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Draft Terms of Reference – Red-bellied Tamarin

- **Provide information on the taxonomy of the species**

Kingdom: Animalia

Phylum: Chordata

Class: Mammalia (mammals)

Order: Primates (monkeys and apes)

Suborder: Haplorrhini (New World primates)

Family: Cebidae (New World monkeys)

Subfamily: Callitrichinae (marmosets and tamarins)

Genus: *Saguinus*

Species: *labiatus*

Subspecies: *labiatus*, *rufiventer*, *thomasi*

Synonyms (disused): *Midas elegantulus* Slack 1862, *Midas erythrogaster* Reichenbach 1862, *Midas griseovortex* Goeldi 1907

Common name: Red-bellied Tamarin

Alternative common names: White-lipped Tamarin; Red-chested Tamarin; Red-chested Moustached Tamarin; Geoffroy's Tamarin.

Note that "Geoffroy's Tamarin" is also the common name for a separate species, *Saguinus geoffroyi*, and there is also the similarly-named Geoffroy's Marmoset *Callithrix geoffroyi*.

Note also that the common name "Moustached Tamarin" is more often used for the species *Saguinus mystax*, and so this is sometimes modified (for *S. mystax*) to "Black-chested Moustached Tamarin" while *Saguinus labiatus* is then known as the "Red-chested Moustached Tamarin".

The Red-bellied Tamarin was first described by Etienne Geoffroy Saint-Hilaire in 1812 as *Midas labiatus*.¹

The subfamily Callitrichinae (marmosets and tamarins) has usually been subsumed into Cebidae as a subfamily, as in Wilson & Reeder (2005)² and Garbino (2015).³ CITES also still includes the callitrichid species under Cebidae.⁴ Equally commonly it is elevated to a full family, Callitrichidae, as in e.g. Rylands *et al* (2016)⁵ and Buckner *et al* (2015).⁶

There are three currently-recognised subspecies of Red-bellied Tamarin: *S. l. labiatus* (Geoffroy's Red-bellied Tamarin), *S. l. rufiventer* (Gray's Red-bellied Tamarin), and *S. l. thomasi* (Thomas' Red-bellied Tamarin).^{7,8} They can be distinguished through relatively minor differences in colouration, in

particular by the patterning on the top of the head. All three subspecies are depicted in, e.g., Rylands *et al* (2016)⁹ for comparison with one another.

The animals kept in zoos worldwide are listed on ZIMS as either being of unknown/unconfirmed origin/subspecies, or as the nominate subspecies *Saguinus labiatus labiatus*.¹⁰

¹ Groves, C. (2001) "*Primate Taxonomy*" Smithsonian Institution

² Wilson, D.E., and D.M. Reeder (eds) (2005) "*Mammal Species of the World: a taxonomic and geographic reference*" (3rd edition), John Hopkins University Press

³ Garbino, G.S.T. (2015) "How many marmoset (Primates: Cebidae: Callitrichinae) genera are there? A phylogenetic analysis based on multiple morphological systems" *Cladistics* vol. 31 (6), pp. 652-678

⁴ CITES species list for "Cebidae": <https://cites.org/eng/taxonomy/term/5882>

⁵ Rylands, A.B., E.W. Heymann, J.L. Alfaro, J.C. Buckner, C. Roos, C. Matauschek, J.P. Boubli, R. Sampaio, and R.A. Mittermeier (2016) "Taxonomic review of the New World tamarins (Primates: Callitrichidae)" *Zoological Journal of the Linnean Society* vol. 177, pp. 1003-1028

⁶ Buckner, J.C., J.W. Lynch Alfaro, A.B. Rylands, and M.E. Alfaro (2015) "Biogeography of the marmosets and tamarins (Callitrichidae)" *Molecular Phylogenetics and Evolution* vol. 82, pp. 413-425

⁷ Wilson and Reeder (2005), *op. cit.*

⁸ Rylands *et al* (2016), *op. cit.*

⁹ Rylands *et al* (2016), *op. cit.*

¹⁰ *Species360* Zoo Aquarium Animal Management Software (ZIMS)

- **Provide information on the status of the species under CITES**

CITES Listing: Appendix II

IUCN Red List Status: LC (Least Concern)

The Red-bellied Tamarin is listed by CITES on Appendix II¹¹ which permits trade when issued with an export permit. The species is listed by the IUCN as LC (Least Concern).¹²

The species has a fairly wide distribution in central Amazonia, within the countries of Brazil, Bolivia and Peru.¹³

Total population figures appear to be unknown but the Red-bellied Tamarin is considered common within its range. The IUCN states that "much of the range of species occurs in one of the least disturbed areas of the Brazilian Amazon, and there are currently no major threats to the species".¹⁴

¹¹ CITES page for "Saguinus labiatus": <https://cites.org/eng/node/24620>

¹² IUCN page for "Saguinus labiatus": <http://www.iucnredlist.org/details/41524/0>

¹³ IUCN page for "Saguinus labiatus": <http://www.iucnredlist.org/details/41524/0>

¹⁴ IUCN page for "Saguinus labiatus": <http://www.iucnredlist.org/details/41524/0>

- **Provide information about the ecology of the species.**

Callitrichids have short lifespans if compared to other of the higher Primates, with averages of less than ten years (with shorter average lifespans in marmosets than in tamarins).¹⁵ In captivity animals live longer than in the wild, often two or three times as long, with longevity records of over twenty

years being available for many species.¹⁶ The oldest Red-bellied Tamarin on record was a captive animal which died aged 20.5 years.¹⁷ Contrasting with this is the observation that in the wild Red-bellied Tamarins are "old" at around eight years of age based on tooth-wear.¹⁸

Petter and Desbordes (2010)¹⁹ give the measurements of the Red-bellied Tamarin as a head-body length of 26cm and tail length of 39cm. Weight is given in the same source as 460 grams. The sexes of all species of callitrichids can be easily determined by examination of the external genitalia.²⁰ In general appearance all callitrichids are monomorphic (male and female are similar in colour and size).²¹

