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The Prince of the Netherlands on the
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at Morges, Switzerland 23rd February 1969.

The Red Book

WILDLIFE IN DANGER

by

James Fisher, Noel Simon, Jack Vincent

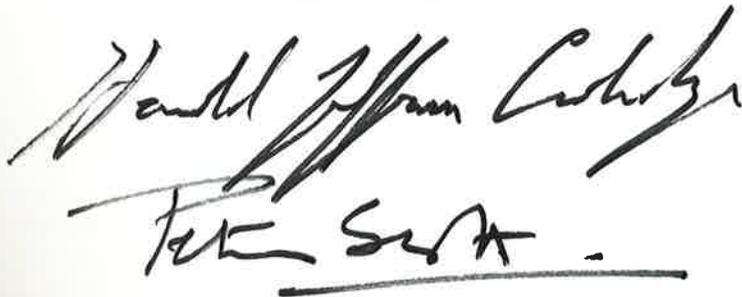
and members and correspondents of the
Survival Service Commission of the International Union for
Conservation of Nature and Natural Resources

Foreword by

Harold J. Coolidge

and

Peter Scott



Handwritten signatures of Harold J. Coolidge and Peter Scott.

COLLINS

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FOREWORD

This book contains information as objective as a global consensus of biological expertise can make it. It is an illustrated collection of facts about some of the more important living things whose survival on our planet is patently in danger.

Its message is of bad tidings: of disaster. Here and there it also carries a message of hope. It is written neither in optimism nor in pessimism, but simply objectively, as part of the duty to focus world attention on wildlife in crisis that the International Union for Conservation of Nature and Natural Resources has charged itself with. To analyse, inform, and prescribe is the I.U.C.N.'s assignment. It has many friends who have helped it with the first two tasks. The third needs money and power; and one of the purposes of this book is to help to raise its money, and increase its power – to turn more of its intelligence files into action files, to spread the conservation message from the committed to the uncommitted. We believe that this may prove to be one of the most important documents that we have so far placed before the general public, and those who form and lead world opinion and are responsible for action.

The I.U.C.N. is a relatively young organization, and it has had a somewhat complicated evolution. In 1934, on private initiative, the O.I.P.N. (l'Office International pour la Protection de la Nature) was founded in Brussels. After an international conference at Fontainebleau sponsored by UNESCO and the Government of France, this evolved into the I.U.P.N. – the International Union for the Protection of Nature. By 1956 its widening circle of supporting naturalists, ecologists, and conservationists felt that its role and new dynamism called for another change of name: and since then its designation has been the International Union for Conservation of Nature and Natural Resources.

The main purpose of the I.U.C.N. is to perpetuate wild nature and natural resources all over the world. It is dedicated to promoting or supporting any action that may ensure this perpetuation. Its devotion to nature is twofold: to its intrinsic cultural and scientific values; and to its values to long-term human welfare, economic and social. Its chief concern is with man's modification of the natural environment through the rapid spread of urban and industrial development and the excessive exploitation of the earth's natural resources, upon which rest the very foundations of man's survival.

It has evolved into an independent international organization whose membership comprises states (irrespective of their political and social systems), government departments, private societies and institutions, and international organizations. It is not a United Nations organization; but it enjoys the support of U.N. agencies such as the Food and Agriculture Organization (F.A.O.), the Educational, Scientific, and Cultural Organization (UNESCO), the Economic and Social Council (ECOSOC), and that of the Council of Europe and other inter-governmental bodies. With all of these it has full consultative status. It also has a special relationship with the International Council for Bird Preservation (I.C.B.P.), an organization of some seniority and experience, first

conceived in 1902 and formally founded in 1922, and with the World Wildlife Fund, founded in 1961.

The I.U.C.N. works through six Commissions: Ecology, Education, Landscape Planning, Legislation, National Parks, and Survival Service. This book has been written by the Survival Service Commission (formed in 1949, and now with over fifty members from over twenty countries), whose responsibility is to collect data on, and to maintain lists of, all wild animals and plants that may be in danger of extinction, and to initiate action to prevent it. Since July 1966 the official version of this list – the Red Data Book – has been published in a new, loose-leaf, lithographed form by the I.U.C.N. from its headquarters in Morges, Switzerland, and a periodic issue is made of new sheets (as the status of organisms changes), which brings the subscribers' information regularly up to date. This present book is an extended, selected, and specially illustrated version of the Red Data Book (which of course continues to expand and maintain its revision service), compiled from the Red Data Book itself, and other sources, by three of the workers most deeply involved.

Jack Vincent, who till recently was responsible for the bird sheets in the Red Data Book, has written the accounts of about half the birds in the present volume. Formerly Director of the National Parks of Natal, South Africa, he represents the International Council for Bird Preservation. Until he returned to conservation service in Natal in the second half of 1967, Col. Vincent was the Secretary of the Survival Service Commission.

Noel Simon, responsible for the mammal (and various other) sheets in the Red Data Book, has written the accounts of the mammals in the present volume. He is responsible for the organization and administration of the I.U.C.N.'s Operations Intelligence Centre. He was founder and first Chairman of the East African Wild Life Society, and Deputy Director of the Kenya National Parks.

