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The Importance of Integrative Anthropology: A Preliminary Investigation Employing Primatological and Cultural Anthropological Data Collection Methods in Assessing Human-Monkey Co-existence in Bali, Indonesia

James E. Loudon

University of Colorado-Boulder, Boulder, CO

Michaela E. Howells

Iowa State University, Ames, IA

Agustin Fuentes

University of Notre Dame, Notre Dame, IN

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*Articles***The Importance of Integrative Anthropology: A Preliminary Investigation Employing Primatological and Cultural Anthropological Data Collection Methods in Assessing Human-Monkey Co-existence in Bali, Indonesia.**James E. Loudon¹, Michaela E. Howells,² and Agustin Fuentes³

*This study investigates the interplay between humans (*Homo sapiens*) and long-tailed macaques (*Macaca fascicularis*) living in sympatric associations at 11 Hindu temple sites on the island of Bali, Indonesia. Primatological methods were utilized to examine demography, habitat type, and record long-tailed macaque feeding, and ranging behavior. Additionally, interviews and questionnaires were conducted to ascertain Balinese individuals' perspectives regarding the macaques, local folklores surrounding the macaques, the perceived level of human-macaque overlap, and the degree of crop raiding by the macaques. Ethnographic methods revealed that attitudes toward long-tailed macaques vary, suggesting that human perceptions are determined by religious/local folklores and potential economic variables. In contrast to reports of ubiquitous protection for the monkeys, informants revealed that macaques in some locations are hunted, eaten, captured, and illegally sold to animal dealers, thus providing important insights into our understanding of nonhuman primate conservation and the impact that each primate can have on the other's behavior.*

KEYWORDS: ethnoprimateology, anthropological methodology, long-tailed macaques, socioecology

INTRODUCTION

Throughout many areas of the world, human and nonhuman primates' lives are interconnected (Fuentes and Wolfe 2002). In these regions humans manipulate nonhuman primate environments directly and indirectly. These modifications can range from general human destruction of landscapes, to human and nonhuman primate commensalisms, to agricultural or pastoral habitat modification. Human and nonhuman primate interconnections are influenced by complicated webs of economic, cultural, and ecological components, which may be unique to specific regions. Many primatologists are aware of human impacts on local ecologies and environments. However, many current socioecological models do not fully take into consideration the impacts of human activities. Sponsel (1997) noted that biologists consider humans as part of nature from an evolutionary sense, yet apart from nature from an ecological sense. This argument can be extended to biological anthropologists, specifically primatologists. Placing humans outside of socioecological models underplays their roles in predator-prey dynamics and can dilute our understandings of how humans are agents of environmental degradation, resource depletion, habitat destruction, and contributors to species extinctions (Sponsel 1997). If primatological inquiries are to continue to make accurate assessments of the interplay between nonhuman primates and their environments, human behavior should be considered an important socioecological variable.

Incorporating human impact into socioecological models suggests that primatologists need to utilize cultural anthropological methodologies. Approaching primatological fieldwork with an ethnographic perspective incorporates human cultural and economical elements and assesses the impact of these elements on nonhuman primate behavior and demography (Cormier 2002). Because anthropology is a holistic approach to studying ourselves (Dolhinow 2002), its insights are valuable, far-reaching, and can develop effective strategies for conservation by identifying the problems faced by humans and their nonhuman primate counterparts. Utilizing ethnographic methods to understanding

¹ Department of Anthropology, 233 UCB, University of Colorado-Boulder, Boulder, CO 80309-0233

² Department of Anthropology, 324 Curtiss Hall, Iowa State University, Ames, IA 50011-1050

³ Department of Anthropology, 648 Flanner Hall, University of Notre Dame, Notre Dame, IN 46556-5611

human needs, hardships, culture, belief systems, behavior, and the interplay of these variables with local ecologies, can provide important insights into nonhuman primate behavior. Thus, the answers provided by ethnographic inquiries provide anthropologists (and in this case primatologists) with a toolkit to appropriately assess conservation problems and human and nonhuman primate behavior. Studying free-ranging primates without exploring the role of anthropogenic factors can provide skewed results and inappropriate conclusions regarding nonhuman primate behavior and develop conservation initiatives that may falter because they do address the local peoples' needs and beliefs.

