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The influence of cultural prohibitions on wildlife hunting and consumption in western Madagascar

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ABSTRACT

Unsustainable hunting is a leading driver of species decline globally, particularly in biodiversity hotspots like Madagascar, where wildlife conservation challenges intersect with severe humanitarian needs. In the Menabe Region near Kirindy Mitea National Park, wildlife hunting persists despite various prohibitions. While national legal frameworks, often developed with limited local input, seek to regulate hunting and consumption behaviors, regional studies have consistently shown that these laws alone are insufficient in safeguarding vulnerable species. In contrast, food prohibitions, such as species-specific taboos (or traditional *fady* in the case of Madagascar), are culturally derived prohibitions and ethical relations that shape how Malagasy individuals perceive and engage with wild and domestic animals. Previous research has highlighted the potential of *fady* to protect particular species while also acknowledging the complex nature of *fady* adherence in conservation contexts. This paper considers the impact of both locally rooted belief systems and national regulatory structures on wildlife use in a village near Kirindy Mitea National Park, where communities are navigating intersecting challenges of food insecurity and reliance on wild meat for sustenance. We carried out quantitative surveys of heads of households regarding their personal beliefs and adherence to taboos and laws, and expanded upon this information through focus groups and semi-structured interviews with key informants. While *fady* discouraged consumption in some species, it did not significantly impact hunting behavior. Similarly, stricter hunting laws are associated with reduced consumption but have little impact on hunting practices, primarily due to poor law awareness. These findings underscore the limitations of top-down conservation policies and the need to support community-led conservation approaches that are informed by local priorities, challenges, and existing governance structures. Effective conservation policies must simultaneously recognize and address structural challenges, like food insecurity, that shape decision-making. These findings suggest the need for ongoing, community-engaged qualitative research into the material and sociocultural contexts that inform decision-making about wildlife use.

RÉSUMÉ

La chasse non durable entraîne le déclin des populations de nombreuses espèces dans le monde, notamment à Madagascar, un hotspot de la biodiversité confronté à de graves défis écologiques et humanitaires. Bien que des lois imposées au niveau central visent à régulariser la chasse et les comportements des consommateurs, des études régionales ont montré que ces lois, à elles seules, ne suffisent pas à protéger les espèces vulnérables. En revanche, les interdictions alimentaires, telles que les tabous spécifiques à certaines espèces (*fady* de consommation dans le contexte malgache), sont des interdits d'origine culturelle qui influencent la perception et l'utilisation de la viande sauvage et domestique par les Malgaches. Des recherches antérieures ont mis en évidence le rôle potentiel des *fady* dans la protection de certaines espèces, tout en reconnaissant la complexité de leur respect dans un contexte de conservation. Cet article examine l'influence des interdictions culturelles et légales sur l'utilisation de la faune dans un village proche du parc national de Kirindy Mitea, dans la région de Menabe, à l'ouest de Madagascar. Ce village est caractérisé par un niveau élevé de chasse aux animaux sauvages, combiné à une insécurité alimentaire et une malnutrition significatives, mais l'effet des interdictions sur l'utilisation de la faune y a été peu étudié. Nous avons mené des enquêtes quantitatives auprès de chefs de ménage sur leurs croyances personnelles et leur adhésion aux *fady*, et complété ces informations par

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des groupes de discussion et des entretiens semi-structurés avec des informateurs clés. Bien que les *fady* influencent négativement la consommation, ils n'ont pas d'effet significatif sur la capture des animaux. De même, des lois plus strictes sur la chasse sont associées à une réduction de la consommation, bien que les résultats soient nuancés. Toutefois, les lois de conservation imposées d'en haut étaient peu connues dans la communauté et n'ont pas réduit la capture et la consommation de la faune sauvage. Nous recommandons des études qualitatives supplémentaires pour mieux comprendre les conditions dans lesquelles les individus consomment des espèces qu'ils considèrent comme immangeables ou culturellement interdites, afin d'expliquer leur prise de décision en matière d'utilisation de la faune.

INTRODUCTION

The unsustainable hunting and consumption of wildlife are major drivers of global population loss (Ripple et al. 2016), with a recent analysis that at least 48% of vertebrate species are declining globally (Finn et al. 2023). Wildlife exploitation, particularly unsustainable hunting, can lead to localized extinctions and cascading ecological consequences (Ripple et al. 2016). Responding to biodiversity loss requires solutions that begin with the needs, knowledge, and priorities of local communities.

Wild meat consumption is influenced by complex and interwoven social, ecological, and personal factors, which result in varying preferences, aversions, and prohibitions (Birch 1999). Taboos, which are culturally defined prohibitions, shape dietary practices worldwide (Birch 1999, Fessler and Navarrete 2003, Meyer-Rochow 2009). These taboos, rooted in beliefs about danger, immortality, or religious impurity, play a significant role in regulating dietary practices across societies (Rozin 1987, Landim et al. 2023). They may apply to entire groups of people, such as religious communities, or can affect individuals during a specific life phase, such as pregnant women (Colding and Folke 1997, Landim et al. 2023). Although created and enforced socially, taboos often become internalized through expectations and fear of stigma, guiding behaviors even sometimes without exterior enforcement. These social rules are created and enforced by individuals (Colding and Folke 1997, 2001, Fessler and Navarrete 2003, Meyer-Rochow 2009). When these norms are violated, not only are external (i.e., social) rules breached, but internal rules aiding one's sense of self and connection to the physical and spiritual world (Lambeck 1992, Meyer-Rochow 2009).

Taboos that restrict the use of a particular species may reflect long standing human-environmental relationships that also result in decreased hunting pressures, indirectly offering conservation benefits (Colding and Folke 2001, Cinner 2007, Jones et al. 2008), especially given that more than 100 documented species that are subjects of taboo (Landim et al. 2023). In some cases, such as restrictions on shellfish in Jewish traditions or beef in Hindu communities, prohibitions may organically align with beneficial ecological outcomes (Meyer-Rochow 2009). Globally, 30% of species-specific taboos pertain to threatened species, often safeguarding those that are endemic or otherwise ecologically important (Colding and Folke 1997, 2001). While global parallels (see Landim et al. 2023 for individual citations) highlight the cultural dimensions of food taboos, Madagascar offers a particularly complex and locally embedded case through the system of *fady*, traditional prohibitions with deep ancestral and spiritual roots.

