

**Small, easily overlooked and in decline. Potoroos in Eastern Australia. A formal division of the genus *Potorous* Desmarest, 1804 (Marsupialia Potoroidae) and the description of a new species from south-east Queensland.**

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**ABSTRACT**

Potoroos within the family Potoroidae are small marsupials which were abundant at the time Europeans first came to Australia (White and Stone 1790).

They have severely declined in number since.

Three main species groups, all currently placed in the genus *Potorous* Desmarest, 1804 (type species *Didelphis tridactyla* Kerr, 1792) have been formally described and named, containing one putative species each based on most recently published classifications.

One of these, the Long-nosed Potoroo *Potorous tridactylus* (Kerr, 1792) was recently subdivided into two species, namely *P. gilberti* (Gould, 1841) from Western Australia and *P. tridactylus* from eastern Australia, treated as consisting three subspecies, being the nominate form from the Central Coast of New South Wales, *P. tridactylus apicalis* (Gould, 1851) from Tasmania and *P. tridactylus trisulcatus* (McCoy, 1865) from Victoria (Frankham *et al.* 2012).

Molecular studies have shown east Australian *P. tridactylus* to consist of four main divergent clades and so the unnamed one is formally named in this paper as *P. waddahyamin* sp. nov. based on well-known morphological divergences.

Each of the four clades are also formally elevated to full species based on known dates of divergence being 1.32 and 2.45 MYA from nearest common ancestor.

Of the three main species groups within the putative genus *Potorous* two have generic names available being *Potorous* and *Potoroops* Matschie, 1916 for the type species *Hypsiprymnus platyops* Gould, 1844. The third species group does not. As the molecular studies of Westerman *et al.* (2004) and Frankham *et al.* (2012) showed genus-level divergences between the groups, the unnamed one is formally named for the first time.

The species *Potorous longipes* Seebeck and Johnston, 1980 is formally placed in the new genus *Rossignolius* gen. nov..

**Keywords:** Taxonomy; nomenclature; classification; Potoroo; Marsupials; Potoroidae; *Potorous*; *Potoroops*; *Hypsiprymnus*; *platyops*; *tridactylus*; *trisulcatus*; *gilberti*; *apicalis*; *longipes*; New genus; *Rossignolius*; new species; *waddahyamin*.

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**INTRODUCTION**

Potoroos within the family Potoroidae are (now) rarely seen rabbit-sized marsupials which were abundant at the time Europeans first came to Australia (White and Stone 1790).

At first glance, the animal with its pointed nose and grey-brown fur looks very much like a better-known bandicoot (family Peramelidae), until it hops away with its front feet tucked into its chest, revealing its closer relationship with the kangaroo family

(Macropodidae). Potoroos exhibit many morphological specializations such as an elongated pointed rostral region, erect ears, large eyes, large claws for digging, and long robust hind legs.

The body length varies between species, but is usually between 34 and 38 cm and the semi-prehensile tail length is 15 to 24 cm. As they are nocturnal, usually live in forests and are rarely seen in the wild, except as road kill, better indicators of its presence

are the runways it makes through the undergrowth and the hollow diggings it leaves behind when feeding on underground roots and fungi.

Due to the introduction by Europeans of competing animals like rabbits and hares and predators like foxes, cats (see Spencer 1991) and dogs, numbers of Potoroos severely declined almost immediately after European settlement in the 1700's.

These animals only remain in large numbers on islands that are effectively predator free and on the east coast in relatively undisturbed forest areas, which in effect also form islands of safety from invasive species that do better in disturbed and agricultural habitats.

The type species for the genus is the Long-nosed Potoroo *Potorous tridactylus* (Kerr, 1792), originally named *Didelphis tridactyla* Kerr, 1792. The genus *Potorous* was erected by Matschie in 1916. This was a widespread putative taxon, being found in south-west Australia and the south-east as far north as wetter parts of south-east Queensland.

The south-west Australian form was named *Hypsiprymnus gilberti* by Gould in 1841, based on a type from King George Sound, but later synonymised with *P. tridactylus* by Iredale and Troughton (1934) and Bannister *et al.* (1988).

Likewise for the putative taxa *Hypsiprymnus apicalis* Gould, 1851 from New Norfolk, Tasmania and *H. trisulcatus* McCoy, 1865 based on a type from near Gisborne, Victoria.