James Fisher, at present Deputy Chairman of the Countryside Commission of the United Kingdom, is a zoologist by training and an ornithologist by vocation. He is a Survival Service commissioner and a council member of the Fauna Preservation Society, a British-based international conservation organization of long standing that works in full and whole-hearted cooperation with the I.U.C.N. (The Chairman of the S.S.C. is also Chairman of the F.P.S., and Mr and Mrs R. S. R. Fitter, also Survival Service commissioners, are respectively secretary to the F.P.S. and editor of its journal *Oryx*.) Mr Fisher has written the accounts of the rest of the birds, and also the reptiles, in this book.

The S.S.C. gratefully acknowledges the special articles that have been contributed to this volume by Dr Coleman J. Goin (amphibians), Dr Robert Rush Miller and Dr Ethelwynn Trewavas (fishes), and Dr F. Nigel Hepper (plants). It is grateful also for the generous support given to the Red Data Book by the New York Zoological Society and by the World Wildlife Fund.

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INTRODUCTION

The Red Data Book of the Survival Service Commission of the International Union for Conservation of Nature and Natural Resources was published in a new, lithographed form in July 1966, and is the guiding intelligence document for workers all over the world in forming their policies for the conservation, and indeed preservation, of endangered species of animals and plants. As it is in loose-leaf form, the batches of new leaves are sent to its subscribers as the status of living things changes (which it does often with alarming rapidity).

The "Red", of course, is for Danger. The S.S.C. has another list, which could be called Black for Death, or rather extinction; organisms extinct since 1600 (or believed to be so) are recorded periodically in the *I.U.C.N. Bulletin*.

The year 1600 might be thought an arbitrary date; but it has been chosen for a good reason. The S.S.C., not surprisingly, has more precise information about the higher vertebrates – the birds and mammals – than about any other organisms. Virtually all the mammals and birds known to have become extinct since 1600 are identified by adequate descriptions or portraits, nearly all of them by skins, and a considerable number also by subfossil bones; all but two that we can critically admit have acceptable Linnean or scientific names.¹ The two will doubtless soon be formally named. The year 1600 is the year after which zoologists know at least the colours (more than less) of the extinct birds and mammals. Of course zoologists know of very many animals extinct in historical times, though before 1600: but only in a few exceptional cases, based on very rare early documentary evidence, do they know the colours of these; and only very exceptionally do they possess their skins, or parts of them. So 1600 is accepted by the S.S.C. as the reckoning date for modern extinction. It is a practical date that happens to coincide with the approximate beginning of the civilized epoch's own special attack on wild nature.

To summarize the erosion of the variety of wild life, whose study and cure is the particular duty of the S.S.C., a simple statement can be made.

In 1600 there were approximately 4,226 living species of mammals. Since then thirty-six (or 0.85 per cent) have doubtless become extinct; and at least 120 of them (or 2.84 per cent) are presently in some (or great) danger of extinction.

In 1600 there were approximately 8,684 living species of birds. Since then ninety-four (or 1.09 per cent) have doubtless become extinct; and at least 187 of them (or 2.16 per cent) are presently, or have very lately been, in danger of extinction. Of the single order Passeriformes (the "higher" singing birds), which with about 5,153 species in 1600 represented nearly three-fifths of the living birds, twenty-eight (0.54 per cent) are now extinct and at least seventy (1.36 per cent) presently in danger; of the rest, about 3,531 species in 1600, sixty-six (1.87 per cent) are now extinct and at least 117 (3.32 per cent) in danger.

To sum up: a hundredth of our higher animals have become extinct since 1600 and nearly a fortieth are now in danger. These figures apply to full species: geographical races – or subspecies –

¹ The expression "Linnean name" is used in celebration of the founder of scientific naming, Linnaeus of Sweden, and in preference to the usual expression "Latin name", not as an exercise in pedantry, but because nearly as many Linnean names are derived from the Greek as from the Latin.

of our higher animals have had a similar fate. Among the mammals whose species survive, at least sixty-four races have become extinct since 1600, and at least 223 races are still surviving but are included in the Red Data Book. Among the birds, 164 races have become extinct and at least 287 are presently endangered.

As will emerge, this is a state of affairs that is quite without parallel in the former span of man's life with nature, that is to say, in his less civilized history before 1600. What has happened to the mammals and birds since 1600?

It is not easy to measure, despite the fact that the files of the Survival Service Commission are much deeper and more complete for the mammals and birds than for any other animals or any plants. What we have tried to do is the following.

Every entry in the Red Data Book mentions the causes of the rarity (or extinction) of an animal as completely as the available information warrants. Not all the evidence is of the same value. Some of it is very deep. Some of it is slender. If some of it is obviously guesswork, we have ignored it. But most of our researches and investigations have given us at least leads and pointers, to the extent that in all cases we have been able to identify one or more of five main factors. These are:

Natural causes. Extinction is a biological reality: it is part of the process of evolution. The study of fossils tells us that before man came on the scene the mean life of a bird species was rather over 2,000,000 years, of a mammal species not much over 600,000. No species has yet "lived" more than a few million years before evolving into one or more others, or "dying" without issue. In any period, including the present, there are doomed species: naturally doomed species, bound to disappear through over-specialization, an incapacity to adapt themselves to climatic change or the competition of others, or occasionally some natural cataclysm of earthquake, eruption, flood, or the like.

