

Results from a Nesting Study of Welcome Swallows in Southern Tasmania

P. PARK

The nesting, pulli development and behaviour of a group of colour-banded Welcome Swallows *Hirundo neoxena* was studied at Campania in southern Tasmania over a period of five years during the time between their arrival each spring and their departure in the autumn.

Observations on nesting, pulli development and behaviour of Welcome Swallows were made during a colour-banding study in southern Tasmania over a five year period (Park 1981).

Study Area

The nesting sites in the study area consisted of:

- (1) a steel-framed, iron-roofed, saw-toothed shed, 13 m x 15 m, enclosed with vertical boards 2.5 cm apart, with one window 100 cm x 60 cm permanently open;
 - (2) a house verandah, and
 - (3) a garage,
- all within 200 m of each other.

The buildings were situated on the edge of the small township of Campania, in open undulating farmland in southern Tasmania 42° 40'S., 147° 25' E. All the swallows nested in the shed, with the exception of one pair which alternated between the verandah and the garage.

Methods

A mist net was used to trap the free-flying birds, except twice when two separate adults were picked off their perches by hand at night, and replaced onto the perch after banding. The pulli were banded when 8-15 days old. The adults were individually identified with a CSIRO* serially-numbered aluminium alloy band and plastic colour bands, whilst the pulli received CSIRO bands but were collectively colour banded; different colours represented each season except for two seasons.

Colour-banded birds are numbered in this paper in numerical sequence with the prefix F (Female) and M (Male). Numbering is in order of banding e.g. F1 is the first colour-banded female.

Over the five seasons many hours were spent watching the birds, mostly from a hide in the shed, and their sex was determined by noting which bird went into the nest to lay the eggs. The nest was checked immediately after the bird had left. During this period the partner would frequently sit near the nest, thus making identification easier.

Results

Nest Site and Construction

In the shed the most frequent positions for the nests were on a gently sloping steel girder backed by a purlin cleat, and always on the darkest side. On the verandah the nest was attached vertically to the wall, and in the garage on a horizontal surface within a disused chicken brooder which rested on the ceiling truss. During six separate observations male birds were seen to be the first to bring mud to the nest site. Prior to this, the male had been at the nest site when it was on a horizontal surface, turning round a few times while vocalizing and appearing to invite the female, who sat and watched. The mud pellets were collected from a nearby waterhole and the swallows would grab and then scoop up the mud with their beaks. Sometimes pieces of dried grass, rootlets and cattle tail hairs were collected and held in the beak before the mud was collected. This binding material was also pushed into the wet mud *in situ*. The pellets were then placed in a position to form the cup-shaped nest, usually with the bird sitting or standing inside the nest, before the pellets were placed on the nest wall. Again, this was when the nest was placed on a horizontal support.

The lining was mostly dry grass (seldom green) and was completed with the addition of sheep's wool, possum, cat or dog hair, and finally feathers. For four successive years F7 surrounded herself with a wall of white feathers, and had to push her head through them to look

* Bands used were provided by the Australian Bird-banding Scheme, Division of Wildlife Research, CSIRO.

out of the nest. All stages of nest building were carried out by both the male and female birds. Some females added more feathers to the nest than others, and some females were seen to add feathers to the nest after incubation had commenced. Frequently both male and female would leave and return to the nest site together. Refurbished nests always had some mud and grass added, and once the nest was relined on top of a deserted clutch.

In two nests small pieces of marine shell and quartz stone, measuring from 3-5 mm, were found under the lining. Construction times varied from 6-24 days. This variation could have been caused by unfavourable weather. Nests were built during the morning and afternoon, although most activity was during the morning.

Copulation

Only once was a possible attempt at copulation observed. This occurred early in the morning, a few moments after the female had left her nest after laying the second egg of a clutch, the male mounted her as she sat on the girder beside the nest, but she flew away almost immediately.

Egg Laying

Of 14 closely watched layings, eggs were laid on successive days, and during November and December 1974 all the eggs were laid between 05:26 and 06:45 hours Eastern Standard Time. As feathers kept being added, it was difficult to know when the nest construction or refurbishing was complete, and to say exactly how many days elapsed before the first egg was laid. The time between previously mated pairs returning together and the laying of their first egg was from 16-45 days (an average of 28.7 days for 14 females). During the five seasons the earliest clutch started was 19 September, and the last 28 January (Table 1).

TABLE 1

Duration of breeding season of Welcome Swallows at Campania, Tasmania.

Season	First clutch started	Last clutch started
1971-72	6.10.71	28.1.72
1972-73	26. 9.72	15.1.73
1973-74	1.10.73	19.1.74
1974-75	3.10.74	6.1.75
1975-76	19. 9.75	5.1.76

From the six clutches which were laid in January, three were successful and three failed.

