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Introduction

This book is about the study of bird remains from archaeological sites: how to study them and what information they provide about human prehistory and early history. Today we eat chicken and eggs in quantities which would have astonished the first people to domesticate the chicken in China or the Indian subcontinent, and we use feathers for pillows and occasionally for decoration. Otherwise, birds impinge little on modern life, though they have come back into prominence for their association with diseases which can be transmitted to humans, especially avian flu, and for the role they play as markers of environmental and climate change.

People were much more interested in birds in the past for non-material as well as material reasons. People admired and read significance into their flight, their colour, and their song. In flying, they could carry messages and even the human spirit to the heavens. Birds, like people, have excellent vision, which includes the ability to see in colour and in three dimensions. They seem to be communicating to us with their song or voice: indeed, parrots, ravens, and crows do communicate with us. Like humans, birds have a relatively poor sense of smell and, except for a few nocturnal species, limited hearing. This is unlike other mammals, most of which depend on a sense of smell and hearing and see only in black and white. The balance in the senses is much closer to that of humans (Morales 1993b), and it must be part of the reason why humans feel an affinity with birds. It certainly helps to explain why so many people in advanced industrial societies become birdwatchers (Barnes 2005).

In the past, both hunters and farmers were surely aware of the seasonal changes in the range of birds around them, even if they could not explain them. They must have watched and listened each year for the arrival of seasonal migrants such as cuckoos and cranes. Even the Palaeolithic hunters who shared a cave with nesting swallows and martins must have watched for their arrival as a sign of spring and their departure as a sign of approaching winter (Eastham 1997). In the days before compasses, mariners depended on birds for navigation: the flight patterns of seabirds

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returning to land in the evening were used by the Polynesian colonists in the Pacific, the Vikings, and even by Columbus (Hornell 1946). The calls of certain birds alerted the hunter to the presence of game (Driver 1999).

The domestication of birds was later than that of mammals – at least as far as we know, because the antiquity of the domestication of chickens and ducks is still uncertain. Several species seem to have been domesticated because the bird or its feathers played a part in religious or ritual activities; other birds such as the sacred ibis and the scarlet macaw were kept in captivity in the prehistoric past in surprisingly large numbers for the same reason. Birds play a part in myths and legends out of all proportion to the numbers in which their remains are found. In the context of medicine bundles of the Plains Indians (see Chapter 14), Ubelekar and Wedel (1975) wrote 'The ethnographic specimens are believed to identify the archaeological remains as to function; conversely, the archaeological materials add important time perspectives to native use of the ritual items in museum collections and in the documentary record'.

We are acutely aware today of how bird distributions are influenced by changes in the environment and by climate change. Remains from archaeological sites provide evidence for the major distribution changes which took place at the end of the last Ice Age. Butchered bones provide poignant evidence of how human colonisation of new areas brought about the extinction of species such as the moa in New Zealand and the great auk in the North Atlantic.

AIMS AND SCOPE

The first part of this book is concerned with methods of studying skeletal remains: anatomy, biology, ageing, sexing, pathology, quantification, and natural and human modifications. It is not an identification manual, though it does include protocols for setting about bird bone identification in Chapter 4. In the context of taphonomy I shall discuss some problems peculiar to birds, but I do not rehearse the taphonomic problems common to bone in general, as these have been fully explored in earlier volumes in this series (Lyman 1994; Reitz & Wing 1999). The central section of the book discusses eggs and eggshell, feathers and skins, and bird bone tools and ornaments, all subjects on which research has been relatively limited, despite the fact that bird bone flutes or pipes were probably the earliest musical instruments used, going back to the evolution of human culture in the Palaeolithic period. The last section of the book is concerned with the nature of the interactions between people and birds: hunting wild bird for food, the process and history of the domestication

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of birds, species kept for sport and pleasure, and those whose roles in the human past were symbolic rather than material. The discussion throughout focuses sharply on human actions as revealed by bird remains; accounts of bird bone assemblages where human activity is incidental are mainly found in Chapter 15, which is concerned with the environment and on birds themselves in the past. The case studies discussed come from all over the world. While most are from the Americas, Europe, and Oceania, some examples are included from Western and Eastern Asia and also Africa. The species differ, but people often chose birds of the same families for food, feathers, or as ritual offerings.

