

# Cultural association and its role in garnering support for conservation: the case of the Mountain Chicken Frog on Dominica

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**Abstract.**—The cultural significance of a species can play an important role in garnering local support for conservation. In this study, the Critically Endangered Mountain Chicken Frog (*Leptodactylus fallax*) on Dominica is used as a case study to understand whether a species' cultural association affects local opinion towards its use and conservation. The species chosen is emblematic and was once widely consumed. Picture-choice questions were used to explore the effect of cultural associations with *L. fallax* on public preference in comparison with other species. The association with *L. fallax* as a past unofficial national dish garners substantial local support for it relative to other amphibians, but this effect has waned since the species has declined. The influence of *L. fallax* as a cultural icon could be improved by association as a symbol of national respect, much like the national bird (*Amazona imperialis*) which currently benefits from this stature.

**Keywords.** Amphibian, Anura, Caribbean, culture, flagship, *Leptodactylus fallax*

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## Introduction

The cultural significance of a species can be an important factor in garnering public support. Positive cultural beliefs can facilitate conservation efforts (Negi 2010; Ceriaco 2012; Gupta et al. 2015; Schneider 2018), even when the species concerned is involved in human-wildlife conflict (Kanagavel et al. 2014). A species can have cultural relevance in several different ways (Schneider 2018). Religion-mediated beliefs and the consequent worship of flora and fauna across the globe is one form of cultural association (Gupta et al. 2015). In the Hindu faith, nature is believed to be a divine manifestation of the gods, a good example being 'Ganesha,' the elephant god (Anthwal et al. 2010). Islam also has numerous doctrines that mandate natural resource management and conservation (McKay et al. 2014). Animals also take the forefront of many aboriginal beliefs in Australia, such as the omnipotent Rainbow Serpent (Taçon et al. 1996). Other forms of association include cultural beliefs without religious principles, that are highly specific to human communities and the geographic location, which

may also lead to species protection. For example, Monitor Lizards (*Varanus salvator*) and Pythons (*Malayopython reticulatus*) on Tinjin Island in Indonesia are specifically not captured by the local fishermen, due to the perception that the species belong to the island's guardian spirit, and anyone who does so is perceived to be possessed and cursed (Uyeda et al. 2016).

The relationship between nature and human culture is often a double-edged sword and can also inhibit species conservation (Dickman et al. 2015; Douglas and Verissimo 2013; Mikusiński et al. 2014). Species often become embedded within the local culture through use, developing in significance to communities over time (Garibaldi and Turner 2004). Prominent examples include birds nest soup and shark fin soup, the latter having a documented cultural association with good health since 960 AD (Fabinyi 2012). Cultural association is also believed to be a key driving force of the bushmeat trade (van Vliet and Mbazza 2011), and many indigenous medicines, rituals, and ceremonies are reliant on bushmeat (Bobo et al. 2015; Brashares et al. 2004; van Vliet and Mbazza 2011; Kanagavel et al.

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2016). Numerous species are persecuted and killed due to cultural beliefs and practices; for example, folklore in Portugal depicts herpetofauna as “evil” or dangerous and as a result gecko species are heavily persecuted (Ceriaco 2012). In India’s Western Ghats, frogs are believed to be agricultural pests when in fact they are the opposite, and the myth is detrimental to their conservation (Kanagavel et al. 2017).

The Mountain Chicken Frog (*Leptodactylus fallax*) is a Critically Endangered amphibian currently found on the islands of Montserrat and Dominica in the Eastern Caribbean (IUCN SSC Amphibian Specialist Group 2017). The species recently suffered range-wide and catastrophic disease-mediated population declines to near extinction (Hudson et al. 2016a). Whilst the primary driver of *L. fallax* population declines has been amphibian chytridiomycosis, the species is not found in any protected area on Dominica (IUCN SSC Amphibian Specialist Group 2017) and several human activities imperil the remaining individuals on privately-owned land. Despite a hunting moratorium, there were two unsubstantiated reports of continued illegal hunting on Dominica in 2013 (A. Blackman and M. Sulton, pers. comm.). At some sites where *L. fallax* are found, residents pour motor oil in pools that frogs were known to use to make it unsuitable for mosquitoes (B. Tapley, pers. obs.). A significant amount of habitat on private-land where *L. fallax* were known to breed has been cleared and burnt (B. Tapley and D. Nicholson, pers. obs.). As a result of this near extinction, immense efforts have been put into the frog’s conservation, including captive breeding, public outreach, local engagement, and novel research to reduce the impact of disease (Adams et al. 2014; Tapley et al. 2014; Hudson et al. 2016b). On Dominica, *L. fallax* is known as the “crapaud” and is of cultural significance (Tapley et al. 2014). The frog was the unofficial national dish of Dominica, and until the hunting prohibition in 2002, 8,000–36,000 individuals were legally harvested per annum (Malhotra et al. 2007). *Leptodactylus fallax* has an emblematic status on Dominica as it is featured on the coat of arms, as well as the logos of the indigenous bank and several local businesses (Tapley et al. 2014). It is also a prominent protagonist in island folklore and has several proverbs, like “kwapo pa ka vanté soup-yo” (crapaud don’t fan their own soup) and “Sé lanng kwapo ki twayi kwapo” (it’s the crapaud’s tongue that betrayed his own self), associated with it (Tapley et al. 2014). The apparent cultural association, combined with the incentive to protect these large-bodied frogs as a food source, was believed to be extremely advantageous to its conservation (Tapley et al. 2014), ultimately providing a crucial foundation for positive public opinion towards the frog and its conservation (e.g., Tarrant et al. 2016). However, *L. fallax* is not the only species of conservation and cultural importance on Dominica. There are other species with roots in the local culture (Evans 1991; Sammy et al. 2008). Therefore, it is not clear whether the cultural