Clutch Size

Of 67 clutches, egg numbers were as follows:—

$\frac{C/2}{2}$	$\frac{C/3}{11}$	$\frac{C/4}{41}$	$\frac{C/5}{13}$
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Table 2 shows individual clutch sizes and fledging success.

Egg Size

The average measurement from 28 eggs was 18.01 mm x 13.20 mm and ranged from 16.02-19.40 mm x 13.97-12.12 mm. Comparison of egg sizes from three sources is shown in Table 3.

Period between Successive Clutches

Only the clutches where at least some of the pulli were fully fledged have been included, to calculate the time between the laying of the first egg of successive clutches. This period varied from 47-63 days, with an average of 56 days from 18 periods between such clutches.

Incubation

During all observations only the female was seen to incubate, except once when M3 went into the nest and sat for a few seconds on the eggs. On some cold nights a few of the males would occasionally sleep in the nest with their partners. The females would sometimes sit in the nest during the day before the clutch was completed, and more often than not they would sleep in their nests at night. Every now and again the incubating females would dip their heads up and down into the nest, possibly turning the eggs. During incubation the male would often sit near the nest and accompany the female when she flew away from or returned to the nest. An accurate study of 48 clutches found that incubation took from 14-18 days, giving an average of 15.6 days. The mean daily temperatures did not necessarily influence the time, but the females did leave the nest more frequently when the temperature was cooler, possibly to feed. A male was never seen to feed a female on the nest.

Time of Hatching

Usually the eggs hatched in the early part of the morning and in three carefully observed clutches within four hours of each other; but in two other clutches, one egg did not hatch till 24 hours afterwards.

Fledgling Period

This varied from 18-23 days with an average of 20.6 days for 33 broods. The number of pulli

in a brood did not appear to have any effect on this time.

Pulli Weight

Pulli were weighed daily from three separate broods of three, two and one pulli for 13, 11 and 15 days respectively. Skin pencils were used to make individual marks on the pulli, and they were weighed at the same time every morning in

a small nylon sling, suspended from a 50 g pesola spring balance. Weighing ceased and the pulli were banded when explosion from the nest seemed imminent. The pullus which started the heaviest remained the heaviest, and the maximum gain in any 24 hours was 3.50 g for the heaviest pullus of the two-pulli brood. During the 15 days of weighing, the weather was good, with the maximum temperature ranging from 15.7-24.6°C

TABLE 2

Individual clutch size and pulli success over five years, for each female.

Female	No. of clutches Laid				Total No. of Eggs Laid	Total No. of Pulli Fledged	% of Success
	2	3	4	5			
F1			4		16	15	93.75
F2		2	8	2	48	28	58.33
F3			2	2	18	14	77.77
F4		1		1	8	6	75.00
F5		4	3		24	16	66.66
F6		1	1		7	6	85.71
F7			4	2	26	18	69.23
F8			4	2	26	7	26.92
F9				3	15	9	60.00
F10	1	1	6		29	17	58.62
F12			4	1	21	6	28.57
F13	1	2	2		16	7	43.75
F14			1		4	3	75.00
F15			2		8	6	75.00

Neither of the two-egg clutches could be used for analysis, as there was evidence that F10's nest was robbed by a Grey Butcherbird, *Cracticus torquatus*, and a broken egg was found on the ground within F13's nest area. Therefore average clutch size = 4.03.

TABLE 3

Comparison of egg sizes of Welcome Swallows from three sources.

Area	Latitude South	Average Size mm	Range mm
Western* Australia	31°		18.00-19.00 x 13.00-14.00
Northlands† New Zealand	36°		16.00-19.20 x 12.00-14.00
Southern Tasmania	42°	18.01 x 13.20	16.02-19.40 x 13.97-12.12

* Serventy and Whittell (1967).

† Edgar (1966).

and the minimum 7.7-11.1°C. Figure 1 shows details of weight gain for the three clutches weighed.

Development of Pulli

- Day 1: When first hatched the altricial pulli are pink and transparent with the egg tooth appearing white on the beak. The black sphere of the eye dominates the head, and a few down feathers present on the head, neck and back.
- Day 3-4: The eye slit and feather tracts are visible.
- Day 5-6: Eyes will open and some contour feathers have emerged. Making audible food-begging noises.
- Day 8: Cream chest and abdominal tracts in quill.
- Day 9-10: Quills breaking on primary and secondary wing, and tail feathers.
- Day 12: Body well covered with feathers and russet colour above bill appearing, sometimes the russet colour is apparent around the anus.
- Day 14: Two pulli's tarsi were 9.5 mm as compared with the average adult length of 10 mm.
- Day 16: Able to break fall to ground by wing movements, if disturbed in nest.
- Day 18-20: Able to fly from the nest.

