

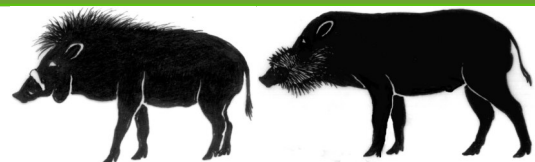
Suiform Soundings

Newsletter of the IUCN / SSC Wild Pig,
Peccary and Hippo Specialist Groups



Volume 17(2)
February 2019
ISSN: 1446-991-X





Suiform Soundings is the newsletter of the IUCN/SSC Wild Pig, Peccary, and Hippo Specialist Groups.

This newsletter is electronically available at:

<https://sites.google.com/site/wildpigspecialistgroup/iucnssc-wild-pig-specialist-group/suiform-soundings-2>

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Bornean bearded pig (*Sus barbatus barbatus*) in Bako National Park, Sarawak, Malaysia. Photo: Daniel Kong.

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Editorial



Dear fellow reader,

It brings me great pleasure to once again see that Bearded Pig on the front cover of this latest issue of Suiform Soundings. Eighteen years ago I started this current newsletter, then still named Asian Wild Pig News, also with a photo of a Bearded Pig. It is this remarkable species of migratory suid that first piqued my interest in the greater world of pigs and peccaries. Bearded pigs – also dubbed the Great Jungle Hipster for its hirsute appearance – epitomize the features that make this group of species so interesting.

Pigs and peccaries are big and normally common enough to have significant impacts on the environment through their feeding and rooting behaviour -- they are ecological keystone species. They are also big and common (and tasty) enough to be the favourite meat for billions of people, either in their wild, or more commonly these days, domestic forms, which also makes them cultural keystone species. The species are smart and sensitive, displaying intricate group behaviour, and caring deeply for their litters; no wonder that characters like Babe or the flatulent Pumbaa became so popular. Pigs and peccaries thus have a lot to say for themselves in the animal kingdom.

It is therefore permanently disturbing me that so many pig and peccaries species are struggling to survive. Pygmies hogs, once thought to be extinct, have just about recovered through the wonderful and concerted efforts of the Pygmy Hog Conservation Program. Other species, however, like the Visayan Warty Pigs, are relatively safe in captivity but may be all but extinct in the wild. Elsewhere, Chacoan Peccaries, which were only discovered to be extant in 1971, are rapidly losing their Chaco habitat to agricultural monocultures like soy that, ironically, feed the domestic pigs and cattle of the world, or produce our tofu and vegetable oils.

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The edition of Suiform Soundings is once again filled with exciting news from the world of peccaries and pigs, with excellent stories on feral boars in Uruguay, conservation of Jawan Warty Pig, behavioural ecology of Bawean Warty Pigs, veterinary science of Collared Peccaries and more. I hope you enjoy reading the news and that you keep supporting the efforts of the specialist groups working on these species.

That brings me to the end of this editorial. I recently stepped down as Co-Chair of the Wild Pig Specialist Group after serving as its Chair for 6 years. Other commitments and another IUCN group I lead, were demanding too much of my time, and I felt I needed to step back and let others take over. With Johanna Rode-Margono joining me as Co-Chair, it was a good moment to pass on the baton to someone highly skilled and with ongoing conservation efforts on wild pig conservation. This won't be the end of my commitment to wild pigs though – these animals are far too cool to walk away from.

Erik Meijaard





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Current distribution of Javan Warty Pig in East Java

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Abstract

The Javan warty pig (*Sus verrucosus*) is endemic to Java and has been reported in very low numbers in a few patches of human dominated forests. The latest distribution assessment in 2004 reported a significant decline of the species from being widely distributed from West Java to East Java to only a few sites in the latter. Our study aimed to reassess the current status of Javan warty pig in East Java. We interviewed local communities and poachers in areas with reported pig distribution and searched social media for pictures and other possible evidence to gather information on the presence of the species and its distribution. The results reveal that there remain several populations of warty pigs in Madiun, Probolinggo, Bojonegoro, Mojokerto, Gresik and Tuban districts as well as Alas Purwo National Park and, possibly, Nusa Barung island. Our study adds important new information about the species in East Java.

Keywords: Javan warty pig, *Sus verrucosus*, wild pig, distribution, East Java

Introduction

The Javan warty pig (*S. verrucosus*) is native and endemic to Java. Together with the common wild pig, *S. scrofa*, it is the only suid on the island (Semiadi & Nugraha, 2009; Fujinuma & Harisson, 2012), where they are believed to have co-existed since the late Pleistocene or early Holocene (Frantz, et.al, 2016). Olivier (1925) reported that *S. verrucosus* and *S. scrofa* were both common in West Java occurring in similar habitats from coastal to montane forests (Meijaard, 2014).

The Javan warty pig is described to roam areas of shifting cultivation, despite high human densities and hunting pressure (Schütz, 2015). For the past three decades, approximately five million hectares of forest habitat has been lost from Java (Global Forest Watch, 2014) and, in addition, the species has sustained high hunting pressure. Local sport hunters and communities engage in hunting for food, sport or in reprisal for crop damage, the latter especially near cultivated areas. The exact annual number of hunted warty pigs remains unknown, although it is believed to be one of the main drivers of its population decline (Oliver & Leus, 2008; Schutz, 2015; Semiadi and Meijaard, 2006). In some areas, the species is considered a pest (Semiadi & Nugraha, 2009), resulting in farmers depositing poisoned bait to eradicate the culprits and prevent crop damage. The combination of habitat loss and ongoing persecution has resulted in the species being pushed to the brink of extinction in the wild and listed as “Endangered” on the IUCN Red List (Semiadi, et al., 2016). However, warty pigs are not listed as “protected species” in Indonesia.

In 1982 the warty pig was reportedly still widely distributed across most of Java. In East Java the species was recorded in Gresik, Tuban, Bojonegoro, Jember, Banyuwangi, Lumajang, Probolinggo, and Lamongan districts (Blouch, 1988), whereas several of these places remain unconfirmed in 2017 (Linkie et al, 2017). In 2002, the species had disappeared except from the





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area around Mt. Penanggungan and Mt. Kelud, Mt. Argapura, Merubetiri National Park and at the slopes of Mt. Raung (Linkie et al., 2017; Meijaard, 2002). In 2004, an interview survey suggested that the population and distribution range had decreased further. In East Java, it was only found in Bojonegoro, Gresik and Lumajang, although a camera trap survey in 2015 recorded it only at Blora and Bojonegoro (Rademaker, 2015; Semiadi & Meijaard, 2006). This survey also reported that *S. verrucosus* was present in only 47 percent of localities where it was known to occur in 1982 (Rademaker, M. 2015; Semiadi and Meijaard, 2006). Since then, warty pigs were regarded as “locally extinct” in most of East Java. This study set out to assess the current distribution of Javan warty pigs in East Java.

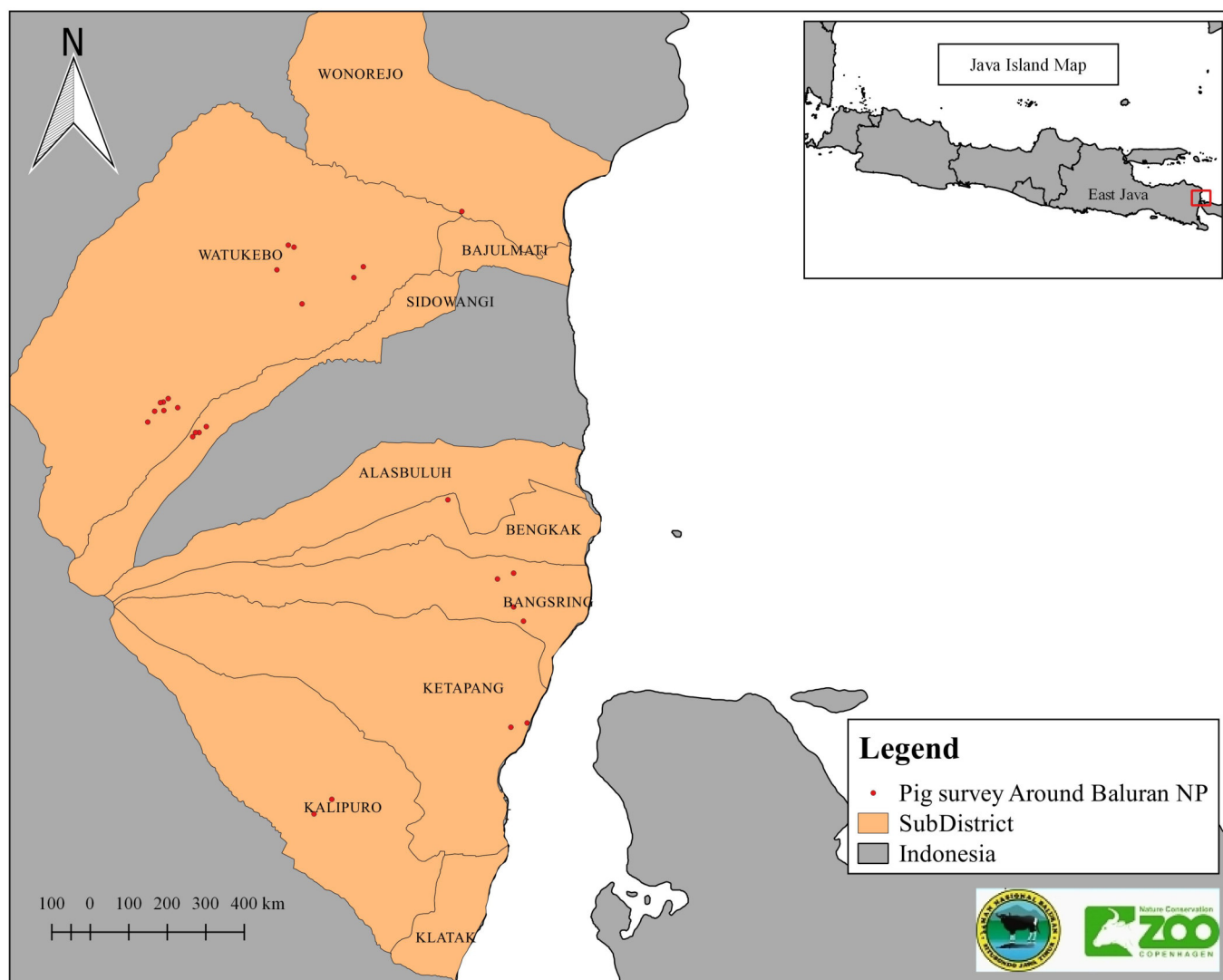


Fig. 1: Coordinate points of the interview survey.