Bali is one of approximately 13,000 islands in the Indonesia archipelago (Bater 1995). While the large majority of Indonesians are Muslims, the Balinese practice a unique form of Hinduism. Questions surrounding how and why the Balinese converted to Hinduism have not been satisfactorily answered. Lansing (1983) suggests that this conversion was a "process" and not a specific event. Hinduism appears to have been adopted voluntarily on a regional basis and subsequently spread throughout the island. No evidence suggests that Bali was conquered or colonized by an outside power or empire and forced to convert to Hinduism. Inscriptions in the 9-century A.D suggest that some indigenous Balinese kings adopted Hinduism and Indic kinships systems and subsequently used Hindu cosmology to validate their status as leaders and justify taxes (Lansing 1983).

Logistically, the island of Bali is an excellent locality to research the interplay between humans and nonhuman primates. It is a small geographic region, consisting of a single polity with an overwhelming majority of the population practicing the same religion (Fuentes et al., in press). The island's small size reduces the types of naturally occurring ecosystems and subsequently the number is ecological variables that influence human and nonhuman primate behavior and the religious uniformity practiced by the Balinese should result in similar cultural attitudes and perceptions regarding the nonhuman primates throughout the island. Thus Bali's small geographic size and religious uniformity limits the number of extraneous ecological and anthropogenic factors.

Humans and long-tailed macaques (*Macaca fascicularis*) have lived in sympatric associations on Bali for thousands of years (Wheatley 1999). Today these sympatric associations occur in forests where humans and macaques compete for natural resources and at temple sites located throughout the island. There are over 20,000 temples in Bali (Lansing 1983) and a single family may belong to several temples, which include the house complex temple, kinship temples, a variety of water temples, a the village temple, and regional temples (Lansing 1995). Local Balinese make offerings at temples (often in the form of food) to the gods for good luck and to promote the welfare of their families (Lansing 1995). Local village populations utilize temples for daily worship, rituals, and for other cultural festivities and ceremonies. These ceremonies include important calendric events, funeral practices, deity worship, and holidays associated with planting and harvesting regimes. The types of interactions that can be studied in Bali range from the interplay between human and nonhuman primate behavior to the manner in which humans and nonhuman primates partition their time and the ways in which they extract resources from agricultural and forest environments (see Fuentes and Gamerl 2005; Stephenson et al. 2002). This project utilized primatological and ethnographic methodologies to collect ecological and anthropogenic variables that influence macaque population sizes, demography, and behavior. We placed these variables into two broad categories, socioecological and ethnoprimate variables. This manuscript is a preliminary attempt to examine human attitudes toward long-tailed macaques, assess the types of interactions that occur between humans and macaques, and examine how human behavior influences macaque behavior at the 11 Balinese Hindu temple sites that were surveyed.

METHODS

Study Sites

The study focused on 11 Hindu temple sites (see Table 1 and Figure 1) used by the Balinese for religious purposes that were also inhabited or frequented by long-tailed macaques (*Macaca fascicularis*).

One temple site, Padangtegal, has been the focus of research by Fuentes and colleagues between 1998-2003 (Fuentes et al. in press). The remaining ten temple sites were surveyed for macaques by members of the University of Udayana between 1998-2001 (Suaryana et al. 2001 and Fuentes et al. in press). Data collection occurred 20 June to 5 August 2003. The study team consisted of three American and six Indonesians researchers from University of Udayana.