Hunting. Pressure on species is exerted by the human hunter for food, clothing, sport, or scientific, quasi-scientific, or status-symbol collection, or as a means of "disease", "pest", or "vermin" control; or pressure as a consequence (usually not intended) of the control of other pests, particularly by poisons.

Introduced predators. These exist most commonly in areas colonized since 1600, where mammal predators particularly have been introduced (as in the West Indies, Australia, and New Zealand) to "keep down" the explosive populations of other introduced animals (for instance, rats and rabbits) and have readily turned their predatory attention to the native fauna.

Other introduced animals. Among these are species that have become supplanting competitors in the native habitats of the indigenous animals, or even crude habitat-destroyers (goats in Galápagos), or animals that have brought into the habitats diseases against which the native forms have had little or no resistance (for example, in the Hawaiian archipelago and New Zealand).

Habitat disturbance and destruction. These involve the modification, degradation, and sometimes total destruction of habitat, usually by humans, and most particularly through the felling of forests and the drainage of swamps, for timber, farming space, reservoirs, buildings, airfields, and many other purposes, even sometimes including recreation.

To arrive at some assessment of the relative importance of these main factors, we have awarded eight marks to each species on our list, and shared them in a proportion between the five factors based on our common-sense judgement of the evidence available. This has been a somewhat arbitrary process in cases where the evidence is slender; but we could not think of a better. Expressed as percentages of the total marks that fell to each factor, the results are as in the table opposite.

From this it appears that only about a quarter of the species of birds and mammals that have become extinct since 1600 may have died out naturally: humans, directly or indirectly, may be

Cause of extinction	BIRDS			MAMMALS
	Non-passerine (large)	Passerine (small)	Total	
	per cent	per cent	per cent	per cent
Natural	26	20	24	25
Human				
hunting	54	13	42	33
introduced predators	13	21	15	17
other introductions	—	14	4	6
habitat disruption	7	32	15	19
	74	80	76	67
	100	100	100	100
<i>Cause of present rarity</i>				
Natural	31	32	32	14
Human				
hunting	32	10	24	43
introduced predators	9	15	11	8
other introductions	2	5	3	6
habitat disruption	26	38	30	29
	69	68	68	86
	100	100	100	100

responsible for the extermination of the rest. Also, about four-sixths of the birds and five-sixths of the mammals presently known to be in danger of extinction may have come to their present state because of man's activities. Most, but by no means all, of these live or lived on islands, whose faunas (and floras) are far more vulnerable than those of continents to the influence of civilized man.

In 1965 fossil bones were found in Hungary belonging to our (probably) ancestral species, *Homo erectus*, in a deposit that was laid down in a shortish period of relaxation of the second principal advance (the Mindelian advance) of the European ice systems in the Pleistocene Ice Age. Radioactive and astronomical datings agree that this man lived about 470,000 years ago – nearly twice as long ago as the oldest known *Homo sapiens*, the famous Swanscombe fossil from Kent. The Pleistocene period is now generally agreed to have started well over 1,000,000 years ago, and has been characterized by a global climate far more fluctuating than at any time in the previous 10,000,000 years (or so) of Pliocene times. In the northern part of the Northern Hemisphere and in the southern part of the Southern Hemisphere the Pleistocene brought in a series of ice advances and retreats – in the north a succession of four major and up to a dozen minor ice advances, with warmer or even sometimes quite hottish periods in between. Some of these ice advances covered very large areas indeed of the northern continents.

There is no evidence, in fact, that we are “out” of the Ice Ages yet: many geologists think that we are living at present in no more than an “interglacial” period that started about 10,000 years ago and may continue for no more than another 10,000 or so before the ice returns.

Despite the climate's alternation of hot and cold in the Pleistocene, unlike any that had previously occurred (as the rock records show) for millions of years, the mammals and birds adapted themselves well to it – better than the flowering plants. After a beginning when a number of specialized Pliocene species and groups fell out, the Pleistocene fauna settled down to evolve in its own way, producing all manner of new genera and species, including some specialist forms and even giant species, and one highly successful species whose very success depended on its non-specialist adaptability – man: whose immediate ancestors are now believed beyond any reasonable doubt to

have evolved in Africa in the period between the end of the Pliocene about 3,000,000 years ago and the onset of Pleistocene glaciations in the north, with parallel dry and wet periods in Africa, about 1,000,000 years ago.

The stabilized Pleistocene faunas of all the continents are – or were – dominated by highly adapted big land animals, with which big predators and scavengers were associated. Huge elephants and rhinoceroses even became successfully adapted to life in the tundra where the under-soil was permanently frozen.

South America had its huge ground-sloths and glyptodons (super-armadillos); North America its super-elephants, super-bison, super-camels, and super-lions; even Europe its share of elephants and hippos and giant bison. All continents had arrays of giant birds: North America had the vast teratorns – the biggest birds of prey known to science; Europe had its Maltese super-vulture (last heard of at Monte Carlo 100,000 years ago or so) and a super-swan so big that it must have been flightless. Only Africa today – and perhaps for special and complicated reasons – still has a characteristic Pleistocene fauna; and that is now mainly in the national parks and game reserves: big elephants, rhinos, giraffes, vultures, and storks, and a galaxy of magnificent antelopes. The isolated lands had their Pleistocene heyday, too – Australia with giant marsupials; New Zealand with its moa fauna, the tallest (up to 12-foot) birds known; Madagascar with its elephant-bird (the biggest, half a ton) and super-lemur fauna. Even the isolated little Mauritius, Réunion, and Rodriguez islands in the Indian Ocean had their own flourish through (and after) the Pleistocene with their dodos and other curious flightless birds.

