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New taxa and combinations in *Eucalyptus* (Myrtaceae) from southern Australia

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Abstract

Within the genus *Eucalyptus*, one new species (*E. scyphata*) and four new subspecies (*E. caesia* subsp. *boodjin, E. urna* subsp. *xesta, E. polita* subsp. *ocreata*, and *E. marginata* subsp. *spurgeana*) are described, and four new combinations (*E.* sect. *Glandulosae*, *E.* sect. *Frutices, E. arctata* and *E. astringens* subsp.*merleae*) are formally made. All nine new taxa occur naturally in southern Australia, with eight of the nine taxa being endemic to south-western Western Australia.

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Introduction

A large number of new *Eucalyptus* species and subspecies have been described from south-western Western Australia over the last 30 years. Ongoing fieldwork, herbarium research, molecular analysis, and common garden trials, by both us and other researchers, continue to undercover new taxa and elucidate existing ones. Here, we formalise the names of nine new taxa and combinations to enable their use in proposed second editions of the Western Australian regional field guides *Eucalypts of Western Australia's wheatbelt* (French 2012) and *Eucalypts of Western Australia, the south-west coast and ranges* (French and Nicolle 2019).

There are other potentially undescribed *Eucalyptus* taxa from south-western Western Australia that are included in Nicolle (2022) but have not been formalised here, as they do not occur within the regions covered by the proposed second editions of French (2012) and French and Nicolle (2019), and/or because further research is required to establish their status, circumscription and relationships.

The new *Eucalyptus* taxa and combinations described here include two new sections, one new species for the taxon historically but erroneously referred to as *E. scyphocalyx* (*E. scyphata*), four new subspecies (*E. caesia* subsp. *boodjin, E. urna* subsp. *xesta, E. polita* subsp. *ocreata*, and *E. marginata* subsp. *spurgeana*). Additionally, *E. leptopoda* subsp. *arctata* is raised to specific status (as *E. arctata*), and *E. merleae* is reduced to subspecific status (as *E. astringens* subsp. *merleae*).

All of the new taxa are fecund, woody, perennial mallees or trees, which are not considered at risk from personal visitation, specimen collection, and related activities (although some are certainly at varying degree of risk from large-scale landscape modifications including climate change, mining, and changing fire regimes). As

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such, we have provided geo-coordinates for all cited specimens where they have been field-recorded and are included on the original label data of herbarium specimens. We consider this locality data to be very useful to enable other researchers and other readers to inspect cited populations, which will help with their own understanding of the new taxa.

The taxonomic sequence of new taxa and combinations follows that of Nicolle (2022). To aid readability, taxon authors are not provided in general text.

Taxonomy

Eucalyptus **sect. *Glandulosae*** **(Brooker) D.Nicolle, *comb. et. stat. nov.***

Eucalyptus subsect. *Glandulosae* Brooker, *Aust. Syst. Bot.* 13(1): 99 (2000).

Type: *Eucalyptus spathulata* Hook.

Diagnostic characters: Trees and mallees; lignotuber present or absent, some species resprouters, many species obligate seeders (see Nicolle 2006); pith of branchlets glandular in most species; cotyledons coarsely bisected to bilobed; juvenile leaves disjunct, petiolate (except in *E. kruseana*); adult leaves concolorous; inflorescences 3–30+-flowered; peduncles often strongly flattened and distally widening; hypanthia fused or free; ovules in 4–8 vertical rows; stamens erect or inflexed, cream to yellow or greenish, or pink to red.

Notes: *Eucalyptus* sect. *Glandulosae* is a large section of 12 series and 93 species (Nicolle 2022). All except one of the 93 species (*E. trivalva*) are endemic to southern Western Australia. *Eucalyptus trivalva* has an extensive but scattered distribution through the arid regions of WA, western SA, and south-western NT.

Eucalyptus sect. *Glandulosae* is equivalent to *E.* subsect. *Glandulosae* plus the taxonomically less numerous *E.* subsect. *Hadrotes* in the classification of Brooker (2000). Brooker placed these two subsections in *E.* sect. *Bisectae* (type: *E. gracilis*), along with numerous other series and species. Using molecular characters and analysis, *E.* sect. *Bisectae* (*sensu* Brooker 2000) has since been demonstrated to be polyphyletic and to consist of two distinct lineages (Steane *et al.* 2002). One of these two lineages remains as *E.* sect. *Bisectae* (Bisectae I of Steane *et al.* 2002) while the other lineage is here described as *E.* sect. *Glandulosae* (Bisectae II of Steane *et al.* 2002).

Eucalyptus sect. *Glandulosae* differs from *E.* sect. *Bisectae sens. strict.* in a number of morphological traits, including the presence of branchlet pith glands in most species (absent in all species of *E.* sect. *Bisectae*), coarsely bisected to bilobed cotyledons (narrowly and deeply bisected in *E.* sect. *Bisectae*), and the often strongly flattened and distally widening peduncles (never strongly flattened and distally widened in *E.* sect. *Bisectae*). The distribution of these two sections also differs, with *E.* sect. *Glandulosae* being almost entirely restricted to south-western WA, while *E.* sect. *Bisectae sens. strict.* has a broader distribution in Australia, with greatest taxonomic diversity in southern Australia, but extending to western Vic and NSW, central Qld, and parts of the Great Dividing Range (e.g. *E. pachycalyx* and *E. squamosa*).

Eucalyptus astringens **(Maiden) Maiden, *Crit. Revis. Eucalyptus* 7(2): 55.**

Eucalyptus occidentalis var. *astringens* Maiden, *J. W. Austral. Nat. Hist. Soc.* 3: 186 (1911).

Type: Broomhill, Western Australia, Dec 1909, *J.H.Maiden s.n.*; holo: NSW; iso: K.

Key to the subspecies of *Eucalyptus astringens*

1	Fruits faintly ribbed. Peduncles 10–30 mm long	**subsp. *merleae***
1	Fruits smooth. Peduncles 8–18 mm long	**2**
2	Fruits 7–10 mm wide	**subsp. *astringens***
2	Fruits 5–8 mm wide	**subsp. *redacta***

Eucalyptus astringens **subsp. *merleae*** **(McQuoid & M.E.French) D.Nicolle & M.E.French, *comb. et. stat. nov.***

Eucalyptus merleae McQuoid & M.E.French, *Nuytsia* 32: 153-157 (2021).

Type citation: south-west of Ravensthorpe [Laurina Road at 33°46'50"S, 120°08'41"E], Western Australia, 3 March 2018, *M.French 2986* (holo: PERTH 09247726; iso: AD, CANB, MEL).

Diagnostic characters: Distinguished within *E. astringens* by its faintly ribbed fruits. The fruit ribbing is often longitudinally slightly spiralled. The subspecies tends to have variably longer peduncles and pedicels, and variably larger fruits than the other two subspecies of *E. astringens,* although significant overlap in the dimensions of these characteristic occur between all three subspecies. The peduncles of subsp. *merleae* also tend to be more strongly pendulous and the fruits more commonly campanulate in shape compared to the other two subspecies.

Notes: Although the taxon was originally described at specific status (as *E. merleae*, McQuoid & French 2021), we believe that subspecific status is more appropriate, especially considering:

- The taxon is morphologically very similar to *E. astringens*, with most of the known differences being variable, or for size characteristics, quite overlapping; and

- There are numerous intergrades between this taxon and *E. astringens* subsp. *redacta* over a moderately large area between the respective distribution of these two taxa; and

Table 1. Morphological differences between the subspecies of *E. astringens*

	subsp. *merleae*	**subsp. *astringens***	**subsp. *redacta***
Peduncle orientation	pendulous	down-turned to pendulous	down-turned to pendulous
Peduncle length	10–30 mm long	10–18 mm long	8–16 mm long
Pedicel length	5–11 mm long	4–6 mm long	2–7 mm long
Bud hypanthium	smooth or faintly ribbed	smooth	smooth
Operculum tip	apex blunt to slightly acute	apex blunt	apex blunt
Flower colour	cream or rarely pink	cream	cream
Fruit shape	campanulate	obconical to campanulate	obconical to campanulate
Fruit length	8–14 mm long	7–12 mm long	5–9 mm long
Fruit width	6–11 mm wide	7–10 mm wide	5–8 mm wide
Fruit ornamentation	faintly ribbed	smooth	smooth

- This taxon, along with the other two subspecies of *E. astringens* (subspp. *astringens* and *redacta*) form a distinct geographical replacement pattern (Fig. 1).

The only characteristic which reliably differentiates *E. astringens* subsp. *merleae* from the other two subspecies of *E. astringens* is its faintly ribbed fruits (see Table 1).

