

INTRODUCTION

With the completion of Volume 2, Stephen Marchant retired as Chief Editor of HANZAB, a role he filled from the start of the project in 1981 up to the successful publication of Volume 2 in 1993. Throughout these 12 years, Stephen was Chief Editor and the driving force behind the project. Before this, Stephen's advocacy of such a project was instrumental in the decision of the RAOU Council to begin production of HANZAB. The RAOU and the Handbook are indebted to his efforts over the past twenty years in seeing the need for such a work, and his tireless efforts and dedication in ensuring the vision became a reality. On behalf of the RAOU, we extend our thanks. We hope we can continue to do justice to his ideal.

Volume 3 deals with the Charadriiformes not already covered in Volume 2 – the Scolopacidae, Glareolidae and Laridae – and the order Columbiformes.

The full introduction to the series is given in Volume 1, including the scope of each section and glossaries where needed. We have followed the style and layout of the two preceding volumes without serious modification. A few remarks are necessary on particular aspects of the text where some minor changes have been made from presentation in Volume 2, or where we have, in this Volume, provided information not included in Volume 2. Abbreviations for all sections are listed on pages 22–24.

TAXONOMY AND NOMENCLATURE The taxonomy, nomenclature and arrangement of orders, families and species in Volume 3 follow those of the revised species list of Australian birds by Christidis & Boles (1994), except for the position of the Scolopacidae within the Charadriiformes. This exception became unavoidable with the split of the Charadriiformes between Volumes 2 and 3, and because work on Volume 2 was too advanced to follow Christidis & Boles (1994) fully. Following Christidis & Boles (1994), the sequence of families of Charadriiformes that occur in the HANZAB region is: Pedionomidae, Scolopacidae, Rostratulidae, Jacanidae, Chionidae, Burhinidae, Haematopodidae, Recurvirostridae, Charadriidae, Glareolidae and Laridae. In our sequence, the Scolopacidae are out of place.

In this Volume, the taxonomic ranking given to the groups that comprise the Laridae follows Christidis & Boles (1994), but differs from that given in the introduction to the Charadriiformes in HANZAB 2 (p. 648).

English names for birds of Australia and Australian territories follow those of Christidis & Boles (1994); English names for species endemic to New Zealand follow those of NZCL (1990).

Botanical names In the Laridae and Columbidae, the names of plants in all sections other than Food were checked by G. Carr using the following authorities:

Allan, H.L. 1961. *Flora of New Zealand*. I. R.E. Owen, Gov't Printer, Wellington.

- Australian Biological Resources Study. 1993. *Flora of Australia*. 50. Oceanic Islands. AGPS, Canberra.
- Hnatiuk, R.J. 1990. *Census of Australian Vascular Plants*. Aust. Flora & Fauna Ser. 11; Bureau Flora & Fauna. AGPS, Canberra.
- Moore, L.B., & E. Edgar. 1970. *Flora of New Zealand*. II. A.R. Shearer, Gov't Printer, Wellington.
- Wallis, J.C., & H.K. Airy Shaw. 1973. *A Dictionary of the Flowering Plants and Ferns*. Cambridge Univ. Press, Cambridge.

FIELD IDENTIFICATION The approach to this section remains much as outlined in the Introduction to Volume 1, though several aspects deserve explanation or comment.

For paragraph one, it was difficult to obtain accurate values for length and wingspan and to establish relative size within genera or families. Published data vary greatly and, in some cases, we had considerable doubts about the accuracy of published data (e.g. the wingspans for many Charadriiformes given in Volumes 3 and 4 of BWP appear consistently too high). Whenever good data from museum specimens were available for birds collected in the HANZAB region, we used these in preference to published data. Otherwise, data were taken mainly from the following sources. **WADERS:** BWP (Volumes 3, 4); Hayman *et al.* (1986); Chandler (1989) and Paulson (1993); **SKUAS, JAEGERS, GULLS AND TERNS:** mainly Harrison (1983, 1987), BWP (Volumes 3, 4), and Olsen & Larsson (1995); **COLUMBIFORMES:** Frith (1982), Crome & Shields (1992), Pizzey (1980) and Slater *et al.* (1989). For relative size within genera or families, we relied entirely on information in the foregoing literature; Paulson (1993) proved particularly useful for many of the waders, as did Olsen & Larsson (1995) for the terns. In light of the difficulties encountered during preparation of this and previous volumes, we strongly encourage museum workers and others to help obtain and make available accurate measurements of length, wingspan and weight for Asian birds, which would be invaluable for use in future volumes of HANZAB.

Species accounts The Charadriiformes present considerable difficulties in identification and ageing in the field. Fortunately, recent years have seen the appearance of a wealth of detailed specialist identification papers and guides covering waders, gulls and other groups, and many field identification problems previously considered almost impossible to resolve (e.g. separation of stints in juvenile plumage) are now possible or even routine in some instances. Resolution of these difficult identification problems has come about largely through adoption of the so-called 'new approach' to identification (see Grant & Mullaney 1989), with its emphasis on topography and moult of birds as well as traditional skills of bird identification. With widespread use of telescopes and specialist identification guides, birdwatchers are nowadays scrutinising birds more closely than ever before and in much greater detail, as they attempt not only to identify a bird to species but also to determine its age, sex and stage of moult where possible. We

have attempted to summarize all characters important in identification, ageing and sexing. The sections of Plumages and related matters are complementary to the Field Identification section and need to be consulted for more detailed information on patterns of individual feathers and of moult. An exception is made for those few very rare vagrant species where only a brief Plumages account is given (usually only when extralimital summaries are already available, e.g. in BWP); in these cases, the Field Identification accounts are more detailed than is normally the case. We have occasionally provided references for some particularly difficult identification problems. For a full review of the new identification techniques, plumages, topography, judgement of size and structure and other aspects of the new approach, see Grant & Mullarney (1989).

