Bird and rabbit studies conducted on China Fleet golf course

(Spring and Summer 2023)

INTRODUCTION

In order to investigate the foraging site selection of woodpigeon, blackbird, carrion crow and European rabbit on golf courses in the UK, two studies were conducted on the China Fleet golf course during spring and summer 2023. GPS-tracking devices were applied to receive accurate data regarding the locations of tagged individuals during at least one day to assess the potential exposure of the focal species. For this purpose, the proportion of time spent in every different habitat was quantified. The method for quantifying was based on the GPS-tracking of at least 20 wild-caught individuals of each of the four species distributed in six golf courses.

This data is required in order to refine the risk assessment for plant protection products as part of their registration process, that might be applied to the lawn of golf courses (e.g. to counteract the development of fungal disease).

Figure 1 - Carrion crow marked with GPS-tag.

Figure 2 – European rabbit marked with GPS-collar

STUDY AREA

The selected golf courses for the studies were located in two different areas. One study area was situated in Powys (Wales) and the other study area was located in Cornwall and Devon (England) (Figure 3).

Figure 3 - General overview of the two areas with the six golf courses

METHODS AND RESULTS

All the methods performed in the field were carried out by qualified and experienced personnel.

Individuals of the target species were trapped using different methods in order to mount the GPS-tracking devices on their bodies. Four blackbirds, two woodpigeons, seven carrion crows (Figure 1) and four European rabbits (Figure 2) were tagged on the China Fleet golf course during the course of the studies (Table 1).

Table 1 - Number of target species trapped and tagged

Common name	Scientific name	N° trapped	N° tagged
Blackbird	*Turdus merula*	14	4
Carrion Crow	*Corvus corone*	7	7
Woodpigeon	*Columba palumbus*	2	2
European rabbit	*Oryctolagus cuniculus*	4	4

BIRD STUDY – METHODS

Transect counts

Two transect counts were conducted covering as much of the golf course area as possible to confirm presence of the focal species and select trapping locations.

Trapping and tagging

Blackbirds were trapped with mist nets, woodpigeons with mist nets and clap net and, for carrion crows, clap net, Larsen trap, ladder trap and mist nets were used.

The objective of the study was to achieve full tracking sessions from every tagged individual.

GPS tracking

GPS tags were used to obtain movement data from tagged individuals to map their total home range and to calculate the proportion of time they spent within the different golf course structures and other habitat types.

During GPS tracking, the position of the bird was continuously recorded at fixed intervals by the tag. Each tag tracked the daily movements of its bearer during the active period, which was approximately one hour before sunrise until approximately one hour after sunset.

The position data was internally stored in the GPS tag. The method to recover tracking data was downloading remotely via VHF signal, without recapturing the bird. To download the position data from a tag, the tag was first tracked and located by its specific terrestrial VHF frequency by a VHF-receiver connected with a Yagi-antenna.

Beside the target species, some other bird species were caught in the traps, ringed and released (Table 2, Figure 4).

Table 2 - Number of non-target species trapped and ringed

Common name	Scientific name	N° of individuals trapped
Blackcap	*Sylvia atricapilla*	4
Blue Tit	*Cyanistes caeruleus*	8
Chaffinch	*Fringilla coelebs*	2
Chiffchaff	*Phylloscopus collybita*	6
Dunnock	*Prunella modularis*	2
Goldcrest	*Regulus regulus*	1
Goldfinch	*Carduelis carduelis*	2
Great Spotted Woodpecker	*Dendrocopos major*	1
Great Tit	*Parus major*	6
Long-tailed Tit	*Aegithalos caudatus*	2
Mistle Thrush	*Turdus viscivorus*	1
Nuthatch	*Sitta europaea*	1
Robin	*Erithacus rubecula*	12
Song Thrush	*Turdus philomelos*	1
Wren	*Troglodites troglodites*	8

Figure 4 - Wren trapped and ringed in the golf course

During the fieldwork, several bird species were observed in the area of the golf course (Table 3).