The Red-bellied Tamarin is largely blackish in colour with silvered streaking on the back. The underparts are bright orange or reddish, hence the common name. There is a white marking covering the nose and encircling the mouth, somewhat likened to a moustache, giving them their alternative common names of White-lipped Tamarin and (Red-chested) Moustached Tamarin. The species is easily distinguished from all other callitrichids by colouration. No other callitrichid has orange underparts, and the only other tamarin with a white nose and lips is the (Black-chested) Moustached Tamarin *Saguinus mystax* which has black underparts. All callitrichids are easily differentiated from other families and species of monkeys by virtue of their small body-size. All species of marmosets and tamarins are illustrated for comparative purposes in Rylands *et al* (2008)²² and Mittermeier *et al* (2013).²³

The Red-bellied Tamarin is found in south and south-central Amazonia, within the countries of Bolivia, Brazil and Peru, where they are found predominantly in primary and secondary forests.²⁴ They cannot survive in or travel across open grasslands or other habitats with an absence of tree cover. As with many Primate species in South America, distributions are often demarcated by large rivers which act as barriers.^{25,26}

The species is sedentary (non-migratory) and, as with all higher Primates, does not hibernate or aestivate. Their area of distribution is within lowland tropical forest with a seasonally-dry climate. Annual temperatures are between 20 and 30 degrees Celsius, and the annual rainfall varies across their range between 1000-2000mm.²⁷ The species is not dependant on waterways - these in fact act as barriers of distribution - and, as an arboreal species, occur in many different forest types sited away from water bodies. They may utilise seasonally-flooded forests but only in the dry season when the habitat is not inundated.²⁸

Based on captive studies, all callitrichids (marmosets and tamarins) have traditionally been thought to have a broadly-similar social structure, with groups being formed from a single mated pair and their (non-breeding) adult offspring from previous births. Field studies, however, suggest that in the wild callitrichids may actually be highly-variable in social structure. Wild studies have shown that various species may live in social groups that are monogamous (a single mated pair), polyandrous (multiple breeding males), polygynous (multiple breeding females), or polygamous (multiple breeding males and females). These social structures may differ between genera (e.g. *Callithrix* [marmosets] versus *Saguinus* [tamarins]), between species or between geographically-separate populations of the same species, or even change in a single group over time.^{29,30}

For Red-bellied Tamarins specifically, wild animals are recorded as living in family groups composed of a monogamous breeding pair and their non-breeding adult offspring.³¹ Average group size is six or seven individuals (from two to thirteen in specific groups).^{32,33} A group will maintain a territory of between 23 to 41 hectares in size.³⁴ Population densities of wild animals have been estimated in various field studies at 1.7 to 4.6 groups per square kilometre.^{35,36,37,38} Individual densities can be as high as 45 animals per square kilometre.³⁹

Callitrichid groups are territorial towards other groups of conspecifics (members of their own species) but regularly form mixed feeding groups with other species. In the Red-bellied Tamarin mixed groups are commonly formed with the Saddleback Tamarin *Saguinus fuscicollis*, and in Bolivia with the Goeldi's Monkey *Callimico goeldii*.^{40,41,42,43}

Callitrichids have small sharp claws and sharp teeth, and are capable of inflicting minor wounds on humans. However the very small size of the animals prevents serious injuries.⁴⁴

¹⁵ Atsalis, S., S.W. Argulis, and P.R. Hof (eds) (2008) "*Primate Reproductive Aging: Cross-Taxon Perspectives*" Karger Publishers

¹⁶ Atsalis *et al* (2008) *op. cit.*

¹⁷ Weigl, R (2005) "*Longevity of Mammals in Captivity; from the living collections of the world*" Kleine Senckenberg-Reihe 48

¹⁸ Suarez, S. (2007) "*Paternity, Relatedness, and Socio-Reproductive Behavior in a Population of Wild Red-bellied Tamarins (Saguinus labiatus)*" Ann Arbor

¹⁹ Petter, J., and F. Desbordes (2010) "*Primates of the World*" Editions Nathan

²⁰ Hubrecht, R., and J. Kirkwood (2010) "*The UFAW Handbook on the Care and Management of Laboratory and Other Research Animals*" Universities Federation for Animal Welfare

²¹ Mittermeier, R.A., A.B. Rylands, D.E. Wilson (eds) (2013) "*Handbook of the Mammals of the World, volume 3: Primates*" Lynx Edicions

²² Rylands, A., R.A. Mittermeier, A.F. Coimbra-Filho, and E.W. Heymann (2008) "*Marmosets and Tamarins: pocket identification guide*" Conservation International

²³ Mittermeier *et al* (2013), *op. cit.*

²⁴ IUCN page for "Saguinus labiatus": <http://www.iucnredlist.org/details/41524/0>

²⁵ IUCN page for "Saguinus labiatus": <http://www.iucnredlist.org/details/41524/0>

²⁶ Mittermeier *et al* (2013), *op. cit.*

²⁷ Alvares, C.A., J.L. Stape, P.C. Sentelhas, J.L. de Moraes Goncalves, and G. Aparovek (2013) "Koppen's climate classification map for Brazil" *Meteorologische Zeitschrift* vol. 22 (6), pp.711-728

²⁸ IUCN page for "Saguinus labiatus": <http://www.iucnredlist.org/details/41524/0>

²⁹ Ferrari, S.F., and M.A. Lopes Ferrari (1989) "A Re-Evaluation of the Social Organisation of the Callitrichidae, with Reference to the Ecological Differences between Genera" *Folia Primatologica* vol 52: pp. 132-147

³⁰ Dunbar, R.I.M. (1995) "The mating system of callitrichid primates: 1. Conditions for the coevolution of pair bonding and twinning" *Animal Behaviour* vol.50, pp. 1057-1070

³¹ Suarez (2007), *op. cit.*

³² Hardie, S.M. (1998) "Mixed species tamarin groups (*Saguinus fuscicollis* and *Saguinus labiatus*) in northern Bolivia" *Primate Report* vol 5: pp. 39-62

³³ Buchanan-Smith, H.M. (1999) "Tamarin polyspecific associations: Forest utilization and stability of mixed species groups" *Primates* vol 40: pp. 233-247

³⁴ Yoneda, M. (1981) "Ecological studies of *Saguinus fuscicollis* and *Saguinus labiatus* with reference to habitat segregation and height preference" *Kyoto University Overseas Research Report of New World Monkeys* pp. 43-50

³⁵ IUCN page for "Saguinus labiatus": <http://www.iucnredlist.org/details/41524/0>

³⁶ Heltne, P.G., C.H. Freese, and G. Whitesides (1975) "*A field survey of non human primate populations in Bolivia, Final Report*" Pan American Health Organization, USA.