Methods

We undertook interview surveys, both directly and via social media. Additionally, we compiled recent published data and obtained personal information about the occurrence of *S. verrucosus* in East Java.

Thirty people who engaged in pig hunting were interviewed directly in eight villages in Banyuwangi and Situbondo, and 10 local poachers from different regencies in East Java were





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interviewed via social media. The respondents were farmers or collectors of forest products, PERBAKIN members (Persatuan Menembak Sasaran dan Berburu Indonesia - Indonesian Target Shooting and Hunting Association) and local poachers. The interviews took place in the following villages, Pringgondani, Pasewaran Utara, Pasewaran Selatan, Blangguan, Maelang, Alas Buluh, Wonorejo and Sumberdilem. The local poachers were from Gresik, Tuban, Probolinggo and Bojonegoro.

Results

The respondents described seven types of wild pigs: celeng gotheng, celeng ubi, celeng tapis, celeng dung-dung, common wild boar, celeng batangan and celeng kutilen. From the description of the seven types of pigs, four matched the characteristics of Javan warty pig: celeng gotheng, celeng ubi, celeng kutilen and celeng tapis. According to the descriptions, these “species” distinguished themselves with the presence of facial warts and contrasting golden yellowish hair on the abdomen (Rademaker, et al, 2016; Meijaard, 2006). Most villagers and farmers confessed that they did not know to distinguish between *S. verrucosus* and *S. scrofa*. Only two respondents from two villages, Alas Buluh and Wonorejo, were familiar with warty pig and illustrated it as distinct species (Fig.2). However, they had not seen any warty pigs since the 1980s.



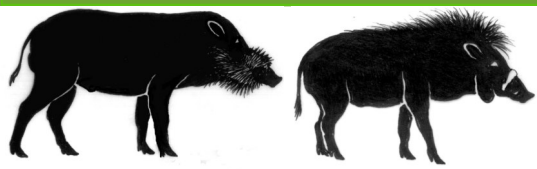
Fig. 2: Illustration of pigs based on information from local community. *Celeng gotheng*/male warty pig (left) and celeng tapis/female warty pig (middle), and common wild pig (right).

Interviews with Alas Purwo National Park staff suggested that that warty pigs are present in the park. Evidence was provided as pictures of warty pigs photographed by one of the park staff inside the park’s teak forest habitat in 2011 and by camera trap in 2015 (Fig.3). A BKSDA staff photographed a pig on Nusa Barung island in 2007, which shows a group of pigs with warty pig traits (Fig. 4), however, further survey is needed to confirm this.



Fig. 3: Pictures of warty pigs in Alas Purwo NP in 2011 by Hariyanto (left) and Alas Purwo NP’s camera trap in 2015 (right).





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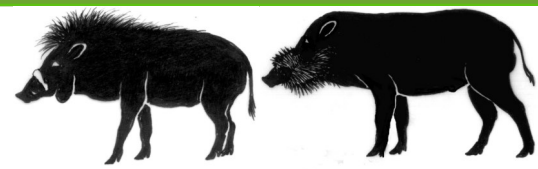


Fig. 4: Pictures of pigs that are suspected as warty pigs in Nusa Barung, Jember.

Information compiled from PERBAKIN and local poachers suggests that the warty pig population has decreased significantly and they were very rarely seen around Banyuwangi since the 1980s. A PERBAKIN member (Heru, pers. Comm., 2017) last saw a warty pig in 1989 in a small group with four individuals. Other PERBAKIN members and local poachers reported wild warty pig populations in Madiun, Gresik, Probolinggo, Tuban, Mojokerto, and Bojonegoro. This was partly corroborated by the act that in 2018 alone hunters killed 40 warty pigs in Bojonegoro and 14 warty pigs

in Tuban between June and November. Local poachers report that most of the pigs inhabiting the teak forest in Bojonegoro and Tuban are the warty pigs. The evidence --- pictures of hunted individuals --- appear to support this statement, since all pictures collected depicted what was identified as warty pig (Fig.5 and 6).



Fig. 5: Pictures of pigs from hunting activities in Mojokerto (left) and Tuban (right) in 2017 by Deny.



Fig. 6: Pictures of warty pigs from hunting activity in Bojonegoro in 2017 (left) and in 2018 (right).





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Discussion

Our interviews suggest that most local people are not knowledgeable about the two species of pigs in Java. Consequently, it is difficult to extract accurate information about a population decline for either of the species. For example, if they consider *S. verrucosus* and *S. scrofa* as one species, the warty pig could possibly have declined to almost extinction, while the common wild boar population increased. The lack of knowledge with regards to the two species was also evident in Alas Purwo NP, where a warty pig photograph (Fig.3 – left) was displayed at Sadengan Resort, yet nobody realized that it was a warty pig. While the species could have disappeared in many places simply because people did not know the difference between the two species, warty pigs could also be less rare than previously anticipated in some areas in East Java, although never reported since they are thought to be *S. scrofa*. Only two respondents from Alas Buluh village and Wonorejo village were familiar with the warty pig as a separate species from *S. scrofa* and they claimed that the species went locally extinct in the 1980's.

In the 1980s, the poisoning of crop-raiding wild pigs was a common practice among villagers. Poisoned jackfruit was the preferred choice for bait (Sahwi, pers. comm., 2017) and this practice is probably one of the main causes for the drastic decline of both *S. scrofa* and *S. verrucosus* in the 1980s and early 1990s. While hybridization between *S. scrofa* and *S. verrucosus* may also happen, with the long-term effect of *S. verrucosus* becoming absorbed into the *S. scrofa* genepool (Frantz, et al, 2016), it is a slow process and unlikely to be the main reason for a drastic population decline of warty pigs.

Our study provides clear evidence that warty pigs are still present in Madiun, Bojonegoro, Tuban, Gresik, Mojokerto, Probolinggo, and Alas Purwo (Fig. 7). This is surprising considering the belief that the species is close to extinction and raise the question of the validity of this? It is indeed good news for the species and offers authorities a rare opportunity to revert a species in decline into a conservation recovery. Perhaps there are more areas where the species still occur in sufficient numbers to allow regular local

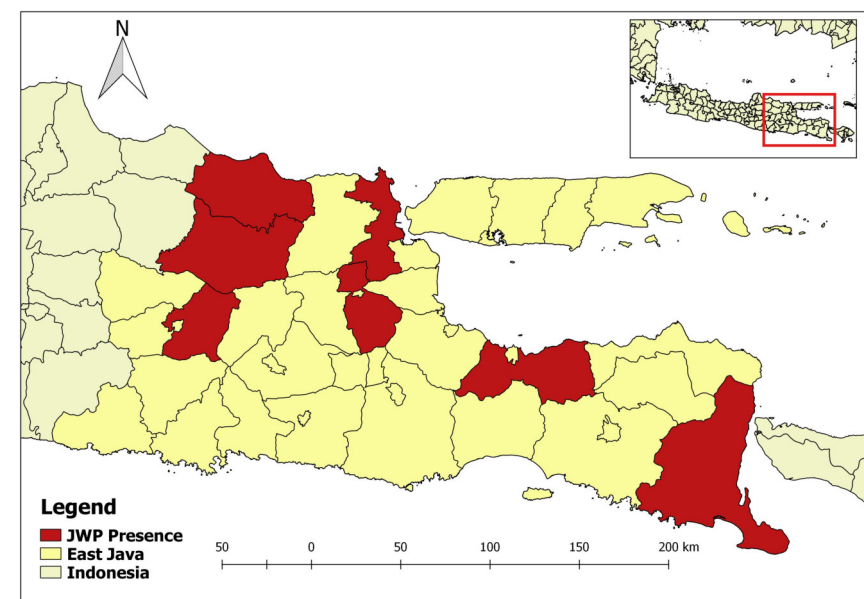


Fig. 7: Map of potential area of Javan warty pig in East Java.

hunting? Our study also suggests that interview surveys must put more emphasis on local names and “morphology” of the various pig species, if any? We recorded villages expressing familiarity with seven pig species, yet a description of them often only returned two species e.g. warty pig male/female and common wild pig (Fig.2). We recommend that camera trap studies are undertaken to assess in more detail the population sizes of warty pigs in the areas with recorded presence.





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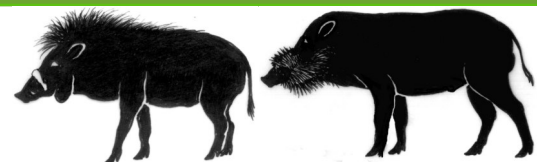
Acknowledgements

Our research is a collaborative effort by Copenhagen Zoo - Baluran Program, Baluran National Park, and The Ministry of Environment and Forestry. Our research was funded by Segre Foundation and Copenhagen Zoo. We would like to thank staffs from Baluran National Park, Perhutan, Pak Juhari (PERBAKIN) and BSH member for their support and information during this project.

