INTRODUCTION

The ancient lineage of parrots is unquestioned, but uncertainties do persist concerning the identification of early fossil material. The oldest putative record comes from the Late Cretaceous (74 to 65 million years ago) Lance Formation in Niobrara County, Wyoming, U.S.A., and identification as a parrot was based on the tip of a lower bill. Material recovered from the Early Miocene (57 to 52 million years ago) London Clay, Essex, Britain, and Middle Eocene (52 to 40 million years ago) deposits at Messeg Hessen, Germany, described respectively as *Palaeopsittacus georgi* and *Psittacopes lepidus*, apparently was misidentified as parrots, but *Quercypsitta sudrei* and *Q. ivani*, two species from the Late Eocene (40 to 36 million years ago) Phosphorites du Quercy, at La Bouffie, France, are widely considered to be the ancestors of modern parrots, or at least vicariant relatives sharing a common ancestor with modern parrots (Boles 2002). Evidence that parrots were widespread and diversified by the Early to Middle Miocene (23 to 11 million years ago) is provided by *Archaeopsittacus verreauxi*, the earliest fossil parrot of unquestioned identification, from the Upper Oligocene or Lower Miocene of France, as well as by an incomplete rostrum from a small *Cacatua* cockatoo found in Early Miocene deposits at Riversleigh, Queensland, Australia, and by *Conuropsis fratercula*, which was described from a left humerus recovered in the Middle Miocene Snake Creek quarries of Sioux County, Nebraska, U.S.A. If the generic designation of *Conuropsis fratercula* is accurate, it and the Riversleigh specimen become the oldest representatives of modern genera.

Because of the obvious antiquity of the origins of parrots, it is not surprising that affinities between parrots and other modern groups of birds are exceedingly obscure, and there appear to be no near relatives. Traditional placement of the order has been between the pigeons (Columbiformes) and the cuckoos (Cuculiformes), mainly because of a sharing of certain anatomical features, including a prominent fleshy cere and zygodactylous feet. An association with pigeons has also been suggested by comparative analyses of egg-white proteins, and by a significant trend toward conditions in parrots being evident in several characteristics of the Tooth-billed Pigeon *Didunculus strigirostris* from Samoa. While watching *Ptilinopus* fruit pigeons feeding with fig parrots and lorikeets, or *Treron* pigeons feeding with *Poicephalus* parrots in fruiting trees, I have noticed similarities in their actions and general behavior. Of course, superficial similarities can be found in other groups of birds. For example, hawks and owls have bills somewhat resembling those of parrots, and zygodactylous feet are also possessed by woodpeckers, jacamars, barbets, and toucans, all members of Piciformes, by cuckoos and turacos, and by trogons, which have the inner or second, instead of the outer or fourth, toe turned backward. More recently, DNA-DNA hybridization studies have suggested that parrots might more appropriately be placed somewhere between the cuckoos and the swifts (Apodiformes), with pigeons somewhat more distant. In the end, I tend to concur with the view expressed long ago by Erwin Stresemann that the parrots are a distinct group having no close relatives.

SYSTEMATICS OF PARROTS

Few groups of birds are more easily recognized by even the most casual observer than are the parrots, and this is due largely to the universal popularity of some species as pets, most notably the Budgerigar *Melopsittacus undulatus* and the Cockatiel *Nymphicus hollandicus*. The most conspicuous external feature making all species easily recognizable as parrots is the short, blunt, rounded bill with a downcurved upper mandible fitting neatly over a broad, upturned lower mandible. Also prominent is the zygodactylous foot, with two toes pointing forward and two turned backward. Other, less obvious, characteristics include the proportionately large, broad head and short neck, the thick and prehensile tongue, and the nostrils, which are set in a bare or feathered fleshy cere at the base of the upper mandible. This striking homogeneity, which so clearly differentiates parrots from other groups of birds, poses problems for taxonomists attempting to formulate a classification within the order.

