the ambiens muscle is absent; and the nostrils are impervious.

Trogoniformes.—Coraciomorphæ in which the *flexor perforans digitorum* leads to the third and fourth digits only; the second digit is reversed; and the nostrils are impervious.

Piciformes.—Coraciomorphæ in which the *flexor perforans digitorum* leads to the third digit only; the fourth digit is reversed; and the nostrils are impervious.

CATHARTIFORMES.

16. Pseudogryphi.

The Pseudo-Vultures, the so-called New World Vultures, the Pseudogryphi or Mimogypes, are very difficult to place in the Systema Avium. It is agreed on all hands that they are not Vultures, but whether they belong to the Falconiformes, the Coraciiformes, the Ciconiiformes, or may reasonably claim to be raised to Ordinal rank is an open question. I have adopted the last-mentioned course on the ground that though probably nearest related to the Coraciiformes, they differ so much from them that they ought to be regarded as a distinct Order.

The Cathartiformes, the Ciconiiformes, the Coraciiformes, and the Falconiformes are all altrices, so that the condition of the

young at birth throws no light on the question. The Pseudogryphi are aquincubital, but so are the Ciconiiformes and the Falconiformes, and some of the Coraciiformes. The Pseudogryphi have median basipterygoid processes, but these occur also in the *Palamedeidæ* among the Ciconiiformes; in the *Puffinidæ*, *Gypogeranidæ*, and *Strigidæ* amongst the Falconiformes; and in the *Caprimulgidæ*, *Steatornithidæ*, and *Trogonidæ* amongst the Coraciiformes. The Pseudogryphi have an ambiens muscle; no other species of Coraciomorphæ has, but it is not surprising that an Order of the Coraciomorphæ should have become terrestrial in its habits at a date early enough to retain the ambiens muscle. The Pseudo-Vultures have a naked oil-gland, but in the Ciconiiformes it is always tufted, and in the Falconiformes it is tufted in the Tubinares and Accipitres, tufted or absent in the Psittaci, and naked only in the Striges. In the Coraciiformes it may be naked, tufted, or absent. In their pterylosis the Pseudo-Vultures agree with the Ciconiiformes, and differ from the Falconiformes, in not having the spinal feather-tract well defined on the neck; but this character is probably a primitive one which has been independently retained by the Pseudo-Vultures, as it appears to have been by the *Bucerotidæ* in the Picariæ, the Pygopodes in the Ralliformes, &c. The small and elevated hallux of the Pseudo-Vultures is certainly unique in the Coraciomorphæ, but is found in some of the Ciconiiformes and Falconiformes. The well-developed hallux on the same plane as the other digits is essentially an arboreal character, and was doubtless a primitive one which has been independently lost by various families which have become more or less terrestrial. The deep plantar tendons are so nearly Coraciiform that the balance of evidence appears to be in favour of regarding the Pseudo-Vultures as a very early offshoot of the Coraciomorphæ, and the one which has departed widest from the typical form.

The Cathartiformes differ from the Coraciiformes in many important particulars:—

They have an ambiens muscle.

The hallux is elevated above the plane of the other digits.

The nostrils are pervious.

The young are covered with a much denser covering of down before the feathers appear.

The adults retain some down both on the feather-tracts and on the bare spaces.

Amongst the Coraciomorphæ the *Cathartidæ* are the only

family which have an ambiens muscle.* They appear to have been isolated from the Coraciiformes at a very early date, before the power to re-develop the ambiens muscle was entirely lost. As soon as they began to be more terrestrial in their habits it may be assumed that it was advantageous to them to arrest the decline of the ambiens muscle and restore it to its former use. Some species belonging to the Coraciiformes (some of the *Bucerotidæ*, to wit) are perhaps more terrestrial than the *Cathartidæ*, but they seem to have become so at a much later date, when the ambiens was lost beyond recall.

* There are very few aquincubital birds that have no ambiens muscle, but there are no quincubital families that contain both birds with and birds without it. It is so very much easier for characters to be independently lost than to be independently acquired, that we must assume the possession of an ambiens muscle to have been a primitive avian character.

Of the Ralliformes the *Podicipidæ* have no ambiens muscle.

Of the Charadriiformes the *Alcidæ* and some of the *Columbidæ* have lost it.

Of the Ciconiiformes the *Ardeidæ*, the *Scopidæ*, and the *Pelecanidæ* have lost it.

Of the Falconiformes the Striges and some of the Psittaci, and of the Ralliformes several genera of the Tubinares have the ambiens muscle either absent or in a vestigial condition.

It is not known that any of the Sphænisciformes have lost the ambiens muscle.

Of the Struthioniformes the Casuarii are the only Order which have no ambiens.

It is quite clear that amongst aquincubital birds it is a normal condition to possess an ambiens muscle. Amongst quincubital birds the contrary appears to be the rule.

It is not known that any of the Passeriformes have an ambiens muscle, but, so far as is known, none of the Galliformes are without it, whilst amongst the Cuculiformes the Upupæ have lost it and the Cuculi have retained it.

The presence or absence of the ambiens muscle was a character to which Garrod and Forbes attached primary value. In Garrod's Classification the Class Aves is divided into two subclasses—the Homalogonatæ (consisting of birds which have an ambiens muscle, or which were supposed by Garrod to have only recently lost it) and the Anomalogonatæ (consisting of birds which were assumed by Garrod to have lost it long ago). Garrod regarded the Passeres and their allies as the most highly developed birds that had adopted the latest improvements of the avian structure, of which the suppression of the ambiens muscle was one. The Gallinæ, on the other hand, were supposed by Garrod to be more archaic in their structure, and he regarded the retention of the Ambiens muscle as an archaic character. It is quite possible, however, that exactly the opposite is the case. If we assume that the ancestral birds lived in trees, and acquired the power of flight because they lived in trees, it seems probable that the ancestral birds had no ambiens muscle, and that those birds which now possess it have acquired it in order to adapt themselves to a life on the ground. It may or may not have been a retrograde step, but it was doubtless made in order to find a *modus vivendi*, in the struggle for existence, for a variety of little aberrant groups of birds, which were thus enabled to fill up some of the holes and corners left by the great mass of their relatives who maintained the ancestral habit of perch-

CORACIIFORMES.

The Coraciiformes may be divided into two Suborders :—

The *Caprimulgi* are aquincubital; the spinal-feather tract is well defined on the neck and forked on the upper back; some down is retained on the bare spaces in the adult; the oil-gland is not tufted (naked or absent); the arrangement of the palatines is not ægithognathous (schizognathous or desmognathous).

The *Picariæ* are mostly quincubital, but a few species are said to be aquincubital; no down is retained in the adult plumage except in the *Cypselidæ*, where it is confined to the bare spaces, and in the *Alcedinidæ*, where it occurs on the feather-tracts and sparingly on the bare spaces; they have no basipterygoid processes; the oil-gland is present (naked or tufted); the arrangement of the palatines is not schizognathous (ægithognathous or desmognathous).

17. Caprimulgi.

The Caprimulgi consist of three families. The *Caprimulgidæ* and the *Steatornithidæ* have basipterygoid processes and oil-glands (naked), both of which are wanting in the *Podargidæ*. The *Steatornithidæ* and the *Podargidæ* are desmognathous, but the *Caprimulgidæ* are schizognathous.

The occurrence of aquincubital species as well as quincubital species in the *Cypselidæ* and *Alcedinidæ*, a statement which, if

ing in trees. It is obvious that the ambiens muscle could be independently acquired (or lost, if Garrod's view be adopted), as there are at least eight sharply defined groups which contain some species with an ambiens muscle and others without. These are the Columbæ, Psittaci, Steganopodes, Herodiones, Tubinares, Gaviæ, Pygopodes, and Casuarii.

It is not easy to explain the number of Orders which contain some families with the ambiens muscle and others without. There seems to be some Orders in which it is exceptionally absent, and others in which it is exceptionally present. The birds which are contained in the latter orders are for the most part inhabitants of the air, perching freely in trees; those in the former live principally on the ground or on the water. The ancestral birds probably lived in trees, and, we may presume, rapidly developed the muscles of their fore limbs at the expense of those of their hind ones. It is not improbable, however, that before the ambiens muscle had been completely lost, one or two groups of birds so far returned to the terrestrial habits of their preavian ancestor that the suppression of the ambiens muscle was arrested, and it became advantageous to some of them to re-develop the partially lost muscle. This explanation seems to be more probable than the assumption that the muscle was independently developed in widely distant groups.

true, implies the independent acquirement of so extraordinary a character as the loss of the fifth secondary, is almost startling enough to shake one's faith in the laws of natural selection from fortuitous variations.

The *Caprimulgidæ* are not found in Arctic climates, otherwise they may be regarded as cosmopolitan; the *Podargidæ* are confined to Papuasia and Australia; and the *Steatornithidæ* to South America.

18. Picariæ.

The Picariæ consist of half-a-dozen families, most of them very nearly allied. The most aberrant appear to be the *Cypselidæ* and the *Coliidæ*. In all the other families the feet are syndactyle. The *Cypselidæ* are further distinguished by being ægithognathous; all the other families are desmognathous. The *Coliidæ* also differ from all the other families in the pterylosis of their underparts; they have no ventral bare tract. The *Buccrotidæ* may perhaps claim to be also aberrant, inasmuch as they have no lateral bare tracts on the neck. As regards the pterylosis of the upper parts, the *Alcedinidæ*, the *Momotidæ*, and the *Todidæ* are peculiar in being typically passerine to the extent of having the dorsal feather-tract well defined from the nape to the oil-gland by lateral bare tracts, but not split by any dorsal bare tract. The *Meropidæ* are peculiar in having the episternal processes fused together anteriorly so as to form a bridge over the feet of the coracoids. The *Todidæ* are peculiar in combining functional cæca with a tufted oil-gland. The *Coraciidæ* agree with the *Meropidæ* in combining functional cæca with a nude oil-gland. The *Alcedinidæ*, the *Coliidæ*, and the *Bucerotidæ* have a tufted oil-gland, but no cæca. The *Momotidæ* and the *Cypselidæ* have a nude or nearly nude oil-gland, and no cæca. These characters are sufficient to diagnose all the families, and leave the *Coraciidæ* as the least specialised or most typical group.

The ranges of the *Cypselidæ* and the *Alcedinidæ* may be regarded as almost cosmopolitan, but they do not extend to the Arctic climates. The *Coraciidæ* and the *Meropidæ* are distributed over the temperate and tropical parts of the Old World. The *Bucerotidæ* are more exclusively tropical, and are also unknown in the New World; the *Coliidæ* are very restricted in their range, which is confined to Africa; whilst the *Momotidæ* and the *Todidæ* are only known from tropical America.

TROGONIFORMES.

19. Trogones.

The arrangement not only of the deep plantar tendons in the Trogons, but also of their digits, differs from that of any other birds. The second digit is reversed, and the *flexor longus hallucis* leads both to it and the hallux, leaving the *flexor perforans digitorum* to lead to the third and fourth digits only. The Order contains only one family (*Trogonidæ*), and consequently only one suborder (Trogones).

The *Trogonidæ* resemble the *Caprimulgidæ*, the *Steatornithidæ*, and the *Cathartidæ* in having basipterygoid processes. They also resemble the *Caprimulgidæ* and the *Picidæ* in being schizognathous. The pterylosis of the Trogons is typically Passerine, in which respect the *Trogonidæ* closely resemble the *Alcedinidæ*. Another Passerine character which they possess is the nude oil-gland—a peculiarity also found in the *Galbulidæ*, the *Cypselidæ*, the *Caprimulgidæ*, the *Steatornithidæ*, the *Coraciidæ*, the *Meropidæ*, the *Cathartidæ*, and some of the *Momotidæ*.

The geographical distribution of the *Trogonidæ* is very remarkable. It is strictly confined to the Tropics: nevertheless it is not confined to tropical America, but extends also to tropical Africa and India—an instance of a discontinuous area of distribution not easy to explain except on the assumption that the family is a very old one.

