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1 **Observations on a breeding pair of Black Falcons *Falco subniger* in southern**
2 **Victoria**

3
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12
13 **Abstract.** Successful breeding activity is described for a pair of Black Falcons *Falco*
14 *subniger* in southern Victoria (south of 37°S) in 2014 and 2015 (brood of two fledglings in
15 each year), among the few confirmed or recent such records for the region (agricultural
16 land and remnant woodland west of Melbourne). Courtship (supplementary) feeding at
17 the nest, male brooding of downy chicks, growth and development of chicks, and other
18 novel aspects of breeding behaviour and vocalisations are described. One nestling period
19 lasted 40 days, and the post-fledging period at least a month. Prey included birds and
20 small mammals. The fledglings and adults appeared vulnerable to vehicle- and train-
21 strike; a road-killed specimen is described for the district. The breeding adults were
22 cryptic, suggesting the need for further survey for nests in the region. They were also wary
23 and susceptible to disturbance, indicating a need for caution when approaching and
24 observing active nests at all stages of the breeding cycle.

25
26
27 **Introduction**

28
29 Although there are regular sightings of Black Falcons *Falco subniger* at the Western
30 Treatment Plant near Werribee, southern coastal Victoria (e.g. Whelan 2013; Bartram
31 2014) and occasional sightings in the outer Melbourne hinterland (DW, BM pers. obs.),
32 there are few confirmed or recent breeding records for central and southern Victoria
33 (Hewish *et al.* 2006). Brittlebank (1899) claimed breeding at Myrniong (37°37'S,
34 144°21'E) in the 1890s, and Len Harvey recorded 'nesting' in October–November
35 1961 at Rowsley (37°43'S, 144°25'E) (Hewish *et al.* 2006). Sixteen of only 17 Victorian
36 breeding records are from north of the Great Dividing Range, north of 37°S, thus

37 highlighting the rarity, or at least infrequent reporting, of such events in the state
38 (Victorian Biodiversity Atlas 2015 and BirdLife Australia atlas data to 2015 combined).
39 One database record near Avenue Hill (37°43'S, 144°28'E) in January 1962 (further
40 details unknown) may relate to the Rowsley event, given the proximity and timing.

41

42 The breeding behaviour of the Black Falcon is incompletely known, with few
43 details on some aspects of courtship (e.g. supplementary feeding) in the pre-laying
44 phase, and of parental roles (e.g. male brooding) in the early nestling phase (Charley
45 *et al.* 2014). In the present study, successful breeding is described for a pair of Black
46 Falcons in southern Victoria near Bacchus Marsh (37°41'S, 144°26'E), in the same
47 region as Myrniong and Rowsley/Avenue Hill, during 2014 and 2015. We also describe
48 little-recorded aspects of courtship (supplementary feeding at a nest in the pre-laying
49 phase) and parental behaviour in the first half of the nestling period. Further, we collate
50 other recent records for the region, which provide other circumstantial evidence of
51 breeding, and describe a road-killed specimen from near Rowsley. As the Black
52 Falcon is listed as Vulnerable on the Victorian Advisory List (DSE 2013), though still
53 not nominated or listed as Threatened on the *Flora and Fauna Guarantee Act 1988*,
54 any information is useful in elucidating its breeding distribution, biology and ecology
55 for management action.

56

57

58 **Study area and methods**

59

60 The Black Falcons' nest area was located in the Bacchus Marsh district (exact details
61 withheld), ~45 km west of Melbourne. The general landscape consists of a cleared
62 grassy valley in flat-to-undulating terrain (agricultural—grazing and cropping) with
63 remnant stands of trees, including Grey Box *Eucalyptus microcarpa*, Yellow Box *E.*
64 *melliodora*, Yellow Gum *E. leucoxylon*, River Red Gum *E. camaldulensis* on
65 watercourses, planted Sugar Gums *E. cladocalyx*, young Tasmanian Blue Gum *E.*
66 *globulus* and other eucalypt plantations, and exotic pines *Pinus* sp. The basaltic (i.e.
67 high-nutrient) soils support a high density of European Rabbits *Oryctolagus cuniculus*
68 and potential avian prey, and a high density and diversity of raptors (DW, BM, LP &
69 SD pers. obs.). For further details of the region, see Douglas & Reid (2010).

70

71 After discovering the Black Falcons' nest-site by observing the routines and
72 behaviour of the pair of adults in the pre-laying phase (late July–August 2014), DW
73 and/or BM, sometimes with LP, observed the nest almost daily from Day 4 after
74 hatching (late September) until fledging. Observation sessions were opportunistic and
75 variable in duration, with use of binoculars, digital photography and sometimes a voice
76 recorder (for later transcription). Some early observations (at Nest 1) were made from
77 within a vehicle parked on the roadside ~40 m from the nest (i.e. as a hide). The longer
78 observation sessions were of up to c. 3h, commonly c.1–2 h, spread through the day
79 variously from 0615 h and finishing as late as 1830 h. The parent Falcons were sexed
80 by relative size in this sexually size-dimorphic species (female larger than the male,
81 which also had paler cheeks). The nestling period is assumed to be within the same
82 range as previously recorded (i.e. 38–42 days: Charley *et al.* 2014), and days/weeks
83 of the nestling period were assigned accordingly from the fledging date of the first
84 nestling. It is possible that observer presence affected the birds' behaviour (e.g. nest
85 attendance).