GLOSSARY

Some terms have been introduced into the accounts or have been used again but were not previously defined.

APICAL SPOT: white tips of primaries of gulls.

CARPAL BAR: band of dark feathers extending diagonally across the inner upperwing, from the carpal joint to the base of the tertials, and contrasting with paler rest of wing; formed by median secondary coverts and rear rows of lesser secondary coverts. Characteristic of many gulls.

COMMIC TERNS: a group of very similar medium-sized *Sterna* terns: Roseate *S. dougallii*, White-fronted *S. striata*, Common *S. hirundo*, Arctic *S. paradisaea*, Antarctic *S. vittata* and Kerguelen *S. virgata*.

CUBITAL BAR: band of dark feathers along the leading-edge of the inner upperwing, and contrasting with paler rest of wing; formed by lesser secondary coverts. Occurs in many terns.

HOOKBACKS: dark markings on the outer primaries of some terns, in which dark areas on tips of the outer webs extends on to the inner webs as a dark line along inner edge; see illustrations on page 690.

INNERWING-COVERTS: Secondary coverts. In this volume, used mainly to refer to those coverts visible on the folded wing of a standing bird.

INNERWING: secondaries and secondary coverts (including tertials and their coverts).

LINING OR WING-LINING: primary and secondary coverts of underwing.

MOULT-CONTRAST: an obvious difference in colour and wear between adjacent feathers of different ages. A classic example occurs in adult breeding Common Terns, in which the contrast between newer paler inner primaries and older darker and more worn outer primaries on the upperwing forms a diagnostic field character.

OUTERWING: primaries, primary coverts and alula.

PRIMARY PROJECTION: on a folded wing, the distance primaries project beyond the longest tertial compared with the length of the exposed tertials.

SADDLE: the mantle, back and scapulars together.

SCAPULAR CRESCENT: narrow pale crescent formed by white tips of rearmost scapulars, often prominent on standing gull or tern.

SECONDARY BAR: contrasting dark band on inner upperwing, formed by dark bases of secondaries.

TAIL-STREAMERS: specialised rectrices (usually long and pointed) that project beyond other rectrices. Examples in this volume are t1 of adult breeding jaegers and t6 of many terns.

TERTIAL CRESCENT: narrow to broad pale crescent formed by white tips of longest tertials, often prominent on standing gull or tern.

UNDERBODY: ventral body plumage, not including underwing and undertail.

WING-POINT: in the Field Identification accounts, refers to that part of the wing-tip visible beyond the longest tertial on a folded wing; see also primary projection. For birds in the hand, refers to the longest primary on the folded wing.

REFERENCES

- Chandler, R.J. 1989. *North Atlantic Shorebirds*. MacMillan, Lond.
 Crome, F.J.H., & J. Shields. 1992. *Parrots and Pigeons of Australia*. Angus & Robertson, Sydney.
 Frith, H.J. 1982. *Pigeons and Doves of Australia*. Rigby, Sydney.
 Grant, P., & K. Mullarney. 1989. *The New Approach to Identification*. Peter Grant, Ashford, Kent, UK.
 Hayman, P., et al. 1986. *Shorebirds*. Croom Helm, Sydney.
 Harrison, P. 1983. *Seabirds: An Identification Guide*. Croom Helm, Lond.
 — 1987. *Seabirds of the World: A Photographic Guide*. Christopher Helm, Lond.
 Olsen, K.M., & H. Larsson. 1995. *Terns of Europe and North America*. Christopher Helm, Lond.
 Paulson, D. 1993. *Shorebirds of the Pacific Northwest*. Univ. Washington, Seattle.
 Pizzey, G. 1980. *A Field Guide to the Birds of Australia*. Collins, Sydney.
 Slater, P., et al. 1989. *The Slater Field Guide to Australian Birds*. Lansdowne Press, Sydney.

DISTRIBUTION AND POPULATION

Vagrant species For species new to Australia and its territories or species listed on the Review List of the RAOU's Record Appraisal Committee (RAC), non-specimen records must be vetted and accepted by the RAC before a species is included on the Australian list or before a record is considered valid. However, the RAC does not review published records unless they have been submitted to them independently. This creates problems with sight-records published before the establishment of the RAC, which, by and large, have not been vetted.

We have usually listed as acceptable only those sight- or sound-records that have been accepted by the RAC. However, records of species on the Review List but published before the establishment of the RAC and that include an adequate description of a species are usually listed as acceptable. All early sight-records without description and all sight-records since the establishment of the RAC that have not been submitted to the RAC are listed as unverified or unacceptable.

Many unverified reports of rare or vagrant species are published in the RAOU Newsletter (till Dec. 1990) or *Wingspan* (in Twitcher's Corner), or in *OSNZ News*. These must be considered unacceptable records until they have been submitted to the RAC (Aust.), Rare Birds Committee (RBC; NZ) or relevant State authority. In the accounts these are usually listed as 'unverified', without reference. In Aust., records in State bird reports are accepted except for species on the RAC Review List.

