Suiform Soundings

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Suiform Soundings

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Photo front page: A bearded pig, *Sus barbatus,* in Danum Valley, Sabah, Malaysia. Photo: A. Stewart

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Editorial: Welcome 2009!

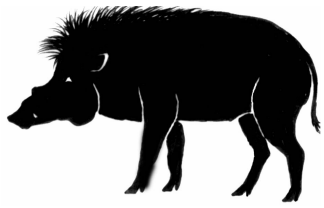
I've read a lot of editorials in January, published in various magazines and online journals, and all seem to say the same thing - Good riddance to 2008! It certainly was a year of huge upsets in the financial world, which in turn affects all of us in the conservation world as belts tighten and funding and sponsorship for conservation and research projects is harder to obtain. But I think it would be unfair to dismiss this past year as a disaster. For one thing, becoming a little more cost conscious has forced people to become more environmentally friendly, whether they realise it or not. This means cutting down on waste and excesses, trying to save money on electricity, buying (cheaper) local food and clothing, thereby supporting local industry and reducing carbon footprints, and even - believe it or not - reusing and recycling! From a PPHSG point of view, 2008 definitely had some success stories. A few that spring to mind include the establishment of a captive breeding programme for *Sus verrucosus* in Indonesia, the first reintroduction of captive-bred pygmy hogs (*Porcula salvania*) into the wild at Sonai Rupai Wildlife Sanctuary in India, and, as reported in this issue, the publication of an extensive and in depth evaluation of the distribution and conservation status of the white-lipped peccaries. Also in this issue, a study on habitat use by peccaries and feral pigs of the Southern Pantanal, Brazil, and an article looking at the distribution of desert warthogs in Tsavo East and West National Parks in Kenya.

I hope you enjoy this edition of our newsletter, and here's wishing you a happy and successful 2009!

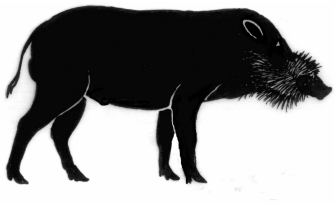
Anne-Marie Stewart, Otjiwarongo, Namibia

Scavenging warthog: These photos were taken by a colleague of mine in Namibia, who photographed this warthog from a hide at a bone-dumping site. Shortly after this donkey carcass was dropped at the site, the warthog moved in and was seen scavenging on the carcass. While it appears as though the warthog is mainly concentrating on the stomach contents, it was also seen pulling off and eating strips of meat from the rib cage. Certainly an interesting set of photographs!

Photos courtesy of Laura Linn



Papers and communications



Desert warthog *Phacochoerus aethiopicus* found in Tsavo East National Park and Tsavo West National Park, southern Kenya

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Both species of warthog, the common warthog *Phacochoerus africanus* and the desert warthog *Phacochoerus aethiopicus,* occur in Kenya. The desert warthog may be Africa's least known non-forest large mammal as its distribution is poorly understood and it has never been the focus of an ecological or behavioural study. None of the earlier books and field guides on the mammals of eastern Africa mention the desert warthog (e.g., Dorst & Dandelot 1969, Haltenorth & Diller 1977, Kingdon 1979), and no game laws recognise this taxon (I. Parker, pers. comm.). Kingdon (1997) is the first major work to recognize the desert warthog as a full species and to bring this species to the attention of a large audience.

The preliminary distribution map for the desert warthog compiled by d'Huart & Grubb (2001) presents only four localities for Kenya. They show the southern-most locality as Mkokoni, 60 km northeast of Lamu Island (north coast of Kenya). d'Huart & Grubb found no evidence for desert warthog south of the Ewaso Ng'iro River in central Kenya or west of the Tana River in eastern Kenya. They questioned whether the common warthog and the desert warthog might be sympatric at some sites.
d'Huart & Grubb (2005) produced a photographic guide that highlights the diagnostic differences between the common warthog and the desert warthog. Some of the main diagnostic phenotypic characters used to identify the two species of warthog in the field are as follows: common warthogs have pointed ear tips, cone-shaped genal warts, a 'diabolo-shaped' head (when viewed from the front), and the suborbital areas are not swollen (fig. 1); desert warthogs have ear tips that are lax and flipped back, hook-shaped genal warts, an 'egg-shaped' head (when viewed from the front), and swollen suborbital areas (fig. 2)

In 2005, we started to opportunistically collect distribution data for both species of warthog in Kenya. TMB and YdJ found desert warthogs 15 km and 80 km west of Garissa town in 2005 when they encountered two solitary individuals in medium-dense *Acacia* bushland during a primate survey. These are the first records west of the Tana River and extend the geographic range to ca. 265 km northwest of Mkokoni, the nearest locality mentioned by d'Huart & Grubb (2001).

In 2007, JC, J. Feely, and S. Bell-Cross visited Tsavo East National Park south of the Voi River. Although they encountered no common warthogs during this trip, they did observe two sounders of desert warthogs in low bush on the edge of the Dika Plains, ca 13 km north and northwest of Buchuma Gate.

Figure 1: Adult male common warthog *Phacochoerus africanus* on the plains of the Laikipia Plateau, central Kenya. Note the pointed ears, the cone-shaped warts, the 'diabolo-shaped' head, and the lack of swelling of the suborbital area.

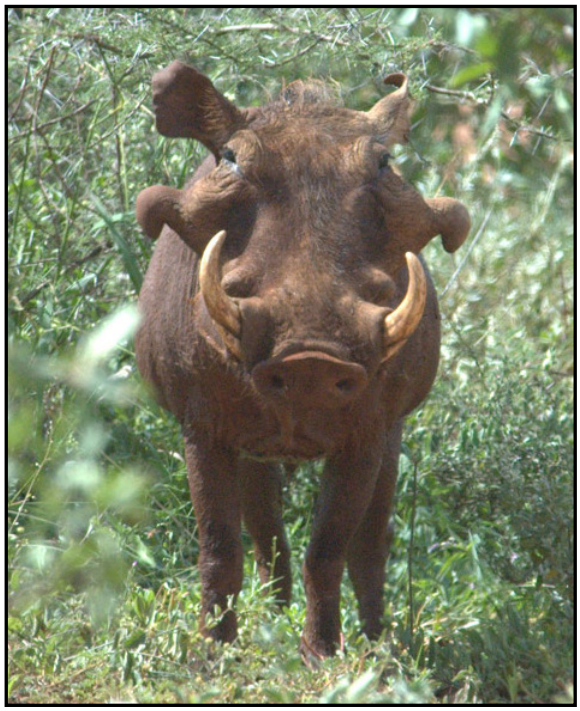

Figure 2: Adult male desert warthog *Phacochoerus aethiopicus* in medium-dense shrub in Tsavo West National Park, southern Kenya. Note the flipped-back ear tips, the hooked warts, the broad, 'egg-shaped', head, and the swollen suborbital area

Photographs were taken and sent to experts for confirmation. Some of these photographs, together with some of our other warthog photographs, are available for viewing on an online digital map at: http://picasaweb.google.com/wildsolutions/WarthogSightingsInKenya/photo?authkey=WigT2oFY78k#map.

These observations considerably extend the known geographical range for the desert warthog (ca. 310 km south from the nearest Garissa sighting and ca. 320 km southwest from Mkokoni) (Fig. 3).

JC made two further visits to the Tsavos in 2007. He found both species of warthog in Tsavo West National Park and desert warthog north of the Voi River in Tsavo East National Park.

In 2008, TMB and YdJ visited Tsavo West National Park and observed several sounders both of common warthogs and desert warthogs. In the northwest of the Park, in low bush on the edge of riverine forest, they found a sounder of six common warthogs only 150 m from a sounder of four desert warthogs. This locality represents not only the south western-most site in the range for desert warthog (ca. 390 km from Mkokoni, the southern-most point of d'Huart & Grubb 2001), but it also provided the first evidence that common warthog and desert warthog are at least narrowly sympatric over this part of their geographic ranges.

Although we have yet to find the common warthog in Tsavo East National Park, it would be surprising if this species were not present there. If not present, however, the common warthog would need to be deleted from the list of large mammals known for Tsavo East National Park. As concerns the desert warthog, Tsavo East National Park and Tsavo West National Park can now add one more species to their already impressive list of large mammals.

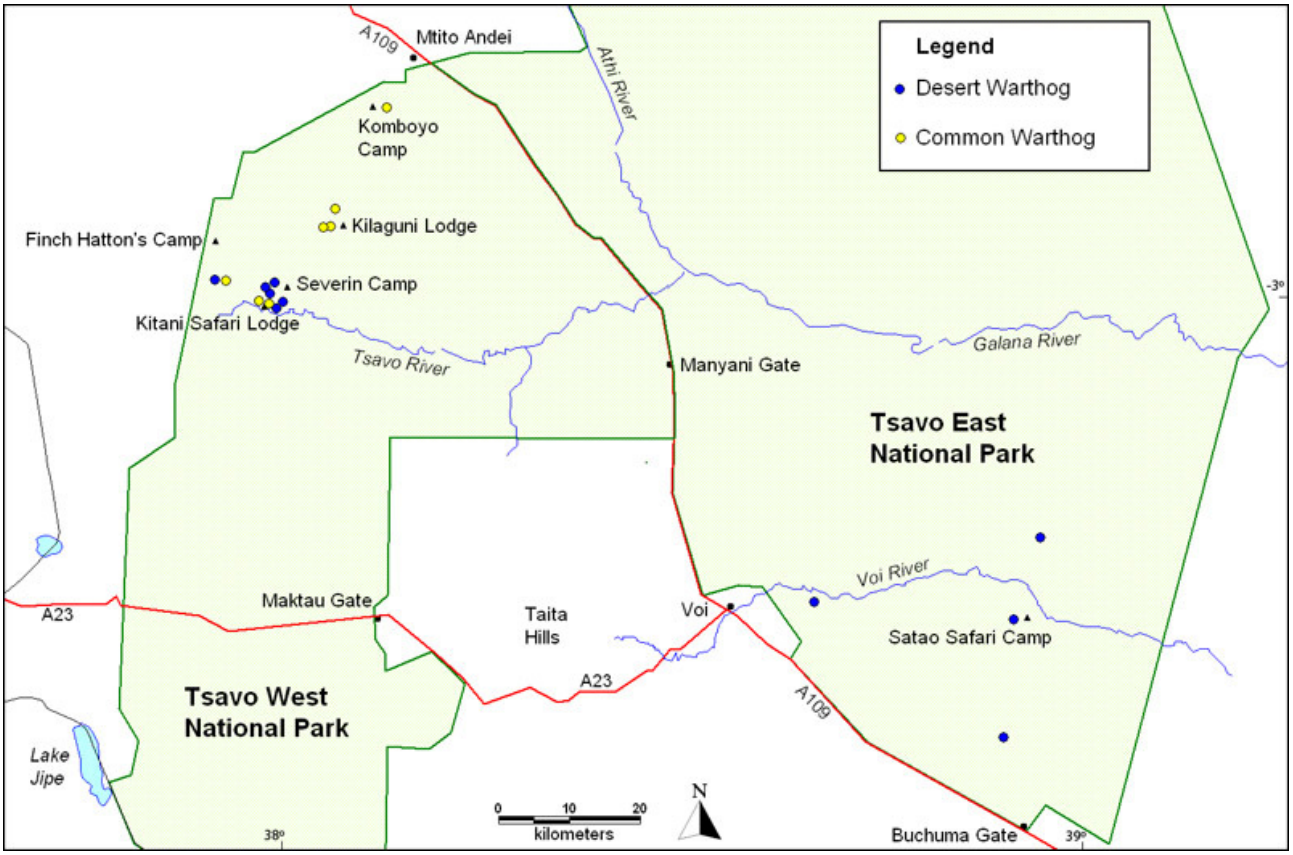

Figure 3: Locations of common warthog *Phacochoerus africanus* and desert warthog *Phacochoerus aethiopicus* sightings in Tsavo East National Park and Tsavo West National Park, southern Kenya.

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Evolution of seroprevalence of Leptospirosis in a captive collared peccary (*Tayassu tajacu*) colony in the Peruvian Amazon

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Adapted from*: Jori F, Galvez H, Mendoza P, Cespedes M and Mayor P. 2008. Monitoring of Leptospirosis seroprevalence in a colony of captive collared peccary (Tayassu tajacu) colony from Peruvian Amazon. Research in Veterinary Science (accepted)*

Leptospirosis has been identified as one of the most commonly encountered zoonosis worldwide. In the Peruvian Amazon region, diverse mammal species of rodents, marsupials and bats have been confirmed as carrier hosts, able to infect humans, and feral and domesticated animals (Bunnell *et al*., 2000; Bharti *et al*., 2003). However, the role of the collared peccary (*Tayassu tajacu*) as a reservoir or carrier host of leptospirosis and its ability to excrete spirochetes into the environment has never been investigated. The objective of this study was to monitor the evolution of seroprevalence of leptospirosis in a captive collared peccary colony, in order to provide additional epidemiological information on the possible role of the collared peccary farms as suitable environments for the maintenance of *Leptospira* spp. in the Peruvian Amazon.

The experimental farm was located near Iquitos, the capital city in the Department of Loreto (Perú). Two surveys were performed at a 27-month interval. The first survey was performed in May 2003 and was part of a previous study published earlier by Mendoza *et al.* (2007). For that survey, 90% of the population was sampled (n=27). The second survey took place between August and September 2005. On that occasion, 37% of the total herd present on the farm was sampled (n=22), including 11 individuals sampled randomly among the population monitored in the first survey (n=27) and a proportion (11/43) of the animals born on the farm since the first survey.

Total seroprevalence changed from 100% with a total of six different Leptospira spp strains identified in 2003 (n=27) to 86.4% (n=22) in 2005. During the 2003 survey, 93% of the population was positive Leptospira licerasiae sv Varillal, a new species of Leptospira isolated from a human patient and rodents in the Peruvian. Maximum titres were recorded for L. borgpetersenii serovar (sv.) Tarassovi (1:6400) and the strain Var 010 (1:1600). During the 2005 survey, 86.4% of the sampled population reacted to five different serogroups. Four serogroups previously reported were not detected in the second survey. The most prevalent serovar was L. interrogans sv. Icteroheamorrhagiae, detected in 50% of the population sample. Other serovars identified were L. kishneri sv. Cynopteri (32%), which was not reported in the 2003 survey, sv Varillal (27%) and L. interrogans sv. Bratislava (23%). Serological reactions to several serogroups suggest that there has been contact with more than one Leptospira.

Our results show that detected serovars in both surveys have changed, suggesting on one side repeated exposure to a variability of circulating serovars and, on the other side, that acquired immunity against *Leptospira* strains has a limited life period. This study suggests that our collared peccary population has been in contact with spirochetes repeatedly for more than 27 months and that farms might play some role in the amplification of the pathogen. Rodents could be considered to be the most important wildlife source of leptospirosis in rural and urban environments (Janssen, 2007). Consequently, collared peccary farms might act as attractants for wild rodents in the area, and that rodent species should be considered as potential sources of leptospirosis for the collared peccary. Further efforts in isolating spirochetes from the studied herd are necessary to ascertain the possible contribution of collared peccaries for maintaining leptospirosis in the Peruvian Amazon.

