

History vs mystery: the reliability of museum specimen data

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SUMMARY

Museum specimens are consistently the most reliable source of many types of information for bird species. While the vast majority of bird specimens provide accurate data that form the baseline of knowledge of bird distributions, a small percentage of specimens carry various types of misinformation, and to maximise the utility of specimen data and avoid perpetuation of errors, users need to be aware of and able to evaluate these problems. This paper discusses and provides examples of many types of misinformation on specimen labels, which include over-generalised or untraceable locality information, careless labelling, consequences of the profit motive among dealers, inadequate training and supervision of collectors, inappropriate curatorial techniques, problems in deciphering and interpreting label data, and fraud. Inadvertent problems such as imprecision and untraceability of localities and other data, as well as subsequent improper curatorial treatment, are common among older specimens, while known cases in which specimen data have been intentionally compromised tend to be rare and small-scale. The most notable exception is the Meinertzhagen Collection, which contains numerous stolen specimens bearing fraudulent data, as well as important specimens with genuine data.

Introduction

The collectors' old adage 'What's hit is history, what's missed is mystery' reflects a deep-seated and well-founded belief in the importance of the tangible evidence represented by the museum specimen. Certainly when compared with the multitude of chronic problems associated with sight records (jokingly summed up as: 'I wouldn't have seen it if I hadn't believed it'), specimen documentation allows more critical and objective study, not only now but also in the future, when new technology and methodology may be available. It is, however, self-evident that the accumulation, maintenance and interpretation of ornithological specimens will continue to be subject to errors of various types and, to a lesser extent, to pathological behaviours; indeed, the literature is replete with suspected or confirmed cases of problematic specimen data. Even so, specimens are being increasingly used in many applications by persons distant from, and unfamiliar with, the historical framework that makes many specimen-related problems transparent, so these data are often uncritically assimilated in the literature. The subject of specimen-based misinformation in ornithology seems not to have been reviewed, a deficit this paper attempts to redress in support of a more confident and accurate utilisation of museum material by future workers.

We review specimen-related misinformation of various categories, beginning with the often pervasive but typically minor types of 'noise' due to carelessness and casual error, and progress through to rarer but more pernicious (on a case-by-case basis) instances of outright fraud involving specimens. However, the ubiquity of the minor types of specimen misinformation probably makes their cumulative negative

effect on ornithology greater than for fraud. Our focus is on the numerous problems that can arise from the specimens and their associated data, but we stress that the very existence of the specimen enables independent, scientific evaluation of its validity, and that some such methods deserve more widespread application. By its nature, the matter under discussion typically involves individual collectors, but our concern is exposition of the problems, over and above personal considerations.

Outside the scope of our review are: specimen-based (and extremely important) sources of error such as misidentifications, hybrids and aberrant or composite individuals; lost or destroyed specimen documentation; and mistakes and misinterpretations of specimen data in specimen catalogues, the published record (as distinguished from errors in baseline data) and, increasingly, in databases. While we recognise that specimen data problems stemming from the earlier years of ornithology are even more prevalent and often less readily solved than more recent ones, our discussion primarily focuses on the latter half of the nineteenth century and later. This review provides a sample of the various types of specimen misinformation. Many additional cases have been published; others are undoubtedly known to living researchers who have not set them in writing; and others surely remain undetected or are long-forgotten. There is an extended history of critical appraisal of specimen records, typically on a regional basis, and comment will be found on the reliability of many major collections, especially the early ones, in scattered sources. Because resolutions to certain problems may seem obvious to a few but not to most, a compilation of such problems to improve the reliability and utility of ornithological collections worldwide would be a valuable long-term goal to serve current and future researchers when evaluating the probability of error or fraud in specimen data of a given collection or type.

Collectors and error

Data-poor labels

Many older museum specimens have little or no associated data. In part this is due to ambiguity or uncertainty over old national borders, but also because early scientists and collectors were unaware of the importance of precise label data, so that it was exceptional for labels to be written in the field. As a result, many early species descriptions were based on specimens of unknown, questionable or mistaken provenance. The demand for new zoological material was overwhelming, and in the early descriptive years it seemed of little consequence whether a new species came from Brazil or Peru. Since many exotic natural history specimens resulted from round-the-world expeditions, it was not uncommon for specimens to be attributed after a voyage to localities in the wrong hemispheres, witness the following Neotropical species with Old World type localities or vice versa: Collared Puffbird *Bucco capensis*, in which the specific name supposes an origin in South Africa rather than the Guianas; *Metriopelia inornata*, a synonym of the Spotted Dove *Streptopelia chinensis*, erroneously described as from Brazil instead of Java (Warren 1966); and

Buff-throated Purplethroat *Pardalotus pipra* Lesson (now *Iodopleura pipra*), who described it as 'à Trinquemalé sur la côte de Ceylan', proposed as an error for Rio de Janeiro by Hellmayr (1915). Several specimens of Hawaiian birds were labelled as from Chile, on the same shipping route to Europe, one misleading Sclater (1862) into listing an 'Elepaio *Chasiempis sandwichensis* as an undetermined tyrannid (Olson 1989); also, a specimen that almost certainly represents the type of the vanished Oahu Thrush *Myadestes lanaiensis woahensis* was registered as 'Sandw Isl. or Chili' (Olson 1996). This could happen by purchase of specimens at ports, by failure to label specimens en route, or by lack of communication between voyager and dealer or naturalist working up the results. The necessarily routine restriction and/or correction of early type localities was sometimes based on questionable or misinterpreted evidence, adding yet another level of uncertainty or error (Dickerman 1981).

Generalised locality data on older specimens risks misleading modern workers because of changes in the geographical applications of names: specimens simply labelled 'Bengal' cannot now be certainly attributed to country (either India or Bangladesh), much less to a more specific locality (Husain & Sarker 1972); 'India' on old labels could mean a much broader region than now, including areas far to the east; and 'Punjab' specimens without more specific localities could be from either present-day India or Pakistan. Numerous species were attributed to the avifauna of Bhutan owing to a misinterpretation of 'Bhootan Duars', which now lie entirely within India. Many of T. C. Jerdon's historic Indian bird specimens were labelled as from 'Madras', which then included a large portion of southern India, not just the city recently renamed Chennai.

Incomplete or generalised label data can also often be misleading on smaller scales. A taxon described from southern Sulawesi, now Rufous Fantail *Rhipidura rufifrons celebensis* Büttikofer 1893, was shown by Hartert (1896) to have been collected from smaller adjacent Tanahjampea. Although Curl-crested Manucode *Manucodia comrii* Sclater 1876 was described from the Huon Gulf, the type actually came from Fergusson Island (Frith & Beehler 1998). Specimens reportedly collected in Leyte, Philippines, were actually from the small island of Buad (Parkes 1965). Often, rather general place names were used for all specimens originating from a given segment of an expedition: Ancón was the locality recorded on the labels of 43 Peruvian Diving-petrels *Pelecanoides garnotii*, although it seems more likely that they were from the offshore Islas Pescadores (Collar *et al.* 1992). Some Ethiopian specimens of White-winged Flufftail *Sarothrura ayresi* were labelled 'Entotto', which is a ridge of wooded hills, but it overlooks the far more plausible, marshy Sululta (Ash 1978).

Of course, many localities at which birds have been collected are known by names shared with other localities. Some common ones such as 'Río Grande' are especially troublesome: in Bolivia, avian specimens bearing this name come from at least two different localities (Remsen *et al.* 1986). An attempt to trace 'Santa María, Oriente' on Cuba for Cuban Parakeet *Aratinga euops* was defeated by the

sheer number of options in the available gazetteers (Collar *et al.* 1992:300); and attempts to trace 'Fategarh' (or, e.g., 'Futtegurh') and 'Rampur' in various parts of India were likewise compromised by the glut of such names in their various permutations (Collar 2001:13). Within Afghanistan, specimens have been collected at two Faizabads, on opposite sides of the country (PCR unpubl.). An 'Allahabad' specimen of Collared Pratincole *Glareola pratincola*, long thought (and recently mapped as) a vagrant to Uttar Pradesh, north-central India, is clearly really from one of several Allahabads in Pakistan, a locality specified by earlier workers and well within the species's known breeding range (Rasmussen & Anderton in press). Similar problems with African collecting localities are discussed by Dowsett (1972b), Morgan *et al.* (1978), Snow & Louette (1981), and Irwin (1991).