By general agreement among geologists and paleontologists (and largely to make definitions and meanings clear), the Pleistocene is considered to have ended “officially” a little over 10,000 years ago. The period we live in is called the Holocene – even if the ice may soon come back (using “soon” in the geological sense), and we may be still in the Pleistocene, in terms of irregular climate-changes. In terms of faunas, the Pleistocene really ended in Europe, perhaps also in most of Asia, more or less at the beginning of the official Upper Pleistocene over 100,000 years ago; in North America about 8,000 years ago; in the West Indies and Central and South America rather later than that; in Australia at the most twenty, but probably only a few, thousand years ago; in New Zealand after A.D. 950. The main reason why the Pleistocene fauna, as characterized by its more exaggerated and highly adapted (and therefore vulnerable) elements, collapsed in these different places at different times seems to be a simple one: the coming of man the hunter, Stone Age man – in the case of the Indian Ocean islands, civilized man.

Now, the Pleistocene fauna has not yet departed from Africa, or rather from the continent south of the Sahara that is the home of the present Ethiopian fauna (this fauna extended sometimes to France up to Miocene times, perhaps 20,000,000 years ago). Yet it was in Africa that man evolved in the Pleistocene period, from higher apes. Is there a paradox here? Probably not. As man evolved, the Pleistocene fauna of Africa evolved with him, and developed defence adaptations as he rather quickly became the most intelligent and skilful hunting animal the world has ever known. Very probably Stone Age man destroyed some large African species; but he did not destroy the Pleistocene fauna. It was when man became an armed invader of new faunal areas that their faunas, without such adaptations, became decimated (in some cases literally so, or more than so).

Sapient man of our own kind was, as we have seen, in Europe about 250,000 years ago. The heavy Pleistocene elements disappeared as his skills improved; the forest elephant and hippopotamus and perhaps the giant vulture about 100,000 years ago; the forest rhino not long afterwards. The bird fauna was already a modern one: of the Pleistocene types, only the French sarus crane and the cave chough lasted until the late Pleistocene times of the sophisticated Magdalenian cave men. The

giant deer lasted beyond the official end of the Pleistocene up to the Iron Age. The other last big animals (apart from bison and aurochs) retreated to Siberia, where the last mammoths and woolly rhinos, tundra-adapted, probably survived until the last glaciation, when a warm spell made it too boggy for them to range in the summer.

The impact of man upon the animals of America was much more sudden and sweeping.

The great Rancho la Brea fauna fossilized in the asphalt tarpits of Los Angeles is the most complete and the best worked out array of its kind in the world. As we now know from carbon dating, it survived, at least in part, well beyond the official end of the Upper Pleistocene 10,000 years ago. It is now certain that the earliest Amerindians reached North America at least 15,000 and possibly (or even probably) over 30,000 years ago – that is to say, in the Upper Pleistocene – and rather quickly penetrated to what is now the western United States.

Early man in North America encountered a Pleistocene fauna. From the evidence of the Rancho la Brea tarpits, his bones and atlatl darts are associated there with the fossils of early prehistoric or Holocene age.

Now, of fifty-four different species of mammals in the la Brea tarpits of Upper Pleistocene to prehistoric date (at the broadest from a little over 18,000 to a little less than 4,500 years ago), twenty-four, or nearly half, are now extinct; and of 113 fully identified birds twenty-two, or nearly a fifth, are extinct.

Gone now, amongst others, are the huge dire wolf; the short-faced coyote; the vast short-faced bear; the big sabre-toothed cat, *Smilodon*; the giant lion (or jaguar), *Panthera atrox* (the present lion in linear measurements plus a quarter); the super-camel or super-llama, *Camelops*, 7 feet at the withers; the American mastodon (6 feet 3 inches); the imperial (10 feet 8½ inches) and Columbian mammoths; and the greater (huge), middle, and lesser la Brea ground-sloths. Gone these are indeed; but it seems certain that they did not go until after the coming of man.

Gone too are Rancho la Brea's peculiarly Pleistocene birds, many of them also giants. Nearly all the great latest-Pleistocene birds of North America that we know of are represented in the Rancho la Brea fauna, including all the remarkable extinct birds of prey of that time. From the regions in which their fossils have been found, we can be sure that at least a dozen of them survived to early human times. The asphalt stork was evidently the New World representative of our Old World white and black storks, and stood, on slender limbs, about 4 feet 6 inches high. The extinct la Brea turkey, or ground-fowl, was a robust bird not unlike the surviving ocellated turkey of Mexico that, from the abundance of its bones, must have been the commonest game bird of what is now the Los Angeles district in la Brea times.

Of the great Rancho la Brea raptors, the largest was Merriam's teratorn, which had a 12-foot wingspread and an estimated weight of 50 pounds, and which was doubtless a scavenger on the corpses of the giant mammals. *Teratornis merriami* may have persisted until the tarpit faunas of about 4,500 years ago. Its congener (member of the same genus), the incredible teratorn, *T. incredibilis*, which, with a wingspan of 16 to 17 feet, was the largest soaring bird of prey yet known to have lived, survived not quite so long – in Nevada, until the Upper Pleistocene.