In conclusion, since animal farming, hunting and meat processing have been found as significant risk factors in the epidemiology of leptospirosis (Slack *et al*., 2006), precautions should be taken in order to limit the potential risks of transmission to domestic animals and human beings by increasing awareness about hygienic precautions and by vaccination of exposed personnel such as farm and abattoir workers, animal keepers, hunters and trappers.

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Habitat use by Peccaries and Feral Pigs of the Southern Pantanal, Mato Grosso do Sul, Brazil

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Introduction & Objectives:

White-lipped and collared peccaries (*Tayassu pecari* and *Pecari tajacu*, respectively) are abundant and widespread fruit-eating (frugivorous/omnivorous) mammals in Neotropical rain forests (Bodmer, 1989a). Recent studies have shown that their role as fruit predators and dispersers affects the biodiversity of certain forest habitats (Painter, 1998; Altrichter *et al.,* 1999; Silman *et al*., 2003; Keuroghlian & Eaton, 2008; Keuroghlian & Eaton, *in press*). The white-lipped peccaries are the only rain forest ungulates which form large herds (50-300 individuals), so their effects on forest habitats can be dramatic. Extirpation of either peccary species from a rain forest area will cause habitat alterations and additional biodiversity losses (Painter, 1998; Altrichter *et al.,* 2001; Silman *et al.,* 2003; Keuroghlian & Eaton 2008; Keuroghlian & Eaton, *in press*).

Unfortunately, local extinctions of the white-lipped peccary have been reported throughout its vast geographical range (Cullen, 1997; Glanz, 1990; Janson & Emmons, 1990; Leigh & Wright, 1990; Peres, 1996; Kiltie & Terborgh, 1983; Ditt, 2003). In regions with large tracts of intact forest, such as the Amazon, the losses have been due to heavy hunting pressure (Peres, 1996). In the Atlantic Forest of southeastern Brazil, a variety of negative consequences associated with habitat fragmentation have been the principle causes for local extinctions of white-lipped peccaries and population declines of collared peccaries (Cullen, 1997). Keuroghlian *et al*. (2008) suggest that preservation of habitat quality and diversity in small Atlantic forest fragments has been important for the maintenance of peccary population densities typical of much larger fragments and continuous forests. Furthermore, white-lipped peccaries have area requirements of at least 2000 to 10,000 ha, depending on the ecosystem (Keuroghlian *et al*. 2004; Fragoso, 1998; Carillo *et al.,* 2002).

Despite increased human interference during the past 50 years, the Pantanal ecosystem is considered to be one of the most well preserved biomes in Brazil. From a conservation perspective, its preservation has resulted from a favourable combination of environmental and socio-economic factors. While extensive flooding produces high quality, seasonally available pastures for grazers, it also limits large-scale development of the region. However, the region is threatened by a variety of environmentally unsound human activities that have intensified over the last 30 years, e.g. large-scale agriculture on the plateaus encircling the Pantanal, gold mining, heavy fishing pressure, and environmentally disastrous development schemes for increasing barge traffic on the Rio Paraguay (Gottgens *et al.,* 2001; Nascimento *et al*., 2001; Oliveira, 2003).

Due to economic pressures, many large fazendas (i.e. ranches) in the Pantanal have been sold and divided into smaller, less viable properties (Alho *et al.,* 1988; Gomes & Villela, 1999; Correa, 1999). As a result, traditional grazing practices, which included the seasonal movement of herds among patches of native savanna, have become less practical and have been abandoned by some ranchers. To make smaller prop-

erties economically viable, ranchers have clear-cut native forests and planted exotic grasses to increase grazing area and productivity. In addition, environmental damage (e.g. erosion and degradation of water quality) and conflicts over uncontrolled burning of pasturelands are likely to increase on small, intensively used cattle ranches. Little is known about the impacts associated with these changes in land use.

Both the white-lipped and collared peccaries are native to the Pantanal region, but there have been no studies on their population dynamics, ranging habits, use of resources, or behavioral ecology. Lourival and Fonseca (1997) showed that both peccary species were favored among hunted native mammals in the Pantanal. Interestingly, peccary hunting is perhaps diluted because of a preference by locals to hunt the introduced feral pig, "porco monteiro" (*Sus scrofa*) (Desbiez, 2007). We have studied the ecology of white-lipped, collared peccaries, and feral pigs, in a relatively pristine region of the Pantanal, Fazenda Rio Negro, which was historically used for cattle ranching. Native wildlife and introduced feral pigs are abundant on the Fazenda. Here we present results of habitat use by the three species and discuss conservation implications.

Methods

Fazenda Rio Negro (FRN), (19°30' S, 56°12.5' W), is a 7647 ha area dominated by large areas of gallery and cordilheira (*cerradão/cerrado/semi-deciduous*) forests, some open grasslands associated with flooded grasslands (*vazantes*), many Nhecolândia lakes, with low-impact, traditional cattle ranching practiced in the region. 10% of FRN was used for cattle during the study period.

Habitat Availability & Use

We measured habitat availability using ArcView GIS and satellite and aerial images of Fazenda Rio Negro (Eaton 2002). The region was divided into the following habitat categories (Prance & Schaller, 1982; Por, 1995; Eaton, 2006) (Fig.1):

1. Gallery or riparian forests: This habitat covers the higher banks along the Rio Negro. Large portions of the forest become flooded as river water level rises (Eaton, 2003, 2006) and spills over banks, or fills seasonal channels, called *corixos* that penetrate laterally from the river into the gallery forest. Dominant plant species in this habitat are Tucum (*Bactris glaucescens*), *Ficus* sp., Pimentinhas (*Licania Parvifolia* and *Couepia uiti*), Inga (*Inga uruguensis*), Bacupari (*Rheedia brasiliensis*), and Acuri (*Attalea phalerata*).

2. Baias & bordering vegetation: Baias are permanent to temporary shallow lakes with low to medium salinities; typically with productive and diverse aquatic plants zones; substrates of silt and aquatic plant detritus. The borders of *baias* are characterized by transitional vegetation, 5 to 50m wide. Distinct vegetation zones follow a seasonally fluctuating moisture gradient and a slight (0.5 to 1m) rise in elevation. The wetter zones consist of flood-tolerant herbaceous plants and bushes, while the higher drier zones consist of grasslands (*campo sujo* and *caronal*) or *cordilheira* forest (see description below). Examples of fruiting tree species that border *baias* are Espinheiro (*Chomelia obtuse*) and Araca *(Psidium guineense).*

3. Salinas and bordering vegetation: Salinas are shallow alkaline soda lakes with high salinities; typically with few types of aquatic plants and no fish, but productive algal and invertebrate communities. The borders of *salinas* are also characterized by transitional vegetation, 5 to 50m wide. The vegetation zones follow moisture and alkalinity gradients, as well as a slight (0.5 to 1m) rise in elevation. Depending on the season, the wetter zones consist of a few herbaceous species that are tolerant of moisture and alkaline conditions (high water periods), or bare sand (low-water periods). The higher drier zones almost always

consist of *cordilheira* forest (see description below). Caranda palms (*Copernicia alba*) are characteristic of *salina* borders.

4. Cordilheira (cerrado, cerradão, and semi deciduous forest): This habitat is a mixture of savanna forest formations (*cerrado*, *cerradão*, and semi deciduous forest) that are typical of the Nhecolândia ecoregion of the Pantanal. These forests are not inundated during the wet season, because they are formed on sandy elevations 1 to 2 meters higher than the surrounding landscape. Typical species encountered are: Pequi (*Caryocar brasiliense*); Lixeira (*Curatella americana*); Taruman (*Vitex cymosa*); Acuri (*Attalea phalerata*); Ximbuva (*Enterolobium contortisiliquu*); Paratudo (*Tabebuia aurea*); Canjiqueira (*Coccoloba cajubensis*); Bocaiuva (*Acrocomia aculeata*); Manduvi (*Sterculia apetala*); and Marmelo (*Alibertia edulis*).

5. Grasslands (campo sujo, caronal, and vazantes): Grassland habitat varies substantially in the Rio Negro region, ranging from areas with scattered trees, *campo sujo*, to open savannas with no trees. Of the latter, one of the most extensive types, *caronal*, is dominated by the grass *Elyonurus muticus*. Seasonally flooded grasslands that frequently link *baias* during high-water periods are called *vazantes*.

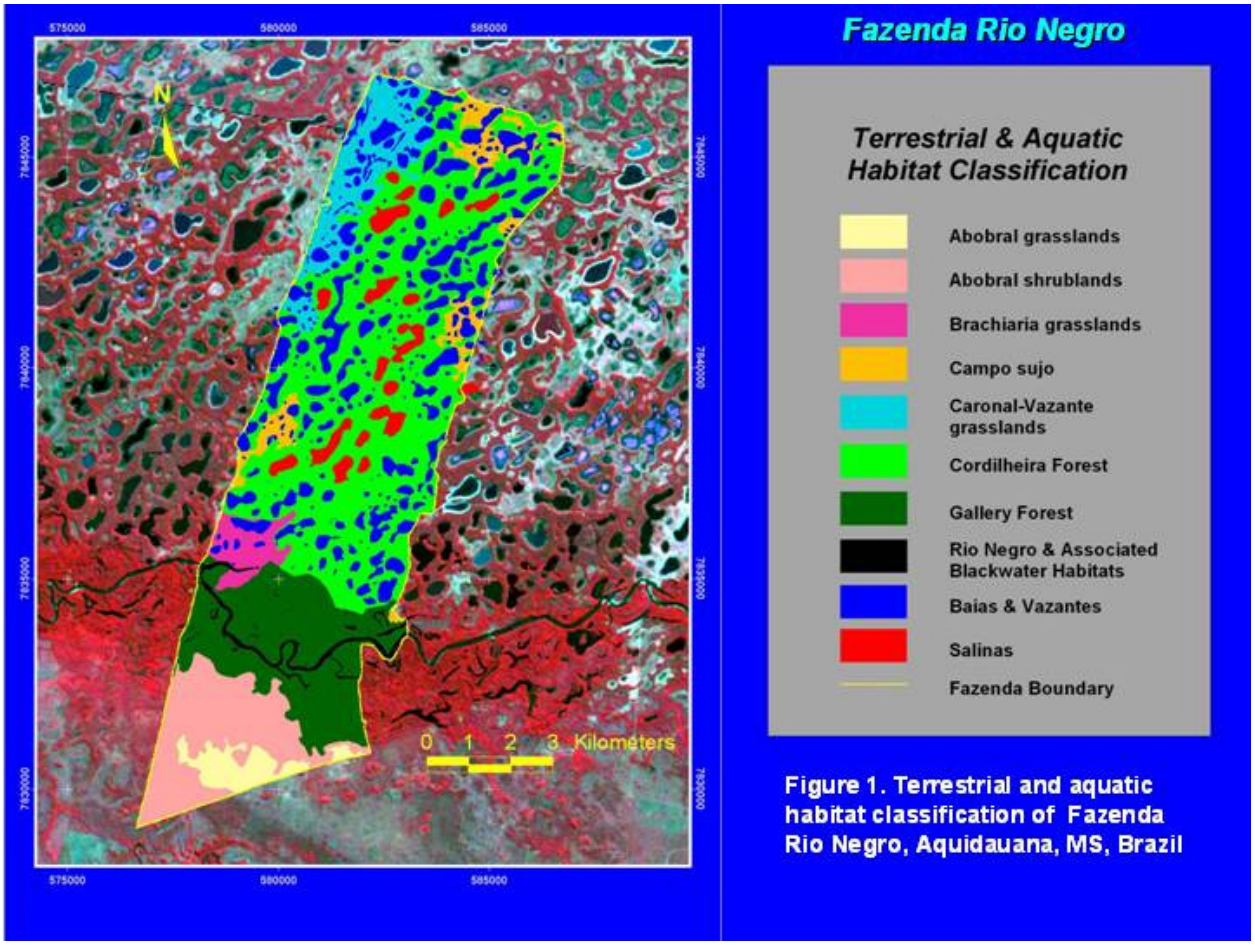

Figure 1: Habitat use by feral pigs, white-lipped & collared peccaries at Fazenda Rio Negro, Aquidauana, Mato Grosso Do Sul, Pantanal, Brazil. Proportions of use were calculated using the number of sightings obtained during transect censuses and relative abundance surveys conducted from 2000 through 2003

To measure habitat use by peccaries (*T. tajacu* and *T. pecari*) and feral pigs (*S. scrofa*), we analyzed a long-term data set, obtained from 2000 through 2003, containing records of animal sightings and the habitats where sightings occurred. The sightings were made during transect censuses and relative abundance surveys, and a GPS unit was used to document locations.

A preliminary 3 by 5 (SPECIES x HABITATS) factorial ANOVA was conducted to test if habitat use (NUMBER OF SIGHTINGS) differed among SPECIES (white-lipped peccaries, collared peccaries, and feral pigs) and HABITATS (gallery, cordilheira, grasslands, baias, and salinas). Because the interaction, SPECIES x HABITATS, was highly significant, it was necessary to compare habitat use among HABITATS within SPECIES categories with 3 one-way ANOVAs. If the ANOVAs produced statistically significant differences ($\alpha = 0.05$), we conducted pair-wise Tukey HSD Multiple Comparison tests to rank habitat categories in terms of use. For all of the above tests, the habitat use response variable, NUMBER OF SIGHTINGS, was natural-log transformed to meet the variance homogeneity assumption. These analyses were conducted using Systat, version 7.0 (1997).

For each species (white-lipped peccaries, collared peccaries, and feral pigs), we ran a Chi-squared test to determine if habitat use (percent of sightings within habitat categories) was random with respect to habitat availability (area of each habitat category at Fazenda Rio Negro). To determine the area of *baia* and *salina* habitats available to peccaries and feral pigs, we calculated the area of the transitional vegetation bordering these lakes, and did not include the open water. Although peccaries and feral pigs frequently enter *baias* and *salinas*, their movements are generally restricted to vegetation zones close to the water's edge.

Results

Habitat Availability & Use

For the 3 by 5 factorial ANOVA comparing habitat use (NUMBER OF SIGHTINGS) among species and habitat categories, the interaction of SPECIES x HABITATS was highly significant ($F = 17.817$, df = 8, 1059, $P << 0.0001$). Therefore, for each species, we conducted a separate comparison of habitat use among habitat categories (one-way ANOVAs and Tukey HSD Multiple Comparison post tests). The one-way ANOVAs for all 3 species were highly significant (collared peccary, $F = 4.777$, df = 4, 164, $P = 0.0011$; white-lipped peccary, $F = 27.704$, df = 4, 600, $P << 0.0001$; feral pigs, $F = 16.269$, df = 4, 295, $P << 0.0001$). Table 1 presents post-test results showing which habitat categories were used significantly more or less than others. Use of gallery forests by white-lipped peccaries was significantly greater than use of all other habitat categories, and *cordilheira* forests and *baias* were used significantly more than grasslands and *salinas* (Table 1, Fig. 2). Collared peccaries were observed significantly more in *cordilheira* forests than in other habitats, and feral pigs significantly more along the borders of *baias* than in other habitats (Table 1, Fig. 2). In addition, feral pigs used *salina* habitats significantly more than gallery forest.