The first significant classification was based entirely on external features, and was put forward in 1891 by Count Tommaso Salvadori, who established seven families, the largest (Psittacidae) being divided into six subfamilies (Salvadori 1891). For the most part, this arrangement was followed by subsequent authors, including James L. Peters, who, in his *Check-List of Birds of the World* (1937), downgraded most higher categories, retaining a single family divided into six subfamilies. In a major review of anatomical, morphological, and behavioral characteristics, George Smith proposed a single family with four subfamilies, and within these subfamilies grouped the genera into tribes (Smith 1975). In my *Parrots of the World*, I adopted with some modification the arrangement proposed by Smith, my arrangement differing mainly in the composition of some tribes and their placement within subfamilies (Forshaw 1989). Recent advances in investigatory techniques, especially biochemical analyses, have contributed significantly to our understanding of relationships among parrots, and their findings are reflected in the taxonomic arrangement used in this book. The most notable change from previously adopted arrangements is the separation of cockatoos at family level. I have also recognized additional subfamilies, including Nestorinae, to reflect affinities between the highly distinctive *Nestor* and *Strigops* species from New Zealand. I have retained tribal categorization for all neotropical parrots, but suspect that further investigation will support an upgrading of Arini to subfamily level.

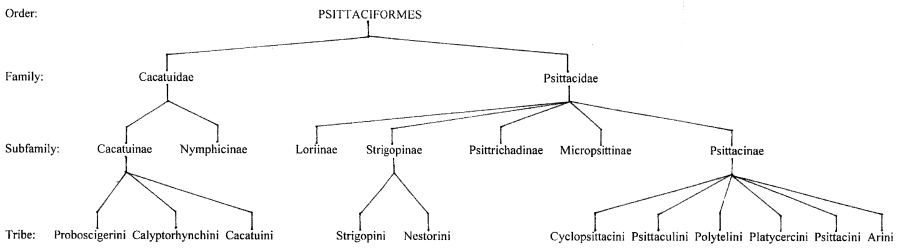

Figure 2. The taxonomic arrangement followed in this book, modified from that adopted by Forshaw (1989). The tribe Arini (at far right) includes only New World parrots.

Not unexpectedly, these same advances in investigatory techniques have brought into question the adequacy of traditional nomenclatural parameters for reflecting phylogenetic relationships, especially at the genus, species, and subspecies levels. At times there arise difficulties in reconciling apparent differences between morphological and biochemical characters, and these difficulties are reflected in perceived or real conflict between the "biological species concept," which is of long-standing usage, and the more recently formulated "phylogenetic species concept." I share the concern expressed by fieldworkers and other "users" of taxonomic arrangements that the "phylogenetic species concept" is subject to variable interpretation and has the potential to confer specific status on populations with little or no distinguishing morphological features. Unfortunately, I foresee a continuation of the present trend of elevating distinctive isolates from subspecies to species and affording generic differentiation to "species groups" within some genera. While acknowledging that biochemical analyses have significantly advanced our understanding of relationships, I remain firmly of the opinion that findings should be interpreted in concert with, and not divorced from, the results of comparative morphological and behavioral studies. Indeed, I suspect that we already have too many species and genera of neotropical parrots, which really do constitute a most homogeneous assemblage of forms.

The taxonomic arrangement used in this book is set out in Fig. 2, and I would point out that a working knowledge of the relationships of parrot groups can in turn give an awareness of morphological and behavioral similarities and differences that often are very relevant to field identification.

PHYSICAL FEATURES OF PARROTS

Despite the marked homogeneity that clearly differentiates parrots from other birds, it will be apparent from illustrations in this book that parrots "come in all shapes and sizes." This variation in external appearances is the key to identification.

Size alone distinguishes the largest and smallest species. Being so much larger than other parrots, the *Anodorhynchus* and larger *Ara* macaws are instantly recognizable, the majestic Hyacinth Macaw *Anodorhynchus hyacinthinus* measuring approximately 100cm in total length. Weighing up to 3kg, the Kakapo *Strigops habroptilus* from New Zealand is the largest parrot by weight, and its bulkiness is quite obvious even in the field. At the other extreme, the diminutive *Micropsitta* pygmy parrots of New Guinea are less than 9cm in total length and thus easily overlooked or often mistaken for small passerines. Size can be a key factor in identifying parrots of similar appearance, and this is particularly evident with the two *Coracopsis* species, with the Red-tailed Black Cockatoo *Calyptorhynchus banksii* and the Glossy Black Cockatoo *C. lathami*, and with *Amazona* and *Pionus* species.

