WATERFOWL COLLECTION

THE most important achievements in this field have been the successful breeding of the Ne-ne or Hawaiian Goose of which less than fifty adults remain in existence (for details see p. 67), and also the rearing of young Hawaiian Ducks of which the world stock is believed to be between 200 and 300. During the year scientific work on the collection was undertaken by Dr Konrad Lorenz of the Max Planck Institute studying courtship behaviour, and by Dr Eric Fabricius of the University of Helsinki, working, in conjunction with our Resident Biologist, Mr Hugh Boyd, on the ' imprinting ' mechanisms in newly hatched ducklings (p. 70).

Meanwhile the collection has been improved by the addition of eleven new species or subspecies during the year. This brings the total to 136 forms and some 996 individual birds. The Trust's collection is still very much more representative than any other in the world.

By far the most important new birds to arrive were the five young Trumpeter Swans presented to Her Majesty the Queen during the Royal Tour of Canada by the Dominion Department of Resources and Development and the Government of British Columbia. The Trust is greatly honoured to have been asked to take care of these fine birds for Her Majesty. An account of their capture is on p. 71.

Various new species were to be seen in flight, notably the Chiloe Wigeon (*Anas sibilatrix*)—the only dabbling duck with a white rump—and the Red-breasted Goose (*Branta ruficollis*).

There were some disappointments when full-winged birds went away, but a few such losses are inevitable and acceptable. The most serious loss was that of a flock of Greater Snow Geese. In a fog on the morning of 30 January 1952, a flock of fourteen Greater Snows and one Greylag took off for their normal morning fly-round, and were evidently unable to find their way back to land. When the fog cleared at about noon they were discovered to be missing, and so, too, were five Barnacles and one Red-breasted Goose—a separate flock. All these geese carried Avicultural Society rings with the address ' Zoo, London'. On the following day the Barnacles and the Redbreast were back and on the day after (1 February) one Snow Goose had returned and was feeding with the wild Whitefronts in the Tack Piece. Later that day it flighted, with them, into the Goose House Ground, and there at dusk it was put up from the seaward side in the hope that it might sweep towards the pens and detach itself from its new friends. However it stayed with the Whitefronts and went out to the sand for the night. Next morning it evidently flighted with

the Whitefronts into one of the fields inland by the canal. In mid-morning the geese there were disturbed and came out to the Tack Piece, where they settled—the Snow Goose with them. After half an hour the Snow Goose suddenly rose by itself, swung over the decoy wood and settled with the remaining Greater Snows (mostly pinioned) in the Big Pen. On the following day (3 February) another Snow Goose had returned, although no one saw it arrive. Since then for six months those two geese have never dared to fly more than a few feet above the ground nor further than across the pen. The regular ten-minute 'fly-rounds' high in the sky which occurred twice daily before the fog have never been resumed. It would appear that their experiences during the short time they were away were so distasteful that they found flying too risky altogether. Meanwhile the loss was reported three times on the radio and large numbers of people wrote or telephoned that they had seen the still missing birds. Following these clues, two searches were made by air (using an Auster Autocrat) but without success. Had the geese been found it was planned to drive them gently towards home with the aircraft. It was disappointing not to be able to put the method to the test.

More than 200 reports were received, and the Trust is greatly indebted to all those who took the trouble to make them. Special thanks are due to Mr C. A. Norris and other Members of the Birmingham and West Midland Bird Club, also to Mr Edwin Cohen and Mr Richard Fitter, for the efforts they made to obtain information, and check reports. Unfortunately most of the reports proved to be Swans, tame geese, Muscovy Ducks, Gulls, Herons, or high flying wild geese. One Snow Goose, however, was shot, out of a flock of five, at Oxford and its head was sent for identification. Another is reported to have been shot near Warwick. Two others reported shot in Essex turned out to be in one case a Bewick's Swan and in the other a farmyard goose. Two reports were received of a white goose in company with wild Pinkfeet. This may have been an albino Pinkfoot, but the later of the two recorded that the bird seemed larger, and stood apart from the small flock of Pinkfeet.

Apart from these records only one other report undoubtedly referred to the missing Snow Geese. This was near Cheltenham at noon on the day they got lost. At this time one of the flock was already so tired that it did not take off with the rest, and almost allowed itself to be driven into a shed. This was quite possibly one of the two which subsequently returned.

It seems probable that the majority of the ten still unaccounted for were shot by people who were unwilling to disclose that they had done so by sending in the rings. There is, however, a possibility that some of them joined up with flocks of wild geese and may even have gone north with them on migration. Such might conceivably reappear with them in the autumn.

A striking feature of the search was that such conspicuous, easily identified and easily described birds—pure white with black wing tips—should have

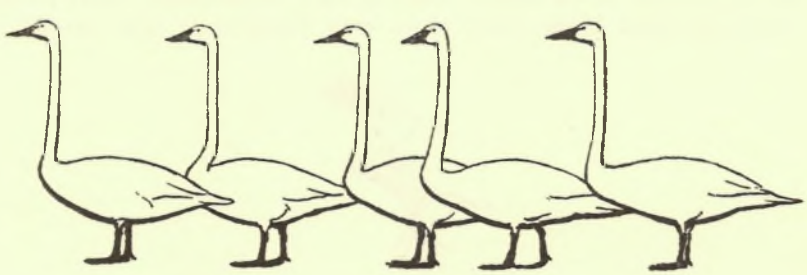
completely escaped observation by the ever-increasing number of experienced bird-watchers, and have disappeared almost without trace in so heavily populated an area as southern England.

In the previous spring a flock of five Greylags and one Bean Goose flew away from the New Grounds ; two of these reached Walcot Hall in Shropshire where, for some months, they stayed with the collection of Mr Noel Stevens, but finally left.

When the Whitefronts left the New Grounds on 10 March 1952, one of two Barnacles which had been in the habit of feeding with them and returning only occasionally to the Rushy Pen left with them. Earlier a pair of Barnacles had left. One of these three has since returned. Bar-headed and Emperor Geese have so far stayed very well and none of them has yet left. The policy of feather-cutting young birds for their first season, and allowing them to fly only when they are a year old and are completely accustomed and attached to their home, seems to have been fairly satisfactory. In the case of a number of ducks with which this policy was not followed—especially Chiloe Wigeon and Bahama Pintail—the losses were more than fifty per cent. Those which did stay, however, seem to have become well settled.

After each loss the question arises whether it is safe or advisable to keep so many species full-winged. It is our view, however, that the immense pleasure derived by hundreds of people at the sight of birds flying round, free to go if they wish, but in the great majority of cases not doing so, much more than offsets even so sad a loss as that of the twelve Snow Geese. For nearly two years these lovely birds had given almost daily displays of aerobatics over the heads of visitors. Had they been there for only half that time it would still have been worth having them full-winged.

There were, it seemed, more wild birds in the pens during last winter than ever before. At least fifty Pintails were living there more or less continuously between December and March in the Rushy and South American Pens and in the Big Pen. The Wigeon flock which divided its time, and sometimes its forces, between the South American and Rushy Pens was often twenty strong. Shovelers were more numerous than usual, four or five being present for most of the winter, and there were usually one or two pairs of Common Teal in the Rushy Pen. Mallard and Gadwall are constantly to be seen in flight over the Pens though they are probably mostly descended from hand-reared birds. The Gadwall which now frequent the area, and breed freely, are likely to form a new British nucleus for this rather local species.



ADDITIONS TO THE COLLECTION

The eleven new forms which were added to the collection during the year are marked thus † in the table which follows. The Trust is extremely grateful to those who have sent birds or eggs ; it is only by such co-operation from Members and well-wishers that it has been possible to build up this unique collection in little more than five years. By showing the arrival of new birds in calendar form we feel that Members will most clearly see how fast the collection is improving.