significance of *L. fallax* is sufficient to endear it to the public and aid its conservation.

Culture is exceptionally difficult to quantify and is often forgotten in conservation practice leading to an unceremonious collision of the two subjects (Schneider 2018). There are examples of conservation programs that focus on the cultural significance of a species to its native country or a specific local community (Bowen-Jones and Entwistle 2002; Bride et al. 2008). However, the magnitude of influence that culture has on conservation is still not well understood. The current study is an attempt to understand whether the cultural association garners local support for the conservation of *L. fallax*, and the strength of this association relative to other species found on Dominica. We ultimately hope to use this information to better inform the policy and outreach programs related to the conservation of *L. fallax* that remain on Dominica.

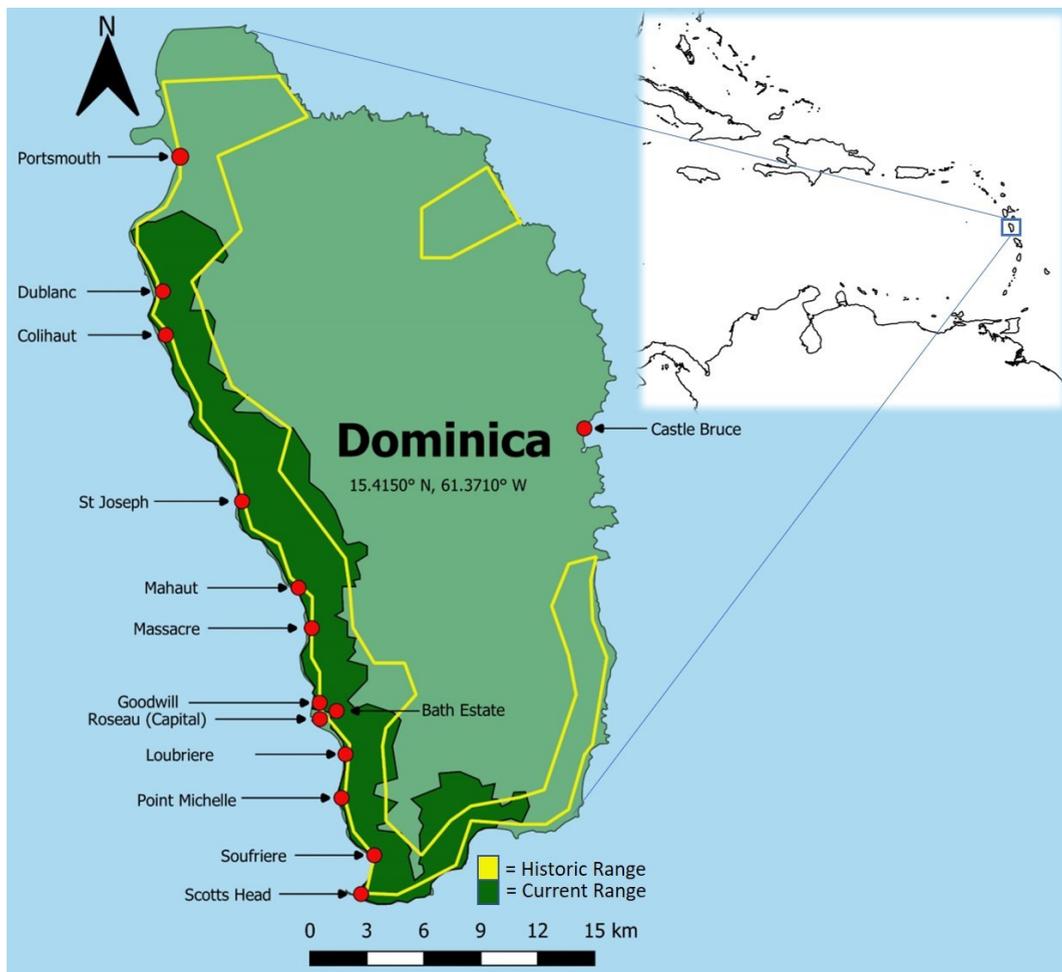
## Methods

### Study Area

The Commonwealth of Dominica has a population of ~72,000 (Dominica Central Statistics Office 2011) which largely depends on agriculture and tourism for its livelihood (Benson et al. 2001). A survey, through facilitated questionnaires, was conducted from 18 May–10 June 2016 at 14 sites across Dominica (Table 1, Fig. 1). Most sites were along the west coast due to travel limitations and the historic distribution of *L. fallax* (Hudson et al. 2016a). Sites ranged in size from the capital (Roseau) with a few thousand inhabitants to small villages (e.g., Dublanc) with ~400 individuals (Dominica Central Statistics Office 2011). Due to variations in site size and street layout, setting a specific number of questionnaires per site was not viable. However, minimum targets were set of 10 for each of the smaller sites and 30 for the larger sites. Questionnaires were conducted face-to-face with Dominican residents who were met on the streets by the interviewers. Larger sites were sampled by walking a selection of streets (one-third of the total number of streets); and these streets were selected using the Google random number generator (<https://www.google.com/search?q=random+number>; Accessed: 25 April 2018). Smaller sites often consisted of only one street; in such cases, this street alone was surveyed. Each street selected was surveyed from the beginning to end, or within the borders of the town or village (determined using road signs at the entrance or exit points).