The study of bird remains in archaeology combines avian osteology with ornithology, economic and social history, and anthropology. The raw material is not only skeletal remains but also includes gizzard stones, feathers, eggshell, and even excrement. Historical records, illustrations, and archaeological material such as dovecots (Chapter 12) and hawking gear (Chapter 13) are also relevant. In the absence of archaeological material from the early millennia, ancient records and depictions are particularly useful for understanding the history of domestic birds in both the Old and New World. Following Clark (1948, 1952), I shall show how ethnographic analogy is invaluable for interpreting wildfowling; ethnography and ancient history are also important for discerning the ritual and symbolic significance of birds in the past.

ZOOARCHAEOLOGY OR PALAEONTOLOGY

The science of the analysis of bird bones from archaeological sites has no name which is universally recognized. 'Avian palaeontology', as Morales (1993b) has pointed out, focuses on the birds themselves, while this book is concerned with the relationships between humans and birds in the past. By analogy with 'palaeoethnobotany', we might coin a new term, 'palaeoethno-ornithology', but that is cumbersome and has never been used. Morales used the term 'archaeornithology', literally, the science of ancient birds, but this suggests the study of birds in their relations to humans, rather than vice versa. 'Ornithoarchaeology', literally the archaeology of birds, is more exact and closer to the focus of this book, but in fact I have chosen to refer to avian zooarchaeology or the zooarchaeology of birds, which emphasises that the book is about birds in contexts connected with human activities in the past.

There is a distinction between the palaeontologist and the zooarchaeologist with a research interest in ancient bird bones. Even though in practice these are sometimes one and the same individual, the goal of palaeontological research, discussed in

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Chapter 15, is knowledge of the distribution and behaviour of avian species and climatic fluctuations in the past, while the aim of zooarchaeological research is to understand past human activities. As discussed in Chapter 4, this is even reflected in the approaches to the identification of archaeological bird remains. However, regardless of the research goal, both disciplines rely equally on knowledge of avian biology, behaviour, and taxonomy.

TAXONOMY AND CLASSIFICATION

Birds evolved from therapod dinosaurs in the Late Cretaceous era (Feduccia 1999) and are distinguished from other vertebrates by the presence of feathers. As all birds evolved from flying ancestors, they retain the pattern of wings and legs even when they have lost the capability for flight. At one time, most speciation was thought to have taken place in the Pleistocene era as glaciers came and went, but recent molecular studies suggest that lineages go back to the Pliocene, and that the Pleistocene merely accelerated trends which started earlier (Blondel & Mourer-Chauviré 1998). Birds belong to the phylum Cordata, the subphylum Vertebrata, and the class Aves. Within the Aves class, they are classified into orders, families, and genera. There are about 30 orders of birds, about 180 families, and about 2,000 genera (Hoyo et al. 1992; Dickinson 2003).

The Linnean classification established in the nineteenth century was based on morphology; it underwent minor changes, but it remained basically the same until the 1980s when cladistics and DNA analysis indicated some drastic changes in the accepted relationships between families (Monroe & Sibley 1997; Cracraft et al. 2003). Most of the research discussed here was reported in terms of the old taxonomy (e.g., Snow & Perrins 1998), but the revised taxonomy (Appendix 3) is increasingly being used.