Fady are important and dynamic prohibitions deeply ingrained in Malagasy society, conferring spiritual, ancestral, and physical well-being (Ruud 1960, Lambeck 1992). *Fady* includes various behavioral prohibitions and social expectations, from breaches of 'good manners' punished by social disapproval to strict taboos enforced by ancestral forces (Lambeck 1992). *Fady* are highly diverse and vary by region, origin, household, and even individual. Some are strict ancestral prohibitions (*sandrana*), while others may be negotiable (*fadin-drazana*) (Jones et al. 2008). *Fady* can also be a health proscription received through spiritual command by a human spirit medium (*ombiasa*) (Golden and Comaroff 2015a). Others relate to wider community norms on what is edible or not (*fadim-paiarahamonia*); however, some authors do not frame this category as *fady*, but more simply shouldn't be done (*tsy azo atao*) (Jones et al. 2008). These examples, however, are not exhaustive given the complexity and richness of the *fady* system.

There have been multiple documented instances of *fady* protecting a wild species from hunting and consumptive behaviors. For example, some ancestral *fady* (*fadin-drazana*) prohibit the consumption of lemurs because of their perceived morphological and behavioral similarities to humans and their representation of ancestors (Loudon et al. 2006, Jones et al. 2008). Other stories of species saving ancestors (e.g., dolphins, sea turtles, and rays rescuing sailors) have led to inherited ancestral *fady* prohibiting the consumption of the subject of the *fady* (Lilette 2006). Some *fady* include fears of spiritual and physical repercussions, like in the Sofia region, where rashes and sores occur after eating octopus and can only be cured by spiritual remedies (Cinner 2007). Others are health-related (*fadin'ody*), such as Tanala pregnant women avoiding crayfish (*Astacoides*) to prevent having multiple births (Jones et al. 2008). Species-specific *fady* are vast, and many overlap with formal conservation efforts (complete list within Appendix A); here, we focus on ancestral and health-promoting taboos. While *fady* may align with conservation in some cases, Keller (2009) cautions against framing Malagasy cultural systems exclusively through the lens of just taboo, which simplifies a much broader cultural landscape. Following Keller's ideas, this study seeks to understand how *fady* and conservation laws shape wildlife use in ways that reflect community realities, perspectives, and knowledge.

Fady can shape wildlife use even when they do not explicitly prohibit hunting, but nonetheless influence how people engage with particular species (Ruud 1960, Lambeck 1992, Jones et al. 2007, 2008, Jenkins et al. 2011). Regional studies indicate that when adhered to, species-specific *fady* can reduce consumption of the animal, inherently reducing hunting pressure. However, there has been documented erosion of *fady* in younger generations (Jones et al. 2008, Randrianandrianina et al. 2010, Jenkins et al. 2011, Reuter et al. 2016, Anania et al. 2018). These dynamics have generated discussion among conservationists aiming to align conservation frameworks with locally grounded systems of environmental stewardship. Yet, Madagascar's high cultural and dietary diversity complicates this alignment. What works in one region may not translate to another without close consideration of the community context. While national assessments of hunting pressure are limited, several regional studies reveal significant use of mammal and bird species to meet economic and nutritional needs (García and Goodman 2003, Golden 2009, Randrianandrianina et al. 2010, Jenkins et al. 2011, Razafimanahaka et al. 2012, Golden et

al. 2014, Borgerson et al. 2019, 2022, 2023, Thompson et al. 2023). Wildlife consumption, which drives hunting pressure, is influenced by several factors including taboo adherence, perceived inedibility, and meat preference (Reuter et al. 2016). However, other research has found no significant link between individual taboos and regional consumption patterns (Golden and Comaroff 2015b), pointing to the need for additional localized studies on how cultural beliefs influence wildlife use.

In this study, we examine *fady* regarding wildlife use, specifically those followed for health or ancestral reasons, in a community neighboring Kirindy Mitea National Park. As taboos represent culturally specific prohibitions imposed within a family or community, we also acknowledge conservation laws as culturally specific prohibitions imposed onto a community, which might similarly influence conservation behavior. Species outside strictly protected zones (e.g., Strict Nature Reserves, National Parks, or Special Reserves with IUCN protection status I, II and IV) are separated into four categories of protection based on Decree No. 2006-400, ranging from no restrictions to complete prohibition of capture. However, awareness of conservation law varies regionally (Keane et al. 2011), and even when individuals are aware of regulations, they may preferentially comply more with social norms when those norms and laws conflict (Rachlinski 1999). Relative compliance with laws often depends on their integration with social practices and ongoing management (Vuola and Pyhälä 2016), and conservation approaches rooted in community-led decision-making tend to reflect local values and thus more enduring support (Rakotoson and Tanner 2006).

Here, we use data from interviews, surveys, and focus group discussions to explore how cultural and legal prohibitions influence the hunting and consumption of wildlife. We hypothesize that (i) cultural prohibitions (*fady* and other aversions) influence only a species' consumption because *fady* typically restricts only the consumption of an animal. Thus, that species may technically be hunted for a second person to consume without breaching the prohibition. Furthermore, we hypothesize that (ii) policy (laws and hunting regulations) will influence only the hunting of a species, since only the hunting, and not the consumption, of a protected species is expressly prohibited by Malagasy law (Decree No. 2006-400). This data will help assess the impact of emic and etic cultural prohibitions on wildlife use and inform regional and national policies that align with Indigenous values, creating formal institutions that are effective yet complementary to existing informal practices.

METHODOLOGY

STUDY SITE. This study was carried out in communities living adjacent to Kirindy Mitea National Park in Madagascar's southern Menabe Region. This area is characterized by a dry forest with a mix of spiny and deciduous ground coverage as well as over 100 bird species, 31 reptile species, and 34 mammal species, including eight lemur species. Many communities in the Menabe Region, including this one, rely on both agricultural and pastoral activities with limited opportunities for wage labor (Thompson et al. 2023). Households in this region face food insecurity, child malnourishment, and multidimensional poverty; 95% of households are 'impoverished,' and 77% are 'severely impoverished' (Romanello et al. 2023). Most households rely on wild animals for food security and cultural practices, many of which are listed as conservation priorities (Thompson et al. 2023). For example, lemur consumption is reportedly higher here than in other study sites in Madagascar, with almost 50% of households eating lemurs in the year prior (Romanello et al. 2023).

