

## Wildfowl distribution, conservation and research in southern Africa

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### Introduction

It is not generally known that the African Wildfowl Enquiry (A.W.E.) was formed in 1954, the year that the International Wildfowl Research Bureau (I.W.R.B.) came into being. The object of this paper is to provide a general background document and to focus international attention on some of the accomplishments and needs of wildfowl conservation and research in southern Africa.

### Physiography

Southern Africa is taken to include the territories of South Africa, Lesotho, Swaziland, Botswana, Rhodesia and South West Africa, as well as south-western Angola and southern Mozambique. Zoogeographically southern Africa embraces the whole of the African landmass situated south of the Cunene and Zambesi Rivers.

The main features of the subcontinent's topography are a relatively flat plateau, averaging 1,000 metres above sea level and occupying most of the central area, a steep escarpment and a narrow coastal plain.

The considerable elevation of the central plateau, especially in the east where mountainous country rises to above 3,000 metres, lowers the temperature, so much of the tableland interior has an annual mean of less than 18°C. The area is thus cooler than might be expected from its latitude, and can be regarded as temperate. By contrast, the eastern coastal plain as far south as Natal, and the lowlands of the Limpopo and Zambesi valleys are subtropical and tropical. In the south and west the subcontinent is washed by the cold Benguella current which maintains a cool coastal belt with annual means of the order of 16°C.

Semi-arid conditions are normal over most of southern Africa. Mean annual precipitation is about 60 mm. in the west and increases from west to north-east, exceeding 1,000 mm. in parts of Mozambique. Over the whole region, however, the mean is about 475 mm. In the extreme south-west the rainy season is in winter, with 75% of the annual fall (577 mm.) occurring between April and September. This south-western Cape area, also known

as the Winter Rainfall area, covers some 15,000 sq. miles and roughly 1% of the whole subcontinent. Over most of the rest of the region, the winters are cool and dry; the rains falling chiefly in summer. In between the winter and summer rainfall areas is a relatively narrow band of country that receives rain at all seasons.

Droughts, often enduring for years, are common. Dry periods may be succeeded by unpredictable years of over-abundance of rain. For the region as a whole, an average 20% deviation from the normal rainfall prevails. As the rainfall increases from west to east it becomes more reliable and predictable from year to year. Over much of the summer rainfall area the fall is in the form of heavy, short-lived thunder showers, often very local in effect. The average annual run off of the rivers is not proportionate to the average rainfall. In South Africa 91% of the precipitation is returned to the atmosphere by evaporation and transpiration; only 9% reaches the rivers. Evaporation generally exceeds rainfall by about three times. As a comparison between the semi-arid south and the well-watered north, total annual run off from all rivers in South Africa is about 42 million acre feet (272,368 Imp. gals.=1 acre ft.); this is exceeded by the Zambesi River alone.

### Habitat

Relatively few permanent natural waters thus exist in southern Africa. In the south and east, rivers draining the escarpment flow all year round, but the narrowness of the coastal plain and the mountainous country militate against the formation of wetlands for wildfowl. Such wetlands that do exist have a low overall biological productivity; a result of acidity, excessive silt-loading and other factors originating from the peculiar soil and rock formations affecting the watersheds. Only in north-eastern Natal and northwards into Mozambique does the well-watered coastal plain widen and flatten sufficiently to allow the formation of extensive, suitable habitat, such as permanent lagoons, estuaries, deltas, shallow lakes, marshes and temporary 'vleis', which are shallow depressions in which water collects during the rainy season (but see Downing (1968) for information on the use of the word 'vlei'). These areas support a rich com-

munity of subtropical and tropical water birds. Penetrating inland are the wide flood plains of the Zambesi and Limpopo, and lesser rivers. The few permanent rivers that empty into the Atlantic provide little of real consequence to wildfowl.

Situated in the north-central area of the subcontinent is the vast Okavango swamp—a complex inland delta covering some 6,000 sq. miles of *papyrus* and *phragmites* beds with open lanes of water. This swamp is fed by the Okavango River which normally dissipates its entire annual flow of 7.5 million acre feet through evaporation and transpiration from the swamp. Nearby the extensive marshes in the Caprivi Strip and the flood plains of the Chobe and Okavango Rivers provide additional thousands of square miles of prime wetlands. Farther to the north, and just beyond the geographical limits of our area, are the Barotse and Kafue Flats where the wildfowl population is to be counted in the hundreds of thousands—truly one of the greatest ‘duck factories’ and spectacles in the world.

