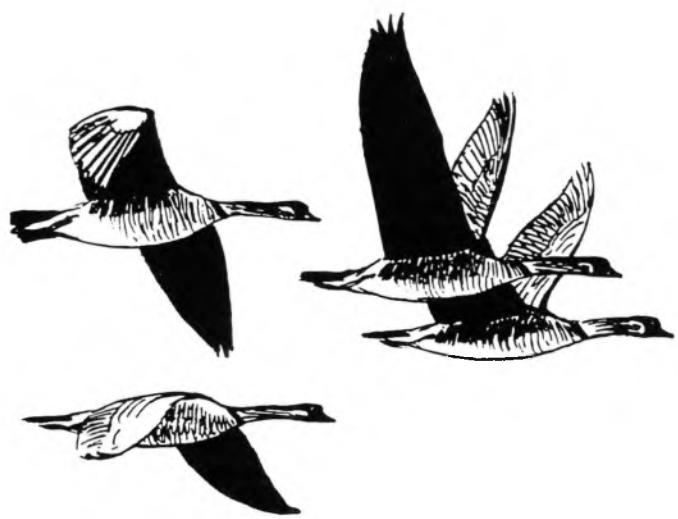
PROGRESS REPORTS



The ecology and behaviour of the North American Ruddy Duck *Oxyura jamaicensis* in Great Britain and its interaction with native waterbirds: a progress report

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Feral North American Ruddy Ducks have now been surviving in Great Britain for nearly 40 years but have been little studied. Previous workers have simply described their distribution, expansion (Hudson 1976, Vinicombe & Chandler 1982) and breeding behaviour (Ladhams 1977). In September 1987, a three year investigation of the ecology and behaviour of Ruddy Ducks in Great Britain began at The Wildfowl & Wetlands Trust, jointly supervised with Bristol University and funded by a NERC studentship. The project also had the aim of examining any interaction between the introduced Ruddy Ducks and native British waterbirds.

Ruddy Ducks were studied throughout the year especially during those periods of the breeding cycle when an increased level of social interaction may be expected, notably during brood-rearing and courtship. The construction of time budgets at these times of the year was selected as the most thorough means by which this information could be collected. In this progress report I present an overview of the results obtained so far.

Wing-tagging

Ruddy Ducks in Great Britain congregate in large flocks on reservoirs during the winter and disperse to smaller waters in the spring to breed. It has been suggested that wintering birds at Chew Valley Lake, Avon migrate north to the midlands to breed, and one aim of the study was to mark Ruddy Ducks at Chew with wing tags to monitor their dispersal from the site. Before this began I carried out a time budget study to assess the effect of attaching patagial tags to Ruddy Ducks using captive birds in the grounds at Slimbridge, Gloucestershire. This work revealed that there was no significant difference in behaviour between tagged and untagged birds after a two week period in which marked birds became accustomed to their tags. Examination of the tagged birds during the nine months in which they retained their tags showed no feather abrasion or damage to the wings save for a slight thickening of the patagium around the point of attachment.

Great effort has since been made to capture Ruddy Ducks at Chew using a variety of trapping methods including baited traps and dazzling from a boat, however, all have proved unsuccessful. This has been due mainly to two mild winters, with an abundance of natural food overwhelming the attraction of the wheat bait in the traps, and to an unexpected nocturnal awareness of the Ruddy Ducks. Three wild Ruddy Ducks have, however, been caught at Slimbridge - two have remained there and retained their tags for 5 and 8+ months (to date). The other bird has not been resighted since it was tagged.

Time budgets

The five time budget studies have amassed a total of 832 hours of observation throughout the year and have shown the behaviour of the Ruddy Duck to differ quite markedly between seasons. The diurnal winter time-budget collected at Chew in January and February 1988 revealed that adult males in alternate plumage, adult males in basic plumage and females/juveniles did not differ significantly in their behaviour (Kruskal-Wallis Test Statistic = 0.51, $P = 0.773$). The Ruddy Ducks spend 70.26% of their time resting (sleeping and pseudosleeping) and only 6.82% feeding (Table 1). Nocturnal observations and energetics calculations of the daily energy expenditure of Ruddy Ducks (using data from previous work by Gray (1980), Tome (1981) and Siegfried *et al.* (1976)) have supported these results in suggesting that Ruddy Ducks feed nocturnally. Other winter studies

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Table 1. Percentage time in activity for diurnal time-budget of Ruddy Ducks at Chew Valley Lake, Avon.