ETHICAL NOTE. We received full informed consent from each participant in this study, using the local dialect of Malagasy. Detailed ethical considerations, including the participant exclusion criteria, participant rights, and matters of participant anonymity, can be found in Thompson et al. (2023). The Stony Brook University Internal Review Board reviewed and approved all research methods (IRB #1183799-4). Our study was conducted with the requisite permits and approval at the national, regional, and local through the facilitation of the Madagascar Institute for the Conservation of Tropical Environments (Permit #171/18/MEEF/SG/DGF/DSAP/SCB.Re).

DATA COLLECTION. We collected information using (i) structured interviews with household representatives on food prohibitions and wildlife use, and used (ii) semi-structured focus groups, and (iii) semi-structured key informant interviews with local hunters to contextualize and ground information learned in structured interviews. We held all interviews from September 2018 to March 2019 in the local dialect of Sakalava Malagasy. Self-identified heads of households were interviewed, and their wildlife-related beliefs and awareness of conservation law were explored (detailed below). We defined a household as individuals who eat together in the same kitchen, and we reached 66 of the community's 89 households (74.2%). Focus group participants were then identified based on their experiences in the community, and their insights were used to understand community-level taboos and animal use practices. Experienced hunters were also identified for interviews to discuss specific hunting practices, meat sales, and evolution of animal use, thereby further grounding the information obtained in structured interviews with household representatives.

Community members consulted in household interviews were first asked about species-specific taboos they personally adhere to (not necessarily the household). First, we asked whether each species (Table 1) was prohibited for them to eat (1 = yes or 0 = no). If a species was considered prohibited by the respondent, they were asked to categorize the reason for the prohibition by selecting one of the following: ancestral *fady*, health *fady*, perceived inedibility, dislike, or other. Medicinal *fady* are those in which the consequences of breaking the *fady* result in harm to health; ancestral *fady* are those imposed through generational ties (*fadindrazana* or *sandrana*); perceived inedibility are species which the interviewee believes it can't be consumed; and dislike meaning the interviewee does not prefer the taste of the meat. Categorizing the reason for consumption prohibition allowed us to filter out *fady* (e.g., followed for medical or ancestral reasons) from unrelated personal preferences, such as dislike or perceived inedibility.

For medicinal *fady*, additional details were requested regarding how the taboo was treated, how long the respondent had been proscribed this taboo, and the duration they were expected to follow it. We also asked participants about the applicability of the taboo across different ages (babies, children, adults, or the elderly), the sexes affected by the taboo (female, male), and the life stages during which it is relevant (options including pregnancy, lactation, infancy, childhood, adulthood, as an elder, when the parents were alive, when the parents were deceased, or other specified stage).

To assess knowledge of conservation regulations, each household representative received a conservation awareness score based on correctly identifying each species' protection status and, where applicable, naming of the legal hunting season. To do this, we first asked the participants about species' conservation status, with respondents categorizing it as protected, game, or nuisance. If the animal belonged to a game species, respondents were asked to specify the months during which it could be caught. We allotted 1 point for knowing the animals' hunting status (allowed or not allowed to hunt) and 1 point for identifying the correct hunting season (0.5 points for partial response). We obtained environmental laws via Malagasy Ordonnance n° 60-128, which categorizes all wildlife in Madagascar into respective protection statuses. In our study sample, seven species are categorized as Protected Class I, five as Protected Class II, four as Game, and one as Nuisance (Table 1) (Ministère de l'Environment, des Eaux et Forêts et du Tourisme 2006). We calculated conservation awareness scores and categorized species based on Malagasy conservation status (0 = Protected Class I, 1 = Protected Class II, 2 = Game, 3 = Nuisance). We combined this data with data from another individual-level survey on wildlife utilization, in which we asked each participant about hunting and consumptive behaviors for each species in the year prior (Thompson et al. 2023).

To examine the effects of different prohibitions on hunting and consumption, we last asked household interview respondents about their food acquisition and consumption practices. This data on taboos and legal proscriptions was combined with data from another individual level survey on wildlife utilization. During this interview, we asked each participant about hunting and consumptive behaviors (Thompson et al. 2023). Specifically, we asked about the use of five species of lemur, three tenrecs, two birds, one swine, three endemic carnivores, one tortoise, and two bats (Table 1). Since respondents typically could not distinguish microbats at the species level, we asked broadly about them. Locally identified bats include *Hipposideros commersoni*, *Myotis goudoti*, *Eidolon dupreanum*, *Scotophilus robustus*, and *Miniopterus gleni*. Although we did not include the pale fork-marked lemur (*Phaner pallescens*) in this measure, we included it in a version data after identifying it as locally relevant. We excluded the spotted fanaloka (*Fossa fossana*), also known as a Malagasy civet, for similar reasons. For this study, hunting refers to species capture and consumption refers to eating terrestrial wild animals during the year prior, as defined by the respondents' own memory.

Focus group discussions included 6–12 individuals of similar gender, age, and occupation, with all participants in a single group coming from different households in the community. Each discussion group lasted approximately 60 minutes and occurred in a neutral location. Discussion groups, led by KETT reviewed hunting practices, food availability, food insecurity mitigation practices, and financial stressors. Recorded quotes and explanations from these focus groups to provide sociocultural context to individual and household interview data results. We also conducted semi-structured interviews with four hunters, who were recognized as subject matter experts, focusing on hunting practices and *fady* related to hunting. Focus group discussion data, similar to key informant interviews, was used to contextualize individual interview responses and interpret patterns in hunting and consumption behavior. Rather than imposing thematic categories and codes, we allowed insights from collective discussions to guide interpretation and contextual understanding.