Thus the major area of permanent natural water available to wildfowl exists in the north-central and north-eastern parts of the subcontinent. For the rest, there are no more than ten individual permanent natural waters each capable of supporting no more than a few thousand birds. However, the overall area of permanent water has been greatly increased by man, and continues to grow. In South Africa, for instance, artificial waters exceeding 200-1,000 acre feet in size alone account for some 4.7 million acre feet of water. And, among new impoundments and barrages the Orange River project will add another 6 million acre feet. When those on the Orange and the Pongolo are completed the dams in the country's rivers will contain 35% of the run off. When they are all full (a rare phenomenon), South Africa's 100 biggest dams have a surface area of close on 200,000 hectares and a combined shoreline of over 3,000 kilometres, longer than the country's total coastline. The creation of artificial lakes has been vigorous in Rhodesia as well—for instance, Lake Kariba.

These large-scale, man-made habitats have benefited particularly the so-called geese (*Alopochen*, *Tadorna* and *Plectropterus*) which, in the agricultural areas, do most of their feeding away from water. What is not generally recognised is that some of these river impoundments, and especially some of the future grandiose

schemes, destroy extensive natural flood plains which are seasonally of considerable importance to wildfowl.

Except in the north-central and north-eastern parts of the region, ducks are dependent almost entirely upon temporary and semi-permanent waters. These are mainly natural shallow-water vleis, but artificial habitat, primarily in the form of earth dams, for watering livestock and irrigation storage, is growing in importance. The dams improve in quality as they ‘mature’ with age and provide increased shelter and food for wildfowl. Much of the temporary habitat south of the Limpopo is reliable only in the better watered areas east of about 28°E., and in the winter rainfall area. In this connection, the highveld ‘pan country’ in the Transvaal, and to a lesser extent in the Orange Free State, is an important wildfowl breeding area. Essentially, pan country is grazed native grassland supporting many rain-filled shallow depressions. In the semi-arid Karoo, Namaqualand and the southern parts of South West Africa and Botswana temporary habitat is created erratically and mostly locally. Furthermore, the vleis generally are brackish and hence attractive mainly to species such as the South African or Cape Shelduck *Tadorna cana* and Cape Teal *Anas capensis*. In years of exceptionally good rainfall, however, much ‘new’ land is inundated and since the soils in many of these semi-arid areas are alkaline, the temporary waters are highly productive and capable of sustaining quite dense concentrations of species like the Cape Shoveler *Anas smithi*. Due to differences in run off and soil composition and structure, the vleis in southern and eastern South Africa are generally not as productive as those farther north. In the north-west, in northern South West Africa, a combination of favourable soil and fairly dependable rainfall makes for some productive, temporary habitat. The vast, and shallow, Etosha Pan (ca. 3,000 sq. miles) in addition to being very brackish, only fills completely in years of exceptionally heavy rainfall; it is thus not of very much importance to wildfowl (flamingos excluded, of course). Lake Ngami and the saline Makarikari Pan, in Botswana, also become full only in years of high flood. This happened in 1954 when Lake Ngami reached nearly the level recorded by David Livingstone in 1849. Irwin (in Smithers 1964) reports congregations of up to 500,000 Red-billed Teal *Anas erythrorhynchos* there in October 1954.

Most wildfowl habitat and wildfowl in southern Africa are thus found in a moderately broad band of country, with relatively high and seasonally dependable rainfall, extending from northern Natal up through Mozambique to the Zambesi River and from there westwards along the river plain and across to northern South West Africa. The greatest concentrations of birds occur in coastal Mozambique, northern Botswana and southern Zambia.

### Wildfowl

Of the 21 species of Anatidae indigenous to the Ethiopian faunal region, 16 breeding species occur in southern Africa. These are:

- Fulvous Whistling Duck *Dendrocygna bicolor*
- White-faced Whistling Duck  
*Dendrocygna viduata*
- South African (Cape) Shelduck *Tadorna cana*
- Egyptian Goose *Alopochen aegyptiaca*
- Cape Teal (Wigeon) *Anas capensis*
- Hottentot Teal *Anas punctata*
- Red-billed Teal *Anas erythrorhyncha*
- Yellow-billed Duck *Anas undulata*
- Black Duck *Anas sparsa*
- Cape Shoveler *Anas smithi*
- Southern Pochard *Netta erythrophthalma*
- Pygmy (Dwarf) Goose *Nettapus auritus*
- Comb (Knob-billed) Duck *Sarkidiornis melanotus*
- Spur-winged Goose *Plectropterus gambensis*
- Maccoa Duck *Oxyura maccoa*
- White-backed Duck *Thalassornis leuconotus*

In addition, European Shoveler *Anas clypeata*, Pintail *Anas acuta* and Garganey *Anas querquedula* occasionally reach the region, during the austral summer, as vagrant migrants from the north.

