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Green and Black Poison frog
(Dendrobates auratus)

Michelle T. Christy and Win Kirkpatrick
2017

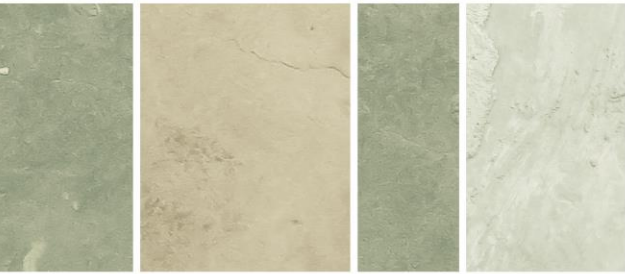
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An Invasive Animals CRC Project



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Summary

Summaries based on assessments carried out in (García-Díaz 2014a, b, c)

Species on VPC List 2007?	Yes
Species on the live import list (EPBC Act 1999)?	Yes
Risk of establishment:	Moderate
Pathways:	Intentional (pet/zoo trade)

Key Messages

Introduction pathway - primarily illegal pet trade, and also for legal education purposes (i.e., zoos)

Impact to Economy - may fetch high prices in the illegal pet trade because of high desirability. The species may also be used as barter for drugs and other items on the black market

Impact to Environment - species is known to carry chytrid fungus and other pathogens that may have negative impacts on native wildlife. If introduced frogs' poison secretions persist in the wild, poisoning of naïve species may occur.

Breeding - Unlike most frogs, females lay eggs in moist, sheltered areas rather than in water. After hatching, the male transports the tadpoles on his back to small pools of water, often water accumulated in the centre of bromeliads.

Classification

Dendrobates auratus (Girard, 1855)

Class:	Amphibia
Order:	Anura
Family:	Dendrobatidae
Genus:	<i>Dendrobates</i>
Species:	<i>auratus</i>

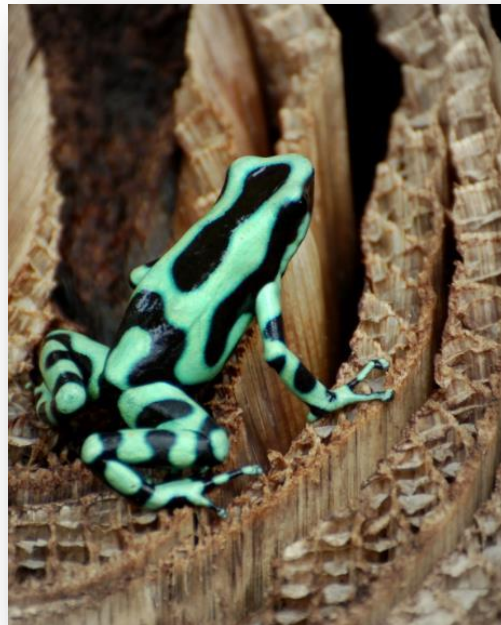


Figure 1. *Dendrobates auratus*. Photo: Greg Gilbert (CC BY 2.0)



Common names

green and black poison frog, gold arrow poison frog, golden poison-arrow frog, green and black poison-arrow frog, green and black poison-dart frog, green and golden poison-arrow frog, green poison-arrow frog, green poison frog

Biology and Ecology

Identification

The green and black poison frog (*Dendrobates auratus*) is one of the most variable of all poison frogs in appearance (Eaton 1941). It is typically mint-green interspaced with black. However, colours vary from forest, lime, emerald green, turquoise, or even cobalt blue or pale yellow contrasted with a dark shade from brown to black. Adult females are larger than males, usually over 25 mm, whereas males average 19 mm.



Figure 2. *Dendrobates auratus*. Photo Josh More (CC BY-NC-ND 2.0)

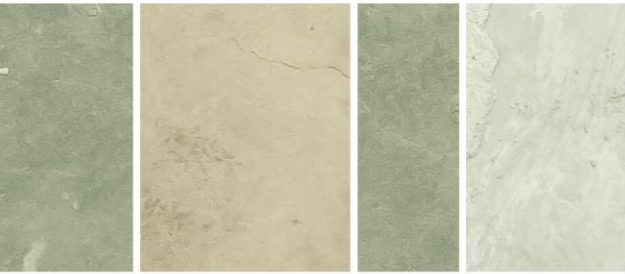


Figure 3. *Dendrobates auratus*. Photo: Pavel Kirillov (CC BY-SA 2.0)

Behaviours and Traits

The green and black poison frog is semi-arboreal (Eaton 1941). It hunts, sleeps and mates in the trees, returning to the ground intermittently to travel as it is too small to move from canopy to canopy. To assist climbing, the frog has small, sucker-like discs on the ends of its toes that provide a suction grip that is mildly adhesive.