VARIABLE ANALYSIS. First, since we aim to determine whether an individual hunted or ate a species rather than the number of animals hunted or consumed, we converted the number of animals hunted or consumed into binary data. From this data, we calculated which species were hunted and consumed for each respondent and across the community. We then created binary data for each *fady* category: ancestral *fady*, health-related *fady*, perceived inedibility, and dislike. Each was coded as 1 if the respondent identified that reason as the cause of aversion, and was coded as 0 otherwise. To generate a conservation law awareness score, each respondent received 0-2 points per species: 1 for correctly identifying its legal protection status and 1 for naming the hunting season (0.5 for partial responses). Scores were then summed across all species to create an overall law awareness score, treating all species equally regardless of their given ecological risk. Species with no legal hunting season were marked as 'prohibited year-round', and any indication of allowed months was

Table 1: Species in the household-level annual surveys with conservation information, hunting status, and calculated conservation awareness scores. (Higher scores indicate a higher awareness of associated wildlife laws; * = likely not in the area; (1) from IUCN 2025; (2) from Ministère de l'Environnement, des Eaux et Forêts et du Tourisme 2006; (3) see methodology; (4) insectivorous bats include the following species which are locally identified but indistinguishable: *Hipposideros commersoni*, *Myotis goudoti*, *Eidolon dupreanum*, *Scotophilus robustus*, and *Miniopterus gleni*)

Species	Malagasy name	IUCN status (1)	Malagasy protection status (2)	Hunting season (2)	Average conservation awareness score (3)
Reptilia, Testudinidae					1.56
Pyxis planicauda	Kapiky	CR	Protected I	Prohibited	1.56
Aves					0.22
Numida meleagris	Akanga	LC	Game	1 May–30 Jun	0.36
Carocopsis vasa	Tsiotry	LC	Protected II	1 May–30 Jun	0.08
Mammalia, Chiroptera					0.08
Pteropus rufus	Fanihy	VU	Game	1 May–1 Sep	0.03
Insectivorous bats (4)	Angavo, Kitrotro, Kinakina		Protected II	1 May–1 Sep	0.13
Mammalia, Suidae					1.26
Potamochoerus larvatus	Lambo	LC	Nuisance	Unrestricted	1.26
Mammalia, Eupleridaedae					0.17
Mungodictis decemlineata	Andrao, Bokiboky	EN	Protected I	Prohibited	0.21
Cryptoprocta ferox	Fosa	VU	Protected II	1 Apr–30 Jun	0.18
Fossa fossana	Fanaloka	VU	Protected II	1 Apr–30 Jun	0.11
Mammalia, Lemuriformes					1.48
Lepilemur ruficaudatus	Boenga	CR	Protected I	Prohibited	1.73
Eulemur rufifrons	Gidro	VU	Protected I	Prohibited	1.71
Lemur catta *	Maky	EN	Protected I	Prohibited	1.70
Propithecus verreauxi	Sifaka	CR	Protected I	Prohibited	1.71
Phaner pallescens	Tanta	EN	Protected I	Prohibited	0.76
Microcebus murinus	Fitilivahy	LC	Protected I	Prohibited	1.33
Cheirogaleus medius	Kelybehohy	VU	Protected I	Prohibited	1.42
Mammalia, Tenrecidae					0.94
Tenrec ecaudatus	Trandraka	LC	Game	1 Apr–31 May	0.91
Setifer setosus	Sora	LC	Protected II	1 Apr–31 May	0.96
Echinops telfairi	Tambotriky	LC	Game	1 Apr–31 May	0.96

scored as incorrect. To integrate legal protection categories into our statistical model, we assigned ordinal numeric codes: 0 = Protected Class I, 1 = Protected Class II, 2 = Game, 3 = Nuisance.

We used general linear models, and a rare events logistic regression model when appropriate, to assess how cultural and legal prohibitions influence hunting and consumption in our study community. Rare events logistic regression was used because the hunting variable had a very low event rate (2%), which a standard logistic regression would underestimate event probability. While consumption occurred at an event rate of 15%, which is not considered rare, hunting occurred at an event rate of 2%, requiring a rare events logistic regression model. For the rare events model, we performed regressions for dichotomous dependent variables with the Zelig package in R Statistical Software v4.1.1 using a ReLogit model (Imai et al. 2007). When certain ReLogit models were performed, particularly in the case of *fady* (ancestral and health origin reasons), model overfitting occurred, indicating this model was too complex for our sample size. Given this, general linearized regression models were used. When neither model produced unrealistic parametric estimates or uninterpretable results with similar AIC scores, we conducted Fisher's Exact Tests, which are robust to small and uneven sample sizes.

RESULTS

HUNTING AND CONSUMPTION. Sampled community members hunted an average of 0.9±SD1.2 animals per individual (median=0, range=0–8) and consumed an average of 1.9±SD2.6 animals (median=0, range=0–11) during the prior year. Forty-two (63.6%) respondents reported not hunting any species, while one (1.5%) reported hunting 11 species during the previous year.

The most hunted taxa were tenrecs (mean=10.1% of catch), with the greater hedgehog tenrec (*Setifer setosus*) being hunted by the highest number of individuals in our community (11 respondents, 16.7%, Figure 1, Table 2). Though the common tenrec (*Tenrec ecaudatus*) occupies a similar ecological niche, it was hunted by substantially fewer individuals (2 respondents, 3.0%). Bird species and the tortoise were also caught at moderate levels, while lemurs were generally caught in numbers less than other species (Table 2). Only the fosa (*Cryptoprocta ferox)* and Verreauxi's sifaka (*Propithecus verreauxi*) were not hunted at all.

Regarding consumption, birds were the most commonly eaten taxa, with the helmeted guinea fowl (*Numida meleagris*) most consumed wild meat, despite moderate hunting levels (21 individuals, 31.8%, Figure 1, Table 2). Although only two individuals hunted it, a quarter of respondents (25.7%, n=17) ate bush pig meat (*Potamochoerus larvatus*). While lemur consumption was relatively low across all species within our sample, a more comprehensive study of lemur hunting in this community suggests more extensive lemur consumption than was captured in our current dataset (Romanello et al. 2023). The most consumed lemurs were red-tailed sportive lemur (*Lepilemur ruficaudatus*) and Verreauxi's sifaka, each of which was consumed by seven households (10.6% of study households). The tortoise and bat taxa were both consumed at low to moderate levels. The fosa was the only species reported as not consumed.

INFLUENCE OF *FADY* ON HUNTING AND CONSUMPTION. Several *fady*, among other food aversions, were reported by community members surveyed. We distinguish these in the text and visualizations. '*Fady*' refers specifically to cultural taboos

Table 2: Hunting and consumption levels of species utilized near Kirindy Mitea National Park, Madagascar (2018–2019).