TABLE XVIII

Date and Species	Numbers	Terms	From	Remarks
1951—May 1				
European Goldeneye (*B. c. clangula*)	10 eggs	Gift	C. F. Lundevall, Sweden	1 pair reared
May 6				
Andean Goose × Lesser Magellan Goose (*C. melanoptera* × *C. p. picta*)	1 ♂	Purchased	C. U. L. Behrend, Argentine	
Lesser Magellan Goose (*C. p. picta*)	2 prs.			1 ♂ barred 1 ♂ white-breasted
†Southern Crested Duck (*L. s. specularioides*)	1 pr.			
Silver or Versicolor Teal (*A. v. versicolor*)	2 ♂ 6 ♀			
Chilian Pintail (*A. g. spinicauda*)	1 pr.			
S. American Red Shoveler (*A. platalea*)	3 ♂			
†Ringed Teal (*A. leucophrys*)	2 ♀			
June 19				
†Longtailed Duck (*C. hyemalis*)	5 ♂ 1 ♀	Collected in Iceland	J. Yealland	None of these ducks survived more than 6 months. Diet evidently inadequate
†Harlequin Duck (*H. h. histrionicus*)	4 ♂ 3 ♀			
Common Scoter (*M. n. nigra*)	1 ♂ 1 ♀			
June 20				
N. American Black Duck (*A. f. rubripes*)	1	Gift	A. H. A. Hamilton	—
July 24				
Pink-footed Goose (*A. brachyrhynchus*)	1	Gift	Mrs Tyser	—
July 26				
†Falkland Kelp Goose (*C. h. malvinarum*)	1 pr.	Gift	Dr W. Sladen	Brought back from the Falkland Is.
Falkland Flightless Steamer Duck (*T. brachypterus*)	1 ♂			

TABLE XVIII—*continued*

Date and Species	Numbers	Terms	From	Remarks
July 26				
Chestnut-breasted Teal (*A. castanea*)	1 pr.	Exchange	Leckford Estates	—
Cape × Chilean Teal (*A. capensis* × *A. f. flavirostris*)	2			
September 4				
Shoveler (*A. clypeata*)	6	Purchased	W. Williams, Boro' Fen Decoy	—
Garganey (*A. querquedula*)	1			
September 11				
Orinoco Goose (*N. jubatus*)	3	Purchased	C. U. L. Behrend, Argentine	—
†Brazilian Teal (*A. b. braziliensis*)	10			
S. American Comb Duck (*S. m. carunculatus*)	3			
†S. American Pochard (*N. e. erythrophthalma*)	3			
September 12				
Pintail (*A. a. acuta*)	3 ♂	Gift	J. F. Sandars	—
September 24				
†Southern Cinnamon Teal (*A. c. cyanoptera*)	8	Purchased	C. U. L. Behrend, Argentine	—
Chile Teal (*A. f. flavirostris*)	3			
Schuyl's Teal (*A. b. vittata*)	1 ♀			
Silver or Versicolor Teal (*A. v. versicolor*)	6			
September 24				
Canada Goose (*B. c. canadensis*)	1	Gift	Mrs Brock	—
September 28				
Bar-headed Goose (*A. indica*)	1 ♂	Exchange	Leckford Estates	—
Mandarin Duck (*A. galericulata*)	1 ♂			
October 4				
Chiloe Wigeon (*A. sibilatrix*)	1 ♂	Exchange	Leckford Estates	—
October 11				
Red-breasted Goose (*B. ruficollis*)	2 ♂	Exchange	N. Stevens	—
October 11				
Pink-footed Goose (*A. brachyrhynchus*)	4	Collected	Rocket-netting team Scotland	—
October 14				
Pink-footed Goose (*A. brachyrhynchus*)	2			
October 18				
Philippine Duck (*A. luzonica*)	1 ♂	Gift	Dr Dillon Ripley, U.S.A.	Wedding present to the Director
October 23				
Pink-footed Goose (*A. brachyrhynchus*)	1	Collected	Rocket-netting team, Scotland	—

TABLE XVIII—*continued*

Date and Species	Numbers	Terms	From	Remarks
October 28				
White-eye (*A. nyroca*)	2 ♂♂	Purchased	W. C. Duyzend, Holland	—
Indian Pygmy Goose (*N. coromandelianus*)	1 ♀			
December 19				
Indian Pygmy Goose (*N. coromandelianus*)	8	Gift	R. Vlasto, India	—
1952—January 8th				
†Kerguelen Pintail (*A. a. eatoni*)	2 ♂♂	Exchange	Parc Zoologique de Clères	Two of nine brought to Europe all of which turned out to be males
January 8				
Barnacle Goose (*B. leucopsis*)	1 pr.	Gift	R. Pilcher	—
February 6				
Pintail (*A. a. acuta*)	1 ♂	Gift	C. H. Bois	—
February 13				
†Trumpeter Swan (*C. c. buccinator*)	5	Loan	H.M. The Queen	—
March 10				
Mandarin Duck (*A. galericulata*)	4 prs.	Exchange	London Zoo	Freshly imported from Singapore
March 14				
Wandering Whistling Duck (*D. arcuata*)	1 pr.	Exchange	Rotterdam Zoo	—
March 28				
Andean Crested Duck (*L. s. alticola*)	1 ♂	Exchange	Leckford Estates	—
April 1				
Falcated Duck (*A. falcata*)	1 ♂			
April 3				
Swan Goose (*A. cygnoides*)	1 pr.	Purchased	Hamburg Zoo	—
April 4				
Goosander (*M. merganser*)	10 eggs	Gift	H. Duncan, Scotland	—
April 9				
Ring-necked Duck (*A. collaris*)	2 ♂♂	Gift	Delta Waterfowl Research Station, Canada	—
American Goldeneye (*B. c. americana*)	1 ♂			
April 10				
Cape Shoveler (*A. smithi*)	1 ♂	Exchange	Rotterdam Zoo	—
White-eye (*A. nyroca*)	1 ♀			
April 17				
†Andean Goose (*C. melanoptera*)	3 prs.	Purchased	C. U. L. Behrend, Argentine	2 pairs were still in down
April 18				
Goldeneye (*B. c. clangula*)	1 ♂	Gift	D. Dandridge	—