Feeding

Both the adult birds would frequently give a short call as they landed on or near the nest when bringing food. Usually only one pullus was fed at a visit; only once were two seen to be fed, one after the other.

The only definite identification of the insects which the swallows were feeding on:

- from alimentary tract of F12 after she was killed;
- a few insects removed from beaks of swallows when they were mist netted;
- once when the swallows were feeding very close to the ground and seen to be catching flies, some of these were caught and later identified;
- remains of regurgitated pellets found in the nests or on the ground in the shed.

The following types of insects have been found in the food of Welcome Swallows — Hemiptera (sub-order Heteroptera); Coleoptera (sub-order Polyphaga, family Staphylinidae); Diptera (sub-

order Nematocera, family Tipulidae; and sub-order Brachycera, family Bombyliidae); Trichoptera; Hymenoptera (sub-order Apocrita).

The wide selection of insects found in the diet thus includes beetles, flies, caddisflies and wasps.

Breeding Success

The very low success rate for 1974-75 (Table 4) could be accounted for by predation by Butcherbirds and the disappearance of two females early in the season, after each had laid a clutch of eggs. The most successful clutch size was C/3 (72.7%), and the second clutch to be laid had the highest fledgling rate 76.9% as compared with the first (51.6%) and the third (50%). Schrader (1976) also found that the second clutch was the most successful.

Lind (1960) stated in his paper on the House Martin *Delichon urbica* that in Europe they lay fewer eggs on the average when they build a new nest as compared with a refurbished nest. In this study 123 eggs were laid in new nests and 139 in refurbished ones.

The 59.4% successful fledgling rate for the whole study period is higher than Schrader's, but during the five breeding seasons there were no prolonged adverse weather conditions.

Leaving the Nests

On occasions the adults would entice the fledglings from the nest by making the same call as when they arrived at the nest site with food. The length of time that the fledglings came back to the nest site at night varied considerably, from a few days to three weeks.

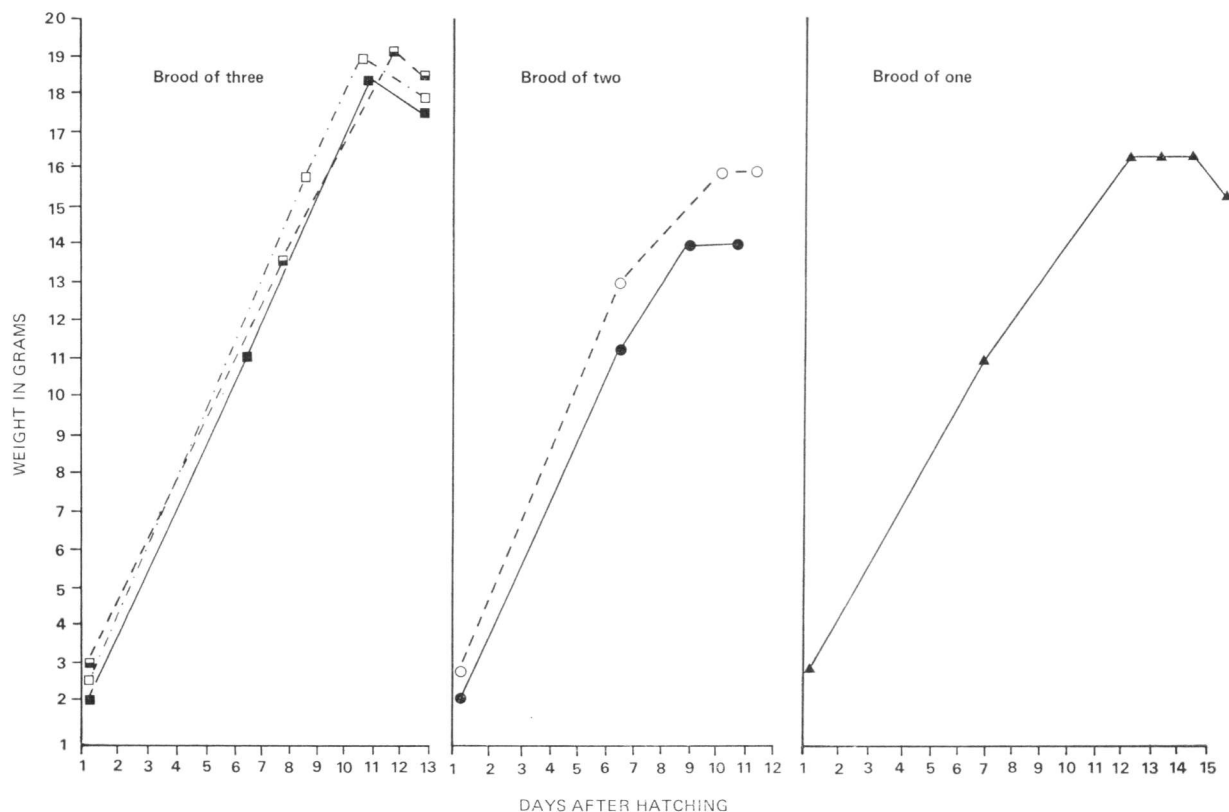
Weight

Over the five years the weight of 31 of the adult birds was as follows:

Sex	No: weighed	Average wt: (g)	Range (g)
Female	16	15.06	12.75 - 17.25
Male	15	14.33	12.75 - 17.25

Territories

The swallows in the shed defended a smaller area around their nest sites as compared to the single pair on the verandah. A strange swallow could fly around the shed and sit on the girder unnoticed as long as it was not too near an occupied nest, whereas the verandah swallows would sit 4-6 m from the nest and strongly vocalize if there were any swallows flying into the



●Figure 1. Details of weight gain for three clutches of Welcome Swallows at Campania in southern Tasmania.

TABLE 4

Breeding success of Welcome Swallows over the five seasons by clutch size.

Season	C/2	C/3	C/4	C/5	Number of eggs laid	Number fledged	% success
1971-72		4	8	1	49	44	89.8
1972-73		3	6	4	53	32	60.3
1973-74		1	7	7	66	46	69.6
1974-75	2	2	13		62	17	27.4
1975-76		1	7	1	36	19	52.7
Total	4	33	164	65	266	158	59.4
per cent successfully fledged per clutch	50%	72.7%	46.1%	36.9%			

verandah, and usually they were chased out. Pairs frequently changed their nest site but kept to their side of the shed. The farthest moves were the verandah pair to the garage (6 m) and M11 and F10 from one end of the shed to the other (15 m).

Sunning

On occasions the verandah pair was seen to sun themselves on a piece of concrete in front of the garage door. They would lie on their sides at right angles to the sun, spread their tail feathers partially raise the uppermost wing, raise their contour feathers, open their beaks and close their nictitating membranes. (At this time they appeared to be in a very vulnerable position.) After staying like this for 1-2 minutes, they would fly onto the roof and preen themselves.

Predators and Disturbances

Rats *Rattus rattus*, House Sparrows *Passer domesticus*, Grey Butcherbirds *Cracticus torquatus*, and cats were the main predators confronting the swallows. Rats killed and ate two adults at the beginning of the 1971-72 breeding season. They crawled up the girders at night to kill the sleeping Swallows. During the early part of 1972-73 breeding season a pair of House Sparrows successfully removed an egg from the nest of M6 and F5, and during the following two days began to fill the nest with grass, but they abandoned it. Periodically a Grey Butcherbird came into the shed and would be furiously mobbed by the swallows. They could have accounted for the missing eggs and pulli. Once a Grey Butcherbird was seen to squeeze himself through a 3 cm gap in the slatted wall. Cats were unable to get into the shed during the breeding season but one did catch F4 outside the shed at the beginning of the 1972-73 breeding season, and two pulli which had recently left the security of the shed.

Behaviour

- Once the pulli were flying they would come back into the nest in the late afternoon and the parents would continue to feed them. They would also leave the nest much later in the morning than their parents.

- During the first few days after feeding the pulli, the adults would dip their heads into the nest to pick up the faecal sac. As the pulli grew older they voided over the edge of the nest. Whilst the adults waited to catch the sac. It was then dropped about 30-50 m away. Twice a female was seen to swallow the sac when the pulli were

two and three days old. At approximately six to eight days the adults stopped removing the sacs, which piled up on the ground under the nest.

- On at least five occasions, pairs were seen to drop a feather and catch it again, quite a few times in succession.

- One pair did not sleep in the shed until the first egg was laid, whilst another pair slept in the nest when it was only half built. Sometimes both male and female would sleep together in a nest, and once both adults plus two juveniles slept in one nest which contained three eggs. The adults did not necessarily sleep together in the nest on the coldest nights.

- A few of the swallows stood out as individuals. M9 was very aggressive, he usually flew at every bird which came near his nest except his partner. When the pair M10 and F8 flew into the shed and sat on their girder, they would "harshly chatter" to each other. Had the swallows not been individually colour banded, it would have been impossible to know that M3 paired with three separate females in one season; or that a pair with no obvious trait was the same pair as the previous season. And yet Crouchley (1979) assumed that they were studying the same pair of Welcome Swallows over four consecutive breeding seasons.

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