86

87 In 2015, the observation protocol and methods were similar. After discovery in
88 the incubation phase (late August), the nest area was generally avoided until late in
89 Week 2 of the nestling period. In the nestling period a telescope was used, usually
90 from a greater distance than in 2014 (~100 m, i.e. outside the Black Falcons' alert
91 distance), other than occasional approaches for photography and one all-day and one
92 half-day nest-watch (both late in Week 3). In the post-fledging period, effort by DW
93 and BM concentrated mostly on obtaining photographs and video footage in the first
94 month, and in the second month searching in the wider area (by DW, BM and SD) for
95 the Falcon family.

96

97 Prey items in pellets were identified by SD by comparison with reference
98 material in the Zoology Museum, University of New England, New South Wales, and
99 prior relevant samples (e.g. Charley *et al.* 2014).

100

101

102 **Results**

103

104 The Black Falcons initially occupied a vacant Whistling Kite *Haliastur sphenurus* nest
105 ~15 m above the ground in a ~22-m tall Yellow Gum (Nest 1) during 27 July–1 August
106 2014. The tree was situated in woodland on the slope of a gully in farmland ~40 m
107 from a road. Courtship feeding and sitting in the incubation posture took place.
108 Subsequently, eggs were laid and young raised in another nest (Nest 2), also a
109 Whistling Kite nest used by the Kites in 2013 (information from landholder). This nest
110 was situated ~12 m above the ground on the edge of the canopy of a ~15-m-tall, partly
111 dead-topped Grey Box in woodland on the edge of a gully, ~1.3 km from Nest 1 and
112 ~250 m from a house. There was open access and good visibility (for the Falcons)
113 around the nest, which was effectively in an emergent tree at that site. A raised railway
114 line, on an embankment, was located ~150 m away. Although the Falcons were first
115 observed occupying Nest 2 from 27 August 2014, back-dating from the fledging date
116 (29 October) would place hatching in mid–late September and laying in mid August
117 (from values quoted by Charley *et al.* 2014).

118

119 In 2015, Black Falcons did not use Nest 2, and on 23 August a pair (suspected
120 to be the same adults, based on plumage and behaviour) was found re-occupying
121 Nest 1, late in the incubation stage. Hatching occurred around 1 September (see
122 below) and laying therefore occurred in late July. Whistling Kites had a new, active
123 nest in the adjacent tree, ~20 m from the Falcons' Nest 1. The Falcon pair was seen
124 throughout the year before and between the nesting events, sometimes near either
125 nest or a third, similar stick nest ~1 km from the other two nests.

126

127

128 *Courtship and copulation*

129

130 On 26 July 2014, a pair of Black Falcons was first observed soaring, displaying and
131 calling together for ~15 minutes before the male departed and the female flew to their
132 perch-tree (a 20-m-tall, dead-topped eucalypt ~100 m from Nest 1), later to be joined
133 by the male on a nearby perch. The display manoeuvres included soaring close
134 together, punctuated by diving to follow the contours of the valley, the male shadowing
135 the female's path, and the occasional calls during this aerial display were of a chattering
136 type.

137

138 On 27 July, from c. 0830 h, the male arrived at Nest 1 and the perched female
139 flew to the nest to greet him, with mutual clucking calls while the male sat in the nest.
140 After the male left to hunt at 0900 h and the female left for the perch-tree at 0905 h,
141 he returned to the perch-tree at 0916 h amid intense mutual calling (wailing by the
142 female), followed by copulation for c. 8–10 seconds (Figure 1) then perching side by
143 side. The male then departed and returned with small prey, taking it to the nest-side
144 branch and repeatedly giving a *tik-tik-tik...* call, rapidly at first but slowing down towards
145 the end of the sequence. As the female arrived to join him, he placed the prey in the
146 nest and stepped to the rim, while the female stepped into the nest, seized the prey
147 and started to feed while standing on the nest-rim, before taking the prey to pluck and
148 feed at the perch-tree as the male departed. He returned c. 30 minutes later with
149 another small prey item, both Falcons plucking and feeding on their respective items
150 on the branch ~30 cm apart. After the male flew and returned, they mated for c. 10–
151 12 seconds, for the second time (c. 80 minutes apart). In the afternoon (1330 h) as
152 DW drove past, the female was sitting low in the nest but stepped onto the rim, then
153 the nest-side branch when DW turned and drove slowly past again.

154

155 On the morning of 28 July, the male was harassed by 4–5 vocal Sulphur-
156 crested Cockatoos *Cacatua galerita* in the perch-tree, one approaching to perch near
157 him, but he held his ground before eventually (1 h later) flying to the nest-side branch
158 for 10 minutes, after the female had flown towards and possibly sat in the nest. In the
159 evening (1735 h) of 30 July, the female gave the *tik-tik-tik...* call from the nest,
160 whereupon the male flew from the perch-tree to the nest-side branch, followed by
161 mutual *tik-tik-tik...* calling. The female was sitting deep within the nest, hidden from
162 view and invisible from the road. Observations were minimised at this stage, in case
163 the female was laying, and activity at Nest 1 was last observed on 1 August.