³⁷ Puertas, P., F. Encarnación, and R. Aquino (1995) "Análisis poblacional del pichico pecho anaranjado, *Saguinus labiatus*, en el sur oriente peruano" *Neotropical Primates* vol 3(1): pp. 4-7

³⁸ Yoneda (1981), *op. cit.*

³⁹ Suarez (2007), *op. cit.*

⁴⁰ Buchanan-Smith, H.M. (1990) "Polyspecific association of two tamarin species, *Saguinus labiatus* and *Saguinus fuscicollis*, in Bolivia" *American Journal of Primatology* vol 22(3): pp. 205-214

⁴¹ Pook, A.G. and G. Pook (1982) "Polyspecific association between *Saguinus fuscicollis*, *Saguinus labiatus*, *Callimico goeldii* and other primates in north-western Bolivia" *Folia Primatologica* vol 38: pp. 196-216

⁴² Yoneda (1981), *op. cit.*

⁴³ Hardie (1998), *op. cit.*

⁴⁴ Hubrecht, R., and J. Kirkwood (2010) "*The UFAW Handbook on the Care and Management of Laboratory and Other Research Animals*" Universities Federation for Animal Welfare

- **Provide information on the reproductive biology of the species**

In callitrichids in general, female sexual maturity is attained between 12 and 17 months of age, and in males 13 to 25 months.⁴⁵ However in the wild both sexes of Red-bellied Tamarins are recorded as attaining sexual maturity between two and four years (24 to 48 months) of age.⁴⁶ Reproductive suppression of females other than the dominant female is normal in callitrichid groups.^{47,48} As in all Primates, males and females are distinct sexes (i.e. not hermaphroditic, and parthenogenetic births are not possible), and they cannot change sex.⁴⁹

Uniquely amongst higher Primates, all callitrichids typically produce litters of non-identical twins, although births can also less commonly be of just a single baby, or of three or very occasionally four babies (triplets or quadruplets). However, only in rare circumstances would more than two babies survive.⁵⁰

In the wild Red-bellied Tamarins generally give birth between August and December,⁵¹ but in captivity births can occur at any time of the year.⁵² In captivity they can also produce two litters per year.⁵³ The gestation period is 150 to 170 days.⁵⁴

In captivity nest-boxes are routinely provided for callitrichids, but animals in the wild do not normally use cavities for either sleeping or breeding.⁵⁵

Hybridisation in callitrichids is known to occur in the wild where the distributions of two related species meet, creating "hybrid zones".^{56,57} Possibly all intrageneric hybrids within this family would be fertile.⁵⁸ With regards to Red-bellied Tamarins specifically, a wild individual suggested to be a hybrid between this species and the Emperor Tamarin *Saguinus imperator* was reported by Izawa and Bejarano (1981)⁵⁹

There is no possibility of Red-bellied Tamarins hybridising with native Australian mammals, as there are no Primate species native to Australia.

⁴⁵ Digby, L.J., S.F. Ferrari, and W. Saltzman (2007) "Callitrichines: The Role of Competition in Cooperatively Breeding Species" pp. 91-107, in Campbell, C., A. Fuentes, K.C. MacKinnon, M. Panger, and S. Bearder (eds) "*Primates in Perspective*" Oxford University Press

⁴⁶ Suarez, S. (2007) "*Paternity, Relatedness, and Socio-Reproductive Behavior in a Population of Wild Red-bellied Tamarins (Saguinus labiatus)*" Ann Arbor

⁴⁷ Digby *et al* (2007), *op. cit.*

⁴⁸ Sodaro, V. and N. Saunders (eds) (1999) "Callitrichid Husbandry Manual" AZA Neotropical Primate Taxon Advisory Group: Chicago Zoological Park

⁴⁹ Napier, J.R. and P.H. Napier (1985) "*The Natural History of Primates*" M.I.T. Press

⁵⁰ Digby *et al* (2007), *op. cit.*

⁵¹ Suarez (2007), *op. cit.*

⁵² Coates, A. and T. Poole (1983) "The Behavior of the Callitrichid Monkey, *Saguinus labiatus labiatus*, in the Laboratory" *International Journal of Primatology*, vol. 4 (4), pp. 339-371

⁵³ Coates and Poole (1983), *op. cit.*

⁵⁴ Suarez (2007), *op. cit.*

⁵⁵ Sodaro and Saunders (1999), *op. cit.*

⁵⁶ Arnold, M.L. and A. Meyer (2006) "Natural hybridization in primates: One evolutionary mechanism" *Zoology*, vol. 109 (4), pp. 261-276

⁵⁷ Malukiewicz, J., V. Boere, L.F. Fuzessy, A.D. Grativol, J.A. French, I de Oliveira e Silva, L.C.M. Pereira, C.R. Ruiz-Miranda, Y.M. Valenca, and A.C. Stone (2014) "Hybridization Effects and Genetic Diversity of the Common and Black-tufted Marmoset (*Callithrix jacchus* and *Callithrix penicillata*) Mitochondrial Control Region" *American Journal of Physical Anthropology* vol. 155 (4), pp. 522-536

⁵⁸ Coimbra-Filho, A. F., A. Pissinatti, and A.B. Rylands (1993) "Experimental multiple hybridism among *Callithrix* species from eastern Brazil" pp. 95-120, in Rylands, A.B. (ed) "*Marmosets and Tamarins: Systematics, Behaviour, and Ecology*" Oxford University Press