Obvious mostly in overhead flight, various characteristic shapes derive mainly from structure of the wings and tail. To illustrate these identifying features, diagrams of the flight silhouettes of some species are shown in Fig. 3. As depicted in these diagrams, wings can be long, narrow, and pointed, as in the Cockatiel *Nymphicus hollandicus*, the Swift Parrot *Lathamus discolor*, and some *Psittacula* species, broad and pointed, as in many lories or lorikeets, or broad and rounded, as in *Eclectus* and *Amazona* parrots. Tails are particularly variable, being long or short, narrow or broad, and rounded, squarish, wedge-shaped, or pointed. Tails also may feature specially structured feathers, such as markedly elongated central feathers in the Papuan Lory *Charmosyna papou* and Long-tailed Parakeet *Psittacula longicauda*, or the bare-shafted, spatulate-tipped central feathers in *Prioniturus* species (see Fig. 6, p. 53). Long, pointed wings, often opened in a backward-swept formation, together with a long, narrow, pointed tail produce a characteristically streamlined appearance in flight, whereas broad, rounded wings and a short, squarish or rounded tail produce a very different "top-heavy" flight silhouette, and these differences are important for field identification.

Of course, plumage coloration is the key element in parrot identification. Apart from the cockatoos, most parrots have a predominantly green plumage. Cockatoos stand apart because of the absence of green in their coloration, as also do the few, normally unmistakable "non-green" species within Psittacidae. Red, yellow, and blue figure consistently in distinguishing markings, which tend to be concentrated on the head, uppersides of the wings, and the rump to upper tail-coverts, thus producing color patterns that are of prime importance in identifying most species. Accurate identification is often determined by certain prominent fea-

1. Broad, pointed wings and short, pointed or wedge-shaped tail.
2. Broad, pointed wings and short, squarish or rounded tail.
3. Broad, pointed wings and long, graduated tail.
4. Broad, pointed wings and long, rounded tail.
5. Broad, rounded wings and short, squarish or rounded tail.
6. Broad, rounded wings and long, graduated tail.
7. Narrow, pointed wings and long, sharply graduated tail.

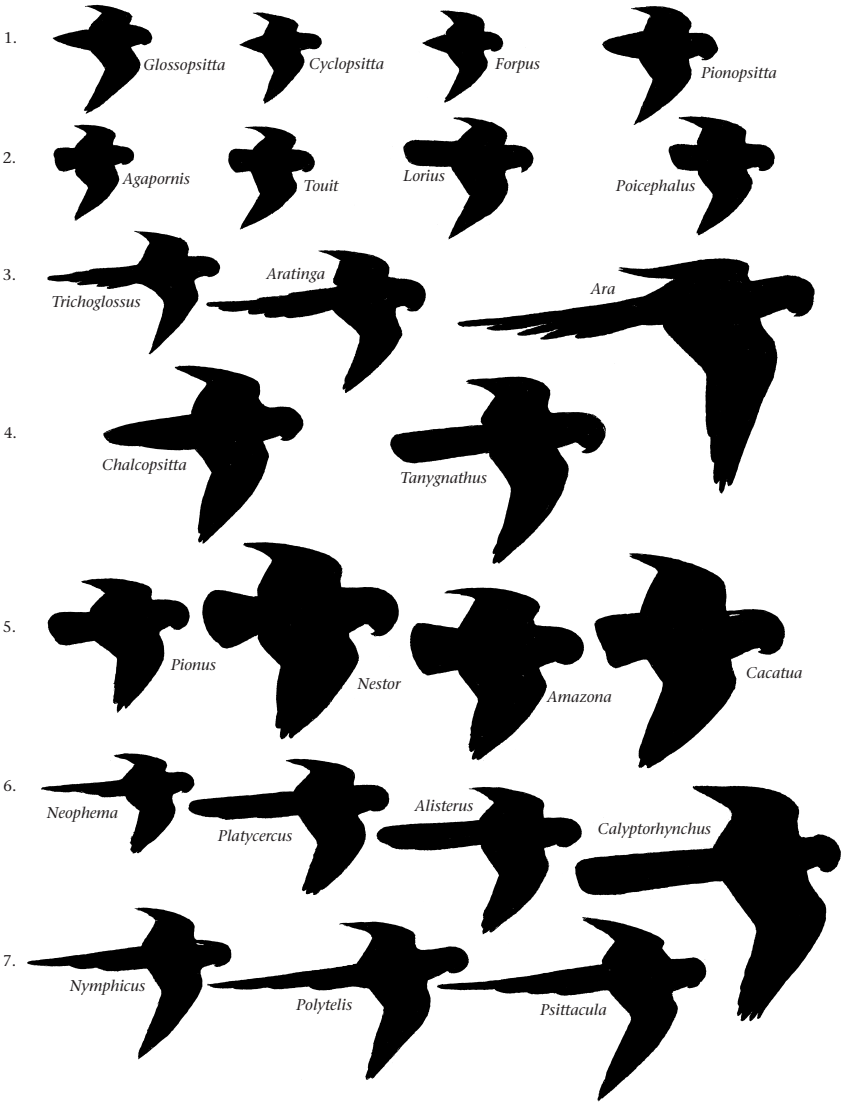

Figure 3. Some examples of principal flight silhouettes for parrots. (The drawings are not to scale).