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Behaviour and ecology of Bawean warty pigs (*Sus blouchi*)

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Introduction

The Bawean warty pig (*Sus blouchi*) is an endemic taxa living on the small and isolated island of Bawean, Indonesia. The species is currently categorised as Endangered by the IUCN Red List, in which it is considered to be a sub-species of the Javan warty pig (*Sus verrucosus*) (Semiadi et al., 2016). However, recent publications have treated it as its own species based on morphological differences (Rode-Margono et al., 2017; Groves & Grubb, 2011). There are projected to be between 234 – 467 mature *S. blouchi* on Bawean Island, but estimates vary seasonally (Rode-Margono et al., 2018, in press). Although the population seems to be stable (Rademaker et al., 2016; Rode-Margono et al., in press), the fact that it is restricted to a single location makes the species particularly vulnerable to stochastic events and human-induced threats such as habitat destruction or conversion, hunting, and disturbance by feral hunting dogs.

Until 2014, it was not clear whether *S. blouchi* still occurred on Bawean or whether it had been outcompeted by European wild boar (*S. scrofa*). It has since been confirmed as the only species of pig on the island (Semiadi, pers. comm.). Population estimates and basic habitat preferences were established for *S. blouchi* during a 13-month camera trapping study in 2014-15 (Rode-Margono et al., in press). In addition, a small study based on direct behaviour observations during twelve observation sessions has given some initial ideas of *S. blouchi*'s behavioural repertoire (Rode-Margono et al., 2016). However, as yet there has been no in-depth study of the behaviour of the Bawean warty pig and how it varies across time and space.

We report here on the behaviour of wild Bawean warty pigs based on 13 months of camera trapping data. Specifically, we (1) describe overall activity patterns, (2) identify common state and event behaviours, (3) assess how behaviour is influenced by site- and observation-level environmental covariates, and (4) assess whether behaviour is influenced by group structure.

Methods

Study site

The island of Bawean (S 05°46'0.00", E 122°40'0.00") is located in the Java Sea, 120 km north of Java and 260 km south of Kalimantan. The 192 km² island is a remnant of an extinct volcano that separated from mainland Java around 10,000 years ago (Nijman, 2006; Meijaard, 2003) and reaches 646 m asl at its peak. The dry season occurs between April and November, while the wet season takes place from December to March (Hamada et al., 2002). Approximately one quarter of the island is encompassed within a 46.6 km² protected area consisting of the Bawean Nature Reserve, the Bawean Wildlife Reserve and Community Wildlife Reserves (Semiadi & Meijaard, 2013; Nijman, 2006) (Figure 1). These different reserves together form one large protected area in the centre of the island, and four smaller fragments (Figure 1).





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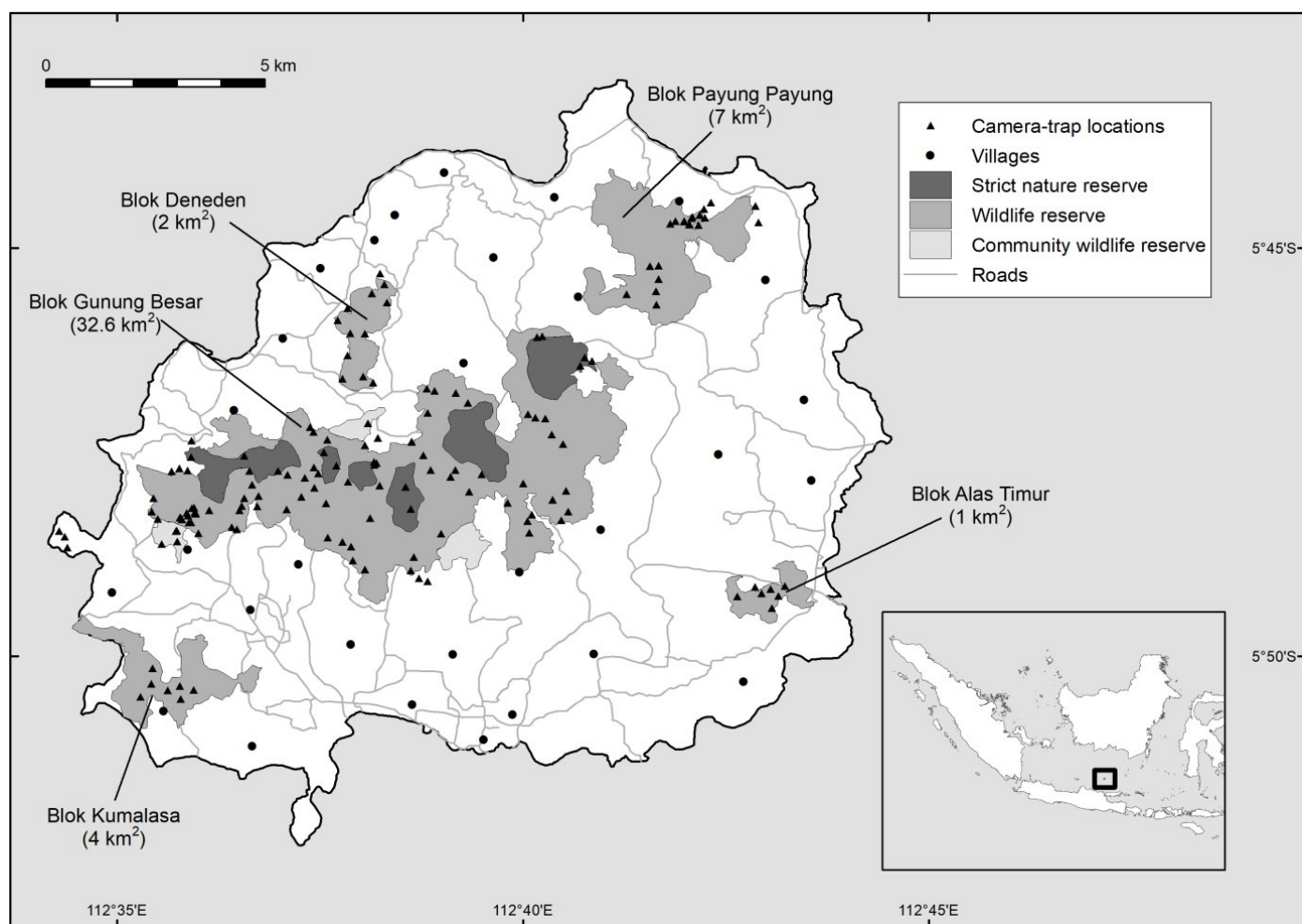


Fig. 1: Map of Bawean Island and locations of camera traps between November 2014 and December 2015 (reprinted from Rode-Margono et al., in press).

Data collection

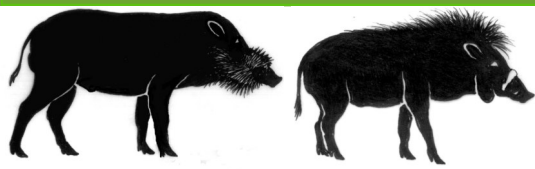
We installed up to 23 infrared camera traps (Cuddeback Long Range IR/E2) in random locations throughout Bawean Island’s protected areas between November 2014 and December 2015 (Figure 1). Camera traps were spaced at least 150 m apart, and recorded 30 seconds of video with a minimum of a one-minute interval between each video. We employed a one-hour interval to ensure the independence of behavioural data points.

Three observers reviewed all independent camera trap videos and recorded the number of animals in the video (minimum group size), the sex category of each animal (male [with warts], female, or unknown), and age category (adult, juvenile [50-80% of adult size] or piglet [<50% of adult size]). Group behaviour was assessed in two ways. We first assigned ‘state

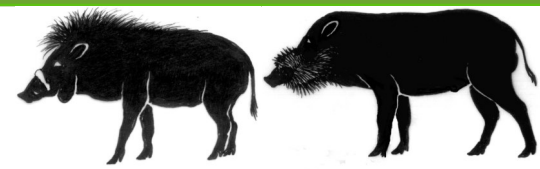
Tab. 1: Ethogram for behavioural states exhibited by the Bawean warty pig (*Sus blouchi*), partially adapted from Rademaker et al. (2015).

Behavioural state	Description
Alert	Cessation of behaviour and/or sniffing of the air upon detecting disturbance
Feeding	Consuming a food source
Foraging	Sniffing and/or rooting in soil for food
Other	Behaviour unclear
Out of sight	Behaviour not visible
Travelling	Purposeful movement from one point to another with absence of foraging behaviour
Resting	Motionless, standing or lying on the ground
Social	Interactions between individuals; may involve aggression, grooming, play





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Tab. 2: Ethogram for behavioural events exhibited by the Bawean warty pig (*Sus blouchi*), partially adapted from Rademaker et al. (2015).

Behavioural event	Description
Aggression	Launching, snapping or chasing performed by one individual towards another
Allogroom	Rubbing of one another with the snout
Autogroom	Self-grooming activity including scratching, nibbling, licking or rubbing of the skin/coat
Exploring camera	Purposefully moving towards and/or sniffing the camera
Reacting to camera	Cessation of behaviour and looking towards the camera
Spooked by camera	Jumping or running away from the camera
Spooked by unknown factor	Jumping or running away from something that is not visible

Rademaker et al., 2016), and tree density using the T-square method (Rode et al., 2013) with two sample points (for details see Rademaker et al., 2016). We recorded mean tree diameter at breast height (DBH) in a 10 m x 10 m plot around the camera trap location. In addition, we measured the average leaf litter depth in each corner of four 1 m x 1 m subplots. We used ArcGIS to calculate distances to the nearest village and to the nearest road. Depending on the location, camera trap sites were classified as 'protected' or 'unprotected' area and 'edge' or 'interior' forest habitat. Daily minimum and maximum temperature and daily precipitation were recorded from the meteorological station in Sangkapura. We retrieved lunar illumination by using the software MoonDV vers.1 (Thomas, 1998).

Data analysis

In order to make sure the three observers classified behaviour in the same way, we conducted an inter-rater reliability test based on the first 100 videos. We used Light's Kappa test (McHugh, 2012) to confirm that our assessments were generally in agreement ($\kappa = 0.62$). We found that the categories 'feeding' and 'other' were identified most variably between observers. We therefore clarified the description of these behaviours prior to conducting further observations.