⁵⁹ Izawa, K. and G. Bejarano (1981) "Distribution ranges and patterns of nonhuman primates in Western Pando, Bolivia" *Kyoto University Overseas Research Reports of New World Monkeys* vol. 2, pp. 1-11

- **Provide information on whether the species has established feral populations**

The Red-bellied Tamarin has never established wild breeding populations outside of its natural range.⁶⁰ Within its natural range it is not considered a pest in any economic way.⁶¹

The only callitrichids reported by Long (2003)⁶² as being introduced to the wild in a foreign country or re-introduced within their natural ranges are the Cottontop Tamarin *Saguinus oedipus* and the Golden Lion Tamarin *Leontopithecus rosalia*, both as re-introductions within their natural ranges, and the Common Marmoset *Callithrix jacchus* as introductions within Brazil, to Guanabara in c.1900 and the city of Rio de Janeiro in the mid-20th century. In no cases was damage to humans or the environment noted by Long. Malukiewicz *et al* (2014) note that the introduced population in Rio de Janeiro is actually a hybrid swarm formed from introductions of two species, the Common Marmoset *Callithrix jacchus* and the Black-tufted Marmoset *Callithrix penicillata*.⁶³

⁶⁰ Long, J.L. (2003) "*Introduced Mammals of the World*" CSIRO

⁶¹ IUCN page for "*Saguinus labiatus*": <http://www.iucnredlist.org/details/41524/0>

⁶² Long (2003), *op. cit.*

⁶³ Malukiewicz, J., V. Boere, L.F. Fuzessy, A.D. Grativol, J.A. French, I de Oliveira e Silva, L.C.M. Pereira, C.R. Ruiz-Miranda, Y.M. Valenca, and A.C. Stone (2014) "Hybridization Effects and Genetic Diversity of the Common and Black-tufted Marmoset (*Callithrix jacchus* and *Callithrix penicillata*) Mitochondrial Control Region" *American Journal of Physical Anthropology* vol. 155 (4), pp. 522-536

- **Environmental risk assessments of the species**

The Red-bellied Tamarin is not included in the Vertebrate Pests Committee's 2007 "List Of Exotic Vertebrate Animals In Australia".⁶⁴ Of the callitrichid species listed in the document, the Common Marmoset *Callithrix jacchus* is assigned a threat rating of "2/extreme", while the remaining listed species - the Pigmy Marmoset *Cebuella [Callithrix] pygmaea*, Golden Lion Tamarin *Leontopithecus rosalia*, Black Lion Tamarin *Leontopithecus chrysopygus*, Cottontop Tamarin *Saguinus oedipus*, Red-

handed Tamarin *Saguinus midas*, and Emperor Tamarin *Saguinus imperator* - are assigned a threat rating of "2/Serious".

The number "2" in the threat rating is used to denote "limited to statutory zoos or endorsed special collections".

The rating of "serious" is qualified as "These animals may be introduced and/or should be kept only in collections approved by the relevant State/Territory authority as being primarily kept for (1) public display and education purposes, and/or for (2) genuine scientific research approved by the relevant State/Territory authority, and as meeting Best Practice for the purposes of keeping the species concerned".

The rating of "extreme" is qualified as "These animals should not be allowed to enter, nor be kept in any State or Territory. (Special consideration may be given to scientific institutions on a case by case basis.) Any species that has not been assessed previously should be considered to be in the Extreme Threat Category and should be treated accordingly, until a risk assessment is conducted."

It should be noted that almost every species of exotic mammal listed in the document has been categorised as either "extreme" or "serious".

Quarantine requirements for live Primates have been established by Biosecurity Australia, and would cover Red-bellied Tamarins if these were to be imported.⁶⁵

Seven species of callitrichids are already included on the list of exotic zoo animals allowed to be imported into Australia, including the Common Marmoset *Callithrix jacchus* and Pigmy Marmoset *Cebuella pygmaea* (listed as *Callithrix pygmaea*), three species of *Saguinus* tamarins (the Emperor Tamarin *Saguinus imperator*, Red-handed Tamarin *Saguinus midas*, and Cottontop Tamarin *Saguinus oedipus*), and two species of *Leontopithecus* tamarins (the Golden Lion Tamarin *Leontopithecus rosalia* and the Black Lion Tamarin *Leontopithecus chrysopygus*).⁶⁶

⁶⁴ Vertebrate Pests Committee "List of Exotic Vertebrate Animals in Australia":

<https://www.pestsmart.org.au/wp-content/uploads/2010/03/VPCListJuly2007.pdf>

⁶⁵ Australian Government "Captive non-human primates" (2017):

<http://www.agriculture.gov.au/biosecurity/risk-analysis/animal/captive-non-human-primates>

⁶⁶ Australian Government "List of Specimens taken to be Suitable for Live Import" (2017):

<https://www.legislation.gov.au/Details/F2017C00434>

- **Assess the likelihood that the species could establish a breeding population in Australia**

The likelihood of Red-bellied Tamarins establishing a breeding population in Australia outside effective human control is low if based on historical data. There are no wild populations of Red-bellied Tamarins established outside their natural range,⁶⁷ and despite callitrichids being common in zoos, laboratories, and in private trade throughout the world, the only wild-introduced populations of any species are either deliberate re-introductions to their former range for conservation purposes (e.g. the Golden Lion Tamarin *Leontopithecus rosalia*) or, in the cases of the Common Marmoset *Callithrix jacchus* and Black-tufted Marmoset *Callithrix penicillata*, to non-native parts of their native country of origin (Brazil) via a large-scale pet trade in these species.^{68,69}

Numerous species of marmosets and tamarins have been held in Australian zoos and laboratories over the last hundred years. Currently there are over 300 animals of six species of callitrichids held in Australian zoos as (contained) breeding populations.⁷⁰ Despite this long history and the population figures, no species of callitrichid has ever formed a wild population in Australia via escaped or released animals.