LIST OF BIRDS (with Numbers of Specimens) IN THE COLLECTION ON 30 APRIL 1952

Magpie Goose (*Anseranas semipalmata*) 4
Black-billed Whistling Duck (*Dendrocygna arborea*) 1
Southern Red-billed Whistling Duck (*D. autumnalis discolor*) 9
Fulvous Whistling Duck (*D. bicolor*) 1
Wandering Whistling Duck (*D. arcuata*) 3
Javan Whistling Duck (*D. javanica*) 2
Eyton's Whistling Duck (*D. eytoni*) 2
White-faced Whistling Duck (*D. viduata*) 8
Coscoroba Swan (*Coscoroba coscoroba*) 4
Whistling Swan (*Cygnus c. columbianus*) 3
Bewick's Swan (*C. columbianus bewicki*) 2
Eastern Bewick's Swan (*C. columbianus jankowskii*) 1
Whooper Swan (*C. c. cygnus*) 3
Trumpeter Swan (*C. c. buccinator*) 5
Black-necked Swan (*C. melanocoryphus*) 2
Mute Swan (*C. olor*) 6
Black Swan (*C. atratus*) 2
Canada Goose (*Branta canadensis canadensis*) 3
Lesser Canada Goose (*B. c. parvipes*) 1
Dusky Canada Goose (*B. c. occidentalis*) 5
Vancouver Canada Goose (*B. c. fulva*) 1
Tundra Canada Goose (*B. c. leucopareia*) 6
Cackling Goose (*B. c. minima*) 10
Hawaiian Goose (*B. sandvicensis*) 3
Barnacle Goose (*B. leucopsis*) 14
Dark-bellied Brent Goose (*B. b. bernicla*) 5
Light-bellied Brent Goose (*B. b. hrota*) 3
Black Brant (*B. b. nigricans*) 3
Red-breasted Goose (*B. ruficollis*) 19
Swan Goose (*Anser cygnoides*) 2
Greylag Goose (*A. a. anser*) 9
Eastern Greylag Goose (*A. a. rubrirostris*) 7
Yellow-billed Bean Goose (*A. f. fabalis*) 2
Bean Goose (*A. fabalis* ssp.) 7
Pink-footed Goose (*A. brachyrhynchus*) 14
White-fronted Goose (*A. a. albifrons*) 6
Greenland White-fronted Goose (*A. a. flavirostris*) 8
Pacific White-fronted Goose (*A. a. frontalis*) 2
Perry River White-fronted Goose (*A. albifrons* ssp.) 2
Lesser White-fronted Goose (*A. erythropus*) 8
Bar-headed Goose (*A. indicus*) 10
Emperor Goose (*A. canagicus*) 9
Blue Goose (*A. c. caerulescens*) 6
Lesser Snow Goose (*A. c. hyperboreus*) 4
Greater Snow Goose (*A. c. atlanticus*) 8
Ross's Goose (*A. rossi*) 16
Ruddy Shelduck (*Tadorna ferruginea*) 4
South African Shelduck (*T. cana*) 7
Australian Shelduck (*T. tadornoides*) 3
New Zealand Shelduck (*T. variegata*) 5
Red-backed Radjah Shelduck (*T. radjah rufitergum*) 2
Common Shelduck (*T. tadorna*) 2
Egyptian Goose (*Alopochen aegyptiacus*) 6
Orinoco Goose (*Neochen jubatus*) 6
Abyssinian Blue-winged Goose (*Cyanochen cyanoptera*) 5
Ashy-headed Goose (*Chloephaga poliocephala*) 4
Ruddy-headed Goose (*C. rubidiceps*) 5
Greater Magellan Goose (*C. p. leucoptera*) 1
Lesser Magellan Goose (*C. p. picta*) 7
Cereopsis Goose (*Cereopsis novae-hollandiae*) 8
Southern Crested Duck (*Lophonetta s. specularioides*) 1
Andean Crested Duck (*L. s. alticola*) 4
Marbled Teal (*Anas angustirostris*) 6
Cape Teal (*A. capensis*) 7
Silver or Versicolor Teal (*A. v. versicolor*) 12
Puna Teal (*A. v. puna*) 4
Red-billed Pintail (*A. erythrorhyncha*) 4
Southern Bahama Pintail (*A. bahamensis rubrirostris*) 15
Chilean Pintail (*A. georgica spinicauda*) 9
Pintail (*A. a. acuta*) c40
Kerguelen Pintail (*A. a. eatoni*) 2
Chilean Teal (*A. f. flavirostris*) 10
Common Teal (*A. c. crecca*) 5
Green-winged Teal (*A. c. carolinensis*) 6
Baikal Teal (*A. formosa*) 2
Australian Grey Teal (*A. gibberifrons mathewsi*) 5
Chestnut-breasted Teal (*A. castanea*) 4
New Zealand Brown Duck (*A. aucklandica chlorotis*) 1
Mallard (*A. p. platyrhynchos*) c120
Hawaiian Duck (*A. p. wyvilliana*) 8
North American Black Duck (*A. f. rubripes*) 5
Florida Duck (*A. f. fulvigula*) 2
Mottled Duck (*A. f. maculosa*) 3
Indian Spot-bill (*A. p. poecilorhyncha*) 2
Australian Grey Duck (*A. superciliosa rogersi*) 4
South African Yellow-bill (*A. u. undulata*) 10
Abyssinian Yellow-bill (*A. u. rupelli*) 5
Cameroon Yellow-bill (*A. undulata* ssp.) 1
Philippine Duck (*A. luzonica*) 1
South African Black Duck (*A. s. sparsa*) 3
Gadwall (*A. s. strepera*) 28
Falcated Teal (*A. falcata*) 5
Wigeon (*A. penelope*) 24
American Wigeon (*A. americana*) 7
Chiloe Wigeon (*A. sibilatrix*) 13
Blue-winged Teal (*A. discors*) 7
Southern Cinnamon Teal (*A. c. cyanoptera*) 4
North American Cinnamon Teal (*A. c. septentrionalium*) 13
Garganey (*A. querquedula*) 8
South American Shoveler (*A. platalea*) 5
Cape Shoveler (*A. smithi*) 4
Shoveler (*A. clypeata*) 17
Ringed Teal (*A. leucophrys*) 2
Red-crested Pochard (*Netta rufina*) 6
Rosy-bill (*N. peposaca*) 8
South American Pochard (*N. c. erythrophthalma*) 5
South African Pochard (*N. c. brunnea*) 12
Canvasback (*Aythya vallisneria*) 4
Common Pochard (*A. ferina*) 7
Red-head (*A. americana*) 9
White-eye or Ferruginous Duck (*A. nyroca*) 4
Ring-necked Scaup (*A. collaris*) 3

Tufted Duck (*A. fuligula*) 8
Common Scaup (*A. m. marila*) 7
Lesser Scaup (*A. affinis*) 5
Brazilian Teal (*Amazonetta b. braziliensis*) 2
Schuyl's Teal (*A. b. vittata*) 3
Maned Goose (*Chenonetta jubata*) 11
Mandarin Duck (*Aix galericulata*) 24
Carolina Duck (*A. sponsa*) 26
Indian Pygmy Goose, or Cotton Teal (*Nettapus c. coromandelianus*) 5
Indian Comb Duck (*Sarkidiornis m. melanotus*) 2
South American Comb Duck (*S. m. carunculatus*) 6
Hartlaub's Duck (*Cairina hartlaubi*) 3
Muscovy Duck (*C. moschata*) 6
Spur-winged Goose (*Plectropterus g. gambensis*) 3
Black Spur-winged Goose (*P. g. niger*) 3
European Eider (*Somateria m. mollissima*) 5
Long-tailed Duck (*Clangula hyemalis*) 1
Barrow's Goldeneye (*Bucephala islandica*) 9
American Goldeneye (*B. clangula americana*) 2
European Goldeneye (*B. c. clangula*) 4
Smew (*Mergus albellus*) 1
Goosander (*M. m. merganser*) 1
Red-breasted Merganser (*M. serrator*) 5
North American Ruddy Duck (*Oxyura jamaicensis*) 9
Total 963
Total number of forms 136

HYBRIDS

Andean Goose × Upland Goose 2
Greylag Goose × Barnacle Goose 2
Ross's Goose × Red-breasted Goose 1
Red-breasted Goose × Lesser White-fronted Goose 3
Lesser Snow Goose × Blue Snow Goose 3
Greylag Goose × Canada Goose 1
White-fronted Goose × Bean Goose 2
Tundra Canada Goose × Lesser Snow Goose 1
Andean Goose × Egyptian Goose 1
Rosy-bill × Yellow-bill 1
Chilean Teal × Carolina Duck 3
Red-crested Pochard × Chilean Pintail 2
Cape Teal × Tufted Duck 1
Chilean Pintail × Bahama Pintail 2
Chilean Teal × Chestnut-breasted Teal 3
Blue-winged Teal × Cinnamon Teal 3
Cape Teal × Chilean Teal 2
Total 33
Total number of birds at the New Grounds 996

THE BREEDING SEASON, 1951

(NOTE. *Due to inevitable delays in the publication of the Annual Report there has been another breeding season* (1952) *since the one here described.*)

As might be expected the increases in the collection itself and the rapid accumulation of experience of rearing waterfowl under the New Grounds conditions have made each successive season better than its predecessor. Of the fifty-one species and subspecies which laid eggs twelve did so for the first time at the New Grounds ; and young birds of forty-four species and subspecies were reared to maturity. Some 1564 eggs were laid in 209 nests. The losses are still great at the various stages of development, but with greater knowledge we hope to be able to reduce them steadily.

The following table shows the overall improvement :—

TABLE XIX

Year	No. of Species and Subspecies Reared	No. of Cygnets and Goslings	No. of Ducklings	Total No. Reared
1947	14	18	31	49
1948	17	—	—	147
1949	37	41	269	310
1950	39	61	221	282
1951	44	72	338	410

NOTE : Mallards are excluded from the table.

The greatest improvement was among the ducks. The goslings were more disappointing, and for the first time some were lost through infestations of Gape-worms (*Syngamus trachea*). Perhaps the most important success was the rearing of six young Koloas or Hawaiian Ducks (*Anas platyrhynchos wyvilliana*) ; although they are by no means so rare as the Ne-ne or Hawaiian Goose, it is believed that not more than 300 exist. Unfortunately only one of the six was a female; thus, including the parents, the collection contained, during the year, two pairs and four odd drakes.

A single South American Red Shoveler (*Anas platalea*) was one of the most interesting birds reared. Unluckily this bird was a drake, so that the mother was still the only female in the collection, although there were already two spare drakes which had been imported from the Argentine.

A single Ashy-headed gosling (*Chloephaga poliocephala*) was the first of this genus to be reared successfully at the New Grounds.

Much more satisfactory numbers of some of the commoner species were reared. For example, the figures for European Wigeon (*A. penelope*) ducklings were: 1950, ten ; 1951, forty-one ; for Pintail (*A. a. acuta*): 1950, four ; 1951, twenty-six ; for Red-crested Pochard (*N. rufina*) : 1950, two ; 1951, thirty-three.

At least half a ton of duck-weed (*Lemna* spp) was brought in each week during the rearing season. The advantage of this supply, of course, is that in addition to the valuable vegetable food there is often a quantity of animal life amongst the weed. Nevertheless it was, as usual, difficult to maintain an adequate supply of live food, in spite of efforts to culture Mosquito larvæ and other pond life in barrels. Determining the cause of death in very young waterfowl is extremely difficult. Many are chilled and some die apparently of unassimilated yolk. Parasites such as Gapes and Tape Worms (*Hymenolepis*) may be a cause of death when in heavy infestation, but the prevalence of these worms in young waterfowl in the wild state indicates that it may not be a primary factor in mortality. *Salmonella* was not disclosed during the 1951 season, but one whole brood of Mandarins (*Aix galericulata*) died from coccidiosis.