Species	Hunters	Percent Hunters (n=66)	Consumers	Percent Consumers (n=66)
Reptilia, Testudinidae (N=66)	5	7.6%	7	10.6%
Pyxis planicauda	5	7.6%	7	10.6%
Aves (N=132)	11	8.3%	34	25.8%
Numida meleagris	5	7.6%	21	31.8%
Carocopsis vasa	6	9.1%	13	19.7%
Mammalia, Chiroptera (N=132)	4	3.0%	4	3.0%
Pteropus rufus	3	4.6%	3	4.6%
Insectivorous bats	1	1.5%	1	1.5%
Mammalia, Suidae (N=66)	2	3.0%	17	25.8%
Potamochoerus larvatus	2	3.0%	17	25.8%
Mammalia, Eupleridaedae (N=132)	3	3.0%	8	25.8%
Mungodictis decemlineata	3	4.6%	8	12.1%
Cryptoprocta ferox	0	0.0%	0	0.0%
Mammalia, Lemuriformes (N=330)	13	3.9%	29	8.8%
Lepilemur ruficaudatus	3	4.6%	7	10.6%
Eulemur rufifrons	3	4.6%	5	7.6%
Propithecus verreauxi	0	0.0%	7	10.6%
Microcebus murinus	4	6.1%	5	7.6%
Cheirogaleus medius	3	4.6%	5	7.6%
Mammalia, Tenrecidae (N=198)	20	10.1%	26	13.1%
Tenrec ecaudatus	2	3.0%	11	16.7%
Setifer setosus	11	16.7%	4	6.1%
Echinops telfairi	7	10.6%	11	16.7%
Total (N=1056)	58	5.5%	125	11.8%

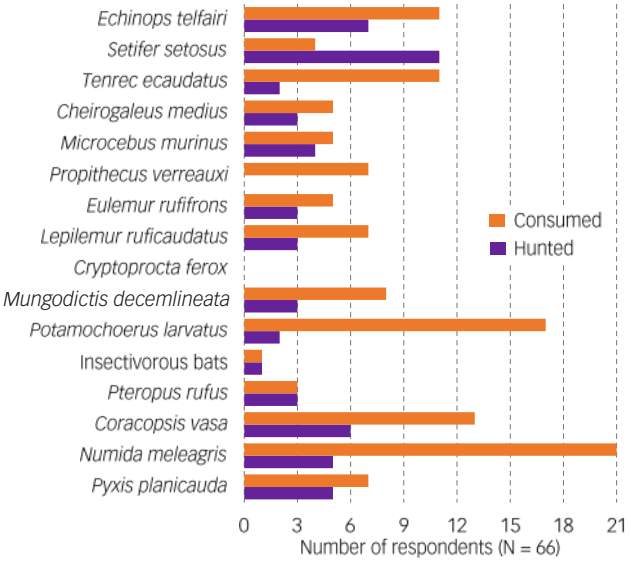

Figure 1: The number of respondents which hunted and consumed wildlife species near Kirindy Mitea National Park, Madagascar (2018–2019).

(as characterized by Jones et al. (2007, 2008), while 'aversions' include more general food avoidances like perceived inedibility and personal dislike. While *fady* was not as frequent as perceived inedibility, *fady* significantly influenced behavior, with community members each reporting a mean of 1.80 species as *fady* (median = 2, SD ± 2.0). The maximum number of individual *fady* by a respondent was 12 species, and 16 respondents said they had no *fady* for consuming any species. Respondents most perceived Malagasy Eupleridae as *fady*, with approximately half viewing the consumption of fosa (53.0%, n = 35) and spotted fanaloka (*Fossa fossana*, 43.9%, n = 29) as *fady*. Almost all attributed these *fady* to ancestrally-derived teachings, obligations, or prohibition (Figure 2 and Table 3). Although the vontsira (*Mungodictis decemlineata*) is similar in appearance and ecological niche to the spotted fanaloka and fosa, *fady* adherence in our study village was notably much lower. Several respondents cited bush pig consumption as *fady*, most of whom noted health-related reasons. Some community members reported insectivorous bats as *fady* (15.1%, n = 10), but none reported the Madagascar flying fox (*Pteropus rufus*) as such. *Fady* existed in relatively low numbers across all lemur species except for the ring-tailed lemur (*Lemur catta*) and the pale fork-

Table 3: Instances of aversions (broken down into fady and other aversions) near Kirindy Mitea National Park, Madagascar (2018–2019).

Species	All aversions	Fady: ancestral & medicinal reason	Other aversions: dislike & inedible	Aversion Reason 1: Ancestor	Aversion Reason 2: Medical	Aversion Reason 3: Don't like	Aversion Reason 4: Inedible
Reptilia, Testudinidae (N=66)	5 (7.6%)	3 (4.6%)	5 (7.6%)	4			1
Pyxis planicauda	5 (7.6%)	4 (6.1%)	1 (7.6%)	4			1
Aves (N=132)	0	0	0				
Numida meleagris	0	0	0				
Carocopsis vasa	0	0	0				
Mammalia, Chiroptera (N=132)	57 (43.2%)	10 (7.6%)	47 (43.2%)	8	1	3	43
Pteropus rufus	4 (6.1%)	0 (0%)	4 (6.1%)				4
Insectivorous bats	53 (80.3%)	10 (15.2%)	43 (80.3%)	8	1	3	39
Mammalia, Suidae (N=66)	14 (21.2%)	14 (21.2%)	0 (21.2%)		12		
Potamochoerus larvatus	14 (21.2%)	14 (21.2%)	0 (21.2%)		12		
Mammalia, Eupleridaedae (N=198)	91 (46%)	66 (33.3%)	25 (46%)	63		1	24
Mungodictis decemlineata	7 (10.6%)	2 (3%)	5 (10.6%)	2			5
Cryptoprocta ferox	47 (71.2%)	35 (53%)	12 (71.2%)	33			12
Fossa fossana	37 (56.1%)	29 (43.9%)	8 (56.1%)	28		1	7
Mammalia, Lemuriformes (N=462)	79 (17.1%)	23 (5%)	56 (17.1%)	17	1	2	54
Lepilemur ruficaudatus	2 (3%)	1 (1.5%)	1 (3%)	1			1
Eulemur rufifrons	3 (4.6%)	2 (3%)	1 (4.6%)	1			1
Lemur catta	7 (10.6%)	6 (9.1%)	1 (10.6%)	4			1
Propithecus verreauxi	5 (7.6%)	4 (6.1%)	1 (7.6%)	1	1		1
Phaner pallescens	33 (50%)	6 (9.1%)	27 (50%)	6		2	25
Microcebus murinus	15 (22.7%)	3 (4.6%)	12 (22.7%)	3			12
Cheirogaleus medius	14 (21.2%)	1 (1.5%)	13 (21.2%)	1			13
Mammalia, Tenrecidae (N=198)	0	0	0		1		
Tenrec ecaudatus	0	0	0				
Setifer setosus	0	0	0				
Echinops telfairi	0	0	0		1		
Total (N=1254)	248	118	133	92	15	6	122

Table 4: Regression results indicating the relationships between hunting or consumption and taboo, perceived inedibility, protection status, and knowledge of conservation laws.

