CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

Twenty-eighth meeting of the Animals Committee
Tel Aviv (Israel), 30 August-3 September 2015

Interpretation and implementation of the Convention

Exemptions and special trade provisions

Implementation of the Convention relating to captive-bred and ranched specimens (Decision 16.65)

FACT SHEET: *DENDROBATES TINCTORIUS* (AMPHIBIA: ANURA: DENDROBATIDAE)

The attached information document has been submitted by the International Union for Conservation of Nature (IUCN) in relation to agenda item 13.*

Summary

Dendrobates tinctorius (CITES App. II) is a colorful, widely traded frog endemic to the eastern part of the Guiana area in northern South-America. Brazil and French Guiana prohibit the export of specimens. Exports originate mostly from Suriname and to a lesser degree from Guyana, with both countries having a voluntary export quota. The scientific basis of this quota is not clear. In 1999 Suriname was asked by the CITES Animals Committee (AC) to provide biological data on which they based their export quotas, but the information was not disclosed. Nevertheless, in 2008, as explained in more detail below, the Standing Committee on the advice of the Secretariat and the Chair of AC lifted the import ban that had been installed in October 2000.

Historically and at present, no captive bred specimens originate from Suriname; all specimens exported are wild-caught. In 2013 Suriname exceeded its export quota for this species considerably. The questions posed to Suriname by the AC in 1999 remain valid and should be answered in order to decide whether the voluntary quota is sustainable. Suriname also should indicate how they prevent smuggled specimens from surrounding countries to be exported through Suriname.

---

* *The geographical designations employed in this document do not imply the expression of any opinion whatsoever on the part of the CITES Secretariat (or the United Nations Environment Programme) concerning the legal status of any country, territory, or area, or concerning the delimitation of its frontiers or boundaries. The responsibility for the contents of the document rests exclusively with its author.*

More recently it became clear that specimens from Brazilian populations were smuggled out of Brazil into the European Union where they sell for high prices. These specimens are easily laundered as "legal" because of the captive breeding of the species in Europe. Most specimens are for the pet trade, but recently attempts to smuggle specimens from French Guiana for the pharmatheutical industry were thwarted.

Species

This is a medium-sized frog, about 4-5 cm snout-vent length (SVL); colorful, with a black or blue body with a pattern of orange, yellow or white lines on the head and the back, sometimes broken up in small spots, sometimes forming a large blotch covering most of top of head and back. It is one of the most popular Dendrobatid species in the pet trade.

The species is highly variable in regard to color patterns. Dendrobatid fanciers recognize many color/pattern morphs based on rather minuscule differences, most of which are from Suriname and French Guiana. None of these morphs have separate taxonomic status, they all belong to the species *D. tinctorius* (Lötters at al. 2007). The fact that both references mentioned above provide lists of morphs that are not consistent, only partly overlap, and with several morphs being indicated by multiple names, demonstrates the confusion inherent to the use of popular morph names. What is clear, however, is that some populations are rather distinct in their color patterns, populations are localized and occur in small areas surrounded by areas where the species apparently is absent (Noonan and Gaucher 2006), and that some populations (e.g. the "citronella" morph from Suriname) have been over-collected and are now difficult to observe in the wild.

The following is a list of "Brazilian" morphs listed by the Morphguide:

"Blue Sipaliwini" -- No information and no pictures are provided in the Morphguide. Note that the Sipaliwini is an area in southern Suriname on the border with Brazil.

"Brasilianer" -- The Morphguide states that the exact locality and distribution of this morph are not yet clear, but according to J. Avaros of AFFILIATION, the locality is near Vila Nova in Amapá.

"Green Sipaliwini" -- The Morphguide notes that this morph was imported into Holland about 12 years ago. Note that Sipaliwini is an area in southern Suriname on the border with Brazil.

"Lorenzo" -- According to the Morphguide, this morph is found near Lourenço in Amapá. Females seem to be nearly completely black while males have a yellow pattern on the head.