### Questionnaire Design

The pilot and the final questionnaires were approved by the ZSL Ethics Committee (Project Reference: ZFP16) and the Department of Forestry, Wildlife, and Parks,



**Fig. 1.** The Commonwealth of Dominica, and its position in the Caribbean, showing the distribution of *Leptodactylus fallax* and the study locations (After Adams et al. 2014; IUCN SSC Amphibian Specialist Group 2017).

Dominica. Only residents who verbally consented to participate in the survey and were over the age of 18 were interviewed. The entire questionnaire (Fig. 2) was conducted in English (the official language of Dominica) by two interviewers (DJN and JB) who received training on conducting questionnaire surveys by ZSL's Social Dimensions Specialist. Before starting the interview, every participant was read a standardized introduction, which also outlined a brief background of the facilitator (see **Supplementary Materials**). To avoid bias, the study aims were explained at the end of the questionnaire (see **Supplementary Materials**). In cases where individuals refused the use of their responses, completed questionnaires became void. The questionnaire was composed of three questions about *L. fallax* and two other species for comparison in different scenarios. For each question, the respondent was requested to select one of the three species from a photo board (Fig. 2) and asked to explain their choice. The explanation was sought as an open-ended response. Photo boards consisted of standardized images of each relevant species, its common name, a scale depicting its size and a short brief about the species corresponding to the question. Since *L. fallax* was repeated in each photo

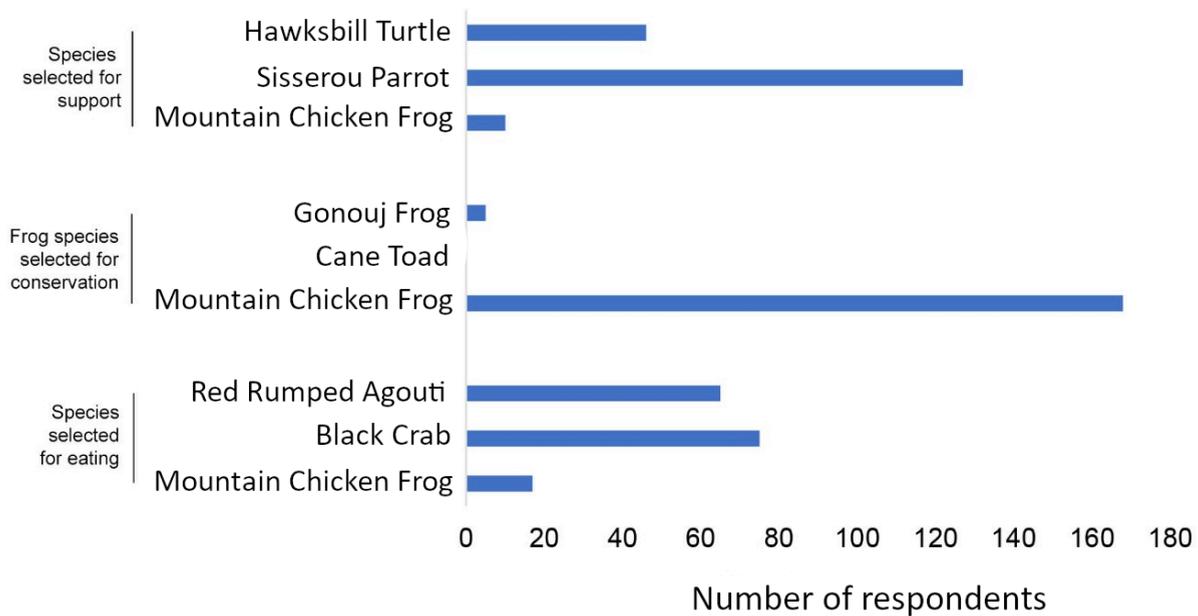
board, its position relative to the other two species was changed in each question to avoid potential respondent bias. The sequence of the species in the three photo boards was retained for all respondents.

