A female Noisy Scrub-bird *Atrichornis clamosus* at nest (photo G. Chapman, CSIRO Wildlife Research).

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Morphology of the Noisy Scrub-bird, *Atrichornis clamosus* (Passeriformes: Atrichornithidae): Introduction, with Remarks on Plumage and Systematic Position

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ABSTRACT. A brief review is given of previous morphological studies of *Atrichornis* and its relationship to other passerine families. Renewed interest in the relationships of *Menura* and *Atrichornis* in the last two or three decades led to efforts to obtain suitable specimens of both genera. The efforts to obtain the specimen of the rare *Atrichornis clamosus* used in this study are described in detail. This account highlights the long periods necessary to obtain governmental permission to study an endangered species and suggests that *bona fide* scientific enquiry can be stifled by unyielding governmental regulations designed to regulate commercial trade. The studies in this volume illustrate the wealth of scientific data that can be obtained from a single specimen in a carefully co-ordinated study.

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Within the uniquely Australian avifauna, the two species of scrub-bird (*Atrichornis*) are unquestionably among the most intriguing. Found in restricted ranges on opposite sides of the continent, scrub-birds have long been ornithological enigmas. Because they live in exceptionally dense habitat, are terrestrial and cryptically coloured, they are notoriously difficult to see — even when you know, from the loud and persistent song, that a bird is somewhere within a few metres of you. Many professional ornithologists and amateur bird-watchers alike have spent hours sitting or crouched in a spot, with a bird moving about and calling all around them, without catching even a glimpse of the small brown form. Accordingly, until intensive study was begun by the C.S.I.R.O. on the Noisy Scrub-bird in recent years, almost nothing was known of the details of distribution, ecology, behaviour, or even many of the basic facts of the life histories of these birds — and much still remains to be learned (Chisholm, 1951).

The Noisy Scrub-bird (*Atrichornis clamosus*) was first discovered by J. Gilbert in 1842, and described formally in the scientific literature two years later by J. Gould (1844). Gould's original generic name, *Atrichia,* was later found to be preoccupied (Stejneger, 1885) and altered to the present spelling. The species occurred in south-westernmost Western Australia, and was recorded occasionally in the coastal region between Perth and Albany until late in the 19th century (localities mapped by Smith, 1977). After 1889 it was not seen (or, to be more realistic, heard) again for many decades and was presumed to be extinct. Its rediscovery by H. O. Webster in 1961 at Two Peoples Bay, some 40 km east of Albany, electrified the ornithological world (Serventy, 1966). Since that time, the Noisy Scrub-bird population has increased from 40–45 singing males (the population statistic) (Smith & Forrester, 1981) to 138 in 1983 (Smith, unpublished data). It is a species clearly still in need of continued study and help, if it is to be saved.

The Rufous Scrub-bird (*Atrichornis rufescens*) was described in 1866 by E. P. Ramsay. It was originally found in several isolated areas in south-eastern Queensland and north-eastern New South Wales.

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Although its range has since constricted (Smith, 1977), it still occurs in several montane localities within the same general region. *Atrichornis rufescens* is also a rare bird. Although its population is somewhat larger than that of *A. clamosus,* it is similarly of concern to conservationists and ornithologists. Its distribution and habitat requirements have been studied in detail by Simon Ferrier (pers. comm.). Other facets of its ecology have been little studied.

For several decades after scrub-birds first became known to science, studies of their taxonomy were based solely on the external features visible in museum study skins. Although both J. MacGillivray and Ramsay had superficially examined and noted several anatomical peculiarities in *Atrichornis,* neither communicated their findings (Chisholm, 1951). Gould (1865) assumed scrub-birds to be closely related to the superficially similar bristlebirds (*'Sphenura'* = *Dasyornis*), but commented on the curious lack of rictal bristles in *Atrichornis,* considering that they were such a characteristic feature in the other genus.

It was not until the first anatomical material was studied (Newton, 1875; Garrod, 1876) that *Atrichornis* was found not to be related either to other small brown Australian birds (especially certain malurines or timaliines) or to the South American tapaculos (Rhinocryptidae). Instead, the only group that shared distinctive morphological characteristics with *Atrichornis* were the equally anomalous lyrebirds (*Menura*). Lyrebirds (two species) are also Australian, but are so large-bodied that not until their anatomy was studied in the 1840's, were they proved to be passerines (perching birds) rather than some form of pheasant or other galliform. Although definitely passerine, *Atrichornis* and *Menura* were so different from other perching birds that Garrod (1876) erected a special small taxonomic grouping just for them: the 'Acromyodi Abnormales.' This was in contrast to the 'Acromyodi Normales' which constituted the thousands of species of true songbirds.