It is worth bearing in mind, however, that the prehistoric and early historic peoples with whom we are concerned here classified birds in ways other than the Linnean system. The birds in North America were given names by the colonists with little regard for scientific equivalence. For example, the North American robin is a thrush that is different in size and habits from the European robin, with which it shares only a reddish breast. Gould (1980) has investigated the extent to which folk taxonomies and scientific taxonomy agree in New Guinea and Mexico: he found that there was a high correspondence at the species level, though some problems arose at the higher level. Against this, the various members of the thrush family (Turdidae) were not distinguished in England until the seventeenth century (Fisher 1966, 300–338). The bird depicted on the wall of the Palaeolithic cave of Grotte Cosquer has been

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claimed as a great auk but it could be a razorbill, and Palaeolithic food-gatherers may even not have distinguished the two (Eastham & Eastham 1995). To understand former distributions it is important to know which species of cormorants (Phalacrocoracidae) were present in Patagonia in prehistoric times (Causey & Lefèvre 2007), but it probably did not matter to the people who ate them. In the Western Isles of Scotland the people, who used to eat them until 60 years ago, said of the two species found there, the great cormorant and the shag, 'we juist call them all cormorants'.

HISTORY OF THE STUDY OF BIRD REMAINS

Avian anatomy has been the subject of study from the eighteenth century onwards by naturalists such as Brisson in France, but it was only in the mid-nineteenth century that scientists turned their attention to the whole skeleton rather than just the beak, claws, and skins. At that time, any work on archaeological as well as natural fossil bird bone assemblages was carried out by avian palaeontologists such as Alphonse Milne-Edwards in Paris and Richard Owen at the Natural History Museum (Olson 2003). Their primary interests were the evolution, distribution, and extinction of birds. When Owen was sent some limb bones of the extinct moa from New Zealand (Figure 1.1), he was certainly more interested in the birds themselves than the colonists from Polynesia who had killed them off. Darwin (1868) studied the origin and development of domestic chickens and pigeons by using contemporary comparative skeletons but was not concerned with ancient skeletal material, which is not surprising since very little was available at the time. However, it is notable that, of the palaeontologists working on fossil material, Milne-Edwards (1875) did observe and comment on cut marks on the bones of the avifauna from French cave sites, recognising that some were present in the caves because early humans had carried them there.

It was only in the twentieth century that bird bones began to be used to answer archaeological questions. In the 1920s Hildegard Howard, after working on the Rancho La Brea avifauna, which was uninfluenced by human intervention, went on to study the bird remains from the Emeryville shellmound on the shores of San Francisco Bay. In her book, she pointed out the significance of the remains for understanding the season during which the site was occupied (Howard 1929), a subject of continued interest in the archaeology of hunter-gatherers, as we see in Chapter 10. This publication also fixed the terminology for the skeletal elements for bird bone research in North America.

Graham Clark (1948, 1952) was the first archaeologist to summarise what was known about prehistoric relationships of people and birds in Europe. He drew on the

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FIGURE 1.1. Tarsometatarsi of various species of moa, Dinornithiformes, sent from New Zealand to Richard Owen at the Natural History Museum, London, in the 1840s (from Owen 1879, pl. 27).

many classic nineteenth-century ethnographic and historic accounts of wildfowling to interpret the significance of bird remains for human prehistory. A comprehensive worldwide survey published ten years later includes references to only about 200 publications on bird remains from archaeological sites (Dawson 1969). That figure today has expanded tremendously.

One of the most important developments since the 1960s has been the creation of skeleton reference collections in institutions other than natural history museums. This gave a strong impetus to the study of bird remains in archaeology in Germany, with the methodological and zooarchaeological research carried out in Munich by Boessneck and von den Driesch. In England, the first substantial collection outside a museum was created by Jennie Coy at the University of Southampton. The subject came of age in the early 1990s with the recognition that a forum was needed for those concerned with archaeological as well as palaeontological reconstruction. The Bird Working Group of the International Council for Archaeozoology was founded

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in Madrid in 1991. It has now met five times and published four collections of papers (Morales 1993a; Serjeantson 1997; Bochenski 2002; Peters & Grupe 2005). From the beginning, it has been concerned both with methods of analysis and with interpretation.