164

165

166 *Incubation period*

167

168 In 2014, Nest 2 was discovered on 27 August, by which time (back-dating from the
169 fledging date) incubation was in progress. During this phase the male appeared to
170 provision the incubating female (see Hunting and prey, below), as he took his catches

171 to the nest and departed. The hatching date is assumed to have been around 22
172 September (i.e. 38 days before the first young fledged).

173

174 In 2015, the female was found incubating at Nest 1 on 23 August, and was
175 perched beside the nest then incubating on 30 August. The hatching date is assumed
176 to have been 1 September, as on our next visit (2 September) the female fed small
177 chick(s) invisible from the observation position, then settled in the brooding posture,
178 and 2 weeks later both adults were still brooding the chicks (see below).

179

180

181 *Nestling period*

182

183 During this phase in 2014, the adults were mostly seen guarding the nest from the
184 nest-tree, nearby tree(s) or from flight, sometimes exchanging or delivering prey or
185 feeding the chicks, and defending them against other birds (see below and Table 1).
186 One aerial prey exchange was from the male's bill to the female's feet as she
187 approached from below. The smaller male was twice seen brooding the small downy
188 chicks, in Weeks 1 and 2 (Days 6 and 12), while the female perched nearby. The
189 adults were seldom seen on the nest during the early chick phase, perhaps because
190 they flushed before the observer(s) arrived. Growth and development of the young are
191 summarised in Table 2 and Figure 2a–d.

192

193 In 2015, the female was observed to feed and brood hatchling(s) on 2
194 September (here assumed to be Day 2). Prey was delivered to the nest-side branch
195 by the male as the female begged with a wailing call. On Day 12, as the observer
196 approached, the perched female called and a standing chick flattened itself in the nest.
197 On Day 15, over 2.3 h from c. 1550 h to sunset, the male brooded for 4+ minutes until
198 the female arrived with prey and fed the two chicks, then both adults departed together.
199 After c. 35 minutes, the male had arrived on the perch-tree and the female brought
200 partly eaten prey to the nest and fed the chicks while he departed again (suggesting
201 that he had guarded her back to the nest with prey that she had collected from him).
202 During the remainder of the afternoon, the female brooded (c. 1 hr in strong wind),
203 discarded the skeletal remains of prey near the perch-tree, and returned after c. 35
204 minutes (at sunset) to brood the chicks, presumably for the night.

205

206 For the rest of the nestling period, from Day 13 onwards, parental behaviour
207 was similar to that observed in 2014. For example, one of the adults guarded the nest
208 from a branch in the nest-tree while the other was absent or on the perch-tree, or either
209 or both soared over or defended the site against other birds. On Day 22, a changeover
210 of guard duty occurred when the female went from the perch-tree to the nest-tree,
211 called, and the male changed places with her. Details of the growth stages of the
212 chicks are included in Table 2. Both young fledged on 11 October, giving a nestling
213 period of 40 days. BM obtained video of the female feeding the nestlings on their last
214 day in the nest: www.vimeo.com/149554505.

215

216

217 *Fledging*

218

219 In 2014, the older female nestling fledged on 29 October, before the smaller, less-
220 developed male fledged 4 days later (Tables 1 and 2). On the first fledging day, after
221 the older fledgling was perched on a dead tree, the adults flew together over the nest
222 area, calling to the young, and were high over the nest as a Swamp Harrier *Circus*
223 *approximans* flew past the nest-tree. The fledgling was moving about the branches
224 and flapping its wings. It then flew to a live Yellow Gum and after c. 10 minutes took a
225 longer flight and landed in the top of a tall Sugar Gum. BM obtained video of the
226 fledgling: www.vimeo.com/111306811 and www.vimeo.com/113139093.

227

228 The following day, the adult female delivered prey to the nest around midday.
229 In the late afternoon of that and the following day, both young were in the nest or the
230 older was perched beside the nest within 1 m. Even on Day 3 post-fledging, the older
231 fledgling's wings and tail were short (Figure 2c), suggesting that it fledged at the lower
232 end of the recorded range (i.e. ~38 days old). Finally, by the fifth day (2 November, on
233 Day 44), the younger fledgling was perching beside its sibling on a dead branch near
234 the nest-tree.

235

236 In 2015, the two young fledged, with short wings and tail, at 40 days old (Figure
237 2d); on the preceding day there had been strong winds that may have dislodged them
238 from the nest.

239

240

241 *Post-fledging period*

242

243 In 2014, on the day after both young had fledged (i.e. on 3 November), an adult
244 (apparently the female) carried prey to a leafy eucalypt within ~100 m of the nest and
245 was followed by (presumably) a juvenile. There was some calling, and they
246 disappeared farther into the trees. Thereafter, it was not possible to follow the Black
247 Falcons after the family group left the immediate nest area, and there were no
248 sightings after 4 November.