We estimated diel activity patterns and proportion of time spent active for *S. blouchi* based on camera trap detections using the R package activity (Rowcliffe et al., 2014). In addition, we used the activity package to compare circular distributions between different behavioural states and habitat types, and supplemented this with Watson-Wheeler tests for homogeneity using the R package circular (Agostinelli & Lund, 2017).

Due to low numbers of records in some of our ethogram categories, the major state behaviours chosen for analysis were feeding/foraging, travelling, and alert, which collectively made up 84% of observations. We used binary state behaviour categories as dependent variables to estimate the probability of observing a particular state behaviour compared with the probability of observing any other behaviour in relation to site- and observation-level covariates. We first analysed the impact of site-level covariates consisting of altitude, habitat type, DBH, litter depth, tree density, distance to the nearest road, distance to the nearest village, and forest edge vs. interior location. Due to low numbers of records in some habitat types, we collapsed habitat categories into 'disturbed' habitats (community forests, degraded forests, garden cultivation, rice cultivation, scrubland and teak plantations) and 'undisturbed' habitats (coastal forest and tall forest) for our

behaviour' categories which corresponded to any ongoing, group-wide activities (Table 1). We then noted down 'event behaviours', which corresponded to a single occurrence of a particular behaviour exhibited by at least one individual in the group (Table 2).

At each camera trap location, we recorded the GPS coordinates, altitude, major habitat type (see





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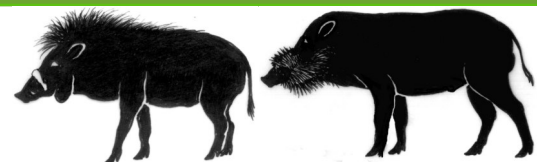


Fig.2: Male and female Bawean warty pig. Image extracted from camera trap video of March 2015. Photo by Bawean Endemics Conservation Initiative

Results

We accumulated 4,516 camera-trap days and captured 985 videos of Bawean warty pigs (Fig. 2).

Activity patterns

Overall diel activity patterns of *S. blouchi* indicated that they were active for 60% of the day, with peaks at dawn and dusk, some nocturnal activity, and lowest activity levels around midday (Figure 3A). However, activity patterns varied between disturbed and undisturbed habitats, with more nocturnal activity observed in disturbed habitat, and a more even spread of activity throughout the day in undisturbed habitat (overlap coefficient $\Delta = 0.75$; Watson-Wheeler test $\chi^2 = 19.38$, $df = 2$, $p < 0.01$) (Figure 3B). Activity patterns were also significantly different when compared between individuals and groups ($\Delta = 0.84$, $\chi^2 = 9.38$, $df = 2$, $p = 0.01$), with individuals exhibiting strong avoidance of daylight hours (Figure 3C).

Influence of site- and observation-level covariates on common behaviours

The most frequently recorded behavioural states for *S. blouchi* were feeding and foraging (43% of videos), travelling (38%), and alert (3%), with resting, social activity and unidentifiable behaviours making up the remaining 16%. Feeding and foraging behaviours were not found to be significantly associated with any site- or observation-level covariates. The probability of observing travelling behaviour was negatively associated with daily maximum temperature (Figure 4A),

analyses. Subsequently, we assessed the influence of observation-level covariates associated with group structure (group size, male presence and immature presence) and environmental factors (daily minimum temperature, daily maximum temperature and daily rainfall). We included camera trap location as a random factor in all models.

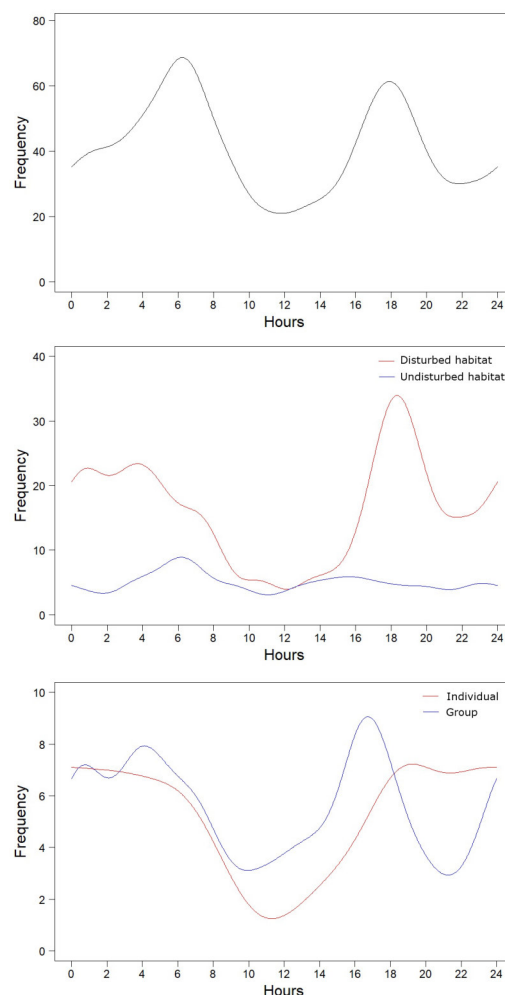


Fig. 3: Diel activity pattern of the Bawean warty pig (*Sus blouchi*) based on 13 months of camera trapping data. (A) reflects all captures, while (B) compares trends in disturbed and undisturbed habitats and (C) compares individuals and groups (two or more individuals).





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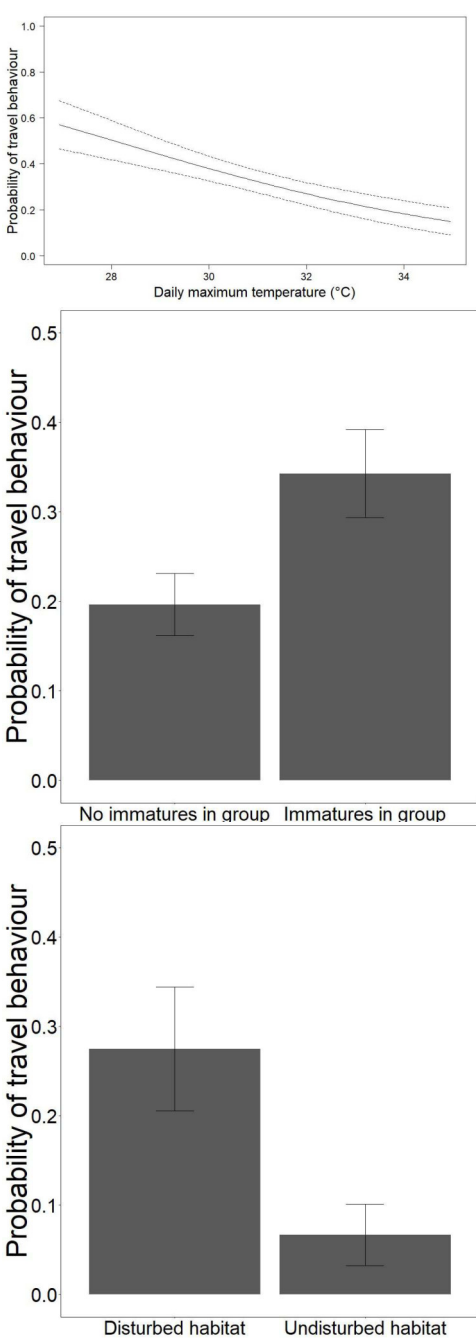


Fig. 4: Probability of travelling state behaviour in the Bawean warty pig (*Sus blouchi*) in relation to (A) daily maximum temperature, (B) presence of immatures, and (C) habitat disturbance.

modified environments, e.g. plantations and agricultural areas, and retreat to the interior of the forest during the day. Although none of our tested variables had an influence on the probability of observing feeding behaviour, the overall activity pattern of *S. blouchi* was significantly influenced by habitat type. Behaviour was strongly crepuscular in disturbed areas, compared with a very even temporal distribution of activity in undisturbed habitat. The activity patterns of a wide variety of species are known to be sensitive to anthropogenic disturbance (e.g. Gaynor et al., 2018; Oberosler et al., 2017). For example, Gaynor et al. (2018) performed a comprehensive analysis

higher when immatures were present in the social group (Figure 4B), and greater in disturbed than undisturbed habitats (Figure 4C). The probabilities of observing alert behaviour and exploration of the camera trap were also significantly higher in disturbed habitats (Figures 5 and 6). Diel patterns of each major behavioural state overlapped significantly with overall activity patterns, indicating that specific behaviours were not associated with particular times of day (alert: $\Delta = 0.81$, $\chi^2 = 3.38$, $df = 2$, $p = 0.18$; feed/forage: $\Delta = 0.93$, $\chi^2 = 2.07$, $df = 2$, $p = 0.36$; travel: $\Delta = 0.94$, $\chi^2 = 1.29$, $df = 2$, $p = 0.53$). All other associations between behaviour and site- or observation-level covariates were found to be insignificant.

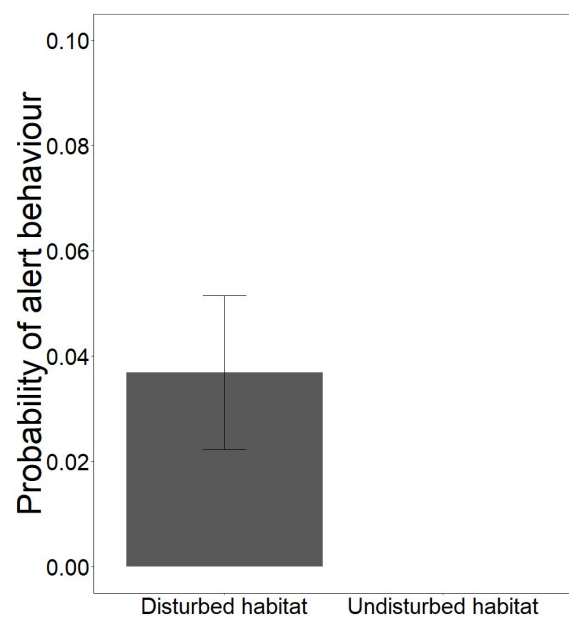


Fig. 5: Probability of alert behaviour in the Bawean warty pig (*Sus blouchi*) in response to habitat disturbance.

