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# Foraging patterns and hunting success of the Eastern Barn Owl *Tyto javanica delicatula* in temperate Australia

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**Abstract.** The foraging behaviour and success of the Eastern Barn Owl *Tyto javanica delicatula* were studied by JGM in an agricultural area of north-western Victoria in 1988–1990, by means of quantifying the owls' nocturnal search and attack methods ($n$ = 97 observations) and success rates ($n$ = 55 observations) by habitat (open fields vs denser verge habitats) and season. Stationary perch-hunting formed 75%, low slow quartering 21% and sustained hovering 4% of observations. Terrestrial prey was captured by glide attacks from perches (75%) and hover-drop attacks from quartering flight (25%). Overall capture success rate of Barn Owls was 60%; glide attacks were successful on 64% of attempts, and hover-drop attacks on 40%. Overall, 65% of attacks were made in verge habitats and 35% in field habitats, although success was higher in field habitats (72%) than in verge habitats (54%). Perch-hunting comprised 85% of observations during autumn–winter and 64% during spring–summer, whereas quartering was recorded more frequently during spring–summer (32%) than during autumn–winter (11%). Verge habitats were more important during autumn–winter (87% of attacks) than spring–summer (39%). Perch-hunting was used throughout the night, but quartering and hovering were used after dusk and before dawn, more so in spring–summer than in autumn–winter.

## Introduction

The hunting strategies and habitats of the global Barn Owl *Tyto alba* complex have been well described (e.g. Bunn *et al.* 1982; Cramp 1985; Taylor 1994; del Hoyo *et al.* 1999; Roulin 2020). The foraging behaviour and hunting success of the Eastern Barn Owl *T. javanica delicatula* (hereafter Barn Owl) in Australia, to the extent known, were summarised by Higgins (1999), based largely on an unpublished thesis by McLaughlin (1994) and a preliminary study by Baker-Gabb (1984). Fleay (1968) and Hollands (2008) have inferred apparently high predatory efficiency of the Barn Owl, based on delivery rates of prey to the young. Described here are Barn Owl hunting behaviour and capture success as they relate to habitat use and foraging techniques, thus presenting the detail supporting the summary statements of Higgins (1999) that cited McLaughlin (1994). Background to the study, and taxonomic considerations, were provided by McLaughlin & Debus (2025). Barn Owls are essentially nocturnal (sometimes crepuscular) in Australia, have high aural acuity, and can locate and strike prey by sound in almost total darkness, facilitated by the facial ruff and other adaptations (e.g. Schodde & Mason 1980; Higgins 1999; Hollands 2008), including sound camouflage by deliberately soft landings on hunting perches (Schalcher *et al.* 2024).

## Study area and methods

Barn Owls were studied by JGM from July 1987 to December 1990 in the semi-arid Mallee wheat-belt of north-western Victoria, on and around the Mallee Research Station at Walpeup (35°08′S, 142°02′E), ~30 km west of Ouyen, as previously described (McLaughlin 1994; McLaughlin & Debus 2025). In the study area, the Owls preyed mainly on House Mice *Mus musculus* (McLaughlin 1994; McLaughlin & Debus in press).

### *Field methods*

Data on the hunting behaviour and capture success of Barn Owls were collected by JGM in January 1988 to April 1990, although most data were obtained after the House Mouse population crash in July 1988 (see McLaughlin 1994; McLaughlin & Debus 2025). All observations on foraging were made in agricultural cropping areas. All observations were made at night, mainly of Barn Owls that were located initially by hand-held spotlight (of either 50 or 100 watts) or by car headlights, primarily from a vehicle driven at ~40 km/h (or slower) along roads and tracks in the study area. Most owls were located during spotlight searches of >50 km, although some data were collected opportunistically while commuting within the study area. The number of different individual Barn Owls located was unknown, but data were collected from a broad area over *c.* 28 months, so it is unlikely that the hunting preferences of individual owls biased the results.