249

250 In 2015, over their first week, either fledgling remained close to the nest, being
251 seen back on the nest (Days 3, 6 and 7) or on the nest-branch (Day 7), and the adult
252 female brought prey to the nest-tree. In Week 2 the fledglings focussed on a dead tree
253 in the nest area; they still had short, blunt wings but were flying and chasing (Day 8)
254 and play-fighting in the air (Day 9). In Week 3 (Day 15), they appeared to have adult
255 proportions, and one chased a Black Kite *Milvus migrans* (Day 17); by Day 21, they
256 focussed on the perch-tree ~100 m from the nest. In Week 2, an adult delivered prey
257 to a juvenile (Day 8) and fed a juvenile bill to bill on a dead tree (Day 9). On Days 14
258 and 25, a juvenile was seen on the ground with prey (presumably delivered by an
259 adult), and on Day 24 one begged to an adult. On Day 28, a juvenile was in the perch-
260 tree, and after that date (7 November) the Falcons could no longer be located
261 (although the site was not checked at sunset for roosting Falcons). On 13 December,
262 2 months after the date of fledging and after a month's lapse in sightings (despite
263 frequent searching), the pair of adults was found in the nest area, without the juveniles.

264

265

266 *Nest defence*

267

268 During the courtship phase in 2014, a male Little Eagle *Hieraaetus morphnoides*
269 circled above Nest 1, unchallenged by the Falcons. During the incubation period in
270 2014, the foraging male Black Falcon flew directly at treetop height near a Peregrine
271 Falcon *Falco peregrinus* eyrie on a building ~2 km from Nest 2, intently watching the
272 female Peregrine Falcon on her perch on a tall industrial chimney and veering off when

273 he was within 100 m of her (i.e. avoiding the Peregrine Falcon's territory) before
274 heading for Nest 2.

275

276 During the nestling period in 2014 and/or 2015, the adult Black Falcons
277 frequently (though somewhat inconsistently) defended the nest area by attacking or
278 chasing other birds, including: Noisy Miner *Manorina melanocephala*, Black-faced
279 Cuckoo-shrike *Coracina novaehollandiae* and Australian Magpie *Cracticus tibicen* in
280 the nest-tree; other raptors within 200 m (Whistling Kites, Brown Goshawks *Accipiter*
281 *fasciatus*, Wedge-tailed Eagles *Aquila audax* within 400 m, Little Eagle, Brown
282 Falcons *Falco berigora*, Australian Hobby *F. longipennis*, Peregrine Falcon; Little
283 Ravens *Corvus mellori* within 300 m; a Straw-necked Ibis *Threskiornis spinicollis* flying
284 past; and Sulphur-crested Cockatoos that landed in the nest-tree and even at the nest
285 (Table 3). A female Collared Sparrowhawk *Accipiter cirrocephalus* flying 300 m from
286 the nest went unchallenged. Early in the post-fledging period, the adults repelled a
287 Brown Falcon, Wedge-tailed Eagles and a Little Raven.

288

289 In 2014 (Nest 2, nestling period Day 36), in the adult Black Falcons' absence,
290 a pair of Wedge-tailed Eagles (which had a nest ~500 m away) approached the
291 Falcons' nest low and at speed, and reached within 50 m of the nest before both adult
292 Falcons appeared and chased away the Eagles. In both years, the adult Black
293 Falcon(s) called when harassing larger raptors: a slow, hoarse cackle (~2 notes/sec.),
294 less excited or frenzied than the calls from a defending Peregrine Falcon.

295

296

297 *Hunting and prey*

298

299 The two prey items delivered by the male to the female in the courtship phase in 2014
300 were both small birds (a probable Yellow-rumped Thornbill *Acanthiza chrysorrhoa* and
301 an unidentified species).

302

303 During the incubation period in 2014, the male on several occasions hunted
304 Black Rats *Rattus rattus* from a nearby chicken run on a small hobby farm ~600 m
305 from the nest-tree. On at least three occasions, he caught what appeared to be Black

306 Rats and took them to the nest, presumably to give to the incubating female because
307 he immediately departed without prey.

308

309 In the nestling period in 2014, the male delivered a bird and a possible rodent
310 to the female, chased a bird (unsuccessfully), and fed on prey (probably a Common
311 Starling *Sturnus vulgaris*) on a tree near the nest without sharing the prey with the
312 female or near-fledged young. When both adults were circling together, one carried
313 prey (probably a Mouse *Mus musculus*) in its bill. In Week 3 (Day 21, the first time that
314 she was seen hunting), the female dropped from a dead tree and killed a Rabbit kitten
315 on the ground below. After the female had fed and left the prey, the male Falcon took
316 it to pluck/feed on a nearby stump, then left the remains on the stump and returned to
317 perch beside the female.

318

319 In the Black Falcon's fledging phase in 2014, the female brought a passerine
320 to the nest and, after both young had fledged, an adult (probably the female) had a
321 bird which it apparently gave to a fledgling. Only one pellet was found beneath the
322 nest, but any others may have tumbled down the gully slope below the tree. The single
323 pellet (1.7g) consisted of feathers, including from a parrot (most likely Eastern Rosella
324 *Platycercus eximius*) and apparently a Common Starling, and fragments of a beetle
325 (Coleoptera).