"New River" -- This name is wrong because *D. tinctorius* would not occur on the New River in Suriname. This morph would be from a savanna area with forest islands crossed by small streams, about 50 km north from "Vila Nova" in Amapá. There are at least two localities with that name in Amapá. This morph appears to be very similar to the morph Villa Nova, mentioned below. Avila-Pires et al. (2010) reported a blue variant of *D. tinctorius* from the Serra Acarai Ecological Station in Grão-Pará North which is close to the Guyanan border in the municipality Oriximiná, close to the source of the New River. This blue variant is also known from Porto Trombetas (also in Oriximiná), and in southern Guyana (Avila-Pires et al. (2010). These blue *D. tinctorius* which have a white or light blue pattern on the back seem to agree rather well with this "New River" morph but the locality given as 50 km N of Vila Nova is dubious (see below).

"Monte Dourado" -- No information and no pictures are provided in the Morphguide. Monte Dourado is a village in the municipality of Almeirim in northern Pará at the border with Amapá. *D. tinctorius* has been reported there by Avila-Pires et al. (2010). In that locality it is black, with a broad, bright yellow horseshoe-shaped spot on the head and two narrow pale yellow lines on the back that fuse above the sacrum.

"Tumucumac" -- This spectacular orange/yellow and blue morph is only known from a locality in Tumucumaque National Park in Amapá, at its northeastern border close to the Oyapoque river, the frontier with French Guiana (Bernard 2008). The Morphguide refers to Bernard (2008) for details on the locality.

"Villa Nova" -- This morph would have been imported in Germany in the early 1990s. Details about the locality seem very precise (0°43'44 N, 56°46'48 W) and includes road names yet it is incorrect as one road is well outside the range of *D. tinctorius* in Pará south of the Amazon river and the other is in Amapá. The map coordinates fall in northern Pará in an area without any road for hundreds of kilometers around. Thus it remains unclear where these specimens originated.

“Weygoldt ”: This morph was collected in 1980 by P. Weygoldt near Serra do Navio, Amapá and exported to Germany. At that time the species was not yet listed on CITES App. II, but Brazilian law applied, which prohibited exports of fauna.

Dendrobates azureus (with only a small distribution area in southern Suriname) was recently synonymized with *D. tinctorius* (see Wollenberg et al. 2006). Ouboter and Jairam (2012) suggest that several subspecies could be discerned (in Suriname) and they even consider *D. azureus* as a subspecies of *D. tinctorius*, an opinion not followed by other sources (Hoogmoed 2013; Frost 2014; Kok 2014; AmphibiaWeb 2015). As a result of this change in taxonomic designation and noting that this change has been accepted by CITES, *D. azureus* can officially be traded as *D. tinctorius*, unless the Suriname Authorities maintain the special status in trade (zero quota) that *D. azureus* had before its synonymization (see Hoogmoed 2013).

Distribution

D. tinctorius is endemic to the eastern part of the Guiana Shield in French Guiana (throughout the country), Suriname (absent in most of the eastern part of the country), south and southeastern Guyana, and adjacent parts of northern Pará and Amapá in Brazil. The species is not distributed evenly throughout this region.

Habitat

D. tinctorius occupies lowland tropical rainforest (above 100 m), but also open rock slabs with isolated patches of bushy vegetation and dry forest on top of Tafelberg mountain (850 m) in central Suriname. It is diurnal and terrestrial. The extreme inter-populational phenotypic variation could be related to the apparent patchy distribution of suitable habitat for *D. tinctoriu*s throughout its range (Noonan and Gaucher 2006).

Natural history

D. tinctorius deposits clutches of 3-14 eggs in leaf litter. Adults transport 1 or 2 larvae at a time to small water bodies for further development.