A small population of about 120 feral Mute Swans *Cygnus olor* has become established, mainly on two estuaries, in the southern Cape Province of South Africa. These birds stem from a few introduced from Europe into the area some 50 years ago. Apparently no other exotic wildfowl introductions have succeeded in southern Africa, though reports come in from time to time about wild Mallard *Anas platyrhynchos*.

There are, of course, no true geese — the vacancy being occupied by *Alopochen*, *Tadorna* and *Plectropterus*. There are no

specialised fish-eaters (for example mergansers). In short, the wildfowl community is entirely a freshwater one (though the Shelduck and the Cape Teal do make extensive use of saline estuaries). One species, the Black Duck, is virtually confined to streams and rivers. As a whole, the wildfowl feed on plants and invertebrate animals. It is possible that southern Africa's rich cormorant community (four marine, two freshwater forms), one *Anhinga*, one Finfoot (*Podica*) and a battery of kingfishers precludes the presence of fish-eating ducks. One final point is that southern Africa is not used by Palaearctic anatids. This is in marked contrast to the Palaearctic waders (*Charadrii*) whose migratory populations winter there in colossal numbers in both freshwater and marine habitats.

Winterbottom (1967) shows that the avifauna of the major marshes and lakes from Lake Edward in Uganda to St. Lucia in Natal, must be considered as a unit and that Ngamiland has the closest affinities with St. Lucia and with the Kafue Flats. Lake Chad and the Niger flood plain, however, appear to support a different and separate West African aquatic avifauna. In the extreme south of the continent the avifauna is again quite distinct. Winterbottom also distinguished an East African Tropical Aquatic Avifauna, having the following characteristic species: *Dendrocygna viduata*, *Thalassornis leuconotus*, *Plectropterus gambensis*, *Sarkidiornis melanotus* and *Nettapus auritus*. Other species are notably *Anas punctata*, *Anas erythrorhyncha* and *Dendrocygna bicolor*.

Thus it is evident that the major wetland areas in southern Africa are populated by a primarily tropical community of ducks. Over the rest of the region, and especially in the south and west, an essentially temperate community prevails. The dominant species are: *Tadorna cana*, *Anas capensis*, *Anas undulata* and *Anas smithi*. Also essentially a bird of cooler areas, but somewhat local in distribution, is the Maccoa Duck. It should be noted that where some of these species occur beyond our region to the north, they are also primarily inhabitants of temperate areas.

Comparing the tropical and temperate wildfowl communities in southern Africa, it emerges that the tropics have the largest number of species (and individuals). This is in contradistinction to the northern hemisphere where the tropical regions generally have fewer species. This serves to underline the relative paucity of

aquatic habitats in temperate southern Africa.

Finally, we are left with the Egyptian Goose, Black Duck, Red-billed Teal and Southern Pochard. In these species the tropical/temperate affinities are not quite as clear-cut. The Egyptian Goose, while perhaps more tolerant of low than high temperatures, is probably the most adaptable and catholic of all our wildfowl — it is the only species which breeds both north and south of the Sahara. The Southern Pochard, like its South American form apparently, is not as common in the warm tropics as in cooler areas. The same would seem to apply in the Black Duck. The Red-billed Teal is probably southern Africa's most abundant duck, occurring fairly commonly over the whole of the subcontinent, but attaining maximum abundance in the tropical and subtropical zones; it is out-numbered by the Yellow-billed Duck, Cape Shoveler and Cape Teal in the extreme south.