326

327 In 2015, observed prey in the nestling period included three Australian Wood
328 Duck *Chenonetta jubata* ducklings, three unidentified ducklings, a passerine, three
329 unidentified birds (one small), a Rabbit and a small unidentified mammal, and in the
330 post-fledging period a passerine, an unidentified bird and a Rabbit kitten. In one
331 instance (nestling period Day 20, male on guard), the female departed and returned
332 with prey in 10 minutes. In another (nestling period, Day 39), the adults together
333 departed from a recently burnt paddock, one carrying prey (possibly a rodent) in its
334 foot. The prey was transferred during flight (foot to foot as the captor, rather than the
335 receiver, rolled) and taken towards the nest ~2 km away (C. Lindorff pers. comm.),
336 thus indicating a minimum foraging distance from the nest.

337

338 Three fresh pellets and fragments (5.4 g) of a further two were found under the
339 nest (disregarding old mammalian skeletal material referable to prior occupation by
340 Whistling Kites):

341 (1) 48.5 × 19.0 mm, 3.6 g, entirely feathers and a few bone fragments of small bird(s)
342 including Common Starling.

343 (2) Flattened, 1.9 g, mostly feathers by volume, including green parrot (probably a
344 juvenile Crimson Rosella *Platycercus elegans*); some rat fur.

345 (3) 36.7 × 27.5 mm, 4.3 g, entirely feathers and a few bone fragments of small bird(s)
346 including Common Starling.

347 The fragmented pellets were mostly feathers by volume, i.e. bird(s) including Eastern
348 Rosella, with some Rabbit fur and beetle fragments. The mean dry weight of four intact
349 pellets was 2.9 g.

350

351

352 *Moult*

353

354 By early November 2014, nearly a month after the juveniles had fledged, the adult
355 female Black Falcon was moulting her middle primaries, and by early December she
356 was in more advanced quill moult and regrowing a central tail-feather (rectrix). The
357 adult male had also started moulting his middle primaries during this period.

358

359

360 *Other remarks*

361

362 The adult Black Falcons were often secretive or cryptic and left the nest area low,
363 sometimes on a path that kept a tree between them and the observer. When perched
364 in the nest area or tree, they also watched the observers warily and sometimes
365 flushed, slipping away unobtrusively. Observer attention at the nest-selection stage
366 may have influenced the switch from Nest 1 to Nest 2 in 2014. Observations of the
367 breeding cycle at Nest 2 in 2014 may also have influenced the switch back to Nest 1
368 in 2015, although by then Nest 2 had become rather dilapidated.

369

370 During the 2014 breeding event, the adults often flew low over or along the
371 nearby railway line and perched on it, raising the possibility that they, and the

372 fledglings, would be vulnerable to train-strike. On its fledging day, the younger fledgling
373 was dangerously close to the line. DW therefore arranged for V/Line (rail company) to
374 be contacted, and they agreed to reduce train speeds on the relevant section of line
375 for the duration of the breeding event and for some weeks after.

376

377 The Falcons also appeared vulnerable to vehicle-strike. For example, in the
378 post-fledging period in 2014, an adult flew low and fast across the road in front of BM,
379 as it attacked prey in the treed area around a house. It flew so low across the road
380 that it would have collided with any traffic passing at the same time.

381

382 After the breeding event in 2014, five Black Falcons were seen foraging at
383 stubble fires at the Bacchus Marsh sewage treatment works in April 2015 and six were
384 seen following farm machinery that was direct-seeding at the Western Treatment
385 Plant, Werribee, in June. In May 2013, four were seen at stubble fires south-east of
386 Bacchus Marsh, towards Werribee.

387

388 After the Black Falcons' post-fledging period in mid December 2015, the local
389 dimorphic pair of Little Eagles inspected the vacated Nest 1, thus suggesting
390 awareness of and competition for available stick nests among the local raptor and
391 corvid community (e.g. Debus & Tsang 2011; Debus & Zuccon 2013).

392

393

394 *Other records and aspecimen*

395

396 A pair of Black Falcons was reported mating on a power pylon at Mt Rothwell in the
397 You Yangs (37°56'S, 144°26'E), on 7 September 2013 (S. Davidson, Birdline Victoria,
398 www.eremaea.com, retrieved on that date). A Black Falcon was reported to attack a
399 Spotted Harrier *Circus assimilis*, giving a 'falcon-like chatter' as it did so, at Balliang
400 (37°50'S, 144°21'E) on 6 December 2014 (J. Duffy, Birding-Aus chatline, per G.
401 Clancy; photograph verified by SD). In late August and early September 2014, at
402 Doreen (outer Melbourne), BM saw a Black Falcon carry freshly caught prey
403 (ducklings) on a direct path towards a possible nest, given the flight paths and dates.
404 At Staughton Vale (~6 km west of Balliang and ~15 km south of the subject Falcon
405 nest) in early December 2015, DW saw a Black Falcon catch a bird in newly harvested

406 stubble, and next day the farmer saw a Falcon catch a quail *Coturnix* sp. flushed by
407 the harvester; in both cases the Falcon carried the prey on a direct path towards a
408 possible nest or dependent young in that area. Also in April 2015, DW observed a
409 Black Falcon fly up to and sit in a Little Raven nest in a Sugar Gum, i.e. probably nest-
410 selection behaviour, ~15 km south-east of the subject Falcon nest (towards Werribee).
411 These observations may be indicative of inter-nest distances on the Werribee–Balliang
412 Plains.