Eucalyptus urna D.Nicolle, ***Aust. Syst. Bot.*** **12: 227 (1999).**

Type citation: Western Australia: 0.6 km along Old Ravensthorpe Road from Lake King – Newdegate road, 21 Jul 1988, *M.I.H.Brooker 10008* (holo: PERTH; iso: AD, CANB).

Nicolle (2022) placed *E. urna* in *E.* subg. *Symphyomyrtus* sect. *Bisectae* ser. *Subulatae* subser. *Decurrentes*, together with nine other named species. *Eucalyptus* subser. *Decurrentes* has distinctive seedling morphology, in which the seedling leaves are arranged in opposite, decussate pairs, and are sessile with strongly decurrent leaf margins.

Within *E.* subser. *Decurrentes*, *E. urna* is distinguished by its tree (mallet) habit and lack of a lignotuber (an obligate seeder), its non-pruinose adult features, and its highly glossy, green adult leaves.

Two subspecies are now recognised in *Eucalyptus urna*, forming a geographical replacement pattern in southern Western Australia (Fig. 2), and differing primarily in the size, shape and ornamentation of the buds and fruits. Intergrades between the subspecies occur where their distributions adjoin.

The morphological analysis and taxonomic revision of *E.* ser. *Subulatae* subseries *Decussatae* and *Decurrentes* by Nicolle (2005) included six populations of *E. urna*, all of which are placed in subsp. *urna* as defined here. No populations attributable to *E. urna* subsp. *xesta* were included in that study.

Key to the subspecies of *Eucalyptus urna*

1 Buds <14 mm long x ≤5 mm wide, smooth. Fruits always smooth, not flared at the rim **subsp. *xesta***

1 Buds >14 mm long x ≥5 mm wide, ribbed. Fruits usually ribbed, often flared at the rim **subsp. *urna***

Eucalyptus urna subsp. ***xesta*** D.Nicolle & M.E.French, ***subsp. nov.***

Type: Western Australia: Parker Range Road, south of Marvel Loch, 31°37′50″S, 119°34′06″E, 24 Nov 2013, *D.Nicolle 6696 & M.E.French* (holo: PERTH; iso: AD, CANB).

Eucalyptus sp. 'Dunbar Road' (*D.Nicolle 5466 & M.E.French*): Nicolle *et al., Nuytsia* 22(3): 106 (2012).

Mallet to 13 metres tall, lignotuber absent, obligate seeder. Erect habit, dense crown. *Bark* smooth, peeling in strips, pale grey to pale brown. *Branchlets* without pith glands. *Juvenile leaves* strongly decurrent, blue-green to very slightly pruinose. *Adult leaves* lanceolate, (35–) 50–115 (–130) mm x 7–20 mm, glossy, dark green. *Inflorescences* 7–11-flowered, held on down-curved, angular to flattened peduncles, 6–12 mm long. *Buds* smooth, 10–13 mm long x 3.5–5 mm wide, pendulous, pedicels 3–5 (–6) mm long. *Hypanthia* urceolate, smooth,

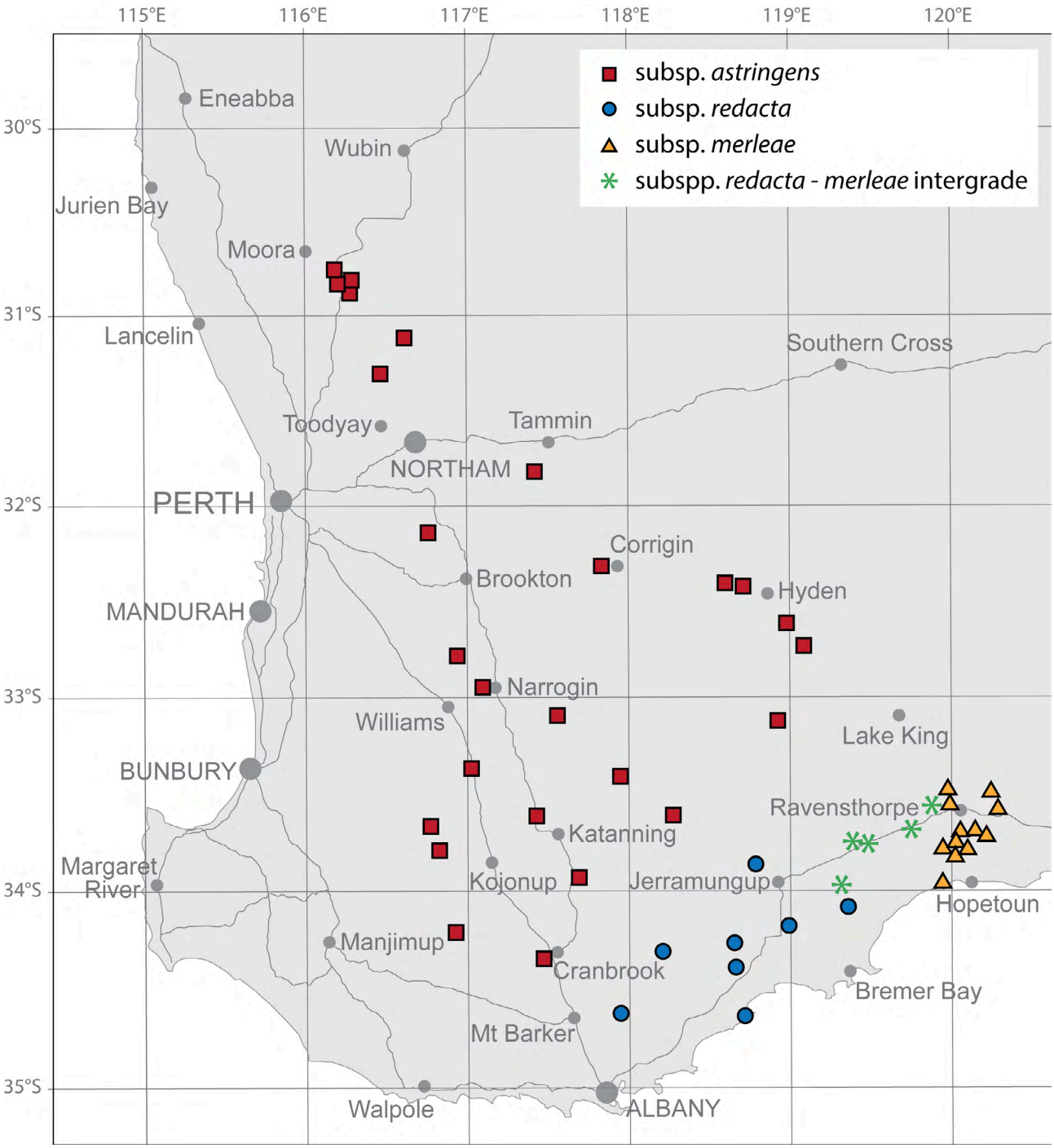

Figure 1. Distribution of *Eucalyptus astringens* in south-western Western Australia.

5–7 mm long. *Opercula* horn-shaped, smooth, equal at the join with the hypanthia, 6–10 mm long. *Flowers* white, occurring in summer and autumn. *Fruits* urceolate, smooth, 5–8 (–9) mm long x 4–6 (–7) mm wide, slightly constricted up to 3 mm below rim, flare usually erect (little widening), disc descending, valves 3 to 4, deeply enclosed or exserted due to split style remnants. *Seeds* grey-brown.

Diagnostic characters: Distinguished within the species by its relatively short pedicels (3–6 mm long), its relatively small, smooth (non-ribbed) buds (10–13 mm long x 3.5–5 mm wide) and its relatively small, smooth (non-ribbed) fruits (5–9 mm long x 4–7 mm wide) that are not prominently flared.