Whether thermal effect has a direct or indirect bearing on limiting range is not known. In fact, many ecological conundrums await answer. For instance, the Pygmy Goose, belonging to an essentially tropical genus, is reported to feed mainly on the plants and seeds of the waterlily *Nymphaea*. This plant, while widely distributed in southern Africa, is only really common and abundant in the warmer, wetter climatic zone. Further, in southern Africa at least, the Pygmy Goose has a clear preference for tree-hole nesting (*Zaloumis* in prep.), and woodland suitable for this habit is predominant only in the tropical areas. It is, of course, known to the aviculturist that *Nettapus* is sensitive to cold, but what is not known is whether temperature rather than food or nest site availability limits its range in southern Africa. Thus in Nigeria the species apparently must nest mainly on the ground (Pitman 1965). The Spur-winged Goose, while also a dominant member of the tropical community, does not display the same conservative attachment to the warmer and wetter areas. It is a common breeding resident in some of the coldest parts of South Africa, particularly the high altitude grassland areas fringing the Drakensberg mountains. In recent years it has increased and spread over much of the region. This relatively modern change in status is due to pastoral and agricultural practices which have created new feeding grounds for it and also for *Alopochen*.

The Shelduck also has undergone a considerable alteration in range. Until

recently the species was confined to South Africa, but during the last decade it has invaded South West Africa where it is spreading and becoming a common, albeit locally, breeding resident. Latest reports indicate that the Shelduck has reached as far north as the Okavango. Here again, undoubtedly, man's influence, through dam-building and irrigation farming, has been responsible for the spread.

### Conservation

It is probably fair to say that there are more wildfowl in southern Africa today than there were before the first arrival of Europeans. This is most true for *Alopochen*, *Plectropterus*, *Tadorna* and *Anas undulata* in South Africa; and barring effective artificial control, the numbers of geese will continue to show a rising trend. For the rest, it is my considered opinion that the tide is turning. The artificial benefits (dams, sewage ponds, etc.) are now being more than offset by the increasing destruction of prime natural habitat. In South Africa especially, in the developed farming areas drainage and reclamation of marshland are proceeding apace. The summer rainfall pan country suffers through drainage, ploughing, burning, overgrazing and trampling by domestic livestock. In the winter rainfall zone vleis have been disappearing one after the other. In many areas natural waters are choked by silt or pumped dry. Exploitation of subterranean water for irrigation has caused the water-table to drop by hundreds of feet in some areas. The net effect has been steady progress towards the irreversible disappearance of much high quality wildfowl habitat.

The plight of certain species is more acute than others. For instance, the Cape Shoveler may be regarded as potentially the most vulnerable: because it is virtually confined to the more temperate areas (which are the most developed); because its total population is relatively small (Siegfried 1965); and because its somewhat specialised feeding habits demand just that type of habitat which is disappearing most rapidly.

The subtropical and tropical areas in South Africa, especially in Natal, are on the threshold of intensive sociological, industrial and agricultural development. Silting has already assumed alarming proportions in some of the Natal rivers. St. Lucia, a proclaimed nature reserve and formerly one of the finest water bird areas in the world, is dying as a wildfowl

refuge — the result of a combination of decreased inflow of fresh water, silting and build-up of salinity (van der Merwe 1967; Forrest 1969). Schemes in progress to impound rivers such as the Pongolo will result in the disappearance of thousands of acres of valuable wildfowl habitat.

Although other territories have not yet experienced the same magnitude of change, engineering and sociological projects are either already underway or mooted. Much of northern South West Africa, including Ovamboland and Okavangoland, is faced with overpopulation (human and domestic livestock) and consequent degradation of the land. In Mozambique the Portuguese began draining the Limpopo delta (about 140,000 acres) for rice-fields in 1956. In northern Botswana developers plan for some 'use' to be made of the abundant water and marshes. Schemes to grow rice and pulp papyrus have been proposed, as well as barrages, dykes and canals to lead the water elsewhere. Attwell (1970) has drawn attention to some of the deleterious effects on the ecology of the mid-Zambesi floodplain as a result of the control imposed by the Kariba impoundment.

In parts of northern Botswana, and also in areas along the Zambesi and Okavango Rivers, human activity over the last 100 years has had a marked effect on the natural ecosystem. The swamp grassland and grassy pans are important in providing grazing for domestic livestock and also for cultivation, crops being sown in the moist soil left after flooding. Too frequent burning and over-grazing have resulted in widespread deterioration and in the suppression of perennial grasses; in many areas bush encroachment has proceeded vigorously. One final point is that logging, and particularly the ruthless exploitation of mature trees, might lead to a shortage of nest-sites for hole-nesting species.