Careless labelling

It is typically difficult and frequently impossible to prove that any given specimen bears unreliable data, and efforts to do so often involve a degree of circular reasoning. Cautionary comments on certain collectors are commonplace, e.g. on Goodfellow and Hamilton (Zimmer 1947), Swainson (Parker & Benson 1971), Loria (Somadikarta 1975), A. Garrett (Hoyoak & Thibault 1978), R. H. Lefevre (Meyer de Schauensee in Greenwood 1980), Doggett (Jackson in Cunningham-van Someren 1981) and A. Ruiz (Blair in McGowan & Massa 1990), but objective evaluation is needed in each case.

Charles Hose is best known for his pioneering Bornean collections, and had several birds named after him. However, after a short trip to northern Sulawesi in 1895, he reported four species new to that island (Hose 1903), including one new to science (*Dicaeum hosii* Sharpe 1897). The material of *D. hosii* was later shown (Stresemann 1940) to comprise two mislabelled Bornean flowerpeckers and another of a known Sulawesi species. Another species (Pied Fantail *Rhipidura javanica nigritorquis*) reported from northern Sulawesi by Hose (1903) is otherwise only known from the Philippines, and the remaining two novelties are also questionable (White 1974). These apparent errors were formerly attributed to the once-common practice of attaching printed labels to specimens *a posteriori* (White 1974), but the considerable problems with Hose (1903) suggest more catastrophic lapses on his part (see Collar 2001:792).

Several Southern Ocean procellariiform species have long been on the North American list (main or hypothetical: AOU 1983) on the basis of specimens that J. K. Townsend sent to Audubon, saying they had been procured near the mouth of the Columbia River, between Oregon and Washington (Stone 1930). Townsend, who also sent Audubon a Chilean finch *Brachyspiza* which the latter innocently named *Fringilla mortoni* (Stone 1930), is assumed to have been careless in labelling.

A number of specimens from Paraguay collected by Schulze and Haack in 1939 have caused considerable confusion: the locality (235 km W of the Riacho Negro) has proved difficult to pinpoint, their field numbers are out of sequence, dates spent at what seem to be two different sites overlap broadly, the collection contains a

mixture of Chaco and Oriente species, and the labels are typewritten, indicating the strong probability of their having been prepared subsequent to the expedition (Short 1972, Hayes 1995).

Hugh Cuming (a well-known malacologist and plant collector, but the namesake of Tabon Scrubfowl *Megapodius cumingi* and Scale-feathered Malkoha *Phaenicophaeus cumingi*) was disparaged as the authority for several species from Sri Lanka by Layard (1880), who wrote 'I should be very loth to accept a "habitat" on the ground that Cuming had stated it'. Cuming's collection included the only record for Sri Lanka of Broad-tailed Grassbird *Schoenicola platyura* (otherwise a narrow Western Ghats endemic), a record which has received cautious acceptance to this day (see Collar 2001:2199). The *Schoenicola* specimen is said to have come in with others collected in Sri Lanka by T. Thwaites (Sharpe 1906), and Natural History Museum (NHM) records do not readily elucidate its acceptability. However, Cuming has also been blamed for mixing up T. Bridges's specimens from Bolivia, Chile and Argentina (Sclater & Salvin 1879), and his Philippine localities have been considered unreliable (Parkes 1961, Parkes 1988, Dickinson *et al.* 1991). Regarding Cuming's vast shell collection, it is agreed that, owing to his own carelessness and that of those who cared for his collection, many specimens are wrongly labelled or have lost their data (Dance 1966). Given such independent support for Layard's concerns about accepting locality records from specimens dealt or collected by Cuming, lone Cuming specimens, such as the *Schoenicola*, cannot be accepted as vouchers.

The failure of some collectors to label their specimens properly meant that mistakes in the hands of their agents were inevitable. Richard Crossley's pioneering Madagascar collections all passed first through a dealer's hands, and mistakes evidently occurred when the usual letter recounting Crossley's itinerary failed to accompany a shipment (Sharpe 1875, Rasmussen *et al.* 2000). M. Humblot dispersed his Comoran scops owl specimens through various agencies, and thus they bear different 'original' labels depending on the dealer or institution that handled them, suggesting subsequent labelling. This probably explains a Humblot specimen labelled 'Grand Comoro' but identical with Anjouan Scops Owl *Otus capnodes* of Anjouan and quite unlike Comoro Scops Owl *O. pauliani* of Grand Comoro (Rasmussen *et al.* 2000).

Many early collectors did not have ready-made paper labels, and often used cut-up scraps, relied on memory, or sent birds back in batches using a general locality name. Subsequent assumptions are unreliable. Charles Darwin failed to label his now-famous Galapagos finches until 'after leaving the Galapagos Archipelago in late October 1835' (Sulloway 1982a:27), resulting in considerable confusion and even unwarranted doubts as to the provenance of some of Captain Fitzroy's own carefully labelled specimens. Sharpe (1879) considered the Sulu Islands the source of a single Reddish Scops Owl *Otus rufescens* that had come in unlabelled (Guillemard 1885) along with specimens both from the Sulus and Borneo; he did not venture to name it, but Hachisuka (1934) did so, apparently assuming the

correctness of the locality Sharpe had ascribed it to. The fact that the bird matches darker examples in the now-larger series from Borneo means that *Otus rufescens* cannot be maintained on the Philippines list (Dickinson *et al.* 1991).

The large collections of specimens from the Yucatán Peninsula and Cozumel amassed by George Gaumer were received enthusiastically in museums, and formed the basis of numerous descriptions of taxa and several papers. Three species of *Chaetura* alone were described by G. N. Lawrence from Gaumer's material, although for one Gaumer apparently sent Lawrence '20 tails and one entire bird' (Greenway 1978). For many years, very little else was known of birds of the region, and only later, when other collections began to come in, especially from the islands off Yucatán, did something seem amiss with Gaumer's specimens. So many of his records stood alone or flew in the face of other data that Paynter (1955) became sceptical of them. Nevertheless, Thompson (1962) published a number of Gaumer specimens as new regional records, prompting Parkes (1970) to set out the apparent problems with the material, including Gaumer's habit of sending boxes of unlabelled specimens to museums, where 'Yucatán' labels would be attached. Many records of mainland species for small islands off Yucatán and for Cozumel are still only based on Gaumer specimens, including groups typically lacking on islands such as woodcreepers and antbirds. For this reason a special category based only on Gaumer specimens was created in a table of Mexican island bird distributions (Howell & Webb 1995). Occasionally, however, species long known from Cozumel only by Gaumer skins have since been found there, e.g. Yucatan Flycatcher *Myiarchus yucatanensis* (Lanyon 1965, Parkes & Phillips 1967), illustrating the dangers of becoming over-sceptical (see also Smith 2001).

Even in recent times the problem of *post hoc* labelling has adversely affected what ought to have been valuable material. A very large collection amassed by Mario del Toro Avilés in Mexico is flawed owing to his labelling specimens long after their collection, sometimes perhaps not until they had been requested by a museum; he even admitted that a series he had labelled as from Oaxaca was actually from Puebla (Binford 1989). Some unique records from one side or other of the Isthmus of Tehuantepec, and new taxa described (e.g. Saw-whet Owl *Aegolius acadicus brodkorbi*) on the basis of the del Toro Avilés collection, therefore require confirmation (Binford 1989, Peterson & Nieto-Montes 1996).