	All birds (n=280)	Adult Males Alternate plumage (n=72)	Adult Males Basic plumage (n=74)	Females/ juveniles (n=134)
BEHAVIOUR				
Major behaviours				
Rest	70.26	71.02	68.94	70.59
Comfort Movements	5.89	5.42	5.81	6.18
Swim.	16.55	16.17	16.97	16.53
Feed	6.82	7.12	7.84	6.10
Minor behaviours				
Alert	0.38	0.22	0.32	0.50
Social Interaction	0.06	0.03	0.10	0.06
Fly	0.01	0.00	0.01	0.02
'Skeeter'	0.02	0.03	0.02	0.02

from Pennsylvania (Stark 1978) and South Carolina (Bergen *et al.* 1989), found that they feed most during the night.

Other major behaviours recorded were comfort movements (preening, bathing etc.) which constituted 5.89% of the total time budget and swimming (including loafing and locomotion) which made up 16.55%.

When behaviour (mean half-hourly values) was plotted against time of day, a decline in feeding was apparent around mid-day with an associated increase in resting (Fig. 1). Resting behaviour also declined sharply at 16.00 h when swimming increased markedly. Preening was commonest in the early morning. Resting never fell below 50% of the hourly time budget, except for the value at 16.00 h. This may be suspect due to a small sample size (n = 3) but is probably genuine and caused by gulls coming in to roost on the lake at this time.

A total of 318 hours of observation during the summer of 1988 and 1989 at Mere Sands Wood Nature Reserve in Lancashire yielded only about 140 hours of usable time budget data for brood females. This was due to an unexpectedly low breeding success with only two broods reared per year, and to the fact that family groups tended to spend a lot of time out of sight in the lakeside vegetation. Analysis is yet to be completed on these data sets, however initial results indicate that brood females spend about 25% of the time in which they are in sight feeding, 30% swimming and about 15% resting. The behaviour of the brood females observed each year will be compared in terms of brood size, brood age and date to examine the relationship between the female and her ducklings. Females were observed to desert their offspring at 2.5 to 3 weeks of age, approximately 5 weeks before the young could fly.

The time-budget work on courting males produced 192 hours of observation, however no analysis has yet been performed on the data set.

Social interactions

A summary of the social interaction data analysed so far is presented in Tables 2 and 3. The summer time budgets of 1988 and 1989 were collected at Mere Sands Wood where there was a breeding population of ten pairs of Ruddy Ducks. Six females with broods were involved in 1469 social interactions with 22 species in approximately 140 hours of data collected. A total of 75 interactions with seven species was recorded for all the age/sex classes in 176 hours of observation during the winter time budget. Approximately 62% of all interactions were intraspecific. In the summer, brood females initiated all intraspecific interactions - these mainly involved chasing away displaying males, usually the attending male. 'Attending' males were probably paired to the females as their presence was tolerated to a certain degree. Drakes were also seen to defend the female and brood on a number of occasions and sometimes pair with the female once she had deserted her brood. The presence of 'other' males was not tolerated anywhere near the brood and these were probably either unpaired males or males paired to another bird. As no birds could be individually recognised, there was no way of determining whether this was the case or, in fact, whether the female was attended by more than one male during the