Populations In the Charadriiformes, the estimated total Aust. population for each species is taken from Watkins (1993). We have also included the results of long-term surveys conducted in Aust. and NZ. In Aust., regular counts are usually only a small proportion of the estimated total population. However, we have included these data to show annual variation in numbers in Aust., which, for at least some species, reflects breeding success.

Unlike earlier volumes, Christmas I. refers to the Australian

territory in the Indian Ocean unless followed by '(Pac.)', which then indicates the island in the central Pacific Ocean.

Maps Presentation of maps remains as in Volume 2, with breeding areas shown in full red and areas of occurrence where breeding has not been recorded in half-tone red. Because we know little of the limits of breeding and non-breeding distribution of species in New Guinea and Indonesia, distribution in these regions has usually been shown in half-tone red, giving no indication of breeding range outside the HANZAB region.

REFERENCES

Watkins, D. 1993. *RAOU Rep.* 90.

MOVEMENTS The text summarizes available information that describes movements in the HANZAB region. For species that move into and out of the HANZAB region, relevant extralimital movements are also described. The patterns of movements of species in this volume vary widely, from species that are sedentary (e.g. Wonga Pigeon *Leucosarcia melanoleuca*) to those that undertake trans-global migration (e.g. Arctic Terns *Sterna paradisaea*). Some species display a variety of movement strategies, e.g. Silver Gull *Larus novaehollandiae*. This volume includes the longest band-recovery known to date: a South Polar Skua *Catharacta maccormicki* banded in Antarctica and recovered in Greenland.

Presentation of this section remains much as in Volumes 1 and 2. The first paragraph summarizes the patterns of movements of a species and, where appropriate, the nature of passage. If available, flight-speed is also mentioned. Subsequent paragraphs describe movements in detail, often population by population or, for migratory species, in relation to the breeding cycle. The results of banding, colour-marking and radio-tracking studies are given in the final paragraphs.

Long-distance banding recoveries (>100 km) are listed in the final paragraph. These data were provided by the Australian Bird and Bat Banding Schemes (ABBBS) in Canberra and by the Australasian Wader Studies Group (AWSG), including records published in their journal *The Stilt*. Band-recoveries are also listed in *Corella* and *Aust. Bird Bander* and, in some cases, might be more complete than data available from the ABBBS. Where appropriate, summaries of other banding records and the results of radio-tracking studies are also presented.

Banding summaries, as in earlier volumes, are presented in the following summarized form:

46S151E	03	P	U	14	2837	288	ABBBS
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

(1) Co-ordinates of banding site (degrees latitude, degrees longitude); (2) month of banding; (3) age at banding (P = pullus; J = juvenile; 1 = 1 year old; 1+ => 1 year old, etc.); (4) sex (M = male; F = female; U = unknown); (5) number of months between banding and recapture; (6) minimum distance to location of recovery (great circle); (7) direction to location of recovery (degrees from N); (8) scheme under whose auspices bird banded (see Abbreviations and Conventions, page 24).

For some species, banding recoveries are presented on maps. The banding site is shown by a symbol and recoveries of birds from that site shown by a smaller version of the symbol. If there was more than one recovery at a site, the number of recoveries is placed next to the symbol.

FOOD For skuas, jaegers, gulls and terns, descriptions of feeding behaviour (at sea) have been standardized using the terminology of Harper *et al.* (1985). During preparation and review of the terns (Sterninae), much information was provided by S.J.M. Blaber and attributed to him in the accounts. These data have now been published in Blaber *et al.* (1995; see below) but it was too late to incorporate the citation in individual reference lists. All scientific names, other than those of birds, were checked against the following references or by authorities at the Museum of Victoria and the National Herbarium of Victoria, or both. **PLANTS:** For Aust., Hnatiuk (1990); for NZ, Poole & Adams (1963). **GENERAL INVERTEBRATES:** Marshall & Williams (1972). **CRUSTACEANS:** R. Marchant, R. Wilson and G. Poore. **MOLLUSCS:** Vaught (1989); S. Boyd. **INSECTS:** CSIRO (1991). **ECHINODERMS:** T. Stranks. **FISH:** Paxton *et al.* (1989), Eschmeyer (1990) and Gomon *et al.* (1994); T. Bardsley. **AMPHIBIANS AND REPTILES:** Cogger *et al.* (1983). **MAMMALS:** Bannister *et al.* (1988).

Abbreviations Some special abbreviations are used in the detailed descriptions of food; these are listed on page 24.

REFERENCES

- Bannister, J.L., *et al.* 1988. *Fauna of Australia*. 5. AGPS, Canberra.
 Blaber, S.J.M., *et al.* 1995. *Mar. Ecol. Prog. Ser.* 127: 1–13.
 Cogger, H.G., *et al.* 1983. *Fauna of Australia*. 1. AGPS, Canberra.
 CSIRO. 1991. *The Insects of Australia*. CSIRO, Melbourne.
 Eschmeyer, W.N. 1990. *Catalogue of the Genera of Recent Fishes*. Calif. Acad. Sci., San Francisco.
 Gomon, M.F., *et al.* (Eds) 1994. *The Fishes of Australia's South Coast*. State Printer, Adelaide.
 Harper, P.C., *et al.* 1985. *BIOMASS Handbook* 24.
 Hnatiuk, R.J. 1990. *Census of Australian Vascular Plants*. Aust. Flora & Fauna Ser. 11; Bureau Flora & Fauna. AGPS, Canberra.
 Marshall, A.J., & W.D. Williams. 1972. *Textbook of Zoology: Invertebrates*. Macmillan Press, Melbourne.
 Paxton, J.R., *et al.* 1989. *Zoological Catalogue of Australia*. 7: *Pisces*. AGPS, Canberra.
 Poole, A.L., & N.M. Adams. 1963. *Trees and Shrubs of New Zealand*. R.E. Owen, Gov't Printers, Wellington.
 Vaught, K.C. 1989. *A Classification of the Living Mollusca*. Am. Malacologists Inc., Melbourne, Florida.