To sum up: natural habitats for wildfowl are degrading and disappearing relatively rapidly in temperate southern Africa; and while the main strongholds (including Mozambique) of the tropical habitats are still in a comparatively healthy state, there are widespread signs of general deterioration of conservation values which cause concern for the future.

What is being done to conserve wildfowl habitat? In South Africa and Rhodesia various government agencies are bringing home to the general public the need to conserve water resources. (In the early 1960's South Africa was already using 50% of her available surface water resources.) It is doubtful, however,

whether the average citizen understands water conservation to mean much more than a need to build bigger and better dams and river impoundments. He does not appreciate that water conservation in the urban and industrial sectors rests in the multiple re-use of water from river impoundments and that the landowner needs to conserve vleis and marshes to maintain *inter alia* the ground water, much of which ultimately discharges into rivers.

Thus very little of immediate practical value has been done to conserve vleis generally, and in South Africa there are only five natural waters which have been made reserves on a basis of their importance to water birds. Although southern Africa has a comparatively good record in establishing nature reserves and national parks, these generally contain little in the way of water bird habitats. Fortunately, in Zululand a fair amount of the land originally reserved for the conservation of the mammalian fauna, includes much prime wildfowl habitat. In Botswana this applies especially in areas where special efforts are being made to arrest the decline of the Lechwe *Kobus leche* and Sitatunga *Tragelaphus spekei* by protecting their habitats in the Chobe-Okavango area.

At least in South Africa and Rhodesia almost all the artificial waters under control of national or local government agencies are nominally reserves, and all birds are nominally protected. There is also a fair body (but still a definite minority) of enlightened progressive opinion in the private sector. Of late it has become quite common to see islands being built, especially for wildfowl, as part of construction of new earth dams.

Although wildfowl occurring on most of the larger artificial and natural waters may not be hunted there, they face other man-made hazards. Chief among these is the rapidly growing popularity of water-sport. In South Africa this form of recreation, mainly speed-boating and water-skiing has boomed during the last decade. This is particularly so in summer in the southern Cape estuaries, a number of which are important moulting and refuge areas for Shelduck at this time of year. At present there is little effective control over these activities although proposals for draft legislation are being considered.

Finally, it remains to mention, very briefly, a few of the more insidious processes contributing towards adulteration and grave degradation of wetlands.

Pesticides are used throughout southern Africa, and aerial spraying and other extensive methods for broadcasting chlorinated hydrocarbons and other chemical poisons are common. One specific example can be cited here: the Ndumu wildlife reserve in northern Zululand contains some of the most fertile small lakes in Africa which have been contaminated by DDT and other mixtures aerially sprayed on to cottonfields (Dutton 1968). Carp *Cyprinus carpio* introduced into South Africa about 100 years ago are today found in most of the country's major river systems and other inland waters; the deleterious effects sometimes brought about by these fish are well known. In addition to the Carp, other exotic fishes have been introduced, and some of the plant-eaters have altered the ecology of a number of natural waters. The slaughter of the crocodile for its skin over much of its range has brought about profound changes in the fish fauna due to reduced predation (Cott 1961), and so ultimately in the aquatic vegetation and microfauna. The introduction of the exotic water plants *Myriophyllum braziliense*, *Salvinia auriculata*, *Elodea canadensis* and *Eichornia crassipes* (proclaimed noxious weeds in most territories in southern Africa) and even some of the exotic paspalums (for example *P. vaginatum* in marshes in the winter rainfall area) have choked and modified many inland waters. A cause for some concern is the possible effect of the spread of *Salvinia* in the Botswana wetlands; it is spreading in the Chobe system, is close to Lake Liambezi and could get into the Okavango swamp.

What the precise effects of all these changes to the natural ecosystem will be on water birds and their habitats are not known. They are adulterations none the less, and provide sufficient reasons for the setting aside of further natural wetlands to be kept as nature reserves in the strict sense of the term.