Most important of all among six other birds of prey of Rancho la Brea, for the simple reason that it is (just) with us, and a Red Data Book bird of the Survival Service Commission, was *Gymnogyps*. Males of the California condor (and there are about twenty of them left alive) run to a wingspread of 9 feet 7 inches and a weight of 23 pounds. The California condor, *Gymnogyps californianus*, and what is probably its rather bigger direct ancestor, *G. amplus* (the transition from one species to the other, if separate species they really were, seems to have taken place around the official end of the Pleistocene 10,000 years ago), in Pleistocene years ranged west of the Rocky

Mountains from the border of Washington and British Columbia in the north to that of California and Mexico's Lower California in the south; also in a great strip across the southern states from New Mexico through Texas to Florida. By the time the modern Americans had opened up the West, it had retreated west of North America's great Rocky Mountain spine. To cut a story short, it was confined to a few counties of California with a population of about sixty in 1947; by 1963 was nesting and roosting in but two California counties; and between these two main years of survey (on behalf of the National Audubon Society) had been reduced to a world population of only about forty-two (see p. 198).

To bring the story of the California condor up to modern times has been a digression. Only in the last forty years has the Upper Pleistocene presence of man in America been confirmed, and only lately have archaeologists and paleontologists begun to collate his hearths and flints and other remains with the last of the North American mastodons and mammoths, big tortoises and birds. With the success and spread of carbon dating, the collapse of the North American Pleistocene super-fauna has been narrowed down to a period of between 11,000 and 8,000 years ago; which makes it very sudden. Only a few of the big extinct mammals and birds held on longer. The period of "Pleistocene over-kill", now recognized as a phenomenon that has occurred at one time or another all over man's realm, which means all over the world, was short in North America, and marches with the development of the sophisticated flints of the Clovis and Folsom cultures, tools quite effective enough to kill and butcher an elephant.

New Zealand's higher vertebrate fauna has naturally consisted almost entirely of birds, which had a remarkable adaptive radiation into mammal niches, the great order of the moas taking the place of big grazers. When the first humans - Polynesians - discovered the main islands and the offlying Chatham Islands in about A.D. 950, they were confronted with an array of classic Pleistocene quality, an indigenous bird fauna that can be guessed, from the evidence of the fossil and living examples, to have been over 150 species. Before Captain Cook's time, the Polynesians had killed off at least twenty species of moas, and shortly after the European discovery the last one was killed, on South Island, in the late eighteenth century. The Polynesians and the Europeans (who helped a little towards the end) killed off about a third of the birds of the islands. The fact that the present nesting fauna of the islands is up to about 147 is the consequence of thirty-five successful introductions of non-native birds by the Europeans, and eight known natural colonizations in European times. At least forty-three New Zealand species have been globally lost since the Polynesians arrived, nine of them since 1600. Both families of the moas have been totally exterminated, and with them two flightless geese, a great swan, a great eagle, flightless rails, interesting passerines like the extraordinary huia (this, early in the present century). At least a dozen surviving New Zealand birds are in the Survival Service Commission's Red Data Book. A few, like the famous flightless rail, *Notornis*, the takahé (p. 231), seem to be holding their own under close protection. The very status of others (that is, whether surviving or extinct), like the piopio, or New Zealand thrush (p. 301), and the New Zealand laughing owl (p. 261), is still mysterious. New Zealand is blessed with energetic and skilful ornithologists; but it is a rugged country to work over, and the competition of the introduced exotics may be an important cause of the rarity and "pocket isolation" of the ancient indigenous song-birds at least.

In Hawaii, a still further isolated archipelago, even more exotics have been introduced than in New Zealand. Here the old fauna does not seem to have been destroyed by the first Polynesian colonists, who probably arrived there before they discovered New Zealand. But the Westerners who arrived since Captain Cook have brought about the extermination of fourteen species, and have brought perhaps as many more to Red Data Book status. Destruction of habitat has been as powerful

as the introduction of disease and competitors. The status of many species now hangs in the balance, despite the efforts of the excellent farming and conservation authorities, and the watchful Hawaiian Audubon Society. There is a triumph here to report, though. The native Hawaiian goose, or *néné* (p. 189), with the help of a remarkable programme of captive culture in England at the Wildfowl Trust's Slimbridge and in Hawaii at Pohakuloa, and with the successful release of nearly 200 birds into the wild population, has been restored in numbers from its all-time lowest around fifty just over a decade ago to ten times that. The population of the Hawaiian duck (p. 192) is turning the corner, too; and the Laysan teal (p. 195) is now flourishing both on its isolated home at the western end of the long Hawaiian chain, and in captivity.