SOCIAL ORGANIZATION AND SOCIAL BEHAVIOUR

Arrangement mainly follows that of Volumes 1 and 2. In the skuas *Catharacta*, there have been many detailed studies, and additional headings have been used for clarity. Within Aust. pigeons and doves, the function of the Display Flight is unclear and may have both territorial and sexual components. We have placed Display Flights in an additional section, Aerial Activity, in the first paragraph of Social Behaviour (as was done for aerial displays in raptors).

VOICE¹ Sonagrams are included where suitable recordings were available. Recordings were analysed using Apple Macintosh computers. Sounds were digitized at 16-bit resolution and edited using SoundEdit software (Macromedia Inc.). Sonagrams were made using Canary 1.1 software (Bioacoustics Res. Prog., Cornell Lab. Orn.). Sonagrams were sent in electronic form (as PICT files) to the publisher. Recordings were analysed over a frequency range of 0–8 kHz using a Hamming window function, a filter bandwidth of c. 350 Hz, smooth display style, 50% overlap and 256 point FFT size. Each sonagram is shown

¹ Serious problems arose with the reproduction of sonagrams in Volume 2 (see page 24).

with an overlay with time on the horizontal scale and frequency on the vertical scale. The amplitude (loudness) of a sound is shown by the darkness of the tracing. Irrelevant intrusions and background noises have, as far as possible, been removed.

To permit reference to the actual sound used to make a sonagram, published recordings have been used as much as possible, particularly those from the compilations attempting to cover all species in our region (Buckingham & Jackson for Aust.; McPherson for NZ). Recordings from the sound library of the Australian National Wildlife Collection, CSIRO Division of Wildlife and Ecology, Canberra, have been used to complete the coverage. The caption to each sonagram lists the recordist, place and date of the recording, and the source of the recording. If the source is given as the letter P followed by a number then the source is a published recording and is listed below.

As in Volume 2, the survey and review of published information on calls of shorebirds by Miller (1992) was a valuable reference.

PUBLISHED SOUND RECORDINGS

P36 Buckingham, R., & L. Jackson. 1987. *A Field Guide to Australian Birdsong. 3: Red-necked Crane to Crested Tern*. Birds Obs. Club Aust., Melbourne.

P39 —, — 1988. *A Field Guide to Australian Birdsong. 4: Sooty Tern to Superb Parrot*. Birds Obs. Club Aust., Melbourne.

P100 Wildlife Service, NZ Dept Int. Aff. 1980. *Birds of New Zealand: 38 Forest and Sea Birds*. Viking Music Cassette VP445C.

P104 McPherson, L.B. 1989. *New Zealand Birds: A Sound Guide. 4*. Author, Christchurch.

P105 — 1990. *New Zealand Birds: A Sound Guide. 5*. Author, Christchurch.

REFERENCES

Miller, E.H. 1992. *Acoustic Signals of Shorebirds*. Roy. Br. Columbia Mus. Tech. Rep., Victoria, BC, Canada.

BREEDING Arrangement follows that of Volumes 1 and 2. In this Volume, we have not used generalized linear diagrams to show the breeding season.

PLUMAGES AND BARE PARTS Colour names given are simple (e.g. dark brown) so that readers unfamiliar with more technical names (e.g. burnt umber) will not be misled. Wherever possible we have also used the F.B. Smithe *Naturalist's Color Guide* (1975, 1981) in describing colours. The identification numbers for the closest equivalent from this guide are bracketed in the text, after the simple names of colours, e.g. dark brown (121). When the match is not particularly close the colour number is qualified, often with the abbreviation 'c', e.g. dark brown (c121). No numbers are given for colours that have no equivalent in the guide. If we have not been able to compare colours with the guide and this is not clear from the context, we have denoted such colours (-). Where two colours are combined, the last-named colour is dominant (e.g. buff-yellow is more yellow than buff); sometimes the suffix 'ish' is added to a colour to denote a weaker tinge of that colour (e.g. buffish yellow has a weaker tinge of buff than buff-yellow).

This Volume deals with many species that have complex sequences of moult, so we again present the nomenclature used for plumages and moults. All plumages and moults are given names corresponding roughly with the role they play in

the life cycle, following the terminology used in BWP. The terms used will be familiar to most readers, but they can often be misleading, or imply relationships between specific plumages and moults with maturity or breeding, which have not been established or, in some cases, do not exist (see, for example, the introduction to Volume 1). The scheme of moult and plumage nomenclature developed by Humphrey & Parkes (1959, 1963; also summarized in the introduction to Volume 1) is more precise and usually less likely to be misleading. We have used both systems, which are summarized in Table 1, placing the Humphrey & Parkes nomenclature in brackets after the main heading. The conceptual differences between the two schemes are greater than the table below implies; see Humphrey & Parkes (1959), Thompson & Leu (1994) and references therein for further information.