The tables which follow show comparative details of the rearing success. Although these details are perhaps of limited value at this stage, it is felt that after a few more years these comparisons may well indicate new lines of study. Fluctuations in the incidence of infertility, for example, when correlated with climatic conditions and phenology may well produce significant data. As changes in rearing technique are gradually introduced, so their success can be measured. When electricity is available at the New Grounds the efficacy of electric incubators and brooders can be precisely compared with the more primitive methods now in use. And in the meanwhile these figures provide a useful yardstick against which others who are rearing waterfowl, either in Zoos or in the many private collections, will be able to check their results. The figures could be made even more interesting if other waterfowl breeders would also keep such data and make them available for comparison. In this way it may be possible to advance avicultural methods much more rapidly than in the past.

TABLE XX

HATCHING AND REARING

Species	Breeding Pairs	Date of First Egg	No. of Eggs	Taken by Vermin	Infertile	Broken by Hen	Addled	Dead in Shell	Hatched	Percentage Hatched of Eggs Laid			Crushed by Hen	Taken by Vermin	Reared	Percentage Reared of Eggs Hatched			Remarks
										1951	1950	1949				1951	1950	1949	
Grey-breasted Whistling Duck	1	6.3.51	73	2	40	—	6	2	23	31%	92%	—	—	—	5	21%	23%	—	Laid more or less continuously until last clutch which hatched 12 out of 13
White-faced Whistling Duck	3	1.6.51	38	—	1	—	—	1	36	94%	—	—	—	—	10	27%	—	—	First to lay at New Grounds
Interior Canada Goose ..	1	25.4	5	—	—	—	—	—	5	100%	—	—	—	—	5	100%	—	—	—
Western Canada Goose..	2	24.4	12	—	4	—	1	—	7	58%	33%	—	—	—	4	57%	100%	—	—
Tundra Canada Goose ..	2	21.4	24	—	7	—	2	—	15	62%	39%	17%	—	—	13	86%	66%	100%	—
Cackling Goose	1	5.5	4	—	4	—	—	—	—	—	—	—	—	—	—	—	—	—	First to lay at New Grounds
Hawaiian Goose	1½	13.3	18	—	18	—	—	—	—	—	—	—	—	—	—	—	—	—	Without gander until second clutch laid when male in full moult
Barnacle Goose	1	25.6	3	—	1	—	—	—	2	66%	75%	50%	—	—	1	50%	—	67%	—
Red-breasted Goose ..	1	11.6	6	—	6	—	—	—	—	—	20%	—	—	—	—	—	100%	—	—
Lesser White-fronted Goose	1	31.5	3	—	1	—	—	—	2	66%	18%	—	—	—	2	100%	100%	—	—

[*continued*

TABLE XX—*continued*

Species	Breeding Pairs	Date of First Egg	No. of Eggs	Taken by Vermin	Infertile	Broken by Hen	Addled	Dead in Shell	Hatched	Percentage Hatched of Eggs Laid			Crushed by Hen	Taken by Vermin	Reared	Percentage Reared of Eggs Hatched			Remarks
										1951	1950	1949				1951	1950	1949	
Eastern Greylag Goose ..	1	11.3	4	—	—	—	—	1	3	75%	—	—	—	—	3	100%	—	—	First to lay at New Grounds
Bar-headed Goose ..	2½	11.4	19	—	8	1	—	1	9	50%	54%	89%	—	—	4	44%	100%	75%	—
Emperor Goose	1	26.4	11	—	2	1	1	1	6	54%	18%	33%	—	—	4	66%	33%	100%	One gosling turned out to be hybrid
Lesser Snow Goose ..	1	18.5	3	—	1	—	—	—	2	66%	40%	—	—	—	2	100%	50%	—	—
Blue Snow Goose ..	1	18.4	9	—	9	—	—	—	—	—	33%	—	—	—	—	—	100%	—	—
Greater Snow Goose ..	8	12.5	47	3	27	—	1	—	16	34%	40%	50%	—	—	3	18%	53%	30%	Fertile eggs out of two clutches sent away
Ross's Snow Goose ..	4	14.5	15	—	6	—	1	1	7	46%	56%	23%	—	—	3	42%	44%	50%	Only one full Perry River bird survived
Blue Snow—Lesser Snow cross	1	12.5	5	—	2	—	1	1	1	20%	—	—	—	—	1	100%	—	—	—
Lesser Snow Goose × Blue Snow Goose	1	15.5	6	—	2	—	—	—	4	66%	—	—	—	—	3	75%	—	—	—
Lesser Snow Goose × Tundra Goose	1	10.5	5	—	1	—	—	—	4	80%	—	—	—	—	4	100%	—	—	—

Cape Shelduck	1	7.4	15	—	4	—	—	—	11	73%	—	—	—	—	5	45%	—	—	First to lay at New Grounds
Common Shelduck ..	1	30.4	3	—	1	—	—	—	2	66%	—	—	—	—	2	100%	—	—	First to lay at New Grounds
Egyptian Goose	2	11.3	26	—	13	—	—	1	12	46%	41%	77%	—	—	12	100%	100%	90%	One pair's eggs infertile in '50 and '51
Ashy-headed Goose ..	1	11.4	4	—	1	—	—	2	1	25%	—	—	—	—	1	100%	—	—	First *Chloephaga* to be reared at New Grounds
Upland Goose	1	6.4	9	—	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cereopsis Goose	1	24.12.50	9	—	5	—	4	—	—	—	80%	50%	—	—	—	—	100%	—	Deserted eggs which got frozen
Marbled Teal	1	1.6	11	—	11	—	—	—	—	—	100%	—	—	—	—	—	11%	—	—
Puna Teal..	1½	20.3	26	—	7	—	4	5	10	38%	33%	—	—	—	2	20%	20%	—	—
Bahama Pintail	5	28.4	33	—	9	—	—	—	24	72%	75%	88%	—	—	17	70%	67%	64%	—
Chilian Pintail	1	6.4	15	—	5	1	2	1	6	40%	—	25%	—	—	—	—	—	50%	—
Common Pintail	7	29.4	61	—	14	—	9	5	33	54%	25%	43%	—	—	26	48%	57%	33%	—
Falcated Duck	1	20.5	10	—	7	—	1	—	2	20%	—	—	—	—	2	100%	—	—	First to lay at New Grounds
Hawaiian Duck	1	7.4	14	—	2	—	1	2	9	64%	—	—	—	—	6	66%	—	—	First to lay at New Grounds
Mottled Duck	1	20.4	3	—	3	—	—	—	—	—	66%	58%	—	—	—	—	100%	71%	—
North American Black Duck	2	24.3	14	—	4	—	—	—	10	70%	83%	69%	—	—	—	—	15%	44%	Left to parents
Australian Grey Duck ..	2	22.3	16	—	8	—	—	—	8	50%	53%	62%	—	—	—	—	73%	40%	Left to parents

[*continued*

TABLE XX—*continued*

Species	Breeding Pairs	Date of First Egg	No. of Eggs	Taken by Vermin	Infertile	Broken by Hen	Addled	Dead in Shell	Hatched	Percentage Hatched of Eggs Laid			Crushed by Hen	Taken by Vermin	Reared	Percentage Reared of Eggs Hatched			Remarks
										1951	1950	1949				1951	1950	1949	
African Yellow-billed Duck	2	15.3	20	—	8	1	2	1	8	40%	10%	41%	—	—	—	—	—	25%	—
Gadwall	?	9.5	44	—	20	—	—	—	24	50%	75%	83%	—	—	21	87%	95%	19%	Some 70 eggs left with parents who reared 6
Wigeon	?	17.5	79	—	10	2	—	1	66	83%	33%	43%	—	—	41	62%	100%	60%	Two clutches left with parents, one reared
American Wigeon ..	3	20.5	13	—	5	—	—	1	7	54%	18%	26%	—	—	3	43%	—	89%	—
Chiloe Wigeon	2½	29.4	32	—	12	—	—	—	20	62%	8%	53%	—	—	20	100%	—	67%	One pair have laid infertile eggs '50 and '51
Blue-winged Teal ..	1	5.6	8	—	—	—	—	—	8	100%	—	—	—	—	2	25%	—	—	First to lay at New Grounds
Cinnamon Teal	4	13.4	71	—	15	—	3	—	53	74%	76%	63%	—	—	28	53%	50%	8%	—
Garganey	2	27.5	8	—	3	—	2	2	1	12%	—	29%	—	—	—	—	—	50%	—
Red Shoveler	1	16.4	6	—	—	—	—	1	5	83%	—	—	—	—	1	20%	—	—	First to lay at New Grounds
Common Shoveler ..	3	22.4	45	—	6	1	1	4	33	61%	50%	95%	—	—	28	85%	50%	63%	—
Red-crested Pochard ..	3½	21.3	54	—	4	—	1	3	46	88%	75%	56%	—	—	33	71%	8%	41%	—