Since Garrod's dissection of an anatomical (spirit) specimen of *Atrichornis rufescens,* few morphological studies have been conducted to solve the puzzle of the relationships of this pair of Australian genera. Clearly, they were different from all other perching birds in several important features, notably in the structure of the syrinx, sternum and clavicles. Largely, however, through a lack of available specimens (Forbes, 1881), together with a general waning of interest in avian anatomy after the turn of the century, the enigma remained. Taxonomists continued, of course, to propose new systems of classification, but they merely reinterpreted the sparse existing data on *Atrichornis* and *Menura.* The taxonomic history of these genera was summarized by Sibley (1974) and is discussed in detail in the concluding paper of this monograph. It is sufficient to note here that, for the past century, *Atrichornis* and *Menura* have remained classified together (and with no other close relatives) somewhere just outside the true songbirds. They are most generally accepted as constituting the Suborder Menurae, placed just before the true songbirds, Suborder Passeres, of the Order Passeriformes (Wetmore, 1960).

THE PRESENT STUDY

In the past two or three decades, there has been a renewed interest in avian morphology, particularly in studies that might help to solve persistent systematic puzzles. With the long hiatus in anatomical work, however, many key specimens either no longer exist, or were never acquired during the routine growth of museum collections. In 1966 an attempt was made to locate the few skeletons and spirit specimens that had once existed of *Atrichornis* and *Menura.* Apparently the specimens in England either had been lost or destroyed by the London bombing during World War II (Chisholm, 1951; Heimerdinger & Ames, 1967). The only pertinent material located was four skeletons and two spirit specimens (in alcohol) of *Menura* (both the latter being partly grown nestlings, one much-dissected in the National Museum of Natural History, Washington, D.C., and the other, still unstudied, in the Royal Scottish Museum, Edinburgh), and a spirit specimen of *Atrichornis clamosus* (in the Museum of Victoria, Melbourne; Reg. no. R11354).

The *Atrichornis* specimen is very old. It is undated, but was received in Melbourne in 1889; it may be the specimen collected that year by A.J. Campbell (Chisholm, 1951). Apparently it originally was preserved in rum (a poor preservative but commonly used in remote collecting localities in the early years) and may have been prepared as an anatomical specimen because it was badly shot-damaged and would have been difficult to make into a study skin. The muscles are hard, the bones somewhat cleared and softened after nearly a century in fluid, and parts of the specimen were further destroyed by an attempt, in 1927, to determine the sex internally. Studies of its pterylosis and syrinx were conducted, with varying degrees of success (Clench, 1985; Ames, 1971).

Efforts were begun to acquire new spirit specimens of both genera, as the existing material was not even minimally satisfactory. Through the cooperation of several Australian ornithologists and the appropriate Australian authorities, a few specimens of *Menura* were preserved and made available for study. The comparisons within the Menurae in the following papers are primarily based on a well prepared pair of *M. novaehollandiae* obtained by Carnegie Museum of Natural History through the courtesy of H. J. deS. Disney and the Trustees of The Australian Museum, Sydney. Acquiring an *Atrichornis* was not so easy.

At the urging of several colleagues not directly involved, we have summarized here some of the many steps involved in the *Atrichornis* specimen acquisition. This account may serve as an example (perhaps an object lesson) to scientists, both to point out the very long periods of time necessary to obtain governmental permission to study a regulated species, and to suggest

that *bona fide* scientific inquiry can be stifled by unyielding governmental regulations formulated to control commercial trade. Truly, one must be both patient and persistent if one wishes to study a species that has been formally designated as endangered. As a result, too many discouraged scientists are abandoning such studies — to the detriment of the species being protected. Our saga also points out what can be accomplished with the sacrifice of just one individual bird.

At the International Ornithological Congress in Canberra in 1974, Clench and Smith informally discussed the possibilities of obtaining a spirit specimen of *Atrichornis*. As Smith was engaged in a long-term study of *A. clamosus,* and had shown that the population was increasing, it appeared reasonable to request permission to collect a single specimen. It was decided to collect a breeding female as such birds are the easiest to capture alive and, from the knowledge of the non-breeding population, it could be assumed with a high degree of confidence that she would be replaced by the following season and thus not affect the breeding population. Convinced of the importance of such a study, the governmental agencies charged with the protection of rare birds (Western Australian Wildlife Authority, Western Australian Department of Fisheries and Wildlife) issued the necessary collecting and export permits. Accordingly, on 15 August 1976 at 1330 hours, under conditions of gale force winds and biting sleet (fortunately not an omen) L.A. Moore snared a breeding female Noisy Scrub-bird at her nest 1.6 km north-east of Mt. Gardner, Two Peoples Bay (40 km east of Albany), Western Australia: 35°00′S, 118°10′E. The female chick from the nest was taken to Perth that night to form part of a small group (three females, one male) of birds to be used in an attempt to breed the species in captivity.