MOULTS A conceptual advantage of using the Humphrey & Parkes system of moult and plumage nomenclature is that it encourages critical thought about homologies of moults in related species and which feathers are replaced in a particular moult (or, more often, to which moult replacement of specific feathers should be assigned). This is not always easy to establish, even in species in which moults have been studied in detail; see, for example, published discussions of the correct terminology for moults of North American buntings (Rohwer *et al.* 1992; Willoughby 1992; Thompson & Leu 1994 and references therein). In this Volume, we have often been hampered by a lack of information on subadult moults and plumages, especially on extent of first pre-alternate moult of many Charadriiformes. In many species, first alternate plumage is similar to the preceding first basic and following second basic plumages, and identification of generations of feathers has proved difficult (especially in Laridae).

Despite widespread interest and an extensive literature on ageing and plumages of Charadriiformes, few studies have tried to assign all feather-replacement to specific moults according to the Humphrey & Parkes system. A particular problem was the partial moult of outer primaries undertaken by many migratory waders of the HANZAB region during their first austral autumn (or late austral summer). The usual approach has been to treat this moult as part of the body-moult occurring at the same time (e.g. BWP; HANZAB 2). However, inconsistencies can result, as the moult usually occurs between first pre-basic and first pre-alternate moults, and may overlap with either, neither or both. For example, use of this approach led to what is essentially the same moult being assigned to first pre-basic in Lesser Sand Plover *Charadrius mongolus* but to first pre-alternate in the closely related Greater Sand Plover *C. leschenaulti* (see HANZAB 2). Such a situation is unsatisfactory, especially as the moult appears to have little in common with pre-basic or pre-alternate moults in subsequent cycles. We suspect it is a derived moult that evolved to replace worn outer primaries of young trans-equatorial migrant waders but without the energetic cost of moulting inner primaries that are not very worn (and which are, in any case, among the first feathers to be replaced in second pre-basic moult) and which brings wear of primaries into synchrony with that of adults. We further suspect that this moult is homologous among Charadriidae and Scolopacidae (and possibly other waders). Accordingly, we have treated it as a first pre-supplemental moult, but freely acknowledge that other interpretations are possible and the problem deserves more analysis than was possible here.

Table 1. Nomenclature of plumages and moults. Plumages are given in bold print, moults in italics. Square brackets denote moults or plumages that are absent in some species. Note that pre-supplemental moults may either follow or precede pre-alternate moults (Humphrey & Parkes 1959). Modified from Volume 1 of HANZAB.

CYCLE	BWP	Humphrey & Parkes	Notes
First	Natal	Natal	Complete Defined as first pennaceous feathering Complete or partial
	<i>Pre-juvenile</i> Juvenile	<i>Pre-juvenile</i> Juvenile	
Second	<i>Post-juvenile</i>	<i>First pre-basic</i>	Usually partial
	First immature non-breeding [<i>First immature pre-breeding</i>] [First immature breeding]	First basic [<i>First pre-alternate</i>] [First alternate]	
	<i>First immature post-breeding</i>	<i>Second pre-basic</i>	Complete
	Second immature non-breeding [<i>Second immature pre-breeding</i>] [Second immature breeding]	Second basic [<i>Second pre-alternate</i>] [Second alternate]	Usually partial
Definitive (Adult)	<i>Adult post-breeding</i>	<i>Definitive pre-basic</i>	Complete
	Adult non-breeding [<i>Adult pre-breeding</i>] [Adult breeding]	Definitive basic [<i>Definitive pre-alternate</i>] [Definitive alternate]	Usually partial
Other moults within a cycle	[<i>No standard terminology</i>]	[<i>Definitive pre-supplemental</i>]	Rare
	[No standard terminology]	[Definitive supplemental]	Rare

MEASUREMENTS Measurements of skins are given for nearly all species; details of the sources of data are given in brackets. All measurements of skins for which we simply give the institutes holding the specimens were taken by K. Bartram, A.M. Dunn, D.J. James, D.I. Rogers, R.P. Scofield or A.J. van Loon. For species in which males and females look similar, sexing of skins has been based on data on labels. Several authors (e.g. Parkes 1963; Schodde *et al.* 1992) have pointed out that the sexes assigned on labels are not always accurate. It should be possible to sex all fresh specimens by dissection but, in practice, it can be difficult, especially when birds are not in breeding condition. At such times their gonads are small, difficult to find and readily confused with the adrenal glands or other organs; when dissected by the inexperienced, mis-sexing can often occur. In addition, sexes recorded on labels of some old specimens (e.g. those collected by Robert Grant) appear not to have been based on dissection. We have reduced the numbers of mis-sexed birds in our samples by relying mainly on specimens for which gonads were sketched or described, and on specimens prepared by experienced workers, a process that can involve rather subjective decisions. It is likely a few mis-sexed specimens were not discarded; we have mentioned those few cases where it is thought that mis-sexed specimens may have affected the means calculated for either sex. Where published measurements contained obvious errors, we have often included the measurements, with a note of the error.

The following standard measurements have been taken for almost all species. As in Volume 1 and 2, when quoting measurements from the literature we always mention cases where measuring methods differ from ours, or are not known. Differences between sample means were tested with two-tailed t-tests (if $n > 3$ for each sample).