Rosy-billed Pochard ..	4	24.5	24	—	11	—	—	—	13	59%	68%	48%	—	—	7	53%	31%	67%	—
Redhead	3	1.6	22	—	9	—	2	2	9	49%	—	87%	—	—	4	44%	—	77%	—
Scaup	3	31.5	24	—	8	—	—	—	16	66%	43%	—	—	—	9	56%	50%	—	—
Carolina	12	23.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Incubated at high humidity
Incubated by Incubator	—	—	75	—	25	—	17	33	—	—	—								
Incubated by hens ..	—	—	70	—	17	—	2	10	41	58%	41%	47%	—	—	40	44%	46%	46%	—
Incubated by parent bird	—	—	78	10	11	—	2	2	50	68%	49%								
Mandarin	8	22.4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Incubated by hens ..	—	—	45	—	20	—	7	5	13	29%	28%	—	—	—	13	50%	60%	—	—
Incubated by parent bird	—	—	15	—	2	—	—	—	13	86%									One brood of six died in 24 hours from coccidiosis
Eider	1	10.5	9	—	5	—	—	1	4	80%	—	—	—	—	—	—	—	—	—
Goosander × Red-breasted Merganser	1	—	9	—	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ruddy Duck	—	25.5	23	1	4	—	3	—	15	65%	90%	80%	—	—	2	13%	20%	—	—
Mallard × African Yellow-billed Duck	1	—	6	—	1	—	—	—	5	85%	—	—	—	—	5	100%	—	—	—
								EGGS BROUGHT											
Pochard	—	—	18	—	16	1	—	—	1	—	—	—	—	—	1	100%	—	—	Eggs very stale

[*continued*

TABLE XX—*continued*

Species	Breeding Pairs	Date of First Egg	No. of Eggs	Taken by Vermin	Infertile	Broken by Hen	Addled	Dead in Shell	Hatched	Percentage Hatched of Eggs Laid			Crushed by Hen	Taken by Vermin	Reared	Percentage Reared of Eggs Hatched			Remarks
										1951	1950	1949				1951	1950	1949	
						EGGS BROUGHT													
Tufted	—	—	11	—	9	—	—	—	2	—	—	—	—	—	2	100%	—	—	Eggs very stale
Harlequin	—	—	25	—	7	—	2	6	10	40%	—	—	—	—	—	—	—	—	—
Longtail	—	—	25	—	14	—	3	2	6	24%	17%	—	1	—	—	—	—	—	—
Barrow's Goldeneye ..	—	—	25	—	4	—	7	6	8	32%	29%	—	—	—	2	25%	50%	—	—
Common Goldeneye ..	—	—	10	—	2	—	1	3	4	40%	—	—	1	—	2	50%	—	—	First reared at New Grounds
Scoter	—	—	25	—	9	—	—	2	14	56%	18%	—	—	—	—	—	—	—	—
Common Shelduck ..	—	—	8	—	—	—	—	—	8	100%	—	—	—	—	6	75%	—	—	—

DIET

It has not been easy to determine the ideal diet for both adult and young waterfowl of so many different species with so many different habits and habitats. The basic food for the geese and goslings is, of course, grass and clover. This is augmented with wheat for the adults and biscuit-meal for the young. In the case of the ducks not very much natural food can remain in the ponds which are so heavily stocked with birds. The ducks and the swans are, therefore, much more dependent on artificial feeding than the geese. Wheat, stale bread, some coarse biscuit-meal and some duck-weed (*Lemna* spp.) are the principal foods for most of the adults.

Fish-eating ducks, such as Goosander, Merganser and Smew, are fed on eels whenever possible and, failing eels, then herrings or sprats. Goldeneyes, Long-tailed Ducks and Eiders take some of this fish food. They also have a mash into which are mixed substances containing vitamins (such as cod liver oil) and trace elements. The small ducklings have been fed on fine biscuit-meal to which dried milk, fishmeal and cod liver oil are added. For very small ducklings maize-meal has been used in order to reduce the fibre content, but in normal summer weather this mash goes sour very quickly and has not been found very satisfactory.

Trials are being carried out using Blue Cross pellets and meals in which vitamins and trace elements are included, and the Trust is extremely grateful to the proprietors, Messrs J. V. Rank Ltd., for their co-operation in the search for the ideal diet for the waterfowl in the collection, both adult and young.

PATHOLOGICAL INVESTIGATIONS

J. A. J. Venn, M.R.C.V.S., D.V.S.M.

MINISTRY OF AGRICULTURE VETERINARY INVESTIGATION CENTRE, LANGFORD

(*It will be obvious that, in the preparation of this paper, the work involved in post-mortem examination alone, apart from special studies in bacteriology, mycology and parasitology, is very considerable. Once more the Trust is most grateful for the helpful spirit in which this work has been undertaken at Langford House.*—ED.)

During the year under review, the majority of the losses fall under three headings : Aspergillosis, Parasitism and Nutritional Disorders.

Aspergillosis

This is an infection with a fungus of the genus *Aspergillus*. The fungus is usually found in the respiratory system, although it may occur elsewhere.

No cure is known for this condition, and there is reason to believe that some birds imported into the collection may have been affected before their arrival. In view of the widespread nature of this condition, some preliminary work, at present mainly concerned with the establishment of artificial infection, has been started by the University of Bristol Veterinary Staff under the direction of Professor F. Blakemore. It is hoped that this work will lead to an increase in the existing knowledge of many aspects of this disease, but it would be optimistic to expect an easy solution to this difficult problem.

Parasitism

The incidence of parasitic infestation in adult stock has shown a definite fall this year in contrast to the year 1950–51. This is due in the main to the

pursuit of a vigorous policy of medication by various drugs which have proved in general efficacious. An occasional loss attributable to drug idiosyncrasy must be expected (Puna Teal), but it is well worth taking that risk. Unfortunately it is impossible to maintain the collection free from the risk of parasitism because the intermediate hosts of the majority of the parasites are free living Crustacea that form an essential proportion of the food of many species.

Nutritional Disorders

It must be appreciated that this heading which embraces many of the losses is essentially a loose one covering many different conditions. Three aspects of this question engaged the interest during the year : imperfect skeletal ossification, gizzard erosion and peripheral neuritis.

The first of the conditions had been observed as a secondary abnormality in many post mortems, and as a measure of control the amount of cod liver oil in the diet has been increased.

The disorder known as gizzard erosion is one which is accepted as being due to deficiency of vitamin B12. Its presence has been observed in various species during the year, and as a result the diet has been fortified with this vitamin and the results are very encouraging.

A number of Harlequin ducks imported from Iceland became paralysed soon after arrival and post mortem of one revealed a definite neuritis. Such a condition has been recorded in birds in association with deficiency of various members of the B vitamin complex. To control this it was decided to incorporate Dried Brewers' Yeast in the ration for these birds. No further cases of paralysis occurred in these birds, and some of the affected ones recovered.

Deaths in Young Stock

During the previous year there were many losses due to Salmonellosis (paratyphoid). It was therefore decided to attempt control by vaccination should the condition occur in the following season. A vaccine was accordingly prepared and it appeared from preliminary tests that it would be efficacious. It was never put to the test, however, because there were no cases of the disease during the whole of the season. Such losses as were investigated were mainly of a non-specific nature due either to inherently weak stock or to chilling shortly after hatching.

In addition to the losses already discussed, there have been a variety of deaths from various causes, as may be seen on the following pages.

There appears little reason to doubt that whilst, in a collection as large as that held on the New Grounds, there are bound to be yearly losses, a considerable reduction in what might be termed preventable losses can be effected. The policy that is being pursued in this connection is to concentrate on certain conditions such as those discussed in this report, and once they have come under control, to consider other less common causes of loss. This method is adopted in preference to a consideration of individual cases. It may well be, for example, that conditions such as the hepatites and enterites recorded are in fact secondary manifestations caused by imperfect assimilation of the foodstuffs directly associated with an eroded gizzard.