Frankham *et al.* (2012) published a phylogeny for the putative species *P. tridactylus* including specimens from across the known range and found significant divergences between the populations.

They found putative *P. gilberti* diverged from the (south) eastern populations 5.77 MYA and 7.2 MYA from those from the New South Wales (NSW) Central Coast and further north (a total of two main identified groups). In turn they found Tasmanian specimens diverged from those of Victoria and southern NSW by 2.45 MYA and the two northern populations to have diverged from one another 1.32 MYA.

They made the taxonomic judgements of recognizing *P. gilberti* as a separate species and in turn recognizing the single species *P. tridactylus*, with both *P. apicalis* and *P. trisulcatus* as subspecies of that.

The taxonomy did not make sense in that both putative species *P. apicalis* and *P. trisulcatus* (diverged from one another 2.45 MYA) were in fact more closely related to putative *P. gilberti*, with a 5.77 MYA divergence as opposed to a 7.2 MYA divergence from putative *P. tridactylus*.

In order to resolve this clear error of assignment, one must either transfer both putative subspecies to the synonymy of *P. gilberti* and continue to regard each as subspecies, or in the alternative, and based on quoted divergences, simply elevate all to full species, which in the absence of evidence to the contrary would be the most sensible outcome.

In terms of the remainder of putative *P. tridactylus*, Frankham *et al.* (2012) found a divergence between two main groups of 1.32 MYA, which is again a species-level divergence.

With the northern group unnamed, it again seemed logical to name that as a new species to enable proper conservation measures to take place and allow zoologists to do proper studies involving known taxa as opposed to directly transposing potentially misleading results from other taxa to it.

In terms of the morphologically similar species formally named *P. longipes* Seebeck and Johnston, 1980 from south-east Australia, Frankham *et al.* (2012) found a divergence of 9.4 MYA which is a genus-level divergence.

Westerman *et al.* (2004) found the putative species *P. platyops* (Gould, 1844) to have diverged 14.5 MYA from nearest common ancestor of the other extant putative *Potorous* species.

Hence on the basis of the preceding, it seemed self-evident that the taxonomy of the *P. tridactylus* group needed to be reviewed

in line with what has just been said and that *P. longipes* was in need of a genus-level reassignment.

Before doing any of the above, it was however important to review the relevant literature as well as inspect specimens of all relevant putative taxa.

## MATERIALS, METHODS AND RESULTS

Before a decision is made to name any new taxon, reasonable steps must be taken to ensure that it is justified on all relevant grounds, including that it is morphologically, genetically and reproductively isolated from their nearest relative and to a sufficient degree to be of taxonomic significance.

A further relevant question to ask is should the reproductively isolated and morphologically divergent entities be labelled as subspecies, full species, or potentially higher level again.

Key literature relevant to the taxonomic and nomenclatural conclusions within this paper include Abbott (2008), Amos (1982), Bannister *et al.* (1988), Bee and Close (1993), Bennett (1993), Bensley (1903), Bougher and Friend (2009), Browning *et al.* (2001), Bryant and Krosch (2016), Burbidge and Manly (2002), Butler and Merrilees (1970), Byrne *et al.* (2008, 2011), Claridge *et al.* (2007, 2010), Courtney (1963), Desmarest (1804), Dexter and Murray (2009), Eldridge (1997), Eldridge and Close (1992), Eldridge and Potter (2020), Eldridge *et al.* (2001), Finlayson (1938), Ford (2014), Frankham *et al.* (2011, 2012), Friend (2003), Groves *et al.* (2005), Guiler (1958, 1960, Guiler and Kitchener (1967), Gould (1841, 1844, 1851), Gray (1837), Heinsohn (1936), Hoke (1990), Hope (1969), Hoser (1991), Iredale and Troughton (1934), Jackson (2008), Johnson (2003), Johnston (1973), Johnston and Sharman (1976, 1977), Johnston *et al.* (1984), Kerr (1792), Kitchener (1973), Lawlor (1979), Linné *et al.* (1792), Long (2001), Mahoney (1964), Mason (1997), Matschie (1916), Maxwell *et al.* (1996), McCoy (1865), McDowell and Medlin (2010), Menkhorst (2001), Meredith *et al.* (2008), Mitchell (1908), Nguyen *et al.* (2005), Norton *et al.* (2010a, 2010b), Potter *et al.* (2012a, 2012b, 2012c, 2014), Ride (1970), Ride *et al.* (1999), Rounsevell *et al.* (1991), Seebeck (1991), Seebeck and Johnston (1980), Shaw (1800), Short (1998), Shortridge (1910), Sinclair and Westerman (1997), Sinclair *et al.* (1996, 2000, 2002), Spencer (1991), Stead-Richardson *et al.* (2010), Strahan (1988), Tate (1948), Thomas (1888, 1909), Vaughan *et al.* (2007), Vaughan (1986), Vaughan-Higgins *et al.* (2011), Vernes and Jarman (2014), Westerman *et al.* (2004, 2010), White and Stone (1790) as well as sources cited therein (duplicitous references not necessarily included).