tures, such as frontal bands, cheek-patches, ear-coverts, nuchal collars, and wing-patches, and this is particularly true when separating closely related species. Such features can also be helpful in differentiating unrelated, though superficially similar, species or groups. For example, *Agapornis* lovebirds from Africa and *Forpus* parrotlets from Central and South America are small, stocky parrots with short, rounded tails, but only the lovebirds have colored bands in their tails.

Among peculiarly distinctive plumage features are the bare face or head of Pesquet's Parrot *Psittrichas fulgidus*, the Vulturine Parrot *Pionopsitta vulturina*, and the Orange-headed Parrot *P. aurantiocephala*. Extreme sexual dimorphism distinguishes the Eclectus Parrot *Eclectus roratus*, and erectile, elongated nuchal feathers are present only on the Hawk-headed Parrot *Deroptyus accipitrinus*. Colors of the bill, iris, and feet can also be important elements in identification. Colored bills, notably red, orange, or yellow, are present in many Old World parrots, especially among the lories or lorikeets, but are decidedly uncommon in neotropical species.

Obvious modifications in bill structure can aid identification, but other anatomical differences normally are inconspicuous. An enormous, projecting bill with the closed mandibles not completely fitting together, thus exposing the small, bicolored tongue, is diagnostic of the Palm Cockatoo *Probosciger aterrimus*, and the peculiarly bulbous bill of the Glossy Black Cockatoo *Calyptorhynchus lathami* usually is discernible when birds are observed while feeding. Narrow, protruding bills with elongated, less decurved upper mandibles are conspicuous distinguishing features of the Slender-billed Corella *Cacatua tenuirostris*, the Western Corella *C. pastinator*, the Red-capped Parrot *Purpureicephalus spurius*, and the Slender-billed Conure *Enicognathus leptorhynchus*. Conversely, bill differences that separate the very similar Carnaby's Black Cockatoo *Calyptorhynchus latirostris* and Baudin's Black Cockatoo *C. baudinii* seldom are obvious to field observers. Likewise, the "brush-tipped" tongue of lories and lorikeets can be seen only when a feeding bird is viewed at close quarters, and identification of these nectar-feeding parrots normally is made from behavioral characteristics.

In summary, discernible groupings of parrots can be identified by differences in physical features, and then, within each group, further differentiation can be made through more detailed comparisons of plumage and behavioral characteristics. This is the procedure that has guided the descriptions given in this book.

CONSERVATION

Disappearance in 2000 of the last known Spix's Macaw *Cyanopsitta spixii* from the wild in northern Brazil and rediscovery in July 2002, in the mountains of western Colombia, of a small remnant population of the Indigo-winged Parrot *Hapalopsittaca fuertesi*, lost since its initial finding in 1913, epitomizes the parlous status of many parrots, especially in the neotropics. Of the 356 extant species recognized by Birds International, no fewer than 123 species, or 34.6 percent, are listed as being near-threatened to endangered, thus making parrots one of the most threatened groups of birds (Birdlife International 2004). It seems that in addressing the conservation needs of parrots little attention has been given to the susceptibility of these birds to adverse pressures. Historical records clearly show a poor survival rate, with at least 18 species known to have become extinct between 1600 and 1980 (Collar 1997). Loss of the once spectacularly abundant Carolina Parakeet *Conuropsis carolinensis*, the only parrot endemic to the United States of America, was an appalling tragedy, one that has been expertly chronicled by Noel Snyder in his *The Carolina Parakeet: Glimpses of a Vanished Bird* (2004). Examining museum specimens of lost parrots is a particularly sobering exercise, and illustrating some of these species in this book is intended to reinforce strongly the need to prevent any increases in their ranks. Regrettably, I am not confident that this can be done, and I anticipate that the rate of extinction which prevailed between 1600 and 1980 could well be exceeded in the next 380 years!