Chi-square analyses indicated that habitat use for all three species was significantly non-random with respect to habitat availability (Table 2). Proportions of habitat availability at Fazenda Rio Negro and habitat use by the three species are presented in Table 2 and Figure 2. The habitat most available at Fazenda Rio Negro is *cordilheira* forest, and the habitat least available is the vegetation bordering *salinas* (Table 2, Figs. 1 and 2).

Table 1: Summary of Tukey HSD Multiple Comparison post-test results comparing habitat use among habitat categories for collared peccaries (CP), white-lipped peccaries (WL), and feral pigs (FP), in the Rio Negro region of the Pantanal, Aquidauana, Mato Grosso do Sul, Brazil. Habitat categories for each species are sorted from most to least used. Habitat categories that share the same letters (A, B, or C in Sig. Diff. columns) were not significantly different in terms of habitat use.

Relative	**CP**		**WL**		**FP**	
Use	**Habitats**	**Sig. Diff.**	**Habitats**	**Sig. Diff.**	**Habitats**	**Sig. Diff.**
most	Cordilheira	A	Gallery	A	Baia	A
↓	Salina	B	Cordilheira	B	Salina	B
↓	Baia	B	Baia	B	Grassland	B C
↓	Grassland	B	Grassland	C	Cordilheira	B C
least	Gallery	B	Salina	C	Gallery	C

Table 2: Habitat availability at Fazenda Rio Negro, Aquidauana, Mato Grosso do Sul, Brazil and habitat use by feral pigs (FP), white-lipped peccaries (WL), and collared peccaries (CP). Proportions of use were calculated using the number of sightings during transect censuses and relative abundance surveys conducted from 2000 through 2003. Results of Chi-square tests to determine if habitat use was random with respect to availability are also shown.

	Habitat Availability		Habitat Use		
Habitat categories	Area (ha)	Proportion[a]	WL (N = 220)	CP (N = 38)	FP (N = 92)
Gallery	1220	0.18	0.45	0.08	0.01
Cordilheira	2984	0.43	0.24	0.47	0.08
Baia	1356	0.20	0.20	0.16	0.58
Grassland	980	0.14	0.06	0.11	0.09
Salina	326	0.05	0.04	0.18	0.24
Abobral	1016				
Chi-square:		X^2 :	119.95	16.68	158.85
		df :	4	4	4
		P value :	<<0.001	<0.005	<<0.001

[a] The calculation of proportional habitat availability did not include Abobral vegetation, because the region was inaccessible for censuses and surveys.

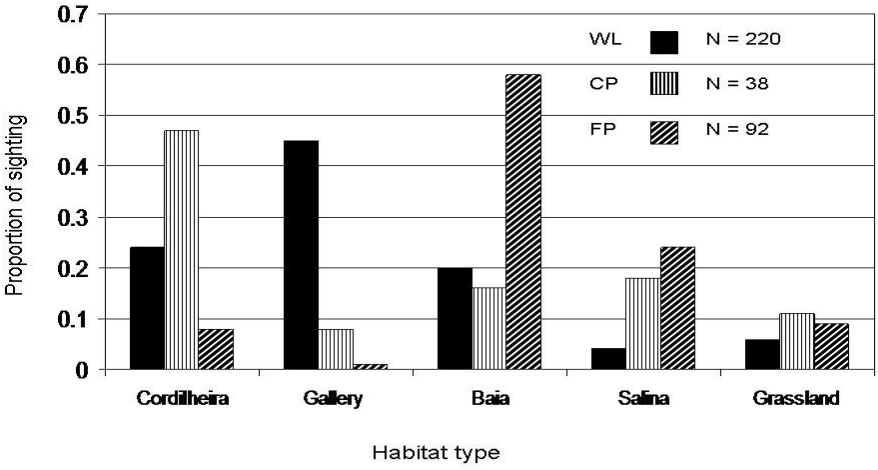

Figure 2: Habitat use by feral pigs, white-lipped & collared peccaries at Fazenda Rio Negro, Aquidauana, Mato Grosso Do Sul, Pantanal, Brazil. Proportions of use were calculated using the number of sightings obtained during transect censuses and relative abundance surveys conducted from 2000 through 2003.

Discussion & Conservation Implications

Habitat Availability & Use

Habitat use trends indicated that there is a strong association between white-lipped peccaries and forested areas, especially gallery forest**.** Other studies have also shown that white-lipped, as well as collared peccaries, prefer forest cover, but collared peccaries appeared to use open habitats to a greater extent (Bellantoni & Krausman, 1993; Taber *et al*., 1994; Fragoso, 1994, 1999; Ilse & Hellgren, 1995; Carrillo, 2000; Reyna-Hurtado & Tanner 2005; Keuroghlian & Eaton, 2008; Desbiez *et al*., in press). Similar to our results from the Pantanal, white-lipped peccaries from other regions have affinities for specific humid habitats, such as palm-dominated swamps and gallery forests, while collared peccaries use them less (Bodmer, 1990; Fragoso, 1994, 1999; Ilse & Hellgren, 1995; Keuroghlian & Eaton, 2008). Collared peccaries in our study showed a close association with the drier *cordilheira* forests. Contrary to the peccaries, feral pigs showed a strong preference for open aquatic habitats, such as *baias* and *salinas*. Desbiez *et al.* (in press) found that habitat use overlap between the feral pig and the peccaries was low, and niche overlap was highest between the native peccaries. Keuroghlian *et al* (2004) suggested that periodic range expansions of collared peccaries were related to avoidance of white-lipped peccaries and concomitant shifts in diet during these periods of interspecific overlap. Resource overlap between the two peccary species results in behavioral changes to avoid the consequences of direct aggressive encounters. Even minimal peccary and feral pig overlap could exacerbate already existing behavioral alterations related to the high niche overlap between the peccary species.

Gabor and Hellgren (2000) showed how the presence of feral pigs affects peccary densities where they occur sympatrically. Desbiez *et al*. (2004) compared density estimates of feral pigs and the two peccary species at Fazenda Rio Negro and Fazenda Nhumirim. White-lipped peccaries were the most abundant species at both locations (7,5 ind./km² and 9.6 ind./km² at FRN and Fazenda Nhumirim, respectively). Collared peccary density estimates at Fazenda Nhumirim (5.5 ind./km²) were greater compared to feral pigs (3.5 ind./km²), and at FRN there were 3.7 ind./km² for collared peccaries and 6.35 ind./km² for fe-

ral pigs (Desbiez *et al*., 2004), i.e data from Fazenda Rio Negro showed higher feral pig densities compared to collared peccary densities, and Fazenda Nhumirim showed the opposite trend. Although these data represent only two sites, they appear to support the findings of Gabor and Hellgren (2000), that feral pigs can affect peccary densities (in this case collared peccaries).

Our preliminary results on habitat use and availability have clear conservation implications. The non-random use of habitats observed for white-lipped and collared peccaries, and feral pigs, illustrates the importance of habitat diversity, especially diversity of forest types and their associated fruiting species. The Pantanal landscape is heterogeneous; peccary and pig populations and habitat use will vary according to the habitat types available (e.g. presence or absence of rivers vs. flooded grasslands). One of the next steps is to analyze these data seasonally to understand the importance of forest heterogeneity, habitat use, and existing population densities during periods of fruit scarcity. One hypothesis suggested by these results is that areas in the Pantanal that have been deforested in the past, or are currently being deforested, will negatively affect peccary populations and increase favourable habitat for feral pigs (Desbiez *et al.,* in press).

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The Destiny of the Neotropical Forest Architects: An Evaluation of the Distribution and Conservation Status of the White-lipped Peccaries

Reduced version of the executive summary prepared by Rafael Reyna-Hurtado

This is a summary of a project that began in 2005 to evaluate and update the status of the distribution of the white-lipped peccary (*Tayassu pecari*), and the lowland tapir (*Tapirus terrestris*). Here we present a reduced version only for the evaluation process of the white-lipped peccary. The authors of all the processes, including both species, are introduced at the end of the document. The complete report is already available for the public and soon will be published in a special edition of this newsletter. To receive a PDF copy of it, please write to Andrew Taber (taber@wildlifetrust.org).

This study provides range-wide information for conservation planning and a baseline against which to evaluate future changes in the species' status and distribution. It also provides an indication of ecosystem health across its ranges since the species is highly susceptible to human pressures and is useful for monitoring habitat conservation status. To undertake this survey, top peccary biologists from fourteen countries across the Neotropics provided data and contributed to the analysis and conclusions. Salient findings are outlined below.

The white-lipped peccary is one of the most ecologically and economically important mammal species of the Neotropics. It has an enormous range extending across tropical and subtropical habitats from Southern Mexico to northern Argentina. This species together with tapirs are so- called architects of ecosystems across the Neotropics because of their vital roles in structuring plant communities. White-lipped peccaries have long been key food sources for subsistence hunters throughout the region and international trade in peccary products has also been economically significant, although threatening to the species where harvesting is unsustainable. As a result of over-hunting and habitat destruction, the species is considered endangered or threatened in a number of countries, and is listed on Appendix II of CITES (Convention on International Trade in Endangered Species).

The white-lipped peccaries' historic distribution covered some 14,220,461 km². Using direct and indirect means, this species' presence was documented at 887 localities across its range, and it was judged extinct in another 49 localities. The pool of experts was able to evaluate white-lipped peccary status in almost all of its total historic range. As of 2005 it had gone extinct in 20.5% of this area and its actual distribution had declined to 11,177,435 km². Major range contractions were observed in Central America, Mexico, northwestern South America, northeast Brazil, and along the southern fringes of its distribution in Argentina and Brazil.

White-lipped peccary status was classified as having a low probability of survival in 20.1% of its historic range with only small isolated and scattered groups persisting. In these areas it is now unlikely to be a factor in ecological processes, making it functionally extinct even though it survives in small numbers. In 17% of its range, it was judged to be of medium probability of survival and, if trends continue, the species will likely be reduced to a low probability of long-term survival and localized extinction in these areas. White-lipped peccary populations were still broadly intact across 41.5% of their historic range.
This species' distribution incorporated 32 eco-geographical regions. Across these, 61% of its range area was found in only four: the Cerrado plus three Amazonian moist forest types. Its range has declined by 97.3% in the Catinga of northeast Brazil (739.000 km² lost) and the species is at risk, with 70% or greater range reductions in another six of the eco-geographical regions.

Of the six major habitat types in its historic range, grouping eco-geographical regions (Regiones Eco-Geográficas—REGs), 66% of the areas were in evergreen tropical and subtropical humid forest. White-lipped peccaries were also found in montane tropical and subtropical moist forest; montane grasslands; tropical and subtropical dry forests, savanna and scrublands; seasonally humid grasslands and savannas; and mangroves. Of these major habitat types it has been most impacted in the mangrove systems where it has disappeared from at least 43% of the area.

While it was historically found in 19 countries it is now extinct in El Salvador and its distribution has shrunk to less than 20% of its historic range in Mexico, Guatemala, and Costa Rica, the country where it is most at risk of extinction. Data were lacking from Panama. While Brazil remains a stronghold for this species, with its current range covering more than 7,000,000 km², even here it has disappeared from at least 1,000,000 km². Its probability of long-term survival at the country level is good in Peru, Bolivia, French Guyana, Guyana, Suriname, and large portions of Colombia and Venezuela (fig. 1 in Spanish text). The principal threats to the species, identified by the experts, were habitat loss and degradation, hunting, growing human population pressure, resource extraction, and ranching. The latter three are indirect threats that contribute to species loss by increasing more direct threats such as hunting. This species needs large areas with low levels of threat; 71% of its current distribution is in regions that have suffered minimal habitat alteration.

Fifty-seven Peccary Conservation Units (Unidades de Conservación para Pecarí Labiado— UCPs) were identified covering 48% of the current species' distribution (fig. 2 in Spanish text). These units varied in size from 119 km² to over 2,000,000 km², with the largest spanning parts of the northern Amazon and Guyana Shield of Brazil, Guyana, Surinam, French Guyana, Venezuela and Colombia. Most UCPs were tiny and isolated in Central America and also in southeast Brazil. Based on a variety of criteria, 86.6% of the total UCP area was judged of high quality (Type I) distributed in 19 separate units. These are the strongholds upon which the species' long-term survival depends. Five REGs did not have any UCPs; and UCPs were either nonexistent, of low quality (Type II's), or covered small areas in Belize, Costa Rica, Panama, Honduras, and Argentina. Peccary populations were judged stable in approximately 70%, and declining in 25% of the total area of the UCPs. Of the total surface area of the UCPs, 26% were in either

strict nature reserves or national parks. However, only 20% of the area in all IUCN categories, and only 9% of the total UCP area, were judged to have effective protection.

Discussion and conclusion

This is one of the largest distributional status data sets ever collected on such a wide-ranging species. Nevertheless, the power of the data was limited given the uneven coverage of the area by the experts. More surveys are needed to fill in knowledge gaps, particularly in poorly known regions of Brazil, Colombia, Surinam, Guyana and Peru. White-lipped peccary specific surveys are needed for all or parts of Ecuador, the Atlantic coast of Brazil, French Guyana, Venezuela, Honduras, Mexico (particularly mangroves), Nicaragua and Panama. Also, the importance of mangrove ecosystems to peccaries is not well understood, nor is their status in these habitats.
The country where white-lipped peccaries are most at risk is Costa Rica followed by Guatemala, Mexico and Panama. In contrast, in Bolivia, Colombia, Peru and Venezuela the species long-term future seemed assured as of 2005. In Brazil, while the species is in good shape in parts of the country such as the northern Amazon, it faces a likely further range reduction of as much as 40% in the near future given deforestation and fragmentation trends.

In terms of planning for the conservation of all ecological forms of white-lipped peccaries, the major habitat types and conservation units were the most realistic targets. Given the current number of species specialists and resources available, white-lipped peccary conservation planning and action at the level of the eco-geographical regions is unlikely to be practical in most cases. Also, given the country-focused structure of most conservation efforts, transnational efforts to protect and manage all different eco-types of peccaries will require significantly improved coordination.
One notable finding from the experts was that protected areas were clearly not fulfilling their functions of adequately protecting the species, nor did they provide sufficient coverage of all eco-geographic regions, major habitat types, and species conservation units. The need to improve protected area coverage, and internal management and protection at the species level, continues to be a challenge across the Neotropics. Also, to conserve the species as functional parts of ecosystem at the landscape scale, conservation efforts must also focus on communal and private lands.
This report presents specific conservation recommendations, although priorities varied from region to region, with a particular emphasis on getting more and better conservation and management information to decision makers at local, regional and national levels. As of 2005, white-lipped peccaries can't be considered endangered as a species. However the conservation glass for the species is neither half full nor half empty, and a concerted effort is needed to maintain the species as an ecologically important part of its ecosystem, as well as for its symbolic value for conservation as a natural gardener and architect of Neotropical ecosystems.