WING: Length of the wing, measured to the nearest millimetre on the folded wing, from the carpal joint to the tip of the longest primary. We measure maximum chord, flattening the wing against a butted ruler and straightening it as much as possible; maximum chord is the longest measurement between the carpal joint and the tip of the longest primary.

TAIL: Length of tail, measured to the nearest millimetre with a ruler, as the distance between the point of emergence of the central tail-feathers from the skin to the top of the longest tail-feather.

BILL-LENGTH (Bill): measured with calipers to 0.1 mm; we usually measured exposed culmen, the chord of the culmen from the tip of the frontal feathering. In some groups the junction of the frontal feathering with the culmen is not clearly defined and a different method was used; these methods are given in the respective texts.

BILL-DEPTH (Bill D): measured from the junction of frontal feathering with the exposed culmen, to the lower edge of the mandibular ramus below; it is the minimum depth possible at this point.

BILL-WIDTH (Bill W): the distance between the tomia at the junction of frontal feathering with the exposed culmen.

Other conventions for taking measurements of depth and width of the bill are used for some species; these are given in the text. Width and depth of bill are subject to a great deal of shrinkage (Kinsky & Harper 1968; Fjeldså 1980) and are seldom used on skins.

TOTAL HEAD-LENGTH (THL): measured to 0.1 mm with calipers, from the back of the skull to tip of bill. The measurement is becoming widely used for live birds because there is little variation between individual measurers. We have included it when data are available. THL cannot be taken consistently on

skins, because the backs of their skulls are removed to differing extents during preparation.

TARSUS: Length of tarsus measured with calipers to 0.1 mm, from the midpoint of the hindside of the tibio-tarsal joint, to the midpoint of the joint between tarsus and middle toe in front.

TOE: As TOE C, but excluding the middle claw.

TOE C: Length of middle toe measured with calipers to 0.1 mm from the joint at the base of the middle toe (in front of the leg) to the tip of the middle claw.

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 Humphrey, P.S., & K.C. Parkes. 1959. *Auk* 76: 1–31.
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 Kinsky, F.C., & P.C. Harper. 1968. *Ibis* 110: 100–2.
 Parkes, K.C. 1963. *Living Bird* 2: 121–30.
 Rohwer, S., et al. 1992. *Condor* 94: 297–300.
 Schodde, R., et al. 1992. *Corella* 16: 23–8.
 Smithe, F.B. 1975. *Naturalists Color Guide*. Am. Mus. Nat. Hist., New York.
 — 1981. *Naturalists Color Guide*. III. Am. Mus. Nat. Hist., New York.
 Thompson, C.W., & M. Leu. 1994. *Condor* 96: 769–82.
 Willoughby, E.J. 1992. *Condor* 94: 295–7.

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ABBREVIATIONS AND CONVENTIONS

Compass directions

N, NE, E, SE, S, SW, W, NW + standard intermediates. Note, however, when used as an adjective (e.g. northern Aust., north-eastern coast, and so on), the style is lower case, with a full period: n., ne., e., se., s., sw., w., nw., and so on.

Units

Standard SI units and their recommended abbreviations are followed throughout the text.

Statistical arrangement

Throughout, simple statistical data are presented in the form: MEAN (STANDARD DEVIATION; RANGE; SAMPLE SIZE), e.g. 28.5 g

(5.01; 27.6–29.8; 14). If only the range is available, it is presented in brackets as before, e.g. 28.5 g (27.6–29.8). If only standard deviation is available, it is presented as MEAN ± STANDARD DEVIATION, e.g. 28.5 ± 5.01 g. If only the sample size is available, it is presented as MEAN (n=...), e.g. 28.5 g (n=14).

In the sections on Measurements and Weights, the last column of the tables indicates significance of the t-test of the sample means:

ns no significant difference
* means are significantly different at 0.05
** means are significantly different at 0.01

GENERAL ABBREVIATIONS

A'asia	Australasia	p.	page
A'asian	Australasian	p.a.	per annum
ACT	Australian Capital Territory	Pen.	Peninsula
Arch.	Archipelago	Pl.	Plate
asl	above sea-level	Pll	Plates
Aust.	Australia(n)	PNG	Papua New Guinea
BMR	Basal Metabolic Rate	pp	pages
C.	Cape	ppt	parts per thousand
c.	<i>circa</i>	Prom.	Promontory
Ck	Creek	Pt	Point
CSN	Classified Summarized Notes (published in <i>Notornis</i>)	Pte	Pointe
Div.	Division (e.g. Kimberley Div.)	Qld	Queensland
Grp	Group	R.	River
h	hour(s)	Ra.	Range
Hwy	Highway	Ras	Ranges
I.	Island	Rd	Road
Is	Islands	Rs	Rivers
Isl.	Islet(s)	s	second(s)
L.	Lake	SA	South Australia
Ls	Lakes	SF	State Forest
MIA	Murrumbidgee Irrigation Area	SI	South Island, NZ
min	minute(s)	sp.	species
Mt	Mount, Mountain	spp	species
Mts	Mountains	St	Saint
NI	North Island, NZ	Stn	Station
NP	National Park	Str.	Strait
NR	Nature Reserve	Tas.	Tasmania
NSW	New South Wales	UK	United Kingdom
NT	Northern Territory	USA	United States of America
NZ	New Zealand	Vic.	Victoria
		WA	Western Australia