Red-bellied Tamarins are omnivorous. Their diet includes plant components such as nectar, flowers and fruits but excluding leaves and bark; and various animal components such as invertebrates and small herptiles (lizards and frogs). In wild animals, up to 70% of the diet is composed of fruit, with nectar becoming more dominant in the dry season when fruit is scarce.^{71,72} Animal prey is predominantly large-bodied insects such as Orthoptera (grasshoppers).⁷³ Like other tamarin species they feed opportunistically on plant exudates (i.e. tree sap and gum), although unlike marmosets they have no dental modifications to allow them to access this food source unless it is already exposed on the trunk, and the gut is not specifically adapted for the digestion of exudates.⁷⁴

Because Red-bellied Tamarins feed largely on fruit and insects they would find food easily in most rainforest habitats of tropical Australia, but would likely find it difficult to survive in non-rainforest habitats (e.g. eucalyptus forest) due to the limited availability of fruit.

In their natural range, Red-bellied Tamarins are found in seasonally-dry lowland tropics.⁷⁵ Annual temperatures range between 20 and 30 degrees Celsius, and the annual rainfall is 1000-2000mm.⁷⁶ As with all callitrichids, they are arboreal and cannot survive in treeless habitats (grasslands, desert, etc). Related species such as the Common Marmoset *Callithrix jacchus* are well-documented as being able to live easily in human environments such as gardens and city parks⁷⁷ but the Red-bellied Tamarin occurs only in natural forest.⁷⁸ Although in the wild state all callitrichids are tropical, in captivity they display no discomfort to cold weather, even coping with snowy conditions so long as they have dry and warm retreats.⁷⁹ Wild-living animals do not necessarily utilise cavities for shelter, however, so would likely not be able to survive low temperatures or the lack of fruit and invertebrate prey during winters in temperate climates.

Callitrichids have a very different reproductive strategy than that of other higher Primates (monkeys and apes), having evolved a high birth-rate combined with a relatively short lifespan. For the higher Primates a single offspring is the norm, with a long rearing period, meaning births occur only at periods of once a year to once every several years; and the lifespan of individual animals is typically many decades long.⁸⁰ In contrast, marmosets and tamarins typically produce litters of two offspring which are weaned and become independent quickly, with two litters per year being normal for a breeding female.^{81,82} The lifespan of individuals is also relatively short compared to other higher Primates, usually less than ten years on average.⁸³

These factors potentially could increase the likelihood for callitrichids such as the Red-bellied Tamarin to establish wild populations if escaped or released, if compared to other species of Primates.

In the wild state, callitrichids including the Red-bellied Tamarin are preyed upon by birds of prey, snakes, and predatory mammals (Felidae, Mustelidae, Procyonidae).⁸⁴ Because of their very small size they are a potential prey item for more predatory species than is the case for the larger Primates. Partly this is combated by group-living and a relatively high reproductive output.⁸⁵ In

Australia a similar suite of predators is available in terms of birds of prey and large snakes, although the number of mammalian predators is much more restricted (primarily quolls and feral cats; foxes are terrestrial and would have no impact on wild-living tamarins).

Red-bellied Tamarins in Australia would be legally restricted to licenced holders (i.e. zoos) and thus importation of additional animals past an initial import would likely not result in any increase in risk of the establishment of wild populations via escape or release. Numerous species of marmosets and tamarins have been held in Australian zoos and laboratories over the last hundred years, and currently there are over 300 animals of six species of callitrichids held in Australian zoos as (contained) breeding populations.⁸⁶ Despite this long history and the population figures, no species of callitrichid has ever formed a wild population in Australia via escaped or released animals.

⁶⁷ Long, J.L. (2003) "*Introduced Mammals of the World*" CSIRO

⁶⁸ Long (2003), *op. cit.*

⁶⁹ Malukiewicz, J., V. Boere, L.F. Fuzessy, A.D. Grativol, J.A. French, I de Oliveira e Silva, L.C.M. Pereira, C.R. Ruiz-Miranda, Y.M. Valenca, and A.C. Stone (2014) "Hybridization Effects and Genetic Diversity of the Common and Black-tufted Marmoset (*Callithrix jacchus* and *Callithrix penicillata*) Mitochondrial Control Region" *American Journal of Physical Anthropology* vol. 155 (4), pp. 522-536

⁷⁰ Australian zoo census data from Zoo and Aquarium Association (ZAA)

⁷¹ Porter, L. (2001) "Dietary Differences Among Sympatric Callitrichinae in Northern Bolivia: *Callimico goeldii*, *Saguinus fuscicollis* and *S. labiatus*" *International Journal of Primatology*, vol 22 (6): pp. 961-992

⁷² Buchanan-Smith, H. (1991) "A Field Study on the Red-Bellied Tamarin, *Saguinus labiatus labiatus*, in Bolivia" *International Journal of Primatology* vol 12 (3): pp. 259-276

⁷³ Porter (2001), *op. cit.*

⁷⁴ Buchanan-Smith (1991), *op. cit.*

⁷⁵ IUCN page for "*Saguinus labiatus*": <http://www.iucnredlist.org/details/41524/0>

⁷⁶ Alvares, C.A., J.L. Stape, P.C. Sentelhas, J.L. de Moraes Goncalves, and G. Aparovek (2013) "Koppen's climate classification map for Brazil" *Meteorologische Zeitschrift* vol. 22 (6), pp.711-728

⁷⁷ Malukiewicz, J., V. Boere, L.F. Fuzessy, A.D. Grativol, J.A. French, I de Oliveira e Silva, L.C.M. Pereira, C.R. Ruiz-Miranda, Y.M. Valenca, and A.C. Stone (2014) "Hybridization Effects and Genetic Diversity of the Common and Black-tufted Marmoset (*Callithrix jacchus* and *Callithrix penicillata*) Mitochondrial Control Region" *American Journal of Physical Anthropology* vol. 155 (4), pp. 522-536

⁷⁸ IUCN page for "*Saguinus labiatus*": <http://www.iucnredlist.org/details/41524/0>

⁷⁹ Mallinson, J.C.C. (1971) "Observations on the Breeding of Red-handed Tamarin, *Saguinus (=Tamarin) midas* (Linnaeus, 1758) with comparative notes on other species of Callithricidae (=Hapalidae) breeding in captivity" *Annual Report 1971: Durrell Wildlife Conservation Trust*, pp. 19-31