Table 3 - List of species of birds seen in the golf course along the study

Common Name	**Scientific Name**
Barn Swallow	*Hirundo rustica*
Blackbird	*Turdus merula*
Blackcap	*Sylvia atricapilla*
Black-headed Gull	*Chroicocephalus ridibundus*
Black-tailed Godwit	*Limosa limosa*
Blue Tit	*Cyanistes caeruleus*
Bullfinch	*Pyrrhula pyrrhula*
Canada Goose	*Branta canadensis*
Carrion Crow	*Corvus corone*
Chaffinch	*Fringilla coelebs*
Chiffchaff	*Phylloscopus collybita*
Coal Tit	*Periparus ater*
Collared-Dove	*Streptopelia decaocto*
Common Buzzard	*Buteo buteo*
Common Greenshank	*Tringa nebularia*
Common Sandpiper	*Actitis hypoleucos*
Common Shelduck	*Tadorna tadorna*
Common snipe	*Gallinago gallinago*
Common Swift	*Apus apus*
Dunnock	*Prunella modularis*
Egyptian Goose	*Alopochen aegyptiaca*
Eurasian Coot	*Fulica atra*
Eurasian Green Woodpecker	*Picus viridis*
Goldcrest	*Regulus regulus*
Goldfinch	*Carduelis carduelis*
Gray Heron	*Ardea cinerea*
Great Cormorant	*Phalacrocorax carbo*
Great Spotted Woodpecker	*Dendrocopos major*
Great Tit	*Parus major*
Greenfinch	*Chloris chloris*
Herring Gull	*Larus argentatus*
House Sparrow	*Passer domesticus*
Jackdaw	*Corvus monedula*
Jay	*Garrulus glandarius*
Lesser Black-backed Gull	*Larus fuscus*
Linnet	*Linaria cannabina*
Little Egret	*Egretta garzetta*
Little Grebe	*Tachybaptus ruficollis*
Long-tailed Tit	*Aegithalos caudatus*

Common Name	Scientific Name
Magpie	*Pica pica*
Mallard	*Anas platyrhynchos*
Marsh Tit	*Poecile palustris*
Mistle Thrush	*Turdus viscivorus*
Moorhen	*Gallinula chloropus*
Northern Wheatear	*Oenanthe oenanthe*
Nuthatch	*Sitta europaea*
Ring-necked Pheasant	*Phasianus colchicus*
Robin	*Erithacus rubecula*
Rock Pigeon	*Columba livia*
Rook	*Corvus frugilegus*
Sand martin	*Riparia riparia*
Song Thrush	*Turdus philomelos*
Sparrowhawk	*Accipiter nisus*
Spotted Redshank	*Tringa erythropus*
Tawny Owl	*Strix aluco*
Tufted Duck	*Aythya fuligula*
White Wagtail	*Motacilla alba*
Willow Warbler	*Phylloscopus trochillus*
Woodpigeon	*Columba palumbus*
Wren	*Troglodytes troglodytes*

RABBIT STUDY – METHODS

Night observations

Night observations were performed on the golf course during dawn and night using binoculars and thermal vision devices. Eight observation points were established along a fixed route. The number of rabbits and the habitat of their position were recorded (Figure 5, Figure 6).

In addition, other identifiable mammals (excluding bats, voles, mice and shrews but including hares or hedgehogs and larger mammals like deer or fox) were also recorded.