The absence of any outbreak of infectious disease during the year under review is a matter for congratulation but not complacency. Wherever living creatures are kept in close contact then the risk is ever present, and it is only by constant attention to hygiene, general preventive measures and post-mortem

examinations of all deaths other than those from obvious external causes that the danger is minimized.

TABLE XXI

CAUSES OF DEATHS IN THE COLLECTION

(May 1951—April 1952)

Cause of Death	Species	Young	Adult	Total
Bacterial Infection				
Avian Tuberculosis	Red-breasted Merganser	—	2	2
Fungoid Infection				
Aspergillosis	Blue-winged Goose	—	1	—
	Long-tailed Duck	—	1	—
	Mute Swan	—	1	—
	Kelp Goose	—	1	—
	Chiloe Wigeon	—	1	—
	Brazilian Teal	—	1	—
	Andean Crested Duck	—	1	—
	Hartlaub's Duck	—	1	—
	Flightless Steamer Duck	—	1	—
	Bewick's Swan	—	1	—
	Whistling Swan	—	1	11
Parasitic Infestation				
Nematodes				
Amidostomum spp. (Gizzard Worm)	Kelp Goose	—	1	—
	Barrow's Goldeneye	—	1	—
Acuaria sp.	Chiloe Wigeon	—	1	3
Cestodes				
Hymenolepis spp.	Puna Teal	—	1	—
	Barrow's Goldeneye	—	1	—
	Cinnamon Teal	—	1	—
	Pochard	—	1	4
Trematodes				
Echinostoma spp.	Versicolor Teal	—	2	2
Coccidiosis	Mandarin Duckling	4	—	4
Nutritional Disorders				
Gizzard Erosion (B12 deficiency)	Barrow's Goldeneye	—	2	—
	Indian Cotton Teal	—	4	—
	White-faced Whistling Duck	—	2	—
	Long-tailed Duck	—	1	—
	Eider Duck	—	1	10
Vitamin B Deficiency	Harlequin Duck	—	1+	1+
Vitamin D Deficiency	Scaup	—	1	—
	Harlequin	—	1	2
Hatching and Brooding Disorders				
Chilling	Cereopsis Gosling	1	—	—
	Yellow-bill Duckling	1+	—	—
	Bar-headed Gosling	1+	—	3
'Visceral Gout'	Southern Red-billed Whistling Duckling	1	—	1
Acute Nephritis..	Barrow's Goldeneye Duckling	2+	—	—
	Harlequin Duckling	2+	—	4
Congestion of Lungs	Yellow-bill Duckling	3+	—	3+
Non-specific Causes				
Hepatitis	Chile Teal	—	1	—
	Spur-winged Goose	—	1	2
Enteritis	Southern Crested Duck	—	1	—
	Scoter	—	1	—

TABLE XXI—*continued*

Cause of Death	Species	Young	Adult	Total
Enteritis	Spur-winged Goose	—	1	—
	Brent Goose	—	1	4
Pneumonia	Chile Teal	—	1	1
Tenosynovitis	Tree Duck	—	1	1
Generalized Congestion ..	Crested Duck	—	2	2
Hexyl Resorcinol Idiosyncrasy	Puna Teal	—	1	1

NOTE.—This table does not include all birds which died during the year. Since there is at present no electrical supply at the New Grounds it is not possible to place dead birds immediately in a refrigerator. Thus it is sometimes useless to send them for post mortem, especially if they die on a Friday or Saturday. This applies particularly to young birds during the summer. The situation will be greatly improved as soon as electricity is available.

THE BREEDING OF THE NE-NE OR HAWAIIAN GOOSE

MANY members will already know that the Trust has been successful in breeding the very rare Hawaiian Goose (*Branta sandvicensis*), but it is important that the details should be fully recorded in the Annual Report, notwithstanding the Bulletins, the article in *The Times* and its reprint and the fact that the story extends beyond the period under review.

Briefly the background is as follows :

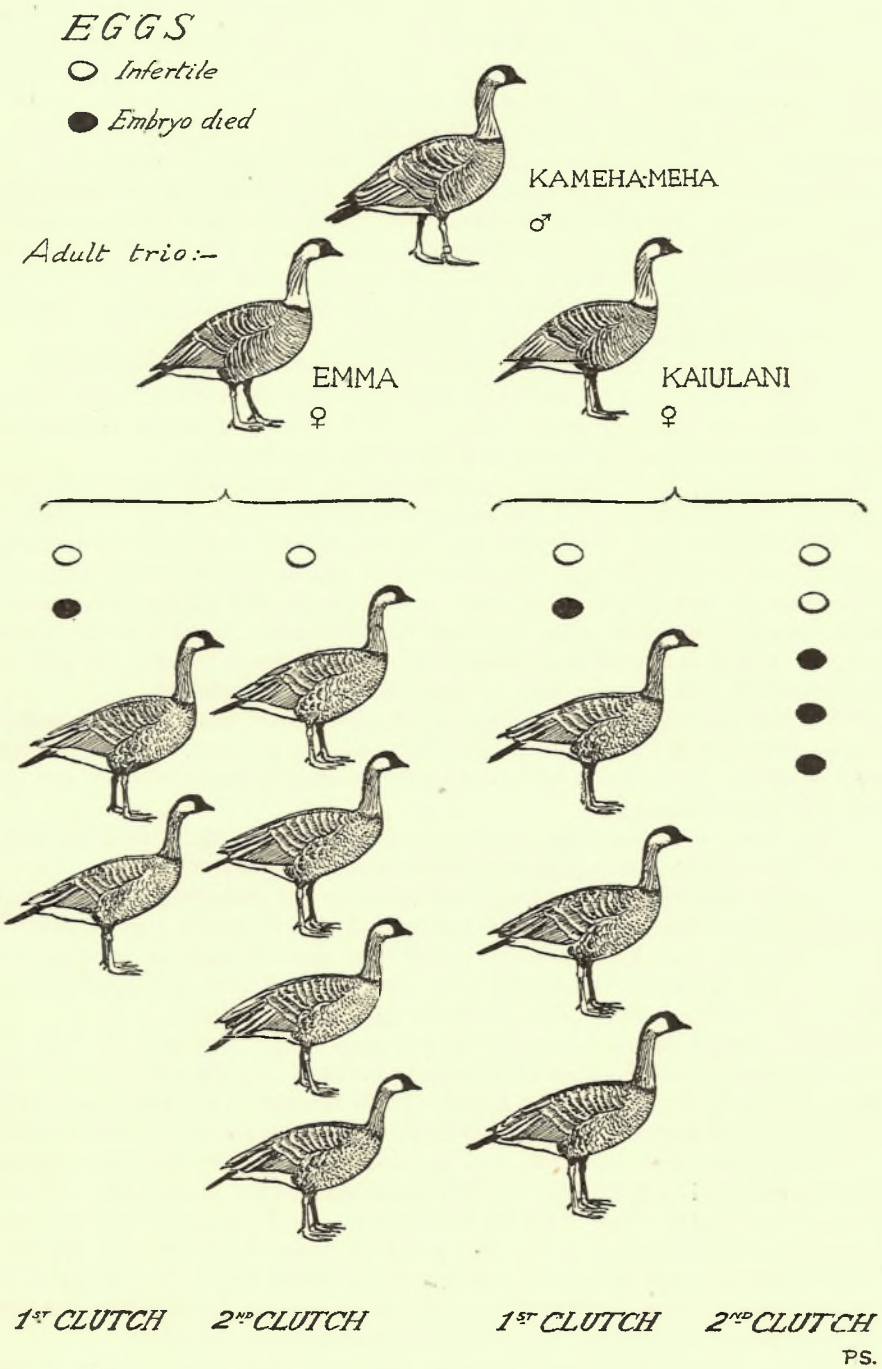
The numbers of adult Ne-nes in existence were believed, in 1951, not to exceed fifty ; only thirty-two were counted in a recent check. This is largely due to the introduction of various mammals into Hawaii, notably the pig, dog, cat and mongoose. A century ago there were still many thousands. A large proportion of the present population now lives either in captivity or semi-captivity.

Before the Second World War the Director had been in communication with Mr H. C. Shipman, who has kept a number of Ne-nes at liberty in his garden at Hilo on the east coast of Hawaii. But for Mr Shipman's interest the Hawaiian Goose might well be extinct, or at any rate beyond rescue today.