Table 1. Temple Site and Reference Number

Temple Site	Map Reference Number
Padangtegal	1
Pulaki	2
Tejakula	3
Wanagiri	4
Pacasari	5
Angseri	6
Alas Nengan	7
Mekori	8
Kunin	9
Tegal	10
Bukit Gumang	11

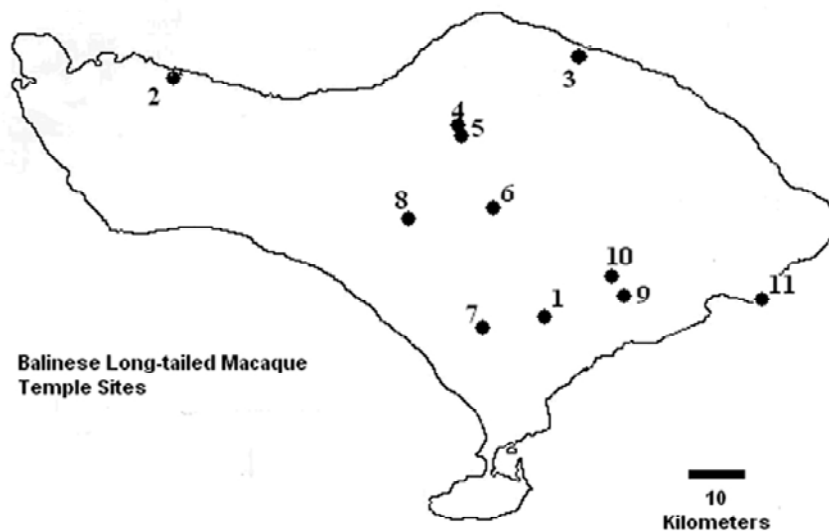


Figure 1. Map of Bali with Temple Sites

Primatological Data Collection Methods

Primatological methods were used to collect behavioral and socioecological data. Focal animal scan sampling was utilized (Altmann 1974) to record primate behavior on the three groups of macaques that inhabit the Padangtegal temple complex (see Fuentes and Gamerl 2005 for site description). However we do not report the broader results of primate behavior studies from Padangtegal in this manuscript. At the remaining ten temple sites, the study team split into groups of two or three observers to census each macaque population and determine the number of groups at each temple site, and record the demography (number of juveniles, infants, and adult males and adult females) of each group. These surveys were

conducted repeatedly (approximately eight censuses at each temple site) to ensure that we obtained an accurate population count. At each population we noted differences in physical morphologies such as facial pigment and facial shapes, mohawk (tuft of hair on head) shape and facial hair patterns, and the coloration of the pelage. These morphologies were recorded via a SONY digital camera. We employed *ad libitum* sampling (Altmann 1974) to record macaque behavior. We noted macaque feeding, agonistic, and affiliative behavior. We also recorded what foods the macaques consumed, this included naturally occurring foods, crops that they raided, temple provisions for the Balinese and tourists, and offerings to the gods. Provisions consisted on natural fruits and vegetables and processed foods (i.e. rice, taro, potato, and corn chips, crackers, candy, and breads). The type of habitat at each of the 11 temple sites were placed in broad categories and determined by the flora composition, topography, temperature, and annual rainfall (Southwick 1976).

Ethnographic Data Collection Methodologies

We used ethnographic methods to collect the ethnoprimate variables shown in Table 3. Ethnographic methods consisted of questionnaires and interviews. Questionnaires were developed with the University of Udayana staff to characterize the attitudes of local humans toward each macaque population at the 11 temple sites (see Figure 2 for questions.). This included documenting the perceived degree of crop raiding by the macaques, the frequency of crop raiding, and methods utilized to discourage the macaques from this behavior. Questionnaires were also utilized to examine the local histories regarding origins of the macaques, documenting local folklores associated with the macaques, and determining the degree of food provisioning and habituation at each temple. Non-scripted informal interviews were conducted to elucidate salient topics that the questionnaires did not or could not target and allowed the interviewees to express themselves in their own terms, and at their own pace (Bernard 1994). Questionnaires and interviews were conducted in English, Bahasa Indonesia (Indonesia's *Lingua Franca*), and Bahasa Bali (the language of ethnic Balinese). The comfort level of the interviewee determined the language the questionnaires were conducted in. In pastoral regions where English, and Bahasa Indonesia are not frequently spoken, the University of Udayana staff conducted interviews with informants in Bahasa Bali. At the Padangtegal temple site, questionnaires and interviews were conducted from 1998-2002. However the results of these previous surveys are reported in this manuscript.