The first question assessed the popularity of three different species for consumption: *Leptodactylus fallax*, the Agouti (*Dasyprocta leporina*), and the Purple Land Crab (*Gecarcinus ruricola*). The latter two species were selected for comparison as both are popular food items, can be legally hunted during a three-month hunting season (Government of the Commonwealth of Dominica 2018), and do not have a known cultural association. Respondents were asked which of the species they would prefer to consume, rather than if they consumed any; this was to encourage honest answers regarding the choice of consumption of a strictly protected species like *L. fallax*.

The second question assessed the popularity of *L. fallax* among other amphibians on Dominica. The Endangered Gounouj (*Eleutherodactylus amplinympha*) is Dominica's only endemic amphibian (Hedges and Powell 2010), and not the focus of any conservation intervention. The Cane Toad (*Rhinella marina*), an invasive species, was detected recently on Dominica and is subject to a media alert (Dominica Vibes 2017). These two species do not have

<p><b>Q1</b>      <b>A</b></p>  <p>The Mountain Chicken or Crapaud was Dominica's national dish. But it is now illegal to hunt and eat.</p>	<p><b>B</b></p>  <p>The Black Crab is found across Dominica it is legal to hunt and eat but only during the hunting season.</p>	<p><b>C</b></p>  <p>The Agouti is found across Dominica it is legal to hunt and eat but only during the hunting season.</p>
<p>Of these animals found in Dominica, which one would you choose to eat? <input type="checkbox"/></p> <p>Could you detail why you chose this species?</p> <p>.....</p> <p>.....</p>		
<p><b>Q2</b>      <b>A</b></p>  <p>Gounouj found only in Dominica and only in the high mountains. This species is the second rarest frog on Dominica.</p>	<p><b>B</b></p>  <p>Mountain Chicken or Crapaud found only on Dominica and Montserrat, where it lives in river valleys. It is the rarest frog on Dominica.</p>	<p><b>C</b></p>  <p>Cane Toad, originally from South America and has the potential to establish populations on Dominica. They live in grassland and farmland.</p>
<p>Of these amphibians found in the West Indies, which one would you choose to conserve? <input type="checkbox"/></p> <p>Could you detail why you chose this species?</p> <p>.....</p> <p>.....</p>		
<p><b>Q3</b>      <b>A</b></p>  <p>Sisserou; a rare Parrot found only on Dominica. The National Bird of Dominica and featured on the Dominican Flag. There is a conservation programme in place on Dominica to monitor numbers.</p>	<p><b>B</b></p>  <p>Hawksbill Turtles; they nest on the beaches on Dominica and several other Caribbean countries and live on coral reefs. They are Very Rare. Their nesting sites and their eggs are protected on Dominica.</p>	<p><b>C</b></p>  <p>The Mountain Chicken or Crapaud is very rare. It is only found on Dominica and Montserrat. It appears on the coat of arms and was the national dish. There is a captive breeding and monitoring project on Dominica.</p>
<p>Of these animals in Dominica, which one would you choose to support? <input type="checkbox"/></p> <p>Could you detail why you chose this species?</p> <p>.....</p> <p>.....</p>		

Fig. 2. The photo boards used in the questionnaire survey.



**Fig. 3.** Species selected by residents of Dominica to eat, conserve, and support on their island.

any cultural association comparable to *L. fallax* as they are not known to be affiliated with any folklore or symbols, neither are they consumed by people on the island.

The third question assessed the popularity of *L. fallax* as a local conservation flagship among two other threatened species on the island. The Endangered and endemic Sisserou Parrot (*Amazona imperialis*), which is culturally associated, is featured on the island's flag, its coat of arms and local business logos and products, and is the national bird (Evans 1991; Douglas and Winkel 2014; Birdlife International 2016). In the past, it was hunted for its meat and captured for the pet trade; both of which are currently prohibited (Evans 1991). The Critically Endangered Hawksbill Turtle (*Eretmochelys imbricata*) is widely distributed globally and the most common marine turtle visiting Dominican shores (Franklin et al. 2004; Mortimer and Donnelly 2008). Though the species is not symbolically represented like *L. fallax* or *A. imperialis*, marine turtles in general are a part of the island's folk-stories and legends (Sammy et al. 2008). Consuming turtle meat and eggs is considered traditional by communities on the island and they can be legally consumed outside of the nesting season (Sammy et al. 2008). These two species are also the focus of sustained conservation initiatives on Dominica, which include public outreach initiatives (Malhotra et al. 2007; Douglas and Winkel 2014).