Several of the archaeological bird bone assemblages discussed in this book feature in more than one chapter. Some of the key research includes innovative methodology as well as new insights into the significance of the bird remains. Where an assemblage is referred to more than once, there is a reference to the first time that the assemblage is discussed.

BIRD REMAINS: THE QUESTIONS

With bird remains, even more than with those of mammals and fish, it is important to consider whether they were actually associated with people or whether they accumulated naturally. If anthropogenic, were they killed for reasons other than for food? Were the birds killed – or perhaps scavenged – for feathers or for tools? Are the remains of domestic or wild birds? This is not a problem with a species such as the chicken when remains are found out of context, but it is a real – and unsolved – problem with pigeons, geese, and ducks over much of their range, as discussed in Chapter 12. Why were some birds given special burial or special treatment? Interpretation is not made easier by the fact that the remains are often meagre, small, and fragmentary and consequently sometimes given little attention by archaeologists.

The basic data are the same as in all zooarchaeological analysis: the identified and the unidentified bones, the parts of the body present, and the size, age, sex, and skeletal health of the bird. Natural modifications and the butchery are equally important. Above all, knowing the context in which the bones were found and the associated finds are essential for answering some of the more complex questions. For this, close collaboration between the zooarchaeologist and the excavation team is crucial. Together, all these data suggest the significance of archaeological bird bones, and each of these topics is discussed in the chapters which follow.

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Biology, Behaviour, and Anatomy

To interpret the remains of birds from ancient sites, it is as important to understand their behaviour as it is to understand their anatomy. This chapter deals with both topics. The account of bird behaviour focuses on those aspects which are particularly relevant to the zooarchaeologist. The descriptions of the characteristics of bird bone and the individual bones which follow highlight the characteristics of avian osteology which differ from those of mammals, and they point out some of the features of the skeletal elements which may be valuable for the identification to family or species.

BIRD BIOLOGY AND BEHAVIOUR

Flight and Flightlessness

Birds as a class are defined by the presence of feathers. The majority of birds can fly and use flight as their main means of locomotion, but some have lost the use of their wings and some spend more time swimming than flying. Those families which are flightless today, the ratites, evolved from birds which originally flew but lost the ability to do so, rather than from ancestral species which failed to develop flight at an early stage in their evolution (Feduccia 1999). Some landbirds lost the ability to fly after they found themselves on islands on which there were no ground predators. Some became very large. The best known extinct large bird is the dodo from the island of Mauritius, but many oceanic islands formerly had populations of smaller species such as flightless rails which have become extinct, as discussed in Chapter 15. A few seabirds which live by swimming and catching fish have also lost the use of their wings for flying and instead use them for swimming: these include the flightless cormorant of the Galapagos Islands (see Figure 15.3), the larger penguins (Spheniscidae), of the southern hemisphere (see Figure 10.2), and the single flightless species of the

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northern hemisphere, the now extinct great auk. The ancestor of the ostrich, which lives in Africa, abandoned flight for a different reason. The wings adapted as an aid to running faster, rather like a kite or a sail (Cramp 1977, 1980; Hoyo et al. 1992).

Even some species which can fly spend a lot of time either on the ground or in the water. Galliformes such as the turkey, the peafowl, and the junglefowl are poor flyers, as they obtain most of their food on the ground or the forest floor. The auks (Alcidae), which obtain their food (fish) by swimming and diving, are also poor flyers. Some domestic birds fly with difficulty: one of the effects of domestication has been that body size grows so large that they can no longer fly, as discussed in Chapter 12.