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El Destino de los Arquitectos de los Bosques Neotropicales: Evaluación de la Distribución y el Estado de Conservación de los Pecaríes Labiados

Versión reducida del resumen ejecutivo del proyecto preparada por Rafael Reyna

Este es un resumen de un proyecto que comenzó en el 2005 para evaluar y actualizar el estatus a nivel de la distribución del pecarí labiado (*Tayassu pecari*) y el tapir de tierras bajas (*Tapirus terrestris*). Aquí presentamos una versión reducida únicamente del proceso de evaluación del pecarí labiado. Los autores de todo el proceso, incluyendo ambas especies, se presentan al final del resumen. El informe completo ya esta a disposición del publico y pronto será publicado en un numero especial de este newsletter. Para recibir una copia en PDF del informe final dirigirse a Andrew Taber (taber@wildlifetrust.org).

Este trabajo ofrece información para la planificación de la conservación y una línea de base para evaluar cambios futuros en el estatus y distribución del pecarí labios blancos. Para llevar a cabo este trabajo, profesionales de 14 países del Neotrópico que estudian los pecaríes aportaron datos y contribuyeron al análisis y conclusiones. A continuación se presentan los resultados más sobresalientes:

El pecarí labiado es una de las especies de mamíferos más importante ecológica y económicamente del Neotrópico. Tiene una área de distribución enorme que se extiende a lo largo de hábitats tropicales y subtropicales desde el sur de México hasta el norte de Argentina. Esta especie junto con los tapires son llamadas "arquitectos de ecosistemas" ya que cumplen roles vitales en la estructuración de las comunidades vegetales. El pecarí labios blancos ha sido una de las fuentes clave de alimento para cazadores de subsistencia en toda la región y el tráfico internacional de productos de los pecaríes ha sido también económicamente significativo, aunque a veces se convierte en una amenaza para la especie cuando la cosecha no es sustentable. Como resultado de la cacería excesiva y la destrucción de sus hábitats, la especie es considerada en peligro o amenazada en varios países y está incluidas en el Apéndice II de la CITES (Convención sobre el Comercio de Especies Amenazadas de Fauna y Flora Silvestres).

La distribución histórica del pecarí labiado cubría aproximadamente 14.220.461 km². Mediante registros directos e indirectos, su presencia fue documentada en 887 localidades a lo largo de toda su distribución y se lo consideró extinto en 49 localidades. El grupo de investigadores pudo evaluar el estatus del pecarí labiado en casi toda su área de distribución histórica. Para el 2005 se lo consideró extinto en 20,5% de esta área y su distribución abarcando11.177.435 km². Las principales reducciones se observaron en Centroamérica, México, el noroeste de Sudamérica, noreste de Brasil y en el extremo sur de su distribución en Argentina y Brasil.

El estatus de conservación del pecarí labiado fue clasificado como con bajas probabilidades de supervivencia en 20,1% de su área de distribución, donde persisten poblaciones aisladas. En estas áreas es poco probable que el pecarí labiado influya en los procesos ecológicos, por lo que se lo consideraría funcionalmente extinto, aunque sobreviva en pequeños números. En el 17% de su área de distribución se lo consideró con medianas probabilidades de supervivencia y si esta tendencia continúa, la especie podría reducirse hasta tener baja probabilidad de sobrevivir a largo plazo y registrarse extinciones locales. Las poblaciones de pecarí labiado se consideraron como aún intactas en un 41,5% de su área de distribución actual.
En su área de distribución se incluyen 32 regiones eco-geográficas. El 61% del área se encuentra sólo en cuatro: el Cerrado y los tres tipos de bosque lluvioso tropical Amazónico. El pecarí desapareció en un

97.3% en la Catinga del noreste de Brasil (739.000 km² perdidos) y la especie está en riesgo en otras seis regiones eco-geográficas, donde se registraron reducciones de 70% o más. Con respecto a los seis tipos principales de hábitat (agrupaciones de regiones eco-geográficas) dentro de su distribución histórica, el 66% del área de distribución se encontró en los bosques lluviosos latifoliados tropicales y subtropicales. En los sistemas de manglares la especie ha sufrido mayores impactos, desapareciendo de al menos 43% de estas áreas.

Encontrado históricamente en 19 países, el pecarí labiado ahora está extinto en El Salvador y su distribución se ha reducido a menos del 20% del área histórica en Guatemala, México y Costa Rica. Se considera que la especie está en mayor riesgo de desparecer en Costa Rica. Faltaron datos para Panamá. Aunque Brasil se mantiene como un importante núcleo para la especie, con un área de distribución actual de más de 7.000.000 km², aún aquí el pecarí ha desaparecido de por lo menos 1.000.000 km². La probabilidad de supervivencia a largo plazo es buena en Perú, Bolivia, Guayana Francesa, Guyana, Surinam y en grandes porciones de Colombia y Venezuela. (Mapa 1)

Las principales amenazas para la especie que fueron identificadas por los investigadores fueron: pérdida y degradación de hábitats, cacería, crecimiento poblacional humano, extracción de recursos y ganadería. Las tres últimas son amenazas indirectas que contribuyen a la disminución de las poblaciones incrementando otras amenazas directas como la cacería. Esta especie necesita grandes extensiones de hábitat intacto, con bajos niveles de amenaza, y el 71% de su distribución actual se encuentra en regiones con pocas alteraciones del hábitat.

Se identificaron 57 Unidades de Conservación para Pecarí Labiado (UCP), cubriendo 48% de su área de distribución actual (Mapa 2). Estas unidades varían en tamaño desde 119 km² a más de 2.000.000 km², ubicándose las de mayor extensión en el norte de la Amazonía y el escudo de las Guayanas brasileras, Guyana, Surinam, Guayana Francesa, Venezuela y Colombia. La mayoría de las UCP en Centroamérica y en el sudeste de Brasil son pequeñas y aisladas. Con base en varios criterios, se consideró que el 86,6% del área total de las UCP es de alta calidad (Tipo I), distribuida en 19 unidades separadas. Estos son los núcleos más importantes de los que depende la supervivencia a largo plazo de la especie. En cinco REG no se ubicaron UCP y en Belize, Costa Rica, Panamá, Honduras y Argentina no existen, son de baja calidad (Tipo II) o cubren áreas muy pequeñas. En aproximadamente 70% de la superficie total designada como UCP se reportaron poblaciones estables y en un 25% se reportaron poblaciones que están disminuyendo. Del total de la superficie de las UCP un 26% se encuentra en reservas naturales estrictas o en parques nacionales. Sin embargo, solo un 20% de la superficie en todas las categorías de manejo de la UICN y un 9% de la superficie total de las UCP se reportan como efectivamente protegidas.

Discusión y Conclusiones

Este es uno de los conjuntos más grandes de datos colectado para una especie de tan amplia distribución. Se necesitan más exploraciones para llenar los vacíos de conocimiento, especialmente en regiones poco conocidas de Brasil, Colombia, Surinam, Guyana y Perú. Se necesitan evaluaciones para pecarí labiado en todo o parte de Ecuador, la costa Atlántica de Brasil, Guayana Francesa, Venezuela, Honduras, México (particularmente los manglares), Nicaragua y Panamá. Existe también la necesidad de llenar vacíos de información sobre el tapir en áreas del Gran Chaco de Argentina. Además, no está bien comprendida la importancia de los ecosistemas de manglares para ambas especies, así como su estatus en estos hábitats.

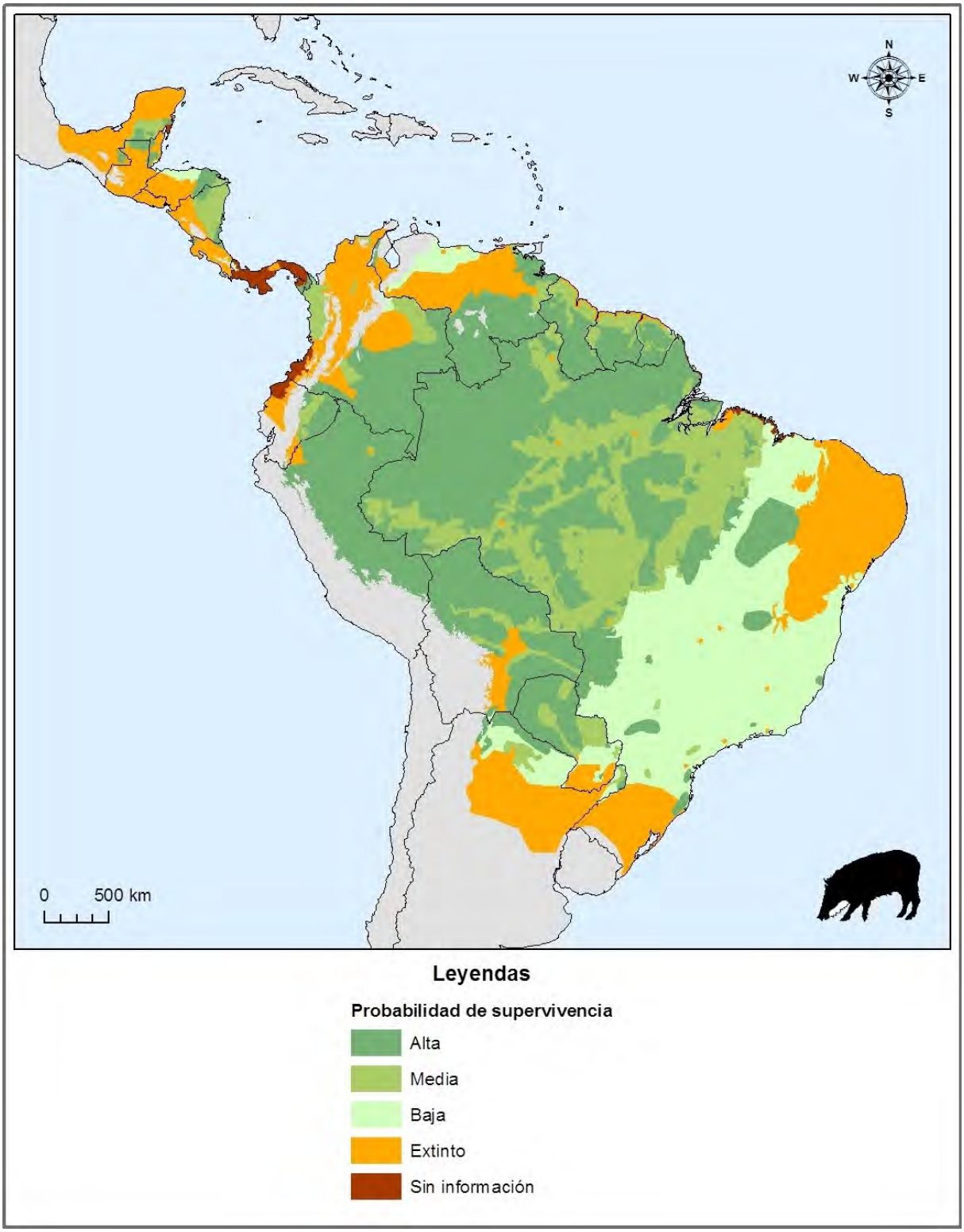
Los pecaríes se encuentran en mayor riesgo en Costa Rica seguido por Guatemala, México y Panamá. En contraste, su futuro a largo plazo parecía asegurado en 2005 en Bolivia, Colombia, Perú y Venezuela. En Brasil, aunque la especie se encuentra bien en algunas partes del país, como el norte de la Amazonía, la especie enfrenta una posible reducción de 40% en el futuro cercano, dadas las tendencias de la deforestación y fragmentación.

En términos de planificación para la conservación, considerando la existencia de diferentes tipos ecológicos de pecaríes labiados, los objetivos más realistas de atención son los tipos principales de hábitat y las unidades de conservación. Dado el número actual de especialistas y los recursos disponibles, la planificación y acción para la conservación del pecarí a nivel de regiones eco-geográficas es poco práctica en la mayoría de los casos. Además, dada la estructura de la mayoría de los esfuerzos de conservación, que tiende a enfocarse a nivel de país, los esfuerzos transfronterizos para proteger y manejar todos los distintos eco-tipos de pecaríes requerirá una importante mejora en coordinación.

Un hallazgo notable fue que las áreas protegidas no están cumpliendo sus funciones para proteger adecuadamente a estas especies, ni proveen suficiente cobertura de todas las regiones eco-geográficas, los tipos principales de hábitat ni las unidades de conservación. La necesidad de mejorar el área de cobertura de las áreas protegidas, además del manejo interno y la protección a nivel de especies, sigue siendo un desafío en todo el Neotrópico. Además, para conservar estas especies como parte funcional de los ecosistemas a escala de paisajes, los esfuerzos de conservación deben también focalizarse en tierras comunitarias y privadas.

El informe presenta recomendaciones específicas de conservación. A pesar que las prioridades variaron de una región a otra, siendo una prioridad especial proporcionar más y mejor información sobre conservación y manejo a nivel local, regional y nacional. Para el 2005, ni los pecaríes labiados ni los tapires de tierras bajas podían considerarse en peligro como especie, pero el vaso de la conservación para ambos está esencialmente medio lleno o medio vacío, y es necesario un esfuerzo conjunto para mantenerlos como parte funcional importante de sus ecosistemas y por su valor simbólico para la conservación como los "arquitectos Jardineros naturales" del Neotrópico.

Autores del informe: *Andrew Taber, Silvia C. Chalukian, Mariana Altrichter, Karen Minkowski, Leonidas Lizárraga, Eric Sanderson, Damián Rumiz, Eduardo Ventincinque, Edsel Amorim Moraes, Jr, Carlos de Angelo, Miguel Antúnez, Guido Ayala, Harald Beck, Richard Bodmer, Salvador Boher B., José Luis Cartes, Soledad de Bustos, Don Eaton, Louise Emmons, Neyreda Estrada, Luiz Flamarion de Oliveira, José Fragoso, Rony Garcia, Claudia Gomez, Humberto Gómez, Alexine Keuroghlian, Karim Ledesma, Diego Lizcano, Carolina Lozano, Olga Montenegro, Nora Neris, Andrew Noss, Juan Alejandro Palacio Vieira, Agustin Paviolo, Pablo Perovic, Héctor Portillo, Jeremy Radachowsky, Rafael Reyna-Hurtado, Juliana Rodriguez Ortiz, Leo Salas, Adriana Sarmiento Duenas, Javier A Sarria Perea, Karina Schiaffino, Benoit de Thoisy, Mathias Tobler, Victor Utreras, Diego Varela, Robert B. Wallace, y Galo Zapata Ríos*



Mapa 1: Situación de la conservación del pecarí labiado

Figure 1: Conservation status of the white-lipped peccary

Mapa 2: Estado de conservación de las unidades de conservación del pecarí labiado

Figure 2: Conservation situation of the Peccary Conservation Units

Conservación de pecaríes en los paisajes humanos de la Amazonía nororiental ecuatoriana: impacto de la cacería y la pérdida del hábitat.