PICIFORMES.

20. Scansores.

The Piciformes are a very sharply defined group, which may easily be diagnosed, irrespective of the deep plantar tendons. They have zygodactyle feet; the spinal feather-tract is well defined on the neck and upper back by lateral bare tracts, and is forked on the lower back; and they have no basipterygoid processes.

The families contained in this Order may be reduced to four: The *Picidæ* are schizognathous; the *Capitonidæ* (including the *Indicatorinæ*) are ægithognathous; the *Galbulidæ* (including the *Bucconinæ*) and the *Rhamphastidæ* are desmognathous, the former

with great and the latter with small subclavicular processes of the coracoid. These families appear to be so nearly related to each other that there seems to be no reason why the Order should be split into suborders.

The *Picidæ* are almost cosmopolitan. Their range extends as far as the limit of forest-growth, except that they are unknown in Madagascar, Australia, and Polynesia. Of the *Capitonidæ*, the *Capitoninæ* may be described as circumtropical, whilst the *Indicatorinæ* are restricted to tropical Africa, India, and Borneo. The *Galbulidæ* and the *Rhamphastidæ* are confined to tropical America.

ÆGITHOMORPHÆ.

The Ægithomorphæ are the predominant birds at the present time, and contain far more species than all the other groups combined. The subclass comprises those birds which are so far typical of the Class that their deep plantar tendons are normal (the *flexor perforans digitorum* not leading to the hallux but to all the other digits), and their wings are normally developed (the fifth secondary being present, the quills being differentiated from the smaller wing-feathers, and the wings being capable of sustaining flight). All these characters may be regarded as primitive, and have probably been handed down by the laws of heredity from their primæval avian ancestors; nevertheless the group appears to be more highly developed than any of the others.

The Ægithomorphæ may be subdivided into four Orders, which may be diagnosed as follows:—

Cuculiformes.—Ægithomorphæ with desmognathous palates, altrical young, and with the spinal feather-tract forked on the upper back.

Passeriformes.—Ægithomorphæ with free maxillo-palatines, with the young altrices, with the spinal feather-tract well defined on the neck but not forked on the upper back,* and without basipterygoid processes or ambiens muscle.

Turniciformes.—Ægithomorphæ with schizorhinal nasals;

* The pterylosis of the upper parts in the Passeriformes is subject to some variation. The spinal feather-tract is always well defined on the neck by lateral bare tracts, and always continues uninterruptedly between the shoulders. On the lower back it may be (*a*) forked as in *Hirundo* and *Eurylæmus*, or widened

maxillo-palatines not coalesced with each other; ambiens muscle present.

GALLIFORMES.—Ægithomorphæ with schizognathous palate, holorhinal nasals, and an ambiens muscle.

CUCULIFORMES.

The *Cuculidæ*, the *Musophagidæ*, and the *Upupidæ* agree together in certain characters in which they differ from the other quincubital birds with normal plantars. They are the only birds amongst the Ægithomorphæ which are desmognathous. They further differ from the Passeriformes in having the spinal feather-tract forked on the upper back; from the Turniciformes in having holorhinal nasals; and from the Galliformes in being hatched blind, naked, and helpless.

21. UPUPÆ. 22. CUCULI.

The *Musophagidæ* agree with the *Upupidæ* in having the oil-gland tufted. The *Musophagidæ* further differ from the *Cuculidæ*, as well as from the *Upupidæ*, in having the spinal feather-tract interrupted at the base of the neck, but not divided on the back by bare spaces. The *Cuculidæ* have a vomer, which is not found in the *Upupidæ* or the *Musophagidæ*. The *Cuculidæ* and *Musophagidæ* possess the ambiens muscle, which is not found in the *Upupidæ*. They also agree in having more or less zygodactyle feet, which is not the case with the *Upupidæ*. Both carotids are also present, whilst the *Upupidæ* only possess the left one. There will probably be little difference of opinion that the *Cuculidæ* and the *Musophagidæ* may reasonably be associated together as *Cuculi*, leaving the *Upupidæ* to form the *Upupæ*.

The *Cuculidæ* are distributed over the temperate and tropical parts of both hemispheres; the *Upupidæ* are not found in the New World; whilst the *Musophagidæ* are confined to Africa.

into a saddle, which may contain (*b*) a central bare space as in *Corvus*, &c., or (*c*) may be solid as in *Passer*, &c.

None of these variations have been found amongst the Pelargomorphæ; but in the Ægithomorphæ they occur in various groups outside the Passeriformes, such as Turnices, Crypturi, and many of the Galli.

Of the Coraciomorphæ the *Alcedinidæ*, the *Todidæ*, the *Momotidæ*, the *Coliidæ*, the *Trogonidæ*, and all the families of the Scansores have the spinal feather-tract well defined on the neck and not forked on the upper back.

PASSERIFORMES.

23. Trochili. 24. Passeres.

The Passeriformes embrace two Orders—the Trochili * and the Passeres—very nearly related to each other, and possibly not sufficiently distinct to be placed in different Orders.

The Passeres have a broad and truncated vomer. The Trochili also have a broad and truncated vomer, but the truncation is not complete; it leaves a long mesial spine. The Trochili only contain one family; but the Passeres may be divided into four families.

The *Passeridæ* and the *Menuridæ* differ from the *Tyrannidæ* and the *Eurylamidæ* in having the intrinsic muscles of the syrinx fixed to the ends (not the middle) of the bronchial semi-rings. The *Eurylæmidæ* differ from the other three families in having the *flexor perforans digitorum* connected by a vinculum with the *flexor longus hallucis*. The *Menuridæ* differ from the other three families in having no interclavicular process.

The *Passeridæ* are not only the most numerous but also the most cosmopolitan of all birds. The *Trochilidæ* are distributed over the tropical and subtropical parts of the New World. The range of the *Tyrannidæ* is rather more extended climatically, and in the Old World extends to various parts of the tropics. The *Eurylæmidæ* are locally distributed in tropical Asia; whilst the *Menuridæ* are confined to Australia.

* In spite of anything that may have been written to the contrary, there can be no doubt that the deep plantar tendons of the *Trochilidæ* are normal; that is to say, the *flexor perforans digitorum* leads to the three front digits and does not lead to the hallux. The *flexor longus hallucis* is a more erratic tendon in the *Trochilidæ*, as elsewhere. In some species it is united by a vinculum to the other tendon, but in others no trace of this has been found. In addition to the excellent dissections which were made for me by Miss Lister, Professor Stewart, and Mr. Bourne, of the Royal College of Surgeons, have been kind enough to make others which confirm in every particular those already made and figured. The two tendons appear to coalesce before the slip leaves for the hallux, but shortly afterwards the coalesced tendon appears to bifurcate; the outer branch very soon again bifurcates, leading to the third and fourth digits, whilst the inner one leads to the second digit. The two tendons are, however, very imperfectly coalesced, and with a little pulling may be separated, when it is at once obvious that the *flexor perforans digitorum* leads to the second, third, and fourth digits, whilst the *flexor longus hallucis* leads to all four digits. An almost exact replica of this arrangement is to be found in the Osprey.

TURNICIFORMES.

The schizorhinal Ægithomorphæ consist of a few waifs and strays which appear to be all that remain of an aberrant and probably ancient group. They represent the survival of a side branch of the predominant group of Birds, which, from the restricted geographical range of the families and the small number of the species, must be regarded as not very successful in the struggle for existence. They appear to be very closely related to the holorhinal Psophiæ, which are also remarkable for the fewness of their species and the smallness of their ranges. The Galli, on the other hand, have been much more successful; and their families are wider in their ranges and much more numerous in their species. It is difficult to determine whether the Psophiæ belong to the Turniciformes or to the Galliformes, or whether these two Orders ought to be amalgamated; but it is much easier to diagnose the subclasses if they be kept separate, and if the Psophiæ be relegated to the Galliformes.

The Turniciformes appear to fall naturally into three Suborders which are very easily diagnosed:—

*Eurypygæ.**—Turniciformes with the vomer free from the maxillo-palatines, with no basipterygoid processes, the oil-gland nude, and powder-down patches on each side of the rump.

Turnices.—Turniciformes with the vomer free from the maxillo-palatines, with basipterygoid processes, but with the oil-gland tufted, and no powder-down patches on either side of the rump.

Crypturi.—Turniciformes with the vomer coalesced with the maxillo-palatines in front, and with the pterygoids and palatines behind; basipterygoid processes present; powder-down patches on each side of the rump.

The three suborders of the Turniciformes also differ in their dorsal pterylosis. There is no spinal bare tract in the Crypturi; it is confined to the lower back in the Turnices; but in the Eurypygæ it extends to the base of the neck in the *Eurypygidæ*, and some way up the neck in the *Mesitidæ* and *Rhinochetidæ*.

* I have very carefully examined the wings of *Eurypyga*, *Mesites*, and *Rhinochetes*, and have been unable to find any trace of surplus wing-coverts to indicate the loss of the fifth secondary.

25. Turnices.

The Turnices consist of one small family confined to the tropical and semitropical parts of the Old World. It has been customary to include the Australian genus *Pedionomus* amongst the *Turnicidæ*, but in my classification it falls naturally into the *Charadriidæ*.

26. Eurypygæ.

This suborder has been provided for the reception of four very widely separated species. Two Sun-Bitterns (*Eurypygidæ*) inhabit tropical America; the Kagu (*Rhinochetidæ*) is confined to New Caledonia; whilst the fourth species (*Mesitidæ*) is only known from Madagascar.

The *Rhinochetidæ* differ from the other two families in having impervious nostrils, and no notches on the posterior margin of the sternum.

The *Mesitidæ* differ from the other two families in having one notch only on each side of the posterior margin of the sternum, in having no furculum, and in having the posterior episternal process large and forked.

The *Eurypygidæ* differ from the other two families in having two notches on each side of the posterior margin of the sternum, and in having the plumage of the neck continuous.

27. Crypturi.

The Neotropical Tinamous are perfectly unique in the form of the sternum, which has a narrow median process to support the keel, and on each side a still narrower process, the three processes occupying four-fifths of its entire length. The keel of the sternum is well developed, and in the arrangement of the feather-tracts and bare spaces the Tinamous are almost Passerine, nevertheless they possess some remarkable Struthionine characters. They differ from all other birds in retaining when adult some down on the feather-tracts but not on the bare spaces. The pelvis and the palate possess characters which are only to be found elsewhere in the Dromæomorphæ. The cartilage which connects the ilium with the ischium is not ossified, and the vomer coalesces with the maxillo-palatines in front and with the

pterygoids and palatines behind. The backward position of the basipterygoid processes, which are situated on the basisphenoid rather than on its rostrum, is another eminently Struthionine character, though it reappears in the *Turnicidæ*. Precisely the same remarks apply to the curious fact that the male of the Tinamous incubates the egg.

GALLIFORMES.

It is curious how many characters the Passeriformes have in common with some of the Galliformes. That they both belong to the Passeromorphæ implies that every species in both Orders has normal plantars and is quincubital. The Passeriformes feed their young in the nest for many days, and it is said that *Opisthocomus*, one of the Galliformes, and *Eurypyga*, one of the Turniciformes, do the same. The Passeriformes have a very simple pterylosis, the spinal feather-tract is well defined on the neck and is not forked on the upper back; a similar pterylosis is found in the Crypturi amongst the Turniciformes, and in many of the *Phasianidæ* amongst the Galliformes. All the Passeres (except the *Eurylæmidæ*) are without any vinculum to connect the two deep plantar tendons, and the same peculiarity is found in the Upupæ amongst the Cuculiformes.

It is not known that any of the Galliformes have lost the ambiens muscle.