In southern Africa shooting pressure on wildfowl is not heavy, though some local areas are intensively shot over. McLachlan (in press), employing comparative data derived from ringed birds, has estimated that in the ducks the rate of mortality caused by shooting is generally well below that in certain northern hemisphere countries. For the African 'geese' the rate is a little higher, but still well below European figures. Certainly it is true to say that by North American and European standards wildfowl shooting is not popular and lacks tradition. Hunting

methods have nowhere near reached the degree of refinement and sophistication (pseudo or real) practised in the northern hemisphere, and there is little or no 'status' to be gained from wildfowling. Hunting is directed mainly at mammals and to a lesser extent upland gamebirds. Properly organised shooting of wildfowl is virtually absent. In a way this is unfortunate, since the geese constitute a natural resource yielding a surplus which could be legitimately harvested, and so help towards controlling their numbers and reducing damage to agricultural crops. There are no commercial decoys in southern Africa, and the use of traps, snares, etc., for taking wildfowl is illegal, unless done under special permit. In South Africa the provision of properly controlled public shooting areas on state-owned land would be a constructive measure in a multi-use conservation policy.

There are six separate hunters' associations in southern Africa whose combined total membership does not exceed 5,000 individuals; the wildfowling element comprises a distinct minority group. In the Transvaal, for instance, Mr. P. le S. Milstein (pers. com.) has estimated, on the basis of numbers of hunting licences sold in 1968 and 1969, that interest in wildfowling rates about 7% compared with 93% for upland gamebirds. It is difficult, if not impossible, at present to get any sort of reliable figures for the numbers of ducks and geese shot every year. In South Africa wildfowl belong to the landowner and not the State. In effect, this means that the landowner is in control of wildfowl on his land and is not obliged to take out a licence to shoot on his own property. (His shooting is, however, subject to regulations governing seasons and bag-limits and he may not hunt species accorded special legal protection.) Non-landowners require licences to hunt, but are not bound to render any form of report on their hunting activities (plans exist, however, to rectify this omission). Revenue earned by the State (or local authority) through the sale of licences does not go directly into promoting the hunters' interests.

In South Africa, South West Africa, Botswana and Rhodesia adequate provision has been made to meet the requirements of sound, balanced conservation legislation. Excluding relatively minor anomalies, the setting of hunting seasons, bag-limits and the issuing of licences and special permits are all regulated according to the latest available information

concerning the bio-ecology of the birds. Conservation laws in Lesotho and Swaziland are antiquated and inadequate, and outside the Mlilwane Sanctuary (in Swaziland) there is no enforcement.

Mozambique has poor laws and scant respect is paid to birdlife. According to Mr. R. D. Jacka (pers. com.), shooting pressure is high. Ducks and geese may be bagged in unlimited quantities. In spite of a so-called closed season (January to March), hunting takes place all year round but is heaviest in winter. Any resident may purchase a R10 (£6) unlimited hunting licence for ducks, geese, doves and hares. Herons, egrets, Spoonbills and Hammerkops are usually used as target practice before and after duck shoots.

Even in the areas with reasonable conservation laws, the big problem is enforcing the regulations. It is certainly not a rare phenomenon for parties of hunters to enter remote areas by 'plane or overland vehicle, to slaughter hundreds of ducks in the space of a few days. In the developed areas small scale poaching by peasant farm workers, using snares and traps is of common occurrence, and the cumulative 'take' of wildfowl and their eggs is quite large. Especial problems are posed in the Bantu homelands, trust areas and tribal reserves. A full discussion of these would, as a matter of course, necessitate the introduction of a whole range of complicated sociological factors. It suffices to say that wildfowl are hunted with impunity quite relentlessly the whole year round; fortunately the number of firearms is still small. Nevertheless, the combined onslaught brought to bear in certain over-populated, protein-starved areas (the Transkei for instance) is a vicious circle and enough to ensure the virtual disappearance of nearly all passerines let alone wildfowl.

Parts of southern Africa, like most areas in the world where wildfowl and agriculture come together, experience crop-damage. The main offenders in South Africa are the Egyptian Goose, Spur-winged Goose and the Shelduck—in that order. Damage is chiefly on cultivated land and in three areas: the winter rainfall area where mainly wheat is damaged and the chief culprit is the Egyptian Goose; the maize growing districts of the summer rainfall highveld where the Egyptian Goose and the Spur-winged Goose operate; and the northern Transvaal and other areas where tuberous and groundnut crops are attacked by both species. For the most part, crop-damage is local, but can be severe, and is almost

invariably on farms near large reservoirs providing the birds with shelter during the day. Most of these big dams are the property of the State (Department of Water Affairs) which allows no hunting whatsoever on its premises. Congregations of up to 5,000 Spur-winged Geese and over 8,000 Egyptian Geese have been counted on single dams respectively in the maize and wheat growing districts (Siegfried 1967; Milstein 1968). Permits may be issued to individual landowners allowing them to attempt at any time to control geese on their lands when sufficient cause can be shown. Similarly, in any local area where a species becomes a serious problem, a proclamation can be issued declaring it temporarily open for hunting. Complaints are also made by farmers in parts of South Africa that geese compete with sheep and cattle for grazing. Damage to permanent pasture is hard to assess, but these complaints are not very common and the problem is not a serious one. In the tropical areas the Knob-billed Duck is regarded as a pest in certain areas where it damages maize plants, and it and other species damage rice crops in parts of Mozambique.

