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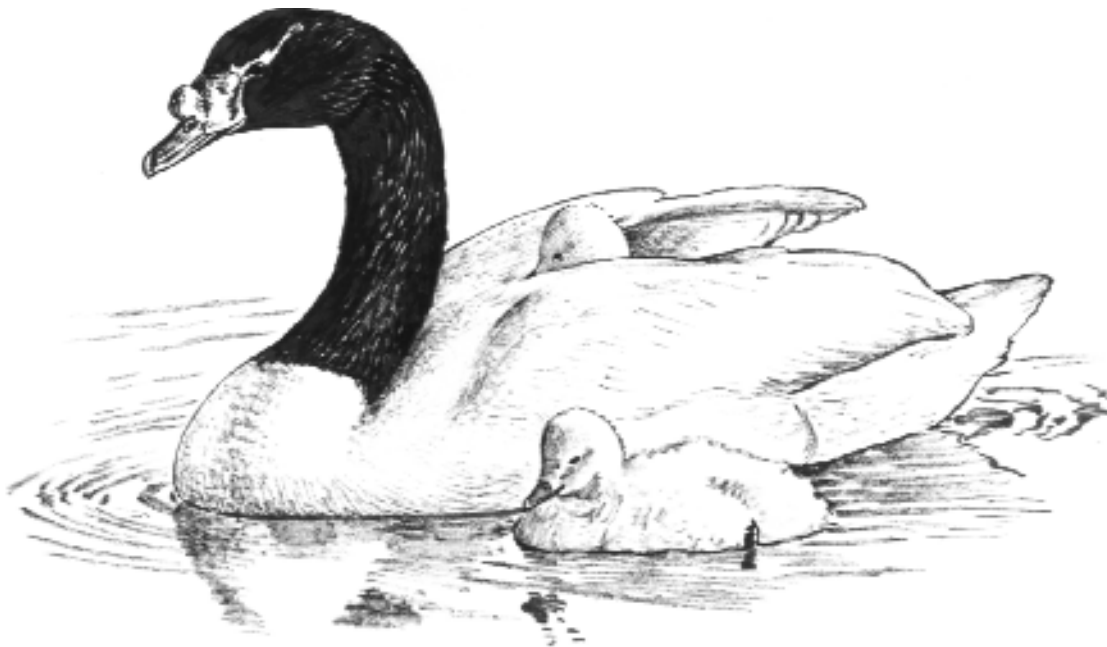
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Plan of the book



The book contains two parts spread over two volumes. Part I consists of eight general chapters, contained wholly within Volume 1, while Part II is composed of 165 species accounts split between both volumes.

PART I

After a general introduction, Chapter 2 deals with wildfowl Taxonomy and Systematics. A listing and discussion of fossil Anseriformes can be found in Chapter 2, but the taxonomic status of all extant tribes precedes their treatment in Part II. There are then five chapters dealing with aspects of life history, and a final

chapter on Conservation and Management. Figures and tables in Part I are numbered according to the chapter in which they appear, i.e. Figure 1.1, Table 2.2, Figure 3.1 and so on up to Chapter 8.

PART II

The species accounts describe the screamers, ducks, geese and swans in detail but, in an effort to save space, the accounts in Part II have been condensed. A multiple-authored book of this kind is hard to control minutely, and the treatment given to the species is not uniform. Authors obviously differ in the emphasis that they have chosen to give to the

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various sections—they were encouraged to write at greatest length about those aspects of the bird's biology that they felt were crucial, unusual or where research findings were recent or unpublished. Where information is readily available elsewhere, the reader is referred to that source. In a few cases, where there is a wealth of relatively new information, it seemed sensible to have separate accounts of subspecies, as with the two races of the Tundra Swan (the Whistling Swan and Bewick's Swan), and the South Georgia and Brown Pintails. On the other hand, the Eurasian and American Green-winged Teal was split by the British Ornithologists' Union (but not by the American Ornithologists' Union) into two species while the book was being written and, as relatively little is known about differences between the two, they are dealt with in the same account. Figures and tables in Part II have been given the prefix 9.

Nomenclature

Jim Peters's *Checklist of the Birds of the World* (1931), of which the section on Anseriformes was revised by Paul Johnsgard in 1979, was used as the source of most of the species citations. This citation is given beneath the title of every account; the type locality (where the described specimen was found) is on the next line, plus any comments; the author and date of the genus name (if different from that in the main citation, and if this is the first species within that genus) are on the following line. As an example, the Canada Goose *Branta canadensis*, which is the first *Branta* goose to be dealt with, reads thus:

Anas canadensis Linnaeus, 1758, Syst. Nat., ed. 10, p. 123

Canada; City of Québec suggested

Branta Scopoli, 1769

For the etymology of scientific names, Jobling (1991) was the usual reference, while Lockwood (1984) provided interpretation of vernacular names in the English language. Scientific names of plants and animals that are not wildfowl are given at the first mention in Part I and, again, on first mention in Part II.

Sequence and taxonomy

The decision about which sequence to use in listing the species was not an easy one to make. Current work on DNA is altering earlier ideas on taxonomy, but many of the findings are still not published, nor subject to critical review. We have, in general, followed the sequence and major groupings of Brad Livezey (1997b) except where recent work has suggested other evolutionary pathways, for instance, in the position of the stiff-tailed ducks, Musk Duck and White-winged Duck.

Description

Male and female plumages are described, sometimes rather briefly as full treatments are available in earlier publications. Nonbreeding plumages, usually of the male, are dealt with under MOULT. Immature plumage is also described, as is the downy cygnet, gosling or duckling.