Discussion

General behaviour of wild animals captured on camera trap images is rarely looked at. Most camera trap studies focus on biodiversity surveys, population monitoring, or habitat preferences. The Bawean warty pig is an understudied species and with very little known about its behaviour and the factors that modulate this.

We found that Bawean warty pigs were generally most active at dusk and dawn. This crepuscular pattern has been previously described in other wild suids such as *S. scrofa* in tropical woodland environments (Caley, 1997). It is also supported by the only study on the behaviour of Bawean warty pigs, which observed that *S. blouchi* consistently came to feed in open forest plantations at sunset (Rode-Margono et al., 2016). Anecdotally, it is believed that Bawean warty pigs come out at these times to feed in human-





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of 76 studies of 62 species, and found that animals increased their nocturnality by an average factor of 1.36 in response to human disturbance. Suids are no exception to this trend. For example, *S. scrofa* have been observed to become more nocturnal in disturbed areas and when under hunting pressure (Keuling et al., 2008).

We observed group sizes of Bawean warty pigs ranging between one and nine animals (average 2.04 ± 1.44 ; Rode-Margono et al., 2018, in press). Individual animals were observed to exhibit more nocturnal activity patterns than those observed in groups. This may be a predator avoidance strategy, reflecting the reduced probability of detecting a predator as a lone individual compared to within a group (e.g. Fairbanks & Dobson, 2007; Bertram, 1980). There are no native predators of *S. blouchi* present on Bawean Island. However, feral hunting dogs are abundant and are frequently captured on camera traps in the forest, and could pose a potential threat or act as a form of disturbance. An alternative or additional explanation could be that individuals are more strongly influenced by hunting pressure. Lone Bawean warty pigs in our dataset were likely to be males. In the case of *S. scrofa* in Europe, males are preferentially targeted for hunting over females or offspring (Keuling et al., 2013). This may reflect moral attitudes, and/or the belief that males are more important for population growth. Despite differences in culture in different regions of the world, this may also be the case on Bawean, and could cause lone males to become more nocturnal due to hunting pressure (Keuling et al., 2008).

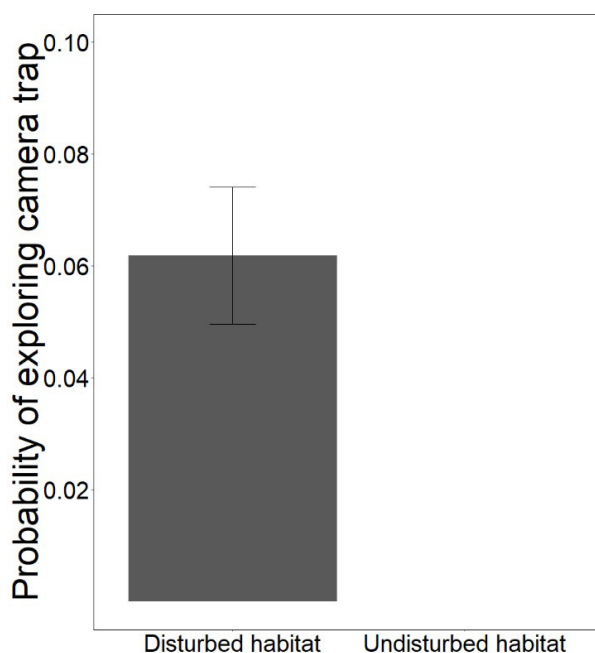


Fig. 6: Probability of camera trap exploration behaviour in the Bawean warty pig (*Sus blouchi*) in response to habitat disturbance.

The probability of observing travelling behaviour in *S. blouchi* was found to decrease with increasing daily maximum temperature. This is not unexpected, as many animals reduce their activity levels in high temperatures. For example, Copado et al. (2004) found that free ranging pigs (*S. scrofa*) in Mexico spent significantly more time feeding and travelling in the cooler wet season and significantly more time resting in the dry season (Figure 7). During the study period, Bawean Island experienced a very hot dry season with many fires occurring in the forest, several of which were even filmed by the camera traps. It is therefore also possible that animals retreated to safer areas during this period to avoid the fires, and therefore spent less time travelling.

In addition, the probability of travelling was higher when immatures were present in the group. This result is somewhat surprising, as higher energy requirements of mothers with piglets would suggest an increase in feeding rather than travelling behaviour. Potentially, groups with immatures prefer highly safe hiding places, e.g. deeper in the forest, that may be further away from feeding grounds, and thus increase travelling time. These and other explanations should be explored in further studies about ranging behaviour. In disturbed areas, pigs were more likely to exhibit travelling behaviour, alert behaviour, and exploratory behaviour towards the camera traps.





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Fig. 7: Fire in the protected forest area on the island of Bawean. Image extracted from camera trap video of June 2015.

Photo by Bawean Endemics Conservation Initiative

This is likely to reflect high vigilance levels and reluctance to dwell in disturbed areas due to human disturbance. We expected that disturbed areas would be used more for feeding, based on Rode-Margono et al. (2016) and anecdotal reports, however our analysis did not confirm this.

Conclusion

Bawean warty pigs are endemic to Bawean Island, and thus highly vulnerable to stochastic events and pressure from anthropogenic activities. We have shown in this study that human disturbance modulates daily patterns of activity in this species. It is unclear what impact this has on the animals' energy reserves and population viability. We advise that further research on the behavioural ecology of the Bawean warty pig is urgently required to inform effective conservation planning for this species.

Acknowledgements

We thank all field staff, volunteers and the protected habitat management office and their staff for making this study possible. Respective permits were issued by the Indonesian Ministry for Research and Technology (RISTEK) and the Office of Conservation of Natural Resources (BBKSDA), part of the Ministry of Forestry (permit numbers: 367/SIP/FRP/SM/X/2014, 89/SIP/FRP/SM/III/2015 and SIMAKSI no. SI.21/BBKSDA.JAT-2.1/ 2014).

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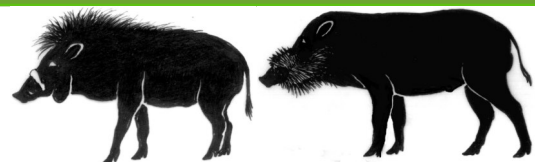


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Sometimes forgotten babirusa (*Babyrousa babyrussa*) in zoos

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Introduction

Various elements of the history of the babirusa (*Babyrousa* spp.) in private and zoological collections have been published recently (DKKH, 2015; Tjiu and Macdonald, 2016; Macdonald, 2017, 2018), and more recent information has now been systematically collected into the World Association of Zoos and Aquariums (WAZA) Babirusa (*Babyrousa* spp.) Global Species Management Plan (GSMP) (Leus et al, 2017) and the WAZA International Babirusa Studbook database (Kauffels and Beckmann, unpublished data). However, there will always be stray pieces of data which have lain un-noticed in zoological archives, newspaper reports, long-forgotten zoological magazines and personal correspondence. Most of this information will tend to be incomplete, sometimes cryptic, often puzzling. However, it provides a skeleton upon which to build further, patient studies of additional sources to give additional clarity. We have therefore gathered together such information as we have been able to document, while fully recognising that there will be some that has escaped our notice. Where-ever possible we have referenced the information as completely as we are able to. Please note this cautionary tale, a few of our references, collected several decades ago, have become 'trapped' in out-of-date computer software.

Tab. 1: Early arrivals of babirusa (*Babyrousa* spp.) to Paris, London and Amsterdam.

Sex	SIRE_ID	DAM_ID	LOCATION (Int'l stbk nr)	SPECIES	ARRIVAL	DEATH	Reference	Comment
M	WILD	WILD	Manado to	celebensis	?		Quoy & Gaimard (1830) Dumont D'Urville (1832), Jardine (1836), Cuvier (1836-1849).	Illustrated
			Paris (9001)	celebensis	00.07.1829	00.00.1833	(from zoo records in Paris) Blainville (1839-64)	examined the skeleton
F	WILD	WILD	Manado to	celebensis			Quoy & Gaimard (1830)	Illustrated
			Paris (9002)	celebensis	00.07.1829	04.08.1832	(from zoo records in Paris) Blainville (1839-64) examined the skeleton	
M	9001	9002	Paris. (9003)	celebensis	10.02.1830	04.02.1831	(from zoo records in Paris) Quoy & Gaimard (1830)	Illustrated in. Q & G said it was born 11.03.1830. Blainville said that it died 12.12.1931
?	WILD?	WILD?	London	?	18.02.1841	01.02.1843	(perhaps illustrated in Goldsmith 1846-47)	Present from E. Belcher
M	WILD?	WILD?	Amsterdam	?	14.08.1841	24.01.1843	(Amsterdam zoo records)	From London dealer Jamrack Dissected by Vrolik (1844)
F	WILD?	WILD?	Amsterdam	?	14.08.1841	01.07.1844	(Amsterdam zoo records)	from London dealer Jamrack (Could this have been dissected by C. Mayer (1847)??) in Bonn
M	WILD?	WILD?	Amsterdam (9004)	?	19.05.1842	08.12.1842	(Amsterdam zoo records)	Presented by Colonel de Steurs, dissected by Vrolik (1844), mentioned by Boitard (1845)
?	?	?	Amsterdam (9005)	?	17.01.1843	16.02.1843	(Amsterdam zoo records)	(possibly born to (14.08.41 F)
F	WILD?	WILD?	London (9007)	?	16.01.1844	[1846 NHM]	Flower (1929)	
?	WILD?	WILD?	Amsterdam	?	02.06.1853	6,041855	(Amsterdam zoo records) (Johannes, 1855)	gift from Mr A.D. Duymaer van Twist





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Materials and methods

Searches were made of the archives of the zoos known to have received babirusa since 1830. Information was also gathered from publications of the results of animal dissections and pathological investigations. Annual Reports and Zoological Proceedings also yielded information, as did articles reporting visits to zoological collections overseas. Some information came from advertisements by animal dealers.