The Galliformes may be arranged in two suborders, the Psophiæ and the Galli, which differ from each other in various ways. In the first place, they differ in their pterylosis, the Psophiæ having the down of the adult more or less sparingly distributed over the bare spaces as well as over the feather-tracts, whilst in the Galli it is confined to the latter. The Galli resemble the *Anatidæ* in having the basipterygoid processes placed as far forward as possible; in the Psophiæ they are absent altogether. The Galli resemble the *Upupidæ*, the *Meropidæ*, and the *Bucerotidæ* in having the anterior and posterior episternal processes fused together to form a bridge over the coracoids, a peculiarity not found in any other birds.

28. Psophiæ.

The Psophiæ consist of three South American families and one African and Indian family, differing very widely from each other. The *Opisthocomidæ* are in some respects the most aberrant of birds: the sternum looks as if the keel had been turned upside down, the posterior half projecting more than the anterior portion. Neither the *Opisthocomidæ*, the *Podicidæ*, nor the *Cariamidæ* have lateral bare tracts on the neck. The subclavicular process is very large in the *Opisthocomidæ*, the *Podicidæ*, and the *Psophiidæ*, but only rudimentary in the *Cariamidæ*. The *Opisthocomidæ* and the *Podicidæ* are said to be altrices, but the *Psophiidæ* and the *Cariamidæ* are supposed to be præcoces. In the *Podicidæ* the toes are narrowly margined with a lobe.*

29. Galli.

The Galli consist of three well-marked families. The *Phasianidæ* and the *Cracidæ* have the oil-gland tufted (except in the genus *Argus*, which has no oil-gland); the *Megapodiidæ*† have the oil-gland nude. The *Cracidæ* and the *Megapodiidæ* have the hallux on the same level as the other digits, and its basal phalanx is as long as that of the third digit. The *Phasianidæ* have the hallux raised above the level of the front digits, and its basal phalanx is shorter than that of the third digit. In the *Phasianidæ* the inner notch on the posterior margin of the sternum is more than half the length of the whole sternum; in the other two families it is less.

The *Phasianidæ* are almost cosmopolitan; the *Cracidæ* are confined to tropical America; whilst the *Megapodiidæ* are found in Australia, New Guinea, and other more or less contiguous islands.

* Lobed feet appear to have been independently acquired by various genera. They are found in all the *Podicipidæ*, in *Phalaropus* amongst the *Charadriidæ*, in *Fulica* amongst the *Rallidæ*, in *Podica* amongst the Psophiæ, and in *Heliornis* amongst the Fulicariæ.

† It has been stated that the Megapodes have lost the fifth secondary. After very careful examination I can find no evidence in support of the statement.

DROMÆOMORPHÆ.

If the Penguins may be supposed to have concentrated their energies upon the task of diving under water like fishes, the Ostriches must be regarded as having done their best to vie with the racehorse in running over land. There can scarcely be any doubt that the Ostriches, like the Penguins, are descended from birds which could fly, and that their wings have ceased to be functional from disuse. At what period they were isolated it is impossible to guess, it may have been before or it may have been after the isolation of the aquincubital birds. Inasmuch as no trace of the loss of a fifth secondary from the imperfect wings of the Ostriches can be detected, and their affinities appear to be most with the quincubital series, it is quite possible that they may represent the survivors of a later branch than that from which the Penguins are descended. Under any circumstances it is scarcely probable that any one will deny them the rank of a Subclass. The idea of dividing all living birds into two subclasses, Ratitæ and Carinatæ, has been abandoned as unwarranted by the evidence. Whether the *Apterygidæ* differ sufficiently from the other three families to entitle them to ordinal rank is an open question. That *Dromæus* should have lost the ambiens muscle * is not regarded as a sufficient reason for separating it from *Casuarius*.

APTERYGIFORMES.

30. Apteryges.

It is a matter of opinion how far the Apteryges differ from the Struthiones, but I have placed them in separate Orders in deference to the opinion of Fürbringer, to whom we are indebted for an enormous collection of facts bearing upon the classification of birds. A few of the characters in which these groups differ from each other are enumerated below.

* So far as is known, the habits of the Cassowaries and the Rheas resemble those of the Ostriches and Emus, and it is very difficult to imagine any possible reason why it should have been to the advantage of the Emus to have lost the ambiens muscle that does not equally apply to the other Dromæomorphæ. The only explanation that suggests itself is to assume that *Dromæus* adopted a terrestrial life somewhat later than the other Dromæomorphæ, so late, indeed, that the last rudiments of the ambiens muscle had been lost beyond recall.

STRUTHIONIFORMES.

31. Struthiones.

The Dromæomorphæ contain four families, which differ from each other very widely. The feet of the *Apterygidæ* may be regarded as normal; the *Rheidæ* and the *Casuariidæ* have lost the hallux; whilst the *Struthionidæ* have not only lost the hallux, but also the second digit. The *Struthionidæ* differ from the other three families in having the vomer abruptly truncated posteriorly instead of being produced and bifurcated to coalesce with the palatines and pterygoids. The *Rheidæ* differ from the other three families in having the vomer free from the maxillo-palatines. The *Apterygidæ* may be regarded as normal in having the bridge over the *extensor digitorum* on the tibia ossified, which is not the case in the other three families. The *Casuariidæ* and the *Apterygidæ* have a much shorter humerus (less than the combined length of four dorsal vertebræ) than the *Rheidæ* and the *Struthionidæ* (more than the combined length of six dorsal vertebræ). The *Rheidæ* differ from the other three families in having a pair of tracheo-bronchial muscles.

The *Apterygidæ* inhabit New Zealand, the *Casuariidæ* Australia, the *Struthionidæ* Africa, and the *Rheidæ* South America.

GEOGRAPHICAL DISTRIBUTION

OF

BRITISH BIRDS

By HENRY SEEBOHM

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PREFACE

THE following attempt to make some amends to the Members of the British Ornithologists' Union for the thousand and one blunders contained in a list of British Birds compiled by their Committee, for which I, as one of the seven delinquents, must bear my share of responsibility and blame, does not pretend to be exempt from the universal liability to error. All it can claim is that some pains have been taken to master the subject and to weigh the balance of evidence in each case as impartially as possible.

The attempt has been made to classify British Birds in three different ways. Firstly, as to their distribution within the British Islands; secondly, as to their distribution during the breeding season outside the British Islands; and thirdly, as to their climatic distribution during the breeding season.

H. S.

LONDON, 1893.

GEOGRAPHICAL DISTRIBUTION

OF

BRITISH BIRDS

Introductory Remarks.

GEOGRAPHICAL DISTRIBUTION is a branch of the science of Zoology which has very greatly increased in interest since the theory of Evolution has been generally accepted. It was Darwin's opinion, which recent research has invariably confirmed, that without isolation the differentiation of species is impossible, and of all possible modes of Isolation, Geographical Isolation is the most important.

The number of species which have been included in the list of British Birds at various times considerably exceeds four hundred, but of these many have been admitted on most untrustworthy evidence.

The sources of error are various. In some cases a mistake has been made in the naming of the examples, in others the examples have been correctly named, but they were not obtained in the British Islands, having been changed either by accident or by design by a careless or fraudulent birdstuffer, or by a collector ignorant of the value of scientific accuracy.

A third and very frequent source of error, which it is often impossible to avoid, is caused by the escape of imported birds from aviaries, or the attempts which have been from time to time made to introduce new species into this country by importing birds from abroad and turning them out in the most favourable localities. We may also include under this head the birds which are occasionally helped over the ocean by alighting on the rigging or frequently the decks of the ships which are always scattered over the high seas.

The greatest difficulty which presents itself, in attempting to estimate the number of visitors to our Islands, is to be found in the vagueness of the records of their supposed visits. These records display, for the most part, a lamentable want of knowledge of the nature and value of evidence. The mere statement that a certain bird was shot at a certain place on a certain day is not enough. The characters relied upon for the determination of the species should in all cases be stated. The condition of the plumage and the appearance of the feet should be noted, and any peculiarity of habit which might possibly throw any light upon the chances of the bird having escaped from confinement ought to be recorded. Every scrap of evidence to prove that the example was actually procured in this country in an apparently wild state, and was examined in the flesh by absolutely trustworthy witnesses, is of the greatest interest and scientific value.

In consequence of the absence in so many cases of this all-important evidence, too many records have to be accepted or rejected on the most unsatisfactory ground—the supposed probability or improbability of the occurrence of the species recorded.

It seems to be generally admitted that birds which are only seen and not procured, however competent the observer, must be entirely excluded. The maxim of the "Old Bushman" that *what is hit is history, but what is missed is mystery*, must be rigidly enforced. Of birds that have only once been recorded as British the balance of probabilities must be weighed as best it may. The fact that the Siberian Thrush (*Geocichla sibirica*) has occurred at ten or more places in Europe increases the probability that the English record is a correct one. The circumstance that several species of Gallinules (*Porphyrio*) are kept in aviaries and on ornamental waters very much weakens the evidence in favour of any of them having visited the country in a wild state. Many examples of the Virginian Colin (*Ortyx virginianus*) and of the Andalusian Hemipode (*Turnix sylvatica*) have been turned out in the attempt to naturalise them in this country, and it is only reasonable to suppose that records of the capture of either of these species probably refer to imported birds or their descendants.

Some species are rejected on the ground of the inherent improbability of their ever having voluntarily paid a visit to our Islands, such as the Gold-vented Bulbul (*Pycnonotus capensis*), a species supposed to be absolutely confined to the extreme south of Africa. There can be no doubt that migratory birds are much more likely

to visit us accidentally than those which are non-migratory; and it must also be admitted that most accidental visitors from America or Asia which have been caught in Europe are those which breed in the Arctic Regions, and have, consequently, to deviate less from their usual course in straying to our shores.

Supposed Accidental Visitors.

In a score of cases I have admitted the existence of some evidence in favour of a species having paid a voluntary visit to the British Islands by recording it as a *supposed* accidental visitor. It is impossible to say how much doubt ought to cause the complete rejection of a species, or what amount of evidence may justify its being admitted to the rank of a supposed visitor; but I have endeavoured to draw the line as fairly as possible, and have included the following species in this doubtful class.

Eleven of these are supposed to have visited our Islands from Arctic or Subarctic America—

Ceryle alcyon,
Agelaius phœniceus,
Sturnella magna,
Scolecophagus ferrugineus,
Progne purpurea,
Elanoides furcatus,
Falco sparverius,
Cygnus americanus,
Bernicla canadensis,
Anas americana,
Anas discors;

five from Central or Southern Europe—

Turnix sylvatica,
Phœnicopterus roseus,
Porphyrio cœruleus,
Pyrrhocorax alpinus,
Fringilla serinus;

one from East Siberia—

Emberiza cioides;

one from the Azores or Madeira—

Fringilla canaria ;

one from tropical India—

Falco juggur ;

one from tropical Africa—

Porphyrio smaragdonotus ;

and one from tropical America—

Porphyrio martinicus.

Introduced Species.

In addition to the doubtful species we may exclude one or two other species which have been artificially introduced from more or less distant localities, and have therefore nothing to do with the geographical distribution of the Birds of any part of Western Europe—

Phasianus torquatus,

introduced from China, a species ranging from Dauria to the Pacific, and—

Phasianus colchicus,

introduced from the basin of the Black Sea.

Subspecies.

After the exclusion of the doubtful species and those which have been introduced from distant countries, there still remains 391 species and subspecies of birds which have a fair claim to be regarded as British; but of these there are thirteen subspecies which appear to be local races or climatic forms of species which are already included in the British list, so that the number of species of British Birds is reduced to 378. These subspecies are—

Cinclus aquaticus melanogaster.
Parus ater britannicus.
Troglodytes parvulus hirtensis.

Corvus corone cornix.
Loxia curvirostra pityopsittacus.
Loxia leucoptera bifasciata.
Fringilla linaria rufescens.
Fringilla linaria hornemanni.
Surnia funerea hudsonia.
Falco gyrfalco islandus.
Falco gyrfalco candicans.
Charadrius fulcus americanus.
Charadrius hiaticula major.