Size

There is a maximum size which a species can attain while still retaining the ability to fly, which is dictated by the wing size. Consequently, the size range in flying birds is not as great as in mammals and fish. The wing increases only as the square of bone length, while body mass increases with the cube of those lengths (Worthy & Holdaway 2002). A few recent species seem to have approached this maximum, including the female Haast's eagle, *Harpagornis moorei.* This extinct giant eagle of New Zealand had a wing span of 2.4 m and a mass of up to 12.5 kg (Worthy & Holdaway 2002, tab. 8.16). Other species close to the maximum are the marabou, the Andean condor, and the black vulture. The ostrich, the southern cassowary, and the emu are the largest flightless birds, but they were exceeded in size by some of the dozen or so species of extinct moa, Dinornithiformes, of New Zealand (see Table 10.1; also see Worthy & Holdaway 2002). The largest moa, *Dinornis giganteus*, may have weighed as much as 240 kg (Worthy & Holdaway 2002, tab. 5.3). The smallest birds are in the hummingbird family; the smallest, the bee hummingbird, weighs less than 2 g. Hunters in general have been more interested in killing large rather than small birds for food (Chapter 10), but where feathers, especially decorative feathers, are concerned, small birds are sometimes just as significant if they have striking colours (Chapter 8).

Nesting and Breeding

Most birds make a nest of some sort, but a few, mainly cliff-nesting, seabirds, do not make any kind of nest (O'Connor 1984, 18). The rock dove and some species within families such as the swallows and choughs breed within caves and their remains

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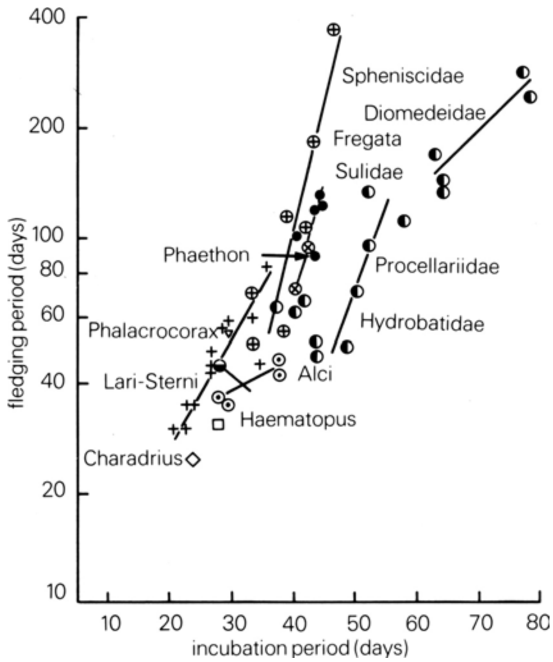

FIGURE 2.1. Relationship of the incubation period to the fledging period (days) in seabirds (redrawn from Nelson 1980, 146). Waders, gulls, and auks have a relatively short fledging and incubation period; frigate birds, penguins, gannets, boobies, and albatrosses have a lengthy fledging period; the latter two families also have a lengthy incubation period.

can potentially be confused with human prey brought to a cave as food (Chapter 5). Birds in seasonal environments nearly always breed in summer but some seabirds are an exception to this rule; being fish-eaters, they are less constrained by a dearth of food in winter. Nearer the tropics, nesting can take place at any time of year. Some birds space their nests and breeding sites within individual territories, but many breed in colonies. This is especially typical of seabirds, a habit which makes them more vulnerable to predation by humans than solitary nesters, as many of the studies discussed later in this book show.

The number of eggs is very varied, from clutches of more than a dozen (this is found particularly with the Galliformes) to those of a single egg (see Chapter 7). When they first hatch, chicks are described as 'hatchlings', then, until they leave the nest, as 'nestlings'. 'Fledglings' refers to birds before they are fully fledged, that is in full feather, which usually also coincides with the time when they cease to be fed by the parents. In ornithology, 'juveniles' describes birds in immature plumage before they have started to breed. This period lasts several years in long-lived species, but it should be noted that, unlike mammals, birds are skeletally mature at a much earlier age (Chapter 3) and these terms are not always appropriate for skeletal remains.

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