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BEHAVIOUR OF NON-BREEDING OR POST-BREEDING WILLIE WAGTAILS *Rhipidura leucophrys* IN THE WARRUMBUNGLE MOUNTAINS, NEW SOUTH WALES

HELEN C. STEVENS

Tibuc Road, Coonabarabran, New South Wales 2357

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The behaviour of Willie Wagtails *Rhipidura leucophrys* was observed during late summer in the Warrumbungle Mountains, New South Wales. Eight behaviours were described and time budgeted while diurnal changes in calling and foraging activity were also examined. The time budget revealed that birds were stationary for 54 per cent of time, and spent 15 per cent preening, 12 per cent food-gathering and 8.6 per cent flying. The rate of territorial calling was highest in the morning and declined steadily throughout the day, while 'chitty' calling occurred at a lower frequency which did not vary greatly throughout the day. The proportion of prey that were butterflies increased during the course of the day.

INTRODUCTION

Willie Wagtails *Rhipidura leucophrys* are sedentary flycatchers of open grassy habitats. Their foraging strategies have been documented (Cameron 1985) and although some aspects of behaviour have been described (Davis 1997), little has been published on the behaviour of these birds. Willie Wagtails defend a territory throughout the year (McFarland 1984). I considered that they may call more frequently early in the day, to emphasize territory ownership. They may also catch more food early in the day when most hungry after the overnight fast. This paper describes the range of behaviours exhibited by post-breeding Willie Wagtails and the time spent in each, as well as diurnal changes in the frequency of calling and prey-catching activity.

Study area

The Warrumbungle Mountains lie 25 kilometres west of Coonabarabran, New South Wales. Three sites located between 31°17'S, 149°06'E and 31°18'S, 149°00'E with open areas favoured by Willie Wagtails at 500–800 metres a.s.l. were chosen. These sites were woodland or open woodland dominated by Apple Box *Eucalyptus bridgesiana*, White Box *E. albens*, Red Stringybark *E. macrorhyncha* and Blakely's Red Gum *E. blakelyi*, with an understorey of native grasses and shrubs including *Acacia decora*, *Olearia elliptica* and *Cassinia quinquefaria*.

METHODS

All observations were carried out over a three-week period in late February and early March 2000. Seven adult birds at the study sites were watched for as long as they remained in view, using Swarovski 8 × 30 binoculars. I watched birds for three to four hours before describing and classifying their behaviours.

A time budget was constructed using a Digitor microcassette recorder, by recording the sequence of actions of the bird in view. I counted aloud the number of seconds for each action. Later, the audio record was transcribed into a written record of behaviour. Observations were spread as evenly as possible over daylight hours to give a representative time budget.

To see if Willie Wagtails call or feed more frequently at different times of day, I studied the rate of calling and consuming prey at three different times of day — morning (0630–0930 Eastern Standard Time, EST), midday (1030–1330 EST) and afternoon (1430–1730 EST). Two to three hours of observations were performed for each time interval over a five-day period in late February.

Active Willie Wagtails were often observed only for short periods of time before they disappeared from view. Therefore the technique employed by Armstrong (1996), recording the presence or absence of a particular behaviour in 15-second intervals of time, was used when quantifying behaviour.

Two types of calling were recorded: the 'sweet-pretty-creature' call (the territorial call; McFarland 1984) and variations on this; and the rattling 'chitty-chitty-chitty' call (the 'chitty' call). For each 15-sec interval (timed using a sweep-hand watch), I recorded whether or not the bird had called, which type of call it used, and the number of prey items taken. A bird was recorded as 'calling' in a 15-second period if it performed one or more calls of that type. The number of prey items consumed in any 15-second period was recorded, to determine the number of prey items consumed per minute. I recorded prey as consumed only if I saw the bird eat the prey. As butterflies are an easily identified prey, I recorded the species where possible, and number taken per hour of observation. All data were stored in a spreadsheet for analysis.

RESULTS

Description of behaviours

Willie Wagtails were seen engaging in eight behaviours and each could be assigned to one of four broad groups — perching (stationary/alert), comfort (preening), movement (flying, tail-wagging, running/hopping) and foraging (gleaning, hawking, snatching/pouncing). They also spent some time subduing prey. There was little interaction with conspecifics in the form of aggression or diving and dancing displays (*sensu* Davis 1997), apart from some association with semi-dependent/independent young of the breeding season just passed. The following descriptions were based on observations totalling 5 032 seconds on seven adult birds.