In southern Africa there are nine statutory bodies entrusted with matters relating directly to conservation of wild-life resources, including the control and management of nature reserves. In South Africa each of the four provinces has its own independent nature conservancy; in addition, a federal body—the National Parks Board—provides for the establishment of national parks. Similar organisations exist in South West Africa, Botswana and Rhodesia, but Lesotho and Swaziland lack governmental nature conservancies.

### Research

In southern Africa as a whole, the combined conservancies currently provide employment for some 110 university-trained biologists. Many are obliged to perform mainly administrative tasks, another substantial part is concerned with management—the practical application of research. For the rest, original research is directed mainly at practical problems relating to inland fisheries, mammals and plants. In all, the conservancies currently offer directed employment for six biologists engaged chiefly in ornithological research, which includes, *inter alia*, attention to wildfowl, upland gamebirds, cage-birds, pests, and rare and endangered species. There is no single conservancy

post in southern Africa devoted solely to wildfowl research; and, furthermore, most of the existing ornithological employment opportunities were created very recently.

This is not criticism, merely statement of fact. Small conservation agencies must of necessity establish priorities within their programmes of research. Both protectionist and shooting interests, being most concerned with big game, have exerted relatively little pressure for specific research aimed at conserving wildfowl. Yet the South African conservation bodies generally have given wildfowl far more attention than terrestrial (upland) gamebirds, although the latter are at least ten times more popular with hunters.

Other governmental agencies (such as agricultural and public health departments) also employ a small research staff on control of wildlife which are pests or vectors and reservoirs of disease. Such research on wildfowl may be on crop depredation or on bilharzia snails, for example. However, in these cases little actual work on wildfowl has been done.

Scattered in the museums, universities and other scientific institutions in southern Africa are some 18 professional biologists who give a major part of their working time to ornithological research. Only one of the present incumbents is by personal inclination, more than moderately interested in duck biology.

Summarising, it can be said that there are at present in the whole of southern Africa only two university-trained biologists who profess wildfowl as a major research interest. Among professional and amateur ornithologists who have received no formal biological training, there are fewer than six persons of whom it can be said that they have carried their interest in wildfowl to a level at which they can, and do, undertake independent research of a reasonable standard.

This is not to deprecate the efforts of that large body of enthusiasts who are content to remain observers and enumerators of wildfowl. These field observers play an exceedingly important role in the advancement of research and the gain in knowledge relating to the bio-ecology of wildfowl in southern Africa. Amateur workers are spread all over the sub-continent, but their efforts are organised and co-ordinated by the African Wildfowl Enquiry.

The A.W.E.'s primary object is to obtain fundamental scientific knowledge regarding the biology, movements and status of indigenous ducks and 'geese'.

The organisation comprises an advisory panel, regional committees or representatives and associate workers. At present there are about 100 associate workers. They function through regional representatives who organise field-work—mainly censuses—and submit records and reports to a central organiser at the Percy FitzPatrick Institute of African Ornithology, University of Cape Town, where all records are housed.

To date, close on 10,000 census record forms have been accumulated of which about 90% are from South Africa and the balance from South West Africa and Rhodesia with a small amount of extralimital data from Central and East Africa. In addition many notes on display and reproduction have been filed. More than 50% of the records are owed to about 5% of the Enquiry's workers.