1. Do the macaques frequent this temple? If so, how often?
2. What time of the day do the macaques arrive?
3. How many macaques come to this site?
4. Where do the macaques live?
5. Do you pester the macaques? If so, how often?
6. Do the macaques at this site raid your crops? If so, how often and when?
7. How do you deter the macaques from coming to the temple or raiding your fields?
8. Are you afraid of the macaques?
9. What is the origin of the macaques at this temple?
10. Where did the macaques come from?
11. How many macaques were here before people settled here?
12. Are the macaques scared?
13. Do you think there will be changes in the way people perceive the macaques here?
14. Does anyone keep the macaque as pets?
15. Do the macaques share a water source with this village?
16. Do the macaques eat trash?
17. Have you seen any dead macaques here?

Figure 2. Interview Questions

Respondents

The interviewers collected data primarily from temple staff and farmers directly associated with the temple. These individuals are predominantly male. Questionnaires and interviews were also conducted with local vendors, hotel owners, and nearby village members. Interviewees were chosen randomly and we attempted to speak with an equal number of adult males and adult females in order to obtain a wide representation (see Bernard 1994) of the attitudes that each population of local Balinese have toward the macaque population which they are living sympatric with. Our overall respondent pool is biased towards adult males and thus the responses reported here are in large part representative of male Balinese perspectives.

Definitions

Socioecological Variables

Socioecological variables refer to environmental forces or factors that influence the social organization of primate groups (Smuts et al. 1987). Since humans play an integral role in primate behavior and population structure, socioecological variables include anthropogenic factors. The first variable, *Habitat Type*, is a general characterization of the local flora and the composition of the landscape. *Deliberate Provisioning* refers to the presence of a hired temple staff and/or local Balinese that provide the population of macaques with a steady (daily) supply of food for religious and/or economic purposes. This also includes tourists who buy foods (natural and processed) from local vendors and feed the macaques. *Habituation* occurs when a local macaque population is tolerant and not fearful of human presence. *Crop Raiding* occurs when macaques consume crops that are intended to feed Balinese families or are used by the local Balinese for economic gains. Crop raiding is determined from the perspective of the local human population and does not include food provisions intended for the macaques or temple offerings which the macaques eat. *Communal Water Sources* are sources of water used by macaques and humans.

Ethnoprimate Variables

Ethnoprimate variables refer to those factors regarding human attitudes and perceptions toward nonhuman primates and human behavior that influences macaque behavior and social structure based on these attitudes and perceptions (Sponsel 1997; 2002). To avoid ascribing perceptions and attitudes toward macaques by our Balinese informants, the ethnoprimate variables reported here were obtained only from questionnaires and interviews and not from our observations of Balinese and macaque interactions. *Cultural Views* refers to the attitudes and perceptions that the local human populations hold regarding the macaque populations. For broad comparability, we combined the responses in three general categories: protected, semi-protected, and non-protected. Protected populations of macaques are either largely ignored by the local populations or are provisioned and habituated. Local populations of Balinese who have only minimal interactions/overlap with the macaques but do not harm the macaques are characterized as semi-protected. Lastly, a non-protected status includes human populations who achieve monetary gains by capturing macaques to sell to illegal markets and dissuade macaque populations from crop raiding via harmful methods such as using fire, air guns, and throwing stones. *Methods of Deterrence* refers to the mode(s), which the local human population employs to dissuade macaques from raiding their crops. *Economic Benefits* are modes of financial gain derived from temple entrance fees, trading goods with monetary value (crops or natural resources), or selling macaques.