Stone Age man, then, has been a fauna-extermiator. If we narrow the period of Pleistocene over-kill in North America to 3,000 years, we can find with some reasons that in or around that time about fifty mammals and forty birds may have been extinguished at most: that is to say, not more than three every century on average. Between the Polynesian colonization of New Zealand in about A.D. 950 and Cook's first voyage there in 1769, about thirty-six species of birds (there were no land mammals save rodents and bats) were extinguished – not more than one every twenty years on average. Since 1769 seven more have gone, or about one every twenty-seven years on average. The world is not comparable with a part of itself; but it seems quite clear that on islands and in other specially vulnerable areas, where most of the modern extinctions have taken place and most of the Red Data Book animals are presently found, modern man has contrived to arrange an extinction rate even higher than that attained by an Old Stone Age community that discovered a fauna hitherto unknown to man. Of the ninety-four birds believed extinct since 1600, only the following became extinct that lived on continents: in Asia the pink-headed duck (1944), the Himalayan mountain quail (1868), Jerdon's courser (1900), and the forest spotted owl (c. 1872); in North America the Labrador duck (1875), Cooper's sandpiper (1833), the passenger pigeon (1914), the Carolina parakeet (1914), and Townsend's bunting (1833). All the others have become extinct on islands large and small, particularly in New Zealand, Hawaii, and others of the South Seas, the Mascarene Islands of the Indian Ocean, and the West Indies. In the West Indies, from fossil and other evidence, we can calculate that the average expectation of total "geological" life of the larger bird species was about 180,000 years, before any humans arrived (much smaller than on the North American continent at the same time, owing to the specially fast natural evolution rate on islands). It was brought down to about 30,000 years by the aboriginal colonists in about 5,000 years of prehistoric times. It was brought down to a bare 12,000 years or so since 1600, after the establishment of the more sophisticated and civilized Western colonists. The pre-man bird species of Mauritius and Rodriguez in the Indian Ocean seem to have had a mean geological life-span of only about 6,000 years, from the fossils and their likely dating; these islands had no Stone Age phase, and their Western discoverers quickly brought the span, after 1600, down to about 1,000 years.

We have already seen that the suppression of fauna by man has been, and is, attained in several ways, and that hunting and habitat destruction are by far the most important and powerful. Hunting is our own society's almost ineradicable link with Old Stone Age times.

Hunting was the living of our species for 250,000 years or more, in which the Old Stone Age peoples learnt its art and tradition by trial and error. Masters of tools and fire, and, doubtless early on, of speech and pictorial art, the men of the Old Stone Age became food-gatherers, and skilful hunters of all things of the land and shallow waters, from shellfish to honey, from tubers to fruit, from sparrows to ostriches, from rodents to at least eight kinds of elephants and mastodons, rhinos, tapirs, bison, wild cattle, and huge deer. Hyena, wolf, cave lion, sabre-tooth, cave bear were their rivals at the top, and they learnt to master them, usurp their homes, share space and prey with them,

and dominate the hunting-grounds. At some time in their evolution, many Stone Age groups encountered the effects of their own Pleistocene over-kill and developed lore of totem, taboo, and self-denying ordinance, cropping and rationing rules. Inventions, often quite independent, carried them over thresholds of hunting power: bolas, hand-dart, spear-thrower, bow-and-arrow, throwing-stick, boomerang, blowpipe, stalking-horse, deadfall, trap, snare, net, decoy; and the domestication of the faithful dog and horse.

With the invention of methods of polishing and grinding stone to make tools for cutting tree and earth, our neolithic ancestors found it possible to settle, to let the nomadic rhythms of a purely hunting life cease or run down, to carve farms from the forests, plant seed, and become pastoralists. But even with metal, first copper and bronze and later hard iron, they never stopped hunting. Hunting became then a facet of their lives, not the main thing in their lives. Its rules and arts became more complex, and its practice began to have a class structure. In the Dark Ages of the early sophistication of iron, a trend began – to organize hunting as a noble pursuit: parks in the Dark Ages became conservation areas under rules in essence no different from (though cruder than) those that exist in modern African game reserves, or syndicate areas in Britain's pheasant woodlands, or in the hills and fields of Pennsylvania at the opening of the deer season, or the wetlands of Russia when duck-hunting begins. High hunting art, the more interesting because of its relative, and perhaps unconsciously fostered, inefficiency, reached its climax with the invention of falconry, probably in several countries quite independently; in the English Bronze Age; at about the same time, or a little earlier, in China (c. 2000 B.C.); and with a wonderful flourishing in Dark Age Persia and Arabia and Europe.

The painters of magical animals of the chase at Lascaux in France have left us what is doubtless the earliest surviving work of art, including a picture of a rhinoceros that can represent (unless the artist took remarkable liberties) none other than Merck's forest rhinoceros, a very close relation of the Sumatran rhinoceros (p. 114), which is not known from any fossil deposits younger than about 30,000 years! The Persian kings of old enclosed little wildernesses of hunting land and called them paradises, and the Norman kings of England did the same and called them parks and chases. The Zulu King Dingaan, himself no mean hunter of elephants and trader in ivory, established a protected game park years before the present game-park system was developed in Africa, north of the Umfolozi River, where today the square-lipped rhinoceros (p. 117) still has a headquarters. The Vikings of a thousand years ago or more established a sea-bird hunting culture in St Kilda and other parts of the Hebrides, and in Faeroe and Iceland, which still thrives in much of its old range (still shared by as many – or more – sea-birds), with very strict rules about the cropping season and the size of the "take". The northern world in America and Eurasia is networked with a complex array of public licence systems, and conservation areas both public and private, designed to foster hunting and at the same time the populations of the hunted; and the enlightened emergent nations are learning and copying and adapting the rules and experience with gratifying speed, especially in Africa.

The statements in the previous paragraph may appear to be somewhat disconnected. They have been so arranged deliberately, to show a common thread that runs through the history of hunting, woven from the facts that hunting has its atmosphere as well as its achievement, and that, even when it no longer supplies the main tribal or national protein, it continues to have, or indeed further refines, its complicated rules. It is when the rules are unknown, or lost and forgotten, or (as has happened lately) ruthlessly ignored, that a situation of over-kill develops.