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Desde hace ocho años, el Programa Ecuador de la Wildlife Conservation Society (WCS) ha estado implementando una serie de iniciativas de investigación y manejo enfocadas en promover la conservación de la fauna silvestre en el Parque Nacional Yasuní (PNY) en la Amazonía ecuatoriana. El PNY es considerado una ecoregión de importancia global y es el área protegida más grande y biodiversa del Ecuador continental (~ 10.000 km^2; Fig. 1).

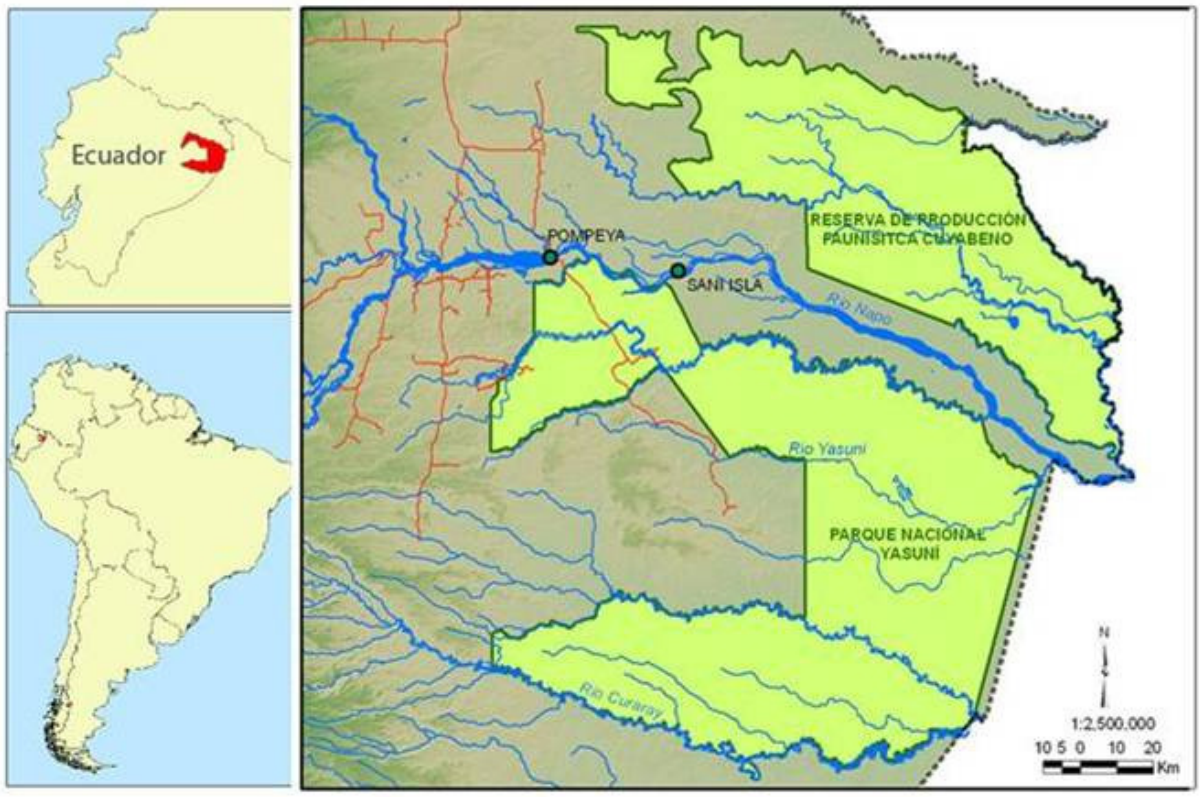

Figura 1: Mapa de la Amazonía nororiental ecuatoriana

Actualmente, esta área protegida se encuentra amenazada por la extensión de la frontera agrícola, la explotación forestal ilegal, la actividad petrolera, actividades turísticas desordenadas, y la extracción comercial de carne silvestre. Algunos de nuestros sitios de estudio están ubicados en los territorios de varias comunidades Kichwa de la ribera del río Napo cuyas tierras se superponen con la parte noroccidental del PNY, y varias comunidades Waorani del interior de la reserva. Entre otras actividades, nuestros proyectos incluyen: i) monitoreo de fauna en sitios con y sin presión de cacería, ii) monitoreo de

los hábitos de cacería y pesca en comunidades Kichwa y Waorani, y iii) monitoreo del tráfico de carne silvestre y animales vivos en un mercado semanal en el borde del Parque.

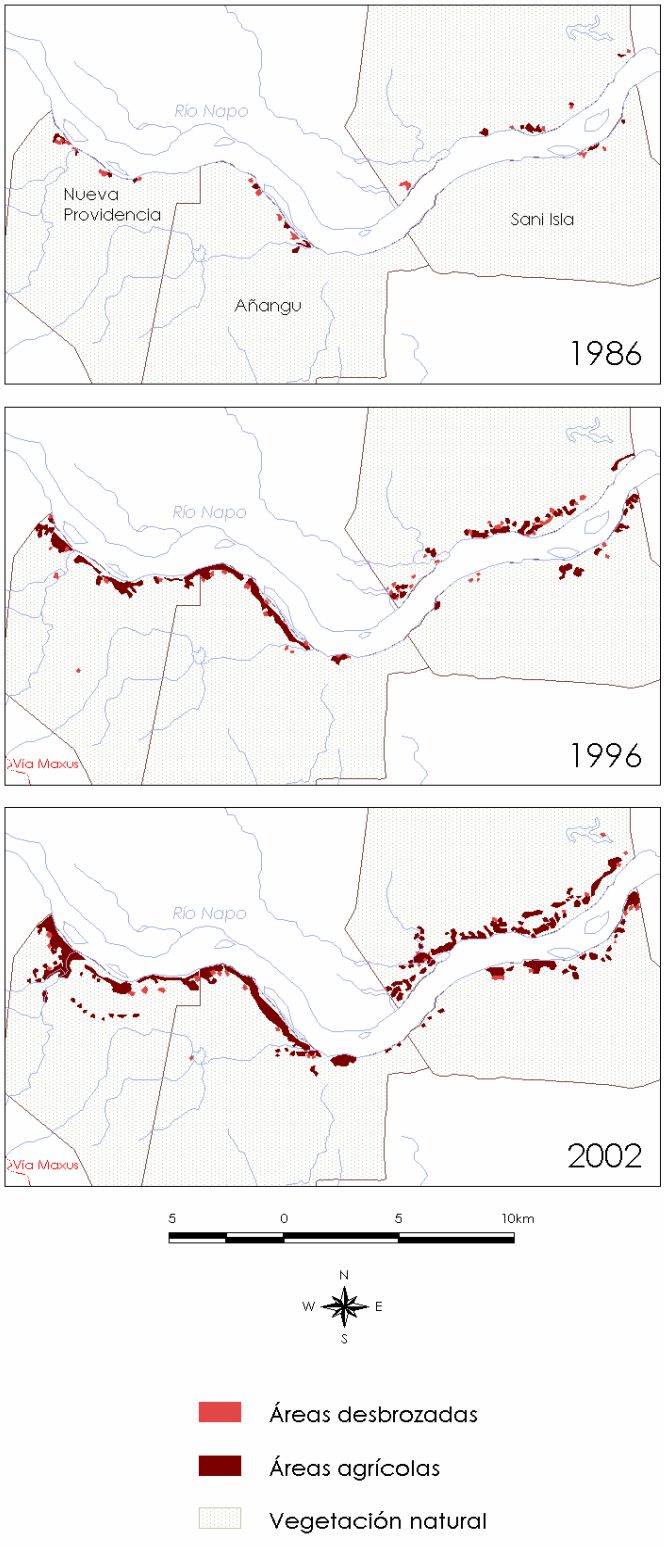

Figura 2: Mapa de cambios en el uso del suelo en tres comunidades Kichwa de la ribera del río Napo (Zapata Ríos, *et al*. 2005).

En el Ecuador los pecaríes (*Pecari tajacu* y *Tayassu pecari*) están ampliamente distribuidos en la Amazonía y la Costa, y pueden ser encontrados hasta los 1600 m de altitud, dependiendo de la especie. Sus áreas de vida cubren en general grandes extensiones, y los reportes de estimaciones de ámbito hogareño varían desde unas pocas hasta varias miles de hectáreas (*e.g.*, Sowls, 1984; Fragoso, 1998; Keuroghlian *et al.*, 2004). Una de las particularidades ecológicas de los pecaríes, especialmente el de labios blancos, es su requerimiento de extensas áreas de bosque y de corredores que le permitan desplazamientos entre distantes áreas de alimentación, fuentes de agua y saladeros. En el caso de la Amazonía ecuatoriana, el río Napo representa un sitio clave que provee conectividad entre diversos ecosistemas, y son frecuentes los recuentos de la gente local que describen la forma en que grandes manadas de pecaríes cruzaban el río. Estos movimientos, son esenciales en términos de conectar las poblaciones que ocupan ambas riberas del río, y de mantener la dinámica de los bosques que forman la transición entre los bosques de *terra firme* del Yasuní, hacia el sur, y los bosques inundados por aguas negras de la zona del Cuyabeno, hacia el norte. Sin embargo, según testimonios de la gente local, estos cruces del río son cada vez menos frecuentes, seguramente debido a la creciente presión de cacería y al aumento de la población en las riberas del Napo (Fig. 2).

Durante los dos últimos años, hemos reportado tres cruces del río Napo que evidencian por un lado la vigencia de este río en términos de influir la dinámica y el uso del espacio por los pecaríes de esta región, pero también su sensibilidad a las crecientes amenazas que experimentan. En mayo de 2007, por ejemplo, un grupo de más de 30 pecaríes de labio blanco intentó cruzar el río Napo, cerca de la comunidad de Pompeya, precisamente en un día sábado cuando las comunidades desarrollan la feria semanal en la que funciona un mercado de carne silvestre y de animales vivos (WCS-Ecuador, 2008).

Los cazadores y comerciantes que se encontraban en el mercado, se dieron cuenta del hecho y salieron tras los pecaríes que fueron fácilmente cazados desde las canoas, mientras nadaban en el río. Al menos seis ejemplares adultos fueron capturados, faenados, y vendidos inmediatamente en el mismo mercado de Pompeya (Fig. 3).

Figura 3: Pecaríes de labio blanco (*T. pecari*) comercializados en el mercado de Pompeya; Foto: R. Cueva.

En abril del 2008 observamos a un individuo juvenil de pecarí de collar (*Pecari tajacu*) cruzando el río Napo desde la orilla sur hacia la orilla norte (Fig. 4) en una sección en la que el río mide aproximadamente 1 km de ancho. Este animal cruzó el río precisamente en medio de los territorios de una comunidad kichwa en donde la alimentación local esta fuertemente basada en la cacería de pecaríes (*P. tajacu* y *Tayassu pecari*), guantas (*Cuniculus paca*) y especies de monos grandes como los aulladores (*Alouatta seniculus*) y chorongos (*Lagothrix lagotricha* y *L. poeppiggi*). Finalmente, en julio de 2008, un grupo de aproximadamente 50 pecaríes cruzaron el río Napo, en el territorio de la comunidad Kichwa de Sani Isla. Aproximadamente una docena de individuos fueron cazados y una cría capturada y mantenida en cautiverio. Además de estas observaciones directas, hemos documentado en repetidas ocasiones cruces del río a través de la observación de huellas (Fig. 5). Esta información empírica respalda modelos espaciales que resaltan la importancia de mantener la conectividad entre las riberas norte y sur del río Napo (Zapata Ríos, 2001).

Por otra parte, nuestros datos indican que la intensa presión de cacería que la zona del río Napo está experimentando ya ha afectado considerablemente a las poblaciones de pecaríes. Mientras que en los transectos de estudio en un sitio control sin presión de cacería reportamos un promedio de abundancia relativa de 3,8 registros directos por cada km de transecto recorrido, nuestro muestreo simultáneo de transectos en los territorios Kichwa del río Napo aun no ha producido registros de esta especie desde abril de 2006. En lo que respecta a *P. tajacu*, no hemos observado una gran diferencia en las tasas de encuentro de esta especie en las zonas con y sin cacería (0,13 registros directos/km en las comunidades y 0,12 registros directos/km en el sitio control), lo que respalda observaciones previas sobre la menor sensibilidad de esta especie en lugares con presión de cacería y alteración de hábitat en comparación con otros mamíferos, como los tapires y los primates grandes (Bodmer *et al*. 1990; Peres, 1996; Altrichter & Almeida, 2002). A la cacería de subsistencia en la zona del Napo, hoy se suma la creciente amenaza de la cacería comercial, la cual se triplicó entre el año 2005 y el año 2007. Solamente en el mercado de Pompeya, registramos un total de 4580.6 kg de carne de pecaríes (38% del total de carne de mamíferos vendida en Pompeya), y nuestras observaciones en las comunidades locales sugieren que esta cacería comercial se esta dando como un rubro adicional a la cacería de subsistencia y no en substitución de la misma (Suárez *et al.* manuscrito aceptado).

La creciente presión de la cacería y la alteración del hábitat en la Amazonía del Ecuador requieren de

medidas urgentes para asegurar la conservación de las especies de pecaríes y su insustituible rol ecológico. En particular, requerimos de información adicional acerca de la distribución y uso del hábitat a escalas espaciales y temporales relevantes, y de cómo estos patrones están siendo alterados como consecuencia de las actividades humanas. Al mismo tiempo, se requieren esquemas de manejo de los territorios indígenas comunitarios ubicados dentro del PNY, que regulen el uso de fauna silvestre, asignen áreas grandes como reservas comunitarias que funcionen como fuentes de animales para las zonas de cacería y que permitan el desplazamiento de las especies de fauna silvestre entre diversos elementos del paisaje. Actualmente, WCS trabaja en la implementación de varias de estas iniciativas, pero se requerirán esfuerzos adicionales y colaboraciones interinstitucionales para cubrir las necesidades actuales de investigación aplicada y manejo que requiere la conservación de los pecaríes en la Amazonía ecuatoriana.

Figura 4: Pecarí de collar cruzando el río Napo, Comunidad Kichwa de Sani Isla; Foto: J. Torres.

Figura 5: Huellas de pecarí de labio blanco cruzando un río amazónico (*T. pecari*); Foto: G. Zapata Ríos.