Data Analysis

To obtain the macaque population size and the number of groups at each temple site, we used the average of our multiple censuses. Provisioning was determined by our observations and questionnaires. We determined habituation by our ability or inability to approach the macaques without food. Cultural views, crop raiding, use of a communal water source, hunting macaques, eating macaques, methods of deterring macaques, and economic gains derived from macaques were determined by questionnaires. To gain a better understanding of each human population's perceptions of the macaques, interviews were

utilized allowing the informants to discuss (and embellish) their interactions with the macaques and the local folklore associated with the macaques.

RESULTS

Macaques exhibited some differences in physical morphologies between temple sites. For example, macaques at Pulaki and Bukit Gumang exhibited darker faces, which is probably an adaptation to living in a desert environment. The macaque population at in the mountainous sites of Wanagiri and Pancasari exhibited thicker pelage which appeared to be an adaptation to living in cooler environment.

During this study, 153 total questionnaires and interviews were conducted. On average, 15 questionnaires were conducted at each temple site. The villages of Wanagiri and Pancasari are within three to four kilometers of each other and our informants reported that these four groups utilize both temples and villages. The results of our observations, questionnaires, and interviews are shown in Table 2 and Table 3.

Table 2. Socioecological Variables at Each Temple

Temple Site	Population Mean/ #Groups	Habitat type	Deliberate Provisioning	Habituation	Crop Raiding	Communal Water Source
Padangtegal	220 3 groups	secondary riparian forest	yes	yes	yes	yes
Pulaki	124 3 groups	coastal desert and xerophytic forest	semi	semi	yes	yes
Tejakula	57 1 group	secondary deciduous forest	no	no	yes	yes
Wanagiri & Pancasari	143 4 groups	secondary deciduous (mountainous) forest	yes	yes	yes	yes
Angseri	43 1 group	secondary deciduous and bamboo forest	no	no	yes	yes
Mekori	55 2 groups	secondary deciduous forest	yes	semi	yes	yes
Alas Nengan	30 1 group	secondary riparian	no	no	yes	yes
Kunin	20 1 group	secondary riparian	no	no	yes	yes

Tegal	13 1 group	secondary riparian forest	no	no	yes	yes
Bukit Gumang	174 4 groups	arid shrub and xerophytic forest	semi	semi	yes	yes

Table 3. Ethnoprimateological Variables at Each Temple

Temple Site	Cultural Views	Hunted or Eaten	Captured	Method of Deterrence	Economic Benefits
Padangtegal	Protected	no	No	sound, scarecrow, chase	yes- temple entrance fees, local people sell provisions
Pulaki	Protected	no	No	chase	yes- donations to temple
Tejakula	Non-protected	hunted and eaten	captured for pets	throwing stones, chase	no
Wanagiri & Pancasari	Semi-protected	no	No	sound, chase	yes- local vendors sell provisions
Angseri	Non-protected	no	No	scarecrows, throwing stones	no
Mekori	Protected	no	No	sound, chase	no- local people are attempting to habituate the macaques in order to charge entrance fees
Alas Nengan	Protected	no	No	scarecrows, chasing, stones	no
Kunin	Non-protected	hunted and eaten	captured and sold illegally to market vendors	guns, stones, fire, chasing, scarecrows	yes-economic gains via illegal selling to vendors
Tegal	Non-protected	hunted and eaten	captured and sold illegally to market vendors	guns, stones, fire, chasing, scarecrows	yes-economic gains via illegal selling to vendors
Bukit Gumang	Protected	no	No	scarecrows, chasing	no