Selected specimens: Western Australia (west to east): Boolanelling Nature Reserve, 32°08′35″S, 117°44′54″E, 3 Sep 1998, *M.Brainbridge & C.Harding BO 10.9* (PERTH); Lambiri, NE of Narembeen, 6 Nov 1996, *M.E.French 93* (PERTH); Marvel Loch - Forrestania Rd, S of Marvel Loch, 31°32′56″S, 119°35′12″E, 24 Nov 2013, *D.Nicolle 6695 & M.E.French* (AD, PERTH); Dunbar Rd, SE of Marvel Lock, 31°47′01″S, 119°35′37″E, 20 Mar 2010, *D.Nicolle 5466 & M.E.French* (CANB, PERTH); Great Eastern Hwy, E of Karalee, 31°16′12″S, 119°58′02″E, 24 Oct 2019, *D.Nicolle*

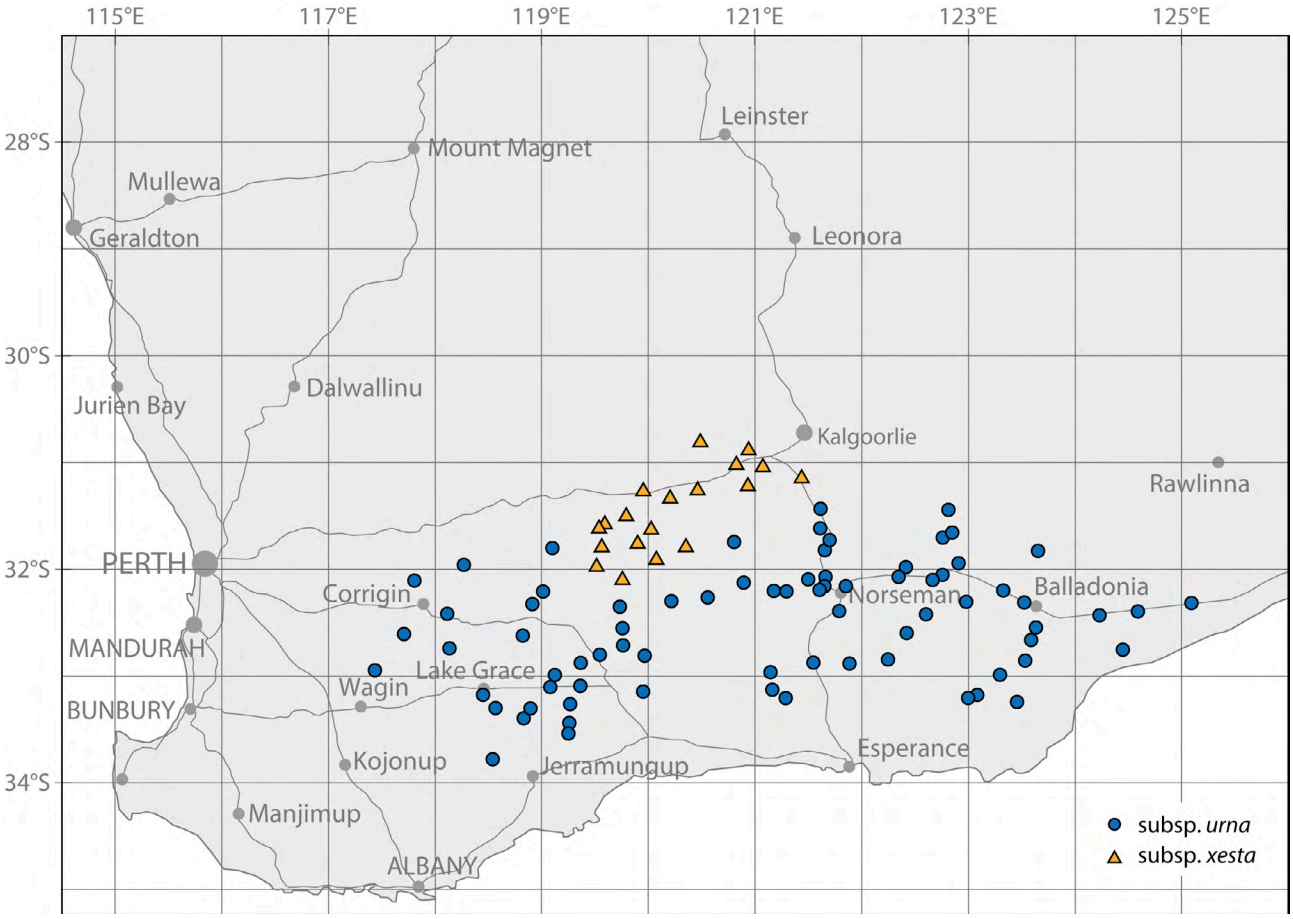

Figure 2. Distribution of *Eucalyptus urna* in south-western Western Australia.

7778 & M.E.French (PERTH); 5 km N Mount Day Rd, Holland Track, 31°52′27″S, 120°11′37″E, 23 Nov 2001, *L.S.J.Sweedman 5656* (PERTH); ca. 68 km S from Great Eastern Hwy on cutline towards Mt Day, 31°48′11″S, 120°21′24″E, 24 Oct 2019, *D.Nicolle 7788 & M.E.French* (PERTH); Walleroo Rock to Jaudi Station Homestead track, 30°48′45″S, 120°29′13″E, 2 May 2015, *D.Nicolle 7002 & M.E.French* (PERTH); W of Coolgardie on highway, 31°01′34″S, 120°50′52″E, 15 Aug 1997, *M.E.French 250*(PERTH); NW of Coolgardie on Trans Australia Railway, 30°52′52.6″S, 121°02′01.3″E, 13 Sep 2014, *M.E.French 2718* (PERTH).

Distribution and habitat*:* Occurs in a roughly west-east band, from the Parker Range area (south of Southern Cross) eastwards to the Coolgardie area, generally to the north of the distribution of subsp. *urna* (Fig. 2). It usually occurs on level to undulating terrain or around salt lakes, in red clay-loam or gravelly clay overlying limestone, where it occurs as a component of mallet woodland. Associated eucalypts include *E. distuberosa, E. kochii* subsp. *yellowdinensis, E. longicornis, E. polita* subsp. *polita, E. salmonophloia, E. salubris, E. tenera*, *E. vittata*, and *E. yilgarnensis*.

Conservation status: Not yet assessed under the IUCN Red List of Threatened Species (IUCN 2020). The subspecies is a fire-sensitive obligate seeder, and is therefore at risk of increased fire frequency and intensity associated with climate change. Considering its known distribution, life cycle, and threats, we believe that an IUCN Red List category of 'Vulnerable' is appropriate for the subspecies.

Etymology: From the Greek *xestos* (polished or smoothed), referring to its smooth, shiny buds and fruits, which distinguishes the subspecies from subsp. *urna*.

Notes: *Eucalyptus urna* subsp. *xesta* is the northern variant of the species, and is distinctive within the species by its relatively small, smooth (non-ribbed), weakly constricted buds and fruits. It has been recognised as a potential new taxon from the Marvel Loch area for some years (as *E.* sp. 'Dunbar Road' (*D.Nicolle 5466 & M.E.French*), e.g. Nicolle *et al.* 2012), but is now known to be more widespread, occurring from south of Southern Cross eastwards to the Coolgardie area.

The more widespread *E. urna* subsp. *urna* occurs mainly to the south of subsp. *xesta*, from east of Narrogin eastwards to the western fringe of the Nullarbor Plain near Caiguna. It is somewhat variable in fruit size and ornamentation, with populations centred in the Newdegate to Lake King area having the largest, most prominently ribbed and flared fruits.

Figure 3. *Eucalyptus urna* subsp. *xesta* (*D.Nicolle 6695 & M.E.French*, south of Marvel Loch). **A**, habit. **B**, bark.

Eucalyptus caesia Benth., *Fl. Austral.* 3: 227 (1867).

Type citation: Western Australia, *J.Drummond 5: suppl. 36* (holo: K; iso: BM, CGE, FI, G, MEL, W).

Eucalyptus caesia is placed in the monotypic *E.* ser. *Caesiae* Brooker & Hopper, which is distinguished within *Eucalyptus* by its combination of lignotuberous mallee habit, minniritchi bark, pruinose branchlets which lack pith glands, bisected cotyledons, petiolate juvenile leaves, its pendulous inflorescences on long peduncles, its conspicuous red or pink flowers, and its large, urceolate fruits.

The species is restricted to isolated populations occurring on and around granite outcrops in south-western Western Australia (Fig. 4). Three subspecies are now recognised in *E. caesia*, differing from one another in their habit, juvenile leaves, and adult morphology.

The new subspecies described here (subsp. *boodjin*) is known from a single granite rock complex (Boyagin Rock). *Eucalyptus caesia* subsp. *magna* occurs on a number of extensive granite rock outcrops north and north-east of Merredin, namely at (west to east) Billyacatting Hill, Yanneymooning Hill, Coorancooping Hill, Chiddarcooping Hill, Chutawalakin Hill, Walyahmoning Rock, and Keokanie Rock.

Eucalyptus caesia subsp. *caesia* occurs as isolated populations on granite outcrops between the respective distributions of subssp. *boodjin* and *magna*, with morphological variation apparent between populations, especially with regard to fruit size. Typical and large-fruited variants of subsp. *caesia* are distributed as such (populations listed west to east for each variant):

Subsp. *caesia* typical variant: Mt Stirling, Mt Caroline, Kokerbin Hill, The Humps, King Rocks.