⁸⁰ Napier, J.R. and P.H. Napier (1985) "*The Natural History of Primates*" M.I.T. Press

⁸¹ Dunbar, R.I.M. (1995) "The mating system of callitrichid primates: 1. Conditions for the coevolution of pair bonding and twinning" *Animal Behaviour* vol.50, pp. 1057-1070

⁸² Sodaro, V. and N. Saunders (eds) (1999) "Callitrichid Husbandry Manual" AZA Neotropical Primate Taxon Advisory Group: Chicago Zoological Park

⁸³ Sodar and Saunders (1999), *op. cit.*

⁸⁴ Digby, L.J., S.F. Ferrari, and W. Saltzman (2007) "Callitrichines: The Role of Competition in Cooperatively Breeding Species" pp. 91-107, in Campbell, C., A. Fuentes, K.C. MacKinnon, M. Panger, and S. Bearder (eds) "*Primates in Perspective*" Oxford University Press

⁸⁵ Digby *et al* (2007), *op. cit.*

⁸⁶ Australian zoo census data from Zoo and Aquarium Association (ZAA)

- **Provide a comprehensive assessment of the potential impact of the species should it become established in Australia**

A. Does the species have similar niche/living requirements to native species?

Red-bellied Tamarins are small, arboreal, group-living, diurnal mammals which feed primarily on plant material (fruit, flowers, nectar, and plant exudates), and insects. They are restricted to areas with extensive tree cover (i.e. continuous forest or within forest strips/patches).⁸⁷ Although they utilise nest-boxes in captivity, in the wild they generally sleep on branches or amongst epiphytes rather than in tree holes.⁸⁸ Insect prey is obtained mostly by searching amongst plants and leaves for hidden insects.⁸⁹

In Australia almost all the native mammals are nocturnal or crepuscular,⁹⁰ so would not be directly in competition for living space with Red-bellied Tamarins should a wild population become established. Arboreal mammal species native to Australia are largely folivorous (leaf-eaters), nectivorous (nectar-feeders), or exudativorous (sap-feeders).⁹¹ Red-bellied Tamarins do not feed on leaves; they feed on nectar mainly when fruit is unavailable; and they feed on tree saps only opportunistically.⁹²

B. Is the species susceptible to, or capable of transmitting any pests or diseases?

Red-bellied Tamarins can be carriers of external parasites such as ticks and internal parasites such as nematodes, all of which can be easily and effectively treated/removed before undergoing quarantine. There are a number of Zoonoses (protozoal, fungal, and bacterial infections) transferrable in either direction between humans and non-human Primates, and these are well-covered in the medical literature due to the widespread use of Primates - including tamarins - in laboratories where they are used for studies into human diseases. Few zoonoses are of concern in non-wild (i.e. captive-bred) animals. New World Primates do not carry or transmit Herpes B which is of a concern in Old World macaques (*Macaca spp*). The Princeton University datasheet here briefly covers those Zoonoses associated with callitrichids: <https://ehs.princeton.edu/laboratory-research/animal-research-health-and-safety/zoonotic-disease-information/zoonoses-associated-new-world-monkeys>

Biosecurity Australia has an existing comprehensive set of quarantine requirements for the importation of live Primates, which covers disease control.

C. Probable prey/food sources.

Red-bellied Tamarins feed largely on fruit and large-bodied insects. In studies of wild Red-bellied Tamarins, up to 70% of the diet is made up of fruit, with the rest composed of nectar and invertebrate prey.⁹³ Callitrichids in general have been recorded as feeding on small vertebrates (lizards and frogs) and birds' eggs^{94,95} although these items do not seem to have been recorded for Red-bellied Tamarins - in fact Porter (2007)⁹⁶ specifically noted that vertebrate prey was never recorded in her wild study groups.

Red-bellied Tamarins are found in continuous natural forest and do not utilise human habitats (i.e. orchards and plantations).⁹⁷ They will not damage or feed upon commercial animal species, but do

eat fruit/buds from fruiting plants. In their native range callitrichids are not considered a pest in any regard.⁹⁸

D. Impacts on habitat and local environments.

If a wild population should become established there would be little impact on the local environment. Red-bellied Tamarins do not destroy vegetation or dig burrows. Callitrichids are not considered a pest in any respect in their native country, even when living in human habitats (e.g. plantations or gardens).⁹⁹ As fruit-eaters they can spread seeds via their faeces or potentially on their fur, which could include those of invasive or unwanted plant species. In the wild state they are known to be important seed dispersers of many fruiting species.¹⁰⁰

E. Discuss any control/eradication programs that could be applied in Australia if the species escaped or were released.

If a wild population were to become established, detection and capture in continuous forest would probably be extremely difficult due to their small size and arboreal nature, although this may be offset somewhat by the species being group-living, noisy, and active by day. In human habitats (e.g. plantations or orchards) or in isolated forest patches they would probably be quite noticeable.

Wild callitrichids for scientific studies are captured using elevated live-traps, although this is only of use for small individual numbers of live-captures. Shooting and trapping would likely be the most appropriate options if a wild population needed to be controlled or eradicated.

F. Behaviours that cause environmental degradation.

The Red-bellied Tamarin does not have any behaviours or physical attributes which could cause environmental degradation. Based on the known ecology of callitrichids, they do not impact the ground, dig burrows, or damage or pollute waterways.^{101,102,103}

G. Impacts on primary industries.

An established wild population of Red-bellied Tamarins would have little or no impact on primary industries such as farming or agriculture. In their native ranges callitrichids are not considered to be pests in any regard, even when living in commercial tree areas (plantations and orchards).¹⁰⁴ They do feed on fruit and buds/flowers as part of their diet, which could bring conflict with orchardists although this seems to not be the case in South America even with those species which can be found in human habitats.

H. Damage to property.

The Red-bellied Tamarin is a very small arboreal Primate, and does not damage property.