MUSEUMS AND OFFICIAL ORGANIZATIONS

AAD	Australian Antarctic Division		
ABBBS	Australian Bird and Bat Banding Schemes	MM	Macleay Museum, University of Sydney
ABC	Australian Bird Count (RAOU)	MV	Museum of Victoria, Melbourne
AIM	Auckland Institute and Museum, Auckland (formerly AWMM)	NMNZ	National Museum of New Zealand, Wellington
AM	Australian Museum, Sydney	NPIAW	National Photographic Index of Australian Wildlife (now Nature Focus)
AMNH	American Museum Natural History, New York	NRS	RAOU Nest Record Scheme (also as Aust. NRS)
ANARE	Australian National Antarctic Research Expedition	NSW NPWS	NSW National Parks and Wildlife Service
ANCA	Australian Nature Conservation Agency (formerly Australian National Parks and Wildlife Service [ANPWS])	NTM	Northern Territory Museum, Darwin (now MAGNT)
ANWC	Australian National Wildlife Collection, CSIRO, Canberra	NZ NRS	OSNZ Nest Record Scheme
AOU	American Ornithologists Union	NZWSG	New Zealand Wader Studies Group
AUST. NRS	RAOU Nest Record Scheme	OM	Otago Museum, Dunedin (formerly Otago University)
AWMM	Auckland War Memorial Museum, Auckland (now AIM)	OSNZ	Ornithological Society of New Zealand
AWSG	Australasian Wader Studies Group	PWH	Department of Parks, Wildlife and Heritage (Tas.)
BAS	British Antarctic Survey	QDEH	Queensland Department of Environment and Heritage (formerly QNPWS)
BMNH	British Museum of Natural History	QM	Queensland Museum, Brisbane
BOU	British Ornithologists Union	QNPWS	Queensland National Parks and Wildlife Service
BTO	British Trust for Ornithology	QVM	Queen Victoria Museum and Art Gallery, Launceston
CALM	Department of Conservation and Land Management (WA)	QWSG	Queensland Wader Studies Group
CAMBA	China Australia Migratory Bird Agreement	RAC	RAOU Records Appraisal Committee
CCNT	Conservation Commission of the Northern Territory	RAOU	Royal Australasian Ornithologists Union
CM	Canterbury Museum, Christchurch	RBC	OSNZ Rare Birds Committee
CNR	Conservation & Natural Resources (Vic.) (formerly Department of Conservation and Environment [DCE])	RFBPS	Royal Forest and Bird Protection Society (NZ)
CSIRO	Commonwealth Scientific and Industrial Research Organization (Aust.)	RMNH	Rijksmuseum van Natuurlijke Historie, Leiden (now National Museum of Natural History)
DOC	Department of Conservation, Wellington, New Zealand	RSPB	Royal Society for the Protection of Birds
DSIR	Department of Scientific and Industrial Research (NZ)	SA NPWS	SA National Parks and Wildlife Service
HLW	H.L. White Collection (housed in MV)	SAM	South Australian Museum, Adelaide
ICBP	International Council for Bird Preservation (now Birdlife Int.)	TMAG	Tasmanian Museum and Art Gallery, Hobart
JAMBA	Japan Australia Migratory Bird Agreement	VWSG	Victorian Wader Study Group
MAGNT	Museum and Art Gallery of the Northern Territory, Darwin (formerly NTM)	WAM	Western Australian Museum, Perth
		WWF	World Wide Fund for Nature
		ZMA	Zoological Museum, Amsterdam

STANDARD REFERENCES

Some references appear *ad nauseum* throughout the book. These are given in an abbreviated form in running text and are not cited in the list of references at the end of each text.

ACT Atlas	Taylor, M., & Canberra Ornithologists Group. 1992. <i>Birds of the Australian Capital Territory. An Atlas</i> . Canberra Orn. Group/National Capital Planning Auth., Canberra.	Aust. Seabird Atlas	Reid, T., M.A. Hindell, D.W. Eades, & M. Newman. In prep. <i>Atlas of Seabirds of Southeast Australia</i> .
Aust. Atlas	Blakers, M., S.J.J.F. Davies, & P.N. Reilly. 1984. <i>The Atlas of Australian Birds</i> . Melbourne Univ. Press, Melbourne.	BWP	Cramp, S., & K.E.L. Simmons. 1977, 1980, 1983, 1985, 1988, 1992, 1993, 1994. <i>The Handbook of the Birds of Europe, Middle East and North Africa — The Birds of the Western Palearctic. Vols 1-9</i> . OUP, Oxford.
Aust. CL	Condon, H.T. 1975. <i>Checklist of the Birds of Australia. I. Non-Passerines</i> . RAOU, Melbourne.	Campbell	Campbell, A.J. 1900. <i>Nests and Eggs of Australian Birds</i> . Privately, Sheffield.
Aust. RD	Reader's Digest Complete Book of Australian Birds. 1976. Reader's Digest, Sydney.	Cleland	Cleland, J.B., J.H. Maiden, W.W. Frogatt, E.W. Ferguson, & C.T. Musson. 1918. <i>Scient. Bull. Dept agric. NSW</i> 15: 1-112.
		FAB	Barker, R.D., & W.J.M. Vestjens. No date [c. 1989]. <i>The Food of Australian Birds. I. Non-passerines</i> . CSIRO, Canberra. <u>AND</u> Barker, R.D., & W.J.M. Vestjens. No date [c. 1991].