413

414 DW found a freshly road-killed adult female Black Falcon at Glenmore (37°43'S,
415 144°20'E) on 30 January 2014, and lodged it with Museum Victoria (registered no.
416 NMV B 34533). It weighed 861 g and its stomach contained small mammal bone
417 fragments, dark-grey fur, flesh, grass blades and two small leaves (the plant matter
418 presumably ingested with the prey); similar grey fur was stuck to its feet. It was in
419 active body, remex and rectrix moult (inner and outer primaries growing, some new
420 secondaries at two centres in each wing; rectrix pairs t5 new, t4 growing, centrals fairly
421 new) (B. Bird, Museum Victoria, pers. comm.; SD's examination of DW's
422 photographs).

423

424

425 **Discussion**

426

427 Our observations on the courtship and mating period of the Black Falcon supplement
428 those of Debus & Tsang (2011), and suggest that the male may entice the female to
429 a potential nest by transferring prey items (in courtship/supplementary feeding) at the
430 nest. The 'clucking' calls at this time are probably the typical falcon 'creaking' or *ee-*
431 *chip* calls (e.g. Debus & Tsang 2011; Charley *et al.* 2014). The *tik-tik...* food-
432 presentation call is apparently a courtship call and the chattering display call is perhaps
433 a variation of the 'chattering trill' and 'chuckles', variously mentioned by Marchant &
434 Higgins (1993) and/or Charley *et al.* (2014).

435

436 little information was obtained on the incubation period, other than inferring
437 that the male provisioned the incubating female, as previously found (Debus & Zuccon
438 2013; Charley *et al.* 2014). Charley *et al.* (2014) established that the male also shares
439 incubation, but sex roles (incubation time-budgets) in this phase are still unquantified.

440

441 Our observations establish that at least some male Black Falcons take a share
442 in brooding small, downy chicks within their first 2 weeks, but otherwise sex roles and
443 parental time-budgets are still unquantified in the first half of the nestling period,
444 although quantified at two other nests in the second half of the nestling period (Debus
445 *et al.* 2005; Charley *et al.* 2014). Brooding of chicks by the male, albeit minor compared
446 with the role played by females, occurs in at least some other falcon species (e.g.
447 Marchant & Higgins 1993; McDonald 2004).

448

449 Our observations on the development of the Black Falcon nestlings provide a
450 little more detail on age-related growth stages, especially for the first 3 weeks, than
451 was previously available, and the nestling period was within known values (cf. Charley
452 *et al.* 2014). The morphological characters of the fledglings were consistent with
453 previous information, e.g. darker (more blackish) brown with a conspicuous pale tail-
454 tip, but otherwise similar plumage markings to their worn parents; brown (not pale)
455 cere (Debus *et al.* 2005; Debus & Zuccon 2013; Charley *et al.* 2014). Little information
456 was obtained for the post-fledging period, but juveniles appeared dependent for a
457 month and then spent daytime away from the nest area, consistent with the account
458 of Charley *et al.* (2014).

459

460 Defence of the nest area was similar to previous descriptions, but included
461 more intense targeting of other falcon species of similar size, and of corvids (cf. Debus
462 & Zuccon 2013; Charley *et al.* 2014). Competition with Peregrine Falcons thus extends
463 not only to similar avian prey, but to mutually defended or avoided breeding territories
464 (cf. Debus & Olsen 2011; Debus 2012). Conversely, Black Falcons (unlike Peregrine
465 Falcons) take many terrestrial mammals when available (this study; Charley *et al.*
466 2014; Corbett *et al.* 2014). Harassment by abundant Sulphur-crested Cockatoos
467 appears to be a common hazard for breeding Black Falcons (Debus & Tsang 2011; S.
468 D unpubl. data).

469

470 The moult patterns of the breeding pair and the dead specimen were consistent
471 with previous, limited information on this species (Debus 2015), and confirm that Black
472 Falcons moult remiges and rectrices in the typical falcon pattern: centrifugal from the
473 central primaries and secondaries, and outwards/inwards from the central rectrices

474 and t6 in an alternating pattern, with breeding males commencing moult later than their
475 mates (Marchant & Higgins 1993; Edelstam 2001).

476

477 The earlier records, this study, and other circumstantial evidence provided
478 herein indicate that Black Falcons can breed in southern Victoria. However, nesting
479 may be seldom recorded because breeding Black Falcons are secretive, cryptic (when
480 perched or flying) and their nests are not obvious, their adopted stick nests in leafy
481 tree canopies often being visible only from certain angles. This study also further
482 highlights the risk of vehicle collision to this species (Charley *et al.* 2014; Debus 2014;
483 Zuccon 2014), and that birdwatcher attention (e.g. visibly stalking them, approaching
484 a nest closely, flushing them) may affect the breeding behaviour (e.g. nest
485 selection/use, nest attendance) of at least the more sensitive or wary individuals. This
486 study suggests that sufficient search effort may reveal Black Falcons breeding in Little
487 Raven nests in tall Sugar Gums and other eucalypts at, for example, the Western
488 Treatment Plant and in other suitable habitat on the Werribee–Balliang plains. Further
489 survey for breeding pairs in southern Victoria would be useful, but should maintain site
490 confidentiality and avoid disturbing nesting individuals by limiting observations to
491 outside the Falcons' alert distance, e.g. by telescope.