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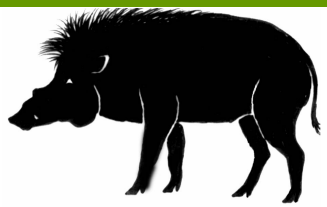
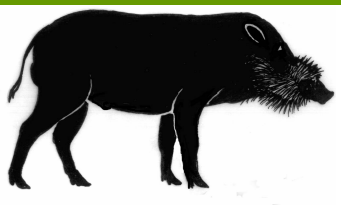


News in Brief



First detection of Ebola-Reston virus in pigs

(From http://www.porkworld.com.br/index.php?documento=5418#)

12/01/2009 17:17

FAO/OIE/WHO offer assistance to the Philippines. Further tests are required to learn more about the transmission and virulence of the virus.

Following the detection of the Ebola-Reston virus in pigs in the Philippines, FAO, the World Organization for Animal Health (OIE) and the World Health Organization (WHO) announced today that the government of the Philippines has requested the three agencies send an expert mission to work with human and animal health experts in the Philippines to further investigate the situation.

An increase in pig mortality on swine farms in the provinces of Nueva Ecija and Bulacan in 2007 and 2008 prompted the Government of the Philippines to initiate laboratory investigations. Samples taken from ill pigs in May, June and September 2008 were sent to international reference laboratories which confirmed in late October that the pigs were infected with a highly virulent strain of Porcine reproductive and respiratory syndrome (PRRS) as well as the Ebola-Reston virus.

Although co-infection in pigs is not unusual, this is the first time globally that an Ebola-Reston virus has been isolated in swine. It is not, however, the first time that the Ebola-Reston virus has been found in the Philippines: it was found in monkeys from the Philippines in outbreaks that occurred in 1989-1990, 1992, and 1996.

The Ebola virus belongs to the Filoviridae family (filovirus) and is comprised of five distinct species:

Zaïre, Sudan, Côte d'Ivoire, Bundibugyo and Reston. Zaïre, Sudan and Bundibugyo species have been associated with large Ebola hemorrhagic fever (EHF) outbreaks in Africa with high case fatality ratio (25-90%) while Côte d'Ivoire and Reston have not. Reston species can infect humans but no serious illness or death in humans have been reported to date.

Since being informed of this event in late November, FAO, OIE and WHO have been making every effort to gain a better understanding of the situation and are working closely with the Philippines Government and local animal and human health experts.

The Department of Health of the Philippines has reported that initial laboratory tests on animal handlers and slaughterhouse workers who were thought to have come into contact with infected pigs were negative for Ebola-Reston infection, and that additional testing is ongoing. The Bureau of Animal Industry (BAI) of the Philippines Department of Agriculture has notified the OIE that all infected animals were destroyed and buried or burned, the infected premises and establishments have been disinfected and the affected areas are under strict quarantine and movement control. Vaccination of swine against PRRS is ongoing in the Province of Bucalan. PRRS is not transmissible to humans.

The planned joint FAO/OIE/WHO team will work with country counterparts to address, through field and laboratory investigation, important questions as to the source of the virus, its transmission, its virulence and its natural habitat, in order to provide appropriate guidance for animal and human health protection.

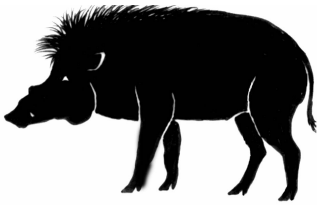
Ebola Reston Virus in Pigs
Disease situation in swine in the Philippines – An unfolding situation

5 December 2008: Over the past several weeks, FAO has engaged with officials at the Philippine Department of Agriculture in Manila and other national and international agencies (i.e. the World Health Organization, the World Organisation for Animal Health, the United States Department of Agriculture, the Centers for Disease Control and Prevention of the United States Department of Health and Human Services, and the Australian Animal Health Laboratory) to better understand the laboratory findings of Ebola Reston virus in pigs in the Philippines. This situation represents the first time that the virus, a known primate pathogen, has been identified in a food-producing animal.

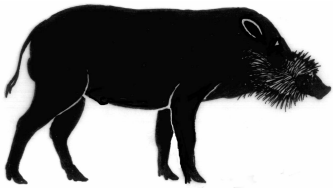
The laboratory findings came about after the Bureau of Animal Industry (BAI) of the Philippine Department of Agriculture undertook field investigation and sample collection activities related to suspected outbreaks of porcine reproductive and respiratory syndrome (PRRS). PRRS had been affecting several swine production areas in the Philippines and was characterized by having a greater virulence than what had been described decades earlier in North America and Europe. Such increased virulence in the PRRS virus (an Arterivirus) had also been seen in 2006 and 2007 in China and Viet Nam, respectively.

BAI sent samples to a laboratory with enhanced PRRS experience to facilitate PRRS characterization and to rule out other swine pathogens, such as porcine circovirus, classical swine fever virus (a Pestivirus), or Nipah virus (a Paramyxovirus) using classical and molecular diagnostic laboratory techniques.

During the laboratory investigations, viral particles and genetic sequencing showed that several of the swine samples were infected with: the PRRS virus; circovirus; other agents; and the Ebola Reston virus. Previously, no Ebolavirus had ever been found in swine tissues.



New Literature on Suiformes



Article in press:

Removal of palm fruits and ecosystem engineering in palm stands by white-lipped peccaries (*Tayassu pecari*) and other frugivores in an isolated Atlantic Forest fragment.

Biodiversity and Conservation
DOI 10.1007/s10531-008-9554-6
Alexine Keuroghlian · Donald P. Eaton

Long-term studies in a 2178 ha fragment of semi-deciduous Atlantic Forest demonstrated important interactions between white-lipped peccaries (*Tayassu pecari*) and the common palms, *Syagrus romanzoffiana* and *Euterpe edulis*. We conducted fruit removal and medium-to-large-sized mammalian exclusion experiments to: 1. measure seasonal fruit consumption from high-density patches beneath parent trees by *T. pecari* and other consumers; and 2. measure impacts of *T. pecari* rooting and foraging activities on seedling dynamics in *E. edulis* stands. A diverse array of fauna consumed *S. romanzoffiana* fruits. During the dry season, when *S. romanzoffiana* palms provided 68% of fruit dry weight in the fragment, *T. pecari* consumed significantly greater amounts than other consumers, and along with *P. tajacu* and *Tapirus terrestris*, were potential seed dispersers. The rodents, *Sciurus ingrami* and *Agouti paca*, consumed most *S. romanzoffiana* fruits in the wet season, acting as both seed dispersers and predators. More than 95% of *E. edulis* fruit removal was due to seed predation by white-lipped peccaries. Intense removal during the dry season was closely linked with previously documented range shifts and habitat preferences by *T. pecari*. Exclusion plot experiments in *E. edulis* (palmito) stands showed that the number and proportion of non palmito (not *E. edulis*) seedlings increased dramatically in the absence of *T. pecari* rooting and foraging activities that disturbed soil and thinned seedlings. We discuss the importance of these ecosystem engineering activities and palm-peccary trophic interactions for long-term maintenance of *E. edulis* stands and *T. pecari* populations, as well as water balance, in the forest fragment.

Veterinary, Genetic and Physiological Studies

Jiang YN, Wu CY, Huang CY, Chu HP, Ke MW, Kung MS, Li KY, Wang CH, Li SH, Wang Y and Ju YT. 2008. Interpopulation and intrapopulation maternal lineage genetics of the Lanyu pig (*Sus scrofa*) by analysis of mitochondrial cytochrome b and control region sequences. Journal of Animal Science 86(10): 2461-2470

The Lanyu pig is an indigenous breed from the Lanyu Islet, which is southeast of Taiwan. Two herds of Lanyu pigs were introduced from the Lanyu Islet into Taiwan in 1975 and 1980. The current population of conserved Lanyu pigs consists of only 44 animals with unknown genetic lineage. The Lanyu pig possesses a distinct maternal genetic lineage remote from Asian and European pigs. The present study aimed

to understand the phylogenetic relationship among conserved Lanyu, Asian, and European type pigs based on the cytochrome b coding gene, to ascertain the maternal lineage and genetic diversity within the conserved Lanyu pigs, and to address whether genetic introgression from exotic or Formosan wild pigs had occurred in the conserved Lanyu pigs. Entire mitochondrial genomes of both types of Lanyu pig comprised 2 ribosomal RNA, 22 transfer RNA, and 13 protein-coding genes. Only 2 haplotypes of the mitochondrial DNA (mtDNA) control region and cytochrome b were identified in the conserved Lanyu pig herds. When maximum likelihood trees were constructed, the Type I Lanyu mitochondrial genes formed a unique clade with a large pairwise distance of both cytochrome b and the control region from Asian and European type breeds, Formosan wild pigs, and exotic breeds. Significant loss of genetic diversity of mtDNA within the conserved Lanyu pigs was demonstrated by low haplotype and nucleotide diversities, supported by Fu and Li's D* neutrality test (1.44055; $P < 0.05$). The mtDNA control region sequences of extant pigs in the Lanyu Islet, however, showed high haplotype and nucleotide diversity, and clustered with exotic pigs. These results indicate no maternal lineage mtDNA gene introgression from Formosan wild pigs and introduced exotic pigs to conserved Type I Lanyu pigs, and a severe loss of heterozygosity of mtDNA in conserved Lanyu pigs. The remaining extant pigs on the Lanyu Islet have been introgressed with exotic breeds. Strategies for future conservation of native Lanyu pigs are now even more urgent and important.

Herrera HM. Abreu UGP. Keuroghlian A. Freitas TP and Jansen AM. 2008. The role played by sympatric collared peccary (*Tayassu tajacu*), white-lipped peccary (*Tayassu pecari*), and feral pig (*Sus scrofa*) as maintenance hosts for *Trypanosoma evansi* and *Trypanosoma cruzi* in a sylvatic area of Brazil. Parasitology Research 103(3): 619-624

The Brazilian Pantanal has been considered one of the richest and most diverse wetland ecosystems in the world. It is occupied by cattle ranching, and a variety of wildlife species share the same habitats with domestic livestock. We investigated infections of *Trypanosoma evansi* and *Trypanosoma cruzi* in the sympatric suiformes-collared peccary (*Tayassu tajacu*), white-lipped peccary (*Tayassu pecari*), and feral pig (*Sus scrofa*) by parasitological, serological, and molecular tests. Additionally, we evaluated the health status of both positive and negative suiformes by hematological and biochemical parameters. The results show that peccaries and feral pigs play an important role on the maintenance of both *T. evansi* and *T. cruzi* in the Brazilian Pantanal. Health impairment was observed only in the white-lipped peccary infected with *T. evansi*. Despite presenting low *T. evansi* parasitemia, all infected white-lipped peccaries displayed low hematocrit values and marked leucopenia. The hematological values showed that the *T. evansi* infection is more severe in young white-lipped peccaries. The presented data show that feral pigs and peccaries are immersed in the transmission net of both trypanosome species, *T. cruzi* and *T. evansi*, in the Pantanal region.

Sato H, Suzuki K and Yokoyama M. 2008. Visceral helminths of wild boars (*Sus scrofa leucomystax*) in Japan, with special reference to a new species of the genus Morgascaridia Inglis, 1958 (Nematoda : Schneidernematidae) Journal of Helminthology 82(2): 159-168

Twenty-nine Japanese wild boars (*Sus scrofa leucomystax*), collected during the hunting seasons of 2005 and 2006 in the western part of the mainland of Japan (Honshu), were examined for their visceral helminths. Eighteen helminth parasites were prevalent in them, including 17 Nematoda species (*Metastrongylus elongatus, Metastrongylus salmi, Metastrongylus asymmetricus, Metastrongylus pudendotechus, Stephanurus dentatus, Gnathostoma doloresi, Physocephalus sexulata, Ascarops strongylina, Capillaria suis, Ascaris suum, Globocephalus samoensis, Globocephalus longimucronatus, Strongyloides*

ransomi, Trichuris suis, Bourgelatia diducta, Oesophagostomum dentatum, and Oesophagostomum watanabei), and one Cestoda species (*Pseudanoplocephala nipponensis*). Muscle digestion of the diaphragm (using an artificial gastric juice) of 24 wild boars detected a single diplostomulum of probably *Pharyngostomum cordatum*. In addition, four female and six male adults of *Morgascaridia kugii* sp. n. (Nematoda: Schneidernematidae) were recovered from the large intestine of a single wild boar. Examination of an additional 20 samples of the stomach and 27 samples of the large intestine could not find this species. To date, recorded species of the genus *Morgascaridia* are limited to *M. sellsi* collected from wild boars in Uganda and Congo several decades ago, and thence, no records of the recovery are available. *Morgascaridia kugii* sp. n. differed from *M. sellsi* by smaller body dimensions, shorter distance between the precloacal sucker and the cloaca, smaller sizes of the copulatory spicules and the gubernaculum, and smaller sizes of uterine eggs.

de Deus N, Peralta B, Pina S, Allepuz A, Mateu E, Vidal D, Ruiz-Fons F, Martin M, Gortazar C and Segales J. 2008. Epidemiological study of hepatitis E virus infection in European wild boars (*Sus scrofa*) in Spain. Veterinary Microbiology 129(1-2): 163-170.

Evidence of hepatitis E virus (HEV) infection in Spanish domestic pig has been reported and hence it was advisable to search for this zoonotic pathogen in wild boar populations. A total of 150 wild boar serum samples from eight geographic areas from South-Central Spain were used to investigate HEV infection in European wild boar (*Sus scrofa*) by means of serology and PCR and its distribution by age, region and management system. Anti-HEV IgG, IgM and IgA were determined by an in-house ELISA. The overall seroprevalence was 42.7% (range 30.63-55.65%) and 19.6% (range 13.53-27.40%) of the animals tested positive for HEV RNA. Wild boar sequences were, clustered within the genotype 3. This is the first description of HEV infection in Spanish wild boar and the results obtained may suggest a possible role of wild boar as a HEV reservoir for both domestic animals and humans.

de Souza PC, Khayat AS, Seligmann IC and Burbano RMR. 2008. Chromosome comparison between populations of the collared peccary, *Tayassu tajacu*, raised in captivity. Biocell 32(2): 207-210.

The collared peccary (*Tayassu tajacu*) is widely distributed over the American continent, being found from the south of the USA to the north of Argentina. In Brazil, it is spread all over the Country, being one of the potential species to be raised in captivity. Therefore, the cytogenctic techniques could be a potential tool for reproductive monitoring of animals raised in captivity, mainly when destined for commercial purposes. This study had the objective of determining the chromosome number of two populations raised in captivity and characterizing them by GTG banding. For this purpose, an analysis was made of mitotic metaphases obtained from lymphocyte cultures made from blood samples of 11 animals, six of which were from the Northeast and five from the North of Brazil. The results of this analysis showed the same karyotype pattern for the species (2n=30 chromosomes and NF=48), besides corresponding to the South American pattern of the species, i.e., without a translocation between autosomes 1 and 8, chromosome X acrocentric, and no differences were found between the two populations studied. However, chromosomal polymorphisms were observed compared to data from the literature on populations from North and South America.