Live and dead specimens as well as available bone specimens, were examined as was other relevant material, including past climate data for the applicable regions, sea level depths and other relevant information.

In summary, as inferred already, the results of Frankham *et al.* (2012) as interpreted and corrected in the introduction stood up to scrutiny.

Therefore *P. tridactylus* as currently recognized is herein split into four species, as well as the sometimes separately recognized species *P. gilberti*, making a total of five.

The unnamed taxon from south-east Queensland, with a divergence of 1.32 MYA from nearest congener is formally named *P. waddahyamin* sp. nov..

I note that a 1.32 MYA is definitely worthy of taxonomic recognition and that as recently as year 2020, Eldridge and Potter (2020), gave taxonomic recognition to a central Australian population of Rock Wallaby with a divergence less than 1 MYA from the nominate form.

*Potorous* Desmarest, 1804 with a type species of *Didelphis tridactyla* Kerr, 1792 has until now been treated by most publishing authors as having three putative species.

These are *P. tridactylus*, herein divided into five as outlined above as well as two others.

The other species are *Hypsiprymnus platyops* Gould, 1844, better-known as the Broad-faced Potoroo, believed to be extinct

(Hoser, 1991), and the Long-footed potoroo *Potorous longipes* Seebeck and Johnston, 1980.

Westerman *et al.* (2004) found the putative species *P. platypus* (Goeldi, 1844) to have diverged 14.5 MYA from the nearest common ancestor of the other extant putative *Potorous* species.

Hence, after taking the divergent morphology of the taxon into account, there is no doubt it is highly divergent of the other two species. The genus name *Potoroops* Matschie, 1916 is available for this taxon and so is adopted herein in line with Tate (1948) based on the significantly divergent morphology as detailed by Tate (1948).

Frankham *et al.* (2012) in their published phylogeny of the other living species found a 9.4 MYA divergence between *P. tridactylus* (all five forms adopted as species herein) and *Potorous longipes* Seebeck and Johnston, 1980, which is clearly a divergence worthy of genus-level separation.

I note other mammals have been divided into separate genera on the basis of far lower divergences than this including for example *Petrogale* Gray, 1837 and *Peradorcas* Thomas, 1909 with a divergence estimated at under 9 MYA (Potter *et al.* 2012b).

The species *Potorous longipes* Seebeck and Johnston, 1980 is therefore formally placed in the new genus *Rossignolius gen. nov.*

#### INFORMATION RELEVANT TO THE FORMAL DESCRIPTIONS THAT FOLLOW

There is no conflict of interest in terms of this paper or the conclusions arrived at herein.

Several people including anonymous peer reviewers who revised the manuscript prior to publication are also thanked as are relevant staff at museums who made specimens and records available in line with international obligations.

In terms of the following formal descriptions, spellings should not be altered in any way for any purpose unless expressly and exclusively called for by the rules governing Zoological Nomenclature as administered by the International Commission of Zoological Nomenclature.

Material downloaded from the internet and cited anywhere in this paper as being sourced online was downloaded and checked most recently as of 22 January 2020 (including if also viewed prior), unless otherwise stated and was accurate in terms of the content (as described) cited herein as of that date.

Unless otherwise stated explicitly, colour and other descriptions apply to living adult specimens of generally good health and not under any form of stress by means such as excessive cool, heat, dehydration or abnormal skin or fur reaction to chemical or other input.