Voice

No sonograms are drawn, but where these have been published elsewhere, the reference is given. Calls that are rendered phonetically are printed in italics.

Measurements

Weights and measurements of wing, bill and tarsus of live wild birds are given where these are available; if captive birds or skins have been used, this is stated. Some of the information on egg size and weight, and on the weight of newly hatched ducklings, was collected from captive birds at WWT, and is previously unpublished—again, it has been used where there is a shortage of data from the wild. Weights are in grammes, dimensions in millimetres and standard errors indicated, unless stated otherwise. Body length measurements in the section on 'Field characters' are from Delacour (1954–64) and Madge and Burn (1988) or, in a few cases, are original.

Displays

As is usual, ritualized displays have their initial letter capitalized.

Conservation and threats

Continuing favourable conservation status was important to all authors, but the emphasis that this section has been given varies. Where a species or subspecies has been listed recently as in danger

of extinction by BirdLife International or the Threatened Waterfowl Specialist Group, this is indicated.

References

The references contain the papers, books, theses and other publications cited in the text. Major publications on the wildfowl group are fairly numerous and all are referred to; readers should consult them for details of earlier work.

1

Introduction

Janet Kear

Wildfowl (often called waterfowl in North America) consist of the ducks, geese and swans which, with the screamers and Magpie Geese, make up the avian order Anseriformes. It is a large order, divided unequally into the suborder Anhimae, or screamers, and the suborder Anseres which, in turn, is divided into the unique Magpie Goose within its own subfamily, tribe and genus, plus all the others in a single huge subfamily called the Anserinae (Livezey 1997b). The Anserinae are diverse in form so that although most species, in comparison with most songbirds for instance, are large, they vary from the small pygmy-geese (a female African Pygmy-geese may weigh as little as 260 g) to the swans—among the largest of flying birds. The clearest feature in their evolution is that species within the group seem to become better and better adapted to living in and on water. However, the picture is complicated by the fact that diving, as a method of foraging, has evolved a number of times. The protection that water can give from land-based predators means that, unlike most birds, the Anserinae can manage a simultaneous moult of wing and tail quills that renders them flightless for three to four weeks annually.

A factor that unites wildfowl is their dependence on wetlands at various stages of their lives. These productive habitats are under threat in many parts of the world through the increasing demands of human beings for whom water has become a diminishing and precious resource. Wildfowl are among the most obvious indicators of the richness and diversity of wetland habitats; they are at the top of the wetland food-chain, and are peculiarly susceptible to disturbance, pollution, drainage and development.

Most ancient human communities arose alongside wetlands (Coles and Coles 1989) where the presence of water met a basic need, and fish and fowl were crucial dietary items. Today, wetlands continue to supply food, water storage, flood control, the stabilization of shorelines, retention of chemicals, sediments and nutrients, wildlife habitat, recreation and aesthetics. They are defined in the Ramsar Convention (which is more fully covered in Chapter 8) as 'areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed 6 m'. As a habitat, wetlands occupy only a small part of the Earth's surface but biodiversity and rates of endemism in these areas are high, and many plants and animals live only in freshwater ecosystems. Wetlands are as variable as the wildlife that occupies them; their dynamism means that classification and definition are difficult, and will depend on latitude, altitude, water chemistry and underlying geology (Finlayson and Moser 1991). Definition is complicated further by the fact that American usage often differs from European (Mitsch and Gosselink 1993). Some examples of wetlands and of the types of wildfowl that they support are described below.

The arctic *tundra* of the northern hemisphere is a vast, generally flat, treeless region with underlying permafrost. It is perhaps the wetland type that has been least altered by human activity. Its marshy surface is frozen for much of the year, but the spring snow-melt floods huge areas of low-lying river valleys, and shallow lakes and ponds become numerous. In the warmth and long days of summer, the

4 Ducks, Geese and Swans

tundra produces flushes of insects and protein-rich vegetation that are exploited by the young of a number of ground-nesting wildfowl, such as Whistling and Bewick's Swans, some of the smaller geese like the Brent Goose and Lesser White-fronted Goose, and by ducks such as Baikal Teal, Northern Pintail, eiders and scoters. The birds have in common a strong migratory habit and a short breeding season; they enjoy a relative scarcity of mammalian predators while nesting, but their offspring must grow and fledge rapidly in order to fly south, or move to the sea, before winter returns and the land freezes once more. In some years, when the arctic spring comes late, breeding failure is complete and no young are produced, so it is not unusual for population size to fluctuate markedly.

The *taiga* is the mainly coniferous forest that lies between the tundra and the steppes, extending from the Urals to Kamchatka, and across sub-arctic North America. Little that remains of the forest is entirely pristine; it has been felled, replanted and managed, and much has been replaced by agriculture. Predatory birds, mammals and a few reptiles are commoner here, and what trees there are provide nesting cavities that are more difficult for a predator to enter than an open nest on the ground. Breeding ducks of Eurasian woodlands include Mandarin, Smew, goldeneyes and mergansers. The females are smallish in order to make use of holes for incubation, and both sexes can fly among trees with ease, have largish eyes, webbed feet that are adept at perching, and sharp claws that can cling to tree bark. Within the *taiga*'s countless lakes, marshes and bogs are some of the world's famous waterbodies, such as Lake Baikal in the heart of Siberia, and Lake Kanka in the far west. Asia's 'duck factory'—the middle and lower basins of the Ob and Irtysh Rivers in western Siberia, covering about 1.8 million km²—is a summer home to many of the ground-nesting ducks that winter in the Mediterranean, the Middle East and the western side of the Indian subcontinent, and is comparable in productivity to the prairie pothole region of North America.