The use of artificial light to assist in viewing owls was avoided where possible. Once located, Barn Owls were frequently viewed under existing moonlight, although car headlights or a low-power (50 watt) spotlight covered with a red-cellophane filter (see Southern 1955) was most often used. To assist in determining whether an attack was successful, a spotlight (either 50 or 100 watt, with or without filter) was used to illuminate the owl, either immediately following the attack, or after the owl had returned to a perch. In many cases this disturbance caused the owl to vacate the immediate area. Barn Owls that might have been searching for prey, but were clearly disturbed by the presence of the observer (e.g. an owl that became 'fixated'

by the spotlight), did not exhibit attack behaviours. Data were not recorded in these situations. Owls were viewed with the aid of 7 × 50 binoculars (i.e. high light-gathering power), from distances of between 25 and 150–200 m. Night-vision equipment was not available. The observation method might have produced biases, e.g. in owl detection, which were nevertheless constant across seasons and habitats (see Discussion).

Observation periods commenced at dark, generally 15–30 minutes after sunset. Data were recorded in 1-hour blocks commencing at dark. Observations were spread throughout all seasons of all years, but were generally concentrated in the first half or three-quarters of the night. Observations throughout the study period were heavily biased toward periods of fine weather (because, for example, rain suppresses Western Barn Owl *T. alba* hunting activity: Bunn *et al.* 1982; Mikkola 1983; Roulin 2020). The effect of weather variables on hunting activity was therefore not compared. Most observations of owls were made under full, or near full, moonlight, and hence variation in capture success under varying ambient illumination was not compared, though probably relevant (e.g. greater illumination increases the effectiveness of Barn Owls preying on terrestrial rodents, notably those owls with white-breasted plumage: Kotler *et al.* 1991; San Jose *et al.* 2019; Negro *et al*. 2025).

For each observation the search technique, attack method, approximate height from which the attack was initiated, general habitat characteristics (field versus verge – see below), whether the attack was successful (where this was possible) and type of prey were recorded. General observations were also made on patterns of hunting behaviour.

### *Definitions*

Hunting was considered to comprise two phases: a searching phase, during which a Barn Owl initially determines the location of potential prey, and an attack phase, in which an attempt is made to capture prey (e.g. after Baker-Gabb 1984 and Aumann 2001). In this study, searching behaviour was so recorded only if it was followed by an attack, because a Barn Owl encountered either in flight or perched could not be assumed to be actively involved in searching for prey (a conservative approach). The terminology used to describe the search and attack techniques used by Barn Owls follows Bunn *et al.* (1982) and Baker-Gabb (1984). Spring–summer was considered to extend to March in the study area because the warm March is still summer-like in this Mediterranean semi-arid zone.

### *Analysis*

*Chi*-squared tests were used to make comparisons between seasons, habitats and hunting methods. Because each comparison involved only one degree of freedom, Yates's correction for continuity was incorporated (Fowler & Cohen 1987). For comparing the relative proportions of various behaviours, data were analysed using 2 × 2 contingency tables.

## Results

### *Search and attack techniques*

Ninety-seven observations were made of Barn Owls searching for and attacking prey. Three searching methods were recorded. The most commonly observed method was stationary perch-hunting, which accounted for 75.3% ($n$ = 73) of all observations. Barn Owls using this technique surveyed for prey from a perched position, using successive perches for periods of *c.* 2–5 minutes. Artificial structures (fence-posts, roadside marker-posts and other sign-posts) accounted for 75.3% ($n$ = 55) of all perches from which attacks were instigated, but were possibly biased by the roadside survey method. Trees and other natural vegetation comprised the remainder (24.7%, $n$ = 18). Low slow quartering (slow prospecting flight conducted ~1–3 m above ground) accounted for 20.6% ($n$ = 20) of all observations, and sustained hovering (stationary flight 2–5 m above ground) 4.1% ($n$ = 4) (Table 1).

Two major attack techniques were recorded. Glide attacks were associated with all (and only with) stationary perch-hunting, and accounted for 75.3% ($n$ = 73) of all attacks. Glide attacks were initiated from perches averaging 1.5 m high (range 0.9–3.5 m, $n$ = 71). Hover-drop attacks, in which an Owl dropped onto prey from a hovering position, were associated with all slow-quartering (hovering conducted only briefly and as a transition from slow-quartering flight) and sustained hovering (24.7%, $n$ = 24). One other attack method, described as an ancillary pounce attack, was occasionally employed (four observations only) following the failure of a main attack method. This attack method, in which the Owl made a secondary pounce or jump at prey, was instigated from a position on the ground, presumably within close proximity of the intended prey. It was not possible to determine if this ancillary attack method was ever successful.