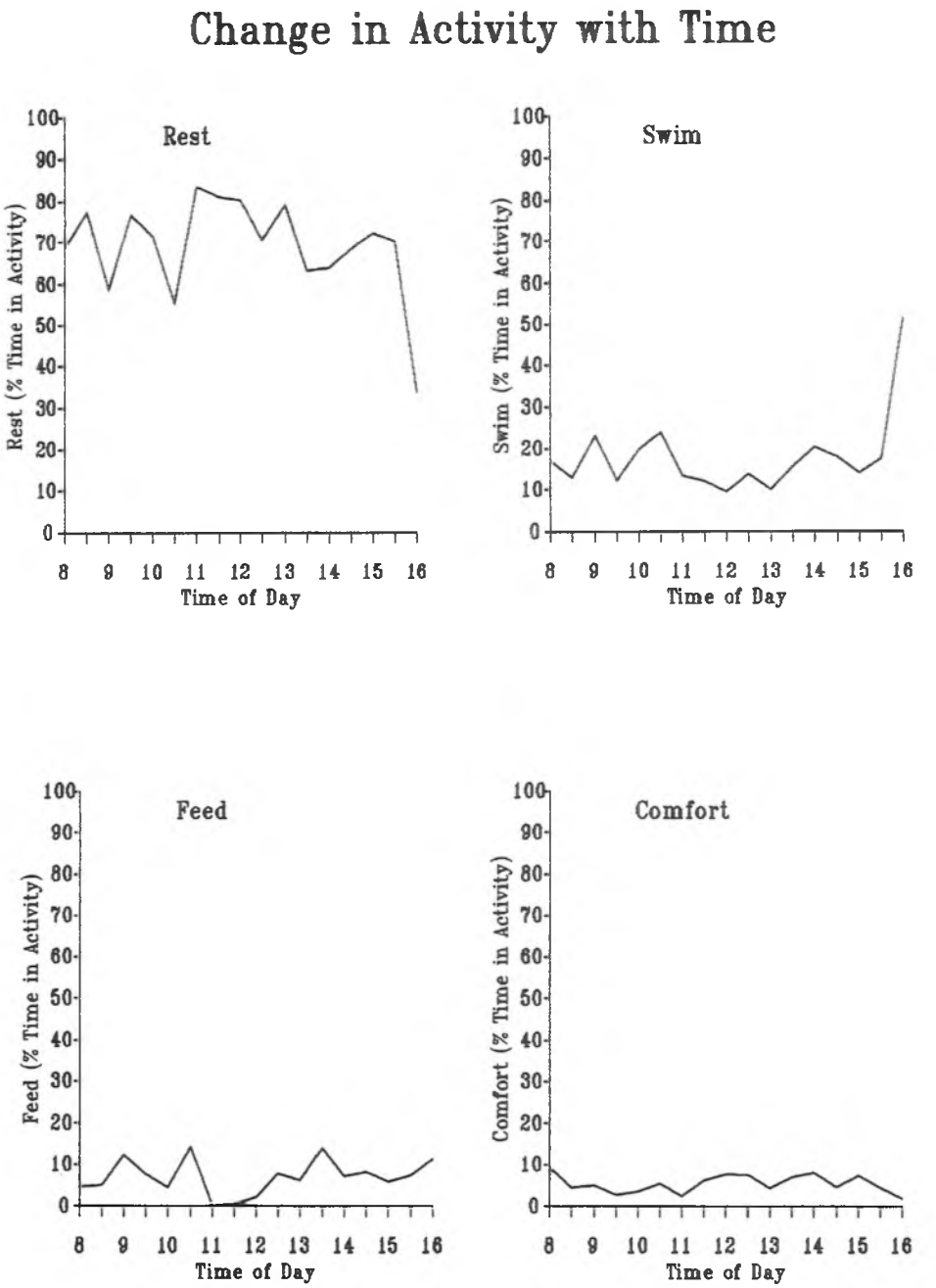

Figure 1. Plot of winter behaviour of Ruddy Ducks at Chew Valley Lake, Avon against time of day.

Table 2. Social interactions of Ruddy Ducks during the summers of 1988 and 1989. Percentage of total number of interactions in parenthesis.

	Number of interactions							
	Initiated by study female		initiated by other bird		Undetermined		Total	
INTRASPECIFIC								
Ruddy Duck								
Male - attending	465	(31.7)	0		0		465	(31.7)
Male - other	198	(13.5)	0		0		198	(13.5)
Male (undetermined)	21	(1.4)	0		0		1	(1.4)
Female	39	(2.7)	0		0		39	(2.7)
Duckling	187	(12.7)	0		0		187	(12.7)
Details not recorded	9	(0.6)	0		0		9	(0.6)
Multiple	11	(0.7)	0		0		1	(0.7)
TOTAL	93	(63.3	0		0		930	(63.3)
INTERSPECIFIC								
Little Grebe	15	(1.0)	4	(0.3)	0		19	(1.3)
Great Crested Grebe	25	(1.7)	11	(0.7)	1	(0.1)	37	(2.5)
Heron	7	(0.5)	0		0		7	(0.5)
Greylag Goose	3	(0.2)			0		3	(0.2)
Canada Goose	3	(0.2)	1	(0.1)	0		4	(0.3)
Shelduck	18	(1.2)	2	(0.1)	0		20	(1.3)
Gadwall	1	(0.1	0		0		1	(0.1)
Teal	1	(0.1)	0		0		1	(0.1)
Mallard	14	(9.8)	0		0		144	(9.8)
Shoveler	1	(0.1)	0		0		1	(0.1)
Pochard	8	(0.5)	0		0		8	(0.5)
Tufted Duck	7	(0.5)	0		0		7	(0.5)
Goldeneye	2	(0.1)	6	(0.4)	0		8	(0.5)
Moorhen	30	(2.0)	0		0		30	(2.0)
Coot	136	(9.3)	1	(0.1)	0		137	(9.3)
Lapwing	25	(1.7)	1	(0.1)	0		26	(1.8)
Black-headed Gull	42	(2.9)	0		0		42	(2.9)
Lesser Black-backed Gul	9	(0.6)	5	(0.3)	0		14	(1.0)
Feral Pigeon	1	(0.1)	0		0		1	(0.1)
Blackbird	1	(0.1)	0		0		1	(0.1)
Rabbit	7	(0.5)	0		0		7	(0.5)
Undetermined	9	(0.6)	1	(0.1)	0		10	(0.7)
Multiple	1	(0.1)	0		0		1	(0.1)
TOTAL	496	(33.8)	32	(2.2)	1	(0.1)	529	(36.0)
UNKNOWN	10	(0.7)	0		0		10	(0.7)
GRAND TOTAL	1436	(97.8)	32	(2.2)	1	(0.1)	1469	(100.0)

course of brood-rearing.