Peatlands or *mires* occur throughout the world, often underlying marshes, swamps, floodplains and coastlines. They are particularly common across

the northern regions of Canada and Russia, and form when decomposition fails to keep pace with the growth of vegetation. There are two types: nutrient-rich peat swamps that have a water supply that is additional to rainfall, and nutrient-poor bogs that rely only on local rain, are often acidic and dominated by *Sphagnum* moss.

Marshes have good supplies of fresh water and develop in low-lying, flat ground over mineral soils, and are dominated by reeds, rushes and sedges. They are found at all latitudes and were common in temperate Europe until the eighteenth and nineteenth centuries, when vast areas were drained for agriculture. The water level may rise and fall with the seasons, and is deepest after snow has melted on higher ground. Marbled Teal, Red-crested Pochard and Ferruginous Duck are typical European reed-bed nesters. In the US, marshes make up 90% of wetland areas, and the famous potholes of the prairies are depressions left from the last ice age that developed slowly into marshland. The stiftails are also marsh ducks that feed by diving for insect larvae living on the surface of the bottom ooze; these insects are often especially adapted to live with a rather poor oxygen supply and, like chironomids, are rich in haemoglobin.

Swamps are typically flooded for most of the growing season, and form over waterlogged soils. *Phragmites* is the principal plant seen in temperate areas, while large tropical swamps may be dominated by papyrus and cat-tail. American swamps often have trees standing in pools created by North American Beavers *Castor canadensis*, and Buffleheads, Hooded Mergansers and Wood Ducks nest within tree cavities. Screamers wade through the humid, tropical swamps of northern South America, taking emergent plants by grazing. Some deeper swamps of Africa, Asia and Northern Australia are home to the floating water-lilies whose buds and seeds provide food for pygmy-geese. Predators are common in tropical swamps, so many tropical ducks have both parents present to defend the ducklings until they are able to fly. Protein foods may be in short supply, and many young wildfowl grow slowly and are at risk of predation for a relatively long period.

Temperate *watermeadows*, especially temporarily flooded grassland, make valuable autumn and winter

feeding grounds for migratory seed-eating dabbling ducks. They dry out during the summer half of the year, and are then invaded by annual plants that grow rapidly and seed prodigiously before dying in the autumn as rainfall increases and the floods recur, thus providing quantities of food for ducks, many of which will have bred further north, such as Northern Pintail, Eurasian Teal and Northern Mallard. Nowadays, much short-term flooding is under human control, and increasing numbers of dabbling ducks of Asia, such as Baikal Teal and many whistling-ducks, use rice paddies, and other temporarily irrigated cultivated land.

Ephemeral tropical wetlands are typical of northern Australia with its unpredictable rains, sudden filling of dry lake beds and the germination of seeds that have lain dormant in the parched soil for years. As in temperate floodplains, plants grow quickly, flower and seed, invertebrates reach maturity and breed, and ducks fly in to make use of both. Australian wildfowl tend to have extended nesting seasons and, often, long-term pairbonds so that male and female remain close and can breed rapidly (within three weeks) if the right conditions occur. They also tend to be nomadic, moving with the rains, like the Wandering Whistling-duck and the Magpie Goose of northern Australia which, since wild rice was one of their natural foods, took to cultivated rice with enthusiasm.

Tropical *rainforests*, where birds in the canopy are particularly difficult to count, are where the cavity-nesting, tree-perching and sedentary White-winged Duck of southeast Asia, wild Muscovy of northern South America, and Hartlaub's Duck of west Africa are found. They are well camouflaged, which suggests that they may have evolved in the presence of aerial predators.

Large *lakes* are usually a sign of glaciation, and so are more common in northern regions than, for instance, in the Mediterranean basin. They are areas in which wildfowl may roost at night, safe from land-based mammals, or in which they moult and replace wing feathers during the flightless phase. If the water is fairly shallow, diving ducks such as Canvasback may find starch-rich roots on which to feed, Tufted Duck will take molluscs from the bottom, while the mergansers catch fish. *Reservoirs*,

dams and *borrow pits* are increasingly common in places where there were originally few stretches of open water, and are used frequently by adaptable species as roosts and feeding sites.

A linear stretch of *river* or *stream* may be claimed by territorial species, such as African Black Duck and Meller's Duck, and the turbulent white waters of the southern hemisphere by the even more aggressive Blue Duck, Salvadori's Duck and Torrent Duck. These ducks all have a disposition that is intolerant of close neighbours, and knobs on the 'wrists' of their wings with which to fight; they dive for an aquatic insect diet that, in the north, would be more likely to sustain fish of the salmonid family. The Harlequin is the only equivalent white-water diver of the northern hemisphere, feeding underwater on blackfly *Simulium* larvae and pupae. The banks of, and islands in, rivers and streams are selected by many riparian ducks that breed surrounded by flowing water, usually at rather low densities, such as the fish-eating Goosander (at 0.16 pairs per km), Red-breasted Merganser (at 0.03 pairs per km) and Brazilian Merganser (at one pair per 9 km) (Holmes and Clement 1996, Silveira and Bartmann 2001).