Subsp. *caesia* large-fruited variant: Gathercole, Uberin Rock, Chingah Hills, numerous low but extensive granite outcrops from Kuender to Pingaring.

Nicolle (2022) refers to the large-fruited variant of subsp. *caesia* as the phrase name *Eucalyptus caesia* subsp. Southern rocks (Nicolle 3813 & French), but this variant is not formally described here, pending further research.

Key to the subspecies of *Eucalyptus caesia*

1 Juvenile leaves dull, blue-green, pruinose. Adult leaves lanceolate to ovate, 45–95 mm long **subsp. *boodjin***

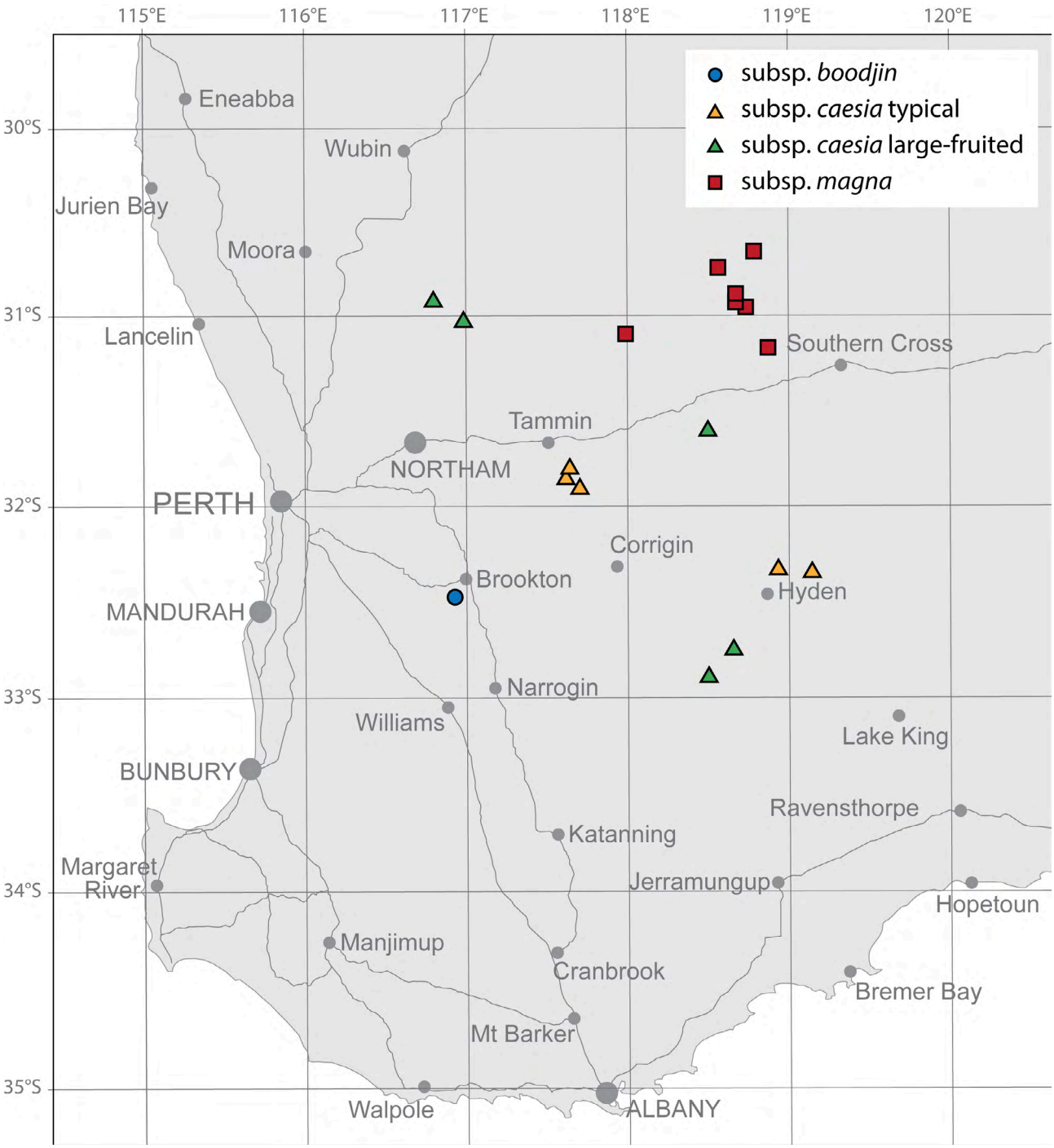

Figure 4. Distribution of *Eucalyptus caesia* in south-western Western Australia.

1 Juvenile leaves glossy, green, not pruinose. Adult leaves lanceolate, 65–220 mm long **2**

2 Branches erect or only slightly pendulous. Adult leaves 65–140 mm long x 12–30 mm wide. Flowers pink. Fruits 15–20 mm wide **subsp. *caesia***

2 Branches tumbledown or very pendulous. Adult leaves 100–220 mm long x 20–46 mm wide. Flowers dark pink to red. Fruits 17–33 mm wide **subsp. *magna***

Eucalyptus caesia subsp. ***boodjin*** D.Nicolle & M.E.French, ***subsp. nov.***

Type: Western Australia: rock 500 metres south-south-west of Boyagin Rock, Boyagin Rock Nature Reserve, 32°28′23″S, 116°52′42″E, 25 Mar 2010, *D.Nicolle 5542 & M.E.French* (holo: PERTH).

Eucalyptus caesia subsp. 'Boyagin Rock' (*D.Nicolle 5542 & M.E.French*): Nicolle, *Classification of the eucalypts (*Angophora, Corymbia *and* Eucalyptus*) Version 6*: 23 (2022).

Figure 5. *Eucalyptus caesia* subsp. *boodjin* (*D.Nicolle 5542 & M.E.French*, Boyagin Rock). **A**, habit. **B**, habit and habitat.

Figure 6. *Eucalyptus caesia* subsp. *boodjin*. **A**, stems/bark (*D.Nicolle 5542 & M.E.French*, Boyagin Rock). **B**, Seedlings (grown from *D.Nicolle 5542 & M.E.French*, Boyagin Rock).

Mallee, to 5 metres tall, lignotuberous. Spreading, open habit (particularly older plants). *Bark* rough up to 1 metre from the base, fibrous, blackish, then minniritchi above. Smaller plants entirely with minniritchi bark. *Branchlets* shiny, red, pruinose, pith glands absent. *Juvenile leaves* rounded to heart-shaped, to 55 mm wide, dull, blue-green, pruinose, especially on new growth. *Adult leaves* lanceolate to ovate, 45–95 mm long x 11–25 mm wide, dull, grey-green to blue-green, petioles 15–25 mm long. *Inflorescences* 3-flowered, rarely 7-flowered, held on down-curved, terete peduncles, 18–30 mm long. *Buds* 20–27 mm long x 10–16 mm wide, pinkish, pruinose, pedicels, 10–20 mm long. *Opercula* conical to slightly beaked. *Flowers* pink, occurring in late autumn and winter. *Fruits* cupular to urceolate, 16–25 mm long x 15–22 mm wide, pinkish-red to grey or silver-white (due to heavy pruinose coating), pendulous, disc broad, descending, valves 4–6 (7), enclosed. *Seeds* black.

Diagnostic characters: Distinguished within the species by its consistently small habit (≤5 m tall; Fig 5), its dull, blue-green, pruinose seedling leaves (especially in the new growth; Fig. 6), and its shorter, more ovate adult leaves (mostly 60–70 mm long, all ≤95 mm long).

Selected specimens: Western Australia: Boyagin Reserve, 12 miles N Pingelly, *A.R.Main s.n.* (PERTH); Boyagin Reserve, SW Brookton, 29 Jul 1963, *R.D.Royce 7896* (PERTH); Boyagin Rock, 21 Jul 1969, *M.I.H.Brooker 1858* (CANB, NSW, PERTH); Boyagin Rock Reserve (nr Brookton), 2 Oct 1975, *D.F.Blaxell & M.I.H.Brooker DFB/W75/6* (PERTH); Boyagin Rock Nature Reserve, 17 km SW of Brookton, 17 Jun 1978, *S.D.Hopper 1014* (PERTH); Boyagin Rock, 2 Feb 1980, *M.I.H.Brooker 6752* (CANB, PERTH).