Trade

D. tinctorius is on CITES Appendix II and can be legally traded with the requisite export documents. Guyana and Suriname both are exporting this species pursuant to a yearly export quota of 500 (2015) and 1886 (2014), respectively. Exports from French Guiana and Brazil are prohibited. According to the CITES Trade Database, since 1987 no live *D. tinctorius* for the pet trade have been exported from Brazil, although there was a failed export attempt in 1999 (Pisoni and Toledo 2010) at Guarulhos airport. In French Guiana (an overseas department of France), according to Marty and Vacher (2013) “the Minister´s Order of 15 May 1986 forbids the selling, naturalization, or export outside French Guiana of all native amphibians and reptiles.” Gorzula (1996) provides an overview and discussion of the trade in Dendrobatidae, from which it is clear that *D. tinctorius* is one of the four most traded species.

History of Trade from Suriname:

It is relevant to recap the history of the trade of wild-caught *D. tinctorius* from Suriname. See CITES document “Implementation of Resolution Conf. 12.8 (Rev. CoP13),” (SC57 Doc 29.2 Annex 2), and the following text from Hoogmoed (2013):

Pet Trade: During the past 20 years or so the trade in frogs as pets has been steadily increasing, mainly centered on frogs of the former genus Dendrobates (*D. tinctorius* and *Epipedobates trivittatus*). Both these species are on Appendix II of CITES since 22 October 1987, and trade is subject to export and import permits.

Suriname has been exporting ever increasing numbers of, mainly, *D. tinctorius* (Fig. 4) under a voluntary export quotum that was considered “cautious” by CITES until 1999, when the export of this species from Suriname was scrutinized by the CITES Animals Committee, which observed that “Information indicated that virtually all wild specimens of *D. tinctorius* recorded in international trade from 1991 to 1996 originated in Suriname (a total of 5442). Trade in captive-bred animals developed steadily from 1992 onwards and, by 1996, declared captive-bred frogs accounted for approximately 40 % of all specimens traded.” At that time the Animals Committee “recommended that, within 3 months, Suriname should provide the CITES Secretariat with detailed information on the distribution and abundance of this species (including its different colour varieties) in Suriname; provide detailed information on the scientific basis by which it had established that the quantities currently exported were not detrimental to the survival of the species; and provide detailed information on the number and location

of collecting sites [indicating the colour variety(ies) for each collecting site] and period of the year in which collecting was undertaken." The Suriname Management Authority responded and committed itself to provide this information by January 2001; however, such information has not been received by the CITES Secretariat as of June 2001. The Secretariat was informed that exports of the rare blue, and black and blue colour forms was prohibited from October 2000 onward (Mulliken 2008). This probably referred to *Dendrobates azure*us, a related species. Suriname considered it a priority to have the import suspension removed, and that it was necessary to conduct field assessments in order to respond effectively to recommendations resulting from the Review of Significant Trade. Unfortunately, owing to a lack of funding, this has not been done.

The Government of Suriname is still seeking funds to conduct a review of the trade and to provide the information required by the AC. Although the Standing Committee of CITES had recommended not to accept imports from Suriname (June 2001), Suriname has maintained an annual voluntary export quota of 1886 specimens since 1995. Between 2000 and 2004 a total of 5280 specimens was exported in ever decreasing numbers per year (Mulliken 2008), indicating that the recommended import ban on *D. tinctorius* was not very effective. In 2004 Suriname installed an export stop for *D. tinctorius*. The CITES Secretariat recently stated (CITES Secretariat 2008: 13) that "Given the increase in the proportion of the specimens in trade which are from non-wild origin, the original concerns of the AC appear less pressing and they recommend that the CITES SC should withdraw its recommendation to Parties not to accept imports of specimens of *D. tinctorius* from Suriname if the cautious annual voluntary export quota of recent years is maintained." However, no hard data were provided (or known to the Surinamese authorities [Drakenstein, in litt. 3-ix-2008]) about captive breeding of *D. tinctorius* in Suriname, and there is no basis (population data) that would show whether the present quotum of 1886 specimens to be exported per year is indeed cautious. Based on the author's own experience in the field, collecting such a number of specimens is not easy, even if collecting is spread over several localities and carried out by several persons; most likely it is not sustainable, considering the low reproductive rate of the species (only one or two larvae produced at a time). During its meeting of 17 July 2008 the CITES Standing Committee decided to follow the Secretariat's recommendation (see above) and withdrew the import ban. This, unfortunately, just shows that by not taking any action for years, Suriname succeeded in sustaining the situation that originally led to the import ban.