Unless stated otherwise, colour descriptions of species refer to fur colour and not skin.

While numerous texts and references were consulted prior to publication of this paper, the criteria used to separate the relevant species or subspecies has already been spelt out and/or is done so within each formal description and does not rely on material within publications not explicitly cited herein.

In terms of conservation of each population of each species or subspecies as described below, the comments in Hoser (1991, 1993, 1996, 2019a and 2019b) apply.

Wildlife laws as currently enforced in Australia are not in any materially significant way enhancing the long-term survival prospects of any of the relevant species and in any event are being vastly outweighed by other negative impacts of governments, including their ongoing commitment to growing the human population to a level that can only put further pressure on the survival prospects of the relevant taxa.

If the Australian government persists with its ecologically reckless "Big Australia Policy", (see for example Saunders 2019 or Zaczek 2019), that being a long-term aim to increase the human population in Australia to over 100 million people by year

2150 (from the present 25 million as of 2019), all sorts of unforeseen threats to the survival of these species may emerge.

#### ROSSIGNOLIUS GEN. NOV.

LSID urn:lsid:zoobank.org:act:2D06792C-B5AE-43D3-9A9D-FF1F16C77661

**Type Species:** *Potorous longipes* Seebeck and Johnston, 1980.

**Diagnosis:** *Rossignolius gen. nov.* has until now been treated as within the genus *Potorous* Desmarest, 1804 but is readily separated from all members of that genus and the morphologically similar *Potoroops* Matschie, 1916 by the following unique suite of characters: larger adult size, with an average 400 mm head and body length, average 320 mm tail length, 2.1 kg average weight of males and 1.7 kg average weight of females (versus .9 to 1.1 kg in *Potorous* and .5 kg in *Potoroops*, both sexes of each); grey brown above and grey below; hind foot is longer than the head (versus not so in *Potorous*); the skull is lightly built, long and narrow, (versus broad in *Potoroops*); there is a distinctive pad on the sole of the first (big) toe; chromosome count of 34 (versus 12 in males and 13 in females in *Potorous*).

The genus *Potorous* Desmarest, 1804, *sensu lato* including the species within *Rossignolius gen. nov.* and *Potoroops* Matschie, 1916 are readily separated from other marsupials by the following suite of characters: Rhinarium naked, variable in its extent on the upperside of the muzzle. Ears very short, rounded. Fore claws long, rather slender, the median much longer than the outer ones. Hind feet very short, the whole hind limb not disproportionately longer than the fore; soles naked and coarsely granulated. Tail shorter than in the morphologically similar *Bettongia*, tapering, covered with short closely adpressed hairs and without any trace of a crest.

Within the genus *Potorous* Desmarest, 1804, *sensu stricto* the skull is lightly built, long and narrow, the degree of this varying between species being relatively shortest in *Potorous waddahyamin sp. nov.* formally described in this paper. In the genus *Potoroops* Matschie, 1916 the skull is distinctively and obviously short as well as being very wide. The interorbital space is broad, flat or slightly convex, its edges square, not ridged, but in old age forming short postorbital processes. Anterior palatine foramina very short. Palate with a single pair of rather small vacuities opposite the posterior molars, and entirely confined to the palatal bone. Bullae very slightly swollen to distinctly swollen, nearly flat. Lower jaw long and slender, not strongly convex below.

There are typically about 34 teeth in the mouth. Upper incisors small and light, with incisor one long and pointed. Canines are small and thin, compressed laterally; premolar 4 is long and trenchant, though considerably shorter than in *Bettongia*, without trace of internal ledge or postero-internal talon, its outer and inner surfaces with from two to four shallow vertical grooves. Deciduous premolar number three is similar but smaller. Molars quadrangular and quadritubercular, evenly but slightly decreasing in size backwards, except that molar one is generally rather smaller than molar two. Lower incisors very long and slender.

These animals stand on their hind legs like Bettongs, but unlike the Bettongs they run in a different way.

These species use the fore as well as the hind legs in a sort of gallop; they also never attempt to kick with their hind legs.

A colour photo of a live adult specimen of the only known species in the genus, namely *Rossignolius longipes* (Seebeck and Johnston, 1980) can be found on page 206 of Hoser (1991).