Behavior	Predictor	Test	P value	95% Confidence interval
Hunting	Taboo	Fisher's Exact Test for count data	0.068	0.068–1.097
Consumption	Taboo	Fisher's Exact Test for count data	0.004	0.134–0.767
Hunting	Perceived inedibility	Relogit	0.155	
Consumption	Perceived inedibility	Relogit	0.303	
Hunting	Protection satus	GLM	0.976	
Consumption	Protection status	GLM	0.000	
Hunting	Protection status x Conservation score	GLM	0.565	
Consumption	Protection status x Conservation score	GLM	0.284	

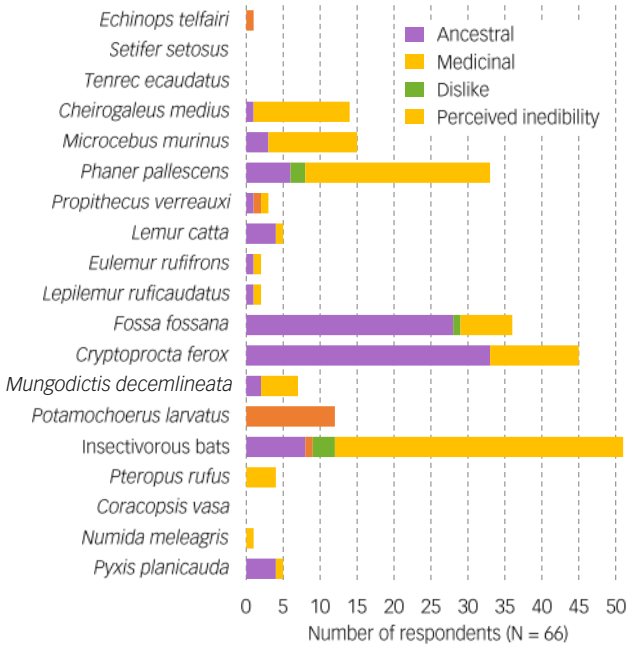

Figure 2: Reason for species aversion near Kirindy Mitea National Park, Madagascar (2018–2019).

marked lemur (*Phaner pallescens*), which were subject to *fady* for some individuals (Table 3). Individuals who cited the fork-marked lemur as *fady* did not provide a definitive origin, and there were no apparent significant factors influencing whether one adhered to the *fady* or did not. Besides one individual who cited health reasons for Verreauxi's sifaka consumption taboo, all other respondents claimed ancestral forces shaped their *fady* for lemur consumption. No respondents surveyed bird species as subject to a consumption *fady*, and only two reported a tenrec as subject to a consumption *fady*, both of which were the lesser hedgehog tenrec (*Echinops telfairi*).

We found that the odds of eating a species for those who report adhering to a *fady* were approximately 65.2% less than for those who do not cite a *fady* (odds ratio= 0.345, p = 0.004) (Table 4). On the other hand, *fady* did not affect hunting (p = 0.0683). When we attempted to subset *fady* by "ancestral" and "health" reasons, sample sizes for some species were too small to allow for statistically valid model estimates, highlighting the limits of categorizing complex cultural beliefs. This includes *Propithecus verreauxi* for which only four respondents report *fady*, with only two of which cited a reason, and *Mungodictis decemlineata* for which two respondents report *fady*, both citing ancestral reasons (Table 3).

INFLUENCE OF PERCEIVED INEDIBILITY ON HUNTING AND CONSUMPTION. Other food aversions, specifically perceived inedibility, were more common in our study village than *fady*, with each individual citing 1.94 aversions (median = 2.0, SD ± 1.6). Individuals more frequently viewed a wild animal as inedible than expressing dislike for its consumption (Figure 2). The most commonly cited "inedible" species were insectivorous bats (n= 39, 59.1%), while only a few respondents thought the Madagascar flying fox was inedible (n= 4, 6.1%). Some respondents (n= 25, 37.9%) also believed certain lemurs, especially the pale fork-marked lemur (*Phaner* spp.), were inedible, while they considered other lemur species edible. No respondents reported aversions to consuming birds or tenrecs. Inedibility did not predict hunting or consumption (p = 0.155, p = 0.303), suggesting no significant relationship between perceived inedibility and these behaviors (Table 4).

ENVIRONMENTAL LAW AND AWARENESS. Participants' knowledge of hunting laws and regulations varied highly by species (Table 1). Most respondents were aware of lemur hunting

laws, with a mean law awareness score of 1.89 out of 2. The flat-tailed tortoise (*Pyxis planicauda*) also had a relatively high awareness score (1.56). The Madagascar flying fox had the lowest awareness score (0.03). Introduced species, bats, and bird species all had relatively low scores, while tenrecs had moderate scores (Table 1).

Based on the general linear regression model, we observed that a one-unit increase in protection status was associated with a significant increase in the odds of consumption (Table 4), meaning that as species moved towards the legal side of the protection status spectrum, respondents were 50.8% more likely to consume it. On the other hand, protection status had no significant effect on hunting. We also explored whether awareness of conservation status affected behaviors more than protection status alone, but neither model detected a significant association.

DISCUSSION

This study explored how Malagasy belief systems and legal frameworks shape wildlife use decisions, guided by two hypotheses: that cultural prohibitions, such as *fady* and other aversions influence consumption, and that formal hunting laws primarily influence hunting. Our findings partially aligned with these expectations. Cultural dimensions of food prohibitions, particularly *fady*, predict reduced consumption and support the idea that culturally-rooted values influence behavior, supporting our first hypothesis, but challenge assumptions about formal deterrents, as protection status was associated with consumption rather than hunting. These results highlight the nuanced, and sometimes counterintuitive, ways cultural and legal prohibitions shape wildlife use. The gap between legal frameworks and lived practice also underscores the need enforcement strategies that are locally derived.