The extent to which the cultural status of *L. fallax* was responsible for its popularity in the three scenarios was explored through the respondent's explanation for species choice. Socioeconomic characteristics, such as gender, age, education, and location were recorded at the beginning of the interview (Table 1). The questionnaire was piloted among nine Dominican residents in the Roseau Botanical Gardens in May 2016, to establish

whether respondents could understand the questions easily and if there was a bias in species selection. The only revision made to the final questionnaire was that respondents were not asked their exact age but rather their age-group, as several individuals were uncomfortable giving their exact age during the pilot.

A total set of 191 responses was used in the analyses, but the number of responses considered for the three questions varied individually (Table 1). Responses for individual questions were omitted in cases where the respondent selected more than one species, refused to answer, or did not explain their selection. Frequencies and the corresponding percentages of the responses were calculated. Spearman's rank correlation was used to determine if any of the socioeconomic characteristics were correlated ( $p \leq 0.05$ ). Fisher's exact tests were undertaken to determine whether the respondents' species choice was influenced by their corresponding rationale for selecting the species. This test was chosen instead of chi-square test since observed values were  $< 5$  in some instances. Multinomial and binary logistic regression models were used to determine the relationships between a respondent's species choice and their socioeconomic characteristics. IBM SPSS Statistics ver. 21 was used for all statistical analyses.

## Results

Respondents ( $n = 191$ ) were predominantly male (59.2%), aged 31–50 years (40.3%) with a primary level education (33.5%) who largely lived within the range of *L. fallax* (66.0%) on the island (Table 1). Age and education were found to be highly correlated (Spearman's correlation = 0.96,  $p < 0.001$ ,  $n = 191$ ), therefore education was not used as a factor in further analyses.

## Cultural association of *Leptodactylus fallax* on Dominica

**Table 1.** Description of socioeconomic characteristics of respondents ( $n = 191$ ) interviewed in Dominica, and their rationales for selecting the particular species they chose.

Characteristics and rationale	Description	Frequency	
1	Gender ( $n = 191$ )	Respondent gender	Male = 113, Female = 78
2	Age ( $n = 191$ )	Respondent age in years	18–30 = 46, 31–50 = 77, 51 and above = 68
3	Education ( $n = 191$ )	Highest educational qualification attained by the respondent	No formal education = 19, Primary = 64, Secondary = 56, College and above = 52
4	Location ( $n = 191$ )	Whether the location where respondent lived in Dominica was within the current crapaud range or not  <i>Within L. fallax range</i> = Bath estate (11), Belfast (1), Bellevue Chopin (1), Cambell (1), Colihaut (10), Colubistrie (1), Dublanc (4), Eggleston (2), Fond Cole (1), Goodwill (7), Loubriere (8), Mahaut (8), Massacre (3), Pt Michelle (20), Roseau (20), Salisbury (1), Scotts Head (13), Soufriere (5), St Joseph (19), St Luke (1), St Mark (1), Tarou (1).  <i>Outside L. fallax range</i> = Calibishe (1), Castle Bruce (12), Good hope (2), Grand bay (1), Grand ford (2), Kalinago Territory (1), Marigot (7), Petite savanne (1), Portsmouth (19), SE side (2), St David (1), Trafalgar (1), Woodford hill (1), Wotten Waven (1).	Within <i>L. fallax</i> range = 126, Outside <i>L. fallax</i> range = 65
5	Respondent rationale for selecting species to eat ( $n = 157$ )	Respondent rationales were grouped into five broad categories:  <i>Convenience</i> = easy to catch, clean, cook or eat; common; easily available.  <i>Culture</i> = cultural ( $n = 2$ )  <i>Health and nutrition</i> = species is vegetarian, eats seeds/grains or grass; species is clean, not a scavenger or not sick; meat is nutritious, proteinaceous, gives strength or good for the body.  <i>Taste</i> = taste is nice, good, best, or most favorite; meat is sweet, more in quantity, expensive, rare, or can be used in numerous delicious dishes; never eaten before.  <i>Familiar</i> = grew up eating, eaten before, or accustomed.	Convenience = 15 ( <i>L. fallax</i> = 0, crab = 9, agouti = 6)  Culture = 2 ( <i>L. fallax</i> = 1, crab = 1, agouti = 0)  Health and nutrition = 43 ( <i>L. fallax</i> = 4, crab = 15, agouti = 24)  Taste = 81 ( <i>L. fallax</i> = 10, crab = 39, agouti = 32)  Familiar = 16 ( <i>L. fallax</i> = 2, crab = 11, agouti = 3)
6	Respondent rationale for selecting amphibians to conserve ( $n = 173$ )	Respondent rationales were grouped into five broad categories:  <i>Culture</i> = our own ( $n = 12$ ), our frog ( $n = 5$ ), our pride ( $n = 1$ ), indigenous ( $n = 3$ ), national frog or national icon ( $n = 5$ ); used to be national dish or local delicacy ( $n = 42$ ).  <i>Charisma</i> = looks nice, lovely, friendly or unique; good, best, biggest, or clean, nice call, eats insects, not poisonous, or more profitable.  <i>Threatened status</i> = scarce, rare or almost extinct; local or endemic; Endangered, sick or needs help; want to help conserve it.  <i>Taste</i> = can be eaten or locally eaten; meat is nice, good or sweet; taste is good, liked or loved.  <i>Familiar</i> = know about it, accustomed, well known or only one known; grew up with it or eating it; used to eat or hunt it.	Culture = 68 ( <i>L. fallax</i> = 68, <i>E. amplinympha</i> = 0)  Charisma = 22 ( <i>L. fallax</i> = 21, <i>E. amplinympha</i> = 1)  Threatened status = 29 ( <i>L. fallax</i> = 26, <i>E. amplinympha</i> = 3)  Taste = 24 ( <i>L. fallax</i> = 24, <i>E. amplinympha</i> = 0)  Familiar = 30 ( <i>L. fallax</i> = 29, <i>E. amplinympha</i> = 1)