We have seen that Stone Age people all over the globe attained the power to over-kill and extinguish at varying times in the Pleistocene and prehistoric epochs; and our ancestors learnt wisdom

from the warning. This wisdom appears to have been widely forgotten again in our later years of post-Renaissance exploration, and particularly since the Industrial Revolution, and the rapid refinement of guns and other hunting tools, in the early nineteenth century. The over-killing of the whales cleared huntable whale populations out of the Northern Hemisphere before that century had finished, and promises (p. 61) to do the same for the Southern Hemisphere before the end of the present century. The modern over-kills are "investment over-kills", with expensive tools and loaned capital behind them. Such investments of money and skill run contrary to the public good and even to the interest of the investments (without mentioning the future of the animal species concerned) unless they can be planned and controlled. In our late historical times such conservation forces as have been available have resembled a weak, unarmed police force in a town where looting is going on. In the past the looters have often looted until there was nothing left worth looting—witness the whale trade, the seal trade, the sea-otter trade, and some fisheries. The bird-plumage trade has been mostly stopped, before any species became badly endangered by it, but was stopped only just in time. Serious over-hunting persists in many parts of Africa and some of Asia and the Americas—not all of it for protein, some in the name of sport: though, in most of the northern world and much of Australasia, the conservation leaders are perhaps more likely than not to be also experienced hunting sportsmen. Many people, especially those brought up in industrial towns, cannot understand that the roles of hunter and conservationist can be compatible, far less that they have proved compatible in some countries for ages, and long before Renaissance thought. Many people still find it hard to understand that the ultimate protection of nature, and all its ecological systems, and all its endangered forms of life, demands a plan, in which the core is a management of the wilderness, and an enlightened exploitation of its wild resources based on scientific research and measurement.

The latest phase of over-hunting is not quite describable as over-kill, since its products are wanted alive. Private aviculture all over the civilized world has multiplied in the last three decades by geometrical progression. There were about 526 zoos in the world in 1965, the number having doubled since 1946! This fantastic increase is largely due to the escalation of roadside menageries, many of which may never attain the standards and rules of the mainstream zoos, whose relation with the Survival Service Commission is excellent. The wholesale trade in zoo animals, involving illegalities and smuggling on its seamy side, is now turning over millions of pounds annually; and it concerns conservationists and opponents of cruelty to animals very deeply indeed.

Perhaps in the long run the over-kill of the over-capture (for it amounts to over-kill) will be controlled and prevented. That is what the I.U.C.N. is for. But the main battle is now, beyond any doubt, in the ecological field of habitat maintenance. It can of course be truly said that ever since New Stone Age times man has altered his environment deeply, with his power to cut down forests and drain wetlands. When the first men shortly reach the moon, they will probably be able to see the forest slashes of the last century with the naked eye, so accelerated have been the environmental changes of the Industrial Age. Already habitat destruction has contributed a significant share of the extinctions and endangerments of species since 1600. In the future, unless controlled, it may contribute an even greater share. In some tropical forest areas, of which the Philippines and Colombia are examples, lumbering has almost run wild: few scientists have been available to monitor and measure its effects, but insofar as they can be measured they are deplorable.

This book has been compiled from I.U.C.N. files as dispassionately as its compilers could find possible. Confronted with a list of species on the verge of extinction, and the high likelihood that three-quarters of them have become so because of man (and thus avoidably), a certain amount of rage might seem justified. Rage, however, does not cure. We hope that we can arouse righteous

indignation with the accounts in this book, which are as true as we, and our many helpful naturalist friends and correspondents, have been able to make them. By the very act of buying it, our readers are supporting the cause of international conservation. We hope that our readers will be able to do more: join their local and national nature conservation societies, if they have not done so already; support their national sections of the International World Wildlife Fund; and help the I.U.C.N. and its Survival Service Commission, beyond the stage where its members and staff have to count the stamps, think twice before telephoning, and hitch-hike to conferences and field programmes. We need more time and power and money to learn, teach, persuade, and dissuade.

J.F.

MAMMALS

Order MARSUPIALIA

Family Dasyuridae: dasyures, etc.

THYLACINE or TASMANIAN "WOLF"

Thylacinus cynocephalus

Largest of the living carnivorous marsupials, the thylacine shows with remarkable clearness how groups of animals can evolve in parallel. Creatures widely separated across the world may, when similar in habits, grow to resemble each other in appearance to an astonishing degree, if only superficially, even though they have evolved from entirely distinct stocks and under different conditions.

The discovery of the fossil remains of *Prothylacinus*, an animal almost identical with the living thylacine, in Miocene beds near Santa Cruz, is of particular interest in this connection, since it lends support to the theory that the thylacine reached Tasmania in warmer times by way of an antarctic continent linked with South America and Australia. On the Australian mainland no evidence of the animal has been found farther north than Victoria.