The interface between the sea and the land is seen in *estuaries* and *deltas*, *intertidal mudflats* and *saline lagoons* (the last particularly common in the non-tidal Mediterranean). These habitats include the tidal freshwater and saltmarshes that occur along sheltered temperate shorelines and which, by buffering storms, help to protect the hinterland. Saltmarshes are among the most productive of natural systems, with annual productivities that equal the highest levels achieved by agriculture. Tidal estuaries are also rich in organic food particles, and are therefore populated by invertebrate-feeding shelducks, or dabbling ducks taking floating seed from upstream vegetation. Many ducks, like the South Georgia Pintail, breed on freshwater, where their tiny offspring escape the burden of dealing with a high uptake of salt, but move to the coast in winter. Wintering Brent Geese feed primarily on algae and *Zostera* grazed from the intertidal mudflats, the Kelp Goose is another coastal grazer of seaweed, and the Cape Barren Goose feeds on turf kept short by sea spray. They must have active salt-excreting glands (explained further in Chapter 3),

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at least during that part of the year when they utilize a saltwater environment. In the tropics and subtropics, *mangrove* creates a shrubby and even forested tidal swamp upon which, for example, the West Indian and Lesser Whistling-ducks, and the grey teal group, especially the rare endemic Madagascar Teal, depend for cavity nests. Crocodiles *Crocodilus* are often an essential part of the mangrove habitat (Mitsch and Gosselink 1993), and present a predatory hazard for ducks and ducklings.

Shallow *coastal waters*, including sea bays and straits over continental shelves, are productive habitats that are also relatively safe from duck and egg-eating mammals. Many wildfowl roost at night, or moult their flight feathers, in shallow sea bays. The extinct diving Labrador Duck once fed in the tidal shoals, other divers such as Greater Scaup feed just offshore, and wintering Harlequin, eiders and scoters are found in deeper water—all are animal eaters, particularly fond of crustaceans and molluscs, as also are the steamer-ducks of South America. Again, salt will be taken in in quantity and must be got rid of; its extraction depending not just on the possession of efficient kidneys, but on supra-orbital glands that birds inherited from their reptilian ancestors. Sea-ducks tend to be medium-sized and well-insulated with a thick layer of body fat and dense outer covering of feathers, and take more than one year to reach full size and sexual maturity. They are vulnerable to oil spills and often get caught in fishing nets (Tucker and Heath 1994). A few inhabitants of the coast, such as the steamer-ducks of South America and the flightless teal of New Zealand, have developed permanent flightlessness and never grow their wings long enough to be able to fly (Livezey and Humphrey 1986, Livezey 1990).

Man and wildfowl

Man has interacted with and exploited wild waterfowl populations for many thousands of years. They are conspicuous, and favourite subjects for killing and eating, surveying, education, recreation and research worldwide; their taxonomy is more thoroughly studied than that of other bird groups, as is their ecology, and they are among the most admired for their beauty and for the mystery of

their migrations. Wetlands, the habitat on which they depend, have not stimulated the same degree of interest until recently (Finlayson and Moser 1991).

Domestication and farming

Man's interest in consuming wildfowl, as well as in using their feathers for warmth and their fat for lighting and heating, was behind their early domestication. Two goose species were involved, the Greylag Goose and the Swan Goose, and two ducks, the Mallard and the Muscovy. Features of all wildfowl domestication include large size, a reduced number of tail and wing feathers, flightlessness, rapid maturation, an increased clutch size, long breeding season, loss of 'broodiness' (so that the technique of artificial incubation becomes necessary at an early stage), loss of aggression, a polygamous mating system, and the laying down of abdominal fat.

The domestication of the goose

The goose and the Rock Dove were the first birds to be domesticated some 5000 years ago. All the important domesticated birds are seed-eaters or grazers that had an early association with humans through their raids on crops, and the goose is no exception. The eastern race of the Greylag Goose is likely to have been the ancestor of most domestic types; it breeds further south than the western race, is large, lays early in the spring and over a long period, has a grey cast to its feathers and a pinkish bill and eye-ring—all features of many farmyard breeds of geese. They were kept mainly for meat and oil (as early as the Egyptians, humans seem to have known that they could be force-fed to enlarge their livers), but also for down and feathers; they provided quills with which to fletch arrows, and for pens. Some dozen breeds have been developed; rapid growth is a feature of white breeds such as the Embden and Roman, while epicurean flesh and a larger egg supply come from the brown ones, such as the Toulouse. The Sebastopol Goose was bred for its curly feathers that were useful for filling pillows and quilts (Kear 1990).

Two domestic breeds of goose descend from the Swan Goose— the Chinese and the African. Their

flesh is less fat and, as they are more tolerant of warm climates, they are usually the type kept in tropical countries, and are found to be particularly useful as watchdogs, having retained a loud voice and acquired a greater inclination to use it during the course of domestication. Again, white forms are primarily kept for meat production and brown ones for their eggs.

Duck domestication

The Mallard has been domesticated for over 2500 years, the Romans initiating the process in Europe, and the Malays in Asia. Ducks, other than wild ones, were not included in lists of poultry sold in London until 1363 (when they were called 'tame Mallard'—the term 'duck' is not seen until 1528), and did not become common in the British diet until the 15th century. The Mallard has produced about 20 farmyard breeds in Europe, but many more in south and east Asia where 75% of all domestic ducks are kept. Those used for egg-laying are usually brown, while pale-plumaged varieties are farmed for their ability to grow and put on flesh quickly. Only five kinds of domestic Mallard have attained any degree of commercial popularity in the West: the Aylesbury (Figure 1.1), Pekin and Rouen have been developed for meat production, the first two being white, and the Khaki Campbell and fawn Indian Runner are excellent egg-layers. In all cases, the male in breeding plumage has retained the curly tail of his wild ancestor.