Results

The data have been summarised in four tables for convenience. From these it will be clear that for many of the animals the data available had been scanty. Where available, complementary information has been listed in the accompanying text and illustrations.

Table 1 indicates that the first babirusa to arrive in Europe came to France in 1829 and are listed in the International Studbook as 9001 and 9002; their male offspring was born on the 10th February 1830 and is listed as 9003 (Kauffels and Beckmann, unpublished data). The skeletal and skin remains of all three were preserved in the National Museum, Paris.

The next babirusa to arrive in Europe, sex unrecorded, was presented to the Zoological Society of London on 18 Feb. 1841, by Captain Sir Edward Belcher, R.N. It survived until 1 February 1843 (Flower, 1929). Thereafter a series of four babirusa arrived in Amsterdam from 1841-1843, one pair coming via the London-based animal dealer Jamrack. In 1844 a female babirusa arrived in London zoo.

Table 2 lists the babirusa recorded during the second half of the nineteenth century. Mr A.J. Duymaer van Twist sent a babirusa to Amsterdam zoo (Zoo records p.88; Johannes, 1855, in the zoo guide). Curiously, although a description of the babirusa was given in the zoo guide of 1872, it was not reported as being present in the zoo (Schlegel and Witkamp, 1872). In December 1859 van Bemmelen (1869) reported the arrival at the Rotterdamsche diergaarde [Rotterdam Zoo] of two babirusa; they were the gifts from R.W. Besier of Soerabaya, and W. Ruys Jun. of Rotterdam. Noll (1870) then reported that a second babirusa had arrived that year in Rotterdam, and that the first had been sent in exchange to London (Sclater, 1860; Weinland, 1862). Sclater (1860) reported this as a fine young male Babirusa (*Babirusa alfurus*) which had come from Sulawesi and been received in exchange from the Zoological Society of Rotterdam.

Sclater (1883) reported that a male and two female Babirusa (*Babirusa alfurus*) from Celebes (now Sulawesi) had been presented by Dr F.H. Bauer, C.M.Z.S. and received July 23rd (1883?) by the Zoological Society of London. One of the female babirusa produced a young (male?) shortly before the termination of the voyage to London, which had reached England safely in company with its mother. A coloured drawing of this little animal by Mr Smit was published.

On January 16th, 1884 a young female Babirusa (*Babirusa alfurus*) was born to one of the females presented by Dr. F.H. Bauer, C.M.Z.S. in July 1883 (Anonymous, 1884, 1896; Sclater, 1884; Flower, 1929). This was the first instance of the animal having been bred in the London Zoological Society's Gardens. It was housed in the ostrich house.

On the 3rd of July 1897 a young pair of babirusa were received from Sulawesi, presented by the Duke of Bedford (Sclater, 1897). The male died on the 28th of June 1905, and it is unclear when the female died.

Elsewhere in Europe, Koln Zoo had exhibited a babirusa in 1860, and a pair of them came from Sulawesi to Koln in 1876 (Funk, 1876). Cornely (1865) reported that the Acclimatisation Garden in Paris obtained a babirusa in 1865.





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Tab. 2: Babirusa (*Babirousa* spp.) from Indonesia to foreign zoos (1850 - 1900).

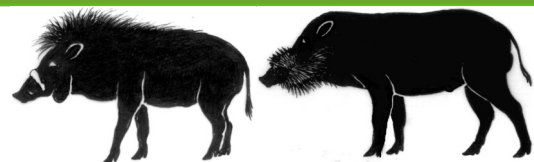
Sex	SIRE_ID	DAM_ID	LOCATION	SPECIES	ARRIVAL	DEATH	REFERENCE	COMMENT
?	WILD?	WILD?	Ternate (and possibly Waigeu)	?	00.00.1855	?	(Bleeker, 1856)	
M	WILD?	WILD?	Rotterdam to	celebensis	00.12.1859		(van Bemmelen, 1869)	Present from W. Ruys J.D. Jun of Rotterdam
			London	celebensis	11.11.1860	09.05.1871	Mentioned by Weinland (1870) and Flower (1931)	Illustrated by Sclater (1860) as very fat young male: possibly spleen seen by Owen (1868)
?	WILD?	WILD?	Rotterdam	celebensis	1860		(van Bemmelen, 1869)	Present from Heer RW. Besier of Soerabaya was this photographed to provide Bremm's (1865, 1877) illustrations? Did the tongue provide
?	WILD?	WILD?	Koln	celebensis	00.00.1860	?	Funck (1876)	Brucher (1884) with his Tubingen tongue illustration? Did it provide illustration for Heck, 1897?)
?	WILD?	WILD?	Rotterdam	?	00.00.1865	<01.01.1872	(Bemmelen, 1869, 1872)	Presented by Heer Besier Cornely (1865)
?	WILD?	WILD?	Paris Jardin des Plantes	?	00.02.1865	?	Cornely (1865) and Weinland (1870)	
M	WILD?	WILD?	London	celebensis	11.11.1870	09.05.1871	Zoo records	
M	WILD?	WILD?	Koln	celebensis	00.10.1876	?	(Funck, 1876)	
F	WILD?	WILD?	Koln	celebensis	00.10.1876	?	(Funck, 1876)	
?	WILD?	WILD?	Antwerp	?	00.00.1878	?	(report by W. Kourist, 1969)	
M	WILD?	WILD?	Calcutta	?	1880 - May	00.05.1884	(Sanyal, 1892)	
F	WILD?	WILD?	Calcutta	?	1880 - May	00.05.1884	(Sanyal, 1892)	
F	WILD?	WILD?	London	?	23.07.1883	21.07.1887	(Sclater, 1883)	Presented by F.H. Bauer

Table 2 continues on page 22.





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Tab. 2 continued.

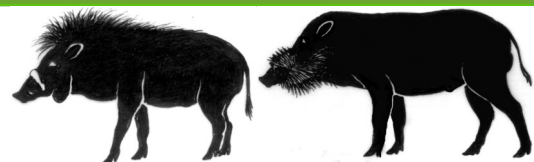
Sex	SIRE_ID	DAM_ID	LOCATION	SPECIES	ARRIVAL	DEATH	REFERENCE	COMMENT
M	WILD?	WILD?	London	?	23.07.1883	03.06.1886	(Sclater, 1883)	Presented by F.H. Bauer. Illustrated in Flower & Lydekker (1891)?
F	WILD?	WILD?	London	?	23.07.1883	21.03.1885	(Sclater, 1883).	Presented by F.H. Bauer (is this where Mitchell (1905, 1916) obtained illustrations of gut, and Beddard (1909) obtained babirusa brain?
M	WILD?	WILD?	London	?	23.07.1883	16.04.1884	(Sclater, 1883), (Sutton, 1884).	Presented by F.H. Bauer. Illustrated in Sclater (1883) and teeth commented upon in Sutton (1884). Perhaps sent to Oslo as skeleton M4410
F	WILD?	WILD?	London	?	16.01.1884	4.02.1885	(Sclater, 1884) (Zuckerman, 1952-53)	
M	WILD	WILD	Talise island, Sulawesi, Indonesia	celebensis	Sepot 1885	Jan 1886	(Hickson, 1889)	
M	WILD	WILD	Kema, Indonesia	celebensis		?	(Sarasin & Sarasin, 1905)	
F	WILD	WILD		celebensis		?	(Sarasin & Sarasin, 1905)	
				celebensis		?	(Sarasin & Sarasin, 1905)	
				celebensis		?	(Sarasin & Sarasin, 1905)	
F	WILD?	WILD?	London	celebensis	03.07.1897	06.01.1908	Sclater (1897), (Anonymous, 1897), (Flower, 1931)	Duke of Bedford presented. (mentioned in zoo guide in 1907 & 1908) (perhaps illustrated young in Bryden 1906).

Table 2 continues on page 23.





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Tab. 2 continued

Sex	SIRE_ID	DAM_ID	LOCATION	SPECIES	ARRIVAL	DEATH	REFERENCE	COMMENT
M	WILD?	WILD?	London	celebensis	03.07.1897	29.06.1905	Slater (1897)	Duke of Bedford presented. (depicted in zoo guide Mitchell, 1904) Anonymous, 1897: brain described by Beddard, 1909) (perhaps illustrated young in Bryden 1906)
F	WILD?	WILD?	London then on 20.04.1908 to		01.10.1898		(Flower, 1931)	
			Hamburg	?	20.04.1908	00.02.1920	(Flower, 1931) (Mohr, 1958, 1960)	

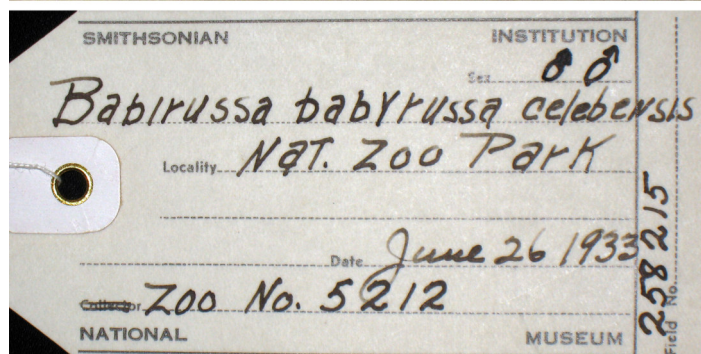
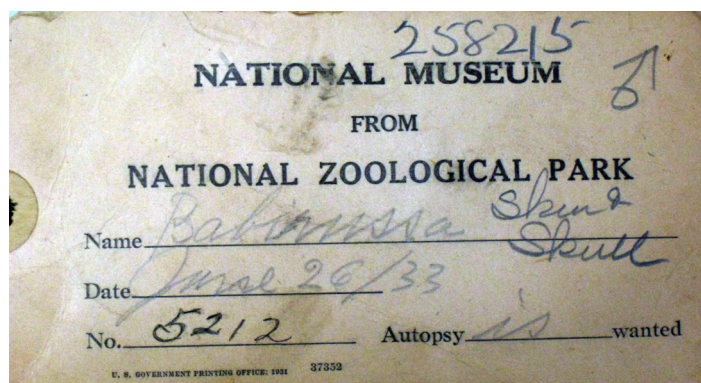


Fig. 1: Smithsonian Institution labels attached to the skin and skeletal remains of the male Sulawesi babirusa (Zoo No. 5212) from the National Zoological Park, Washington.

museum collections. We have not had the resources to track them all down. However, we have noticed, that unfortunately, in a number of instances, the labels that may have been attached are now lost. However, many of the more recent ones have survived (Figure 1).