Willie Wagtails were found to be stationary/alert much of the time; they flew, ran and hopped while moving around their territories; and they performed other visual

(tail-wagging, tail-fanning), foraging (hawking, gleaning, snatching/pouncing) and comfort (preening) behaviour. They also spent time subduing prey.

STATIONARY/ALERT

The bird was usually on a perch between one and six metres above ground, less often on the ground. The bird looked around, especially from side to side, and might rotate through 180° on the perch, or crouch as an insect flew close. On a perch, the bird stood upright, or crouched low with breast feathers fluffed. Bouts of preening were often interspersed with the alert posture.

PREENING

The perched bird ran its beak through its feathers, often digging the beak deeply at one place in the feathers for several seconds. Then the bird moved the beak to another part of the plumage and probed again. The bird occasionally probed the preen gland at the base of the tail before continuing with preening. The bird sometimes extended a wing and passed the beak through the wing feathers with the wing partly or fully extended, or scratched the head with the foot by bringing the foot over the wing. The bird depressed its tail while preening on the upper body, and raised it when preening the lower parts of the body.

Preening was performed in a tree or on the ground at any time of day, but more frequently before 0930. Birds preened in short bursts of 5–20 seconds, but sometimes preened continuously for longer (up to four minutes).

FLYING

The bird flew from one perch to another, or between the ground and a perch. Flight was direct and fast, with strong, even wing beats. Distance covered in most flights was 100 metres or less with some longer flights of several hundred metres.

TAIL-WAGGING

The partly-fanned tail was wagged from side to side two or three times, the bird often moving its whole body through 90° while wagging. The tail was usually raised slightly at the limits of the wag, then dipped towards the ground for the return movement, creating a slight figure-of-eight movement. The bird wagged its tail most often when on the ground, gleaning in the shade, sometimes wing-flicking and tail-fanning in an effort to flush prey. It also wagged when alighting on a perch, and less often while perched.

RUNNING/HOPPING

The bird ran (with one foot forward at a time) or hopped (with one foot just ahead of the other, or both feet parallel) along a perch or the ground, without any obvious pursuit of prey. If the bird was pursuing prey, the activity came under gleaning.

GLEANING

Bird and prey were on the same substrate. The bird ran or hopped along the ground or along a tree branch and often wagged its tail or flicked its wings while gleaning, especially in the shade. When in pursuit of prey, the bird ran with head lowered and body held horizontal. It then extended the head forwards rapidly to capture the prey with the beak.

HAWKING

The bird flew out from a perch, or up from the ground, in a slow and undulating manner with wings fanned and tail depressed, in pursuit of flying prey. The bird often hovered in the air with wings fanned, taking between four and five seconds to cover about ten metres.

SNATCHING/POUNCING

The bird flew out from a perch or up from the ground to take prey from a substrate, usually the leaf or branch of a tree. Occasionally the bird flew down to take prey on the ground by pouncing, an activity included here with snatching.

Calling

There were two main vocal displays: the territorial call and the 'chitty' call. The bird pointed its beak up at an angle of about 45° while giving the territorial song, which was frequently sung by pairs of adults perched in a tree near each other. The song tended to be sung in bouts, sometimes interspersed with the 'chitty' call. The 'chitty' call was generally given when excited or alarmed, for instance when approached by other birds such as its own semi-dependent young. The main interactions observed with conspecifics were with the bird's own semi-dependent young. The tail was often depressed when the bird started the call from a perch, or wagged while giving the call on the ground.

TIME BUDGET

The time budget (Table 1) showed that Willie Wagtails spent over half their time stationary on a perch or on the ground, the longest stationary period observed being 7.5 minutes. Only 12 per cent of time was spent in food-gathering (hawking, gleaning, and snatching/pouncing). Of the time spent food-gathering, 47.3 per cent was gleaning, 46.9 per cent hawking and 5.8 per cent snatching/pouncing. The total percentage of time spent feeding (food gathering + subduing prey) was 14.5 per cent.

TABLE 1

Time budget for Willie Wagtails: time spent in performing a particular behaviour, and percentage of time spent in that behaviour. 'Other' comprised subduing prey (2.5%), wing-flicking (0.7%) and tail-fanning (0.02%).