D. tinctorius has been listed by IUCN as Least Concern over its entire distributional area, but no information was available specific to Suriname (Mulliken 2008). Considering the high and constant pressure on populations in Suriname because of the demands of the pet trade, this species merits continued attention. Hopefully, the Surinamese government will succeed in finding funds for a detailed population study.

A complicating factor is that recently Wollenberg et al. (2006; also see Wollenberg 2007) synonymized *D. azureus* (a taxon with a limited distribution within the geographic range of *D. tinctorius*) with *D. tinctorius*, an action accepted in the most recent version of Frost (2011), which is considered the official CITES standard nomenclatural reference for Amphibians. Thus, future exports of *D. azureus* could simply be made under the name *D. tinctorius* and the small isolated populations of *D. azureus* could be wiped out without anybody noticing. Cover (1996, 1997) and Gagliardo (2004a, b) reported on the status of *D. azureus* in the wild. From their data the species seemed to be doing well and reproducing. Threats of savannah fires for the isolated forest-island habitat seemed to be minimal. Further work was envisaged, but that did not eventuate and no further data have become available. The recent synonymization of this species puts in jeopardy its captive breeding programme because financing will be stopped, now that it no longer is considered (by some) to be a separate species.

Recent trade data indicates that trade in wild-caught *D. Tinctorius* from Suriname is continuing and increasing in number. Without scientific data to support this trade, it may turn out not to be sustainable.

Most recent legal trade data

AC 27 Inf. 2 reports the following net export data for *D. tinctorius* (direct trade only) for the 2007-2012 period:

Year	Annual trade of wild specimens
2007	0
2008	687
2009	1559

Year	Annual trade of wild specimens
2010	1611
2011	1742
2012	1187

On the other hand, the CITES-WCMC trade database reports the following total of wild-caught (W) exports from Suriname for a comparable period (2008-2013):

Year	Annual trade of wild specimens
2008	687 (same as above
2009	1524
2010	1611
2011	1742
2012	No data from Suriname[1]
2013	2939
Total	8503

Over the entire period importers reported 7,333 specimens imported from Suriname. In 2013, for example, Suriname reports the export of 1,541 wild *D. tinctorius* to the United States but the USA only reports an import of 707 specimens. This large discrepancy is not explained. In any case, the 2013 export of 2,939 wild-caught *D. tinctorius* from Suriname is well above (1.5 times) the voluntary annual quota of Suriname and could be unsustainable. For 2012, there is a discrepancy between export data referenced in AC27 Inf. 2 and that obtained from the CITES WCMC trade database with no clear explanation for the difference.

The trade in captive bred specimens mainly takes place in Europe or between Europe and the USA and Japan. Trade in captive bred and wild specimens in principle are two different trade channels, but which are very likely connected through illegally exported specimens that may be white-washed as captive bred. Additional trade data for Dendrobatidae involving Asian countries for the period of 2004-2008 is provided in Nijman & Shepherd (2010).

Illegal trade

Gaucher and MacCulloch (2010) consider illegal collecting for the pet trade a major threat to *D. tinctorius*. There are several reported incidents of illegal trade in *D. tinctorius*. For example:

- Marty and Vacher (2013) mention a 1995 confiscation in French Guiana of 416 amphibians of which 263 were *D. tinctorius*. They also reference similar cases involving *D. tinctorius* in 1997, 1999, 2000 and 2006, but they do not include any numbers relevant to those cases but do refer to unpublished data of the French Customs Department. That data has recently been acquired revealing that the 1997 confiscation involved 29 specimens while, in 2000, 14 specimens and 7 tadpoles were seized.