Before preservation, blood was drawn for later study by C. G. Sibley. The bird was also photographed and the following data taken:

Measurements: weight, 34 g; length of right tarsus, 27.5 mm; length of right wing (flattened wing chord), 63.6 mm; length of exposed culmen, 16.2 mm; overall length of body + tail, 190 mm.

Soft part colours: upper mandible dark greyish brown including operculum, tomium pale silvery pink from gape to near tip (which is the same as the remainder of the upper mandible); lower mandible pale silvery pink; mouth with palate very pale whitish pink, lining of upper mandible very pale grey, lining of lower mandible very pale greyish pink, upper surface of tongue white-cream; eye dark brown; eye ring greyish black; legs pale silvery grey; toes like legs but slightly darker; claws greyish white, darker on ridges.

After the 12 Australian permits were issued, Clench applied to the U.S. Fish and Wildlife Service for an import-export permit, to borrow the specimen for a cooperative study by American anatomists. Because the Noisy Scrub-bird is listed as an endangered species under U.S. law, and because the permit-issuing agency was undergoing an internal reorganization when the application arrived in Washington, the permit took almost five months to obtain. Several more months then passed while arrangements were made with U.S. Customs and a California broker; the package would contain an endangered species so it had to pass Customs at one of the few 'designated ports' — not Pittsburgh, where the specimen was to be studied first. This was such an important and irreplaceable specimen, we went to great lengths and considerable expense to ensure its safe journey.

It did arrive, safely, in March 1977. The sequence in which the specimen would be studied was predetermined, so that each anatomist could do his or her work without damaging the bird for those who would follow. Before the initial dissection, the specimen was photographed whole, to record the external morphology. The study then began with Morlion (who had travelled to Pittsburgh from Belgium) examining the wing and tail pterylosis. Clench followed with the body pterylosis. Raikow then studied several aspects of the external morphology (including a functional analysis of the locomotor apparatus) and the appendicular myology. As soon as the latter dissection was far enough along to disarticulate one wing and one leg, the rest of the specimen was carried to Washington where Zusi studied the myology of the trunk. Again, when the dissection was far enough advanced to disarticulate the head, it was carried to New York for Bock to begin on the jaw musculature and skull morphology. At this time the syrinx was removed and sent to P.L. Ames, and the stapes sent to A.J. Feduccia. After the dissections were completed, some of the now-cleaned bones were sent to the University of Kansas, for casting. Replicas of parts of the skeleton were made after permission was received from Australia to do so, and with care not to damage the bones. By using a casting technique developed for small fragile fossils, the replicas were made for distribution to several museums with major skeleton collections. Casts ('slabs') showing positive impressions of various elements have been deposited at the American Museum of Natural History, the British Museum (Natural History), the Royal Ontario Museum, the University of Michigan Museum of Zoology, the University of California Museum of Vertebrate Zoology, the U.S. National Museum of Natural History, the University of Kansas Museum of Natural History, Carnegie Museum of Natural History and the Australian Museum. These casts include the following elements (in some cases more than one view is shown): humerus, carpometacarpus and phalanges, femur, tibiotarsus, tarsometatarsus, all toes, and coracoid. Additionally, casts of the distal and proximal ends of some elements and of the more delicate ulna, scapula and synsacrum are on deposit at the Kansas Museum of Natural History. A cast of the synsacrum is also at the U.S. National Museum of Natural History. This distribution of casts means that at least some skeletal representation of *Atrichornis* will be available to scientists outside Australia — without an international

loan that currently means long delays, special permits and governmental red tape.

Throughout this study, Smith served as coordinator in Australia, Clench in the U.S. After the specimen arrived in the U.S., two additional permits were required. One was to re-export the specimen to Australia under the then-new Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which was implemented in the U.S. only a month after the specimen arrived. The other was an extension of the original permit — necessary because the cooperative study expanded to include study of other morphological systems after the bird was collected. It took more time than originally anticipated to complete the full round of dissections with the extra workers: everyone involved approached their tasks with unprecedent care. We knew that the *Atrichornis* was a unique specimen — an opportunity to study a key genus in avian systematics that might never again be available.

In December 1978, the specimen, now partially disarticulated and 'down to bare bones' on one side, but relatively intact on the other, was returned to its country of origin and incorporated into the collections at the Western Australian Museum (A15926). During this period we also completed the formal reports required on each of the permits issued.

Those who shared in the study of this exceptional species would like to thank all who cooperated in the project, especially the officials who issued the necessary permits with as much speed as could be managed. In many ways the following set of papers is a memorial to 'Upper Coffin' (whose territory was at the top of Coffin Gully), who contributed her all to science.

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