The frog is a popular species kept and bred by hobbyists worldwide (Mattison 1987; Walls 1994; Zimmermann 1986). The Hawaiian introduced populations on Oahu may be the principle source of all stock for the international commercial pet trade (Walls 1994).

Food and Foraging

In their native range, the green and black poison frog primarily consume ants and mites (Caldwell 1996). Incidentally, the alkaloid toxin in their poison skin glands is purportedly derived from the ants that are ingested (Caldwell 1996). The tadpoles are omnivorous and feed on algae and small invertebrates that inhabit the tiny pool in which the tadpoles live (McKeown 1996).

In Hawaii, the introduced Gold Dust Day Gecko (*Phelsuma laticauda*) has been observed to consume poison frog tadpoles (Chan et al. 2007).



Reproduction and Lifecycle

Green and black poison frogs congregate in large groups before mating. Although they mate in groups, they are patch territorial and will defend their patch from other males. Males are polygynous during the breeding season; however, the females compete for, and guard, their mates from other females (Crump 1996; Summers 1989, 1990), and may even destroy the eggs of competitors (Summers 1989). Unlike most frogs, females lay eggs in moist, sheltered areas. The eggs are fertilized then protected by the male (Crump 1996; McKeown 1996; Summers 1990; Summers et al. 1999; Walls 1994; Wells 1978; Zimmermann 1986). When the tadpoles hatch the male transports them on his back to small pools of water, often accumulated in the centre of bromeliads (Crump 1996; Eaton 1941; Summers 1990; Wells 1978; Zimmermann 1986).

Habitat

The green and black poison frog occurs in various moist, vegetated valleys (Cochran and Goin 1970; McKeown 1996; Oliver and Shaw 1953; Smith and Kohler 1977; Walls 1994).

Global Range

The green and black poison frog is native to Colombia, Costa Rica, Nicaragua, and Panama. It occurs in the humid lowlands from south-eastern Nicaragua on the Atlantic slope and south-eastern Costa Rica on the Pacific slopes to north western Colombia (IUCN 2017; Somma 2017).

The species was intentionally introduced to the upper Manoa Valley on Oahu (Hawaii) in 1932, for mosquito control (Cochran and Goin 1970; McKeown 1996; Oliver and Shaw 1953; Smith and Kohler 1977; Walls 1994). The initial introduction was 206 individuals from Taboga or Taboguilla Islands in Panama (McKeown 1996; Silverstone 1975). A few descendant populations still persist in the mountains and valleys of Oahu (Somma 2017).

Dendrobatids were not known from Maui, Hawaii (McKeown 1996), but the detection of the green and black poison frog in the early 2000s indicate they are established on the island. In early 2002 a single frog was collected from Wailuku, Maui after several years of reported sightings (Somma 2017).

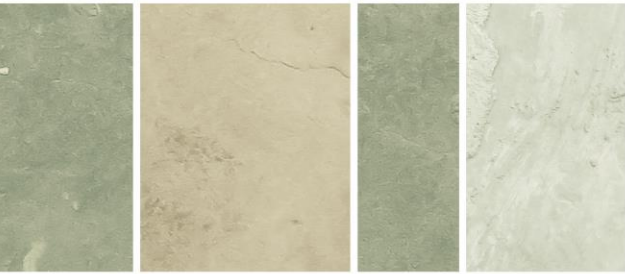


Figure 4. Map showing the native range of *Dendrobates auratus* (red). Image courtesy Smithsonian Tropical Research Institute (September 2017).

Potential for Introduction

Green and black poison frog has been transported to Australia illegally and legally for exhibition in zoos (García-Díaz and Cassey 2014). Because the highest risk is via the illegal wildlife trade, controlling imports is difficult (García-Díaz 2014c). However, the scarcity of records of this species in the illegal trade indicates that it may not be common in Australia (García-Díaz and Cassey 2014).

If captive frogs escape, the risk of an incipient population establishing is moderate (García-Díaz 2014c). As there are no native Dendrobatidae species in Australia (Cogger 2014) and their colouration distinctive, they would be relatively easily to identify.

Based on the short distances the species moves from breeding to wintering habitat (Kraus 2009; Mattison 1987; Summers 1989), it is unlikely to rapidly disperse if a population establishes in Australia.