Distribution and habitat: Known from a single population on the summit and higher slopes of a granite ridge in the vicinity of Boyagin Rock, south-west of Brookton (Fig. 4). The population consists of approximately 100 individual mallees, mainly on the north-west slopes of granite domes.

Conservation status: Not yet assessed under the IUCN Red List of Threatened Species (IUCN 2020). Considering its known distribution, life cycle, and threats, we believe that an IUCN Red List category of 'Vulnerable' is appropriate for the subspecies. The entire population occurs within Boyagin Nature Reserve.

Etymology: From Boodjin, the Indigenous Noongar name for Boyagin Rock (Wheatbelt NRM 2015), to where the new subspecies is restricted. The epithet is used as a noun in apposition.

Common names: The common name 'little princess' has been used for this subspecies in cultivation.

Notes: The dull, blue-green, pruinose seedling leaves of *Eucalyptus caesia* subsp. *boodjin* reliably distinguish the subspecies from the other two subspecies of *E. caesia*. *Eucalyptus caesia* subsp. *caesia* occurs as scattered populations to the north and east of subsp. *boodjin*, and differs primarily in its larger, glossy, green, non-pruinose seedling leaves (to 60 mm wide) and its larger, lanceolate adult leaves (to 140 mm long x to 30 mm wide). *Eucalyptus caesia* subsp. *magna* occurs as scattered populations to the north-east and south-east of subsp. *boodjin*, and differs primarily in its more pendulous, often tumble-down habit, its larger, glossy, green, non-pruinose seedling leaves (to 100 mm wide), its larger, lanceolate adult leaves (to 220 mm long), its larger buds (to 30 mm long), its darker pink or red flowers, and its larger fruits (to 33 mm wide).

Eucalyptus arctata (L.A.S.Johnson & K.D.Hill) D.Nicolle & M.E.French, ***comb. et. stat. nov.***

Eucalyptus leptopoda subsp. *arctata* L.A.S.Johnson & K.D.Hill, *Telopea* 4(4): 621 (1992).

Type citation: WESTERN AUSTRALIA: 20 km E of Dalwallinu towards Kulja, *M.I.H.Brooker 7922*, 12 Jan 1983 (holo NSW; iso CANB, PERTH).

Diagnostic characters: Previously included in *E. leptopoda*, from which it most notably differs in its adult leaves, which lack a visible intramarginal vein (the intramarginal vein is actually likely to be present and confluent with the leaf margin). *Eucalyptus arctata* also differs from *E. leptopoda* in its denser canopy of leaves, its consistently non-pruinose features (branchlets, leaves, buds and fruits), its generally narrower, linear to narrow-lanceolate adult leaves, its 7 (rarely to 11) -flowered inflorescences, its generally shorter peduncles, and its consistently ascending (raised) fruit disc.

Notes: *Eucalyptus arctata* is the only species in E. ser. *Curvipterae* that lacks a visible intramarginal vein in the adult leaves. This feature immediately distinguishes the species from the related *E. leptopoda* (with three subspecies), *E. rosacea, E. synandra and E. beardiana*.

In parts of the northern wheatbelt in WA (e.g. between Koorda and Bencubbin) populations of *E. arctata* and *E. leptopoda* subsp. *leptopoda* occur close to one another (although they are not known in mixed stands) but without apparent hybrids or intergrade zones. In this area, the two taxa are quite distinctive even without close examination, due to the dense canopy of narrow leaves of *E. arctata* contrasting with the sparser canopy of broader leaves in *E. leptopoda* subsp. *leptopoda*.

Populations of *E. arctata* in the south of its range tend to have narrower adult leaves and a less steeply ascending fruit disc than in populations from further north, however this distinction is gradual and variable within populations, and as such we do not consider that subspecific recognition of these variants is warranted.

Prior to the discovery of the intramarginal vein character, some populations of *E. arctata* were previously

included in *E. leptopoda* subsp. *elevata*, presumably because of their more northern distribution and broader adult leaves (e.g. Hill and Johnson 1992). However, these populations clearly fit the current circumscription of *E. arctata*, both in the lack of a visible intramarginal vein in the adult leaves and in their other characteristics.

Eucalyptus polita Brooker & Hopper, *Nuytsia* 9: 51 (1993).

Type citation: 62.7 km west of Mt Day Road on Hyden – Norseman track, 32°21'S, 119°54'E, 7 Nov 1983, *M.I.H.Brooker 8361* (holo PERTH; iso BMAD, CANB, MEL, NSW).

Eucalyptus polita is placed in *E.* ser. *Rufispermae* Maiden, which is distinguished within *Eucalyptus* by its combination of branchlets with pith glands, cotyledons reniform, juvenile leaves petiolate, stamens inflexed, and seeds shiny, reddish. *Eucalyptus polita* is distinguished within *E.* ser. *Rufispermae* by its tree habit and lack of a lignotuber (an obligate seeder), its non-pruinose features, its glossy, green leaves, and its small, sessile buds and fruits.

Two subspecies are now recognised in *E. polita*, forming a geographical replacement pattern in south-western WA (Fig. 7) and differing in their bark morphology. Intergrades between the two subspecies occur in a small area where their distributions adjoin, between Lake Cronin and Middle Ironcap in the Forrestania area.

Key to the subspecies of *Eucalyptus polita*

1 Bark smooth throughout (to ground level) **subsp. *polita***

1 Bark persistent, rough and dark for 1 to 3 m on lower trunk **subsp. *ocreata***

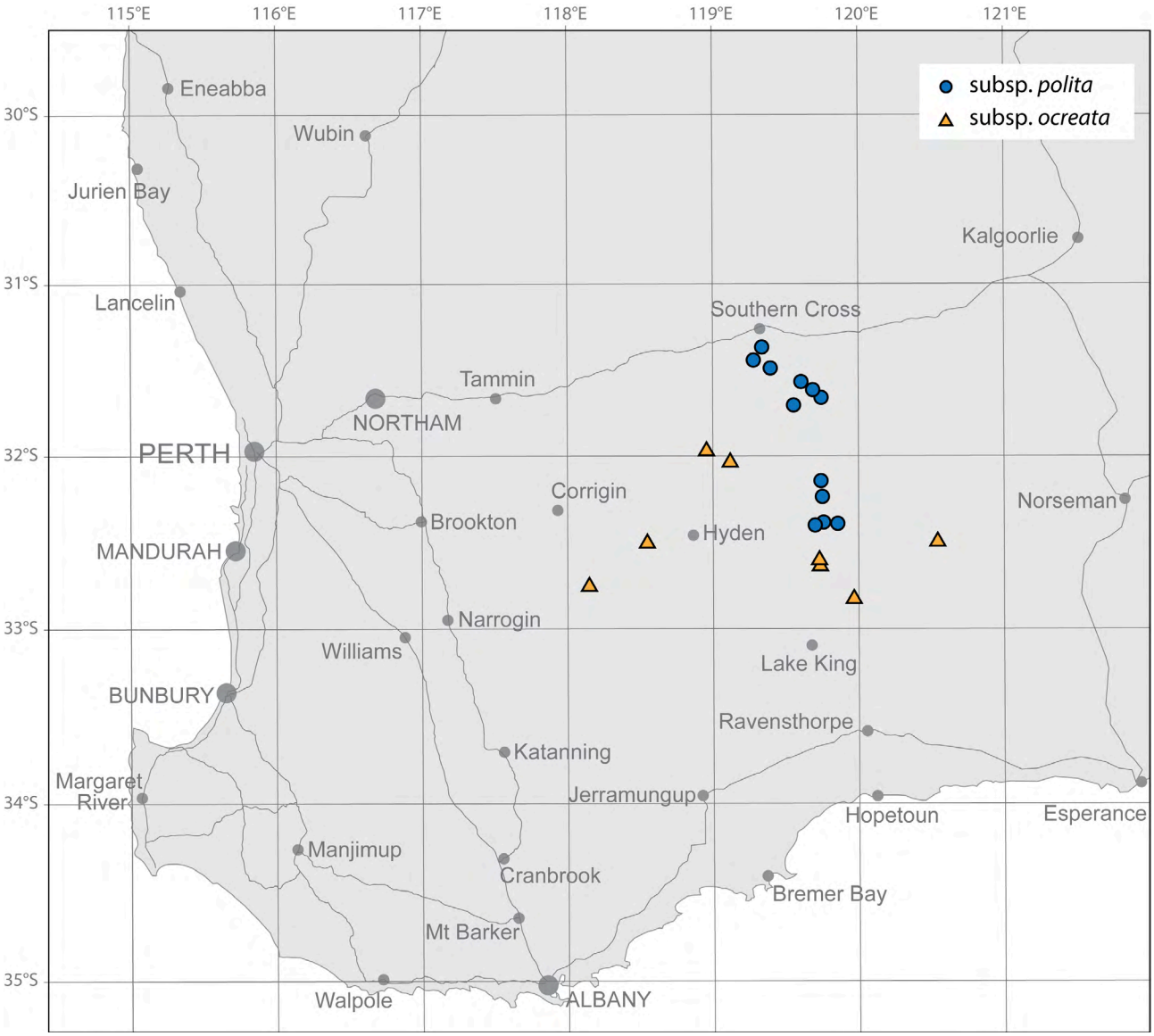

Figure 7. Distribution of *Eucalyptus polita* in south-western Western Australia.