The Linnean name of the thylacine means "pouched dog with wolf head": a very apt description of the animal. Its general build is extraordinarily wolf-like, most so in its relatively large, squarish head. Its jaws are remarkable for their very wide gape, opening almost to its ears. Its teeth are similar to those of the dog family: and, like the African wild dog, the thylacine possesses no hallux or "great toe". Its tail is carried rigidly and cannot be wagged, and is also hairless and laterally compressed. At one time, not long after its discovery, the suggestion was made that the thylacine might be of an aquatic disposition. The pouch, a crescent-shaped flap of skin enclosing four mammae, opens aft, and the young are accommodated upside down; but, beyond the fact that three or

four are normally carried in a female's pouch, little information is available on the animal's reproductive biology.

Until the 1930s, various zoos in Australia, Europe, and the United States exhibited thylacines. When caught young, the animals adapted themselves well to captivity. They have lived in menageries up to nine years, but have never bred; the Hobart Zoo (now defunct) had several in captivity about 1930, but used them for exchange and made no attempt at breeding.

The animal is about 1 foot 6½ inches at the shoulders and has approximately seventeen transverse chocolate-coloured bands on its back, principally on the hind quarters. These stripes were the reason why the thylacine was dubbed "tiger" or "zebra wolf" by the early colonists. This zebra pattern is unusual among mammals. One of the few other animals to share it is the banded duiker (or zebra antelope), in West Africa; another is the numbat (p. 22).

The thylacine is almost entirely nocturnal, spending the greater part of the day in its lair and emerging at dusk to hunt. Its natural food includes wallabies and smaller marsupials as well as birds and small reptiles. When in pursuit of its prey it runs in a somewhat dog-like manner, but not as fast as a dog. It is said to follow its prey by scent at a steady trot, giving a final burst of speed when the quarry shows signs of exhaustion. Early reports said that, when really hard pressed, the thylacine would sometimes bound along on its hind legs much like a kangaroo.

The extinction of the thylacine on the Australian mainland probably came about through the agency of the dingo introduced by early aboriginal colonists. This feral domestic dog is a more successful animal with which it could not compete. The thylacine was still

plentiful in Tasmania, however, no more than a century ago. As settlement increased, it acquired a taste for mutton and inevitably came into conflict with stockowners, because of damage it did to their flocks. This resulted in a relentless campaign to exterminate the carnivore. It was killed at every opportunity and by any means, and was usually so damaged in the process that very few skins and little skeletal material have been preserved for scientific purposes. One man claimed to have killed twenty-four in a single day. Poisoning was tried, but was found useless because thylacines never returned to the same carcass. They were pursued with hounds (although old males generally proved more than a match for several), and were easily snared in traps baited with kangaroo meat.

Between 1888 and 1909 the animal was subject to a Government bounty of £1 for each adult and 10s. for each sub-adult. During this period, and up to 1914, 2,268 thylacines are known to have been killed, but the actual number may well have been much greater.

At the same time the natural habitat was being "tamed" by farming activities, a factor that undoubtedly assisted the decline. A sudden rapid drop in numbers around 1910 is widely believed to have been accelerated by disease.

The westerly advance of settlement, extending from the central part of Tasmania, had the effect of driving the thylacine into the wild rough country in the western part of the state, where it now survives as a tiny remnant in comparison with the numbers that existed in the latter part of the last century. This region is mountainous, covered in parts with almost impenetrable bush, and intersected by numerous steep valleys and rocky gorges. It is a remote area, much of which is inaccessible and therefore free from molestation by trappers and casual shooters. The distribution of the thylacine within this region is presumably dependent on the occurrence of suitable prey species.

Here the thylacine has taken its last stand. Its numbers have declined so drastically that doubts have frequently been expressed whether it survives at all. During a series of investigations undertaken by the Tasmanian authorities shortly before the Second World War, evidence in the form of tracks indicated the existence of at least

half a dozen pairs, and the field studies covered only a portion of the area thought to be inhabited by thylacines. During the last twenty-five years individual animals have seldom been seen; but rare sightings do sometimes occur. There is good evidence that thylacines killed a few sheep in the Derwent Valley near Hobart in 1957. A young male was accidentally killed at Sandy Cape on the Tasmanian west coast in 1961. An animal (possibly a female with pups) used an old boiler as a lair at Mawbanna in the north-west in 1966. The animal is now known to exist in the Cradle Mountain National Park, and other sightings have been made in widely scattered localities, including the Cardigan River, the far north-west coast, and the Tooms Lake region.

The thylacine is now fully protected by law. There are heavy penalties for killing it in any circumstances. The responsible authorities are very conscious of the need to do everything possible to safeguard this interesting marsupial, and the Animals and Birds Protection Board, Hobart, has long been pressing for the establishment of a thylacine sanctuary in the large area lying to the east of Macquarie Harbour. Early in 1966 approval was given to the proclamation of a game reserve of 1,600,000 acres, known as the South-West District, extending from Low Rocky Cape to Sprent, to Kallista, and thence to South-West Cape. Cats, dogs, and guns are now prohibited in the region. The new reserve embraces a large part of the area in which the animal is believed to have survived in the greatest numbers, and where it is least subject to interference. The proclamation of the South-West District is a significant development in retaining a large area of habitat, not only for the thylacine but also for other indigenous fauna, including the rare Tasmanian race of the ground parrot, *Pezoporus wallicus leachi*.

RUSTY NUMBAT

Myrmecobius fasciatus rufus

One of the two races that constitute the numbat species (which is the sole representative of its genus), the "typical" one - *M. f. fasciatus*, the western numbat - occurs in south-western