The reliability of local collectors

Many naturalists employed locals to do their collecting, often not even accompanying them into the field. Frequently these employees excelled at the work, and obviously achieved a great deal. Inevitably, however, such staff could not be expected always to produce specimens with reliable data. Söderstrom's native collectors in Ecuador wrapped but did not attach bands of paper with locality and sex data around their specimens, and these easily became mixed up, leading Chapman (1926:735) to comment ruefully: 'Inaccuracies of this kind cast a suspicion on all records which do not conform to the normal and thereby prevent papers based on native-made

collections from adding much that is new to existing information in regard to distribution.' Leprosy forced the Penards, who assembled the first true series of bird specimens from Surinam, to rely on local collectors, and several species otherwise unknown from the country are represented in their huge egg collection, identified only by their assistants without confirmatory data (Haverschmidt 1955).

Louis Mandelli, a tea plantation manager in Darjeeling (Pinn 1985), provided local collectors with monetary advances, guns and ammunition, and (despite some abscondings and deceptions) thereby amassed a huge collection, by far the largest ever assembled in the central Himalayas. Unfortunately, the specimens have minimal data, such as 'Native Sikkim', 'Thibet', 'Bhotan Doars', no indication of altitude, and no safe indication of sex (Brooks 1880, Pinn 1985). It is furthermore possible that none of his specimens is really from Tibet, owing to the then-undefined borders (Vaurie 1972).

Many of Nepal's birds were discovered in the early nineteenth century by Brian Hodgson (Inskipp & Inskipp 1985), who was stationed (and under orders to remain) in Kathmandu and its Valley; thus he was obliged to rely on collectors (Cocker & Inskipp 1988). He took abundant notes and trained local artists to make coloured illustrations that serve as the types of many species (although by today's standards these would be considered *nomina nuda*). Now the country is relatively well known, but several of his species have not been found there again. This might be due to habitat loss, but so much uncertainty surrounds the exact provenance of some specimens (Cocker & Inskipp 1988) that an origin farther east cannot be ruled out. Even so, Hodgson's 'Nepal' material is less problematic than his later specimens labelled 'Behar' and 'India'. Those labelled 'India' by G. R. Gray (who in accordance with then current museum practice destroyed the original labels) are Himalayan; the preparation style is that of Hodgson's Nepal collectors, not his Indian ones; and they were independently considered by Thomas Moore to be from Sikkim (Horsfield & Moore 1854, Sharpe 1906:386).

A problem particularly acute in the Andes was the failure of some early collectors to record altitudes, for example with Salmon (Chapman 1917) and Söderstrom's collectors (Zimmer 1948:32). Reliance on local collectors often meant that specimens were labelled at a central point such as the camp, as with Söderstrom (Chapman 1926); in the cases of Buckley, Goodfellow and Hamilton even determination of the slope from which specimens came is impossible (Chapman 1926, Zimmer 1951b:35). Tibetan material from the 1924 Mount Everest Expedition was collected by local help, and nearly all the birds are labelled, without specific locality, as being from '10,000 ft', an unconvincing altitudinal uniformity (Vaurie 1972:68-69).

The reliability of testimony of local collectors can have major implications for conservation. Two twentieth-century examples come from Thailand. One concerns the almost mythical White-eyed River Martin *Eurochelidon sirintarae*, the only specimens of which are a small series supplied by local people in response to a broadcast appeal for live wild birds for ringing. According to Thonglongya (1968) the birds were trapped by throwing a net over reedbeds at Bung Boraphet, but a

technical assistant subsequently reported that the birds were brought to the research team's hotel, so that neither the habitat nor the type locality can be entirely certain (P. D. Round in Collar 2001:1946-1947). However, the specimen labels have no indication of doubt as to the locality, thus lending false confidence to a provenance that is otherwise supported only by unconfirmed sight reports.

The second and more telling case, which could perhaps be treated under the heading 'Fraud' below, concerned what were for 50 years the last published records of Gurney's *Pitta Pitta gurneyi*, including the first recorded fledgling: these were supposedly collected at 600–1,060 m on the mountain Khao Phanom Bencha, in southern Thailand (Meyer de Schauensee 1946). These records went unquestioned until the compilation of all other evidence on the species led P. D. Round to perceive that, with the exception of these specimens, Gurney's *Pitta* is an extreme lowland specialist (Collar *et al.* 1986). Ultimately the species was relocated at this mountain, but only at its base; searches higher up were futile (see Collar 2001). As other exclusively lowland species were also represented in Meyer de Schauensee's 'montane' collection, it became apparent that his unaccompanied native collectors had not ascended the mountain, but had labelled specimens in the pretence of having done so (Round & Treesucon 1986, Round 1995).

Dealers and error

Commercial imprecision

The once-thriving business of dealing in natural history objects has long been a source of distrust among ornithologists. Several dealers (e.g. Argent, Turner, Maison Verreaux) were mentioned by Sharpe (1906) as having purveyed specimens with brief or inexact localities, and carelessness by an agent caused Sharpe himself to misattribute specimens in Sir Hugh Low's Bornean collection to the island of Labuan (Sharpe 1906:419). Commercial interests were often so much to the fore that accuracy over the provenance of material was neglected. The dubious origins of many of John Gould's specimens are attributable to such considerations, although perhaps no more so than those of his scientific contemporaries.

Among the most prominent dealers were Maison Verreaux of Paris, whose specimens found their way into numerous collections, and include type and important material for many taxa, which often appear to have acceptable localities. However, Lord Lilford observed them cavalierly assigning identifications for an egg collection (Trevor-Battye 1903, Mearns & Mearns 1998). A notable victim of such indifference to accuracy is the case of *Necropsar leguati*, whose unique specimen, labelled 'Madagascar', was acquired by Lord Derby from M. J. Verreaux in 1850. Aware that 'M. Verreaux was often very inexact in the precise geographical data he inscribed on the labels of his specimens', Forbes (1898) described it as a new species of starling from the Mascarenes, whereas recent examination reveals it to be an albino specimen of a mimid from the Caribbean (Fisher & Jackson 2002, Olson *et al.* unpubl.)! Many Verreaux specimens lack locality data, but bear large labels with

elaborate writing, typically synonymies copied from Bonaparte's *Conspectus* (Sharpe 1906) and general localities (presumably the then-known range of the species) that could be misinterpreted as actual collecting localities.

Henry Whitely Sr: dependably undependable

The material stemming from Henry Whitely Sr is rife with problems. His son is well known for his collections from Japan, Peru and British Guiana (Haverschmidt 1955), although these were largely dispersed through his father's natural history agency (Sharpe 1906). However, many anomalous locality records have come to light based on specimens dealt by the father. These include records that, if credible, would be the sole ones from the Nicobar Islands for three species, White-fronted Falconet *Microhierax latifrons*, Purple-naped Sunbird *Hypogramma hypogrammicum* and Orange-bellied Flowerpecker *Dicaeum trigonostigma* (and, indeed, the sole records from the entire Indian subcontinent for the first two). Despite Whitely's insistence that his two *M. latifrons* specimens really did originate from the Nicobars (Gurney 1881), it is wholly improbable that this narrowly endemic Bornean falconet would occur in an undifferentiated form there. Furthermore, there are numerous other singleton specimens from Whitely Sr with localities that would be remarkable if true. Some have, however, been accepted in the literature, such as the NHM specimen of Japanese Sparrowhawk *Accipiter gularis* supposedly from 'Mhow', central India (Mees 1985a), and the NHM specimen of White-fronted Scops Owl *Otus sagittatus* supposedly from Aceh, Sumatra (van Marle & Voous 1988).