Herrera HM, Abreu UGP, Keuroghlian A, Freitas TP and Jansen AM. 2008. The role played by sympatric collared peccary (*Tayassu tajacu*), white-lipped peccary (*Tayassu pecari*), and feral pig (*Sus scrofa*) as maintenance hosts for *Trypanosoma evansi* and *Trypanosoma cruzi* in a sylvatic area of Brazil. Parasitol-

ogy Research 103(3): 619-624.

The Brazilian Pantanal has been considered one of the richest and most diverse wetland ecosystems in the world. It is occupied by cattle ranching, and a variety of wildlife species share the same habitats with domestic livestock. We investigated infections of *Trypanosoma evansi* and *Trypanosoma cruzi* in the sympatric suiformes-collared peccary (*Tayassu tajacu*), white-lipped peccary (*Tayassu pecari*), and feral pig (*Sus scrofa*) by parasitological, serological, and molecular tests. Additionally, we evaluated the health status of both positive and negative suiformes by hematological and biochemical parameters. The results show that peccaries and feral pigs play an important role on the maintenance of both *T. evansi* and *T. cruzi* in the Brazilian Pantanal. Health impairment was observed only in the white-lipped peccary infected with *T. evansi*. Despite presenting low *T. evansi* parasitemia, all infected white-lipped peccaries displayed low hematocrit values and marked leucopenia. The hematological values showed that the *T. evansi* infection is more severe in young white-lipped peccaries. The presented data show that feral pigs and peccaries are immersed in the transmission net of both trypanosome species, *T. cruzi* and *T. evansi*, in the Pantanal region.

Cole G, Suedmeyer K and Johnson G. 2008. Pheochromocytoma in an African warthog (*Phacochoerus aethiopicus*). Journal of Zoo & Wildlife Medicine 39(4): 663-666.

A 14-yr-old male African warthog (*Phacochoerus aethiopicus*) with a chronic history of intermittent unilateral epistaxis, degenerative osteoarthritis, and intermittent weakness in the distal lumbar trunk was evaluated to determine the source of epistaxis. No obvious cause was determined, and in light of severe osteoarthritis and a holosystolic cardiac murmur, the animal was euthanized. A tumor of the right adrenal gland involving the medulla was found at gross necropsy. Immunohistochemical staining of the tumor was positive for chromogranin and negative for neurofilament protein, which was diagnostic for pheochromocytoma. No lesions were observed in either nasal cavity. Systolic, diastolic, and mean arterial pressures measured at the time of immobilization were elevated when compared with another African warthog immobilized with a similar anesthetic regimen. Additionally, the warthog had pronounced serum norepinephrine dominance with a norepinephrine:epinephrine ratio of 10.0, compared with 0.36 from clinically normal warthogs. Practitioners should consider pheochromocytoma when evaluating warthogs or swine for epistaxis.

Massei G, Cowan DP, Coats J, Gladwell F, Lane JE and Miller LA. 2008. Effect of the GnRH vaccine GonaCon on the fertility, physiology and behaviour of wild boar. Wildlife Research 35(6): 540-547.

Fertility control has the potential to be used as an attractive alternative to lethal methods for limiting population growth in overabundant species. This study tested the effectiveness and potential side effects of the single-dose gonadotrophin-releasing hormone (GnRH) vaccine GonaCon on the physiology and behaviour of two groups of captive female wild boar in two sequential trials (Trial 1 and Trial 2). Following vaccination with GonaCon, data on contraceptive effectiveness were recorded as well as data on time budget, social rank, bodyweight, haematology and biochemistry. The concentration of GnRH-antibody titres peaked 2 - 6 weeks after vaccination and remained relatively high 12 weeks after vaccination. In Trial 1, all control females and none of the treated females gave birth. In Trial 2, faecal progesterone of treated females decreased to basal levels within a month of vaccination. No differences in time budget, social rank and blood parameters were observed between treated and control females. Bodyweight increased more in treated females than in controls. These results indicated that GonaCon can suppress reproduction of wild boar with no significant short-term effects on behaviour and physiology. GonaCon can

be regarded as an effective, humane and safe contraceptive for managing wild boar populations.

Cowled B and Garner G. 2008. A review of geospatial and ecological factors affecting disease spread in wild pigs: Considerations for models of foot-and-mouth disease spread. Preventive Veterinary Medicine 87(3-4): 197-212.

Around the world, wild boar or feral pigs are infected by a range of infectious organisms with important, productivity, public health or economic consequences. Consequently, the potential role of wild pigs in outbreaks of important exotic diseases, like foot-and-mouth disease (FMD), has been a significant consideration in many countries. Disease modelling is one means to study the epidemiology of disease and has been used to assess the potential role of wild pigs in FMD incursions. Many of these models have been strategic in nature. They have contributed to a broad understanding of disease control in wild pigs (e.g. the concept of threshold densities and the need to cull pigs below this density for disease fadeout to occur), but have not incorporated many of the key drivers affecting disease behaviour. Some of these drivers include important ecological, behavioural and geospatial relationships, such as interaction between different host species and the distribution, density and connectivity of pig populations. New approaches to modelling disease spread such as spatial simulation models use spatial data and explicitly incorporate geospatial relationships. These approaches can provide useful quantitative models that can be used to explore mitigation strategies under specific disease outbreak conditions. However, to date, most studies have been limited by inadequate data, and computational issues or have not explored mitigation strategies. To inform management strategies for emergency epidemics such as FMD in wild pigs, there is scope to further develop and use models to explore a range of incursion scenarios and investigate the efficacy of different mitigation strategies.

Delgado R, Fernandez-Llario P, Azevedo M, Beja-Pereira A and Santos P. 2008. Paternity assessment in free-ranging wild boar (*Sus scrofa*) - Are littermates full-sibs? Mammalian Biology 73(3): 169-176

Multiple paternity within litters occurs in various groups of mammals exhibiting different mating systems. Using seven genetic markers (i.e., microsatellites), we investigated the paternity of littermates in free-ranging wild boar (*Sus scrofa*) in a Mediterranean habitat. Using the software CERVUS 2.0 we estimated the probability of detecting multiple paternity across all loci (D), the probability of paternity (W) and a statistic Delta that allows the assignment of paternity to the most likely male with strict and relaxed levels of confidence. Multiple paternity was inferred for one of the nine analysed litters at the 80% confidence level. This suggests that a single male may control the access to receptive adult females and it shows that multiple paternity is not very common in the studied free-ranging wild boar population. Despite the possible occurrence of sperm competition and/or female cryptic choice, mate guarding seems to play a significant role in sexual selection. To better understand the wild boar's mating strategies further studies analysing the reproductive success of both sexes and under different environmental conditions should be conducted.

Harris JM, Cerling TE, Leakey MG and Passey BH. 2008. Stable isotope ecology of fossil hippopotamids from the Lake Turkana Basin of East Africa. Journal of Zoology 275(3): 323-331

The diet of African hippopotamids can be documented through delta C-13 analyses of enamel and other tissues. Analysis of a 10-million-year sequence of hippopotamids in and near the Lake Turkana Basin of northern Kenya shows that hippos have included a substantial fraction of C-3 vegetation in their diets since the late Miocene when C-4 vegetation first appears in hippo diet as a measurable fraction. The C-4

component of vegetation becomes dominant (> 50%) by Upper Burgi time (c. 2 million years ago) but does not reach 100% for all individuals. It is therefore not unexpected that the delta C-13 values of modern hippopotamids show a higher fraction of dietary C-3 biomass than has been estimated from traditional observations. Analysis of delta O-18 of hippos from different stratigraphic levels shows no systematic trend over time; the average value for fossil hippos over the last 10 million years is similar to that of modern hippos from the Omo River system.

Cerling TE, Harris JM, Hart JA, Kaleme P, Klingel H, Leakey MG, Levin NE, Lewison RL and Passey BH. 2008. Stable isotope ecology of the common hippopotamus. Journal of Zoology 276(2): 204-212

The diet of African hippopotamids can be documented through stable carbon isotope ratios (C-13/C-12) analyses of enamel and other tissues. The common hippopotamus *Hippopotamus amphibius* is widely assumed to be a pure grazer; however, the C-13/C-12 ratios of modern *H. amphibius* show a higher fraction of dietary C-3 biomass than estimated from traditional observations. Isotope profiles of modern hair and modern tooth enamel confirm that *H. amphibius* has a variable diet in both the short- (seasonal) and long- (sub-decadal) time scales. Isotopic analyses of extant mammals from the same parks as the analyzed hippos provide comparative examples for diets of C-3-browsers and C-4-grazers. Oxygen isotope ratios (O-18/O-16) show that the hippo is consistently the most O-18-depleted mammal in any one ecosystem; this directly reflects its semi-aquatic habitat.

Schwarm A, Ortmann S, Wolf C, Streich WJ and Clauss M. 2008. Excretion patterns of fluid and different sized particle passage markers in banteng (Bos javanicus) and pygmy hippopotamus (Hexaprotodon liberiensis): Two functionally different foregut fermenters. Comparative Biochemistry & Physiology. Part A, Molecular & Integrative Physiology 150(1): 32-39

Processing of ingesta particles plays a crucial role in the digestive physiology of herbivores. In the ruminant forestomach different sized particles are stratified into a small and a large particle fraction and only the latter is regurgitated and remasticated to smaller, easier-to-digest particles. In contrast, it has been suggested that in non-ruminating foregut fermenters, such as hippopotamuses, larger particles should be selectively excreted since they tend to be digested at a slower rate and hence can be considered intake-limiting bulk. In our study we determined the mean retention time (MRT) of fluids and different sized particles (2 mm and 10 mm) in six pygmy hippos (*Hexaprotodon liberiensis*) and six banteng (*Bos javanicus*) on a diet of fresh grass at two intake levels. We used cobalt ethylendiamintetraacetate (Co-EDTA) as fluid and chromium (Cr)-mordanted fibre (2 mm) and cerium (Ce)-mordanted fibre (10 mm) as particle markers, mixed in the food. Average total tract MRT for fluid, small and large particles at the high intake level was 32, 76 and 73 h in pygmy hippos and 25, 56 and 60 h in banteng, and at the low intake level 39,109, and 105 h in pygmy hippos and 22, 51 and 58 h in banteng, respectively. In accordance with the prediction, large particles moved faster than, or as fast as the small particles, through the gut of pygmy hippos. In contrast, large particles were excreted slower than the small particles in the ruminant of this study, the banteng. Pygmy hippos had longer retention times than the banteng, which probably compensate for the less efficient particle size reduction. Although the results were not as distinct as expected, most likely due to the fact that ingestive mastication of the larger particle marker could not be prevented, they confirm our hypothesis of a functional difference in selective particle retention between ruminating and non-ruminating foregut fermenters.

Adega F, Chaves R and Guedes-Pinto H. 2008. Suiformes orthologous satellite DNAs as a hallmark of *Pecari tajacu* and *Tayassu pecari* (Tayassuidae) evolutionary rearrangements. Micron 39(8): 1281-1287.

In a broad general way, eukaryotic satellite DNA sequences are characterized by a highly dynamic molecular behaviour due to concerted evolution that leads to rapid change between repeat sequences of different species, achieved by amplification of new variants during speciation or by gradual sequence evolution due to the accumulation of nucleotide substitutions. There are, although exceptions for this almost universal rule. We isolated variants from both the Mc1 and Ac2 pig (*Sus scrofa*, Suidae) satellite DNA families from the genomes of two Tayassuidae members: *Pecari tajacu* and *Tayassu pecari*, which have highly derived karyotypes. The presence of these sequences in both families' genomes (Suidae and Tayassuidae) implies their existence in a common ancestor, what confers to the variants the status of orthology and the approximate age of, at least 40 million years. While at the molecular composition level these orthologous sequences are highly homologous, cross-species physical mapping revealed a completely different chromosomal location in Suidae versus Tayassuidae families, most probably, reflecting the high level of divergence and chromosomes evolution pathways after radiation of each family. Detailed comparative analysis of the satellites assignment on the peccary's chromosomes revealed its co-localization with homologous evolutionary breakpoints in both species, suggesting their involvement in the rearrangement events. The complex behavior of the repeats evolution in the pig/peccaries genomes is here clearly illustrated. These sequences are molecularly preserved for a considerable period of time and display slow rates of sequence change, but show a dynamic motion behavior throughout the peccary's genomes that accompanied the great architectonic reorganization of Tayassuidae chromosomes during evolution.

Priya PM, Gururaj K, Rameshkumar P and Shanmugasundaram K. 2008. Isolation and characterization of *Pasterrella multocida* from a wild boar. Indian Veterinary Journal 85(9): 992-993.

Pasteurellosis is a common bacterial disease encountered in domestic and wild animals. Kaden et al. (1999) and Vicente et al. (2004) reported Pasteurellosis in European wild boar, but no such reports are available in India. Hence, the present study records isolation and characterization of *Pasteurellosis multocida* from a septicemic case of Pasteurellosis in a wild boar (*Sus scrofa*).

Taxonomic, Morphological, Biogeographic and Evolutionary Studies

Reimann CK and Strauch F. 2008. A skull of Hippopotamus from the Pliocene of Elis (Peloponnesus, Greece). Neues Jahrbuch fur Geologie und Palaontologie-Abhandlungen 249(2): 203-222

An LIP to now undescribed Late Pliocene/Early Pleistocene fossiliferous site on the Greek peninsula Peloponnesus, province of Elis, has revealed large invertebrate and vertebrate faunas. In this study, a detailed examination of the locality is given, together with the description of a nearly complete hippopotamid skull. According to comparable measurements and the taxonomic discussion of European Plio-/ Pleistocene Hippopotamidae, this skull is ascribed to the taxon *Hippopotamus antiquus*.

Ishiguro N, Sasaki M, Iwasa M, Shigehara N, Hongo H, Anezaki T, Long VT, Hao PX, Trach HX, Nam NH and Thanh VN. 2008. Morphological and genetic analysis of Vietnamese *Sus scrofa* bones for evidence of pig domestication. Animal Science Journal 79(6): 655-664.

In the present study, we used morphological and genetic analyzes to distinguish bones of domestic boars from those of wild boars. We analyzed 65 *Sus* bones (cranium, mandible and teeth) stored in three research institutes in Vietnam and in a village in Vietnam. Based on comparison of bucco-lingual measurements of mandibular parts, the 58 specimens were morphologically classified into two size groups: a large

bone group and a small bone group. Analysis of 572-bp mitochondrial DNA (mtDNA) sequences indicated that the large bones had genetic links to wild boar lineage including Ryukyu, Taiwan and Korean wild boars, and that the small bone group was closely related to East Asian domestic pigs. The phylogenetic analysis and parsimonious networks constructed among mtDNA haplotypes belonging to Ryukyu wild boar lineage showed that the Ryukyu wild boar is closely related to the Vietnamese wild boars, and uniquely miniaturized on their islands after the Ryukyu archipelago became isolated from the Asian continent.