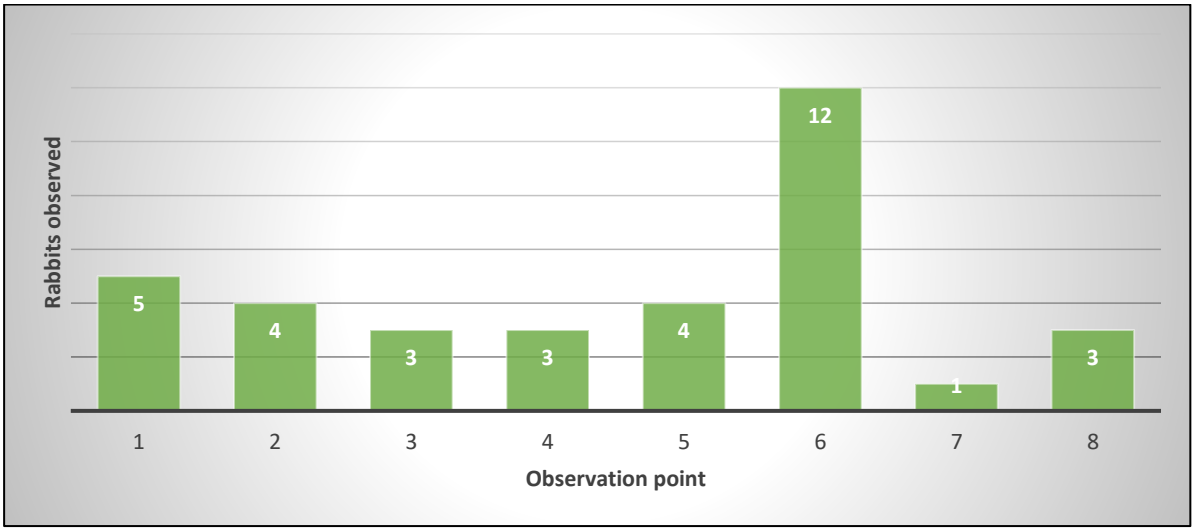

Figure 5 - Maximum number of rabbits seen per observation point during the night observations


Figure 6 - Photo of rabbits taken by a thermal camera during a night observation

Trapping and tagging

Trapping was done to capture and select those individuals that were going to be equipped with GPS collars. All rabbits were trapped with long nets. The handling procedure was carried out as follows: all individuals were checked for their condition, sexed, checked for their reproductive state and weighed. Only animals with a body weight above 1100 g and good physical condition were selected for a GPS collar.

GPS tracking

Collars mounted GPS tags were used to obtain movement data from tagged individuals to map their total home range and to calculate the proportion of time they spend within the different golf course structures. The GPS tags recorded continuously the position of its bearer, at fixed intervals, during the active period, which was mainly during night-time.

The collar was fitted around the animal's neck. All rabbits with collars were tracked at least once within a tracking period of approximately six weeks.

The position data was internally stored in the GPS tag and the data was downloaded remotely via VHF with the same procedure as the birds.

COMPLEMENTARY METHODS – TRAIL CAMERAS

In order to assess the presence of birds and mammals at certain sites on the golf course, motion triggered trail cameras were set up. The animals recorded by these cameras on the China Fleet golf course are listed in Table 4.

Table 4 - List of bird and mammal species recorded by the trail cameras

Birds		**Mammals**	
Common name	**Scientific name**	**Common name**	**Scientific name**
Blackbird	*Turdus merula*	Badger	*Meles meles*
Blue Tit	*Cyanistes caeruleus*	Dog	*Canis lupus familiaris*
Carrion Crow	*Corvus corone*	European rabbit	*Oryctolagus cuniculus*
Chaffinch	*Fringilla coelebs*	Grey Squirrel	*Sciurus griseus*
Dunnock	*Prunella modularis*	Hedgehog	*Erinaceus europaeus*
Great Tit	*Parus major*	Red Fox	*Vulpes vulpes*
Jackdaw	*Corvus monedula*	Wood Mouse	*Apodemus sylvaticus*
Jay	*Garrulus glandarius*		
Magpie	*Pica pica*		
Mistle Thrush	*Turdus viscivorus*		
Ring-necked Pheasant	*Phasianus colchicus*		
Robin	*Erithacus rubecula*		
Song Thrush	*Turdus philomelos*		
Tawny Owl	*Strix aluco*		
Woodpigeon	*Columba palumbus*		

Figure 7 - Photo of a rabbit with collar taken by a trail camera

Figure 8 - Photo of a badger taken by a trail camera