### *Capture success rates and habitat use*

Of the 97 observations of Barn Owls searching/attacking, the attack outcome was determined on 55 occasions (56.7%). The overall capture success rate was 60.0%. Glide attacks were successful on 64.4% ($n$ = 29) of occasions of known outcome. This was the only attack method more successful than unsuccessful, but not significantly so ($\chi^2_1$ = 1.60, $P$ >0.05). Hover-drop attacks were successful on 40.0% ($n$ = 4) of occasions. Based on the searching method used, perch-hunting was found to be 1.5 times more likely to result in the capture of prey (64.4%) than slow quartering (42.9%), and about twice as likely as hovering (33.3%), although few data were obtained for this latter search technique (Table 1).

Overall, 65% ($n$ = 63) of attacks launched by Barn Owls were made on prey occurring along fence-lines, roadside verges, and, to a much lesser extent, water channels (collectively referred to as verge habitat). The remainder (35%, $n$ = 34) of attacks occurred in paddocks, under crop, stubble or pasture (collectively referred to as field habitat). Capture success rates in field habitats (72.2%) were significantly higher than in verge habitats (54.0%) ($\chi^2_1$ = 4.43, 2 × 2 contingency table, $P$ <0.05; Table 2).

**Table 1.** Barn Owl foraging data, north-western Victoria, January 1988 to April 1990 (outcome, perching site and foraging habitat): overall and separately for spring–summer and autumn–winter. For details of field and verge habitats, see text. The unknown (outcome) column refers to all observations of Barn Owls foraging, whereas the success/fail columns refer only to known outcomes; percentages and numbers (*n*) are shown.

| *Search method* | *% (n)* | *Outcome* | | *Site* | | | *Habitat* | |
|---|---|---|---|---|---|---|---|---|
| | | *Success % (*n) | *Fail % (*n) | *Unknown % (*n) | *Post % (n)* | *Tree % (*n) | *Field % (*n) | *Verge % (*n) |
| **All data, all seasons** | | | | | | | | |
| Perching | 75.3 (73) | 64.4 (29) | 35.6 (16) | 38.4 (28) | 75.3 (55) | 24.7 (18) | 26.0 (19) | 74.0 (54) |
| Quartering | 20.6 (20) | 42.9 (3) | 57.1 (4) | 65.0 (13) | – | – | 70.0 (14) | 30.0 (6) |
| Hovering | 4.1 (4) | 33.3 (1) | 66.7 (2) | 25.0 (1) | – | – | 25.0 (1) | 75.0 (3) |
| **Totals** | **100.0 (97)** | **60.0 (33)** | **40.0 (22)** | **43.3 (42)** | **–** | **–** | **35.0 (34)** | **65.0 (63)** |
| **Spring–summer** | | | | | | | | |
| Perching | 63.6 (28) | 78.9 (15) | 21.1 (4) | 32.1 (9) | 82.1 (23) | 17.9 (5) | 50.0 (14) | 50.0 (14) |
| Quartering | 31.8 (14) | 60.0 (3) | 40.0 (2) | 64.3 (9) | – | – | 92.8 (13) | 7.2 (1) |
| Hovering | 4.5 (2) | 0.0 (0) | 100.0 (2) | 0.0 (0) | – | – | 0.0 (0) | 100.0 (2) |
| **Totals** | **100.0 (44)** | **69.2 (18)** | **30.8 (8)** | **40.9 (18)** | **–** | **–** | **61.4 (27)** | **38.6 (17)** |
| **Autumn–winter** | | | | | | | | |
| Perching | 84.9 (45) | 53.8 (14) | 46.1 (12) | 42.2 (19) | 71.1 (32) | 28.9 (13) | 11.1 (5) | 88.9 (40) |
| Quartering | 11.3 (6) | 0.0 (0) | 100.0 (2) | 66.7 (4) | – | – | 16.7 (1) | 83.3 (5) |
| Hovering | 3.8 (2) | 100.0 (1) | 0.0 (0) | 50.0 (1) | – | – | 50.0 (1) | 50 (1) |
| **Totals** | **100.0 (53)** | **51.7 (15)** | **48.3 (14)** | **45.3 (24)** | **–** | **–** | **13.2 (7)** | **86.8 (46)** |

All attacks observed were made on terrestrial prey. With one exception, all prey appeared to be small mammals, and were almost certainly House Mice (see also McLaughlin 1994; McLaughlin & Debus 2025). On one occasion a Rabbit *Oryctolagus cuniculus* kitten was captured. Although birds, amphibians and invertebrates were recorded in the diet of Barn Owls at Walpeup (McLaughlin 1994; McLaughlin & Debus in press), attacks were not seen to be launched at these prey types.