**Distribution:** Known only from a limited area in far north-east Victoria and immediately adjacent south-east New South Wales, in an area closely bound by the coastline (generally within 100 km) bounded by Bondi State Forest in New South Wales as the north-eastern limit, Orbost, Victoria in the South-west, and another known population at Howitt Plains, Victoria in the west.

**Etymology:** *Rossignolius gen. nov.* is named in honour of



Federico (AKA Fred) Rossignoli of Hurstbridge (Melbourne) Victoria in recognition of his services to herpetology for more than two decades, including providing logistical assistances to Snakebusters: Australia's best reptiles shows at times of need and other vitally important services to others involved in scientific research and wildlife conservation.

Through his wildlife display business "Australian Nature Live" Federico educated countless Australians at schools, universities and major public events about reptiles and other wildlife as well as other public interest matters with some of the most informative and educational shows ever performed. While he has retired from doing these displays as of 2020, methods he pioneered are now used by other wildlife displays worldwide, including by Snakebusters: Australia's best reptiles shows.

**POTOROUS WADDAHAYAMIN SP. NOV.**

**LSID** urn:lsid:zoobank.org:act:0148A5E4-79D6-4270-B331-D1F9EE317B2D

**Holotype:** A preserved male specimen at the Australian Museum in Sydney, New South Wales, Australia, specimen number M.44614.001 collected from near Warwick, Queensland, Australia, Latitude -28.21 S. Longitude 152.04 E. This government-owned facility allows access to its holdings.

**Paratypes:** Two preserved male specimens at the Australian Museum in Sydney, New South Wales, Australia, specimen numbers M.44612.006 and M.44615.002 collected from near Warwick, Queensland, Australia, Latitude -28.21 S. Longitude 152.04 E.

**Diagnosis:** *Potorous waddahayamin sp. nov.* has until now been treated as a northern population of the better known *P. tridactylus* (Kerr, 1792), since subdivided by Frankham *et al.* (2012) without morphological diagnosis and merely adopting previously proposed and available names.

*Potorous waddahayamin sp. nov.* is readily separated from all of *P. tridactylus* (Kerr, 1792), *P. apicalis* (Gould, 1851), *P. trisulcatus* (McCoy, 1865) and *P. gilberti* (Gould, 1841), by the following suite of characters: colouration is usually a light brown pelage with numerous lighter tipped or whitish hairs scattered throughout giving a distinctly peppered appearance, versus dark brown in the type form of *P. tridactylus* and dark, slightly reddish brown in *P. trisulcatus* and either rufous brown or grey brown in *P. apicalis*; a lack of a white tip on the end of the tail, versus sometimes present in *P. tridactylus* and *P. trisulcatus* and usually present in *P. apicalis*; nasals are short and strongly expanded posteriorly (versus not so in all of *P. tridactylus*, *P. apicalis*, *P. trisulcatus* and *P. gilberti*) and the general fronto-nasal outline is not distinctly and evenly convex as seen in *P. gilberti*; skull is relatively shorter in *P. waddahayamin sp. nov.* than all of *P. tridactylus*; *P. apicalis*; *P. trisulcatus* and *P. gilberti* and unlike those species is noticeably expanded posteriorly; snout is relatively short in *P. waddahayamin sp. nov.* as compared to all of *P. tridactylus*; *P. apicalis*; *P. trisulcatus* and *P. gilberti*, being longest in *P. apicalis*; *P. waddahayamin sp. nov.* has a deep muzzle, versus not so in all of *P. tridactylus*; *P. apicalis*; *P. trisulcatus* and *P. gilberti*; bullae very slightly swollen, versus distinctively swollen in *P. gilberti* and the average weight of adults of both sexes is just over 1 kg in *P. waddahayamin sp. nov.* versus under 1 kg in all other species.

The five species in the genus *Potorous* Desmarest, 1804 as defined herein are readily separated from species in the genera *Potoroops* Matschie, 1916 and *Rossignolius gen. nov.*

The genus *Potorous* Desmarest, 1804, *sensu lato*, including the species within *Rossignolius gen. nov.* and *Potoroops* Matschie, 1916 are readily separated from other marsupials by the following suite of characters:

Rhinarium naked, variable in its extent on the upperside of the muzzle. Ears very short, rounded. Fore claws long, rather slender, the median much longer than the outer ones. Hind feet very short, the whole hind limb not disproportionately longer than the fore; soles naked and coarsely granulated. Tail shorter than

in the morphologically similar *Bettongia*, tapering, covered with short closely appressed hairs and without any trace of a crest.