Inasmuch, however, as all these subspecies have geographical ranges differing from those of the typical forms (otherwise they could not claim even subspecific rank) they must be regarded as sufficiently distinct to be separately mentioned.

Geographical Distribution of Birds within the British Islands.

The Geographical Distribution of British Birds may be studied from various points of view, and I propose in the first place to classify the 391 birds which have the greatest claim to be regarded as British according to the variation of their distribution within the British Islands.

Those species which are found in the British Islands both in winter and in summer are called *Residents*, though many of them migrate from one part of the country to another part in spring and autumn. Those birds which visit us in spring, remain with us during their breeding season, but leave us again in autumn to winter in more southerly climes, are called *Summer Visitors.* Those which visit us in autumn, remain with us during the winter, but leave us again in spring to breed in more northerly climes, are called *Winter Visitors.* A fourth group consists of species whose breeding-grounds are farther north than the British Islands, and whose winter quarters are farther south, and which consequently are only found in our Islands for a few weeks during migration in spring and autumn. They are called *Spring and Autumn Migrants.*

The fifth group is a very large one, and contains all those

waifs and strays which are supposed to have wandered out of their usual track to our shores, some of them being adult birds that have been driven involuntarily out of their ordinary course by storms and contrary winds; but most of them being very young birds which have accidentally joined the wrong batch of migrants, and have thus been led astray on their first trip, or have lost their way in attempting to find it alone on their second trip. These are called *Accidental Visitors.*

It is impossible to draw a hard and fast line between these various groups, and it must frequently be a question of individual judgment to decide the exact group to which some species ought to be referred.

The Accidental Visitors blend, on the one hand, with the Winter Visitors, and on the other with the Summer Visitors. It is impossible to fix any number of records per year or per century that ought to entitle a species to be removed from the list of Accidental Visitors to those of occasional, very rare, rare, or regular Winter or Summer Visitors. Any line that is drawn between one group and another must of course be arbitrary, and subject also to change with the changed geographical distribution of the species. Many species which can now only be regarded as accidental visitors to our Islands were regular Summer Visitors not a century ago; and some species which were regarded as accidental visitors a century ago appear to have recently extended the range of their breeding-grounds in a westerly direction, and occur so frequently upon our coasts in autumn that they may now be included in the list of Winter Visitors. The Shore Lark and Richard's Pipit are cases in point.

The boundary-line between the Winter Visitors and the Residents is quite as difficult to draw. The number of Woodcocks which visit us in autumn is doubtless very largely in excess of the number which breed in this country; and great numbers of birds of the same species as many of our residents arrive from Scandinavia at various points on the east coast to winter here. Probably the number of more than half of our so-called resident species is increased by visitors from the Continent during the autumn migration. I have endeavoured to ascertain in the various species which predominate the residents or the winter visitors, and to allot them accordingly.

It is obvious that some species may belong to one category in England and to another in Scotland or Ireland. For example,

the Dartford Warbler is a resident in England, but unknown in Scotland and Ireland; whilst the Ptarmigan is a resident in Scotland, but unknown in England or Ireland. In the following summary of the distribution of birds within the British Islands, the word "partial" is prefixed to those appellations which do not apply to all three kingdoms:—

Residents	82	
Partial residents	26	
	—	108
Summer visitors	32	
Partial ditto	16	
	—	48
Winter visitors	66	
Partial ditto	2	
	—	68
Spring and autumn migrants	18	
Partial ditto	14	
	—	32
Accidental	34	
Partial ditto	101	
	—	135
		391

Residents.

Of the 108 species of British Birds which are most accurately described as Residents, three have not occurred in England, three are unknown in Scotland, whilst as many as ten are not known to have visited Ireland.

The following species may be regarded as residents both in England, Scotland, and Ireland:—

Falco peregrinus.
Falco tinnunculus.
Falco æsalon.
Buteo vulgaris.
Accipiter nisus.
Strix otus.
Aluco flammeus.
Corvus corax.
Corvus corone.
Corvus monedula.

Corvus frugilegus.
Pyrrhocorax graculus.
Pica caudata.
Loxia curvirostra.
Pyrrhula vulgaris.
Fringilla chloris.
Fringilla flavirostris.
Fringilla cannabina.
Fringilla cœlebs.
Fringilla carduelis.
Fringilla linaria rufescens.
Passer domesticus.
Passer montanus.
Emberiza schœniclus.
Emberiza miliaria.
Emberiza citrinella.
Turdus viscivorus.
Turdus musicus.
Merula merula.
Erithacus rubecula.
Pratincola rubicola.
Accentor modularis.
Parus palustris.
Parus cæruleus.
Parus ater britannicus.
Parus major.
Acredula rosea.
Troglodytes parvulus.
Regulus cristatus.
Certhia familiaris.
Motacilla boarula.
Motacilla yarrelli.
Anthus pratensis.
Anthus obscurus.
Alauda arvensis.
Alauda arborea.
Sturnus vulgaris.
Garrulus glandarius.
Cinclus aquaticus.
Alcedo ispida.

Columba livia.
Columba palumbus.
Columba œnas.
Tetrao scoticus.
Perdix cinerea.
Gallinula chloropus.
Fulica atra.
Rallus aquaticus.
Numenius arquata.
Vanellus cristatus.
Charadrius hiaticula major.
Totanus calidris.
Scolopax gallinago.
Hæmatopus ostralegus.
Botaurus stellaris.
Ardea cinerea.
Sula bassana.
Phalacrocorax graculus.
Phalacrocorax carbo.
Puffinus anglorum.
Procellaria pelagica.
Alca torda.
Alca troile.
Podiceps cristatus.
Podiceps minor.
Cygnus olor.
Tadorna cornuta.
Larus argentatus.
Larus tridactylus.
Larus ridibundus.
Larus fuscus.
Larus marinus.

Some of these species are very rare or very local in Ireland, such as *Passer montanus*, *Garrulus glandarius*, and *Columba œnas.*

The distribution of the other twenty-six residents may be tabulated as follows. If the total number of residents be added together, it will be found that Scotland heads the list with ninety-eight, England follows with ninety-five, whilst Ireland has only eighty-nine. It must, however, be remembered that these figures

are exclusive of many species of Winter Visitors, a small minority of which are left behind in autumn, and are presumably residents, though the great majority of the individuals representing the species in our Islands migrate in spring to more northerly breeding-grounds, and thus cause the species to be included in the list of Winter Visitors. It is also exclusive of a few species of summer visitors, of which some individuals remain with us all the winter.

Partial Residents.

	England.	Scotland.	Ireland.
Emberiza cirlus	Resident.	Accidental.	Absent.
Sitta cæsia			
Panurus biarmicus		Absent.	
Sylvia provincialis			
Perdix rufa			
Strix aluco		Resident.	
Tetrao tetrix			
Troglodytes parvulus hirtensis	Absent.		
Tetrao urogallus			
Tetrao mutus			
Milvus regalis	Resident.	Accidental.	Accidental.
Gecinus viridis			
Picus major			
Picus minor			
Crex bailloni			
Coccothraustes vulgaris			
Fulmarus glacialis	Accidental.	Resident.	Resident.
Colymbus arcticus			
Parus cristatus			
Alca grylle	Winter.		
Aquila chrysaëtus			
Haliaëtus albicilla			
Colymbus septentrionalis			
Larus canus			
Corvus corone cornix			
Procellaria leachi			

Summer Visitors.

As might be expected, there are no summer visitors to the British Islands that do not visit England. They all come from the south in spring, and could scarcely reach Scotland or Ireland without passing the English coast. There are four summer visitors which do not reach Scotland. None of these four reach Ireland, and an additional species which objects to cross the sea twice raises the number of summer visitors which are unknown in Ireland to five.

There are forty-eight British Birds which may be regarded as Summer Visitors, though in a few species some stragglers remain behind at the autumn migration and spend the winter with us.

Twenty-seven of these species are more or less common summer visitors to our Islands, and five others may also be regarded as summer visitors to the three kingdoms, though they are rare or very local in Ireland:—

Muscicapa grisola.
Acrocephalus phragmitis.
Phylloscopus trochilus.
Phylloscopus rufus.
Locustella locustella.
Sylvia hortensis.
Sylvia cinerea.
Merula torquata.
Saxicola œnanthe.
Hirundo rustica.
Chelidon urbica.
Cotyle riparia.
Cuculus canorus.
Cypselus apus.
Caprimulgus europæus.
Crex pratensis.
Crex porzana.
Coturnix communis.
Totanus hypoleucus.
Sterna cantiaca.
Sterna hirundo.
Sterna arctica.

Sterna dougalli.
Sterna minuta.
Botaurus minutus.
Ardea nycticorax.
Fratercula arctica.
Pratincola rubetra.
Motacilla raii.
Ruticilla phœnicurus.
Sylvia atricapilla.
Phylloscopus sibilatrix.

The last five are very rare and local in Ireland.

The distribution of the partial summer visitors may be tabulated as follows. If the total number of summer visitors be added together, it will be found that England heads the list with forty-eight, Scotland follows with thirty-six, whilst Ireland has only thirty-three.

	England.	Scotland.	Ireland.
Acrocephalus arundinaceus	Summer.	Absent.	Absent.
Acrocephalus palustris			
Erithacus luscinia			
Locustella luscinioides			
Anthus arboreus		Summer.	Accidental.
Muscicapa atricapilla			
Motacilla alba			
Sylvia curruca			
Circus cineraceus		Accidental.	
Upupa epops			
Iynx torquilla			
Oriolus galbula			
Lanius collurio			
Motacilla flava			
Œdicnemus crepitans			
Turtur auritus			Summer.

Winter Visitors.

The Winter Visitors to the British Islands appear to deal very impartially with the three kingdoms. They all visit England,

all but one Scotland, and all but two Ireland. The total number of species which may be regarded as winter visitors to England is sixty-eight, Scotland follows with sixty-seven, and Ireland with sixty-six.

There are sixty-eight British Birds which may be regarded as winter visitors, though in a few species a greater or less number of individuals remain to breed, for the most part in Scotland.

Forty-three of these species are more or less common Winter Visitors to the three kingdoms, but never breed in any of them :—

Archibuteo lagopus.
Accipiter palumbarius.
Surnia nyctea.
Parus ater.
Loxia leucoptera bifasciata.
Loxia curvirostra pityopsittacus.
Fringilla linaria.
Fringilla montifringilla.
Ampelis garrulus.
Ruticilla tithys.
Lanius excubitor.
Turdus pilaris.
Turdus iliacus.
Grus communis.
Otis tetrax.
Scolopax gallinula.
Phalaropus fulicarius.
Tringa maritima.
Tringa canutus.
Stercorarius buffoni.
Stercorarius pomarinus.
Larus glaucus.
Larus sabini.
Larus eburneus.
Larus minutus.
Podiceps rubricollis.
Cygnus musicus.
Cygnus bewicki.
Anser brachyrhynchus.
Anser albifrons.
Anser segetum.

Bernicla leucopsis.
Bernicla brenta.
Mergus albellus.
Somateria spectabilis.
Fuligula nigra.
Fuligula fusca.
Fuligula clangula.
Fuligula glacialis.
Fuligula marila.
Alca alle.
Colymbus glacialis.
Puffinus griseus.

Twenty-two of these species are more or less common winter visitors to the three kingdoms, and are represented in summer by few or many residents, as the case may be, that remain to breed, twelve of them in England, Scotland, and Ireland:—

Circus cyaneus,
Strix brachyotus,
Fringilla spinus,
Anas boschas,
Anas clypeata,
Anas crecca,
Anas strepera,
Fuligula cristata,
Fuligula ferina,
Tringa alpina,
Scolopax rusticola,
Charadrius pluvialis;

one in England and Scotland only—

Somateria mollissima;

three in Scotland and Ireland only—

Mergus serrator,
Anas acuta,
Anas penelope;

and six in Scotland only—

Emberiza nivalis,
Podiceps cornutus,

Stercorarius richardsoni,
Stercorarius catarrhactes,
Anser cinereus,
Mergus merganser.