**Table 1 (continued).** Description of socioeconomic characteristics of respondents ( $n = 191$ ) interviewed in Dominica, and their rationales for selecting the particular species they chose.

	Characteristics and rationale	Description	Frequency
7	Respondent rationale for selecting species to support ( $n = 183$ )	Respondent rationale was grouped into five broad categories:  <i>Culture</i> = national bird ( $n = 67$ ), our bird ( $n = 11$ ), our pride ( $n = 3$ ), national dish ( $n = 2$ ) or symbol on our flag ( $n = 8$ ).  <i>Charisma</i> = like, love or most favorite; nice, cute, beautiful, intelligent, smaller, slowest, poisonous, good abundance, not locally eaten, not destructive, difficult to catch or nice call.  <i>Threatened status</i> = rare, small population, reduced habitat or nearly extinct; mostly or only in Dominica; endangered, overfished, killed or hurt; important, necessary, need to be bred, protected or conserved; not killed or population is improving.  <i>Utilized</i> = nice taste, eggs are good, best meat, locally consumed; like to hunt; can, could or used to be kept as pets.  <i>Familiar</i> = seen, eaten before, relate to call, know about it or accustomed.	Culture = 91 ( <i>L. fallax</i> = 2, <i>A. imperialis</i> = 89, turtle = 0)  Charisma = 29 ( <i>L. fallax</i> = 2, <i>A. imperialis</i> = 18, turtle = 9)  Threatened status = 42 ( <i>L. fallax</i> = 6, <i>A. imperialis</i> = 10, turtle = 26)  Utilized = 13 ( <i>L. fallax</i> = 0, <i>A. imperialis</i> = 4, turtle = 9)  Familiar = 8 ( <i>L. fallax</i> = 0, <i>A. imperialis</i> = 6, turtle = 2)

Respondents mostly selected *G. ruricola* (47.8%) and *D. leporina* (41.4%) to eat with *L. fallax* being the least preferred (10.8%; Fig. 3). The rationale for selecting the three species as a food source was taste (51.6%) followed by health and nutrition (27.4%), with culture being the least-cited reason (1.3%, see categorization detailed in Table 1). The difference between the respondent’s species choice and their rationale for selection was not significant (Fisher’s exact test,  $p = 0.088$ ). Age was the only socio-economic characteristic that had a significant influence on the respondent’s choice (Table 2). Increasing age was associated with an increased selection of *L. fallax* (18–30 = 3, 31–50 = 5,  $\geq 51 = 9$ ) and *D. leporina* (18–30 = 10, 31–50 = 27,  $\geq 51 = 28$ ), while a larger proportion of mid-age ( $n = 31$ ) and young respondents ( $n = 25$ ) chose *G. ruricola* over older respondents ( $n = 19$ ).

Most respondents chose *L. fallax* ( $n = 168$ , 97.1%) as the amphibian species to conserve while a few chose *E. amplinympha* ( $n = 5$ , 2.9%, Fig. 3). None of the respondents chose *R. marina* (Fig. 3). The rationale for

selecting the amphibian species for conservation was mainly culture (39.3 %) followed by being familiar (17.3%) and threatened (16.8%, Table 1). There was a significant difference between the respondent’s species choice and their rationale for selection (Fisher’s exact test,  $p = 0.036$ ). Only *L. fallax* was selected for having a cultural association (100%) and for its taste (100%), while *E. amplinympha* was mostly selected for its perception as being threatened (60%, Table 1). None of the socio-economic characteristics considered significantly influenced the respondent’s choice.