The Muscovy Duck was probably domesticated by the South American Indians of Peru as a pet; it had sentimental value but was also useful for its feathers, and for ridding houses of ants, flies, crickets and other insect pests (Whitley 1973). We do not know when it was first farmed but, by the time the conquistadors reached the New World, the Muscovy was already a household animal (Donkin 1989). Both the duck and its eggs were sometimes eaten but, unlike the Mallard, it was not changed much from its wild ancestor. The domesticated Muscovy is larger than its wild cousin and occurs in a variety of colours, although there are no recognized breeds. Muscovy drakes will cross with females of Mallard-type domestic ducks, producing sterile offspring that mature fast. These 'mules' have



1.1 Aylesbury Duck—bred for its white plumage, large size and for its meat.

been bred commercially in France since the middle of the 19th century; they are lean-breasted birds, the males of which can be force-fed for *pâté de foie gras*, while the females are killed for their breast filets (Kear 1990).

Farming of the Mute Swan

The Mute Swan was semi-domesticated in Europe for its meat and feathers, and pinioned (the joint of one wing tip being removed before the young could fly) for easy control. Pinioning must have restricted the natural choice of mate somewhat, but humans never interfered to stop particular pairs breeding, never killed adult birds, and seldom selected between cygnets that were taken for the table. Almost all British Mute Swans were grounded for 1000 years or so, and yet maintained healthy populations—the sound of their wings in flight would not have been

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heard in Britain, and probably not on the continent of Europe, until the beginning of the last century (Birkhead and Perrins 1986). During the 12th and 13th centuries, any wild swans in Britain became 'owned' by persons with freehold land, and strays were pronounced to be the property of the Crown. They were seen as status symbols, whether alive or dead. No medieval feast was complete without a roast swan or two (up to 400 were sometimes eaten). They had to be young birds to have any gastronomic value, and the practice was to take the cygnets from their parents at 'swan-upping' and put them in special pits containing a pond, to be fattened on barley until Christmas or some other great occasion.

Ownership necessitated a system of marking with a lifelong label (Ticehurst 1957), and the soft tissue of the bill was found to grow scar tissue that remained until death. At swan-upping, all swans were counted, and the cygnets pinioned before they were old enough to fly and their bills marked if they were to be left to mature. An elaborate system of dividing the young between the owners of the parent birds was devised and a swan master, appointed by the King, oversaw the whole operation. As many as 630 swan marks were in use between 1450 and 1600; today, when we have different tastes in meat, only three royalties remain, but still any unmarked swans on the Thames belong to the Crown (Ticehurst 1957, Birkhead and Perrins 1986, Kear 1990).

Eider farming

Feather down is unique to wildfowl and only found in those species where the female incubates alone; in the case of some northern breeding ducks, this down is wonderfully soft and has superb insulating properties, so that the clutch retains its heat in the absence of the female and, perhaps as important, its moisture. Eider farming has been practised in Iceland for nearly 1000 years, the birds providing the material from which the finest eiderdowns are made. Common Eiders are firmly protected and nest in large colonies, 'belonging' to the farmer on whose land they breed. As the down is extremely valuable, farmers encourage their visitors in a variety of ways. Stone slab nesting boxes are provided on the ground, with a slight hollow underneath,

and here the female lays her eggs. Predators, such as Arctic Fox *Alopex lagopus* and the introduced American Mink *Mustela vison*, are kept at bay. Flags are erected to flutter in the breeze and indicate the position of the protected area (Doughty 1979). The suggestion is that the flags resemble the wings of gulls in whose colonies wild Eiders often choose to nest because their eggs suffer less predation if they incubate among a mass of other birds. Once the Eider has started to incubate, she pulls down from her breast to line the nest and to cover the eggs on a few occasions that she leaves during incubation. The farmer makes two collections of down, the first fairly soon after incubation has started (the bird replaces the lost down almost immediately), and the second after she has hatched and left with her ducklings. The first collection is the most valuable as the down is largely pristine, the second needs careful cleaning to remove adhering grass, eggshells and moss (Kear 1990). The annual down harvest may produce a substantial proportion of the farmer's income. The record amount seems to have been collected in 1915 when 4294 kg were gathered—the production of about 280 000 females (Doughty 1979). Currently, about 350 farms produce nearly 3000 kg annually; with prices around 6000 Danish kroner (£512 or US\$746) per kilo, which amounts to an astonishing market value of £1 536 325 or US\$2 240 422 (Hansen 2002).

Wildfowling

Many wildfowl, being relatively large and good to eat, are the prized quarry of hunters, and are a renewable resource of great economic value (Mitsch and Gosselink 1993). They became quarry many thousands of years ago. Fish-hooks, nooses, pitfall traps, snares, loops, bird-lime and flight-nets were all employed in order to catch wildfowl somewhere in the world. The driving and netting of moulting wildfowl, through the use of duck decoys (see below), and some other methods of catching ducks without the use of firearms, persisted well into the last century. At the end of the 1950s, it was estimated that 1 200 000 ducks were killed in an average winter season in the marshes around the Caspian Sea of northern Iran; shooting accounted

for only 9% of them (Savage 1963). The capture was mainly at night, by net, gong and flare. This method involves two boats; in the bow of the first burns a weak, flaring flame. Behind this stands a man with an elongated hand net, and behind him a companion who does the paddling. The second boat travels close by and contains a man beating a brass gong incessantly. Northern Mallard are the ducks most susceptible to this method of hunting; they wait for the boats to approach within a few metres and are caught as they leap into the air; the whole process is dazzling and bewildering, and resembles nothing that they have cause to fear. One team may take 600 birds in a night.