Habitat Interference

Parrots are not immune to the pressures affecting all wildlife, and already there are signs that some species, including the Gang Gang Cockatoo *Callocephalon fimbriatum* of Australia, are being affected adversely by global warming. Habitat interference is, by far, the most serious threat to parrots, with the great majority of endangered populations facing varying degrees of habitat loss, degradation, or fragmentation. Of particular concern is the widespread destruction of tropical and subtropical rainforests, which are preferred habitats for many species. In tropical regions, land clearance is often motivated by economic forces, with logging concessions, for example, featuring prominently in national and international commerce. Mining and the conversion of lands to pastoral or agricultural use can be primary factors in land clearance or can thwart any hopes of rehabilitating logged areas. It is understandable that these practices would be prevalent in Southeast Asia and Equatorial Africa, where there is intense pressure for rapid commercial gain and greatly increased food production, but it would be tragic if in the process insufficient effort was made to preserve viable stands of the magnificent rainforest, which for centuries has been identified with these regions. Already, rapid declines have taken place in parrot populations throughout the Indonesian Archipelago and in the Philippine Islands, where a number of species have become critically endangered. Similarly, in the Congo River basin and in West Africa, the Gray Parrot *Psittacus erithacus* has disappeared from parts of its former range because of widespread land clearance. In the neotropics, too, there is a major, ongoing transformation of the Amazonian landscape, where mining and agricultural or pastoral activities are bringing about the fragmentation of previously extensive tracts of tropical rainforest, the preferred habitat of so many parrots. Even more damaging has been the extensive deforestation in coastal Brazil, where the long-term survival of a number of endemic species, including the Blue-throated Conure *Pyrrhura cruentata*, the Golden-tailed Parrotlet *Touit surda*, and the Red-tailed Amazon *Ama-*

zona brasiliensis, is dependent on the sustained viability of protected stands of forest in reserves and national parks.

Even more seriously threatened than tropical or subtropical rainforests are mountain forests and woodlands in Central and South America and certain *Eucalyptus* woodlands in Australia. Widespread deforestation in the Andes of northern Ecuador and western Colombia has brought the Golden-plumed Conure *Leptosittaca branickii* and several *Hapalopsittaca* species to the brink of extinction, while in northern Mexico the large-scale clearance of *Pinus* woodlands has resulted in the disappearance of Thick-billed Parrots *Rhynchopsitta pachyrhyncha* from parts of their former range, and the species no longer can wander north into Arizona and New Mexico, United States, as it once did. In an advanced nation like Australia there should be an awareness of the need for habitat protection, but the destruction of *Eucalyptus* woodlands, including mallee, a specialized habitat of importance to many parrot species, continues at a demonstrably unsustainable rate, and is a national disgrace for a country that already has the world's worst record for the extinction of wildlife.

Parrots with specialized habitat requirements are especially at risk from habitat interference. *Araucaria* forests in southeastern Brazil, home of the Red-spectacled Amazon *Amazona pretrei*, are being cleared at an alarming rate, and in the Andean highlands of northern Ecuador and western Colombia, where the spectacular Yellow-eared Conure *Ognorhynchus icterotis* is virtually restricted to stands of *Ceroxylon* palms, almost total destruction of the palms has brought the parrots to the brink of extinction. The terrestrial Ground Parrot *Pezoporus wallicus*, a specialized inhabitant of coastal heathlands in eastern and southwestern Australia, is threatened by expanding urbanization and agricultural development along the seaboard.

The particularly high vulnerability of parrots confined to small, isolated islands is well demonstrated by the fact that 16 of the 18 species listed as extinct in 1981 had been endemic to islands, and many currently endangered parrots are restricted to islands. After declining to dangerously low numbers, the spectacular *Amazona* species endemic to the Lesser Antilles, West Indies, are responding to multifaceted conservation efforts, while on Puerto Rico a comprehensive rescue and reintroduction program has enabled the Puerto Rican Amazon *Amazona vittata* to retain a tenuous hold on survival in the last remaining tract of native forest. This vulnerability of island species is strongly evident also in the South Pacific Ocean, where *Vini* lories have disappeared from islands they formerly occupied, and in the Indonesian Archipelago, where some *Eos* lories and populations of *Cacatua* cockatoos are endangered. Similarly at risk are species found only within very restricted ranges on continental landmasses. A disproportionately high concentration of such species occurs in the highlands of Colombia and Ecuador, where the Yellow-eared Conure *Ognorhynchus icterotis*, the Golden-plumed Conure *Leptosittaca branickii*, several *Hapalopsittaca* species, and some *Pyrrhura* conures are among parrots seriously threatened by continued clearing of highly fragmented upland forests. With an estimated total population of just 10,000 birds in two subpopulations occurring within a highly localized range of approximately 2500 sq km in southwestern Zambia, the Black-cheeked Lovebird *Agapornis nigrigenis* remains endangered, and shows no signs of recovering from excessive exploitation, despite the implementation of protective measures (Warburton 2004). Likewise occurring in two subpopulations, the Golden-shouldered Parrot *Psephotus chrysopterygius* continues to decline within a markedly contracted range on Cape York Peninsula, Queensland, northern Australia.