Sanyal (1892) reported that a pair of babirusa was held in Calcutta from April 1880-May 1884. Although generally shy they were less so than the wild Indian pig. The food that they ate comprised fruits, roots, vegetables and grain; they showed no preference for meat in the diet. The female was said to be overweight. It is not clear how much shelter was available to them. They reportedly suffered from the heat during May and June, and at such times they enjoyed a cold bath.

Slater (1895) reported that he saw a babirusa in Giseh during a visit to the zoological gardens of Egypt. The skins and skeletal remains of a number of these animals will have been placed in

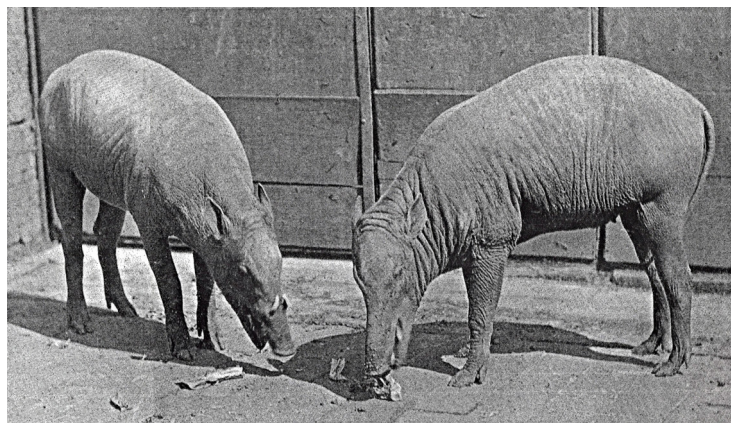


Fig. 2: A pair of babirusa added to the Zoological Society of London's collection during the summer of 1897; young male and adult female. Photo: Scholastic Photo. Co.





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Tab. 3: Babirusa (*Babirousa* spp.) from Indonesia to foreign zoos (1900 - 1915).

STUDBK ID	Sex	SIRE_ID	DAM_ID	LOCATION	SPECIES	ARRIVAL	DEATH	REFERENCE	COMMENT
	F	WILD?	WILD?	Berlin	?	29.09.1904	16.10.1915	(Reinhard & Frädrich, 1983)	remains to Hamburg Hagenbeck photo in Knauer 1914 and photos in Mohr archive of Berlin
9012 ?	M	WILD?	WILD?	Berlin	celebensis?	23.11.1904	13.11.1915	(Reinhard & Frädrich, 1983)	published photos of 1906, 1908 and 1914.
	M	WILD?	WILD?	Hamburg-Hagenbeck	?	00.12.1905	?	1.5 y (Hagenbeck offertes 1905-1947)	
	F	WILD?	WILD?	Frankfurt	?	00.00.1907	00.00.1913	(Scherpner, 1983)	(illustrated in Scherpner (1983)
	F	?	?	Hamburg-Hagenbeck to	?	?	?	(Mohr, 1958)	
				Koln		25.11.1907	?	(Mohr, 1958)	
9019	M	?	29.09.1904	Berlin	?	10.05.1908	21.03.1910	(Reinhard & Frädrich, 1983)	(in Berlin museum with no number)
	?	?	?	Hamburg-Hagenbeck to	?	?	?	(Mohr, 1958)	
				Köln	?	01.06.1908	?	(Mohr, 1958)	
	?	?	?	Hamburg-Hagenbeck	?	~ 1909			
	?	?	?	Koln	?	<00.00.1910		(Stresemann, 1925)	(is it the one offered for sale in 1913, see below?)
	M	?	?	Berlin??	?	04.01.1910	04.01.1910		(in Museum no number) from where?
	F	?	?	Hamburg-Hagenbeck	?	Sep 12	after March 1915	(Hagenbeck offertes 1905-1947)	
	F	?	?	Koln	babyrusa?	12.03.1913	?	(Amsterdam archives)	White haired female offered for sale
	F	?	29.09.1904	Berlin	?	30.10.1913	13.04.1917	(Reinhard & Frädrich, 1983)	
	M	?	?	Rotterdam	?	16.02.1914	04.06.1920		In Naturalis Museum, Leiden

Table 3 continues on page 25.





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Tab. 3 continued

STUDBK ID	Sex	SIRE_ID	DAM_ID	LOCATION	SPECIES	ARRIVAL	DEATH	REFERENCE	COMMENT
	F	Wild	Wild	Berlin	?	~ 1913	07.02.1915	(Reinhard & Frädrich, 1983)	
9029	M	WILD	WILD	Sula islands, Indonesia to	babyrusa	00.00.1913		International stud book	from resident of Ternate. Skin was in Amsterdam museum.
	M	WILD	WILD	Amsterdam	babyrusa	24.10.1915	10.12.1922	Amsterdam zoo records. (Hensius (1916), Portielje (1922)).	(Hensius (1916) has photograph, as does Portielje (1922)). Mohr Archiv has Dutch photo published by AFI Portielje (from resident of Ternate) Skin was in Amsterdam museum?
9030	F	Wild	Wild	Sula islands, Indonesia to	babyrusa	~ 1915		Amsterdam zoo records.	from resident of Ternate. Skin was in Amsterdam museum?
				Amsterdam (9011)	babyrusa	24.10.1915	10.12.1925	Amsterdam zoo records. (Hensius (1916), Portielje (1922)).	(Hensius (1916) has photograph, as does Portielje (1922)). Mohr Archiv has Dutch photo published by AFI Portielje
	F			Berlin	?	07.11.1915	?	(Museum records)	

The anatomy of a female babirusa was dissected by Mayer (1847) and it remains uncertain where this animal came from. Amsterdam would appear to be a likely candidate source. The commercial and scientific value of the skeleton was also being appreciated at this time and it is possible that one of the skeletons of a London male babirusa was sent to Oslo in 1884. It is also clear that artists were being employed to create illustrations of the whole animal, and following the study of their anatomy, to illustrate the structure of their internal organs.

Table 3 summarises the information available from 1900 until 1915. It was prior to and during this period that photographic recording of the babirusa in collections was becoming more common (Figure 2). It was also during this time that differences in the morphology of the babirusa was being noticed and recorded. Stresemann (1925) had reported that he saw a white haired babirusa in Koln zoo in 1910. However, Mohr (1958), investigating this account, reported that the three babirusa in Koln zoo at that time were a female that had arrived on the 25th November 1907 from Hagenbeck, a male that had arrived on the 1st December 1907 from Berlin, and a female arrived on the 1st of June 1908 from Hagenbeck. She stated that there was no evidence that any of these animals was the white-haired animal from Buru. The first babirusa recorded to be from the Sula Islands arrived in Europe in 1913 and they were perceived to be somewhat different from the babirusa from Sulawesi. The pair that arrived in Amsterdam several years later (Figure 3) were photographed a number of times (Heinsius & Vogt, 1916; Mohr, 1958, 1960; E. Mohr, Bilderarchiv).





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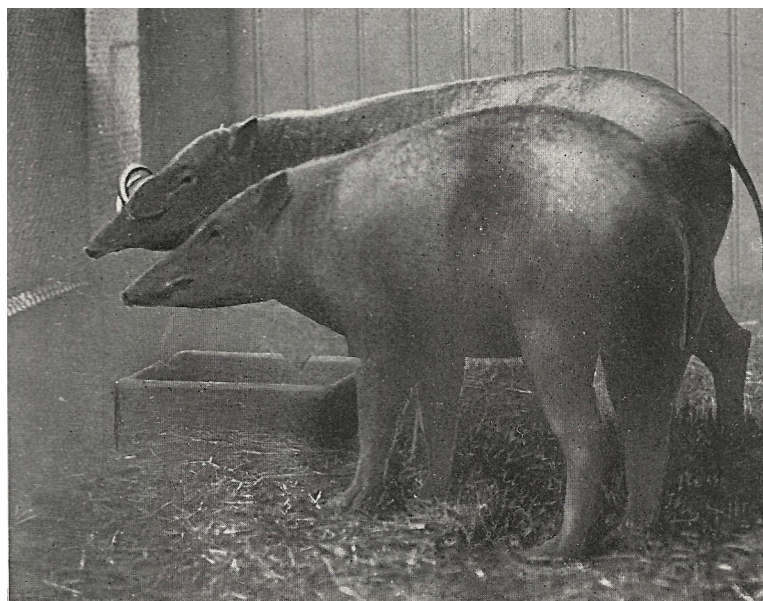


Fig. 3: Pair of Sula Island babirusa in Amsterdam (Heinsius, H.W. & Vogt, A.F.W. 1916. *Wilde dieren naar het leven*. Amsterdam).

hind limbs was offered for 600 marks. In March 1915, a 4-year-old female babirusa, weak in the hind legs, remained unsold and offered for 700 marks, and in July 1916, the now 5-year-old female remained for sale for 700 marks.

From the Amsterdam Archives, the Berlin dealer list No.1643 showed that Berlin was offering for sale a male babirusa on 9th July 1912 for 1000 marks. And again, from the Amsterdam Archives, it is clear that Koln, in 1913, had offered a white-haired babirusa for sale. The question remains whether this was the one reported by Stresemann (1925).