Among the entries of the Rothschild Collection in the AMNH catalogues, the localities of Whitely specimens are often surrounded by quotation marks, indicating that others were suspicious of his often very general localities such as 'Java', 'Nepal', 'NW Australia', 'New Zealand', etc. Tristram's (1889) catalogue contains a listing of a Whitely specimen of Pied Lapwing *Hoploxypterus cayanus* (= *Vanellus cayanus*) from Chile, a country from which it is not genuinely known. A Whitely skin of Purple-bibbed Whitetip *Urosticte b. benjamini* from 'Rio Napo' is the 'wrong' race for the eastern side of the Andes (Zimmer 1951a), and the 'Tinta' locality of a Whitely specimen of Purple-collared Woodstar *Myrtis fanny* is anomalous (Zimmer 1953a). The sole basis for the inclusion of Lesser Swallow-tailed Swift *Panyptila cayennensis* in the Peruvian avifauna is a Whitely skin from 'Samiria' (Zimmer 1953b). Two Whitely *Terpsiphone* specimens labelled as from 'River Gambia' formed the only basis for a new species *T. erythroptera* (Sharpe 1879); however, the specimen was almost certainly a mislabelled Asian Paradise Flycatcher *T. paradisi* (Sclater 1930, Warren & Harrison 1971, F. Salomonsen in Traylor 1986). Numerous other similar problems with Whitely provenances continue to surface.

Not even Whitely specimens labelled 'British Guiana', where Whitely Jr collected extensively, are free of problems. The race *Iodopleura pipra leucopygia* of this otherwise Brazilian species, Buff-throated Purpletuft, was described (Salvin 1885) on the basis of Whitely skins labelled 'British Guiana', but it has never since been found there—unsurprisingly, since this is within the range of a congener (Snow

1982). Whitely Jr's Guianan collecting took place subsequent to the collecting of the *Iodopleura* specimens, which are in a trade skin style, so they seem to be mislabelled (Snow 1982). Furthermore, birds matching race *leucopygia* have since been observed in Brazil (Ridgely & Tudor 1994).

Even more significant is the case of the Scissor-tailed Hummingbird *Hylonympha macrocerca*, named from a specimen bought from Whitely Sr, who had 'received it in a collection of skins which had been formed in Brazil' (Gould 1873), apparently purchased at London Docks (Boucard 1892-1895). More specifically, Simon (1921) recorded that Whitely had given Gould the definite locality 'Matura district, Manawas, on the Bia River, north Brazil'. However, this spectacular species, imported in good numbers by dealers and with all specimens being in the 'Trinidad' style (see below), has never been found in Brazil. Instead, almost 75 years after its description, *H. macrocerca* was finally located in the montane zone of the Paria Peninsula, Venezuela (Phelps & Phelps 1948), to which it is now known to be endemic (see Collar *et al.* 1992).

Misattribution to commercial entrepôts

For many years, countless thousands of exotic bird specimens were collected by locals, who were mostly trained to prepare them for the insatiable European and North American millinery markets. These collectors typically produced specimens of a recognisable preparation style, such as 'Trinidad', 'Bahia', 'Rio' and 'Bombay', obviously named for the point of collection and shipping. Natural history dealers and scientists often scoured incoming shipments for unusual species. Most numerous was the 'Bogotá' make, which some have assumed to come from the environs of the city of Bogotá—as did Vaurie (1967) with a specimen of Blue-knobbed Curassow *Crax alberti* (Collar *et al.* 1992)—when in fact specimens were brought from all over the surrounding country, probably even outside the borders of present-day Colombia and from the far slopes of the Andes (Parkes 1969). Some alleged 'Bogotá' specimens must have come from even farther afield, such as Sickie-winged Nightjar *Eleothreptus anomalus* (Knox & Walters 1994). A great many 'Bogotá' specimens were hummingbirds, and some are still known only from such trade skins of uncertain provenance (Chapman 1917, Graves 1990, 1997). Similarly, trade skins from adjacent Ecuador were often labelled either 'Napo', meaning any elevation on the Amazonian side of the Andes, or 'Guala', meaning the equivalent on the Pacific side (Chapman 1926).

'Malacca' is a very common 'locality' for specimens from a long-standing trading mecca where skins were brought, probably from the entire western seaboard of the Malayan Peninsula (Gibson-Hill 1949) and even farther afield, but which matches a present-day provincial town. Medway & Wells (1976) rightly questioned distributional and migration conclusions based on 'Malacca' trade skins of Japanese Sparrowhawk *Accipiter gularis*, while Mees (1985a) defended the specimens as acceptable. Other trade-skin localities in the Malaysian region included Penang and Singapore (Gibson-Hill 1949). A subspecies of Common Scops Owl, *Otus scops*

obsti, was described from a skin labelled 'Java' (Eck 1973), but the type and only specimen, indistinguishable from dark Sulawesi Scops Owl *O. manadensis* of Sulawesi, bears only a dealer's label and seems most unlikely to represent a valid taxon (Rasmussen 1998, unpubl.). Another major trade point was the port of Manado, in northern Sulawesi. A specimen labelled 'Manado' was named *Rhipidura lenzi* Blasius 1883, but was soon shown to be from Ambon (Forbes 1884) and subsequently synonymised with the form *cinerea* of neighbouring Seram (Stresemann 1914, White & Bruce 1986).

The make of trade skins has sometimes allowed them to be 'identified' by experienced museum workers to a general region (e.g. 'Demerara', 'Bahia', 'Cayenne'), but usually without explanation of how they differ or the levels of certainty. For example, Zimmer (1950:30) stated without elaboration that a bird labelled 'Peru' is of undoubted 'Cayenne' make. Occasionally, specimens of genuine provenance may be taken for trade skins. The Moluccan Scops Owl *Otus magicus morotensis* is an example: numerous old specimens are labelled as being from Ternate, a Moluccan port with little forest, and the base of operations for the dealer Bruijn (Greenway 1973). The scops owls had been considered of doubtful provenance, but they form a series recognisably different from those of other islands (including Morotai, with which they are still combined racially), and a recently collected specimen confirms their Ternate provenance (PCR unpubl.).

Collections personnel and error

Assumption, accident and incompetence

Some treatments and interpretations by museum staff and ornithologists have inevitably resulted in confusion and mistakes with respect to specimen evidence. As noted earlier, we do not dwell here on misidentification of specimens, an inevitable part of curation, but there is clear thematic overlap here with the earlier discussion of data-poor specimens.

Because of problems with the localities of older specimens, these can sometimes be discredited prematurely when they do not seem to fit with current data. The type locality of the Brown Cacholote *Pseudoseisura lophotes* is 'Bolivia?', which subsequent authors presumed to be incorrect, although specimens are now known from the country (Parkes 1960). The type locality of *Formicivora deluzae*, a taxon of uncertain affinities to the White-fringed Antwren *F. grisea*, was judged doubtful because of other mistakes in Ménétries's paper; only later did it become evident that it may well be correct (Gonzaga & Pacheco 1990). Lack of records for a century after the collection of Flores Scops Owl *Otus alfredi* in western Flores led to the view that it was only the rufous morph of *O. magicus albiventris*, precipitating the removal of *alfredi* from lists of threatened species; but close re-examination of specimens vindicated the original data (Widodo *et al.* 1999). Information *in litt.* from O. Neumann led Peters (1945) to substitute the Sula Islands for Makassar, Sulawesi, as the type locality of the Ruddy Kingfisher *Halcyon coromanda rufa*, but

re-examination showed Neumann to have misinterpreted the evidence (Mees 1991). A specimen of White Bellbird *Procnias alba* collected by A. R. Wallace during his historic trip to Belem seemed so far out of range that the record was omitted by Snow (1973), but a population has now been discovered there (Roth *et al.* 1984, Oren & Novaes 1985).