Potential for Eradication

While green and black poison frogs are established in Hawaii, no data on methods of control are currently available. Some control techniques may be similar to those already used in Australia for cane toads (*Rhinella marina*) (e.g., Crossland et al. 2012; Kelehear et al. 2012; Pizzatto and Shine 2012; Saunders et al. 2010), and smooth newt (*Lissotriton vulgaris*) (Dodd and Kay 2013). Methods used to control coqui frog (*Eleutherodactylus coqui*) overseas should also be considered, particularly since both species spawn eggs away from waterbodies (e.g., Sin and Radford 2007; Tuttle et al. 2008; Witmer et al. 2015).

Although green and black poison frogs should be easy to identify, their small size and relatively sedentary nature may hamper early detection (Heyer et al. 1994). Moreover, seasonality may impact detectability; the reproductive season, when the adults are concentrated in the breeding sites, may increase the chance of observing individuals (Vitt and Caldwell 2013).

According to García-Díaz (2014c), eradication of green and black poison frogs should be feasible. Sin and Radford (2007) consider eradication of the coqui frog is no longer attainable on the Island of Hawai'i and unlikely for Maui, but possible on the islands of Kaua'i and O'ahu because populations on those islands are still restricted geographically. This indicates that as long as the incursion is small and geographically contained, the poison frog may be eradicated.

Impacts

Green and black poison frog is considered to have moderate potential impact (García-Díaz 2014a).

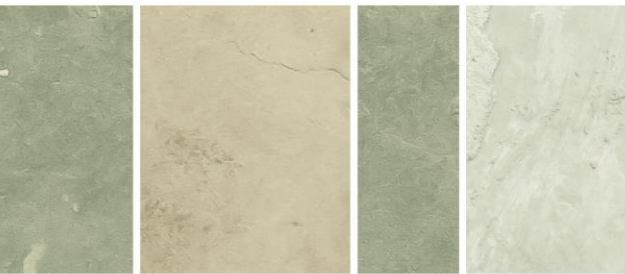
Economic

No economic impacts have been reported in the introduced range. Because of their size, colouration, and toxicity, the frog may fetch high prices in the illegal wildlife trade. The species may also be used as barter for drugs and other items on the black market.

In Australia, species of the family Dendrobatidae have been used for their venom as a drug (García-Díaz 2015, personal data). A very small amount of their poison is enough to arrest a human heart (Somma 2017). Note that the poison frog rapidly loses its toxicity when held in captivity (Caldwell 1996).

Environmental

Green and black poison frogs can carry chytrid fungus, *Batrachochytrium dendrobatidis* (Nichols et al. 2001; Pessier et al. 1999). This fungal disease is responsible for the decline and extinction of amphibians worldwide (Kilpatrick et al. 2010; Skerratt et al. 2007) and has had a significant negative impact on native Australian frogs (e.g., Berger et al. 1998; Fisher et al. 2009; Kilpatrick et al.



2010; Murray et al. 2010; Skerratt et al. 2007; Woodhams et al. 2006). As a consequence, chytrid has been listed in Australia's National List of Reportable Diseases of Aquatic Animals (<http://www.agriculture.gov.au/animal/aquatic/reporting/reportable-diseases#amphibians>). Incursions of the poison frog could further increase the risk of chytrid infections in Australian frogs.

The green and black poison frog is a member of a highly toxic frog family *Dendrobatidae*, that release poison from skin secretions when threatened (Caldwell 1996) but its aposematic coloration deters predators (Clark et al. 2005; Daly and Myers 1967; Darst and Cummings 2006). No poisoning of predators has been recorded in the introduced range so far (Somma 2017).

Social

No economic impacts have been reported in the introduced range.

Legislation

The high risk and potential pest status of the green and black poison frogs is recognised throughout Australia, as indicated in Table 2.