Royal Egyptian carvings and paintings first depicted the thrill and enjoyment of the wildfowling party. Here it was the throwing stick that was aimed skilfully at the neck of the ducks, mostly Northern Pintail, in order to kill them. Hawking has been around since the time of Aristotle, and captive Goshawks *Accipiter gentilis* and Peregrine Falcons *Falco peregrinus* (the falcon that the Americans call the 'Duck Hawk') were flown at wild geese and ducks. As with the Egyptians, this was done mainly for sport rather than for food, and hawking was indulged in only by the wealthy.

Guns did not initially improve man's success in killing wildfowl. The tedious business of muzzle-loading, shoving powder and a projectile down the tube or barrel with a ramrod, tended to ensure that the duck got up and flew away before the wildfowler was ready to fire. The invention of the breech-loading gun, which broke at a hinge and could be loaded near the ignition system, happened during the first part of the 19th century, and was crucial to the evolution of successful wildfowling. Developments in the philosophy of wildfowling gradually produced the idea that the surest way of killing 'cleanly', the hardest and therefore the most sportsmanlike, was to aim at flying quarry.

The modern definition of wildfowling in Britain is precise: it is the pursuit of legally taken ducks and geese below high-water mark with shot-guns. Dogs to retrieve the dead and wounded game, especially after dark, are an essential part of this tidal-zone shooting. The wildfowlers' favourite breed—the Labrador—was developed in the 19th

century as well. They sit by the hunter's side while the ducks and geese are shot, and are then sent out to collect the birds.

Wildfowling, though predominantly a male sport, is no longer the preserve of the rich. In the UK, membership of the British Association for Shooting and Conservation (BASC) stands at around 120 000 with over 1600 affiliated wildfowling clubs. Wildfowling takes part in wildfowl counts, create reserves and, typically, are far-sighted enough to realize that conservation measures ensure the continuation of their sport. In the US, the recreational hunting industry spends huge sums of money in local economies (estimated at US\$58 million for the Mississippi flyway alone) (Mitsch and Gosselink 1993).

Decoys

Before the development and subsequent easy access to guns, many human communities relied on catching wild waterfowl for food by rounding up those that were flightless. Inevitably, their carcasses were then in rather poor condition, with reduced muscle and fat. The Dutch decoy, invented 600 years ago but brought to perfection in the sixteenth century, was a sophisticated system for trapping plump and flying birds that depended, for its effectiveness, upon the mobbing response that swimming ducks show towards mammalian predators such as dogs and foxes. The word 'decoy' comes from a contraction of two Dutch words, *de kooi*, that mean 'the cage'. The device was a modification of a shallow pool, usually not more than 2 ha in extent and surrounded by quiet woodland, from which radiated up to eight ditches or 'pipes'—curved extensions of the pool covered with netting hung over semi-circular hoops. Along the outside curve of every pipe was a range of overlapping reed screens, higher than a man, that worked on the principle of a 'Venetian blind', concealing birds on the pool but enabling those under the netting to see the decoyman if wished. Connecting these high screens at ground level, and making in plan a zig-zag pattern, were shorter screens known as dog-leaps (Kear 1990, Karelse 1994, Heaton 2001). Considerable skill and knowledge of animal behaviour were

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required to operate the system. Wild flying creatures had to be persuaded to use the pond and then be enticed beneath the nets so that they could be caught. It must have been common knowledge among country people that ducks on water will swim towards and follow certain mammals moving on land, but it was a clever operator who devised a strategy for putting the birds' behaviour to use. Ducks respond to a range of mammals, and will approach stoats, squirrels, foxes and dogs; but only the domestic dog can be trained by humans to work at a distance. Traditionally, the decoy dog was small, fox-like, reddish in colour, with a bushy tail and a lively gait. The Dutch developed a special breed called a *kooikerhondje* which looks like a red-and-white, long-legged spaniel, and appears on paintings by artists such as Jan Vermeer (1632–75) and Jan Steen (1626–79).

The tendency to swim towards a dog or fox is related to the collective 'mobbing' response of many birds to a predator. The birds' action must have survival value, and an essential part of the performance is that the participants are not in any perceived danger; close pursuit of ducks by the fox is unlikely since mammals are inefficient swimmers and do not fly. Thus, the real hazard is the possibility of being surprised—of not realizing that the predator is there. Mobbing ensures that all members of the group are aware of the danger, teaches the inexperienced what the enemy looks like, and perhaps gets rid of the problem, causing the predator to depart rather than endure the 'embarrassing' attentions of the mob.

The decoyman first checks that there are sufficient wild ducks on the pond and then tests the breeze. Birds take off only into a wind, so disturbance near a pipe into which the wind is blowing means that the ducks turn back towards the pool and fly from under the nets. That is why decoy ponds needed more than one pipe if they were to operate in all weathers. The dog has then to be shown to the ducks at one of the dog leaps, to walk quickly down the pipe away from the ducks and the pool, disappear behind the next screen, and reappear at the next leap and so on until most of the ducks have followed it under the netting. The man in charge of the dog must, of course, remain

hidden until the right moment. When as many birds as possible have been drawn in, the decoyman appears at the outermost gap in the screen, behind the ducks. The ducks' retreat to the open pond seeming to be cut off, they fly into the wind down the narrowing pipe with the decoyman in pursuit, visible to them but not to the birds on the pond, until he has them caught in a funnel trap at the end. The method was highly successful. In 1790 Londoners alone were said to be consuming over 200 000 decoyed ducks in a season, and the annual take in Holland as late as 1952 was thought to be 300 000, of which 73% were Northern Mallard, 15% Eurasian Teal, 8% Eurasian Wigeon and 4% Northern Pintail (Kear 1990, Karelse 1994).