The remaining three are more or less common winter visitors to England, but are not known to visit Ireland, and the last mentioned is unknown in Scotland as well:—

Alauda alpestris.
Otis tarda (formerly breeding).
Regulus ignicapillus.

Spring and Autumn Migrants.

All the Spring and Autumn Migrants visit England. Three appear to absent themselves from Scotland, and the same number from Ireland. The number of English spring and autumn migrants may be estimated at thirty-two, whilst that of Scotch and Irish is only twenty-nine.

There are thirty-two British Birds which may be regarded as Spring and Autumn Migrants, though in some cases a few individuals remain in autumn to winter with us and a few remain in spring to breed in some part of our Islands.

Of these species eighteen are spring and autumn migrants to the three kingdoms, but do not breed in any of them:—

Coracias garrula.
Crex parva.
Scolopax major.
Charadrius hiaticula.
Charadrius helveticus.
Limosa melanura.
Limosa rufa.
Totanus fuscus.
Totanus ochropus.
Totanus glareola.
Strepsilas interpres.
Tringa subarquata.
Tringa temmincki.
Tringa arenaria.
Tringa minuta.

Himantopus avocetta.
Sterna nigra.
Podiceps nigricollis.

Four other species pass along our shores in spring and autumn without leaving any behind in spring to breed; but the first and second have only been recorded from England, the third only from England and Scotland, and the fourth only from England and Ireland:—

Sterna caspia.
Sterna anglica.
Erithacus suecica.
Tringa platyrhyncha.

Ten species which are principally known as spring and autumn migrants are represented in summer by a few individuals that remain to breed, the first and second in all three kingdoms, the third in England and Scotland, the fourth, fifth, sixth, and seventh in Scotland only, and the eighth, ninth, and tenth in England only:—

Charadrius morinellus.
Anas circia.
Pernis apivorus.
Pandion haliaëtus.
Phalaropus hyperboreus.
Totanus glottis.
Numenius phæopus.
Charadrius cantianus.
Totanus pugnax.
Falco subbuteo.

Accidental Visitors.

There are several reasons why the number of Accidental Visitors to England should so largely exceed those known to have occurred in Scotland or Ireland. England contains a much larger area than either of the sister kingdoms. The number of people capable of recognising a strange visitor is very much larger. Very many of our Accidental Visitors breed in South Europe and visit us in spring, having overshot the mark on their

spring migration. Probably very few of them which reach our shores pass on to Scotland or Ireland.

The total number of Accidental Visitors may be estimated at 135; of which 126 have been recorded from England, fifty-eight from Scotland, and fifty-eight from Ireland.

Of the species of British Birds whose appearance in our Islands is so irregular or so seldom that they can only be regarded as Accidental Visitors, thirty-five have been recorded from all three kingdoms:—

Falco vespertinus.
Falco gyrfalco islandus.
Falco gyrfalco candicans.
Circus æruginosus.
Scops scops.
Merops apiaster.
Pastor roseus.
Lanius major.
Geocichla varia.
Phylloscopus superciliosus.
Sylvia nisoria.
Emberiza lapponica.
Emberiza hortulana.
Ectopistes migratorius.
Syrrhaptes paradoxus.
Botaurus lentiginosus.
Platalea leucorodia.
Ardea purpurea.
Ardea comata.
Ciconia alba.
Tringa pectoralis.
Tringa rufescens.
Numenius borealis.
Himantopus candidus.
Glareola pratincola.
Larus philadelphia.
Larus leucopterus.
Bernicla ruficollis.
Tadorna rutila.
Fuligula perspicillata.
Fuligula albeola.

Fuligula rufina.
Fuligula nyroca.
Puffinus major.
Oceanites wilsoni.

Twenty have been recorded from England and Scotland, but not from Ireland:—

Bubo maximus.
Strix tengmalmi.
Surnia funerea.
Surnia funerea hudsonia.
Nucifraga caryocatactes.
Merula atrigularis.
Saxicola deserti.
Anthus cervinus.
Anthus richardi.
Emberiza melanocephala.
Ardea alba.
Ardea garzetta.
Totanus macularius.
Totanus solitarius.
Macrorhamphus griseus.
Charadrius fulvus.
Charadrius fulvus americanus.
Cursorius gallicus.
Fuligula histrionica.
Alca troile brunnichi.

Fifteen have been recorded from England and Ireland, but not from Scotland:—

Aquila nævia.
Falco cenchris.
Cinclus aquaticus melanogaster.
Muscicapa parva.
Hypolais hypolais.
Alauda brachydactyla.
Cuculus glandarius.
Coccyzus americanus.
Cypselus melba.
Ibis falcinellus.
Tringa bonapartii.

Sterna hybrida.
Sterna leucoptera.
Puffinus obscurus.
Mergus cucullatus.

Two species have been recorded from Scotland and Ireland, but not from England:—

Accipiter atricapillus.
Alca impennis (recently extinct).

One species has been recorded from Scotland only:—

Grus virgo.

Six species have been recorded from Ireland only:—

Turdus migratorius.
Gyps fulvus.
Coccyzus erythrophthalmus.
Anser stolidus.
Anser hyperboreus.
Daption capense.

No fewer than fifty-six species have been recorded from England only:—

Neophron percnopterus.
Milvus ater.
Falco gyrfalco.
Fringilla linaria hornemanni.
Alauda cristata.
Alauda sibirica.
Anthus spinoletta.
Anthus campestris.
Caprimulgus ægyptius.
Caprimulgus ruficollis.
Chætura caudacuta.
Turtur orientalis.
Crex carolina.
Otis macqueeni.
Ardea bubulcus.
Ardea virescens.
Ciconia nigra.

Charadrius vociferus.
Charadrius minor.
Charadrius asiaticus.
Vanellus gregarius.
Totanus bartrami.
Totanus flavipes.
Tringa minutilla.
Tringa acuminata.
Noctua noctua.
Lanius rufus.
Lanius minor.
Geocichla sibirica.
Monticola saxatilis.
Saxicola stapazina.
Saxicola isbellina.
Acrocephalus aquaticus.
Acrocephalus turdoides.
Sylvia galactodes.
Sylvia orpheus.
Acredula caudata.
Tichodroma muraria.
Accentor alpinus.
Emberiza pusilla.
Emberiza rustica.
Carpodacus enucleator.
Carpodacus erythrinus.
Loxia leucoptera.
Larus rossi.
Larus ichthyaëtus.
Larus melanocephalus.
Sterna fuliginosa.
Sterna anæstheta.
Colymbus adamsi.
Œstrelata hæsitata.
Œstrelata torquata.
Bulweria columbina.
Somateria stelleri.
Anser minutus.
Anas carolinensis.

Geographical Distribution of British Birds during the Breeding Season outside the British Islands.

The breeding range of the 391 species and subspecies of Birds which undoubtedly have a claim to be regarded as British varies very greatly both in the degrees of longitude which each species covers during the breeding season and the climates which they select for their breeding-grounds.

The British Islands, being situated in the Palæarctic Region, which extends eastwards across Europe and Siberia to Japan, are naturally frequented by more species belonging to that Region than by those belonging to any other Zoological Region. About 28 per cent. breed across the Palæarctic Region from the Atlantic to the Pacific, but are not known to breed in the Nearctic Region. About 15 per cent. more breed across both these Regions. The breeding range of another 15 per cent. may be described as West Palæarctic, extending from the British Islands to Central Asia, whilst that of an additional 11 per cent. extends some way into Asia, but not as far as the Yenesei. The breeding range of about 6 per cent. may be described as European, and that of about 3 per cent. as West European. About 5 per cent. may be regarded as North Atlantic species, breeding on the coasts of West Europe and East North America and on many of the intervening Atlantic Islands. About 4 per cent. may be described as Circumtropical, breeding on tropical islands. About 8 per cent. are wanderers from the Nearctic Region which are not known to breed in any part of the Palæarctic Region, whilst 2 per cent. are wanderers from East Asia, 2 per cent. from Central Asia, and 1 per cent. from East Europe.

British Birds may be classified according to their breeding ranges as follows:—

Circumpolar	57
Circumtropic	12
Nearly circumpolar	4
North Atlantic	20
Nearctic	32
Carried forward	125

Brought forward		125
Palæarctic		110
West Palæarctic—		
East to 110°	25	
East to 85°	29	
East to 70°	45	
East to 60°	4	
East to 50°	19	
East to 25°	2	
Not east of 10°	10	
	—	134
East Palæarctic		9
Central Palæarctic		13
		391

Circumpolar and Circumtropic Species.

There are no fewer than sixty-nine species of British Birds whose breeding range may be regarded as circumpolar or circumtropical. They may be classified according to the climatic range of their breeding-grounds as follows:—

Arctic	31
Arctic and subarctic	12
Arctic, subarctic, and subtropic	3
Subarctic and subtropic	8
Subarctic, subtropic, and tropic	3
Subtropic and tropic	1
Tropic	11
	69

Of the thirty-one Arctic species, the first two breed in some numbers within the limits of our Islands, the next three in much smaller numbers, and the next two occasionally:—

Tetrao mutus.
Fulmarus glacialis.

Colymbus arcticus.
Colymbus septentrionalis.
Phalaropus hyperboreus.
Emberiza nivalis.
Fuligula marila.
Anser albifrons.
Anas acuta.
Tringa canutus.
Tringa maritima.
Tringa arenaria.
Fuligula glacialis.
Charadrius helveticus.
Stercorarius buffoni.
Stercorarius pomarinus.
Phalaropus fulicarius.
Ampelis garrulus.
Fringilla linaria.
Alauda alpestris.
Somateria spectabilis.
Larus glaucus.
Larus rossi.
Larus sabini.
Surnea nyctea.
Larus eburneus.
Emberiza lapponica.
Strix tengmalmi.
Carpodacus enucleator.
Colymbus adamsi.
Anser hyperboreus.

Of the twelve species whose breeding range is both arctic and subarctic, all except the last two on the list breed within the limits of the British Islands:—

Falco peregrinus.
Alca troile.
Larus marinus.
Larus tridactylus.
Mergus serrator.
Stercorarius richardsoni.
Tringa alpina.

Strix brachyotus.
Anas clypeata.
Sterna arctica.
Fuligula clangula.
Strepsilas interpres.

The breeding range of the three following species is not only arctic, but also subarctic and subtropic: they all breed within the limits of the British Islands:—

Corvus corax.
Aquila chrysaëtus.
Cotyle riparia.

The breeding range of the eight following species extends to both the subarctic and subtropic divisions of the Temperate Region. The two first named breed in some numbers within the limits of the British Islands, the three next more locally, and it is supposed that the sixth occasionally does so:—

Certhia familiaris.
Anas boschas.
Anas strepera.
Pandion haliaëtus.
Procellaria leachi.
Podiceps cornutus.
Podiceps rubricollis.
Anthus spinoletta.

The breeding range of the three following species is not only subarctic and subtropic, but is also tropic. The first mentioned breeds commonly within the limits of the British Islands, the next used locally to do so in small numbers, but the last has not been found breeding on our coasts:—

Aluco flammeus.
Sterna dougalli.
Sterna caspia.

The breeding range of one species may be regarded as subtropic and tropic—

Ardea nycticorax.

Eleven species may be regarded as circumtropic. They are oceanic birds which breed on islands within the tropics, and are, of course, only accidental visitors of more or less frequent occurrence to our Islands:—

Œstrelata hæsitata.
Œstrelata torquata.
Bulweria columbina.
Puffinus major.
Puffinus griseus.
Puffinus obscurus.
Daption capense.
Oceanites wilsoni.
Anous stolidus.
Sterna fuliginosa.
Sterna anæstheta.

Nearly Circumpolar Species.

Four species of birds which are included in the British List are more than Palæarctic in their breeding range, but are not quite circumpolar. The three first named breed regularly in the British Islands, and the last is said to have done so:—

Phalacrocorax carbo.