FREQUENCY AND PATTERNS OF *FADY* ADHERENCE AND ITS INFLUENCE ON ON WILDLIFE UTILIZATION. Wildlife consumption *fady* are common in the study community, and adherence to these beliefs predicted wildlife consumption, but not hunting. This is likely because individuals adhering to a consumption *fady* can still hunt and sell that species to other consumers. Though our sample was too small to subset *fady* by reason (ancestral vs. health) and test their individual influence on behavior, species-specific patterning in our focus groups offered deeper insights into how these patterns are understood locally.

Fosa and spotted fanaloka were the most common subjects of consumption *fady* by respondents. Across Madagascar, carnivoran hunting behavior and taboos vary (Jones et al. 2007, Golden 2009, Farris et al. 2015, Merson et al. 2019). In our study, no one reported hunting or consuming fosa. This lack of variability in our sample precluded statistical analysis, but community discussions suggest that the high prevalence of *fady* related to fosa does in fact influence the decision to avoid this species. Across Madagascar, underlying perceived similarities to dogs also deter consumption in other regions (Merson et al. 2019). A similar sentiment may apply to fosa in this region, as one individual explained, "*Satria mitovy ny alika, ary ny Malagasy tsy homana alika*" ("Because it's [fosa] similar to dogs, and Malagasy people do not eat dogs"). Carnivoran capture and killing is often driven in part by retaliation for livestock predation (Merson et al. 2019). No respondent in our study cited livestock predation as a reason for hunting, possibly because of lower livestock ownership than in other regions. Though the spotted fanaloka was the subject of taboo by many, participants did not provide in-depth explanations of *fady* for fanaloka and we lacked sufficient utilization data to explore trends regarding this species.

Although bush pigs are the subject of many consumption-related taboos, roughly a quarter of respondents consumed bush pig during the prior year. While most *fady* species in our study had ancestral origins, those who reported a bush pig *fady* all cited health-based reasonings. Quotes from surveys indicate that these *fady* were proscribed by a local ombiasy (Malagasy traditional healer) and were related to fertility (Appendix B). For example, one interviewee explained, "*Nanomboka aho niteraka ny zanako voalohany, tsy neken'ny ombiasy miahy hihinanana lambo intsony*," ('Ever since the birth of my first child, the ombiasy has not allowed me to eat bush pig'). Some respondents stated that the *fady* applied to everyone, while others said it applied to only women of birthing age. This could possibly explain why hunting and consumption of bush pig was still relatively high among the community despite high reported taboo adherence. Other communities in Madagascar also have taboos or strong aversion against bush pigs (Randrianandrianina et al. 2010), but the emic origins of this *fady* are unclear. Goodman and Raselimanana (2003) observed hesitation to hunt and eat bush pigs in another community near Kirindy Mitea but also could not determine the origin and did not examine the nuances of who can or cannot eat this meat and when. Globally, pigs (both wild and domestic) are one of the most commonly eaten yet tabooed animals (Lobban 1994, OECD no date); this can appear self-contradictory if belief systems are oversimplified. In some regions, hunters have driven bush pigs out, while in other communities bush pigs are a fast-reproducing and potentially sustainable source of protein. Near Kirindy Mitea, however, the bush pig population is abundant and interactive with the domestic pig population, possibly increasing hunting opportunities (Rakotoarivony et al. 2024). Understanding cultural beliefs surrounding bush pig consumption can help inform recommendations for alternative protein sources, reducing the overutilization of more vulnerable species.

While lemur taxa are subjects of *fady* less frequently than other species, participants frequently cited inedibility as a reason to avoid lemur meat, especially that of the pale fork-marked lemur. Examples of lemur-specific consumption *fady* have been recorded across the island (Appendix A), especially for larger-bodied lemurs such as sifakas (*Propithecus* spp.). Regardless, lemur aversions, including *fady*, are less common here than in other regions (Jones et al. 2007, Randrianandrianina et al. 2010, Jenkins et al. 2011). Fork-marked lemurs' perceived inedibility is consistent with findings across many, but not all, regions of Madagascar, where these lemurs are rarely eaten because of their bitter flavor and low densities (Borgerson et al. 2022). In a key informant interview, one hunter explained that he only captures one individual per group of lemurs to prevent killing all reproductive females. This *fady*, a long-standing ancestral rule, indicates conservation ethics in its origin. Other hunters similarly explained that they attempt not to hunt any pregnant females, mothers, or babies. Such *fady* that stem from conservation concerns are relatively rare, both in our study community and on the island more broadly. Across Madagascar, *fady* that can be attributed to conservation concerns represent less than 1% of observed beliefs (Golden and Comaroff 2015b).

Unlike much of Eastern Madagascar, where the greater hedgehog tenrec (*Setifer setosus*) is commonly subject to consumption *fady* (Golden and Comaroff 2015a,b), this study village does not observe this *fady*. In areas with high *fady* prevalence, there is also a significant occurrence of zoonotic transfer of bubonic plague, with many attributing the persistence of the disease to the consumption of hedgehog tenrecs. As a result, local stories recount ancestors falling severely ill after eating hedgehog tenrecs, sometimes dying (Golden and Comaroff 2015b). If instances of plague are less common near Kirindy Mitea National Park, it may explain the relatively lower rates of health-related prohibitions against hedgehog tenrec consumption. Future research might benefit from combining community-narratives with epidemiological data to better understand health-related taboos.

FREQUENCY AND PATTERNS OF PERCEIVED INEDIBILITY AND EFFECTS ON WILDLIFE USE. In the community, perceiving meat as inedible was more common than *fady*, but was unable to predict hunting or consumption (Table 4), possibly reflecting heightened food insecurity across the village. Future work, as discussed below, should further investigate conditions in which people eat foods seen as inedible. Because only six individuals cited dislike of a wild animal, we could not perform any tests to verify how dislike predicts wildlife use decisions.