Behaviour	Time spent in performing the behaviour (seconds)	(% of total)
Stationary/alert	2 703	53.7
Preening	754	15.0
Flying	435	8.6
Gleaning	286	5.7
Hawking	284	5.6
Tail-wagging	197	3.9
Running/hopping	179	3.6
Snatching/pouncing	35	0.7
Other	159	3.2
Total	5 032	100.0

Rate of Calling and Feeding

Willie Wagtails made the territorial call most in the morning and least in the afternoon, while the rate of 'chitty' calling did not vary much through the day (Table 2). Pairs of birds (presumably male and female) were observed singing in response to the other's song, often for minutes at a time, in the morning and at midday. In contrast, the rate of food consumption was greatest in the middle of the day. Of the food-gathering behaviours, gleaning and hawking were used to similar extents (47.5% and 46.7% of foraging time respectively), while relatively little time (5.8%) was spent snatching or pouncing. The rate at which wagtails took butterflies was highest in the middle of the day and in the afternoon. Most were common brown butterflies *Heteronympha merope merope* but two other types were also taken.

TABLE 2

Percentage of 15-second intervals with calls and number of prey items consumed min^{-1} by Willie Wagtails at different times of day — morning (0630–0930 Eastern Standard Time, EST), midday (1030–1330 EST) and afternoon (1430–1730 EST). Calls were of two types: territorial calls ('sweet-pretty-creature' and variations) and the rattling 'chitty-chitty-chitty' call (the 'chitty' call). The number of prey items consumed min^{-1} (mean±SE) is shown. The number of butterflies consumed h^{-1} and the percentage of food items that were butterflies are also given. Butterflies were primarily common brown butterflies *Heteronympha merope merope* but two other types were also taken.

Time of day (EST)	0630–0930	1030–1330	1430–1730
Observation period (h)	2.02	2.00	2.97
Calling Rate			
% intervals with territorial calls	24.8	15.2	6.2
% intervals with 'chitty' calls	2.9	5.4	3.9
Feeding Rates			
Number of prey items consumed min^{-1} (mean±SE)	0.40±0.06	0.55±0.07	0.31±0.05
Number of butterflies consumed h^{-1}	2.5	4.0	3.7
Butterflies as % of food items	10.4%	12.1%	20.0%

DISCUSSION

In late summer, post-breeding Willie Wagtail behaviour is generally limited to perching, preening, flying and food-gathering with no interspecific aggression. While most of these behaviours have obvious and fundamental functions, the significance of tail-wagging is not clear. Birds wag their tails in many different situations, such as when they alight on a perch while hunting on the ground. Consequently, tail-wagging may be a signal to conspecifics (Davis 1997) and/or a means of flushing prey (Elgar 1995).

Willie Wagtails took large prey items, and the high food value of these clearly allow the birds to spend considerable time perching (54%) and preening (15%). Although some of the perching time is 'static searching' for prey (Cameron 1985), the birds do not appear to be constantly looking for food while still, and spend only 12 per cent of time foraging and 2.5 per cent subduing prey. This low foraging time is similar to that found for a range of honeyeaters feeding on very rich nectar sources (7–18% — McFarland 1986) and considerably less than for other more insectivorous species, e.g. whistlers Pachycephala spp. (33.5–71% — Ford 1989) or Regent Honeyeaters *Xanthomyza phrygia* (39% — Ford *et al.* 1993).

The familiar 'chitty' call of the Willie Wagtail is employed at any time of day and appears to be associated with the bird becoming excited or alarmed in response to various stimuli. The territorial call is sung much more often in the morning, less around midday, and least of all in the afternoon, and may reinforce ownership of a territory. The duetting of pairs of wagtails is typical of birds that are sedentary, defend territories year-round and maintain monogamous pair-bonds (Davis 1997).

Willie Wagtails exploit various food sources using a range of hunting techniques. Such versatility may be the reason for their wide geographic range in comparison with congeners (Drycz and Flinks 1995). The birds in this study employ two main methods of prey-catching — gleaning and hawking. In contrast, birds in the New England region in late summer largely use hawking to catch prey, while gleaning and snatching are much less important (Cameron 1985). Willie Wagtails in the Warrumbungle Mountains actively pursue and eat large numbers of common brown butterflies (*Heteronympha merope merope*) and smaller numbers of other butterflies, especially in the warmer parts of the day.

Willie Wagtails increase their overall prey consumption around midday, a time when butterflies and insects in general may be more active. Later, the birds reduce their overall capture rate but appear to focus more on the larger, and possibly more energetically rewarding, butterflies. In this study, butterflies made up 10–20 per cent of the wagtail diet which is considerably more than that found for birds in New England (2% — Cameron 1985).

The rate of prey capture recorded here (0.31–0.55 prey consumed min^{-1}) is considerably less than the 1.5–2 prey captures min^{-1} observed by Cameron (1985). The difference could be due to greater numbers of large prey (such as butterflies) taken in the present study. However, the present study might also have underestimated captures, as prey was only recorded as consumed if the bird was seen to do so and small items could have been missed.

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