DISCUSSION

Of the 11 macaque populations we surveyed, seven of were considered "protected" (Padangtegal, Pulaki, Mekori, Alas Nengan, and Bukit Gumang) or "semi-protected" (Wanagiri and Pancasari) by the local Balinese. With the exception of Alas Nengan, populations that were considered "protected" and "semi-protected" were large (>50 individuals). Of these seven populations, six were provisioned by the local Balinese or by the Balinese and tourists. Large population sizes appear to be the result of a "protected" or "semi-protected" status and provisioning by humans, not an aspect of a non-anthropogenically-impacted environment. Primates that are provisioned generally experience higher populations via reduced infant mortality, reduced inter-birth intervals, and healthier, long-lived animals (see Asquith 1989; Fa and Southwick 1988; Mori et al. 1997; Wantanabe et al. 1992). The temple sites at Pulaki and Bukit Gumang are excellent illustrations of the effects that provisioning can have. Both sites are characterized by open, arid landscapes, low rainfall, and sparsely distributed xerophytic vegetation. Yet these macaque populations are larger than the non-protected populations of macaques (Tejakula, Angseri, Kunin, and Tegal) that live in habitats characterized by secondary riparian forests, which yield a high plant biomass (Suaryana et al. 2001). At non-protected sites, the macaques were unhabituated, non-provisioned, and deterred from crops and entering the temple grounds by methods that could potentially result in physical injury or death (see Table 3).

At each of the 11 temple sites, macaques raided crops and utilized a communal water source. Throughout Bali, most temples are surrounded by wet rice fields (Lansing 1995) and/or other crops such as peanuts, coffee, cashews, corn, sweet potatoes, and coconuts. Macaques may be attracted to temples because the location of the temple is near a water source (Lansing 1995) and temples provide offerings to the gods in the form of foods, which the macaques exploit. Nevertheless, at each temple surveyed, macaques engage in crop raiding behavior. At these temples informants reported that crop raiding is a daily occurrence, yet some populations of macaques remain "protected" or "semi-protected" and others are not.

The two largest populations of macaques (Padangtegal and Bukit Gumang) were considered "protected" by the local Balinese. Daily crop raiding by these large populations (Padangtegal N = 220; Bukit Gumang N = 174) results in less food for Balinese families, fewer economic gains for families, and less monies to be distributed to local villages (money is distributed via taxes and used for temple ceremonies). At Padangtegal, there is a management committee and staff that provision the macaques and oversee human-macaque interactions (Fuentes et al. in press). Padangtegal also charges entrance fee of 10,000 Indonesian rupiah (approximately \$1 USD) to enter the temple grounds and observe the macaques and temple complex. It is estimated that over 100,000 tourists visit Padangtegal annually (Fuentes et al. in press). Entrance fees are used to purchase food for the macaques, maintain the temple grounds and forest, pay the temple staff, and incorporate the money into the village. Thus, at Padangtegal, maintaining a healthy population of macaques provides the village with a source of monetary gains and employs at staff of 16 workers. In contrast, Bukit Gumang experiences very little tourism and achieves little if any economic gains from the macaques (Fuentes et al. in press; Suaryana et al. 2001). However, the local people still regard the macaques favorably. Interviews with local farmers at Bukit Gumang informed the study team that the regional government developed laws that prohibited the capture and the use of macaque as "pets."

Ethnographic methodologies provided important insights into this study. Interviews elucidated two types of human behavior that traditional primatological methodologies could not have measured. These can be termed "in process" and "secretive" human behaviors. An exceptional example of an "in process" human behavior is the temple site of Mekori. At this temple, the macaques are considered protected and are provisioned but not completely habituated. Interviews with the Mekori priests and temple staff revealed that the local people are in the "process" of provisioning and habituating the macaques for economic gains (in hopes of starting a new "monkey tourism" site). Local people of Mekori

have witnessed the flood of tourists that attend monkey forests at temples sites such as Padangtegal, Sangeh, and Alas Kedaton (the later two temple sites were not focuses of this study) and hope to capitalize on the potential economic gains via entrance fees to observe and interact with macaques. It did not appear that the temple staff intended to habituate this population as we observed priests dissuading the macaques from eating offerings by using smoke and clapping stones. We elucidated the temple staff's intentions of habituating the macaques via interviews. Based on observations of human-macaque interactions, we would have assumed that macaques were regarded indifferently or as pests. However, the interviewees informed us of the opposite.