While insectivorous bats were frequently perceived as inedible, most considered the frugivorous Madagascar flying fox acceptable to eat. Overall, few respondents hunted or consumed either bat taxa; however, it was observed that children in our study village often hunted small insectivorous bats for fun but did not consume them. Across Madagascar, while insectivorous bat consumption is low, frugivorous bats are commonly hunted, eaten, and traded taxa (Jenkins and Racey 2008, Reuter 2015). Future studies should explore how communities conceptualize each subgroup, how beliefs vary between them, why these beliefs persist, and how they influence daily decisions. In regions, various bat species are subjects of *fady*, but the conservation relevance of the beliefs remains unclear (Randrianandrianina et al. 2010, Teixeira Rocha 2018). Teixeria Rocha (2018) identified a community-level *fady* arising from ancestral prohibitions due to insectivorous bats' morphological similarity to rodents, but we found no evidence of a similar origin in our study community.

Fady significantly influenced the odds of an individual consuming an animal, but perceiving the species as inedible did not (Table 4). Globally and throughout time, people have eaten foods perceived as inedible or distasteful during times of nutritional duress and famine (Kamp 2019, Winchcombe 2023), and in Africa particularly, this phenomenon may be exacerbated as a byproduct of conditions created by colonization (Goody and Goody 1995, Minnis 2021). Under dire circumstances, the need for sustenance can often outweigh social or moral prohibitions, even if they were once internalized. While there is little research on this in Madagascar, similar effects may be present in our study community, where most households (94.2%) in our study village experience some level of food insecurity, with almost half (49.4%) relying on less preferred or cheaper food items (Thompson et al. 2023). The heightened need for food likely explains why perceived inedibility does not predict hunting or consumption. Quantitative studies exploring the relationship between food insecurity and consuming "inedible" foods can provide further insights.

CONSERVATION AWARENESS AND EFFECTS ON WILDLIFE UTILIZATION. Protection status did appear to influence consumption (and not hunting), but increased knowledge of laws did not influence the odds of either wildlife use decisions. Although Malagasy law (Ordonnance n°60-128) explicitly prohibits hunting and does not prohibit consumption, our results suggest that legal status only influences whether or not someone consumes wildlife. One explanation for these convoluted results is that our constructed score may not have fully captured respondents' knowledge of conservation laws. Laws cannot be meaningfully prohibitive if individuals are unaware of them, so these convoluted results might indicate that our constructed score may not have fully captured knowledge of these laws. For most species we studied, knowledge of conservation law, quantitatively evaluated by survey responses, was low, similar to observations from other sites within Madagascar (Keane et al. 2011). However, simply being aware of the laws does not correspond to adherence. Another possible explanation for the lack of association is that our constructed conservation knowledge score may have inadequately captured true understanding of the law. Because we ascribed points in only a few categories, based on partial or full recall and without assessing its interpretation, our score may have failed to capture respondents' full understanding of the law. Future studies should thoughtfully create a way to assess how both awareness and attitude inform wildlife, such as models designed to more completely measure individuals' knowledge of conservation laws, environmental issues, and sentiments towards them (Al Amin et al. 2021).

EMIC PROHIBITIONS AND CONSERVATION PROTECTION. In our study village, emic prohibitions (*fady*, perceived inedibility) overlap with conservation aims for species in some instances but not others. While taboo predicts species consumption, other aversions do not influence behavior in any other way, highlighting the existing yet perhaps overstated protection emic prohibitions can offer. Our study shows that while emic proscriptions can influence behaviors, their influence is more nuanced and variable than many conservationists claim it to be for three main reasons. First, Madagascar's cultural and ecological diversity leads to significant variation in responses to social prohibitions. *Fady*, often specific to single communities, families, or individuals, is challenging to generalize. *Fady* are deeply personal and often passed down through family oral traditions unique to specific households or villages. For example, this study identified *fady* that overlapped with conservation priorities for vulnerable species, but were specific only to an individual household (Appendix A, *Pyxis planicauda*). As such, conservation programs and policies cannot rely on generalized assumptions about cultural beliefs may result in externally imposed policies that misunderstand or are not aligned with indigenous systems. Second, discussions of indigenous belief systems within poverty and food security contexts are also important to better understand their effects on behavior. Economic and nutritional pressures may force people to seek nutrition in ways against their beliefs or broader social preferences, highlighting the elasticity of these norms under duress. Madagascar is the fifth most food-insecure country in the world (The Economist Intelligence Unit 2024), with 80.7% of Malagasy individuals experiencing multidimensional poverty (World Bank Group 2023). In our study village, almost all households faced multidimensional poverty (Romanello et al. 2023). Thirdly, and though outside the scope of this

study, internal migration within Madagascar has been documented to decrease the regional-level prevalence of certain *fady* (Jenkins et al. 2011, Golden and Comaroff 2015a,). Future studies may want to include stresses like food and income insecurity in addition to individual demographic factors and settlement patterns in their exploration of belief systems.

CONCLUSION

Cultural and legal prohibitions have become increasingly a central topic of conservation narratives, particularly for their roles in shaping human-environmental relations. This study explored how cultural prohibitions, particularly *fady*, and formal conservation laws influence wildlife consumption and hunting behaviors in a community adjacent to Kirindy Mitea National Park. The findings suggest that while cultural prohibitions, especially ancestral and health-based taboos, offer some reduction on species use, taboos were highly individual and not broadly shared, limiting their reliability as conservation tools. We found that *fady* significantly decreased the likelihood of consuming wildlife but had no effect on hunting (supporting hypothesis 1). Legal protection status increased the odds of consumption but not hunting (partially supporting hypothesis 2), likely because the respondents' knowledge of hunting laws was uneven and did not predict their behavior. These findings highlight that while cultural and legal prohibitions influence wildlife use behaviors, and cannot be assumed to produce predictable outcomes.

Conservation efforts must avoid assuming either traditional beliefs or formal rules will yield predictable outcomes. Instead, policies should be rooted in how people actually navigate wildlife use decisions-making under current conditions, including migration, and limited conservation education and food insecurity. As our data has shown, even traditionally deeply held beliefs may bend under pressure, and even well-written laws may be insufficient in the absence of knowledge or legitimacy.

Our study also underscores the need for conservation research and policies to go beyond quantitative metrics, and center community narratives, lived experiences and cultural nuances of indigenous communities. Sustainable conservation will require co-created approaches that will require culturally grounded, informed, and integrated experiences of rural communities. Adaptive and collaborative conservation frameworks should reflect how people actually navigate environmental choices and respond to current challenges, and honor the ways people manage amid uncertainty and change.

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