Figure 8. *Eucalyptus polita* subsp. *ocreata* (*D.Nicolle 3449 & M.E.French*, Holleton). **A**, habit. **B**, bark.

Eucalyptus polita subsp. ***ocreata*** D.Nicolle & M.E.French, ***subsp. nov.***

Type: Western Australia: c. 200 m north of Hatter Hill summit, 32°49′32″S, 119°58′44″E, 11 Nov 2000, *D.Nicolle 3674 & M.E.French* (holo: PERTH; iso: CANB).

Eucalyptus polita subsp. 'blackbutt' (*D.Nicolle 3432 & M.E.French*): Nicolle, *Classification of the eucalypts (*Angophora*,* Corymbia *and* Eucalyptus*) Version 6*: 28 (2022).

Mallet, to 15 metres tall, lignotuber absent, obligate seeder. Erect habit, dense crown. *Bark* rough at the base, blackish, thick and fibrous extending from ground level up to 3 metres, smooth grey over creamy yellow to pale brown, shed in ribbons. *Branchlets* with pith glands. *Adult leaves* narrow-lanceolate, 40–120 mm x 8–17 mm, glossy, green to dark green, petioles 10-18 mm long. *Umbels* 7-flowered, held on angular peduncles, 4–9 mm long, *Buds* ovoid, 5–10 mm long x 3–5 mm wide, sessile to pedicellate, pedicels to 1.5 mm long. *Hypanthia* cylindrical, 3–5 mm long x 3–5 mm wide. *Opercula* conical, beaked, often slightly wider than the hypanthia, striate, 1.5–3 mm long. *Flowers* white, occurring in summer and autumn. *Fruits* shortly cylindrical, 5–6 mm long x 4–6 mm wide, sessile, disc level to descending, valves (3) 4, at rim level. *Seeds* glossy, red to dark red.

Diagnostic characters: Distinguished within the species by its persistent, rough, dark bark on the lower trunk up to 1 to 3 m (Fig 8).

Selected specimens: Western Australia (west to east): Cargannocking Hill, S of Kulin, 32°44′33″S, 118°09′12″E, 16 Sep 2000, *D.Nicolle 3431 & M.E.French* (CANB, PERTH); 32.2 km W of Hyden towards Kondinin, 8 Nov 1983, *M.I.H.Brooker 8362* (CANB, PERTH); Kalgarin Nature Reserve, 32°29′43.1″S, 118°33′37.8″E, 23 Sep 1997, *G.J.Keighery & N.Gibson 3262* (PERTH); Vermin Proof Fence, NW of Reids Rd, Holleton, 31°57′57″S, 118°58′28″E, 17 Sep 2000, *D.Nicolle 3449 & M.E.French* (CANB, PERTH); S edge Welsh Nature Reserve, 32°01′11″S, 119°06′46″E, 6 Mar 1996, *P.J.White 959* (PERTH); 20.6 km S of Lake Cronin crossroads towards South Ironcap, 32°35′55″S, 119°44′11″E, 10 Nov 2000, *D.Nicolle 3669 & M.E.French* (CANB, PERTH); S of Middle Ironcap on Marvel Loch – Forrestania Rd, SE of Hyden, 32°37′19.6″S, 119°44′37.1″E, 31 Aug 2023, *M.E.French 3773* (PERTH); Hatter Hill, 30 Aug 1986, *S.D.Hopper 5306* (PERTH); on main track running NW - SE ca. 4.5 km 245 degrees WSW of Mt Gordon, 32°29′22″S, 120°41′15.9″E, 10 May 1989, *S.D.Hopper 7201* (PERTH).

***Distribution and habitat**:* Restricted to scattered populations in the central-eastern wheatbelt and adjacent goldfields, from Cargannocking Hill (south of Kulin) in the west, eastwards to near the Bremer Range and northwards to the Holleton area (Fig. 7). It occurs on hills and rises in undulating landscapes or more rarely on level terrain, almost always in clay to clay-loam, occasionally with laterite and ironstone gravel. Associated eucalypts include *E. calycogona* subsp. *calycogona*, *E. cylindrocarpa*, *E. extensa*, *E. longicornis*, *E. pileata*, *E. prolixa*, *E. salubris*, *E. salmonophloia*, *E. tenera*, *E. urna* subsp. *urna* and *E. yilgarnensis*.

Conservation status: Not yet assessed under the IUCN Red List of Threatened Species (IUCN 2020). Considering its known distribution, life cycle, and threats, we believe that an IUCN Red List category of 'Endangered' is appropriate for the subspecies. The subspecies has a very fragmented distribution, partly due to its habitat (rises and low hills) and partly due to extensive clearing for agriculture. The subspecies is a fire sensitive obligate seeder and is at some risk of increased fire frequency and intensity. The subspecies has been recorded from Karlgarin and Welsh nature reserves.

Etymology: From the Latin *ocreatus* (greave, sheath), referring to the rough, dark stocking of bark at the base of the trees, which distinguishes the subspecies from the completely smooth-barked subsp. *polita*.

Notes: *Eucalyptus polita* subsp. *ocreata* is superficially similar to *E. kondininensis*, and has been included with that species in the past. However, *E. kondininensis* is easily distinguished from *E. polita* subsp. *ocreata* in the field, as it is a lignotuberous re-sprouting species, has more extensive rough bark that covers the trunk and often the branches, and occurs on lowland, often somewhat saline sites near salt lakes.

Eucalyptus scyphata D.Nicolle & M.E.French, *sp. nov.*

Type: Western Australia: Mallee Road, north of Reserve Road [east of Lake Magenta], 33°35′37″S, 119°23′54″E, 23 Mar 2010, *D.Nicolle 5507 & M.E. French* (holo: PERTH).

Eucalyptus sp. 'Southern wheatbelt' (*D.Nicolle 5507 & M.E.French*): Nicolle *et al., Nuytsia* 22(3): 107 (2012).

Eucalyptus sp. Southern wheatbelt: French*, Eucalypts of Western Australia's Wheatbelt*: 296–297 (2012); French & Nicolle*, Eucalypts of Western Australia, the South-West Coast and Ranges*: 244–245 (2019).

Mallee, to 5 m tall, lignotuberous. Habit erect, crown moderate to dense. *Bark* smooth, grey to creamy brown. Older plants often with a stocking of rough bark up to 1 m from the base. *Branchlets* not pruinose, with pith glands. *Juvenile leaves* becoming alternating, petiolate, ovate, dull, green to blue-green. *Adult leaves* petiolate, lanceolate, 60–105 mm × 10–20 mm, dull, blue-grey at first, maturing to glossy, green. *Umbels* 7–13-flowered, held on ± angular peduncles 5–10 mm long. *Buds* cylindrical, 9–12 mm long × 5–6 mm wide, pedicels 1–3 mm long. *Opercula* hemispherical to broadly conical, occasionally pileate. *Flowers* white, occurring sporadically throughout the year, peaking in spring. *Fruits* cupular, 7–10 mm long × 6–7 mm wide, smooth, rim thick, disc descending, valves 4 or 5, enclosed. *Seeds* dark brown to grey-black.

Diagnostic characters: A member of *E.* ser. *Furfuraceae* (along with *E. leptocalyx* and *E. platycorys*), which is distinguished by its lignotuberous mallee habit (lignotuber resprouters), glandular branchlet pith, non-pruinose features, reniform cotyledons, erect inflorescences, inflexed stamens, versatile, oblong anthers, and flattened, scurfy seeds. Within the series, *E. scyphata* is distinguished by its completely smooth bark, its terete branchlets, its 7–13-flowered inflorescences, its buds with hemispherical to broadly conical, smooth opercula, and its cupular fruits.