The breeding range of this species extends across Asia and Europe to Iceland, Greenland, and the coasts of Labrador.

Saxicola œnanthe.

The breeding range of the Wheatear extends across Asia to Alaska on the one hand, and across Europe to Iceland, Greenland, and the coasts of Labrador on the other.

Pica caudata.

The breeding range of the Magpie extends across Europe and Asia to Alaska and the Western States.

Podiceps nigricollis.

The breeding range of the Eared Grebe extends across Europe and Asia to the Western States, and probably occurs in Alaska. To the south it extends far into the Tropics both in Africa and America.

Of these four species the Cormorant may be regarded as subarctic, subtropic, and tropic in its breeding range, the Wheatear and the Magpie as arctic, subarctic, and subtropic, and the Grebe as subarctic, subtropic, and tropic.

North Atlantic Species.

There are twenty species of British Birds which may be regarded as North Atlantic species, inasmuch as they breed for the most part on islands in the North Atlantic Ocean, and occasionally on cliffs on both its American and European shores, but are unknown in the Pacific Ocean. Six of these only breed in an arctic climate :—

Alca alle.
Alca troile brunnichi.
Colymbus glacialis.
Anser brachyrhynchus.
Bernicla leucopsis.
Bernicla brenta.

Five others breed not only in an arctic climate, but also in a subarctic :—

Larus argentatus.
Alca torda.
Alca grylle.
Fratercula arctica.
Somateria mollissima.

Four species are only known to breed in a subarctic climate:—

Alca impennis (extinct).
Stercorarius catarrhactes.
Procellaria pelagica.
Sula bassana.

The breeding range of three species extends both to subarctic and subtropical climates:—

Sterna hirundo.
Sterna nigra.
Puffinus anglorum.

The breeding range of two other species is also subarctic and subtropical, but it extends beyond into the tropics:—

Sterna anglica.
Sterna cantiaca.

Nearctic Species.

There are no fewer than thirty-two species of birds which are regarded as accidental visitors to our Islands whose breeding range is confined to the American continent and the islands near it. Of these, fifteen are exclusively arctic in their breeding range:—

Fringilla linaria hornemanni,
Falco gyrfalco candicans,
Falco gyrfalco islandus,
Surnia funerea hudsonia,
Charadrius fulvus americanus,
Numenius borealis,
Tringa bonapartii,
Tringa rufescens,
Tringa pectoralis,
Tringa minutilla,
Totanus flavipes,
Macrorhamphus griseus,
Larus leucopterus,
Fuligula albeola,
Fuligula histrionica;

five are both arctic and subarctic in their breeding range:—

Loxia leucoptera,
Accipiter atricapillus,
Mergus cucullatus,
Anas carolinensis,
Fuligula perspicillata;

one in arctic, subarctic, and subtropic:—

Turdus migratorius;

three are subarctic only:—

Larus philadelphia,
Totanus solitarius,
Crex carolina;

six breed both in subarctic and subtropical climates:—

Coccyzus americanus,
Coccyzus erythrophthalmus,
Ectopistes migratorius,
Totanus bartrami,
Totanus macularius,
Charadrius vociferus;

whilst the breeding range of two extends not only to subarctic and subtropic climates, but also to the tropics:—

Botaurus lentiginosus,
Ardea virescens.

Palæarctic Species.

The breeding ranges of 110 species of British Birds may be regarded as Palæarctic. They extend across Europe and Asia from the Atlantic to the Pacific, but are not known to reach any part of the American continent, nor as a rule to extend beyond the arctic or temperate climates to the tropics. There are, however, a few birds whose climatic tastes are so cosmopolitan that their breeding ranges not only reach both the subarctic and subtropic climates of the Temperate Region, but cover the tropics as well. These birds may be classified according to the climatic range of their breeding-grounds as follows:—

Arctic	17
Arctic and subarctic	15
Subarctic	15
Subarctic and subtropic	49
Subarctic, subtropic, and tropic	8
Subtropic	1
Subtropic and tropic	5
	110

Of the seventeen species which breed only in an arctic climate, a few individuals of the two first mentioned find what they require on some of the Scotch Islands. It may be remarked that they belong principally to the Limicolæ, though the list contains a few Anseres, three Passerine Birds, and an Owl :—

Numenius phæopus.
Totanus glottis.
Tringa temmincki.
Tringa subarquata.
Tringa platyrhyncha.
Totanus fuscus.
Limosa rufa.
Scolopax gallinula.
Cygnus musicus.
Cygnus bewicki.
Anser segetum.
Anser minutus.
Somateria stelleri.
Erithacus suecica.
Anthus cervinus.
Emberiza pusilla.
Surnia funerea.

Of the fifteen species whose breeding range is both arctic and subarctic, at least half of them breed in greater or less numbers in our Islands :—

Falco æsalon.
Larus canus.
Charadrius morinellus.
Circus cyaneus.
Anas crecca.
Mergus merganser.
Anas penelope.
Totanus glareola.
Totanus pugnax.
Mergus albellus.
Grus communis.
Loxia leucoptera bifasciata.
Bubo maximus.
Emberiza rustica.
Nucifraga caryocatactes.

Of the fifteen species whose breeding range is subarctic only, more than half breed in our Islands:—

Loxia curvirostra.
Fuligula cristata.
Fuligula rufina.
Scolopax rusticola.
Scolopax gallinago.
Fringilla spinus.
Tetrao tetrix.
Anas circia.
Numenius arquata.
Regulus cristatus.
Larus ridibundus.
Totanus ochropus.
Fringilla montifringilla.
Larus minutus.
Acredula caudata.

Of the forty-nine species which are both subarctic and subtropic in their breeding range, no fewer than thirty-seven breed in our Islands, and of these twenty-nine may be regarded as residents. Nearly half of this group of species belong to the Passeres:—

Sitta cæsia.
Cinclus aquaticus.
Garrulus glandarius.
Passer montanus.
Passer domesticus.
Coccothraustes vulgaris.
Corvus corone.
Picus minor.
Haliaëtus albicilla.
Accipiter nisus.
Motacilla boarula.
Pyrrhula vulgaris.
Troglodytes parvulus.
Parus major.
Columba livia.
Strix aluco.
Picus major.

Botaurus stellaris.
Falco tinnunculus.
Vanellus cristatus.
Podiceps cristatus.
Coturnix communis.
Totanus calidris.
Strix otus.
Emberiza schœniclus.
Pyrrhocorax graculus.
Alauda arvensis.
Tadorna cornuta.
Motacilla flava.
Sylvia curruca.
Cuculus canorus.
Charadrius cantianus.
Cypselus apus.
Hirundo rustica.
Iynx torquilla.
Falco subbuteo.
Totanus hypoleucus.
Limosa melanura.
Pernis apivorus.
Parus ater.
Parus palustris.
Accipiter palumbarius.
Circus æruginosus.
Ciconia nigra.
Tichodroma muraria.
Charadrius minor.
Tadorna rutila.
Sterna leucoptera.
Anser cinereus.

One species appears to be restricted to a subtropic climate during the breeding season :—

Monticola saxatilis.

The species whose breeding range extends not only over both

the northern and the southern divisions of the Temperate Region, but also to the Tropics, are as follows:—

Ardea cinerea.
Podiceps minor.
Fulica atra.
Gallinula chloropus.
Alcedo ispida.
Himantopus avocetta.
Upupa epops.
Platalea leucorodia.

The range of the following five species does not extend quite so far north, being only tropic and subtropic:—

Himantopus candidus.
Ardea purpurea.
Ardea garzetta.
Ardea alba.
Sterna hybrida.

West Palæarctic Species.

There are no fewer than 134 species of British Birds whose breeding range is confined to the western half of the Palæarctic Region. Of these, ten do not extend eastwards beyond longitude 10°, two reach 25°, nineteen are found as far as 50°, and four as far as 60°, forty-five breed as far east as 70°, the range of twenty-nine extends to 85°, and that of twenty-five to 110°, beyond which the East Palæarctic Region is entered.

Species whose Breeding Range extends from the Atlantic to Longitude 110°.

There are twenty-five species of British Birds whose breeding range extends from the British Islands eastwards across Europe and West Siberia, but does not extend (so far as is known) into East Siberia. The West Palæarctic Region extends to the basin of the Yenesei about longitude 110°. Nature has fixed this boundary very exactly. The Himalayas form a barrier which

many migratory birds object to cross. The autumnal stream of birds seeking milder winter quarters divides, half the species migrating westwards to winter in the basins of the Caspian and Mediterranean seas, if they do not wander as far as Africa, and the other half migrating eastwards to winter in Japan, China, and the islands of the Malay Archipelago, if they do not wander as far as Australia. Birds breeding in the valley of the Yenesei migrate westwards in autumn, whilst those breeding in the valley of the Lena migrate eastwards. Of the twenty-five species whose breeding range extends to longitude 110°, that of three may be regarded as arctic :—

Fuligula nigra.
Archibuteo lagopus.
Tringa minuta.

The following ten species are subarctic as well as arctic :—

Tetrao urogallus.
Phylloscopus trochilus.
Motacilla alba.
Fuligula fusca.
Turdus pilaris.
Charadrius pluvialis.
Acrocephalus phragmitis.
Ruticilla phœnicurus.
Charadrius hiaticula.
Scolopax major.

The breeding range of the following five species may be regarded as subarctic :—

Anthus arboreus.
Circus cineraceus.
Sturnus vulgaris.
Turdus viscivorus.
Turdus musicus.

The following six species breed in subarctic and subtropic climates :—

Muscicapa grisola.
Falco vespertinus.

Fringilla carduelis.
Corvus monedula.
Cygnus olor.
Oriolus galbula.

One species appears to breed in subtropic climates only:—

Grus virgo.

Species whose Breeding Range extends from the Atlantic to Longitude 85°.

The breeding range of twenty-nine species of British Birds extends from the Atlantic as far east as about longitude 85°, reaching across Europe and West Siberia, including the valley of the Ob; and farther south embracing Chinese Turkestan and Kashmir.

None of these species breed in Arctic Regions, but three of them may be regarded as subarctic:—

Muscicapa parva.
Hypolais hypolais.
Sylvia nisoria.

Most of them (as many as nineteen) breed both in subarctic and subtropic climates:—

Emberiza miliaria.
Emberiza hortulana.
Panurus biarmicus.
Merula merula.
Sylvia cinerea.
Sylvia hortensis.
Acroccphalus palustris.
Acrocephalus arundinaceus.
Cypselus melba.
Anthus campestris.
Lanius collurio.
Perdix cinerea.
Otis tarda.
Rallus aquaticus.

Hæmatopus ostralegus.
Crex pratensis.
Crex porzana.
Crex parva.
Ciconia alba.

The breeding range of two species extends not only to subarctic and subtropic climates, but also to the tropics:—

Œdicnemus crepitans.
Coracias garrula.

Four species may be regarded as exclusively subtropic in their breeding range:—

Lanius minor.
Merops apiaster.
Otis tetrax.
Fuligula nyroca.

The breeding range of one species is both subtropic and tropic:—

Ibis falcinellus.

Species whose Breeding Range extends from the Atlantic to Longitude 70°.

The breeding range of forty-five species of British Birds extends from the Atlantic as far east as about longitude 70°, an area which includes Europe, the valley of the Tobol, the basin of the Aral Sea, Asia Minor, Persia, Afghanistan, and Baluchistan.

Of these species none are exclusively arctic in their breeding range, but five breed both in arctic and subarctic climates, and the range of the last mentioned also extends to subtropic climates:—

Emberiza citrinella.
Anthus pratensis.
Turdus iliacus.
Merula torquata.
Chelidon urbica.

Nine species may be regarded as exclusively subarctic in their breeding ranges:—

Columba palumbus.
Fringilla chloris.
Fringilla cœlebs.
Muscicapa atricapilla.
Accentor alpinus.
Corvus frugilegus.
Alauda arborea.
Motacilla raii.
Pratincola rubetra.