## *Seasonal variation*

Observations were classified as occurring either in spring–summer (September–March) or in autumn–winter (April–August). There were significant seasonal differences in the relative importance of hunting techniques: perch-hunting comprised 84.9% of all observations during autumn–winter, but significantly fewer observations (63.6%) during spring–summer ($\chi^2_1$ = 4.78, 2 × 2 contingency table, $P$ <0.05). Low slow quartering was recorded significantly more frequently during spring–summer (31.8%) than during autumn–winter (11.3%) ($\chi^2_1$ = 4.99, 2 × 2 contingency table, $P$ <0.05; Table 1). Overall, the Owls were more successful at capturing prey during spring–summer (69.2%) than during autumn–winter (51.7%), though not significantly so ($\chi^2_1$ = 0.85, 2 × 2 contingency table, $P$ >0.05).

Seasonal differences also occurred in foraging habitat (Table 1). Verge habitats were of greater importance during autumn–winter (86.8% of all attacks during this period) than during spring–summer (38.6%), a difference that was strongly significant ($\chi^2_1$ = 22.44, 2 × 2 contingency table, $P$ <0.01). The most productive environment, in terms of foraging habitat and season, was the field habitat during spring–summer (73.3% capture success) (Table 3).

**Table 2.** Overall capture success rates of Barn Owls, north-western Victoria, January 1988 to April 1990, by foraging habitat; *n* = number.

| *Habitat* | *Successful (*n) | *Unsuccessful (*n) | *% Successful* |
|---|---|---|---|
| Field | 13 | 5 | 72.2 |
| Verge | 20 | 17 | 54.0 |
| **Totals** | **33** | **22** | **60.0** |

**Table 3.** Capture success rates of Barn Owls, north-western Victoria, January 1988 to April 1990, by season and foraging habitat.

| *Season* | *Habitat* | *Success % (*n*)* | *Fail % (*n*)* | *Unknown % (*n*)* |
|---|---|---|---|---|
| Spring–summer | Field | 73.3 (11) | 26.7 (4) | 44.4 (12) |
| | Verge | 63.6 (7) | 36.4 (4) | 35.3 (6) |
| Autumn–winter | Field | 66.7 (2) | 33.3 (1) | 57.1 (4) |
| | Verge | 50.0 (13) | 50.0 (13) | 43.5 (20) |
| **Totals** | | **60.0 (33)** | **40.0 (22)** | **43.3 (42)** |

## *Temporal variation*

Foraging by Barn Owls was observed throughout the night. However, aerial foraging methods were observed only in the first or last hour or so of darkness, and only stationary perch-hunting was observed through the remainder of the night. In both spring–summer and autumn–winter, low slow quartering and sustained hovering were observed only at the start and toward the end of the night. Barn Owls foraged more actively (using more energetic techniques) and for a longer period (generally the initial 2 hours) at the start of the night during spring–summer than they did during autumn–winter (generally only the first hour) (Figures 1–2).

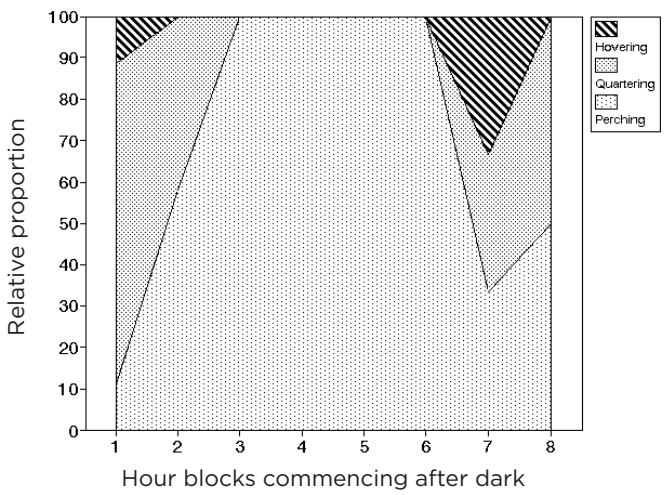


**Figure 1.** Relative proportions and temporal distribution of search methods employed by Barn Owls during spring–summer, north-western Victoria.