I. Is the species a social nuisance or danger?

The Red-bellied Tamarin is not a species which would cause a social nuisance. In the native state callitrichids are not considered to be a pest in any regard.¹⁰⁵

J. Describe any potentially harmful characteristics of the species.

All callitrichids (marmosets and tamarins) have small sharp claws and sharp teeth, and are capable of inflicting minor wounds on humans. However the very small size of the animals prevents serious injuries. The wearing of gloves as protection is recommended if the handling of live animals is required.¹⁰⁶

There are numerous Zoonoses capable of being transmitted in either direction between humans and non-human Primates. The Princeton University datasheet here briefly covers Zoonoses associated with callitrichids: <https://ehs.princeton.edu/laboratory-research/animal-research-health-and-safety/zoonotic-disease-information/zoonoses-associated-new-world-monkeys>

Hubrecht and Kirkwood (2010)¹⁰⁷ also covers Primate diseases in a wider scope.

Some common airborne human diseases such as measles and tuberculosis are easily spread to, and may be lethal to, callitrichids. Zoonoses which can be spread from callitrichids to humans under captive conditions are usually via the animals' faecal matter, such as *Shigella*, *Salmonella*, *Campylobacter* and *Yersinia* bacteria. Viruses such as Monkey Pox can also be carried by callitrichids, although the Princeton datasheet notes that "it is unusual for these and other viruses to be present in purpose-bred animals." Further, Hubrecht and Kirkwood¹⁰⁸ state that "Captive-bred animals of known health status are less of a risk" [than wild-caught animals].

Most transmittable Zoonoses are not specific to tamarins (or, indeed, to Primates) but can be carried by any or many mammals.

Biosecurity Australia has an existing comprehensive set of quarantine requirements for the importation of live Primates, which covers disease control.

⁸⁷ Mittermeier, R.A., A.B. Rylands, D.E. Wilson (eds) (2013) "*Handbook of the Mammals of the World, volume 3: Primates*" Lynx Edicions

⁸⁸ Sodaro, V. and N. Saunders (eds) (1999) "Callitrichid Husbandry Manual" AZA Neotropical Primate Taxon Advisory Group: Chicago Zoological Park

⁸⁹ Mittermeier *et al* (2013), *op. cit.*

⁹⁰ Menkhorst, P. and F. Knight (2010) "*A Field Guide to the Mammals of Australia*" Oxford University Press

⁹¹ Menkhorst and Knight (2010), *op. cit.*

⁹² Porter, L. (2001) "Dietary Differences Among Sympatric Callitrichinae in Northern Bolivia: *Callimico goeldii*, *Saguinus fuscicollis* and *S. labiatus*" *International Journal of Primatology*, vol 22 (6): pp. 961-992

⁹³ Porter (2001), *op. cit.*

⁹⁴ Mittermeier *et al* (2013), *op. cit.*

⁹⁵ Digby, L.J., S.F. Ferrari, and W. Saltzman (2007) "Callitrichines: The Role of Competition in Cooperatively Breeding Species" pp. 91-107, in Campbell, C., A. Fuentes, K.C. MacKinnon, M. Panger, and S. Bearder (eds) "*Primates in Perspective*" Oxford University Press

⁹⁶ Porter (2001), *op. cit.*

⁹⁷ IUCN page for "*Saguinus labiatus*": <http://www.iucnredlist.org/details/41524/0>

⁹⁸ Digby *et al* (2007), *op. cit.*

⁹⁹ Digby *et al* (2007), *op. cit.*

¹⁰⁰ Mittermeier *et al* (2013), *op. cit.*

¹⁰¹ Mittermeier *et al* (2013), *op. cit.*

¹⁰² Digby *et al* (2007), *op. cit.*

¹⁰³ Porter (2001), *op. cit.*

¹⁰⁴ Digby *et al* (2007), *op. cit.*

¹⁰⁵ Digby *et al* (2007), *op. cit.*

¹⁰⁶ Hubrecht, R., and J. Kirkwood (2010) "*The UFAW Handbook on the Care and Management of Laboratory and Other Research Animals*" Universities Federation for Animal Welfare

¹⁰⁷ Hubrecht and Kirkwood (2010), *op. cit.*

¹⁰⁸ Hubrecht and Kirkwood (2010), *op. cit.*

- **What conditions or restrictions could be applied to reduce any potential for negative impacts of the species?**

Importation and transfer of Red-bellied Tamarins would be limited exclusively to recognised zoological facilities as licensed by their respective states and territories. As a containment species, Red-bellied Tamarins would be specifically excluded from import by or transfer to private individuals to keep as private pets.

Measures to prevent breeding such as limiting importation to a single sex or to de-sexed individuals would prevent imported specimens being used to conserve the species in Australian zoos in the future.

- **Summary of proposed activity**

The importation of Red-bellied Tamarins would be for the purposes of starting a captive population within Australian zoos as a part of the overall global captive population, intended to enhance the educational programmes within zoos, especially in relation to illustrating the diversity of life and of Primates and rainforests in particular. As the species is not endangered in the wild state, the global captive population serves primarily as ambassadors for their species and habitat, but also serves as a precautionary "safety net" in the event of future conservation threats.

The proposed import would initially be of 3.3.0 individuals for three zoos. The intention of the importing facility is to hold 1.1 while the remaining pairs will be held at the other two facilities. The intention of importing three pairs of Red-bellied Tamarins is to help achieve and maintain genetic diversity for the species in the Australasian region. The intention is for all imported animals to be from separate bloodlines. Further imports may be undertaken to provide additional genetic stock.

The imported animals will all have been captive-bred in licenced overseas zoos eligible to export animals to Australia.

Individual animals will be contracepted to avoid unwanted breeding.

Planned breeding will be undertaken to preserve genetic diversity and in order to avoid producing surplus stock.

- **Guidelines on how species should be kept**

Red-bellied Tamarins are widely kept in zoos in Europe and North America, and captive care information is readily available in specific husbandry manuals for callitrichids (marmosets and tamarins). In Australia, the Zoo and Aquarium Association (ZAA) has general guidelines governing the well-being of zoo animals.