The breeding range of seventeen species is not only subarctic, but also subtropic:—

Buteo vulgaris.
Milvus ater.
Scops scops.
Gecinus viridis.
Caprimulgus europœus.
Erithacus rubecula.
Fringilla cannabina.
Sylvia atricapilla.
Ruticilla tithys.
Locustella luscinioides.
Acrocephalus turdoides.
Alauda cristata.
Lanius rufus.
Turtur auritus.
Columba œnas.
Botaurus minutus.
Sterna minuta.

The breeding range of thirteen species may be regarded as exclusively subtropic:—

Saxicola deserti.
Saxicola stapazina.
Sylvia orpheus.
Sylvia galactodes.
Alauda brachydactyla.
Emberiza melanocephala.

Cuculus glandarius.
Falco cenchris.
Neophron percnopterus.
Gyps fulvus.
Cursorius gallicus.
Glareola pratincola.
Fuligula rufina.

The breeding range of one species is subtropic and tropic :—

Ardea comata.

Species whose Breeding Range extends from the Atlantic to Longitude 60°.

The breeding range of four species of British Birds extends from the Atlantic as far east as the Ural Mountains, about longitude 60°. They all breed in a subarctic climate, but the range of the last mentioned is also subtropic :—

Accentor modularis.
Lanius excubitor.
Parus cristatus.
Parus cæruleus.

Species whose Breeding Range extends from the Atlantic to Longitude 50°.

The breeding range of nineteen species of British birds extends from the Atlantic to about longitude 50°, an area which embraces the valleys of the Dwina and the Volga, the Caucasus, Asia Minor, and Palestine.

None of them are exclusively arctic in their breeding range, but three species breed in arctic and subarctic climates :—

Anthus obscurus.
Larus fuscus.
Cinclus aquaticus melanogaster.

Seven species may be regarded as exclusively subarctic in their breeding range :—

Pratincola rubicola.
Emberiza cirlus.
Phylloscopus sibilatrix.
Locustella locustella.
Acrocephalus aquaticus.
Milvus regalis.
Aquila nævia.

Six species are not only subarctic, but also subtropic in their breeding range :—

Regulus ignicapillus.
Erithacus luscinia.
Phylloscopus rufus.
Sylvia provincialis.
Noctua noctua.
Phalacrocorax graculus.

The breeding range of one species extends not only to subarctic and subtropic climates, but is also tropic—

Crex bailloni ;

whilst that of a second species may be regarded as exclusively subtropic—

Larus melanocephalus,

and that of a third species as subtropic and tropic—

Ardea bubulcus.

Species whose Breeding Range is confined to Western Europe.

There are six species and as many subspecies of British Birds whose breeding range is confined to Western Europe.

One species is arctic and subarctic, and may breed as far east as longitude 25° :—

Fringilla flavirostris.

Four species are not known to breed farther east than longitude 10°. Two of them are subarctic—

Acredula rosea,
Motacilla yarrelli;

one is subarctic and subtropic—

Pedrix rufa;

and the fourth is subtropic—

Caprimulgus ruficollis.

The breeding range of three subspecies is about the same, of which one is arctic—

Falco gyrfalco (*typicus*),

and three are subarctic—

Charadrius hiaticula major,
Loxia curvirostra pityopsittaca,
Fringilla linaria rufescens.

Only one species is exclusively British—

Tetrao scoticus;

but the Wren of St. Kilda and the British Coal Tit claim subspecific rank—

Troglodytes parvulus hirtensis.
Parus ater britannicus.

East Palæarctic Species.

There are nine accidental visitors to our Islands which may be regarded as East Palæarctic, inasmuch as their breeding ranges extend as far east as the Pacific, but not as far west as the Atlantic. Of these there are six whose breeding range is supposed to be confined to the Eastern Palæarctic Region, from the valley of the

Yenesei to the Pacific. Of these, two are supposed to be exclusively arctic—

Tringa acuminata,
Charadrius fulvus;

two are arctic and subarctic—

Phylloscopus superciliosus,
Geocichla sibirica;

two are only known to breed in a subarctic climate—

Chætura caudacuta,
Geocichla varia;

whilst a third is both subtropic and tropic in its breeding range—

Turtur orientalis.

The breeding range of one species, an accidental visitor from a subarctic climate, extends from the Pacific to the Ural Mountains—

Lanius major.

The breeding-range of one species, an accidental visitor from a subarctic climate, extends from the Pacific to the Baltic.

Carpodacus erythrinus.

Central Palæarctic Species.

The breeding range of thirteen accidental visitors may be broadly described as Central Palæarctic, inasmuch as their breeding ranges neither extend as far west as the Atlantic nor as far east as the Pacific. Of these the range of eight does not extend west of the Caspian Sea nor as far east as China. One is arctic—

Bernicla ruficollis;

three breed in a subarctic climate—

Anthus richardi,
Merula atrigularis,
Syrrhaptes paradoxus;

three choose a subtropic climate—

Charadrius asiaticus,
Larus ichthyaëtus,
Otis macqueeni;

one may be regarded as subtropic and tropic—

Caprimulgus ægyptius.

The breeding range of one species extends from the valley of the Elbe to that of the Yenesei and may be regarded as subarctic and subtropic—

Corvus corone cornix.

The breeding range of four species extends from South-East Russia to some part of Central Asia—

Saxicola isabellina.
Alauda sibirica.
Vanellus gregarius.
Pastor roseus.

They are all accidental visitors, breeding in a subtropic climate.

Climatic Distribution of British Birds during the Breeding Season.

Very few birds have a very wide climatic distribution during the breeding season. They pay little or no attention to parallels of latitude, but they appear to be very particular to choose breeding-grounds with a mean temperature during the breeding season to suit their individual requirements. The isothermal lines of July may be regarded as forming natural boundaries of the latitudinal range of most of our birds during the breeding season, if due importance be attached to two factors which play a very important part in modifying it. In our maps the isothermal lines are corrected to sea-level. The corrections must of course be entirely disregarded in considering the breeding ranges of birds, which are governed by the actual mean temperature, irrespective of cause. The climate may be produced by a low elevation at a

high latitude, or by a high elevation at a comparatively low latitude. For example: the climate of the Dovre Fjeld, 6000 feet above the level of the sea, in latitude 62°, is very similar to that of Lapland, 60 feet above the level of the sea, in latitude 70°, and many purely arctic birds and plants are found in both localities.

The other factor which appears to play an important part in deciding the breeding range of many birds, especially of Passerine Birds, which require a long time to rear their young, is the length of the summer.

The breeding range of many British birds extends much farther north in Scandinavia than it does in East Russia, and in most cases where the breeding range extends across Asia the birds breed farther north in West Siberia than they do in the extreme east of that country. The cause of this peculiarity in the distribution of these birds can scarcely be ascribed to difference of temperature. The isothermal lines of July, which represent midsummer in the Arctic Regions, rise much farther north between the White Sea and the Delta of the Lena than they do in Scandinavia or Kamtschatka. The Atlantic cyclones in the west cause the summers of Scandinavia to be cold and wet, whilst the winter accumulation of ice in the Sea of Okotsk lowers the summer temperature of Kamtschatka and the east coast of Siberia.

The probable cause is the difference in the duration of the summers in the different districts. In any given longitude the summers are shorter as the latitude increases. In the valley of the Yenesei I found that the summer advanced at the rate of 100 miles in twenty-four hours, which may represent a degree a day after due allowance has been made for the winding of the river. Assuming that the advance of winter is at the same rate, a difference of ten degrees of latitude would make a difference of twenty days in the duration of summer—a very important curtailment of the time necessary for the successful rearing of a brood where the summers are so short. The fact that snow disappears in North Scandinavia much earlier than it does in the same latitude east of the White Sea, whilst it lingers much longer in the extreme east of Siberia than it does in the same latitude in Western Siberia, harmonises with the variation in the latitude at which many birds range during the breeding season, so that it is difficult to avoid coming to the conclusion that they are cause and effect.

It must, however, be remembered that the mean temperature is only an approximate index to the climate of a district. The mean temperature in July of the Dovre Fjeld is the same as that of the plains three or four hundred miles farther north. The shortness of the summer nights in latitude 62° causes the climatic condition of the two localities to vary so little that their fauna and flora are almost the same. It is obvious that somewhere in the Alps a similar mean temperature is to be found in July; but in latitude 47° the climatic conditions are very different: the temperature during the day is considerably raised by a much more vertical sun, and the much longer duration of night causes the extremes of temperature to vary so much during the twenty-four hours that a very different climate is the result. Adult birds easily adapt themselves to considerable extremes of temperature provided always that they can obtain a sufficient supply of food; but most of them are careful to avoid great extremes for their young. Hence, though we find an epitome of Arctic ornithology on the tundras of the Dovre Fjeld, we look in vain for a similar epitome on the higher Alps. Though the mean temperature during July may be the same, the cold nights produce a climate sufficiently different to prevent most Arctic Birds from using it as a breeding-ground. It cannot be too clearly laid down that the latitudinal distribution of Birds is purely climatic.

The division of the summer climate of the world into three zones—Arctic, Temperate, and Tropic—is scarcely narrow enough for the present purpose, and it will be more convenient to restrict somewhat the limits of the Arctic and Tropic zones, and split the Temperate zone in two parts, which might be called Subarctic and Subtropic respectively.

The mean temperature for July would then range as follows in each of the four climates:—

Arctic from 40° to 53°, including Iceland, the Highlands of Scotland, North Scandinavia, the Dovre Fjeld, the tundras of East Russia and Siberia, and the mountains of East Siberia.

Subarctic from 53° to 65°, including the British Islands, Central Europe, South Siberia, and the north island of Japan.

Subtropic from 65° to 77°, including South Europe, the mountains of North Africa, Asia Minor, Central Asia, North China, and the south island of Japan.

Tropic from 77° to 90°, including the plains of North Africa, Arabia, India, South China, and the Malay Archipelago.

The climatic breeding-range of British Birds may be summarised as follows:—

Arctic	78
Arctic and subarctic	57
Arctic, subarctic, and subtropic	5
Subarctic	64
Subarctic and subtropic	116
Subarctic, subtropic, and tropic	21
Subtropic	28
Subtropic and tropic	11
Tropic	11
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Plate 9.

White-spotted Bluethroat
(Valconswaard, Holland, May 27, 1876, Wharton and Seebohm).
Red-spotted Bluethroat
(Petchora, June 20, 1875, Harvie-Brown and Seebohm).
Nightingale.
Robin.
Spotted Flycatcher.
Red-breasted Flycatcher
(Pomerania, June 18, 1873, Dr. Krüper).
Pied Flycatcher.
Black Redstart.
Redstart.
Wheatear.
Black-throated Wheatear.
(Parnassus, May 5, 1873, Krüper and Seebohm).
Desert-Wheatear.
Stonechat.
Whinchat.
Great Tit.
Crested Tit.
Marsh Tit.
Coal Tit.
Blue Tit.
Long-tailed Tit.

Plate 10.

Barred Warbler.
Garden Warbler.
Blackcap Warbler.
Orphean Warbler.
Whitethroat.
Lesser Whitethroat.
Dartford Warbler.

Plate 10 (*continued*).

Rufous Warbler.
Yellow-browed Willow-Wren
(Yenesay, lat. 66½°, June 25, 1877, Seebohm).
Willow-Wren.
Chiffchaff.
Wood-Wren.
Icterine Warbler.
Great Reed-Warbler.
Marsh Warbler.
Reed Warbler.
Sedge Warbler.
Aquatic Warbler.
Grasshopper Warbler.
Savi's Warbler.

Plate 11.

Oriole.
Meadow-Starling.
Starling.
Rose-coloured Starling
(Smyrna, 1871, Guido von Gonzenbach).
Lesser Grey Shrike.
Woodchat Shrike.
Red-backed Shrike.
Great Grey Shrike.
Dipper.
Waxwing
(Lapland, Wheelwright).
Rusty Grakle.
Red-winged Starling.
Creeper.
Wren.
Firecrest.
Goldcrest.