Soon after its formation the Trust communicated with the Board of Agriculture of the Territory of Hawaii, but at that time, it seems, no action was possible. Later Mr Charles Schwarz, of Missouri, who had been in contact with the Director for many years, was invited to go to Hawaii in order to advise on Game Bird Management and Conservation. Largely as a result of his recommendations, a project was begun under the able management of Mr J. Donald Smith, of the Division of Fish and Game at Honolulu.

Mr Shipman lent four pairs of geese for the project and special enclosures were built at Pohakuloa, 6000 feet above sea-level on the saddle road between Mauna Loa and Mauna Kea. A wild-caught female and a male from the Honolulu Zoo were added, so that the preliminary stock consisted of ten birds. Mr Smith had previously done some work in association with the Delta Waterfowl Research Station, and on taking up the project in Hawaii he was advised by Mr Al Hochbaum to get into communication with the Trust and to make use of the knowledge and experience of rearing geese in captivity which had been accumulated at Slimbridge. In addition to advice, the Trust offered to send its then Curator, Mr John Yealland (now Curator of Birds at the London Zoo), to help with the first rearing season. Mr Yealland spent the spring of 1950 in Hawaii, and two good goslings were successfully reared at Pohakuloa.

PRODUCTION OF NE-NES AT SLIMBRIDGE 1952



PS.

E

Meanwhile Mr Shipman's flock, after his loan to the new project and such accidents as a tidal wave, had become much reduced. Nevertheless, he most generously presented a pair of the geese to the Trust and they were brought back by Mr Yealland on his return. The ' pair ' turned out to be two females (there is no plumage distinction between the sexes in this species) and in March 1951 both birds nested and laid eggs. The eggs were removed in order that a second set should be laid and an urgent cable was sent to Hawaii for a male. Exactly seven days from the despatch of the cable a fine gander arrived at Slimbridge. He was one of the birds lent by Mr Shipman to the Pohakuloa project, and Mr Shipman's gesture in agreeing to lend the bird to the Slimbridge project, together with the promptness with which Mr Don Smith arranged the transportation, are much appreciated by the Trust. The two female geese were also delighted, but unfortunately the gander was in full moult when he arrived, as the breeding season in Hawaii is about six weeks earlier. So the eggs which both geese laid were again infertile.

During that season three goslings were successfully reared at Pohakuloa.

The three adult geese at Slimbridge have been, for the sake of convenience, named after Hawaiian kings and queens. The gander is Kamehameha, the larger of the two females is Emma and the smaller one Kaiulani.

On 18 February 1952 the first egg of the second season was laid at the New Grounds. Emma started first and the gander seemed to be firmly attached to her. She laid four eggs, but before she had finished the clutch Kaiulani began. In the normal manner the eggs were removed as laid and replaced with dummies which were in turn removed as soon as the clutch was evidently complete. When Emma's dummies were removed Kamehameha transferred his whole attention to Kaiulani who had already laid three of her five eggs. In spite of this apparently late transfer four of these five eggs were fertile.

Of the first four eggs laid by Emma, three were fertile, but only two hatched (in a snowstorm). They were rather weak goslings and one of them did not dry properly so that its down was much thinner and paler than the other, and the bird itself somewhat smaller.

Of the four fertile eggs in Kaiulani's clutch of five, only three hatched, but they were much stronger goslings than either of the first two.

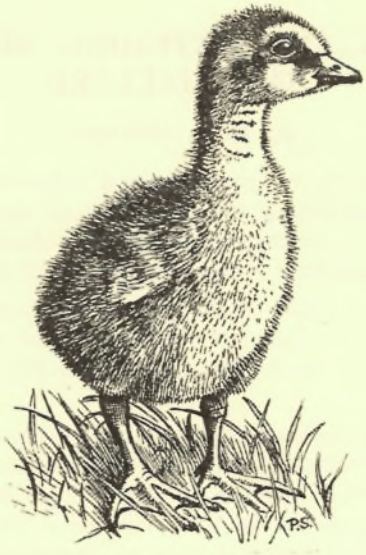
Meanwhile Kaiulani had been allowed to sit on her dummies for a few days so that Emma would have finished her second clutch by the time Kaiulani's second was due, and Kamehameha would have time to transfer his attention from the one goose to the other. The plan worked well, though from the fertility of Kaiulani's first clutch, it was evidently unnecessary.

Emma's second clutch consisted of five eggs ; one was infertile and the remaining four hatched. One of these was normal, two did not dry, like the smaller of the first two, and the fourth, which hatched two days later on the thirty-first day, was very small, though its down was thick and dark and normal.

All these eggs were incubated and hatched under hens or bantams, but the last five eggs, laid by Kaiulani, were left in the nest for her to incubate. By this means it was hoped to hatch all the fertile eggs. As it turned out, she allowed the eggs to get cold and none hatched although three of the five were fertile.

Thus nineteen eggs were laid, fourteen were fertile but only nine hatched. Contrary to expectation, all nine were reared, and when feathered the smaller and more backward goslings were indistinguishable from the others.

With the parents, the Trust now has twelve of these lovely birds—which probably represent about twenty per cent. of the world population.



Ne-Ne Gosling

Unfortunately bad luck has dogged the project at Pohakuloa, and only three goslings were reared there in the 1952 season. Mr Shipman's flock, as a result of his great generosity in sending birds to England and to Pohakuloa, is now only seven strong, and they did not breed this season. It seems, therefore, that the Trust's efforts may play a very important role in saving the species from extinction.

A most interesting paper on the Ne-ne by Mr Don Smith appeared in the *Journal of Wildlife Management* (Vol. 16, No. 1, pp. 1–8), which included a table of known living specimens of the species. This table showed that the total number of geese in 1951 was unlikely to exceed fifty and that only thirty-two had actually been counted. This, it is believed, is the lowest ebb of the species. The table is now brought up to date as follows :

TABLE XXII—HAWAIIAN GEESE KNOWN TO BE LIVING
(June 1952)

Seen in wild state on Hawaii, 1951	10	
Seen in wild state on Molokai, 1951	3	
Mr Shipman's garden at Hilo	7	
Pohakuloa project	12	
Mrs Wall	1	(very old)
Severn Wildfowl Trust	12	
	45	
Estimated additional wild birds	17	
Estimated total	62	

In recognition of his outstanding contribution to the survival of the Ne-ne the Trust has presented to Mr H. C. Shipman the original oil painting by Peter Scott of a pair of the geese which appeared on the cover of the Third Annual Report.

INCUBATION AND HATCHING BEHAVIOUR IN THE MALLARD

By D. F. McKinney

In the course of a study of preening and other everyday activities, some time has been spent observing the behaviour of incubating Mallard ducks. Space does not permit a detailed report of these observations, but a summary of certain aspects of behaviour at the nest may be of interest.

An incubating duck remains on the nest continuously except for one or two periods each day when she leaves to feed and oil her plumage. These periods of absence usually occur in the morning or the evening, and they last from thirty to sixty minutes.

While on the eggs, a duck changes position at intervals varying from fifteen to sixty minutes—the average is about thirty-five minutes. Certain individuals, however, may remain in one position for very long periods ; the longest recorded was 295 minutes. The reason for this variation is not clear. The size of the clutch or the situation of the nest may be important, but it is also possible that some type of physiological rhythm is involved. It is well known that some individual ducks will sit ' tighter ' than others when approached, but it would seem that there is no close correlation between the ability to sit tight and the frequency of turning. Thus some ducks which may be lifted off their eggs are found to have a normal rate of turning.

During the periods of incubation between changing position, the duck does very little. If free from disturbance, most of the time is spent sleeping, though the sleep is seldom very profound. There are usually short periods of blinking or dozing interrupted by brief alerts, during which the head may be cocked to follow passing birds.

All the interesting behaviour occurs at the time of changing position on the eggs. The first sign that the duck is going to turn is usually an increase in alertness, perhaps a turning of the head. Sometimes there is a brief toying with nest-material. Then before rising off the eggs a vigorous preening or tugging at the breast or flank-feathers may occur. This often has the effect of dislodging one or two down-feathers which will eventually be incorporated in the nest. Thus it happens that as incubation proceeds the amount of down in the nest increases gradually. This down becomes arranged around the edge of the nest and is used to cover the eggs when the duck leaves. The nature of these down-pulling movements and the fact that they always precede turning suggest that they may be related to displacement preening.

The bird then rises off the eggs and turns round to a varying extent—sometimes making several complete turns. Before settling again, the duck pokes into the bottom of the nest and turns the eggs by inserting the beak between the nest-edge and the eggs. This poking is repeated a number of times while the bird is turning. The movement is akin to that by which a goose or gull retrieves an egg from outside the nest—it is the chin and underside of the beak which are in contact with the eggs.