These records have been consulted and used by private individuals, government departments (agricultural and nature conservancies) and the Percy FitzPatrick Institute. A number of reports have been produced in which workers have used A.W.E. material to supplement their own research, or which deal exclusively with analyses of such records. Four reports have been compiled bringing together all that is known of the African Pochard (Middlemiss 1958), Yellow-billed Duck (Rowan 1963), Cape Shoveler (Siegfried 1965) and Cape Teal (Skead, in press). In addition, a number of papers dealing with certain species in restricted areas or with aspects of the species' biology have been published; these include reports on the Maccoa Duck (Clark 1964; Siegfried 1969), Hottentot Teal (Clark 1969), and Black Duck (Siegfried 1968). Winterbottom (1964b) has used A.W.E. censuses to report on the numbers of South African wildfowl. These references are not a complete bibliography of reports incorporating A.W.E. material; they indicate the use that has been made of raw data accumulated over the last 15 years. The A.W.E. has stimulated research on, and conservation of, wildfowl in southern Africa and has contributed much on which the official conservancies and other government departments can base sound legislation and management practices.

The A.W.E. is an independent voluntary organisation, financed through donations. All members of the advisory panel serve in their personal capacity. The A.W.E. serves as the Southern African Wildfowl Survey of the I.W.R.B. but pays for its own research and publications. It receives no government aid or subsidy.



—in spite of its proven record of research, and potential for undertaking management-orientated projects of value to the conservancies. At present there is only one government sponsored wildfowl biologist (and his work is not restricted to wildfowl) in the whole of southern Africa. This lamentable state of affairs could be considerably improved if the relatively rich conservancies could convince their governments (provincial or national) that financial investment (in the form of grants-in-aid) in privately organised, reputable wildfowl research will yield good dividends. It is not only paid staff, but basic equipment that is lacking. The accumulated census records are heavily biased in favour of the smaller and more accessible waters. To obtain a truly representative picture, more censusing of wildfowl must be done on the larger sheets of water. However, this can only be done by boat or 'plane. Very few censuses of this type have been carried out in southern Africa.

Another independent voluntary organisation which has made substantial contributions towards our knowledge of southern African wildfowl is the South African Ornithological Society. The S.A.O.S.'s nest record and ringing schemes have been responsible for gathering much information and placing it on permanent record. The nest record scheme, which began in 1952, provides data on breeding seasons, nest sites, clutch size, incubation periods and so on; at present there are some 2,000 separate cards covering the ducks and geese on the southern African list. The ringing scheme started in 1949, and 38,241 wildfowl had been ringed up to 1968 (Table I). The temperate-zone species in South Africa have been ringed far more intensively than the tropical species, and the recovery rates are well below those found in Europe and North America. Outside South Africa ducks have only been ringed on a very small scale in Rhodesia. Even in South Africa, the major share of the ringing is owed to Barberspan in the western Transvaal and Rondevlei near Cape Town. Of late, wildfowl ringing at Rondevlei has fallen away badly (owing to the general decrease in the numbers of birds present at the vlei), but with the reorganisation of Barberspan (Milstein, in press) there is every hope

**Table I. Numbers of wildfowl ringed in southern Africa and recovered in Africa as a whole for the period 1949-1968.**

<i>Species</i>	<i>Number ringed</i>	<i>Number recovered</i>
White-faced Whistling Duck	15	0
South African Shelduck	6550	209
Egyptian Goose	5093	226
Cape Teal	423	20
Hottentot Teal	97	8
Red-billed Teal	2814	93
Yellow-billed Duck	19164	229
Black Duck	12	0
Cape Shoveler	429	10
African Pochard	1423	14
Pygmy Goose	46	0
Knob-billed Duck	274	10
Spur-winged Goose	1870	102
Maccoa Duck	7	0
White-backed Duck	24	0
<b>Total</b>	<b>38241</b>	<b>921</b>

that this station's ringing activities will expand and improve. It is still the only really effective wildfowl ringing station in the whole of southern Africa.

The accumulated data on ringing has been used to some extent (for example Winterbottom (1964a) and Milstein, in press) to analyse the movements of some southern African anatids, but little could be done in the way of population analysis. Recently, however, McLachlan (in press) has estimated shooting pressure, and Siegfried (1970) has analysed ringing recoveries to estimate mortality rate of the Yellow-billed Duck.

As a matter of some urgency, an inventory should be made of the available natural wetlands and their value to wildfowl. In this connection, an important problem is the lack of co-operative programmes of research and management between the nations comprising southern Africa. The development of international agreements relating to wildfowl, which are concerned with zoogeographical and not political boundaries, will stimulate nature conservation in the region.

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#### Summary

After an introduction to the physiography of southern Africa, the region's wildfowl habitat is reviewed. An account is given of the composition and distribution of the wildfowl community. Major problems facing the wildfowl conservationist are examined and discussed in relation to the need for expanded and improved research and management.

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