Respondents mostly chose to support the conservation of *A. imperialis* ( $n = 127$ , 69.4%) followed by *E. imbricata* ( $n = 46$ , 25.1%), while *L. fallax* was the least supported species ( $n = 10$ , 5.5%; Table 1). The rationale for species selected for support was mainly culture (49.7%) followed by being threatened (23.0%, Table 1). There was a significant difference between the respondent’s species choice and their rationale for selection (Fisher’s exact test,  $p < 0.001$ ). *Amazona imperialis* was perceived by a greater proportion of respondents (70.1%) as a cultural icon than *L. fallax* (20.0%) or the turtle (0%). Greater proportions of respondents selected *L. fallax* (60.0%) and the turtle (56.5%) for being threatened than *A. imperialis* (7.9%, Table 1). Also, a greater proportion of respondents selected *E. imbricata* since it could be utilized or they desired to utilize it (19.6%) in comparison to *A. imperialis* (3.1%) and *L. fallax* (0%, Table 1). None of the recorded socio-economic characteristics were a statistically significant influencer of respondent choice.

**Discussion**

This study reveals that the cultural association with *L. fallax* is most effective when it is in competition with the other amphibian species on Dominica; and that when compared to other amphibians, a cultural association is more effective than charisma, threatened status, taste,

**Table 2.** Multinomial logistic regression model predicting the relationship between the respondent’s species choice for consumption and their socio-economic characteristics ( $n = 157$ ). *Gecarcinus ruricola* was considered as the reference category. Model fit statistics: Nagelkerke  $R^2 = 0.1$ , Final model  $\chi^2(df = 6) = 13.79$ ,  $P = 0.03$ .

Choice	Variable	B	SE	Odds ratio
MCF	(Intercept)	-2.04	1.37	
MCF	Gender	-0.54	0.57	0.58
MCF	Age	0.78	0.38	2.19*
MCF	Location	-0.27	0.60	0.77
Agouti	(Intercept)	-0.55	0.84	
Agouti	Gender	-0.70	0.36	0.50
Agouti	Age	0.64	0.24	1.91*
Agouti	Location	0.02	0.37	1.01

MCF = Mountain Chicken Frog; \*indicates  $P < 0.05$

or familiarity. Our findings support the notion that the strongest cultural association for *L. fallax* is its status as the former unofficial national dish of Dominica (Tapley et al. 2014), and also highlight a secondary cultural association for *L. fallax* as a national icon. However, this result could be skewed towards the focal species, since none of the other species were especially charismatic and *L. fallax* is the most threatened and familiar, and the only one that was locally promoted for its conservation (Malhotra et al. 2007). Moreover, *E. amplinympha* is small and only found in forests at high elevations (Kaiser et al. 1994; Malhotra et al. 2007), so opportunities for Dominicans to encounter it are rare. The absolute rejection of *R. marina* agrees with the negative public attitude that the invasive species evokes in Dominica, similar to attitudes seen in other countries like Australia (Fitzgerald et al. 2007).

*Leptodactylus fallax* was the least popular species choice for consumption, this is likely because its national dish status was revoked and hunting was prohibited in 2002, after the disease-mediated population declines (Malhotra et al. 2007; Hudson et al. 2016a). The nearly two-decade moratorium on consumption could have resulted in an entire generation's unfamiliarity with *L. fallax* as a food item, which is further supported by our results that show the oldest age group most preferred to eat *L. fallax*. Similarly, in Hainan (China), only older individuals possessed traditional ecological knowledge of the Critically Endangered Gibbon (*Nomascus hainanus*), which had been extirpated throughout most of its range (Turvey et al. 2018). Severe population decline and/or the prohibition of a cultural association in turn, leads to interruption of the cultural transmission and reduces its public impact over time. In the case of *L. fallax*, almost an entire generation is unfamiliar with the species, and any individuals born during the decline would be entirely unaware of its original high abundance on the island. Due to this unavailability, its cultural significance as the unofficial national dish has likely given way to other available species whose preference is governed by perceptions of taste and how healthy or nutritious the meat is. *Amazona imperialis* is another threatened local flagship species that used to be frequently consumed and captured for the pet trade by Dominicans (Evans 1991). The hunting of *A. imperialis* was prohibited in 1980 and it was in turn elevated as a national icon and associated with respect among the Dominican society by having national awards named after it (Evans 1991; Douglas and Winkel 2014). *Leptodactylus fallax* could perform better as a flagship, particularly among future generations, by rebuilding its national identity.

*Leptodactylus fallax* fared poorly when compared with other charismatic flagship species, and was the least favored species. *Amazona imperialis*, the most popular of the three, was selected for being a cultural icon, which suggests the parrot's position as the national bird has resulted in a stronger cultural association than *L. fallax* as the former unofficial national dish. In this case, culture

appears to be the most important predictor of respondents' collective preference for a flagship species, with charisma, threatened status, familiarity, and potential for utilization being less important. While charismatic values were not selected as a reason for most respondents' choices, it is likely that the charisma of *A. imperialis* was an important driver of its position as a cultural icon (Ducarme et al. 2013; Douglas and Winkel 2014). This would be similar to the Indian Peafowl (*Pavo cristatus*), the national bird of India which is sacred among the Hindu faith, being the most 'strongly liked' among 18 other species including the Asian Elephant (*Elephas maximus*) and the Tiger (*Panthera tigris*) in a survey in India's Western Ghats (Kanagavel et al. 2014).