	<i>The Food of Australian Birds. 2. Passerines.</i> CSIRO, Canberra.		
Gould	Gould, J. 1865. <i>Handbook to the Birds of Australia.</i> Privately, Lond. (Facsimile edn [1972]: Landsdown, Melbourne).	NZRD	1990. <i>Checklist of the Birds of New Zealand and the Ross Dependency, Antarctica.</i> Third Edition. Random Century, Auckland.
Hall	Hall, B.P. (Ed.) 1974. <i>Birds of the Harold Hall Australian Expeditions, 1962-70.</i> Br. Mus. (Nat. Hist.), Lond.	OED	<i>Reader's Digest Complete Book of New Zealand Birds.</i> Reader's Digest, Sydney.
HASB	Serventy, D.L., V.N. Serventy, & J. Warham. 1971. <i>The Handbook of Australian Sea-birds.</i> Reed, Sydney.	Oliver	<i>The Oxford English Dictionary.</i> Clarendon Press, Oxford. Includes abridgements, such as <i>The Shorter Oxford English Dictionary.</i>
Lea & Gray	Lea, A.H., & J.T. Gray. 1935-36. <i>Emu</i> 35: 63-98, 145-78, 251-80, 335-47.	Oliver	Oliver, W.R.B. 1955. <i>New Zealand Birds.</i> Reed, Wellington. (Reprinted 1974).
Mathews	Mathews, G.M. 1910-27. <i>Birds of Australia.</i> Witherby, Lond. (All volumes and supplements).	Peters	Mayr, E., & G.W. Cottrell. 1979. <i>Check-list of Birds of the World. 1.</i> Second Edition. Harvard Museum of Comparative Zoology, Cambridge.
Murphy	Murphy, R.C. 1936. <i>Oceanic Birds of South America.</i> Am. Mus. Nat. Hist., New York.		Peters, J.L. 1934. <i>Check-list of Birds of the World. 2.</i> Harvard Univ. Press, Cambridge, Mass.
North	North, A.J. 1901-14. <i>Nests and Eggs of Birds found Breeding in Australia and Tasmania.</i> Spec. Cat. 1, Aust. Mus., Sydney.	Serventy & Whittell	Peters, J.L. 1937. <i>Check-list of Birds of the World. 3.</i> Harvard Univ. Press, Cambridge, Mass.
NZ Atlas	Bull, P.C., P.D. Gaze, & C.J.R. Robertson. 1985. <i>The Atlas of Bird Distribution in New Zealand.</i> OSNZ, Wellington.	Vic. Atlas	Serventy, D.L., & H. M. Whittell. 1976. <i>Birds of Western Australia.</i> Univ. West Aust. Press, Perth.
NZCL	Ornithological Society of New Zealand.		Emison, W.B., C.M. Beardsell, F.I. Norman, R.H. Loyn, & S.C. Bennett. 1987. <i>Atlas of Victorian Birds.</i> Dept. Cons. Forests & Lands and RAOU, Melbourne.

ADDITIONAL STANDARD REFERENCES

Several references are used as standard references in this volume only:

Crome	Crome, F.J.H., & J. Shields. 1992. <i>Parrots and Pigeons of Australia.</i> Angus & Robertson, Sydney.	Goodwin	Goodwin, D. 1970. <i>Pigeons and Doves of the World.</i> Trustees Br. Mus. (Nat. Hist.), Lond.
Frith	Frith, H.J. 1982. <i>Pigeons and Doves of Australia.</i> Rigby, Melbourne.	Lane	Lane, B.A. 1987. <i>Shorebirds in Australia.</i> Reed, Sydney.

OTHER ABBREVIATIONS

A number of abbreviations are special to various sections.

MOVEMENTS

Abbreviations for contributing banding schemes are:

ABBBS	Aust. Bird and Bat Banding Schemes
BBL	Bird Banding Lab., Dept Int., USA
BMRC	Bird Migr. Res. Centre, Yamashina Inst. Orn., Japan
BTO	Br. Trust Orn., Great Britain
C	Republic of China
CRBPO	Centre Rech. Biol. Popul. Ois., Nat. Mus. Hist. Nat., France
KOREA	Korean Banding Scheme
MAPS	Migr. Animal Pathol. Surv. (McClure 1974)
NZNBS	New Zealand National Banding Scheme, Department of Conservation
RUSS	Russian Banding Scheme
SABRU	S. Afr. Bird Ringing Unit, Univ. Cape Town, Rep. S. Afr.
SOPAN	Stajca Orn. Polska Akad. Nauk., Poland
VH	Vogelwarte Hiddensee, East Germany

FOOD

%freq.	% frequency	%no.	% number
%vol.	% volume	%wt	% wet weight
A	Autumn	W	Winter
S	Spring	Su	Summer
ad.	adult	ads	adults
excl.	excluding	fl.	flowers
fru.	fruits	imm.	immature/s
incl.	including	indet.	indeterminate
juv.	juvenile/s	larv.	larva, larvae
lvs	leaves	sh.	shoots
sds	seeds	tr.	trace
unident.	unidentified		

PLUMAGES AND RELATED MATTERS

PMS	primary moult-score
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ERRATA

Serious problems arose with the reproduction of the sonagrams in Volume 2. On most, the grid of frequency and time over the sonagrams was positioned wrongly and many sonagrams were reproduced much paler than the originals.

Corrected sonagrams, and other corrections to Volumes 1 and 2, will be printed in a separate booklet, copies of which will be available in mid-1996. Copies will be sent to all who purchased HANZAB 2 through the RAOU. Otherwise copies can be obtained from Oxford University Press.