Genuine localities written on labels may also misrepresent the circumstances of the provenance of specimens in other ways. A notable case is a specimen of Grey-faced Buzzard *Butastur indicus* from Sri Lanka, which would have been the first record for that country and the only specimen for the Indian subcontinent. Enquiries established that both the collector and the specific locality were known and presumably reliable, but the chance discovery of an old photo of a *Butastur* in falconer's jesses prompted re-examination of the specimen for signs of captive origin—and indeed it bears signs of having been kept both on a tether and in a pen (PCR unpubl. data).

Carelessness to the point of serious professional incompetence was shown by the taxonomist G. Mathews. He erected an amazing number of new taxa (most now in synonymy) on the most tenuous of grounds. For example, he obtained a number of birds from Gerrard, the London dealer, labelled from 'Mackay, Queensland', from which he described several subspecies, usually bestowing a variant of the locality name on them (Greenway 1973). In one case he later synonymised *Globicera pacifica queenslandica* with the nominate, listing the locality as 'error = Tonga Islands'. His *Ninox rufa queenslandica* remains unique to the area, and the locality has been doubted (Greenway 1978). Mathews named a new species of cuckoo *Cuculus waigouii* (now a synonym of migrant Oriental Cuckoo *C. saturatus*) from a specimen said to have been collected on Waigeu Island in February. He named many new procellariiform taxa, typically surmising on slender or no evidence the natal grounds of birds collected at sea. He named a 'NW Australia' Soft-plumaged Petrel *Pterodroma mollis* specimen (obtained as a duplicate from NHM) as a new species, then synonymised it with the assertion 'locality wrong', despite the fact that the species occurs widely as a vagrant (Greenway 1973). From a series of Lord Howe *Fregetta* he erected four new species, three of them from single specimens (Greenway 1973). Many of Mathews's specimens have no original label, so that their provenance cannot be independently evaluated (Greenway 1973). Indeed, Greenway (1973) was routinely unable even to endorse characters and measurements specifically mentioned by Mathews as applying to his type specimens.

Label substitution

Even the most scrupulous collectors could not guard against events that might befall their specimens in the hands of others. For many years it was standard practice for curators, among them some of the most respected names in ornithology—G. R. Gray at NHM (Sharpe 1906), O. Finsch at RMNH (Mees & Fisher 1986), R. Ridgway at USNM (Deignan 1961)—to discard original labels after copying the data they considered relevant onto labels of their own collection. These removals mean that it

is now impossible to verify spellings, handwriting or other details for affected specimens, or even to determine whether they ever bore original data. Thus Finsch's recopying and discarding of Layard's label on a Lifu Island Thrush *Turdus poliocephalus pritzbueri*, with an error of date, meant that the specimen was likely to have been erroneously considered a type, and indeed it was so labelled by Finsch (Mees & Fisher 1986).

Another case concerns von Rosenberg's Leiden specimens, whose original labels were removed by Finsch (Mees 1953). Von Rosenberg's travels are comparatively well documented (van Steenis 1950), and the dates of his specimens can be checked against his itinerary. However, his series of *Zosterops atrifrons* 'sharppei', supposedly from the Aru Islands (and the only material of this questionable race, described by Finsch), is identical with the nominate race of Black-crowned White-eye from northern Sulawesi (Mees 1953). Moreover, von Rosenberg supposedly—and uniquely—procured a specimen of the extremely restricted Pearl-bellied White-eye *Zosterops grayi* on the Aru Islands (Mees 1953); and he apparently took three Moluccan Scops Owls *Otus magicus* there too, a provenance accepted by most authors though they were suggested by White & Bruce (1986) to have come from the Kei Islands. In this last case, although *O. magicus* is well differentiated with recognisable forms on each island group, the lone adult of the three is indistinguishable from the nominate race of Seram and Ambon, and the juveniles unidentifiable (PCR unpubl. data). Given the considerable confusion between other of von Rosenberg's Aru and Kei specimens, e.g. Pied Imperial Pigeon *Ducula bicolor*, Orange-fronted Fruit Dove *Ptilinopus aurantiifrons*, Red Lory *Eos bornea* and Chestnut-breasted Cuckoo *Cuculus castaneiventris* (= *Cacomantis castaneiventris*) (Holyoak 1970, 1976, White & Bruce 1986), all these records are dubious. Indeed, the provenance of von Rosenberg's specimens had been doubted by Salvadori (1880-1882) well before Finsch's removal of the original labels around 1900, so they seem likely to have previously borne questionable data. Von Rosenberg employed local collectors, and at least sometimes sent them collecting while he himself was ill (van Steenis 1950); he collected in Sulawesi, the Arus and Keis on the same voyage, so the specimens could easily have become mixed, a scenario rendered all the more likely given his characterisation as an 'idler' (van Steenis 1950) and the description of his collection as being of little scientific worth (von Berlepsch 1913).

A similar case is that of the lone specimen of Ambon Yellow White-eye *Zosterops kuehni* from Seram, labelled as having been collected by Moens on the side of Seram farthest from Ambon, to which the white-eye is otherwise thought endemic. While several authors have thought it unlikely that Moens really obtained *Z. kuehni* on Seram, letters show he collected there, and it seems impossible to disprove a Seram origin (Mees 1981, R. W. R. J. Dekker *in litt.*). Often, however, reference to a collector's known itinerary can solve mysteries: by this means a published record of Bare-faced Curassow *Crax fasciolata* from Obidos (Pinto 1938), which seemed to indicate range overlap with Black Curassow *C. alector*, was shown to be an error caused by the loss of the original label (Pinto & de Camargo 1948).

Label-switching has been assumed in a number of cases, although it is usually difficult to prove (e.g. Watson 1969, Farkas 1979, Cardoso da Silva & Oren 1991). Compounding this, over the years labels occasionally fall off and are retied, inevitably sometimes to the wrong specimen, even of another species—e.g. a Siberian Crane *Grus leucogeranus* bearing also a White Wagtail *Motacilla alba dukhunensis* label (Knox & Walters 1994)—and many labels have been and continue to be irretrievably damaged, lost, or rendered illegible. A mysterious ‘species’ of rail (*Tricholimnas conditicius*), suggested to have originated either on the Gilbert or Marshall Islands (Peters & Griscom 1928, Walters 1987), has been shown most likely to have been erroneously associated with a label that led to those conclusions, but in fact to be a synonym of the Lord Howe Wood Rail *Tricholimnas silvestris* (Olson 1992).

A typical loss on recopied labels was the frequent omission of the collector’s own numbering system. However, collectors’ numbers, often involving a simple sequence related to date of collection, can provide critical evidence as to provenance of a specimen. LeCroy & Peckover (1998) showed, through archival research and reference to the original collector’s still-present number, that a subset of a substantial series of specimens taken by A. S. Meek on ‘Misima Island’ off Papua New Guinea had actually been collected from neighbouring islands during the main Misima collecting trip.

The simple fact that a specimen does not now bear confirmatory data does not mean that such data never existed. White (1975) stated that W. Rothschild assigned localities to dataless cassowaries based on preconceptions over the distribution of their phenotypes. It is true that Rothschild ventured to describe a market-bought specimen of Grey-headed Albatross *Diomedea chrysostoma* as a new race he presumed to be from Campbell Island (Hartert 1926). However, White did not present sufficient evidence to support his contention, and Rothschild, who was normally reasonably careful with localities, may well have had correspondence and other information that led him to reasoned assessments, if not watertight facts; unfortunately, many of his potentially corroborating papers were destroyed following an ill-taken official decision (M. Rothschild 1983).