Predation and Disease

Assessing the significance of predation and disease as threats to populations is quite difficult, but there are indications that they can be regionally or locally significant, especially when coupled with other adversely impacting pressures. Predation of eggs and nestlings by the Pearly-eyed Thrasher *Margarops fuscatus* was identified as an apparent major cause of nesting failure among endangered *Amazona* parrots in the Lesser Antilles, West Indies. The disappearance of *Vini* lories from islands in the South Pacific Ocean has been correlated with introductions of black rats *Rattus rattus*, and the spread of avian malaria also was thought to have contributed to the demise of some populations (in Forshaw 1989). On Mauritius, in the Indian Ocean, the efficiency of introduced Crab-eating Macaques *Macaca fascicularis* as nest predators contributed to near extinction of the Mauritius Parakeet *Psittacula echo*, and in New Zealand the introduction of mustelids and *Trichosurus* possums undoubtedly contributed to the extirpation of Kakapos *Strigops habroptilus* from both North and South Islands. Recent studies of Palm Cockatoos *Probosciger aterrimus* and Eclectus Parrots *Eclectus roratus* on Cape York Peninsula, Queensland, northern Australia, have revealed a significant incidence of reptilian predation of eggs and nestlings (in Forshaw and Cooper 2002). Psittacine Circoviral Disease has been recorded in both wild and captive populations of the critically endangered Orange-bellied Parrot *Neophema chrysogaster* in southeastern Australia, and could be a contributing factor in inhibiting recovery of the remnant population, despite apparently successful releases of captive-bred birds. This same disease has been detected also in the endangered southern population of the Cape Parrot *Poicephalus robustus* in the Republic of South Africa. Snyder (2004) points out that disease offers one of the more plausible explanations for the disappearance of the last populations of the Carolina Parakeet *Conuropsis carolinensis* in the southeastern U.S.A. A tendency to feed close to human structures and to roost in barns or other human structures may have exposed these parrots to diseases carried by poultry or other domestic animals.

Conflicts with Agriculture

Much has been said of the love/hate relationship between humans and parrots, a relationship manifested primarily in the unequaled popularity of parrots as cagebirds and in the impact of some species on agriculture. Damage to crops by parrots has been reported from a number of countries, but to date there has been little evaluation of the problem.

When looking at conflicts between parrots and agriculture, attention is often focused unduly on Australia, where crop damage is regularly cited as a reason for relaxing the prohibition on exports of live birds. I am amazed that any credence at all is given to the claim that trapping and export of so-called "pest species" would alleviate conflicts with agriculture, for the two issues are totally divorced from each other; export certainly would not reduce crop damage and could pose very serious environmental and economic risks in the importing countries. Damage to crops in Australia is not economically significant at the national level, for yields are increasing and there is a corresponding buildup in surplus grain stocks. Furthermore, I suspect that because the raiding of crops by parrots is conspicuous there is a tendency to overlook attacks by other animals. I have little doubt that more wheat grains are taken by ants than by parrots! If damage caused by parrots, relative to that caused by other animals, is indeed small, then controlling parrots could not be justified economically. At the local level, however, or in regions where subsistence farms are subject to attack, the problem may be significant, and there can be a real need to protect crops.

It is unlikely that crop damage can be eliminated, but trials undertaken in Australia have demonstrated that damage levels can be reduced by modifications of farming practices or by adopting crop-protection measures based on sound ecological principles. Beeton (1977) notes that shooting has been found to be ineffective in controlling damage to sorghum crops by Little Corellas *Cacatua sanguinea* in the Kimberley division of Western Australia, and he recommends that ripening of the crops be timed to coincide with lowest density levels in the population cycles of the cockatoos, the initial plantings being in plots overflown first by flocks on their regular flight paths; these plantings would ripen first, and the birds could be encouraged to feed there instead of moving to other parts of the crop. Ford (1990) points out that decoy crops are a more effective and economical means of protecting oilseed crops than shooting or scaring, and Garnett (1999) records outstanding success with a decoy crop planted to protect peanut crops from damage by Red-tailed Black Cockatoos *Calyptorhynchus banksii* at Lakeland, on Cape York Peninsula, Queensland, northern Australia. I suggest that similar measures could be effective in other countries, especially in southern South America, where crop damage is cited as justification for widespread persecution of Monk Parakeets *Myiopsitta monachus* and Patagonian Conures *Cyanoliseus patagonus*.