Two hundred years ago, decoys were common in many parts of Europe where there was a seasonal flight of ducks, for instance, in Ireland, Bohemia, France, Denmark and Germany, as well as England, Wales and The Netherlands. Modifications of the decoy system were also known as far away as Iran, Pakistan and Japan. A great decline in the use of decoys for obtaining dead birds for food occurred during the 20th century, as guns became readily available. In The Netherlands, the number of decoys dropped from about 1000 to the 118 registered in 1979 (Karelse 1994). In England and Wales, the number fell from 200 used for catching birds for market, to four still operating in 2002, but for a different purpose—research. In 1907, a decoy in Denmark was used for the first time to catch Eurasian Teal, not to kill them, but in order to release them individually marked (see Chapter 6). Four years later, in 1911, the first duck was ringed in a Dutch decoy (Karelse 1994). The majority of ducks ringed in the UK have been caught in restored decoys, starting at Orierton in Wales in 1934. The results obtained have been invaluable, and our knowledge of wildfowl migrations would be far less advanced had those few decoys not remained sufficiently intact into the latter half of the twentieth century (Kear 1993). Similarly, scientists studying duck migration patterns in The Netherlands have employed the country's historic decoys to catch ducks (Karelse 1994).

The word 'decoy', particularly in North America, nowadays refers to the carved or moulded

model ducks that float on water and entice birds to join them within reach of a gun. The verb 'to decoy' means to lead into danger, and derives from the flocks of domesticated and tame Mallard that were kept in decoys for this function. They were bred small, were often white so that they could be readily distinguished and passed over at the time of slaughter, and noisy since their task was to call their wild brethren from the skies. A female Call Duck, as the breed is known, is noticeably noisier than her wild ancestors. The Decrescendo call—*QUACK, QUACK, quack, quack*—that all female Northern Mallard give in late summer and autumn, apparently in order to summon an intended or absent mate, is especially loud in Call Ducks and very persistently uttered.

Aviculture

Man's admiration for ducks, geese and swans has meant that for many years they have been kept for their beauty and companionship rather than for their utility. They look better than other birds in captivity, and a cage is usually unnecessary and a pond appears so much their natural element that, even when rendered flightless by feather-cutting or pinioning, they need be neither obviously unhappy nor unsightly. Collections of pinioned wildfowl, such as those of the Wildfowl and Wetlands Trust (WWT), have played an important role in informing the general public about the needs of conservation, thus ultimately helping to ensure the safety of the wetland habitats on which their wild relatives depend. They also provide excellent subjects for investigation, and students have made use of these captive assets for research into displays and preening behaviour, calls, breeding performance, moult, disease, parasites and responses to stimuli such as daylength and temperature. It was aviculturists who first thought of providing hole-nesting ducks with artificial cavities in which to nest; the 13th Earl of Derby who, between 1831 and 1851, bred many wildfowl for the first time in captivity at Knowsley near Liverpool, provided his birds with boxes on poles. The provision of boxes is now commonplace for many wild populations in situations where natural holes are in short supply. Observations made in

wildfowl parks and zoos during the last half century were also fundamental to our understanding of ethology, and courtship displays have been used to determine taxonomic relationships (Lorenz 1951–53, 1979, 1991, Lorenz and Von de Wall 1960, Johnsgard 1965a).

Not all wildfowl are equally easy to keep and, among the keener aviculturists, there was in the past great competition to be the first to maintain and breed the rarest. Screamers and Magpie Geese are still unusual in bird collections, but when Magpie Geese were bred, some observations were made that would have been difficult in the wild; it was only after they had hatched young in captivity that it was realized that the adults fed their goslings—a most uncommon occurrence in any goose (Johnsgard 1961b). The smaller whistling-ducks were early favourites with aviculturists—West Indian and Black-bellied Whistling-ducks were kept in captivity before 1750, and the Fulvous Whistling-duck first bred at London Zoo in 1872. Many of their displays and breeding habits were described initially from studies of tame birds, and they were characterized as preferring to keep apart from other ducks. At temperate latitudes, however, they do not reach their potential life span, being vulnerable to the cold and with a tendency to get frostbitten toes in winter (Hillgarth and Kear 1982a).

Captive swans and geese have settled well and are long-lived, since grass and seeds form their natural diet (most cygnets and goslings are even reared entirely on plant proteins), and all species have bred in confinement. However, not all individuals of the small, high-arctic breeders, such as Bewick's Swan, Brent and Red-breasted Geese, will nest readily at the temperate latitudes of most zoos—the days never quite get long enough to stimulate the hormone cycles that the birds would experience in the wild (Murton and Kear 1973). The near-tropical Hawaiian Goose has problems of a different kind: they lay early when daylengths are short, but when the temperature is still cold at temperate latitudes, and females frequently suffer from egg-peritonitis (Kear and Berger 1980, Hillgarth *et al.* 1983). Gizzard worm *Amidostomum* problems can be fairly common in captive geese and sheldgeese, particularly birds at

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a juvenile stage, where they are kept on grass swards that have been used for many years. The larvae attach themselves to grass blades and are taken in by the grazing bird. The thread-like nematodes live beneath the horny lining of the gizzard; the lining can become severely damaged with a heavy infestation, and the bird fails to digest its food properly. Fortunately, routine prophylactic measures have been possible and the cycle of reinfection can be broken if the lawns are rested for a while.