Various users and error

Problems in transliteration, translation, interpretation and reading

Misreading and misinterpretation of label data occur frequently, and have accounted for a great deal of error: ‘Iris Brown’ has been catalogued as a collector (D. E. Willard *per* N. J. Collar verbally), and ‘Mr Fernando Poo’ as a donor (F. E. Warr verbally); ‘Mr. Kaitsumwic’, a supposed collector of *Podiceps ruficollis japonicus*, proved to be a mutilation of the Japanese name for ‘grebe’ (Greenway 1973); ‘Vorondolo’ is a traceable locality in the eastern rainforest of Madagascar from which a specimen of the Malagasy Scops-owl *Otus rutilus* so labelled may plausibly have come, but is also one of several Malagasy names for owl (PCR unpubl.); and ‘Kinkimauro’ was published as a locality for Pollen’s Vanga *Xenopirostris polleni*

(Sharpe 1872) when again it is the local name of the species (Collar & Stuart 1985:430). Pollen's Vanga was also the victim of an error over the type locality by Hartlaub (1877), who published it as north-east Madagascar, evidently because he assumed 'N.O. Madagascar' on the labels of the type series to indicate 'nord-öst' (German north-east) rather than 'nord-ouest' (French north-west) (Collar & Stuart 1985:430). Certainly, foreign-language labels are particularly prone to misinterpretation: Banko (1979) apparently mistook the notation 'Erh[alten] von Chili' ('taken in Chile') for a collector's name (Olson 1989), and 'Enero' (=January) has been used as a locality (S. L. Olson verbally).

A locality written on an Abyssinian Thrush (subsumed into Olive Thrush) *Turdus abyssinicus* label as Entebbe, Uganda, actually refers to N'dabibi (Cunningham-van Someren & Schifter 1981). This mix-up may have been due to poor handwriting, hearing, and/or transcription. The first category is the easiest to document: the untraceable 'Muguazi River' as the type locality of Black-cheeked Lovebird *Agapornis nigrigenis* has been shown to be the Ngwezi River (Dowsett 1972a); the locality 'Sandag, Sarigas' (Seth-Smith 1910) for Philippine Eagle *Pithecophaga jefferyi* is in reality 'Tandag, Surigao' (Collar 2001:672); and, most strikingly, J. Natterer's locality 'Tacuczar' is, *vide* Vanzolini (1992), 'Itacuruca'.

In the field in Myanmar in 1985, PCR's enquiries as to the place name at which the team was collecting resulted in helpful replies, dutifully copied down—one of which turned out to mean 'little stream'. According to J. P. Angle (verbally), D. S. Rabor sometimes took students collecting with him in the Philippines, but some 'localities' written on the labels appeared to be students' home addresses.

Units of measurement

One of the most obvious and yet pervasive problems involving collection dates is the dichotomy between British and American styles of writing dates on labels. One of the seven specimens of Forest Owlet *Heteroglaux blewitti*, that accessioned to MCZ, had the (British) collection date ('5/12', hence 5 December) interpreted in the American fashion (hence 12 May) on the MCZ label (Rasmussen & Collar 1999a:12). In this particular case the species seems to be resident, and so the seven-month disparity matters mainly in study of the plumage cycle, but for many other species such an error would place them far from their normal haunts for that time of year. One specimen in NHM, a House Wren *Troglodytes aedon guadeloupensis*, now bears three label dates (Knox & Walters 1994), evidently at least in part owing to the use of roman numerals for months (II = 2 but easily read as 11).

Numerous specimens lack collection dates on the labels, but may have a date of acquisition by a dealer or accession by a museum that is not stated as such, e.g. a Snail-eating Coua *Coua delalandei* bearing the date 1837, which is the date of its receipt in Stuttgart (Benson & Schüz 1971). Darwin's bird specimens collected during the voyage of the Beagle had labels inscribed "Jan 4th 1837" added to mark the date they were accessed by the Zoological Society, not the date of collection (Sulloway 1982a,b).

Another persistent problem is that of distances, whether kilometres vs miles, metres vs feet, or millimetres vs inches. It has often been taken for granted by collectors that their units would be understood, which has of course not always been true. Several standards of measurement existed within Europe in the past, and are briefly discussed by Zimmer (1947).

Mis-sexing and ageing

Assumptions are often made about sex and age in birds, but museum specimen data cannot be taken as definitive without detailed corroboration. For many older specimens, it may be that the collector did not actually view the gonads when determining the sex. Some collectors operated in an assembly-line fashion, and are reputed to have crossed the legs one way to indicate one sex, and vice versa, a system that cannot fail to produce the occasional error. Early collectors often used an upside-down female symbol to indicate male (Clench 1976, Parkes 1989), which is open to misinterpretation by modern researchers. Collectors whose specimens are *always* sexed can be assumed to have been less careful than they might, as a certain proportion of specimens, especially when shot, will not be confidently sexable. Breeding-condition individuals of most species (a few exceptions are noted below) would rarely be mis-sexed when the gonads are examined, but juveniles and non-breeding birds are subject to unknown and variable, but presumably often significant, rates of mis-sexing. Users of specimens need to consider the field conditions that influence accuracy of sexing, such as poor lighting; exhaustion, illness, and/or training of the preparator; and development or deterioration of the specimen's gonads.

Statements made about sexual dimorphism based on circuitous reasoning led to the belief that the presumed taxon *Psittacula 'intermedia'*, alone among its congeners, had reversed sexual dimorphism (Sane *et al.* 1987). This helped obscure the hybrid origin of '*intermedia*' (Rasmussen & Collar 1999b). Mis-sexing and/or incorrect ageing is also held responsible for some of the apparently distinctive characters of the Moustached Kingfisher race *Halcyon bougainvillei excelsa* (du Pont & Niles 1980).

A few groups of birds have atypical gonads, such as female accipiters, which have two readily visible ovaries, and *Centropus* species in which the males have only one large testis. Members of these groups are obviously more likely to be mis-sexed than those with conventional gonads. Knox & Walters (1992) documented mis-sexing in nearly 15% of Eurasian Sparrowhawk *Accipiter nisus* skeletons checked in the NHM, a surprising percentage given the gender-specific plumage and size of this species; Storer (1989) obtained similar results for skins of the highly size-dimorphic Brown Trembler *Cinlocerthia ruficauda*. RPP-J's own first venture into the NHM collections was prompted by a contradiction between Witherby *et al.* (1943) and Svensson (1970), who respectively maintain that there is complete overlap and no overlap in the wing lengths of male and female Corn Buntings *Emberiza calandra*, a species that shows no sexual plumage difference. Scrutiny of over 40 NHM specimens that would have been available to Witherby *et al.* suggested that nearly

20%, all taken outside the breeding season, had been mis-sexed, obscuring an almost complete sexual size difference (Prŷs-Jones 1976).

Even in species that are strongly sexually dimorphic from their first contour plumage, e.g. Rufous-bellied Niltava *Niltava sundara* (Dickinson 1972), the incidence of apparent mis-sexing may be high. All the specimens of Greenish Puffleg *Haplophaedia aureliae* collected by Goodfellow and Hamilton were shown to have been mis-sexed (Zimmer 1951b:35), suggesting they relied upon the plumage of this drab hummingbird for gender determination. Some scrupulous nineteenth-century collectors (e.g. A. Everett) as a matter of course wrote 'nat. coll.' or its equivalent on the labels of specimens sexed by their assistants and which they had been unable personally to verify.

Ageing of specimens can be notoriously problematic, and many taxonomic blunders have resulted from misinterpretation of specimen ages, e.g. 'Berlioz's Sunbird' *Anthreptes pujoli* is actually a juvenile Green Sunbird *Anthreptes rectirostris* (Erard 1979). The new genus and species *Antiornis grahami* Riley 1926 was described from a series of juvenile specimens which Parker (1964) and Watson (1986) considered to be Aberrant Bush Warblers *Cettia flavolivacea*, but which are actually Brownish-flanked Bush Warblers *C. fortipes* (Rasmussen & Anderton, in press). Even the routinely used notation of cranial ossification has its limitations, as the extent of cranial pneumatization in full adults of many species is not known with certainty; for example, in *Pipromorpha* only a small part of the cranium appears to ossify (Mees 1985b), and incomplete ossification in adults has also been noted for numerous other species (Winkler 1979).