Too often, I hear of crops highly attractive to parrots being planted near tree-lined watercourses, a preferred habitat for many parrots, and high damage levels are the inevitable consequence. In such situations, where severe damage is likely, the substitution of unattractive crops, such as canola or soybeans, becomes a viable option. Investigations have shown that erecting covering nets to protect fruit crops becomes cost-effective in new, intensively grown orchards, but is unlikely to be cost-effective for old, established orchards (Sinclair 1990). The likelihood of damage by birds must be considered in the initial assessment when planning any crop-growing enterprise, and remedial measures should be formulated as an integral component of management practices.

Hunting

Some parrots are hunted for food or plumage, the feathers being used by indigenous peoples in traditional headdresses or other ceremonial adornments. Throughout much of their ranges, macaws and some amazons are commonly hunted for food, and tail feathers from the large macaws are used by tribal communities in the Amazon River basin. In New Guinea there is widespread hunting of Palm Cockatoos *Probosciger aterrimus* for food, and of the Papuan Lory *Charmosyna papou* and Pesquet's Parrot *Psittrichas fulgidus* for feathers. Such exploitation has persisted over countless generations, and presumably had little or no impact on wild populations when undertaken with traditional methods of capture, often using primitive weapons. The use of firearms has certainly upset the balance, and has increased greatly the significance of hunting as an adverse pressure on local populations. Indeed, in some regions the local impact has been quite devastating. For example, in New Guinea the Palm Cockatoo has been extirpated from the environs of towns and villages, and now remains fairly common only in remote, sparsely settled districts.

The International Pet Trade

The popularity of parrots as pets dates from early times. It is possible that the Rose-ringed Parakeet *Psittacula krameri* from northern Africa was known to the ancient Egyptians, and it was probably Alexander the Great who introduced to Europe tame parrots from the Far East. Voyages of discovery to Asia and the Americas during the fifteenth and sixteenth centuries resulted in new parrot species being brought back to Europe, and thus commenced the international trade in live birds, which has now reached alarming and, in some instances, quite unsustainable levels. In a review of the conservation status of neotropical parrots, Collar and Juniper (1992) concluded that half of the 42 threatened species were endangered primarily or secondarily by trade.

Although not wishing to detract from the significance of capture for the live-bird trade as a pressure adversely affecting parrot populations, I must stress that little is to be gained by prohibiting capture if the effects of habitat loss are neglected—the two are complementary! Capture for the live-bird market is seldom a primary pressure threatening the survival of a species, but as a secondary pressure it takes on a much greater significance when the species is already affected adversely by a primary pressure such as habitat loss. Too often does rarity give rise to increased demand, with high prices being offered by "collectors" who want the birds simply *because* they are rare, and will take any measures, legal or illegal, to acquire them.

Keeping parrots in captivity, whether it be possession of one or two household pets or the housing of many birds in elaborate breeding aviaries, is an interesting, worthwhile hobby and can give much pleasure. Of course, the ability of many parrots to imitate human speech is very well known, and owners of "talking" parrots are invariably proud of their

pets. Quiet, tame birds are sought as pets, and these come mostly from captive breeding, but there continues to be a demand for wild-caught birds, and that focuses attention on the need to protect wild populations from excessive exploitation. The World Conservation Union (IUCN) and the World Wildlife Fund (WWF) do not oppose the use of wild animals as pets:

a. if they are adapted to domestic conditions,
b. if their entry into the pet trade does not endanger wild populations, and
c. if the animals pose no threat to the importing country (see *IUCN Bulletin*, 3(3), 1972).

In general terms, I concur with this approach, but am of the opinion that the present trade in live parrots takes little cognizance of any of these factors. If there is to be trade in wild-caught parrots, it must be based on sound principles of sustained harvesting, so as to pose no threat to wild populations.