- In 2010, 43 specimens from COUNTRY destined for a pharmaceutical firm in Germany were confiscated (pers. comm. C. Marty, AFFILIATION).

[1] *Although the 2012 export data for Suriname are apparently not available, importing countries reported having received 1,187 W specimens from Suriname in that year.*

- Pistoni &Toledo (2010) reported a 1999 confiscation in Brazil at São Paulo's Guarulhos international airport of 281 *D. tinctorius* and 279 *D.* cf. *galactonotus*, both species said to originate from the "Alto Trombetas in Pará, Brazil". The latter species does not occur there as it is limited to eastern Brazil south of the Amazon River.

Illegal trade in D. tinctorius from Brazil

Despite the fact that Brazil prohibits the export of all fauna and flora, a number of *D. tinctorius* morphs, only known from Brazil, have been in the terrarium trade for years (see Morphguide *D. tinctorius* (http://www.tinctorius.ch/index.php?id=15)). Note that no legal exports of live *D. tinctorius* from Brazil have ever been recorded (see CITES Trade Database).

The Morphguide lists 41 morphs, nine of which are said to be from Brazil. Lötters et al. (2007) list 38 morphs, of which five are said to occur in Brazil while providing a more detailed locality for the morph "Weygoldt" which is in agreement with the Morphguide.

Of the "Brazilian" morphs listed by the Morphguide, there are several for which there is evidence of illegal trade as explained below:

"Green Sipaliwini"-- This morph was imported to Holland about 12 years ago.

"Lorenzo"-- According to Anonymous (2005) this morph was already known in terraria for several years.

"Tumucumac" -- In 2012, German and Belgian pet traders tried to obtain specimens of this morph for export to Germany via Suriname. In early 2015 this morph was reported in trade in Germany, and clearly has been smuggled out of Brazil in contravention of Brazilian law and without CITES documents.

"Villa Nova": This morph would have been imported in Germany in the early 1990s but . it remains unclear where these specimens originate.

"Weygoldt ": This morph was collected in 1980 by P. Weygoldt near Serra do Navio, Amapá and exported to Germany. At that time the species was not yet listed on CITES App. II, but Brazilian law which prohibited exports of fauna, was applicable. It is unclear whether they were exported legally from Brazil or not.

As indicated here, there is evidence of specimens of five Brazilian populations present in the terrarium hobby. These specimens were most likely smuggled out of Brazil either directly to Europe, or via Suriname to Europe. Because Suriname legally exports *D. tinctorius*, it is easy to include smuggled Brazilian specimens in shipments leaving Suriname for Europe or the USA. In French Guiana collecting and export of this species is prohibited, but nevertheless several shipments have been intercepted in Cayenne (Marty and Vacher 2013; pers. comm. with M. Marty 2015). As the border between Brazil and French Guiana (the Oyapock river) is rather open and difficult to control, specimens of *D. tinctorius* may be smuggled out via French Guiana as well. Specimens are easy to hide in small plastic canisters in luggage and are easily missed by officers. At least three of the Brazilian populations can easily be recognized as being restricted to Brazil and when they are found anywhere in captivity it can be safely assumed that they have been smuggled out of Brazil.

Attempts for smuggling *D. tinctorius* out of Brazil have been known since 1999 (Pistoni and Toledo 2010). The fact that the diverse and spectacularly colored population of *D. tinctorius* "Tumucumac" was found to be in trade in Germany in early 2015, data on earlier trials to obtain specimens of this population in 2012, and the presence of smuggled color morphs of the related *Adelphobates galactonotus* (endemic to Brazil) in the trade in Germany in 2013 and 2015 shows that smuggling of Dendrobatids from Brazil to at least Germany, but possibly also other countries, is an ongoing process that Brazilian authorities have not yet been able to stop.