Fraud

There are a few cases within ornithology that seem to amount to major specimen fraud, but it is often difficult to be certain whether the perpetrators realised the consequences of their actions. Thus it is unclear exactly in what category some of the examples below belong.

The classic case of apparent fraud, less for its intrinsic importance than the wider publicity it received, was the 'Hastings Rarities' (Nelder 1962, Nicholson & Ferguson-Lees 1962, 1971, Harrison 1968, 1971), in which records of birds rare to Britain purported to have been collected mostly by anonymous locals within a 20-mile radius of Hastings were traced to the dealer and taxidermist G. Bristow, who was suspected of having had them brought over from the Continent under refrigeration (Nicholson & Ferguson-Lees 1962). Consequently, in 1962, six species and some 600 (mostly specimen) records of rarities, made in the Hastings area between 1892 and 1930, were removed from the British list, based on the statistical improbability of so many unusual records clustering in so small an area, plus the fact that the great majority had links to Bristow. Bristow had claimed that he had encouraged local people to shoot specimens for him, whether they were common or not; that the sheer numbers of specimens sold to him resulted in the large number of rarities over the

years; and that anonymity was necessary to protect his sources from competitors and prosecution. If we accept that the Hastings Rarities are indeed fraudulent, the reason must presumably have been monetary gain, which is probably true of most situations in which deliberate specimen fraud has been perpetrated.

Much collecting in earlier days was conducted as a commercial enterprise in which the value of specimens was directly linked to their scarcity, either in total or from a particular area. J. H. Batty, working on islands off the west coast of Panama, duped his employer Rothschild by adding mainland (including highland) birds to island collections, and although Hartert caught on at least once, Eisenmann (1950) did not, and reported on Batty's 'surprising number of what have generally been regarded as exclusively mountain birds'. Wetmore (1957) puzzled over discrepancies relating to some of the specimens Batty had collected on the large island of Coiba in 1901 and assumed a specimen mix-up, but Olson (1997) recently concluded that Batty's entire supposed collection from the smaller islands in 1902, including such astonishing records as male Ruby-throated Hummingbirds *Archilochus colubris* with nests, is fraudulent and, indeed, that Batty probably never even visited these islands in 1902.

A collector working in Venezuela for W. Rothschild, A. Mocquerys, was long suspected by Hellmayr and others of having provided unreliable localities for a rather long list of species (Zimmer & Phelps 1954). These authors concluded that Mocquerys's lack of success on a Caripe trip led him to augment it with specimens from Puerto Cabello, where operations were cheaper and easier, a conclusion supported both by Mocquerys's written complaints to Rothschild and by irregularities in field numbers in his 'Caripe' series (Zimmer & Phelps 1954).

Among the most prolific of all collecting teams in the Neotropics, the Olalla family had already been collecting birds professionally when contracted by Chapman. Their collections are of extreme importance for understanding avian distribution within South America. Usually their labelling seems reliable, apart from being ambiguous over which side of a river material was from, and the occasional lapse, e.g. their taking of five specimens of Sharpbill *Oxyruncus cristatus* on a single day at a lowland site from which it was previously unknown, was assumed to reflect failure to label specimens accumulated earlier upstream (Mees 1974). However, Vaurie (1965) rejected A. M. Olalla's specimens of Little Chachalaca *Ortalis motmot ruficeps* supposedly collected within the exclusive range of the nominate race, adding that other naturalists have queried the authenticity of some Olalla material. Moreover, a small proportion of Olalla specimens appear actually to have been fraudulently labelled during a dispute; these include specimens sold to H. Bassler and now at AMNH (J. Haffer verbally).

Egg collections present special problems owing to the difficulty or impossibility of certain identification. In particular, it should be mentioned that the largest collection of Indian bird eggs ever assembled, that of E. C. S. Baker, which serves as the basis for much of our presumed knowledge of the eggs and nesting habits of Indian birds, is seriously flawed. Even discounting the difficulties of identification and the

problems involved with employing native collectors, serious charges of the 'making up' of clutches in Baker's collection have been levelled (Harrison 1966, Harrison & Parker 1966, 1967a,b). Egg collections also have been subject to massive theft by enthusiasts (e.g. stolen eggs of numerous rare species: Knox & Walters 1992, 1994). In the case of the Bald Eagle *Haliaeetus leucocephalus*, eggs with false registration numbers had been substituted for the stolen ones (Knox & Walters 1994). One documented case of specimen fraud is a painted Mute Swan *Cygnus olor* egg now in the NHM that was passed off by a dealer as a genuine Great Auk *Pinguinus impennis* egg (Tomkinson & Tomkinson 1966).

Meinertzhagen

The fraudulent collecting activities of one person, Richard Meinertzhagen, form a subject apart both in scale and, probably, motivation. His case also reveals how slow and difficult the path may be from well-founded suspicion to a reasonable level of proof and how, in the intervening period, most researchers using a collection may remain entirely ignorant of the doubts surrounding the data accompanying it, with negative effects on ornithology. However, on the positive side, the case has also proved to be one in which detailed research is allowing original data to be restored to specimens with a high degree of probability, and which has even led, indirectly, to the rediscovery of a supposedly extinct species (King & Rasmussen 1998). In our discussion here we draw on various sources for general background information, notably Cocker (1989) and Rasmussen & Prŷs-Jones (unpubl.).

The collection Meinertzhagen presented to The Natural History Museum (NHM) before his death in 1967 amounts to nearly 20,000 specimens, with appreciable additional numbers of specimens held in other museums. In the Meinertzhagen Collection are numerous important distributional records. Although born in 1878, Meinertzhagen's first significant publication dates from as late as 1912, on the birds of Mauritius, where he had spent about a year in 1910–1911; the paper contains almost no mention of specimen collecting. By 1919, however, Meinertzhagen had already been excluded from the NHM Bird Room for 18 months for unauthorised removal of specimens, and museum documents spanning the next 30 years contain numerous references to suspicions by staff that he was stealing both specimen and library material; twice these reached the verge of prosecution. Although nothing was made public, clearly at least some senior ornithologists knew that something was amiss. Around 1940, correspondence between H. Whistler and C. B. Ticehurst makes explicit reference to Meinertzhagen's theft of NHM specimens. However, no mention of this reached the published literature until 17 years after Meinertzhagen's death, when Clancey (1984a), who had developed a deep antipathy to Meinertzhagen, drew attention to the flawed nature of his collections. The accusation of fraud was made explicit in a review of Meinertzhagen's redpoll specimens, based on assessment of preparation style and material used (Knox 1993). While compelling, the implications of this paper were so enormous that independent corroboration and further investigations were clearly demanded.

In the case of the redpolls, further research making use of x-rays (radiographs) has largely confirmed Knox's conclusions, although occasionally it has shown up limitations in what is discernible by external examination alone (RPP-J unpubl.). While it cannot be claimed that x-rays can prove who collected a specimen, the x-ray specimen signature of many major collectors is extremely distinctive. In many cases, not only can the fraudulence of a specimen be shown beyond reasonable doubt, but the original data can also be returned to a specimen with a high degree of confidence through the location of gaps in matching specimen series that were recorded in the NHM specimen registers.

In order to judge the scope of the problem, we have examined a large number of Asian bird specimens in the Meinertzhagen collection, in particular focusing on key cases such as at least 14 species and distinctive subspecies on the Indian subcontinent list based entirely on his records. We have found that the scope of the problem is far greater than that so far published by Rasmussen & Collar (1999a); a comprehensive analysis, on which we draw here for examples, is in preparation (Rasmussen & Prÿs-Jones unpubl.).