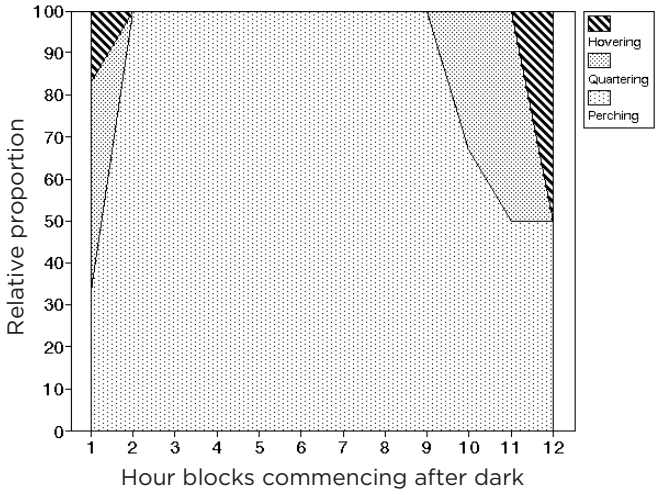


**Figure 2.** Relative proportions and temporal distribution of search methods employed by Barn Owls during autumn–winter, north-western Victoria.

## Discussion

A caveat on the results and the following interpretation is that visual-only methods, disturbance by the observer, artificial lighting, and fieldwork in high moonlight levels could all have been sources of potential bias, e.g. in detection of perch-hunting versus aerial foraging, or effects on the Owls' behaviour. Nevertheless, temporal and seasonal variation in foraging methods and habitats was evident.

### *Search and attack methods*

All search and attack techniques recorded during this study have been noted by previous authors, either in Australia (e.g. Fleay 1968; Baker-Gabb 1984; Hollands 2008) or overseas (e.g. Bunn *et al.* 1982; Cramp 1985; Taylor 1994; del Hoyo *et al.* 1999; König & Weick 2008; Roulin 2020). Hunting techniques may depend on individual Barn Owl preference, gender, levels of hunger, and likely energy reserves (Bunn *et al.* 1982; Roulin 2020; Schalcher *et al.* 2024). In Malaysia, Barn Owls hunting rats *Rattus* spp. in plantations use perch-hunting almost exclusively (Lenton 1984). Hovering, the least recorded search method, is also reported infrequently elsewhere (Bunn *et al.* 1982; Roulin 2020), although König & Weick (2008) noted that it is used in rank habitats such as verges (as in this study: Table 1). Taylor (1994) noted a similar seasonal pattern of hunting methods to that found in the present study, i.e. more perching in winter than in summer. Overseas, female Barn Owls use perch-hunting almost twice as frequently as do males (Schalcher *et al*. 2024).

### *Capture success*

Barn Owls lack substantial reserves of body fat and a crop for storing food (e.g. Bunn *et al.* 1982; del Hoyo *et al.* 1999; Higgins 1999). They also seldom cache food, other than in an active nest (Bunn *et al.* 1982; Cramp 1985; Roulin 2020). Hence, they depend on regular food intake from consistently successful prey capture (Olsen 1989). Few data exist on success rates of prey capture in Australian Barn Owls. Baker-Gabb (1984) observed one successful prey capture in three attacks. The overall capture success rate of 60% determined for Barn Owls in this study was similar to the 64% determined by Baker-Gabb (1984) for the sympatric Black-shouldered Kite *Elanus axillaris*, of similar size and dependence on rodents and other small mammals (Marchant & Higgins 1993; Higgins 1999). The larger, sympatric Brown Falcon *Falco berigora*, having a more varied diet including birds and larger mammals, had overall similar capture success (57%) but was most successful when hunting House Mice (Baker-Gabb 1984). The Barn Owl's rather high success rate (60%) at Walpeup suggests fairly 'easy' prey, and is consistent with the low reversed sexual size dimorphism of Barn Owls, small prey relative to predator, and foraging in open habitats (cf. Higgins 1999; Olsen 2011). In captive simulations, Barn Owls can have 90% capture success on stationary prey, but only 21% success on moving prey (Roulin 2020). In North America with captive owls and live prey, capture success varied between 33 and 84%, depending on rodent species, size, age and behaviour (vulnerability) (Derting & Cranford 1989). In Europe, female Barn Owls were less successful than males at both perch-hunting (27% vs 35%) and aerial foraging (19% vs 26%) (Schalcher *et al.* 2024).