Specimens legally exported from Suriname should be physically checked for the presence of Brazilian (and French Guianan) color morphs in order to prevent laundering of Brazilian (and eventually French Guianan) specimens via Suriname. Such physical checking should preferably be done both in Suriname at export and again by the importing country in order to have a double check on the identity and origin of specimens. Enough information is available in the literature (e.g. Lötters et al. 2007) and on the internet (Morphguide) to enable inspectors to determine the origin of specimens. Using DNA samples for establishing the population from which specimens originate also is a feasible technique. Checking for the presence of skin toxins is an additional technique that readily shows whether specimens at import are wild caught (venom present) or whether they are captive bred (venom absent).

Unfortunately there is historical evidence that Suriname pet traders have been involved in laundering Brazilian reptiles, by importing them illegally from Brazil and then exporting them as Suriname specimens. Thus, this same practice might be used for frogs. It is known, for example, that certain Suriname pet traders obtain much of their specimens in southern Suriname from Indian villages. Contact between Indians from southern Suriname and adjacent Brazil is frequent and this could be a possible way of transferring Brazilian specimens to Suriname, and subsequent export from Suriname. The Brazilian authorities should be attentive to this possibility.

For more information, please contact:

ASG, IUCN SSC:

Dr. Marinus S. Hoogmoed at marinus@museu-goeldi.br

Dr. Ariadne Angulo at aangulo@amphibians.org

Defenders of Wildlife:

Alejandra Goyenechea at agoyenechea@defenders.org

Animal Welfare Institute:

DJ Shubert at dj@awionline.org

References

Anonymous, 2005. *Dendrobates tinctorius* "Lorenzo". Faszination Pfeilgiftfrösche Journal 4: 60-61.

AmphibiaWeb. 2015. AmphibiaWeb: Information on amphibian biology and conservation. [web application]. Berkeley, California: AmphibiaWeb. Available: http://amphibiaweb.org/. (Accessed 24 March 2015).

Avila-Pires, T.C.S., M.S. Hoogmoed & W.A. Rocha, 2010. Notes on the Vertebrates of northern Pará, Brazil: a forgotten part of the Guianan Region, I. Herpetofauna. Boletim Ciências Naturais. Museu Paraense Emílio Goeldi 5(1): 13-112.

Bernard, E. (ed.). 2008. Inventários Biológicos Rápidos no Parque Nacional Montanhas do Tumucumaque, Amapá, Brasil. RAP Bulletin of Biological Assessment 48. Conservation International, Arlington, VA.

Born, M. et al 2010. Dry-season retreat and dietary shift of the dart-poison frog *Dendrobates tinctorius* (Anura: Dendrobatidae). Phyllomedusa 9(1): 37-52.

Courtois, E.A. et al. 2012. Population estimates of *Dendrobates tinctorius* (Anura: Dendrobatidae) at three sites in French Guiana and first record of chytrid infection. Phyllomedusa 11(1): 63-70.

Courtois, E.A. et al., 2014. Monitoring strategy for eight amphibian species ion French Guiana, South America. PLOS One 8(6): pp.?

Frost, Darrel R. 2014. Amphibian Species of the World: an Online Reference. Version 6.0 (*Date of access*). Electronic Database accessible at http://research.amnh.org/herpetology/amphibia/index.html. American Museum of Natural History, New York, USA. Accessed 22 March 2015.

Gaucher, P. & R. MacCulloch, 2010. *Dendrobates tinctorius*. The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Accessed on 22 March 2015.

Gorzula, S.J., 1996. The trade in Dendrobatid frogs from 1987-1993. Herpetological Review 27(3): 116-123.

Hoogmoed, M.S., 2013. Status and conservation of amphibians in Suriname. In: H. Heatwole, C.L. Barrio-Amorós & J.W. Wilkinson (eds.): Amphibian Biology 9. Status of decline of amphibians: Western Hemisphere (Part 3 Venezuela, Guyana, Suriname and French Guiana), Chapter 10: 231-279. Surrey Beatty & Sons, Baulkham Hills, NSW, Australia.

Kok, P.J.R., 2014. Book review of Amphibians of Suriname by P.E. Ouboter and R. Jairam 2012. Herpetological Review 45(4): 716-720.