The results presented here did not reveal a cultural association for *E. imbricata*, as it was predominantly selected due to its threatened status or as a food source. It did, however, score higher with charismatic values than *L. fallax*. Marine turtles are strong, charismatic flagships whose potential to raise funds and garner local support is possibly greater than amphibians (Troeng and Drews 2004; MBZ 2017). There are examples of amphibians having as much flagship potential as charismatic megafauna, and charisma does seem to play a major role (Schlegel and Rupf 2010; Verissimo et al. 2011; Ducarme et al. 2013; Kanagavel et al. 2014). One example is bright-green tree frogs which scored remarkably higher than dull-brown warty toads among stakeholders in both Switzerland and India (Kanagavel et al. 2014). Additionally, the extent to which Dominicans were engaged in the conservation of the three species could also have affected the results. *Amazona imperialis* was the first Dominican species to receive extensive conservation attention, which has included continued public engagement and awareness-raising since 1980 (Evans 1991; Douglas and Winkel 2014). Whereas *L. fallax* and turtle conservation initiatives are more recent (since 2003). Also, turtle conservation could have been more engaging for Dominicans, as the conservation efforts meant the species was visible on beach walks and there were opportunities for people to interact with hatchlings during their release (Malhotra et al. 2007; Franklin et al. 2004). In this study, respondents were only able to choose one of three species during interviews and valuable information may have been lost by this approach. Selecting one species does not necessarily mean that the respondent would not eat or support the conservation of all three. However, the results do provide an insight into people's preferences; and subsequent research adopting an approach where species are ranked by order of preference could be more insightful.

There is a chance that championing three different species as flagships for conservation on Dominica could result in a clash between conservation organizations and diminish the importance of one or two of the species (Verissimo et al. 2011). This could adversely affect the conservation and appeal of *L. fallax*, much as *A. impe-*

*realis* has overpowered its congener – the Jaco Parrot, *Amazona arausiaca* (Douglas and Winkel 2014). This situation could be avoided with *L. fallax* if the conservation issues being tackled and its target audience are better identified, and if *L. fallax* is further elevated as a national symbol much like *A. imperialis* (Verissimo et al. 2011; Douglas and Winkel 2014). These actions may underpin the success of subsequent campaigns that could be adopted to halt the anthropogenic activities that are detrimental to the remaining population of *L. fallax* on Dominica.

Cultural and social dimensions in conservation are notoriously difficult to quantify. While we acknowledge limits of our own study, we believe that our results indicate the prominence of a species' cultural association in garnering local support. Montserrat's population of *L. fallax* has had a more recent and rapid decline, and a repetition of this survey on Montserrat could provide valuable comparative insight.

## Conclusion

Despite the importance of cultural association when garnering local support for conservation, this association is easily eroded when there is competition from other more accessible and charismatic species. This issue is important to consider, especially if a species is highly threatened and subject to on-going population declines, since in such instances the cultural association is also likely to become threatened. The association a community may have with a species is subject to change; conservation scientists should consider the potential for such associations when initiating conservation programs, particularly if the programs hinge on the cultural significance attributed to the species. A cultural association should not be seen as a silver bullet for species conservation, but it can be used as leverage to support conservation actions.

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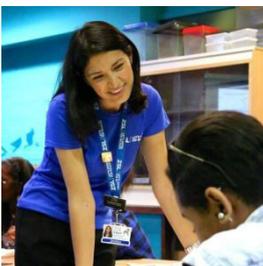
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## Supplementary Material

Questionnaire used to determine the extent of influence that the Mountain Chicken Frog's (*Leptodactylus fallax*) cultural status has on its conservation in Dominica.

Introduction: "I am conducting surveys for the Dominica Forestry department, they are anonymous, and I will not require your name. I just want your opinion on animals that live on Dominica. I will show you a few pictures and request you to select one related to a specific question. It will take less than 2 minutes. Are you willing to participate?"

Your answers are anonymous and will be stored on a password protected computer file, hard copies of data sheets will be destroyed. You may withdraw from the study at any point in time.

Interviewer:		Date:	
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Age: 18-30, 31-40, 41-50 51-60, 60 & above	Gender:		Education:		Location:	
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**Q1:**

Of these species found on Dominica, which one would you choose to eat?	<b>Answer</b>
<b>Reason</b>	

**Q2:**

Of these amphibians found on Dominica, which one would you choose to conserve?	<b>Answer</b>
<b>Reason</b>	

**Q3:**

Of these species found on Dominica, which one would you choose to support?	<b>Answer</b>
<b>Reason</b>	

Standardised explanation: "We work on the Dominican mountain chicken project. We are trying to get a better understanding of how people's opinion on the mountain chicken frog (crapaud) might influence its conservation. We are interested in how people see it compared to other animals on Dominica and if there is anything that influences public opinion towards it. Would it be alright for you if we used your responses for this study? Do you have any further questions?"