### *Habitat*

Because field habitats were less densely vegetated than verge, or sometimes sparsely vegetated, higher capture success in field is consistent with higher susceptibility of small mammals to predation in low vegetative cover (e.g. Brown *et al.* 1988; Kotler *et al.* 1988, 1991, 1992; Longland & Price 1991; Roulin 2020). Some prey age-classes, e.g. juveniles, may be forced by adults into open habitats and so become more susceptible to owl predation (e.g. Dickman *et al.* 1991), and displaced juveniles or transients/dispersers in unfamiliar habitat are also more susceptible to predation (Metzgar 1967; Ambrose 1972; Longland & Jenkins 1987).

### *Seasonal variation*

The higher proportion of attacks in verge than in field habitat (65% vs 35%) might have been related to more sightings of Barn Owls close to roads (and thus roadside verges) than over fields; however, this bias was unlikely to vary between seasons. Verge habitat was more important to Barn Owls during autumn–winter than during spring–summer (as also noted by Taylor 1994), and more attacks were recorded in field habitats during spring–summer than in verge habitats, such variation probably being related to patterns of habitat use by prey populations. During years of normal (i.e. low) House Mouse abundance, mouse populations in the Mallee wheat-belt live in refuges such as fence-lines, roadside verges and waterside vegetation in autumn–winter, breed in late winter/early spring and expand into maturing crops and other habitats in spring–summer as seasonal conditions improve (Pryor & Bronson 1981; Singleton 1989; Mutze 1990, 1991; Tann *et al.* 1991; C. Tann pers. comm.). Barn Owls thus seem able to track seasonal changes in House Mouse distribution.

Changes in the utilisation of foraging habitat by Barn Owls were also reflected in changes in search techniques. Low slow quartering was more important when mice were most likely occupying field habitats, and stationary perch-hunting was most important when mice were probably occupying mostly verge habitats. The higher capture success rates during spring–summer may be explained in part by Barn Owls having lower success on prey in verge habitats during autumn–winter.

### *Temporal variation*

Although Barn Owls were observed to hunt throughout the night, the most energy-consuming search methods (quartering and hovering) were recorded only at the beginning and toward the end of the night. This finding is consistent with the observation that, following a period (30 min.) of unsuccessful slow quartering after which they appear to show signs of fatigue, Barn Owls typically use perch-hunting (i.e. the less energy-consuming foraging method) (Bunn *et al.* 1982). The temporal variation may also have partly reflected activity patterns of mice at Walpeup.

The duration of the early evening period of activity in autumn–winter was shorter than in spring–summer, probably reflecting a lower density of mice in fields during autumn–winter. During this period, Barn Owls showed a lower reliance on quartering over fields.

### *Foraging strategies and energetics*

Of the three major hunting methods recorded during this study, stationary perch-hunting was the one most often employed (75.3%); it was probably the least energy-consuming (Curio 1976), and was the most successful (resulting in 64.4% capture success). Within this restricted context, Barn Owls may be considered to have been foraging optimally. Nevertheless, at low prey densities (as observed during most of this study) such an energy-maximising hunting strategy is also likely to be a time-consuming strategy (Schoener 1971; Ille 1991), resulting in few prey encounters per unit time. However, when prey density is high, the prey encounter rate will also be high, and stationary perch-hunting is likely to be both time- and energy-efficient. Conversely, quartering is likely to be energetically expensive, but results in higher prey encounter rates. Western Barn Owls feeding nestlings mostly use quartering flight when hunting (Bunn *et al.* 1982). Use of such a time-minimisation strategy (Schoener 1971; Ille 1991) when breeding (in spring in the present study) would enable frequent provision of food to females (for egg formation and optimal clutch size) and nestlings.

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