Studies of sheldgeese and shelducks in captivity (Hillgarth and Kear 1979b) revealed that females tend to live longer than males, an unusual situation in wildfowl where sex ratios are often skewed towards males (e.g. Owen and Dix 1986, and see Chapter 5) and where, in captivity at least, males have greater longevity. This may be related to the common observation that the female shelduck is the dominant partner of the pair. Longevity seems partly related to body size, with swans on average living longer than geese, which live longer than ducks.

Mandarin Duck and American Wood Duck have such attractive drakes that almost every aviculturist wants to keep them, and they have a long history in captivity; the Mandarin has been kept in its native China and Japan for centuries. However, like the White-winged Duck of southeast Asia, they are particularly susceptible to avian tuberculosis (Hillgarth and Kear 1981) and, in captivity, frequently die before they reach middle-age. Avian tuberculosis is caused by a bacillus to which most humans are immune; however, interest in the disease has intensified recently because it can become pathogenic in those with HIV.

Seaducks, Kelp Geese and steamer-ducks that spend all or part of their lives on saltwater have generally not done well in confinement, and require special care if they are to survive on freshwater long enough to breed (salt is a natural disinfectant for many waterborne diseases). The Common Goldeneye was established as a captive breeder in 1909, Barrow's Goldeneye in 1937, but the Common Scoter, Harlequin Duck and Long-tailed Duck only nested successfully in the 1970s, and none breeds particularly freely in temperate zoos. Of the sawbills, the robust Red-breasted Merganser and Goosander have been more successful than the others. Aspergillosis, renal

failure and impactions of the gizzard tend to be commoner in captive seaducks than in other waterfowl; however, many of the internal parasites affecting seaducks in the wild, such as *Acanthocephala* and *Coccidia*, are absent because their secondary hosts do not occur. Even common freshwater parasite 'carriers', such as snails, tend to be eaten out of a waterfowl collection (Hillgarth and Kear 1979a).

Captive Ruddy Ducks bred (in their native US) in the 1930s, but the White-headed Duck, Maccoa, Argentine Ruddy Duck and Black-headed Duck not until the 1970s, so close research on captive birds was not possible until then (Matthews and Evans 1974, Carbonell 1983, Rees and Hillgarth 1984). The stifftails had the reputation of being difficult for the aviculturist, and were particularly hard to hand-rear, so that eggs were often left with their mothers to hatch. This resulted in escapes, as in the case of the Ruddy Duck in Europe which now threatens the genetic purity of the native White-headed Duck. Stifftails were found to be summer breeders in temperate wildfowl collections, with egg-laying seasons similar to the tropical whistling-ducks which tend to produce eggs on either side of the longest day in June, rather than only in the spring as in the majority of northern ducks (Morton and Kear 1978).

Since many wildfowl do adapt and breed fairly freely in captivity, there is potential for allowing the release of some species, whose populations are declining in the wild, back into their original habitats. Such reintroduction programmes are not easy to conduct, and only a few have been successful (some examples are examined in Chapter 8). Most aviculture must be seen as existing for itself; often it brings great pleasure, or provides research possibilities, or gives the public the chance to see the birds and habitats on which their taxes and entrance fees are being spent. Humans seem to find therapeutic value in having pets, and in feeding wild animals from the hand, especially when they are as attractive and responsive as cygnets, goslings and ducklings.

Cultural values

Ducks, geese and swans have inspired cultural expression in song, dance, language, poetry, prose

and art (Kear 1990). Their wetland habitat, on the other hand, has often had a bad press, being portrayed as dismal and dangerous, and the source of numerous human ills, including malaria. 'Swamped' and 'bogged down' are not situations that recommend themselves. Our attitudes are ambivalent, but are gradually changing, thanks in part to books on such watery and diverse subjects as Iraq's Marsh Arabs (e.g. Wilfred Thesiger's *Desert, Marsh and Mountain* and Gavin Maxwell's *A Reed Shaken by the Wind*), the European Otter *Lutra lutra* (*Tarka the Otter, Ring of Bright Water*), Water Vole *Arvicola amphibius* (Ratty in *The Wind in the Willows*) and an ugly duckling who was destined to become a beautiful swan. Mother Goose, who features in the title of collections of fairy-stories and nursery rhymes, is a family friend to whom we entrust our children.

Dutch artists of the seventeenth century captured, perhaps for the first time in Europe, the beauty rather than the darkness of wet landscapes. Painters such as Jan van Goyen (1596–1656), Jacob van Ruisdael (1628–82) and Meindert Hobbema (1638–1709) depicted the brightness of flat watery land under a reflected sky with unforgettable brilliance. Across the Channel in East Anglia, artists like

John Constable (1776–1837), who lived near the river Stour in Suffolk, and John Sell Cotman (1782–1842) of Norwich, continued the tradition. Constable's watermeadows seem essentially English, yet it is an England that has almost entirely drained away.

Peter Scott, founder of the Wildfowl & Wetlands Trust and himself a convert from shooting ducks and geese, produced many books and paintings that have been an inspiration, and helped to change attitudes. His legacy, in the form of WWT's nine wetland centres spread around the UK, and which have formed the model for similar centres in many parts of the world, continues to demonstrate the value and essential nature of wetlands and wildlife for people. Economically and aesthetically, wetlands and wildfowl are valuable to us and are worthy of study and conservation. This book details the lives of ducks, geese and swans—their travels, social behaviour, breeding and feeding habits, and the way in which their populations are controlled. The last chapter in Part I looks at some of the threats and conflicts that must be resolved if wildfowl and their wetland habitats are to have a future in our modern world.