492

493

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495

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507

508

509 **References**

510

- 511 Bartram, K. (2014). Black Falcons at Werribee, southern Victoria. *Boobook* **32**, 20.
- 512 Brittlebank, C.C. (1899). Birds of Myrniong and surrounding district. *Victorian Naturalist* **16**, 59–61.
- 513 Charley, D., Lutter, H. & Debus, S.J.S. (2014). Breeding behaviour and prey of Black Falcons, *Falco*
514 *subniger*, including food-caching. *South Australian Ornithologist* **40**, 11–30.
- 515 Corbett, L., Hertog, T. & Estbergs, J. (2014). Diet of 25 sympatric raptors at Kapalga, Northern Territory,
516 Australia 1979–89, with data on prey availability. *Corella* **38**, 81–94.
- 517 Debus, S.J.S. (2012). Hunting behaviour of Black Falcons. *Australian Field Ornithology* **29**, 83–85.
- 518 Debus, S. (2014). Black Falcons and collisions. *Boobook* **32**, 15.
- 519 Debus, S. (2015). Moulting in the Black Falcon. *Boobook* **33**, 47–48.
- 520 Debus, S.J.S. & Olsen, J. (2011). Some aspects of the biology of the Black Falcon *Falco subniger*.
521 *Corella* **35**, 29–36.
- 522 Debus, S.J.S. & Tsang, L.R. (2011). Notes on Black Falcons *Falco subniger* breeding near Tamworth,
523 New South Wales. *Australian Field Ornithology* **28**, 13–26.
- 524 Debus, S.J.S. & Zuccon, A.E. (2013). Observations on hunting and breeding behaviour of the Black
525 Falcon *Falco subniger*. *Sunbird* **43**, 12–26.
- 526 Debus, S.J.S., Hatfield, T.S., Olde, G.S. & Rose, A.B. (2005). Breeding behaviour and diet of a pair of
527 Black Falcons *Falco subniger* in northern New South Wales. *Australian Field Ornithology* **22**, 165–
528 181.
- 529 Douglas, J. & Reid, B. (Compilers) (2010). *Exploring Werribee Gorge 1836–2010*. Friends of Werribee
530 Gorge & Long Forest Mallee Inc., Bacchus Marsh, Vic.
- 531 DSE (2013). Advisory List of Threatened Vertebrate Fauna in Victoria – 2013. Department of
532 Sustainability & Environment, Melbourne.
- 533 Edelstam, C. (2001). Raptor moult patterns and age criteria. In: Ferguson-Lees, J. & Christie, D.A.,
534 *Raptors of the World*, pp. 50–53. Helm, London.
- 535 Hewish, M., Ward, R., Bugg, R. & Munday, D. (2006). *Birds of the Long Forest 1889–2006*. Friends of
536 Werribee Gorge and Long Forest Mallee Inc., Bacchus Marsh, Vic.
- 537 Marchant, S. & Higgins, P.J. (Eds) (1993). *Handbook of Australian, New Zealand & Antarctic Birds*,
538 *Volume 2: Raptors to Lapwings*. Oxford University Press, Melbourne.
- 539 McDonald, P.G. (2004). The breeding ecology and behaviour of a colour-marked population of Brown
540 Falcons (*Falco berigora*). *Emu* **104**, 1–6.
- 541 Victorian Biodiversity Atlas (2015). Black Falcon *Falco subniger*. The State of Victoria, Department of
542 Environment, Land, Water & Planning (retrieved 26 July 2015).
- 543 Whelan, D.J. (2013). Aerial diving display, with calling, by Black Falcon *Falco subniger*. *Australian Field*
544 *Ornithology* **30**, 103–105.
- 545 Zuccon, A. (2014). Why is the Black Falcon declining? *Boobook* **32**, 14–15.

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553 **Figure 1.** Black Falcons mating, pre-laying phase, September 2014. Female is giving wailing
554 call. Photo: David Whelan

555

556 **Figure 2.** Developmental stages of young Black Falcons: (a,b) nestling(s) 27 days old, (a)
557 older sibling and (b) with parent, October 2014; (c) fledgling 41 days old, November 2014; (d)
558 fledgling 40 days old, October 2015. Photos: David Whelan (a,c,d), Bernie McRitchie (b)

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560 **Figure 3.** Adult Black Falcon defending nest against Whistling Kite by grappling. Photo: David
561 Whelan

562

563 **Figure 4.** Adult Black Falcon defending nest against Brown Goshawk. Photo: David Whelan

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565

566 **Table 1.** Events in the nestling period of a pair of Black Falcons, Bacchus Marsh district,
 567 Victoria, 24 September–2 November 2014. Day 1 = approximate hatching date of older chick
 568 (see Methods). M = male adult, F = female adult.
 569