Selected specimens: Western Australia (west to east): Ryans Rd, E of Newdegate-Pingrup Rd, 33°26′43.6″S, 118°53′21.2″E, 11 Aug 2018, *G.Byrne 6869* (PERTH); E side of Lake Magenta, NE of farmhouse, 14 Jan 1985, *M.I.H.Brooker 8783* (AD, CANB, MEL, NSW, PERTH); NW shore of Lake King, 33°0′33″S, 119°32′1″E, 31 Mar 1993, *P.J.White 584* (PERTH); Site 3 Dam 463, UCL NE of intersection of Sugg Rock Rd and Lake Newton Rd, N of Lake King townsite, 32°57′45.9″S, 119°39′32.7″E, 27 Nov 2006, *A.Coates 5577* (PERTH); Bonnymidgup track, N of Ravensthorpe, 33°27′32.5″S, 120°1′59″E, 28 Feb 2018, *M.E.French 2978* (PERTH); 1.5 km from Cascades to Lake King road on Lake Tay road, 33°12′42″S, 120°42′38″E, 21 Jan 2001, *D.Nicolle 3713 & M.E.French* (CANB, PERTH).

Distribution and habitat: Endemic to Western Australia. Widespread throughout the eastern part of the southern wheatbelt, from Lake Grace southwards to the Ongerup area and Fitzgerald River NP and eastwards to the Esperance region. It grows on yellow-brown sandy loams to white sands or occasionally on loams with ironstone, in mallee shrubland. Associated eucalypt species in the south-west region include *E. dissimulata*, *E. flocktoniae* subsp. *flocktoniae*, *E. incrassata*, *E. phaenophylla*, *E. pleurocarpa*, *E. proxima*, *E. suggrandis* and *E. uncinata.*

Conservation status: Not considered threatened. Recorded from Lake Magenta Nature Reserve and Fitzgerald River and Frank Hann national parks.

Etymology: From the Latin *scyphatus* (like a cup), referring to the shape of its fruits. The name *E. scyphata* is also chosen to minimise taxonomic disruption, as the species was previously known as *E. scyphocalyx*.

Notes: This species was previously erroneously referred to as *E. scyphocalyx* (F.Muell. ex Benth.) Maiden & Blakely, a species described from type material collected at 'Eyre's Relief Camp' (Maiden 1929), which is near Point

Culver, about 300 km north-east of Esperance, between Israelite Bay and Toolinna Cove (Brooker 2023). We consider *E. scyphocalyx* to be a poorly-collected species that is restricted to the coast between Israelite Bay and Toolinna Cove on the edge of the Nullarbor Plain. We also consider the later-named *E. surgens* (Brooker & Hopper 1993) to be a synonym of *E. scyphocalyx.* Slee *at al.* (2015) take a somewhat different view regarding the identity of *E. scyphocalyx,* and consider it to be a *a nomen dubium.* In any case, there is consensus that the type of *E. scyphocalyx* is not representative of the more common wheatbelt species historically known under that name, and which is here described as *E. scyphata.*

Eucalyptus scyphata is most closely related to *E. leptocalyx* and *E. platycorys*. It differs from the generally more coastally-distributed *E. leptocalyx* in its less angular branchlets (in cross section), its shorter, less cylindrical buds with rounded opercula, and its cupular fruits. It differs from the generally more inland-distributed *E. platycorys* in its completely smooth or less extensive rough bark, its 7–13 flowered inflorescences, its smaller, more cylindrical buds, and its smaller, cupular fruits.

Eucalyptus marginata Donn ex Sm., *Trans. Linn. Soc. London* 6: 302 (1802).

Type citation: cultivated at Kew Gardens, England, 1799, *W.T.Aiton s.n.* (holo: LINN).

Nicolle (2022) places *E. marginata* in *E.* subg. *Eucalyptus* sect. *Longistylus* ser. *Occidentales*, together with one other species, *E. staeri*. *Eucalyptus marginata* is distinguished from *E. staeri* by its less coarsely-fissured bark, its generally narrower, thinner, discolorous adult leaves which have visible oil glands (concolorous and lacking visible oil glands in *E. staeri*), and its smaller buds and fruits. Intergrades between *E. marginata* subsp. *marginata* and *E. staeri* are uncommon but occur throughout the distribution of *E. staeri.*

Three subspecies are now recognised in *E. marginata*, forming a geographical replacement pattern in south-western WA (Fig. 9) and differing in their leaf colour and flowering season, and to a lesser extent their inflorescence number. Intergrades between subspp. *marginata* and *thalassica* occur where their distributions adjoin, and between subspp. *marginata* and *spurgeana* in a thin band at the margins of the distribution of subsp. *spurgeana.*

Key to the subspecies of *Eucalyptus marginata*

1	Adult leaves dull, blue-green	**subsp. *thalassica***
1	Adult leaves dull or glossy, green	**2**
2	Juvenile leaves dull, green to blue-green. Flowering in winter	**subsp. *spurgeana***
2	Juvenile leaves glossy, green. Flowering in spring	**subsp. *marginata***

Eucalyptus marginata subsp. *spurgeana* D.Nicolle & M.E.French, *subsp. nov.*

Type: Western Australia: Jalbarragup Road, just south of Mowen Road, 33°54′56″S, 115°32′36″E, 1 Sep 2016, *D.Nicolle 7220* (holo: PERTH).

Eucalyptus marginata subsp. 'Dull leaf' (*D.Nicolle 7720*): Nicolle, *Classification of the eucalypts (*Angophora*,* Corymbia *and* Eucalyptus*) Version 6*: 55 (2022).

Eucalyptus marginata subsp. *marginata* Nannup variant: French and Nicolle, *Eucalypts of Western Australia, the south-west coast and ranges*: 20 (2019).

Tree, to 25 m tall, forming an inconspicuous lignotuber. Habit erect, crown dense. *Bark* rough, fibrous, reddish-brown weathering to grey to grey-brown, held in long, flat, longitudinal strips, persistent up to the upper branches. *Branchlets* not pruinose, without pith glands. *Juvenile leaves* ovate to broad-lanceolate, discolorous, dull, green to blue-green. *Adult leaves* petiolate, lanceolate to broad-lanceolate, 50–120 mm × 12–35 mm, discolorous, dull to glossy, green above, paler green below, intramarginal vein prominent and remote from leaf edge. *Umbels* 7-flowered, held on slender peduncles 8–25 mm long. *Buds* cylindrical to fusiform, 11–16 mm long × 4–6 mm wide, pedicels 3–10 mm long. *Opercula* narrowly to broadly conical. *Flowers* white, late autumn to winter. *Fruits* globose to barrel-shaped, 10–15 mm long × 11–18 mm wide, disc often shiny, red-brown, mostly level to descending (rarely ascending), valves 3(4), to rim level. *Seeds* black.

Diagnostic characters: Distinguished within the species by its combination of dull, green to blue-green juvenile leaves, its dull or glossy, green adult leaves (Figures 10 and 11), its winter flowering period (the two other subspecies flower in spring), and its consistently 7-flowered inflorescences.

Selected specimens: Western Australia (west to east): Hayes Rd, SE Dunsborough, 33°40′18.4″S, 115°07′06″E, 1 Aug 2019, *M.E.French 3195* (PERTH); Bell Rd, NE Margaret River, 33°50′48″S, 115°14′36.5″E, 28 May 2019, *M.E.French 3182* (PERTH); Jacka Rd, S of Busselton at western section of Wicher Range, 33°48′21.5″S, 115°16′04.6″E, 9 Jul 2020, *M.E.French 3369* (PERTH); 100 m NW along Jacka Road from junction of Smith Road, 18 km SSW of Busselton, 33°48′21.6″S, 115°16′04.7″E, 9 Jul 2020, *R.Davis 13866 & M.E.French* (PERTH); 250 m W along Mowen Road from the junction of Great North Road, 22 km E of Margaret River, 33°56′14″S, 115°18′31″E, 9 Jul 2020, *R.Davis 13867 & M.E.French* (PERTH); Mowen Rd, NW of Nannup, 33°56′11.1″S, 115°18′58.7″E, 9 Jul 2020, *M.E.French 3371* (PERTH); Crouch Rd, W of Sues Rd, E of Margaret River, 34°00′47″S, 115°22′32″E, 1 Aug 2019, *M.E.French 3197* (PERTH); Jalbarragup Rd, SW Nannup, 33°59′36″S, 115°35′07″E, 23 Jul 2023, *M.E.French 3770* (PERTH);