Plate 12.

Alpine Accentor.
Hedge-Sparrow.
Nuthatch.
Rosy Bullfinch
(Darasun, Dauria, June 1868, Dybowsky).
Bearded Tit.
Bullfinch.
Pine-Grosbeak
(Lapland, Wheelwright; and Muonioniska, June 12, 1870).
Mealy Redpole.
(Petchora, lat. 68°, June 23, 1875, Harvie-Brown and Seebohm).
Greenland Redpole
(Upernavik, North Greenland, June 10, 1870).
Lesser Redpole.
Goldfinch.
Serin Finch
(Malaga, June 8, 1873, Howard Saunders).
Siskin
(Balgowan, Ross-shire, May 30, 1861, A. Macdonald).
Greenfinch.

Plate 13.

Common Bunting.
Cirl Bunting.
Yellow Hammer.
Hawfinch.
Brambling.
Tree-Sparrow.
House-Sparrow.
Chaffinch.

Plate 13 (*continued*).

Linnet.
Twite.
Parrot Crossbill.
Common Crossbill.

Plate 14.

Pied Wagtail.
White Wagtail.
Blue-headed Wagtail
(Malaga, June 2, 1870, Howard Saunders).
Grey Wagtail.
Yellow Wagtail.
Red-throated Pipit
(Yenesay, lat. 70½°, July 16, 1877, Seebohm; Varanger Fjord, June 15, 1874, Nordvi; Petchora, lat. 68°, June 23, 1875, Harvie-Brown and Seebohm).
Rock-Pipit.
Water-Pipit.
Meadow-Pipit.
Tawny Pipit.
Richard's Pipit
(Darasun, Dauria, June 1868, Dybowsky).
American Pipit.
Tree-Pipit.

Plate 15.

Snow-Bunting.
Reed-Bunting.
Lapland Bunting.
Little Bunting
(Yenesay, lat. 66½°, June 27 and 23, 1877, Seebohm).

Plate 15 (*continued*).

Rustic Bunting
(Altai Mountains, Tancré; doubtless an egg of *Emberiza aureola*, and *not* of *E. luteola*, as erroneously stated in the Addendum to vol. ii.).
Ortolan Bunting.
Black-headed Bunting.
Shore-Lark.
Crested Lark.
Wood-Lark.
Sky-Lark.
Short-toed Lark.
White-winged Lark
(Astrakhan, Henke).
Hoopoe.

Plate 16.

Raven.
Hooded Crow.
Carrion Crow.
Rook.
Nutcracker
(Italian Alps, March 1867).
Chough.
Alpine Chough.
Jay.
Jackdaw.
Magpie.

Plate 17.

Ring-Dove.
Stock-Dove.
Rock-Dove.

Plate 17 (*continued*).

Turtle-Dove.
Passenger Pigeon.
Red-necked Nightjar
(Seville, May 16, 1868, Howard Saunders).
Nightjar.
Sand-Martin.
House-Martin.
Swallow.

Plate 18.

Green Woodpecker.
Roller.
Black Woodpecker.
Great Spotted Woodpecker.
Belted Kingfisher.
Bee-eater.
Kingfisher.
Wall-Creeper.
White-bellied Swift.
Purple Martin.
Lesser Spotted Woodpecker.
Wryneck.
Swift.

Plate 19.

White-winged Crossbill.
Cuckoo
(For localities, see vol. ii. p. 384).

Plate 20.

Red Grouse.
Black Grouse.
Ptarmigan.
Red-legged Partridge.
Andalusian Hemipode
(Tangiers, Favier).
Cream-coloured Courser
(Tangiers, Favier).
Quail.
Pallas's Sand Grouse
(Tarei-Nor, South-East Siberia, April 1856, Radde).

Plate 21.

Macqueen's Bustard
(Altai Mountains, Turkestan, June 1882, Tancré).
Capercaillie.
Partridge.
Pheasant.
Virginian Colin.
Thicknee.

Plate 22.

Great Bustard.
Little Bustard.

Plate 23.

Spotted Crake.
Coot.
Waterhen.
Water-Rail.

Plate 23 (*continued*).

Corn-Crake.
Baillon's Crake
(Seville, Lord Lilford).
Little Crake
(Crimea, May 27, 1869).

Plate 24.

Turnstone.
Avocet.
Common Stilt.
Pratincole.
Oyster-Catcher.

Plate 25.

Golden Plover.
Virginian Golden Plover
(Hudson's Bay).
Asiatic Golden Plover
(Yenesay, lat. 71½°, July 1, 1877, Seebohm).
Grey Plover
(Petchora, lat. 68°, June and July 1875, Harvie-Brown and Seebohm).

Plate 26.

Dotterel.
Killdeer Plover.
Ringed Plover.
Kentish Plover.
Little Ringed Plover.

Plate 27.

Lapwing.
Red-necked Phalarope.
Grey Phalarope
(Greenland, 1875, Whymper).
Sanderling
(Iceland, Proctor).
Broad-billed Sandpiper.

Plate 28.

Great Snipe.
Woodcock
(Sherwood Forest, April 18, 1870, Seebohm).
Common Snipe.
Jack Snipe.

Plate 29.

Greenshank.
Black-tailed Godwit.
Ruff.
Bar-tailed Godwit.

Plate 30.

Green Sandpiper.
Wood Sandpiper.
Common Sandpiper.
Spotted Sandpiper.

Plate 31.

Purple Sandpiper.
Buff-breasted Sandpiper.
Bonaparte's Sandpiper.
American Stint.
Dunlin.
Temminck's Stint.
Little Stint
(Petchora, lat. 68½°, July 1875, Harvie-Brown and Seebohm).

Plate 32.

Redshank.
Spotted Redshank
(Muonioniska, Knoblock).
Bartram's Sandpiper.
Yellowshank.

Plate 33.

Curlew.
Esquimaux Curlew.
Whimbrel.

Plate 34.

White Pelican.
Gannet.
Shag.
Cormorant.

Plate 35.

Great Northern Diver.
Red-throated Diver.
Black-throated Diver.

Plate 36.

Crane.
Demoiselle Crane
(Astrakhan, Henke).

Plate 37.

Black Stork
(Pomerania).
Spoonbill.
White Stork.

Plate 38.

Ibis.
Squacco Heron.
Night-Heron.
Buff-backed Heron.
Purple Heron.
Little Egret.
Great White Egret.
Little Bittern.
Common Heron.

Plate 39.

Great Crested Grebe.
Red-necked Grebe.
Sclavonian Grebe.
Little Grebe.
Eared Grebe.
Common Bittern.
American Bittern.

Plate 47.

Rüppell's Tern
(Astola Island, Mekran Coast, June 10, 1878, Capt. Butler).
Gull-billed Tern.
Caspian Tern.

Plate 48.

Sandwich Tern.
Sooty Tern.

Plate 49.

Black Tern.
Noddy.
White-winged Black Tern.
Whiskered Tern.

Plate 50.

Glaucous Gull.
Kittiwake.
Ivory Gull
(Prince Patrick's Island, June 21, 1853, Capt. M'Clintock).

Plate 51.

Herring Gull.
Iceland Gull
(Greenland, May 28, 1878, Ellingren).
Lesser Black-backed Gull.

Plate 52.

Common Gull.
Greater Black-backed Gull.
Laughing Gull.

Plate 53.

Black-headed Gull.
Great Black-headed Gull
(Astrakhan, Henke).
Adriatic Gull.

Plate 54.

Little Gull
(Kassarien River, Esthonia, May 29, 1873, Russow).
Bonaparte's Gull
(Anderson River, June 18, 1863, MacFarlane).
Sabine's Gull
(St. Michael's, Alaska, June 13, 1880, Nelson).

Plate 55.

Richardson's Skua.
Great Skua.
Buffon's Skua.
Pomarine Skua
(Greenland, Governor Fencker, Coll. Smithsonian Institution).

Plate 56.

Fulmar.
Great Shearwater
(This figure is taken from Brewer's description of an egg collected by the Moravians on an island off South Greenland).
Stormy Petrel.
Bulwer's Petrel
(Deserta Islands, Dr. Frere).
Fork-tailed Petrel
(Doon, St. Kilda Group, June 10, 1884, Dixon).

Plate 56 (*continued*).

Manx Shearwater.
Dusky Shearwater

(This figure is taken from Yarrell's description of an egg sent to him with the bird by Mr. E. Vernon Harcourt, who obtained it on the Deserta Islands. It represents the minimum size of eggs of this species. An egg in the Salmon collection (now in the Museum of the Linnean Society), collected by Hurrell in the same locality, measures 1·9 by 1·5 inch. The largest eggs of this species from the Bahamas almost approach the small egg of the Manx Shearwater figured on the same Plate).

Plate 57.

Mute Swan.
Hooper Swan.

Plate 58.

Bean-Goose.
Bewick's Swan
(Petchora, lat. 68°, June 1875, Harvie-Brown and Seebohm).
Grey-lag Goose.

Plate 59.

Common Eider.
King Eider
(Nova Zembla, July 12, 1870).
Steller's Eider

(This figure is copied from Middendorff's plate of an egg of this Duck taken by him on the Taimur River, July 7, 1843).

Plate 60.

Pink-footed Goose
(Cape Thordsen, Spitzbergen, June 15, 1883, Stjernspetz, Swedish Meteorological Expedition).
White-fronted Goose
(Egedesminde, Greenland, 1865).
Brent Goose
(Spitzbergen, 1857, Wolley's Sale).
Bernacle Goose
(Laid in confinement in Capt. Noble's Park, Newcastle).

Plate 61.

Red-breasted Goose
(Yenesay, lat. 70½°, July 1877, Seebohm).
Flamingo
(Astrakhan, Henke).
Snow-Goose
(Fort Anderson, July 1868, MacFarlane, Coll. Smithsonian Institution).

Plate 62.

Egyptian Goose
(Lower Egypt, Stafford Allen).
Canada Goose
(Labrador).
Lesser White-fronted Goose
(Lapland, Wheelwright).

Plate 63.

Golden-eye.
Shoveller.

Plate 63 (*continued*).

American Wigeon
(Anderson River Fort, June 21, 1864, MacFarlane).
Wigeon.
Mallard.
Pintail.

Plate 64.

Tufted Duck
(Muonioniska, July 8, 1857, Wolley).
Scaup
(Petchora, lat. 68°, July 4, 1875, Harvie-Brown and Seebohm).
Gadwall.
White-eyed Pochard
(Cashmere, June 9, 1871, Brooks).
Pochard
(Merton, May 14, 1884, Seebohm).
Red-crested Pochard
(Albufera Lake, Valencia, April 3, 1872, Howard Saunders).

Plate 65.

Black Scoter
(Petchora, lat. 68°, July 4, 1875, Harvie-Brown and Seebohm).
Harlequin Duck
(Myvatn Lake, Iceland, June 20, 1880).
Velvet Scoter
(Petchora, lat. 58°, July 1875, Harvie-Brown and Seebohm).
Surf-Scoter
(Fort Anderson, 1865, MacFarlane).

Plate 66.

Teal.
Garganey.
Long-tailed Duck.
Ruddy Sheldrake
(Volga, 1857, Dr. Cutter).
Common Sheldrake.

Plate 67.

Smew
(Petchora, lat. 65½°, June 10, 1875, Harvie-Brown and Seebohm).
Hooded Merganser.
Goosander.
Red-breasted Merganser.

Plate 68.

Pectoral Sandpiper
(Point Barrow, Alaska, June 21, 1883, P. H. Ray, Coll. Smithsonian Institution).
Red-breasted Snipe
(Franklin Bay, June 21, 1865, MacFarlane, Coll. Smithsonian Institution).
Great Spotted Cuckoo.
Rustic Bunting
(Archangel, June, in coll. Philip Crowley, Esq.).
Yellow-billed Cuckoo.
Black-billed Cuckoo.

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