Meinertzhagen had a seemingly miraculous ability to stop very briefly somewhere but nevertheless collect important material. When his ship unexpectedly docked in February 1901 at Port Blair, Andamans, en route to Burma, he claimed he rushed off to collect birds behind the town. However, of his good Andaman series, all supposedly taken by him during this brief time, we have yet to find any specimens that appear to be genuinely his. For example, his single Andaman Treepie *Dendrocitta bayleyi* matches in every detail, both externally and internally, two specimens collected there by William Davison in 1872, including having an unusual neck support in lieu of a stick, and a distinctive under-the-wing incision, just like that of Davison's specimens. The NHM registers show that a third Davison specimen, collected in the same week as the other two, is now missing.

Similarly, Meinertzhagen's ship stopped briefly in the Seychelles in June 1910 and his collection now holds two specimens of the extremely rare Seychelles Paradise Flycatcher *Terpsiphone corvina*, both with the locality given as just 'Seychelles'. These have the same make and materials as an NHM Nicoll specimen taken on Praslin, Seychelles, in 1906. The NHM register reveals that three adult males collected by Nicoll were accessioned, but only one (with detailed data) is now present in the collection. The other two Nicoll specimens, which probably also once had full data, had been earlier and independently noted as missing by Benson (1971). Moreover, Meinertzhagen's ship docked at Mahé, where the paradise flycatcher does not occur, and according to his diary and itinerary it was present too briefly for Meinertzhagen to have visited the islands the species did inhabit.

Many of Meinertzhagen's frauds have potentially important zoogeographic implications. Among his substantial collection supposedly made in Burma in 1902 are two specimens of the scarce and little-known Blyth's Kingfisher *Alcedo hercules* prepared in dissimilar styles. One of these is very similar in style to an 1899 Whitehead specimen from Hainan, China; the NHM register shows that two such Whitehead

specimens were originally present, but only one now is. The other specimen matches no NHM specimens, but closely matches a series of three taken on Hainan by Owston's collectors in 1905–1906 and now in the Rothschild Collection at AMNH; according to Hartert's (1910) paper on Owston's collection, this originally held four specimens. Thus both Meinertzhagen's 'Burma' specimens are evidently from Hainan, some 1,500 km to the east of the purported locality, and with considerable potential to obfuscate knowledge of geographic variation in a scarce species represented by relatively few specimens.

Occasionally, and notoriously in the case of the exceptionally rare Forest Owlet *Heteroglaux blewitti* (Rasmussen & Collar 1999a), Meinertzhagen had extensively remade an existing specimen in a manner which served to disguise its true origin until detailed examination, including forensic tests, was made. This particular case had a doubly positive outcome, as not only was the specimen—one of only seven of the species in existence—identified as a J. Davidson specimen stolen from the NHM and finally reunited with its original data, but the investigation led directly to the rediscovery of the Forest Owlet 113 years after the last reliable record.

Most Meinertzhagen specimens have basic locality, date and sex data, but some labels contain additional information. For example, a skin of Gould's Shortwing *Brachypteryx stellata* that is almost certainly a stolen Mandelli specimen now has soft-part colour and stomach contents annotated on the label, even though of the thousands of Mandelli's native-collected specimens we have seen none that bears any such data, indicating these must have been guessed at by Meinertzhagen. Similarly, a Black-billed Magpie *Pica pica bottanensis*, supposedly collected by Meinertzhagen 'on a yak!' in 1925 along the Sikkim–Tibet border, closely resembles a Mandelli specimen from Tibet in make-up and structure, to the extent that both are (most unusually) stuffed with moss easily visible in the unsewn belly incisions. In addition, in his own account of his Sikkim expedition, published within two years of his expedition, Meinertzhagen (1927) specifically noted that 'No magpie was met with in northern Sikkim', so he evidently forgot he had written this when relabelling the specimen, presumably some time later.

In addition to the many spurious distributional records published by Meinertzhagen himself on the basis of his mislabelled specimens, others have been published in good faith by other workers, among them Pallas's Bunting *Emberiza pallasi* as new for Burma (Colston 1978), Savi's Warbler *Locustella luscinioides* as new for Arabia (Colston & Holyoak 1970), and a range extension for Mottled Spinetail *Telecanthura ussheri benguellensis* (Benson & Winterbottom 1977). A Meinertzhagen Half-collared Kingfisher *Alcedo semitorquata* was considered probably mislabelled, as the locality he gave would have been a swamp instead of the species's normal clear riverine habitat (Clancey 1984b). Meinertzhagen (1930) reported that Sooty Falcon *Falco concolor* bred regularly at Mombasa Fort, but this casual, unconfirmed record is so greatly at odds with the observations of others that it was not usually accepted (Moreau 1969) even before the exposition of Meinertzhagen's frauds.

Despite all these problems and many more, it is clear that much of Meinertzhagen's collection comprises important specimens bearing genuine data. In particular, either the preparation style of someone who is known to have accompanied Meinertzhagen on a particular trip, or the presence of that collector's handwriting on a label, point to a given specimen being genuine. A case in point is Meinertzhagen's unique South Yemen specimen of Northern Bald Ibis *Geronticus eremita*. We know that P. A. Clancey was on this 1948 trip, and the specimen was prepared in his style and with his unmistakable handwriting on the label, so it is difficult to imagine how this specimen could be other than genuine. Further important specimens from the Meinertzhagen Collection that we are confident are genuine include his type series of Afghan Snowfinch *Montifringilla theresae*. He discovered this species in 1937; the series has all the hallmarks of authenticity, and no other source existed for them. Similarly, our initial suspicions about his two Hume's Owl *Strix butleri* specimens (considered among the highlights of his collection) were allayed by the fact that both still bear their original labels with full data, and Meinertzhagen had not claimed to have collected them himself.

Other indications (to be used advisedly!) that a series purported to be from a given trip in the Meinertzhagen collection may be genuine include: presence of some females and immatures; some specimens being in imperfect plumage; uniformity of preparation style; seasonally appropriate moult condition and soft-part colours; and a lack of reworking of the specimen. In fraudulent material the latter is often evident as a loosely restitched abdominal incision with double thread, fresh clean cotton in belly and eyes, and legs that were crossed well after drying, often breaking delicate bones and twisting the dried skin.

Given that the Meinertzhagen Collection contains material of great importance, and that the original data from fraudulent specimens can often, with some research, be repatriated with high confidence, we disagree with a former NHM curator with first-hand experience of Meinertzhagen, who stated that the entire collection should be destroyed. Without the specimen evidence, suspicion regarding Meinertzhagen's records might never have been made public. Moreover, there would certainly have been no way, many years later, to establish which records are genuine and which fraudulent, and to restore the correct data to at least some of the latter.

Conclusions

We do not wish to leave the reader with the impression that specimen data are unreliable. On the contrary—the vast majority of specimens provide the most reliable source of baseline data available in ornithology. However, specimen evidence must be assessed probabilistically. The user needs to be aware of the exceptions and to be informed as to how to evaluate individual problem cases. It is not sufficient simply to throw out specimen data as unreliable because they do not fit one's hypotheses or the published record. Corroborative evidence should be sought, and there are many ways to seek it. In any particular case the reliability of associated data can often be tested in various ways.

The specimens that exist now in museums are largely irreplaceable. Many of them have been mistreated in various ways, usually by well-meaning collectors, dealers, curators and users. Those who are responsible for the care of specimens and who may consider certain material worthless, for example if data are lacking, should reconsider this stance in the light of the potential for data recovery using combinations of historical reconstruction and modern analytical techniques. A dataless specimen may turn out to be something as valuable as the unique type of the Mysterious Starling *Aplonis mavornata* (Olson 1986), even if it takes 160 years for someone to recognise the fact.

Acknowledgements

We thank J. P. Angle, N. J. Collar, J. Haffer, S. L. Olson, A. T. Peterson and M. P. Walters for providing information and anecdotes included in the present paper. N. J. Collar spent several days helping with the ordering and editing of the typescript.

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Rasmussen, Pamela C and Prys-Jones, Robert. 2003. "History vs mystery: The reliability of museum specimen data." *Bulletin of the British Ornithologists' Club* 123A, 66–94.

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