It is apparent that female Ruddy Ducks with broods are far more aggressive than either sex during the winter. The total number of social interactions observed involving brood females in the summer is far greater than the total number of interactions in the winter. This high degree of brood defence is also illustrated by the wide range of species with which interactions occurred. Females chased such unexpected species as Lapwings *Vanellus vanellus*, Blackbirds *Turdus merula* and rabbits *Oryctolagus cuniculus* feeding around the margins of the breeding pools.

Interspecific interactions during the summer were again mostly initiated by the brood female; however in the winter it was usually the other species which initiated the interaction. Gulls coming in to roost at Chew Valley Lake were mainly responsible as they dive-bombed the Ruddy Ducks. This arrival behaviour had no discernible advantage to the gulls - no food-stealing was involved - however they continued it throughout the study period.

Table 3. Social interactions by Ruddy Ducks during the winter of 1988. Percentage of total number of interactions in parenthesis.

	Number of interactions					
	Initiated by Ruddy Duck		Initiated by other bird		Total	
INTRASPECIFIC						
Ruddy Duck						
Male	26	(34.7)	0		26	(34.7)
Female	9	(12.0)	0		9	(12.0)
Details not recorded	11	(14.7)	0		11	(14.7)
TOTAL	46	(61.3)	0		46	(61.3)
INTERSPECIFIC						
Teal	0		1	(1.3)	1	(1.3)
Pochard	0		1	(1.3)	1	(1.3)
Coot	0		2	(2.7)	2	(2.7)
Black-headed Gull	1	(1.3)	11	(14.7)	12	(14.7)
Common Gull	0		6	(8.0)	6	(8.0)
Lesser Black-backed Gul	0		1	(1.3)	1	(1.3)
Details not recorded	0		6	(8.0)	6	(8.0)
TOTAL	1	(1.3)	28	(37.3)	29	(38.7)
GRAND TOTAL	47	(62.7)	28	(37.3)	75	(100.0)

Moult and feather development

The study of moult and feather development will provide the first comprehensive description of the moult cycle of Ruddy Ducks and has confirmed that British Ruddy Ducks undergo a double wing and tail moult every year as has been reported previously from North America (Siegfried 1973 and others). There are discrepancies between the timing of the double wing moult and that reported for birds at Delta, Canada, by Palmer (1976). Palmer stated that the Basic I, or first winter, plumage of Ruddy Ducks has a new wing and that the Alternate I, or first breeding plumage, wing is retained Basic I feathering. My birds did not moult their wings in the prebasic I moult but renewed them while attaining Alternate I plumage (except for one male which underwent a partial primary moult during the prebasic 1 moult). This aside, the sequence of moult in the captive birds followed that reported by Palmer (1976).

It has also been possible to develop a reliable ageing method for use on birds in the hand. This relies wholly on the shape of certain feather groups as no change in plumage pattern has been found despite an intensive photographic study of 12 captive birds. The method of ageing follows the same general pattern as that used for other western palearctic species and described by Boyd *et al.* (1975). Ruddy Ducks can be accurately aged until they first moult their wing feathers, which occurred in April in the captive birds. Examination of the shape of the greater coverts, axillaries, post-humerals and inner secondaries should allow successful ageing of most Ruddy Ducks until their first wing moult. Juvenile tail feathers are also a good indicator of age before the post-juvenile tail moult - this occurred as early as August in one captive bird but most began their tail moult in October or November. This is probably nearer the norm for wild birds who not suffer the stresses of confinement.

Juvenile wing feathers in the feather groups mentioned above are narrower and more pointed than the equivalent Alternate I or Definitive (adult) feathering. Juvenile inner secondaries are relatively narrow and taper gently to a point whereas older generation feathers are broader and blunt ended. Juvenile tail feathers are again narrower than successive generations and also show the distinctive notching at the tip typically found in all juvenile waterfowl.

Further work

The final period of fieldwork begins in January 1990 and will concentrate on the nocturnal

behaviour of Ruddy Ducks at Chew Valley Lake. Hopefully it will be possible to construct a time-budget although it has proved very difficult to observe ducks at night. They appear to spend most of their time away from the shore and hence out of the range of the image intensifying equipment that I have been using. Failing this, I will attempt to catch birds and attach radio transmitters that will monitor their nocturnal behaviour.

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A pair of North American Ruddy Ducks *Photo: Philippa Scott*