A significant impediment to the adoption of sustained harvesting principles in trade is the high demand for rare or endangered species. In Britain, some years ago, this was demonstrated most forcefully to me when a parrot fancier proudly showed me a pet St. Vincent Amazon *Amazona guildingii* housed in a small "cockatoo cage" in his garage! A need to end the social acceptability of private ownership of endangered parrots is addressed in *Parrots*: *Status, Survey, and Conservation Action Plan 2000–2004* (Snyder et al. 2000), where a recommendation is made for achieving this through a concerted education effort, especially within avicultural societies. I oppose the keeping of globally threatened parrots as pets, but would concur with the *Action Plan* that ending the demand for these species could be very difficult.

Before trade in any species is undertaken it is necessary to ascertain whether wild populations of that species can sustain trade and, if so, at what level. When those data are at hand, regulated trade could be permitted, with periodic checks put in place at harvesting sites to monitor the effects of trade. Such checks should incorporate assessments of recruitment rates to ensure that harvesting is directed at appropriate age cohorts of the population, usually younger, nonbreeding birds. Wasteful and inhumane methods of capture, such as felling nesting trees in the hope of securing chicks, or shooting adults in the hope that one or two will recover from injuries, must be eliminated. Harvesting programs need to be sufficiently flexible to enable action to be taken promptly to restrict, or even halt altogether, the trade if monitoring studies detect declines in the population. Present measures, as effected through the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), adopt a totally inadequate approach, one that makes evidence of scarcity a prerequisite for the imposition of trade controls. Surely, the capability of wild populations to withstand harvesting must be established *before* trade is permitted!

Returning to the criteria set out by IUCN and WWF, I emphasize as well, the need to consider possible hazards in the importing countries. Feral populations are becoming established in various countries, particularly in the United States of America and in the West Indies, where some of these populations are increasing in numbers and expanding their ranges. Concerns have been expressed by agricultural authorities in the United States about the pest potential of the Monk Parakeet *Myiopsitta monachus*, and there must also be concerns about the possible impact of this species on populations of native birds. The appearance of feral Rainbow Lorikeets *Trichoglossus haematodus* in the suburbs of Auckland, New Zealand, was rightly considered by wildlife authorities to pose a serious threat to native nectar-feeding species, and a concerted effort was made to eliminate these unwanted competitors.

From what is known of their biology and status, some species of parrots apparently would be eligible for sustained harvesting, but to date no demonstrably successful harvesting projects with wild parrots have been established (in Snyder et al. 2000). Setting up harvesting regimes with effective controls would be costly, and would require resources not normally available in most of the exporting countries. Resolving these and other difficulties will be a formidable task, and may well prove to be insurmountable in overcoming the threat posed by trade to wild populations of parrots.

The Importance of Research

Some 25 years ago, in the Second (Revised) Edition of my *Australian Parrots*, I commented on the increasing interest in parrots among researchers in Australia and elsewhere. This upsurge in interest had been likened by some ornithologists to that which occurred with raptors in the 1960s, and certainly represented a welcome change from the long-standing neglect of parrots by the scientific community. It is most encouraging that this interest not only has persisted, but has increased significantly, so that at the present time parrots are one of the most intensively studied bird groups, with surveys and field investigations being undertaken in virtually all parts of their worldwide range. Worthy of special mention are the long-term studies of cockatoos undertaken in Australia. Although motivated primarily by perceived conflicts with agriculture, these studies have provided a wealth of information of direct relevance to management and conservation efforts. For example, studies of the impact of *Calyptorhynchus* black cockatoos on commercial *Pinus* plantations in southwestern Australia revealed the existence of two similarly plumaged species, only one of which, Carnaby's Black Cockatoo *C. latirostris*, forages in plantations. More important, it was found that populations of both species are threatened (Saunders 1979). Damage to grain crops also was investigated during field studies on Black-cheeked Lovebirds *Agapornis nigrigenis* in Zambia, but establishing the presence of two, apparently distinct subpopulations and determining a dependence of the birds on diminishing supplies of surface water are seen as key findings to be addressed in efforts to arrest a dramatic decline in their numbers (Warburton 2004). Surveys and monitoring programs are being carried out on endangered parrots in a number of countries, particularly in the neotropics and the Indonesian Archipelago, and detailed studies of the

breeding biology of *Ara* macaws in Amazonia and Costa Rica will provide vital information on potential recruitment levels in local populations.

As essential prerequisites for effective conservation or management programs, these surveys and investigations are dependent on the compilation of reliable field data, which in turn relies on accurate identification. By assisting with identification, I trust that this book can contribute to the conservation of parrots. That has been a motivating factor in its production.