Other ethnographic revelations include "secretive" behavior of the Balinese populations at Tegal, Kunin, and Tejakula that trap, hunt, eat, or illegally sell local macaques to animal market vendors. At Kunin and Tegal, male and female informants disclosed that macaques were captured in wooden cages and eaten or sold. Four male informants claimed that eating macaques occurred very rarely (may be once a year) but that macaque meat possessed medicinal and magical powers that improved virility and "made you strong." These informants also revealed that trapped macaques were sold to Javanese animal dealers who sell macaques at illegal animal markets. Behavior such as these, are rarely reported by anthropologists in Bali or by many Balinese themselves, and are a direct contradiction to general assumption of the "protected" status reserved for macaques near temples (Wheatley 1999, Fuentes et al. in press).

At Alas Nengan, local farmers said the macaques were protected on a conditional basis. These macaques are protected on temple grounds. However, some farmers admitted to attacking individual macaques that they recognized as "repeated crop raiders." This composite negotiation between religious and legal protection and practical engagement as pest or competitor illustrates the complexity of human-macaque interactions in a human culture that has been recently characterized as ubiquitously "protective" (Wheatley 1999) or "semi-protective" of temple macaques (Fuentes et al. in press).

A comparison of these sites demonstrates that a high degree of variation occurs from one site to the next. At present, Fuentes and the University of Udayana staff have identified 44 macaque sites with varying degrees of human overlap (Fuentes et al. in press; Suaryana et al. 2001). This study presents preliminary results from less than 1/4 of those identified sites and suggests there is a wide spectrum of variation among the characteristics of macaque populations throughout Bali. We assert that much of this variation is directly attributable to human influences. Humans play an integral role in macaque environments and their behaviors and activities cannot be set outside of ecological models. In Bali, the interplay between humans and macaques have altered the size of the macaque populations, group compositions, behavior via direct and indirect competition for natural resources, and by the presence or absence of the habituating, provisioning, hunting, and trapping.

Although, Bali is a comparatively small geographic landmass, a single polity, and consists of a fairly homogenous ethnic and religious group, there is a tremendous degree of variability among human perceptions regarding macaque populations. We predict that on larger landmasses, which consist of several ethnic groups (which may utilize different religions) there should be greater variation in human-nonhuman primate interactions and a broader spectrum of human impacts on nonhuman primate populations. Furthermore, from a primatological perspective, we found that studying one population of macaques provides insights into that population. We suggest that caution should be placed on attributing a single population's characteristics to an entire species.

Based on Hindu myths, elements of Balinese traditional folklore, and the macaques' pattern of inhabiting temples, Wheatley (1999) asserted that Balinese long-tailed macaques (*Macaca fascicularis*) are sacred. In contrast, Fuentes et al. (in press) suggests that macaques are not protected because they represent a form of "sacredness," rather they are considered residents of sacred temples or sacred *places*, and therefore protected within those *places*. The fundamental principle of Balinese Hinduism is *Tri Hita*

Karana (three happiness-sources), which posits that happiness is dependent on a harmonious relationship between gods (or God), humans, and the environment (Fuentes et al. in press; Wheatley 1999; Whitten 1996). In addition to temples and religious items, particular species of trees and aspects of the environment may be considered sacred. This sacred status can be transferred to animals (such as monkeys or bats) if they inhabit these locations. This situation is exemplified by macaques at Alas Nengan, which enjoy a “protected” status only on the temple grounds. Although this line of thought is interesting, our results suggest that any generalizing on the religious importance of Balinese macaques is erroneous, and each population of macaques should be investigated within the context of the local ecology and the cultural atmosphere of the people. Furthermore, understanding macaque behavior and social groups requires an understanding of the local ecology, anthropogenic impacts, and the interplay of each.

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