The skull is lightly built, long and narrow, except in the genus *Potoroops* Matschie, 1916 where it is distinctively short. The Interorbital space is broad, flat or slightly convex, its edges square, not ridged, but in old age forming short postorbital processes. Anterior palatine foramina very short. Palate with a single pair of rather small vacuities opposite the posterior molars, and entirely confined to the palatal bone. Bullae very slightly swollen, nearly flat or obviously swollen. Lower jaw long and slender, not strongly convex below.

There are typically about 34 teeth in the mouth.

Upper incisors small and light, with incisor one long and pointed. Canines are small and thin, compressed laterally; premolar 4 is long and trenchant, though considerably shorter than in *Bettongia*; without trace of internal ledge or postero-internal talon, its outer and inner surfaces with from two to four shallow vertical grooves. Deciduous premolar number three is similar but smaller. Molars quadrangular and quadritubercular, evenly but slightly decreasing in size backwards, except that molar one is generally rather smaller than molar two. Lower incisors very long and slender.

These animals stand on their hind legs like Bettongs, but unlike the Bettongs they run in a different way.

These species use the fore as well as the hind legs in a sort of gallop; they also never attempt to kick with their hind legs.

A colour photo of a live adult specimen of the only known species in the genus *Rossignolius*, namely *Rossignolius longipes* (Seebeck and Johnston, 1980) can be found on page 206 of Hoser (1991).

Hoser (1991) at page 205 has a colour reproduction of an image of two *Potoroops platyops* (Gould, 1841) taken from a lithograph in *Gould's the Mammals of Australia*.

The genus *Rossignolius gen. nov.* has until now been treated as within the genus *Potorous* Desmarest, 1804. This genus is readily separated from all members of that genus and the morphologically similar *Potoroops* Matschie, 1916 by the following unique suite of characters: Larger adult size, with an average 400 mm head and body length, average 320 mm tail length, 2.1 kg average weight of males and 1.7 kg average weight of females (versus .9 to 1.1 kg in *Potorous* and .5 kg in *Potoroops*, both sexes of each); grey brown above and grey below; hind foot is longer than the head (versus not so in *Potorous*); the skull is lightly built, long and narrow, (versus broad in *Potoroops*); there is a distinctive pad on the sole of the first (big) toe; chromosome count of 34 (versus 12 in males and 13 in females in *Potorous*).

The genus *Potoroops* Matschie, 1916 as defined in this paper, is readily separated from both *Potorous* and *Rossignolius gen. nov.* by the following unique suite of characters: Naked part of rhinarium not running back along the top of the muzzle. Head short and broad. Hind foot less than 65 mm long. Muzzle very short. Orbit to anterior nares 26 mm or less, not exceeding three fourths of the zygomatic breadth. Premolar four is very small, about 4-5 mm long.

A photograph of *P. waddahayamin sp. nov.* in life can be seen online at:

<https://imagelibrary.qm.qld.gov.au/fotoweb/archives/5020-Learning-Platform/lcmedia/Mammals/pq019.jpg> info where the relatively short and deep snout of this taxon (as compared to *P. tridactylus*; *P. apicalis*; *P. trisulcatus* and *P. gilberti*) is clearly visible.

**Distribution:** *P. waddahayamin sp. nov.* is known from the coast, ranges and nearby elevated slopes of south-east Queensland, south of the dry zone north the Sunshine Coast to near the New South Wales and Queensland border, potentially just into northern New South Wales north of the Clarence River.

**Etymology:** On 30 July 2019, while doing fieldwork on the outskirts of Warwick in south-east Queensland, I asked a local

Keinjan Aboriginal elder who spoke the Wakka Wakka language what they called the local Potoroo species, to which he replied "Waddahyamin". Hence the scientific name. I was later advised the man may have been confused and had simply asked "What do you mean?" and that there may be no local Aboriginal name for his animal, so I decided to retain use of "waddahyamin". The spelling of the scientific name is intentional and should not be changed unless mandated by the rules of zoological nomenclature.

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**CONFLICTS OF INTEREST**

None.

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