<i>Week</i>	<i>Day</i>	<i>Comments</i>
1	4	c. 1530 h F gave begging calls from nest (Peregrine-like cackle, and wail like juvenile Australian Magpie), apparently to induce M to hunt; he appeared from nest area, circled and headed off ~1 km across open country.
	6	Similar behaviour as Day 4 observed in morning (c. 0800 h); at 1100 h M brooding chicks as F flushed from trees in nest area on observer's arrival.
	7	c. 0820 h M prey delivery to F in nest area, mutual calling for c. 20 sec. during transfer. Two chicks (one larger); adults off nest but flying nearby during 2 h to noon.
2	8	0615–0650 h M chased bird from nest area to far distance, returned to perch in nest area; F off nest, perching in trees.
	9	F soaring high above nest with Little Eagle.
	12	At 1015 h M brooding chicks as F flushed from trees in nest area on observer's arrival.
3	15	1500–1600 h M and F soaring high, one carrying prey in bill, then both descended in fast glide to nest area with calls (presumed prey exchange/delivery).
	20	c. 1800 h M prey delivery to F.
	21	1400–1615 h adults perched in trees (dead tree, live Yellow Gum 10–30 m from nest), did not attend nest, otherwise hunted or defended nest. When M returned from foray without prey, he perched beside F, she gave begging calls.
4	22	0630–0800 M and F perched in nearby tree; M circled, landed on topmost branch of nest-tree (guarding?).
	28	0630–0800 h M and F perched in nearby tree; M landed on topmost branch of nest-tree (guarding?). 1400–1630 h F on nest feeding chicks; M soaring high with Little Eagle.
5	33	1630 h, M perched in nearby tree, left to soar with a pair of Little Eagles circling and calling above.
	35	0700–0800 h adults circling, one gave Peregrine-like call as observer drove up, then both perched in nearby tree. Chicks calling quietly.
6	36	1120 h M aerial prey exchange to F. 1600–1800 h both adults guarding nest area from soaring flight, soaring for at least 1 h (c. 2 h?).
	39	Older nestling (female) fledged.
7	43	Younger nestling (male) fledged.

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575 **Table 2.** Development of nestling Black Falcons, Bacchus Marsh district, Victoria: composite
 576 information from 2014 and 2015. See Table 1.
 577

<i>Week</i>	<i>Day</i>	<i>Comments</i>
1	7	Small and downy; sitting up, looking over nest rim.
2	12	Downy; active and strong.
3	15	Downy, primary pin-feathers just burst; first seen defaecating over nest rim, flapped wings.
	18	Primary and secondary pin-feathers along wing edge emerged ~0.5 cm from down.
	19	Chicks standing; still mostly white and downy, scapular feathers emerging.
	21	Dark patches around eyes developing; pin-feathers on head emerging.
4	22	Chicks, active, stretched wings; self-feeding on prey left by adult.
	25	2014: one chick (the older?) mostly feathered dorsally, with cap of down adhering to its crown.
	28	2014: older chick feathering ventrally (mostly brown), with downy cap, tufts of down on underparts; younger chick mostly downy ventrally, dark feather tips protruding through down. Both flapped their wings.
5	31	Chicks a little less downy than on day 28.
	33	Chicks almost entirely dark (brown), i.e. little down visible (cap and breast).
	35	Chicks almost completely dark.
6	36	Chicks now mostly standing on nest (rather than often lying).
	38	Few wisps of down on head and throat; downy flanks concealed by folded wings.
	39	2014: older nestling fledged. 2015 (pre-fledge): very dark; few small white patches of down.
	40	2015: one nestling clambered to nest-branch within 1 m of nest.
	41	2014: older fledgling still not fully developed, wings and tail short. 2015: both young fledged.
7	43	2014: younger nestling fledged; wings and tail of both still short.

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582 **Table 3.** Observed responses (defensive attacks) by adult Black Falcons against other
 583 species during the Black Falcons' breeding cycle.
 584

<i>Intruding species</i>	<i>Attacks</i>	<i>No response</i>
Straw-necked Ibis <i>Threskiornis spinicollis</i>	1	
Wedge-tailed Eagle <i>Aquila audax</i>	5	
Little Eagle <i>Hieraaetus morphnoides</i>	1	3
Swamp Harrier <i>Circus approximans</i>		1
Brown Goshawk <i>Accipiter fasciatus</i>	2	
Collared Sparrowhawk <i>Accipiter cirrocephalus</i>		1
Whistling Kite <i>Haliastur sphenurus</i>	6	1
Australian Hobby <i>Falco longipennis</i>	1	
Brown Falcon <i>Falco berigora</i>	4	
Peregrine Falcon <i>Falco peregrinus</i>	1	
Sulphur-crested Cockatoo <i>Cacatua galerita</i>	5	1
Noisy Miner <i>Manorina melanocephala</i>	1	
Black-faced Cuckoo-shrike <i>Coracina novaehollandiae</i>	1	
Australian Magpie <i>Gymnorhina tibicen</i>	1	
Little Raven <i>Corvus mellori</i>	9	1

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Fig I Mating

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Fig. 2a. Chick, day 28

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Fig. 2b. Chicks + parent, day 28

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Fig. 2c. Fledgling (2014), 41 days old

Fig. 2d. Fledgling (2015), 40 days old

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Fig. 3. Grappling with Whistling Kite.

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Fig. 4. Defence against Goshawk.