Settling on to the eggs is achieved by pushing the breast down and forward while the feet may be seen pushing backward on the edge of the nest. Settling

is followed immediately by 'paddling'; the bird paddles rapidly with alternate feet and the whole body rocks from side to side. This also serves to turn the eggs, though it may be effective more especially in arranging the long axes of the eggs in a horizontal plane. Vigorous poking might well leave some eggs standing on end.

Immediately after paddling come the nest-building movements. These are of two types : patting in the nest-edge with the underside of the bill, and pulling in straws and other material lying near the nest. Patting mainly serves to keep the nest-edge and the down close to the duck's body. This movement increases greatly in frequency when rain begins to fall. Pulling material often goes on for some minutes after turning, and sometimes the duck actually leaves the nest and slowly walks away a yard or two drawing straws backward and tossing them over her shoulders towards the nest. Material is never carried to the nest : the latter gradually increases in size during incubation and is constructed only from material which happens to be within a few yards of the site.

The final movements of the turning sequence are a lateral head-shake and a slight shuffle. The head-shake no doubt serves in many instances to remove down or nesting material which has become attached to the head or bill, but it frequently appears to be performed without any immediate stimulation and it would seem to be a part of the more or less stereotyped sequence of events. The slight shuffling movement is very difficult to describe and evaluate. It is presumably a minor adjustment of position and mainly involves the wings.

It is particularly interesting to note that in any one turning sequence only some of the above movements occur. Despite the fact that there is considerable individual variation, some idea of the relative frequency of these activities may be given. Preening or down-pulling occurs in about 50 per cent. of turning sequences. Preliminary toying with nest-material occurs in under 25 per cent. and poking under the eggs in about 65 per cent. The amount of paddling varies considerably but is usually very high—80–100 per cent. Patting and pulling occur in about 80 per cent. of turns. The frequency of head-shaking and shuffling varies too much to allow of any generalization.

It is perhaps worth stressing that certain activities do not occur on the nest during incubation. For example, many of the "comfort movements" such as general feather-shaking, wing-flapping, scratching and stretching are either absent or only rarely seen. During rain, when a duck would normally remove water from its feathers by shaking or wing-flapping, this is achieved by "drinking" the water off the feathers by removing the beak very lightly over them. The primary function of these "drinking" movements is not at all clear. In any case, at least during a light shower of rain, they do perform the dual service of removing drops of water from the feathers and providing water for drinking or moistening the beak. After prolonged heavy rain, however, the duck may become quite wet.

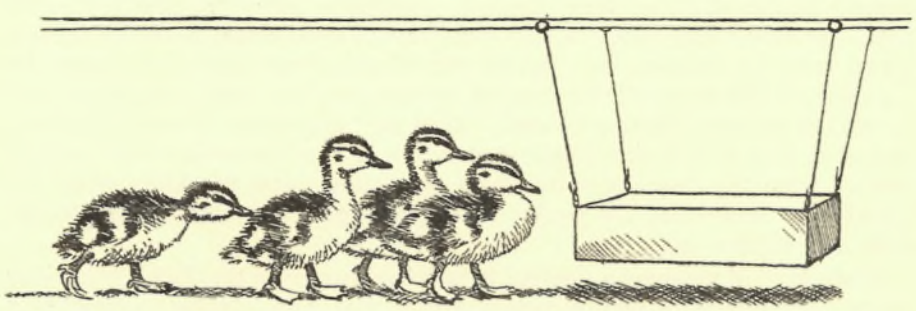
At the time of hatching a number of striking changes in the duck's behaviour occur. The rate of turning increases greatly, and there is some evidence that changes in the frequency of the different turning components also occur. Thus the frequency of poking in the nest increases, while paddling, pulling material and head-shaking may decrease. It would seem that the duck responds to the calling or chipping noises made by the ducklings while they are still in the egg. The rate of turning increases and the duck begins to make very quiet notes.

As soon as the ducklings have hatched and start moving about, the duck's

back may be seen to heave and jerk upwards until she is forced to adopt a half-standing posture. At this stage the turning movements gradually disappear. In a few hours some ducklings are dry and begin to push their way out at the edge of the nest. The duck now begins to perform very frequent oiling preens —perhaps every thirty minutes. These oiling sequences are atypical in that only the breast and belly receive the oil when it is taken from the oil-gland. As a result it seems probable that oil is distributed from the parent's underparts to the ducklings. This frequent oiling appears to go on for some time even after the family leaves the nest. It has been shown experimentally that this oiling is elicited by stimuli emanating from the ducklings. A duck can be induced to oil by introducing ducklings into the nest some days before the eggs are due to hatch. The exact nature of the operative stimuli remains to be investigated.

STUDIES OF LEARNING IN DUCKLINGS

Dr Eric Fabricius of the Söttvattenslaboratoriet, Drottningholm, Sweden, spent June 1951 at Slimbridge making an experimental investigation of some aspects of the behaviour of very young ducklings, assisted by Hugh Boyd. This study, which it is hoped to continue for at least two more years, is an extension of work begun at the University of Helsinki (see Fabricius, 1951, Zur Ethologie junger Anatiden, *Acta Zoologica Fennica* 68, pp. 175). The particular objects of attention are the following-reaction of the ducklings, the stimuli capable of eliciting this reaction, and the relation between the circumstances in which it is first exhibited and its subsequent intensity and persistence. The results will not, of course, be ready for publication until the work has been completed, but this note is intended to indicate the scope of the study.



CAPTURE OF TRUMPETER SWANS IN BRITISH COLUMBIA FOR H.M. QUEEN ELIZABETH II

(*The following note was received from Dr Harrison F. Lewis, Chief of the Canadian Wild life Service, Department of Mines and Resources, Ottawa*)

ABOUT 900 Trumpeter Swans are believed to spend the summer in Canada. Most of them winter in British Columbia. The largest known wintering group, including about one hundred birds, is to be found at Lonesome Lake, a small body of water among forested mountains about two hundred and fifty miles north-west of Vancouver. Here the swans are cared for by Ralph Edwards, a resident trapper, employed as swan guardian, and by his daughter, Miss Trudy Edwards, a young woman in her early twenties. For some years past the actual feeding of the swans has been done chiefly by Miss Edwards and they have become much more familiar with her than with her father.

In early November 1951 Messrs R. H. Mackay and D. A. Munro, scientists of the Canadian Wildlife Service who are stationed at Vancouver, British Columbia, flew to Lonesome Lake, where they and Mr Edwards and his daughter constructed in the water a rectangular trap of netting over a wooden frame. This trap measured forty-five feet by twenty feet and was nine feet high. It was provided with a large door that could be closed suddenly by means of a trip-wire.

The trap was left in place through December and January, without any action to capture swans, so that the swans would gradually become accustomed to it and would enter it readily. By the end of January Mr Edwards was able to inform Messrs Mackay and Munro, by the radio facilities of the British Columbia Forest Service, that swans were going in and out of the trap.

Messrs Mackay and Munro set out by air for Lonesome Lake on 2 February 1952, but were repeatedly held back by snowstorms near the Itcha Mountains. They finally succeeded in landing at Lonesome Lake at noon on 6 February.

Because the Trumpeter Swans were familiar with Miss Trudy Edwards and would go near her to be fed, it was necessary to ask her to assist in trapping the birds desired. At 11.30 on the morning of 7 February she was successful in enticing seven cygnets and one adult swan into the trap. As the trapdoor was closing, the adult and two of the cygnets dashed out of the trap, so only five cygnets were taken.

The remainder of the flock of swans, frightened by the trapping operation and the attempts of the captured birds to escape, left their usual feeding area near the trap and alighted about a mile away. It seemed unlikely that any additional trapping would be possible for some time.

Because of the threat of more stormy weather, it was decided to fly out promptly the five cygnets already captured. They were weighed, ringed, and crated. An aeroplane, summoned by radio of the British Columbia Forest Service, arrived at Lonesome Lake on 8 February.

The captured Trumpeter Swans were flown to Vancouver on 9 February and to Dorval Airport, Montreal, the next day. Awaiting them at Dorval were Messrs William Taylor and R. D. Harris, of the Canadian Wildlife Service, who fed and otherwise cared for them, and attended to the formalities that were necessary in connection with exporting them. The swans left Dorval by air at midnight of 11–12 February *en route* to England.

(*They were uncrated and released in the North American Pen at Slimbridge at* 8 *a.m. on* 13 *February. Her Majesty the Queen saw them on* 25 *April. By mid-May they were feeding from the hand.*—ED.)