Lötters, S., K.-H. Jungfer, F.W. Henkel & W. Schmidt, 2007. Poison frogs. Biology, species & captive care: 1-668. - Edition Chimaira, Frankfurt am Main.

Marty, C. & J.-P. Vacher, 2013. Status and decline of the amphibians of French Guiana. In: H. Heatwole, C.L. Barrio-Amorós & J.W. Wilkinson (eds.): Amphibian Biology 9. Status of decline of amphibians:

Western Hemisphere (Part 3. Venezuela, Guyana, Suriname and French Guiana), Chapter 11: 281-297. Surrey Beatty & Sons, Baulkham Hills, NSW, Australia.

Mulliken, T., 2008. Suriname. *Dendrobates tinctorius*. Pp.63–66 *in* "Implementation of Resolution Conf. 12.8 (rev. cop13) Review of Recommendations to Suspend Trade and Implementation of Related Measures by Range States". An analysis prepared by TRAFFIC for the Cites Secretariat under contract A-257. CITES SC57 Doc 29.2 Annex 2.

Nijman, V. & C.R. Shepherd, 2010. The role of Asia in the global trade in CITES II-listed poison arrow frogs: hopping from Kazakhstan to Lebanon to Thailand and beyond. Biological Conservation 19(7): 1963-1970.

Noonan, B.P. & P. Gaucher, 2006. Refugial isolation and secondary contact in the dyeing poison frog *Dendrobates tinctorius*. Molecular Ecology 15: 4415-4425.

Ouboter, P.E. & R. Jairam, 2012. Amphibians of Suriname.: 1-376. Brill, Leiden, Boston.

Pistoni, J. & L.F. Toledo, 2010. Amphibian Illegal Trade in Brazil: What Do We Know? - South American Journal of Herpetology 5(1): 51-56.

Rojas, B., P. Rautiala & J. Mappes, 2014. Differential detectability of polymorphic warning signals under varying light environments. Behavioural Processes 109: 164-172.

Wollenberg, K.C., M. Veith, B.P. Noonan & S. Lötters, 2006. Polymorphism versus species richness—Systematics of large *Dendrobates* from the Eastern Guiana Shield (Amphibia: Dendrobatidae). Copeia 2006 (4): 623-629.

Websites:

CITESTrade Data Base –Dendrobates: http://trade.cites.org/en/cites_trade/download/view_results?filters%5Btime_range_start%5D=2008&filters%5Btime_range_end%5D=2014&filters%5Bexporters_ids%5D%5B%5D=all_exp&filters%5Bimporters_ids%5D%5B%5D=all_imp&filters%5Bsources_ids%5D%5B%5D=112&filters%5Bpurposes_ids%5D%5B%5D=all_pur&filters%5Bterms_ids%5D%5B%5D=all_ter&filters%5Bselection_taxon%5D=genus&filters%5Btaxon_concepts_ids%5D%5B%5D=1430&filters%5Breset%5D=&web_disabled=&filters[report_type]=comptab

Wikipedie nl: http://nl.wikipedia.org/wiki/Dendrobates_tinctorius

Pfeilgiftfrösche: http://topsespfeilgiftfroesche.de.tl/D-.--tinctorius-%2C%2CPic-Matecho-g-.htm

Dutch Rana fotoalbum tinctorius: http://www.dutch-rana.nl/v2/index.php?option=com_content&view=article&id=91&Itemid=109&lang=nl

ONeilscrossing: http://www.oneillscrossing.com/dart-frogs/

AmphibiaWeb: http://calphotos.berkeley.edu/cgi/img_query?where-taxon=Dendrobates+tinctorius&rel-taxon=begins+with&where-lifeform=specimen_tag&rel-lifeform=ne

Reptiles Canada: http://www.reptilescanada.com/showthread.php/36216-International-Herp-Trade-Trends-Article-figures

Morphguide *Dendrobates tinctorius*: http://www.tinctorius.ch/index.php?id=15 Accessed May 5, 2015