Ecology and Conservation Studies

Gomez JM and Hodar JA. 2008. Wild boars (*Sus scrofa*) affect the recruitment rate and spatial distribution of holm oak (*Quercus ilex*). Forest Ecology & Management 256(6): 1384-1389

The role of herbivores in controlling plant population abundance and distribution is unclear. We experimentally determine the effect of damage by wild boars (*Sus scrofa*) in recruitment rate and spatial pattern of a Mediterranean tree, the holm oak (*Quercus ilex*). We monitored oak establishment in the Sierra Nevada of southeastern Spain during 4 years (1999-2002) in four plots, two fenced and two unfenced that were used as controls. In addition, we planted 1-year-old seedlings in all microhabitats, both in fenced and control plots, to experimentally determine the effect of wild boar on their microhabitat-dependent survival. Despite seedling abundance being similar inside and outside the fences, sapling abundance diminished up to 50% in unfenced plots compared to fenced plots. Wild boars also seemed to modify the spatial distribution of seedlings and saplings. Whereas seedlings were most abundant under pines both in fenced and control plots, sapling abundance was highest under pine trees in fenced plots, but similarly abundant under pines or shrubs in control plots. This change in spatial pattern was due to the effect of wild boars killing seedlings when looking for food under pines. The effects of the different mortality factors were not additive. Where ungulates are absent, recruitment is high and occurs under oaks and especially under pines. Where wild boars are present, recruitment diminishes and occurs mostly under shrubs and pines. Wild boars arrest population growth and modify the spatial pattern of recruitment.

Schley L, Dufrene M, Krier A and Frantz AC. 2008. Patterns of crop damage by wild boar (*Sus scrofa*) in Luxembourg over a 10-year period. European Journal of Wildlife Research 54(4): 589-599

In many European countries, the wild boar (*Sus scrofa*) is often associated with crop damage. In this study, we analyse data relating to 13,276 cases of wild boar damage to agricultural crops over a 10-year period in Luxembourg (an area of 2,586 km(2) in Western Europe). Results show that (1) damage is more severe in this area than in others; (2) damage to permanent grassland is far more frequent and more severe than damage to annual crops; (3) trichomatous crops such as barley are avoided; (4) damage is seasonally distributed according to type of crop; (5) damage is distributed spatially in a non-uniform manner; (6) damage intensity is significantly correlated with wild boar hunting bags, both over time and space. We suggest that wild boar management strategy should always take into account the issue of damage to agricultural crops. Our results imply that measures for preventing or reducing damage should be more targeted in time and space and that adjustments to cropping patterns should contribute towards a reduction of wild boar damage.

Tsachalidis EP and Hadjisterkotis E. 2008. Wild boar hunting and socioeconomic trends in Northern Greece, 1993-2002. European Journal of Wildlife Research 54(4): 643-649

Wild boar (*Sus scrofa*) populations increased worldwide in the last decade, but boar hunters have decreased. To maintain and increase hunters and to clarify the problems for sustainable hunting, we investigated their activities, attitudes, and socioeconomic trends. Drama and Kavala, Northern Greece have the best wild boar habitat in the country. We estimated the percentage of hunters hunting wild boar in Drama and Kavala and studied their profile to determine how the recent socioeconomic changes in the region affected numbers, activities, attitudes, and socioeconomic trend, from 1993 to 2002. In 1993, data were gathered through a questionnaire distributed randomly to 411 and 480 hunters in Drama and Kavala, respectively. In 2002, 320 and 400 questionnaires were collected in Drama and Kavala, respectively. In Drama, 13.6% of the hunters hunted wild boar in 1993 and 12.3% in 2002. In Kavala, 10.0% hunted wild boar in 1993 and 9.3% in 2002. The average age of hunters in Drama in 1993 was 37.9 years and 39.4 in 2002. In Kavala, the average age per hunter was reduced from 42.3 to 37.4 years. The average hunting experience had increased by 4.8% and 0.6%, respectively. In 2002, there was an increase in the distance traveled for hunting, the level of education of the hunters, the number of people working in the private sector, and in the public service. Wild boar hunters are mainly married, middle income class, earning 4,000-7,500 Euros/year. The above data will allow managers to better understand the socioeconomics of the hunters of wild boar and may be able to use the data to encourage increased hunting.

Nores C, Llaneza L and Alvarez MA. 2008. Wild boar *Sus scrofa* mortality by hunting and wolf *Canis lupus* predation: an example in northern Spain. Wildlife Biology 14(1): 44-51

Over the last decades, wolf *Canis lupus* predation in northern Spain has focused on wild ungulates, even though livestock and other prey, such as other carnivores and small mammals, and garbage have been available. During 1994 and 1995, we studied the impact of wolf predation on wild boar *Sus scrofa* in four study areas in Asturias, Spain. The diet of the wolf was assessed by scat collection and analysis (N = 106, 329, 372 and 649, respectively). The mortality of wild boar was deduced from density estimates and hunting records from the Nature Reserve of Somiedo. Wild boar represented 3-31% of the biomass of food found in the wolf scats in the study areas. We estimated that 75% of wild boars eaten were piglets. The wild boar mortality rate was estimated at 38% (146 dead individuals out of 385). Wolf predation was estimated to cause 12% of the mortality of wild boar and to affect 4.5% of the wild boar population. Hunting had a higher importance as a mortality factor than wolf predation (31 and 12%, respectively). Even though, a two-year study is insufficient to come to a final conclusion, our results suggest that wolf predation may have a low impact on young wild boar and that a hunting pressure of the size we found is unlikely to control the wild boar population.

de Azevedo FCC and Conforti VA. 2008. Decline of peccaries in a protected subtropical forest of Brazil: toward conservation issues. Mammalia 72(2): 82-88

While once abundant in the subtropical forest of Iguacu National Park (INP) in Brazil, white-lipped and collared peccary seem to have declined considerably in the last decade. Basic information on the influence of anthropogenic factors on peccary abundance in INP is scarce. To assess the conservation status of white-lipped and collared peccaries in INP and surrounding areas, we recorded encounter rates from 1997 to 2000 along transects in eight study sites subjected to different levels of illegal hunting and vehicle traffic. The average encounter rate for the eight study sites for collared peccaries was 0.022 +/- 0.021 (+/- SD). Despite our intensive monitoring of transects, no signs of white-lipped peccaries were recorded and this species seemed to be locally extinct. In addition, we analyzed the attitude of local people towards peccaries and INP through interviews. Perceptions of local people were strongly positive towards peccaries and INP and seemed to be influenced by the potential of illegally exploiting peccaries within the lim-

its of INP. Our results suggest that efforts to minimize the intensity of vehicle traffic and illegal hunting should be implemented if remaining collared peccaries are to survive in INP.

Harrison ME, Kalindekafe MP and Banda B. 2008. The ecology of the hippopotamus in Liwonde National Park, Malawi: implications for management. African Journal of Ecology 46(4): 507-514

The hippopotamus population in Liwonde National Park, Malawi was studied from December 2002 to June 2003. Motorboat censuses along the River Shire counted 640 animals, but because of the large number of hippos in temporary water sources at the time, the true number is probably closer to 950. Marked shifts in hippo distribution from the Shire into temporary water sources occurred as the wet season advanced. Because of the Shire's year-round water supply, the hippo population is not regulated by the availability of aquatic refuges, but by food availability. By following feeding tracks, dry season grazing range was estimated to extend 5 km east and 1 km west of the river. Grazing intensity transects and visual estimates indicated only a small portion of this area is suitable for hippo grazing, leading to over-grazing in suitable areas. Coupled with low primary productivity levels in Liwonde, this means that dry season food competition between hippos and other herbivores is probably high. Recent proposals to raise the Shire's dry season water level should be considered very carefully, as this will flood late dry season grazing grounds, thereby intensifying grazing competition and increasing grazing pressure in remaining grazing areas, having potentially serious impacts on the animal community.

Herrero J, Garcia-Serrano A and Garcia-Gonzalez R. 2008. Reproductive and demographic parameters in two Iberian wild boar *Sus scrofa* populations. Acta Theriologica 53(4): 355-364.

From 1990 to 2006, we studied the demographic, reproductive, and biometric characteristics of two Iberian wild boar *Sus scrofa* (Linnaeus, 1758) populations in contrasting environments. In the Pyrenees (studied in 1990-1993), forest cover is high, hunting pressure is low, and the density of wild boar is high. In the Ebro Valley (studied in 1994-2006), there are few shelter areas for boars, hunting pressure is high, and density is very low. In the second semester of life and after two years of age, the sows in Ebro Valley were heavier than were those in the Pyrenees. Pregnancy during the first year of life was frequent in the Ebro Valley and rare in the Pyrenees. Litter sizes, ovulation rates, and intrauterine mortalities did not differ significantly between the two populations, but the foetal sex ratio in the Ebro Valley was skewed significantly towards males. Life expectancy was lower in the Ebro Valley (6 yr) than it was in the Pyrenees (10 yr). In the Ebro Valley 75% of the wild boar were > 24 months old, whereas in the Pyrenees, the proportion was 59%. We suggest that shelter availability influenced the growth, productivity, hunting pressure, and life expectancy in the two Iberian populations of wild boar.

Focardi S, Gaillard JM, Ronchi F and Rossi S. 2008. Survival of wild boars in a variable environment: Unexpected life-history variation in an unusual ungulate. Journal of Mammalogy 89(5): 1113-1123.

The wild boar (*Sus scrofa*) is a large, sexually dimorphic ungulate exhibits a life-history tactic different from what would he predicted for a mammal of its size. In particular, litter size is larger and adult survival usually lower in wild boars than in other species of comparable size. We used capture-mark-recapture methods to model survival in a Mediterranean population (*S. s. majori*) of wild boars during ail 8-year period, using a large sample of individually tagged animals of known age, to investigate demographic patterns and the effects of variable environmental conditions (e.g. summer droughts), which are believed to have a strong impact on the demography of this species. Contrary to the predictions based on Our Current knowledge of life-history theory, survival of wild boars differed less among age classes and

between sexes than has been reported in other large mammals.. As predicted from current theories on sexual selection. the impact of environmental factors was stronger on males than on females. This study documents for wild boars a life-history tactic different from the accepted model for large ungulates but similar to the tactic observed in small terrestrial mammals.

Novillo A and Ojeda RA. 2008. The exotic mammals of Argentina. Biological Invasions 10(8): 1333-1344.

Exotic mammals in South America represent about 20% of world mammal introductions. The aim of our paper is to provide a global assessment of the exotic mammals of Argentina, their pathways, impacts, and a synthesis of their attributes as potential invasive species. We reviewed and compiled data from a diversity of sources and databases on alien mammals occurring in feral state exclusively. We recorded 18 species of exotic mammals for Argentina. The majority of introductions occurred between the 18th and 19th centuries and their ports of entry were located in temperate ecosystems, between 34 degrees and 55 degrees SL. Most of their entry pathways were associated with human activities (e.g. sport hunting, food and fur industry). The exotic mammals occupy ecoregions similar to their original distributions, but most of them have experienced a range expansion to novel habitats. The fauna of exotic mammals of Argentina represents a good opportunity to understand the dynamics of the invasion process as they represent a diversity of ecological groups and environmental contexts.

Theuerkauf J and Rouys S. 2008. Habitat selection by ungulates in relation to predation risk by wolves and humans in the Bialowieza Forest, Poland. Forest Ecology & Management 256(6): 1325-1332.

Predation risk is an important factor influencing the distribution of ungulates and their impact on forest structure. However, simultaneous predation risk by wolves and humans is rarely considered in the analyses of habitat selection by ungulates. We counted ungulate pellets on transects to analyse the influence of wolves and humans on ungulate density distribution in the Bialowieza Forest, Poland. We assessed whether (I) forest exploitation influenced ungulate habitat selection, (2) ungulate density was higher in areas without human hunting, (3) ungulates avoided the surroundings of a major road, (4) prey density was higher in the strife zone between home ranges of wolf packs both in the presence and absence of human hunting, (5) ungulates avoided areas selected by wolves, and (6) wolf kill sites were in high prey density areas. Red deer (*Cervus elaphus*) and wild boar (*Sus scrofa*) selected unexploited over exploited forests and areas without hunting, whereas roe deer (*Capreolus capreolus*) preferred exploited forests. Wild boar and European bison (*Bison bonasus*) avoided the area within 300 m of a major road, whereas we could not detect any avoidance by red or roe deer. Prey density was not higher in wolf strife zones, regardless of human hunting. Ungulates did not avoid areas selected by wolves. Wolves killed red deer in areas with prey density of about 4 red deer/km^2, regardless of whether the average red deer density in those areas was higher or lower. We conclude that habitat alteration by forest exploitation and hunting by humans influenced the density distribution of ungulates more than predation risk by wolves.

White AM and Cameron EZ. 2008. Communal nesting is unrelated to burrow availability in the common warthog. Animal Behaviour 77(1): 87-94.

Warthogs, *Phacochoerus africanus*, are an unusual ungulate. They are facultative cooperative breeders where females within the same population display both solitary and cooperative reproductive strategies. Warthogs require burrows for sleeping and rearing their young, yet they are unable to dig their own burrows and rely on aardvark excavations. Studies of warthogs have failed to show any reproductive benefits

to females participating in communal care and suggest a reproductive cost to cooperation. The ecological constraints hypothesis proposes that environmental factors limit an individual's ability to successfully disperse and reproduce. In this study we investigated whether limitations in burrow sites can explain cooperative breeding in this species. We checked over 500 burrows for signs of use systematically for 1 year to determine whether burrows were a limiting resource and to investigate burrow use preferences. Our methodology allowed us to determine whether burrows were used by adults with young or by adults without young. We found that burrow availability did not appear to pose an ecological constraint on independent living, as the percentage of burrows used remained relatively low throughout the year. Additionally, the number of burrows in a warthog clan area did not influence the percentage of females breeding cooperatively. Predator avoidance appeared to be the main factor influencing individual burrow selection by warthogs and communal nesting may best be explained as a form of antipredator behaviour.

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The newsletter of the IUCN/SSC Pigs, Peccaries and Hippos Specialist Group (previously Asian Wild Pig News)

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The IUCN/SSC Pigs, Peccaries and Hippos Specialist Group PPHSG is one of several Specialist Groups of the Species Survival Commission (SSC) developed by the IUCN to foster conservation, research and dissemination of information for species of conservation concern.

It consists of a group of technical experts focusing on the conservation and management of wild pigs, peccaries and hippos.

The broad aim of the PPHSG is to promote the long-term conservation of wild pigs, peccaries and hippos and, where possible, the recovery of their populations to viable levels.

Pigs, peccaries and hippopotamuses are non-ruminant ungulates belonging to the Suborder Suiformes of the Order Artiodactyla (the even-toed ungulates).
Within the Suborder Suiformes, pigs belong to the Family Suidae, peccaries to the Family Dicotylidae and hippopotamuses to the Family Hippopotamidae.

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