Table 2: Current status of the green and black poison frogs under jurisdictional legislation

Jurisdiction	Legislation	Status
Australia	Biosecurity Act 2015	included
Australia	List of specimens taken to be suitable for live import	listed
Western Australia	Biosecurity and Agriculture Management Act 2007	prohibited
South Australia	Natural Resources Management Act 2004	prohibited
New South Wales	Non-Indigenous Animals Regulation	high risk
Queensland	Land Protection (Pest and Stock Route Management) Act 2002	Class 1 declared animal
Victoria	Catchment and Land Protection Act 1994	controlled pest animal



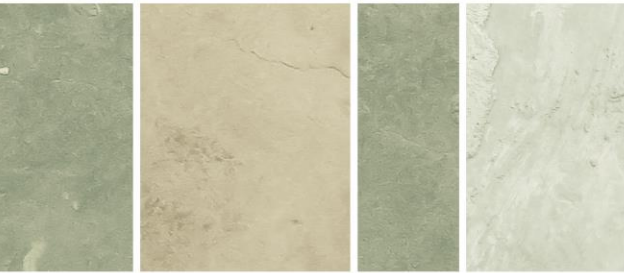
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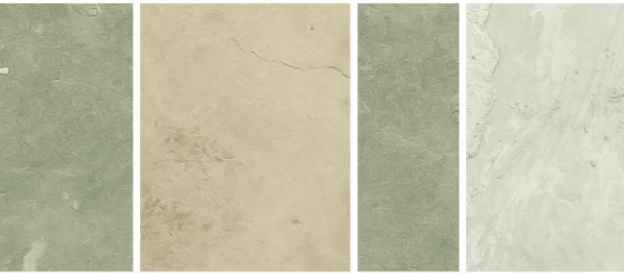
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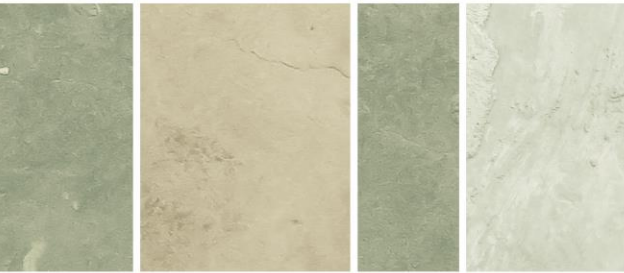
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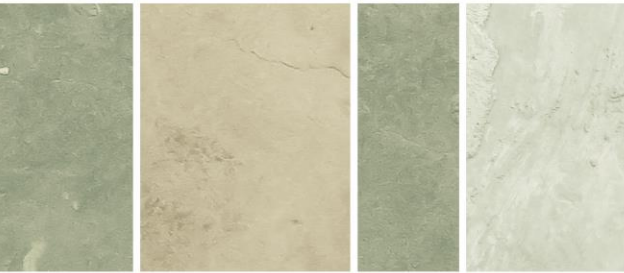








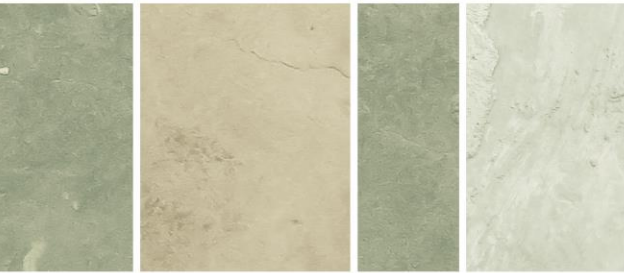
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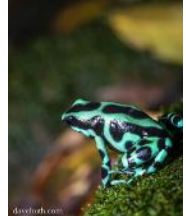


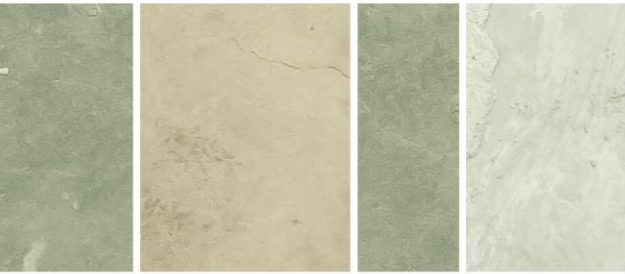
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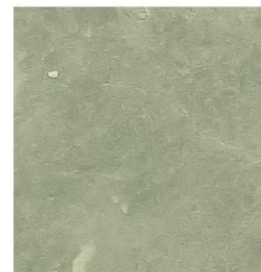


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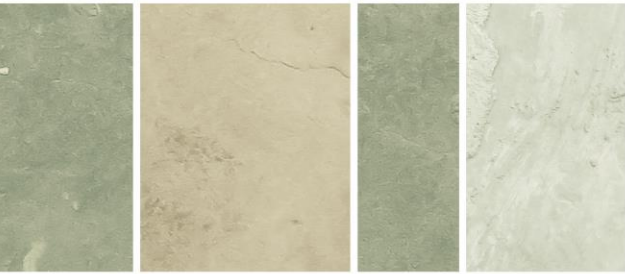


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