Transport of imported Red-bellied Tamarins would follow IATA Live Animal Regulations.

With respect to the importing facility, each imported Red-bellied Tamarin pair will be kept in a secure, aviary style mesh enclosure.

Each enclosure will measure a minimum of 20 square metres and be 3 metres high. Enclosures will be constructed of 25 x 25 x 2 galvanised steel weldmesh on a 40 x 40 x 2 galvanised steel frame.

The rear 1/3 of the enclosure [on the prevailing weather end] will be enclosed with a Colourbond® steel roof and walls. Within this area will be located a heated nightbox. Radiant heat lamps will also be located in this area.

The entire enclosure will be vegetated with non-toxic plants. Plentiful horizontal and vertical climbing opportunities will be provided. Drinking water will be provided *ad lib* in an above ground receptacle and there will be separate, elevated feed stations.

Enclosure substrate will be of pine bark and groundcover vegetation.

Keeper access to the enclosure will be through a lockable airlock and there will be no visitor access to the enclosure.

Visitor viewing will be from the front end only and visitors will be kept two metres back from the enclosure by a 1200 high stand-off fence.

The zoo premises have 24-hour live-in human security presence, and at night guard dogs patrol the grounds. The entire zoo property is enclosed within a security fence with lockable access gates.

- **State/Territory controls**

The Red-bellied Tamarin is not currently kept in Australian zoos and with the exception of New South Wales there are no specific assessments for this species under Australian state legislations. However several other callitrichid species (marmosets and tamarins) are covered by all or most states.

*The Australian Government's "List of Specimens taken to be Suitable for Live Import" lists seven species of callitrichids (marmosets and tamarins) which can currently be imported under licence. These seven species do not currently include the Red-bellied Tamarin.

<https://www.legislation.gov.au/Details/F2017C00434>

*In Queensland the *Exhibited Animals Act 2015* does not cover the Red-bellied Tamarin (or any species specifically) but allows a licence holder to "Exhibit and deal with animals listed on this authority in accordance with information assessed and approved in deciding the application and details listed on this authority". Six species of callitrichids (marmosets and tamarins) are currently housed in Queensland under this Act.

<https://www.legislation.qld.gov.au/view/pdf/2017-07-03/act-2015-005>

*In New South Wales the *Non-Indigenous Animals Regulation 2012* lists the Red-bellied Tamarin as a Category 2 species (under the scientific name *Saguinus labiatus* and the common names of Red-bellied Tamarin and White-lipped Tamarin). Three further species of callitrichids (marmosets and tamarins) are also listed as Category 2 species, and five other callitrichid species as Category 3a species. Species in both of these Categories are restricted to licenced facilities. This regulation allows these species to be kept in zoos with a permit to be issued by the relevant state authority for possession of the species.

<https://www.legislation.nsw.gov.au/regulations/2012-405.pdf>

*In Victoria the *Catchment and Land Protection Act 1994* does not cover the Red-bellied Tamarin specifically but six other species of callitrichids (marmosets and tamarins) are listed in Schedule 2 as Controlled Pest Animals, which allows them to be kept in zoos with a permit to be issued by the relevant state authority for possession of the species. Species not specifically listed in Schedule 2 are automatically included in Schedule 1 as Prohibited Pest Animals.

[http://www.legislation.vic.gov.au/domino/Web_Notes/LDMS/LTObject_Store/ltobjst10.nsf/DDE300B846EED9C7CA257616000A3571/1B88C214FAD7CE39CA2581F7000236BB/\\$FILE/94-52aa057%20authorised.pdf](http://www.legislation.vic.gov.au/domino/Web_Notes/LDMS/LTObject_Store/ltobjst10.nsf/DDE300B846EED9C7CA257616000A3571/1B88C214FAD7CE39CA2581F7000236BB/$FILE/94-52aa057%20authorised.pdf)

<http://www.gazette.vic.gov.au/gazette/Gazettes2010/GG2010S399.pdf>

*In South Australia the *Natural Resources Management Act 2004* does not cover the Red-bellied Tamarin specifically but seven other species of callitrichids (marmosets and tamarins) are listed in Category 1 of Schedule 1, which allows them to be kept in zoos with a permit to be issued by the relevant state authority for possession of the species.

http://www.pir.sa.gov.au/_data/assets/pdf_file/0003/137460/Declaration_of_Animals_and_Plants_Jan_2015.pdf

*In Western Australia the *Biosecurity and Agricultural Management Act 2007* does not cover the Red-bellied Tamarin specifically but seven other species of callitrichids (marmosets and tamarins) are listed in Category C1 as Prohibited Organisms, which allows them to be kept in zoos with a permit to be issued by the relevant state authority for possession of the species.

The *Biosecurity and Agricultural Management (Prohibited Organisms) Declaration 2013* is available here:

<https://www.agric.wa.gov.au/sites/gateway/files/BAM%20Decl%20s22%20%28Prohibited%20Organisms%29.pdf>

The Western Australian Organism List is searchable online for the most current results here:
<https://www.agric.wa.gov.au/organisms>

*In Tasmania the *Nature Conservation Act 2002* does not cover the Red-bellied Tamarin specifically, but has two species of callitrichid (the Common Marmoset *Callithrix jacchus* and Cottontop Tamarin *Saguinus oedipus*) as Controlled Animals, which allow those two species to be kept in zoos with a permit to be issued by the relevant state authority for possession of the species.

<https://www.legislation.tas.gov.au/view/html/inforce/current/act-2002-063>

List of species which have been risk-assessed for Tasmania: <http://dpiw.tas.gov.au/wildlife-management/management-of-wildlife/wildlife-imports/species-risk-assessments>

*There is no specific reference to Red-bellied Tamarins, nor apparently to callitrichids in general, in the legislation for the Northern Territory or the Australian Capital Territory.

Biosecurity Australia has an existing comprehensive set of quarantine requirements for the importation of live Primates, which would cover Red-bellied Tamarins should they be imported.

<http://www.agriculture.gov.au/biosecurity/risk-analysis/animal/captive-non-human-primates>

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