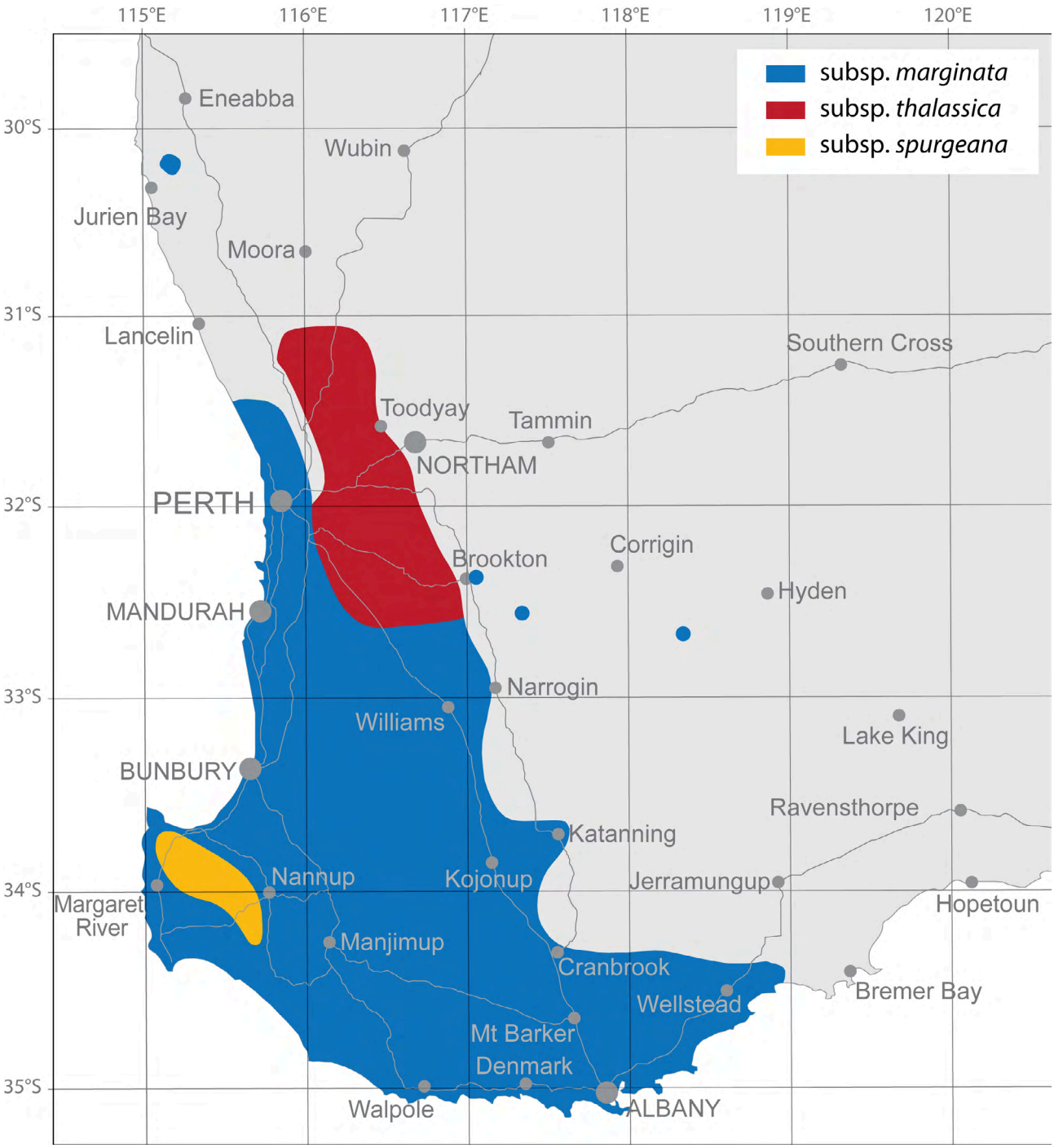

Figure 9. Distribution of *Eucalyptus marginata* in south-western Western Australia.

Brockman Hwy, SW Nannup, 34°02'25"S, 115°41'45.5"E, 26 May 2023, *M.E.French 3754* (PERTH).

Distribution and habitat: Restricted to an area centred west of Nannup, and extending from south of Dunsborough, south-eastwards to Hilliger National Park (Fig. 9). It mainly occurs on lateritic sands to clays. Associated eucalypts include *Corymbia calophylla, C. haematoxylon, E. megacarpa, E. patens* and *E. rudis* subsp. *rudis.*

Conservation status: Not yet assessed under the IUCN Red List of Threatened Species (IUCN 2020). Considering its known distribution, life cycle, and threats, we believe that an IUCN Red List category of 'Least Concern' is appropriate. The subspecies is widespread in Hilliger, Milyeannup and Wiltshire Butler national parks.

Etymology: Named after Ken Spurge (24 Apr 1933–), an apiarist from Waroona in Western Australia, who was the first to recognise the distinctiveness of the subspecies, and alerted us to it. Spurge not only noticed that this subspecies flowered much earlier in the season than the other subspecies of jarrah, but also found the honey to have quite different characteristics, including in colour and taste.

Figure 10. *Eucalyptus marginata* subsp. *spurgeana* (west of Nannup). **A**, flowering trees (23 Jul 2023). **B**, bark.

Common names: The common name 'early flowering jarrah' has been used for this subspecies by local beekeepers, foresters and naturalists.

Notes: *Eucalyptus marginata* subsp. *spurgeana* has long been noted by locals as the 'early flowering jarrah'. The subspecies flowers in May to September, contrasting with the August to December flowering period of subspp. *marginata* and *thalassica*. It also typically has buds and fruits in groups of 7, contrasting with 7–17-flowered umbels of subspp. *marginata* and *thalassica*. The honey of subsp. *spurgeana* also has quite different characteristics to the other subspecies, including in colour (being paler) and taste (K. Spurge pers. comm).

The subspecies was previously included in the much more widespread 'typical' jarrah, subsp. *marginata*, which differs from subsp. *spurgeana* in its consistently glossy, green juvenile and adult leaves, its 7–17-flowered buds and fruits, and its spring flowering period. The more northerly-distributed *subsp*. *thalassica* (blue-leaved jarrah), differs distinctly from subsp. *spurgeana* in its blue-green to grey-green juvenile and adult leaves, its 7–17-flowered buds and fruits, and its spring flowering period.

During its flowering in the winter months, subsp. *spurgeana* is easily recognised in the field due to its white flowers being conspicuous in the canopy. When not in flower, the subspecies is more difficult to distinguish from subsp. *marginata*, although the duller adult leaves of subsp. *spurgeana* distinguish it from subsp. *marginata* where their distributions adjoin. Intermediates, considered to be intergrades between subspp. *marginata* and *spurgeana,* occur in a thin band (up to about two kilometres wide) at the margins of the distribution of subsp. *spurgeana,* but subsp. *marginata* is otherwise not known to occur within the distribution of subsp. *spurgeana.*

Eucalyptus section ***Frutices*** (Brooker) D.Nicolle, ***comb. et. stat. nov.***

Eucalyptus subsect. *Frutices* Brooker, *Aust. Syst. Bot.* 13(1): 131 (2000).

Type: *Eucalyptus diversifolia* Bonpl.

Diagnostic characters: Mallees and small trees, lignotubers present, lignotuber and combination resprouters (see Nicolle 2006); adult leaves concolorous; buds often small relative to fruit size; ovules in 2 vertical rows; anthers ovoid, opening by non-confluent slits; seeds

Figure 11. *Eucalyptus marginata* subsp. *spurgeana*. **A**, coppice growth (west of Nannup). **B**, seedlings grown from *D.Nicolle 7220*.

pyramidal to D-shaped, shiny, black to red-brown, ventral side ribbed.

Notes: *Eucalyptus* sect. *Frutices* consists of 7 series and 19 species (Nicolle 2022). All are lignotuberous mallees or small trees, and all except one species (*Eucalyptus diversifolia*) are endemic to southern Western Australia. *Eucalyptus diversifolia* has an extensive coastal distribution spanning the Great Australian Bight in southern Australia, extending from near Point Culver in Western Australia eastwards to Cape Nelson in Victoria.

Eucalyptus sect. *Frutices* is mostly equivalent to *E.* subsect. *Frutices* of Brooker (2000), except with the addition of *E. insularis*, which Brooker included in the monotypic *E.* subsect. *Unicae*.

Brooker (2000) included *E.* subsect. *Frutices* in *E.* sect. *Longistylus*, which also included *E.* sect. *Arboreae,* comprising four forest tree species (*E. jacksonii, E. marginata, E. staeri* and *E. patens*) from the highest rainfall part of far south-western Western Australia – these four tree species are excluded from *Eucalyptus* sect. *Frutices* in Nicolle (2022) as recognised here.

Disclosures

None.

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