Careful and detailed research of animal dealers' lists is likely to give considerable insight into the manner in which babirusa (and other animals) were made available to zoos in Europe and elsewhere; the appropriate names include Cordier (London), Henry (Brussels), Penatang (?), van den Brink (?), Frank Buck (USA). Inter-zoo trade in animals had been common in the preceding century. Gifted animals sometimes exceeded the zoo's capacity or need to hold a number of the same species, and so the surplus was traded for alternative species. Although improvements in animal husbandry were being made in zoos, breeding of babirusa was still in its infancy at that time, and so trade in replacement animals was deemed essential.

Table 4 summarizes the data available from 1915 until 1950. The evidence suggested that London and Berlin were the most regular recipients of babirusa (Figure 4). Indeed, the substantial numbers of these animals being exported from Indonesia prompted the government there to attempt to restrict this trade. A new hunting and animal conservation ruling announced that only up to two babirusa were permitted to be

Dealer's lists give some insight into the trade in babirusa. From the Amsterdam archive No.1611 it is clear that Hagenbeck, Stellingen were advertising in December 1905 a male *Babirusa alfurus*, 1.5 years old for 1000 marks (was this a Berlin animal?). Several years later, in September 1912 the dealer's list from Hagenbeck was offering a 1.5-year-old female for 1000 marks, and in December of that year the price for the same animal (listed as imported) had risen to 1200 marks. The same (or perhaps another female) animal was again listed in May 1913, for the same price, but by April 1914, a 3/4-year-old adult babirusa (probably same animal), said to be a little bit weak in the



Fig. 4: Female Sulawesi babirusa with two piglets in Berlin Zoo, Bilderarchiv Zoo Berlin and Bilderarchiv E. Mohr. Photo: L. Bab





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Tab. 4: Babirusa (*Babirousa* spp.) from Indonesia to foreign zoos (1926 - 1945).

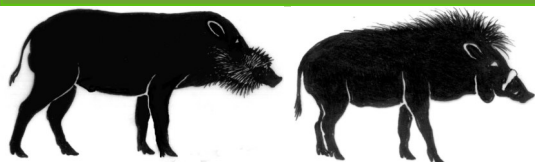
STUDBK ID	SEX	SIRE_ID	DAM_ID	LOCATION	SPECIES	ARRIVAL	DEATH	REFERENCE	COMMENT
	?	?	?	London	?	00.00.1926	?	(mention in London zoo guide, & for sale about 1928)	Is it illustrated in Jennison (1927)?
	F			Berlin	?	00.00.1927	?	(Antonius 1933)	From Sulawesi due to Eberhard Gartner in Malang (Java)
	M			Berlin	?	00.00.1927	?	(Antonius 1933)	From Sulawesi due to Eberhard Gartner in Malang (Java)
	M			Berlin	?	01.01.1928	21.08.1931	?	
	?	?	?	Berlin	?	?? 1929 ??	?	(Reinhard & Frädriich, 1983)	
	?	?	?	Berlin	?	?? 1930 ??	?	(Reinhard & Frädriich, 1983)	
	?	?	?	Berlin	?	?? 1931 ??	?	(Reinhard & Frädriich, 1983)	
9039	F	?	?	London	?	22.10.1931	01.12.1939	(Mitchell 1931) Presence mentioned in zooguides 1934, (Huxley, 1936, 1937).	(Hamerton, 1941 did post mortem)
9040	M	WILD?	WILD?	London	babyrussa	22.10.1931	08.03.1942	Mitchell 1931). Presence mentioned in zoo guides 1934, (Huxley, 1936, 1937).	Presented from Frost on Sula. Illustrated in Mitchell 1934, and London zoo mammal collection photos Sept 1934). (Hamerton, 1943 did post mortem).
	F	?	?	Rotterdam	?	06.05.1932	27.01.1936	(to Naturalis Museum, Leiden)	
	M	?	?	Surabaya to Rotterdam	?	?	?	?	
	M	?	?	Berlin	?	00.00.1933	?	(Schwarze, 1934)	G. Heinrich brought from S. Sulawesi
9044	?	?	?	London	?	23.04.1933	04.10.1936	(Mitchell 1933 & Zuckerman, 1952-53) mentioned in zoo guides 1936 & 1937.	
	M	?	?	Berlin	?	25.06.1933	04.11.1933	(Antonius, 1933)	import due to E Gartner (?)
	F			Berlin to Mulhouse or HHempel	?	25.06.1933	?	(Antonius, 1933)	import due to E Gartner (?)
	M			Berlin	?	19.02.1944	?	?	
	M			Berlin	?	19.07.1934	31.07.1934	?	

Table 4 continues on page 28.

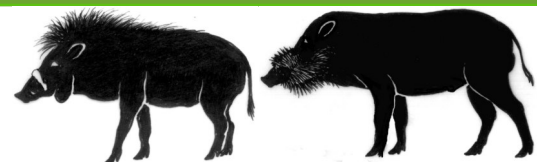
exported alive each year (Anonymous, 1931). In 1935, the economic director reported the export of two live babirusa from Indonesia (Anonymous, 1937). However, in 1933, G. Heinrich brought a male babirusa from South Sulawesi to Berlin (Schwarze, 1934), and the importation of three additional babirusa into Europe in 1933 are listed in Table 4. The following year, four babirusa, three males and a female, were imported from the Sula islands to London by W.C.J. Frost (Schwarze, 1934). They were not grey coloured, which was characteristic of the Buru babirusa, but had black hair. The ventral side was whiteish, and one had whitish cheeks and anal region. The four animals at London zoo were said to be moved elsewhere.

Schroder-Visscher (1939) had noted that babirusa were 'valuable exchange animals' [which could be offered to zoos in exchange for other animals], although they did not appear to be present in the zoo at Jakarta when it was reopened in 1933. An unstated number of Sulawesi babirusa were held by Surabaya Zoo in June 1941 (Anonymous, 1941a; Sody, 1941a). It was also clear that this zoo had already established a good record for the breeding and raising of babirusa (Matur, 1989).





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Tab. 4 continued

STUDBK ID	SEX	SIRE_ID	DAM_ID	LOCATION	SPECIES	ARRIVAL	DEATH	REFERENCE	COMMENT
	M			Berlin	?	19.07.1934	24.01.1936	Berlin Museum records	
	M			London	babyrussa	00.00.1934	?	[Schwarz, 1934]	from Sula islands
	M			London	babyrussa	00.00.1934		[Schwarz, 1934]	from Sula islands
				Rome	?	20.10.1934	31.12.1941	(Rome zoo archives; skull in museum)	Purchased from Frost
	F			Paris-Vincennes	?	01.08.1934	09.06.1939	[Jones, 1990]	from Cordier, London (was it imported by Frost?)
	M			Paris-Vincennes	?	01.08.1934	04.03.1940	[Jones, 1990]	from Cordier, London (was it imported by Frost?)
9032	M			Berlin	?	13.10.1935	21.09.1935	International studbook (Reinhard & Frädri ch, 1983) (Klos, 1969)	Listed in museum 47505 (born 12.9.35, died 27.09.35) evacuated to H.Hempel (or Mulhouse?)
9033	F			Berlin	?	13.10.1935	19.02.1944	International studbook (Reinhard & Frädri ch, 1983) (Klos, 1969)	evacuated to H.Hempel (or Mulhouse?)
9034	F			Berlin to Ru he	?	13.10.1935 18.01.1938	?	International studbook (Klos, 1969) [parents M. Garteurs F. Makassar] (Klos, 1969)	
	?			Berlin	?	16.09.1935	?	[Anonymous 1936, Sody 1941]	born in zoo
	?			Berlin	?	16.09.1935	?	[Anonymous 1936, Sody 1941]	born in zoo
	M			Surabaya to San Diego	?	?	18.06.1941	International studbook Dolan 1990	Sula babirusa
9050	F			Surabaya to San Diego	?	?		International studbook Dolan 1990	Sula babirusa
9051	M			Berlin	?	16.07.1936	15.05.1944?	(Reinhard & Frädri ch, 1983)	It went to H. Hempel, perhaps on 19.02.1944 (?)
	F			Rotterdam			27.01.1936	2423_Skeleton & skin Leiden	
	M			Frankfurt to Adelaide	?	03.09.1936 ~1937	16.01.1947	International stud book (Rix 1978, Craig, 1997)	
9049	F			Frankfurt to Adelaide	?	03.09.1936 ~1937	16.01.1947	International studbook (Rix 1978, Craig, 1997)	
	F			Paris-Vincennes	?	28.01.1937	27.11.1951	[Jones, 1990]	from Henry, Brussels
	?			Paris-Vincennes	?	28.01.1937	20.07.1946	[Jones, 1990]	from Henry, Brussels
	?			Paris-Vincennes	?	24.05.1938	16.08.1939	[Jones, 1990]	from Penatang

Table 4 continues on page 29.

Sody (1941b) reported that twins were born in Surabaya zoo on the 8th April (1941?) and he recalled that there had been an earlier birth of a singleton at the same zoo. It is possible that further detailed information may be held in the first six issues of the Surabaya zoo monthly magazine 'Onze Dierentuin' which had a short publication run from January to September 1938 (Anonymous, 1941).

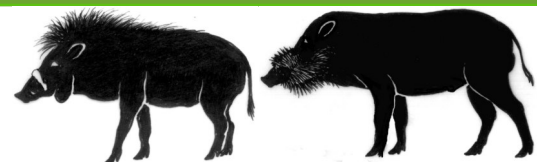
Discussion

The data presented in this paper largely excludes the information we collected about the animals which have already been included in the International Studbook. Only one or two examples of these have been mentioned to draw attention to the availability of complementary information, such as photographs, on museum labels and in museum records. It is highly likely that many of the pre-1950 babirusa in zoological collections were drawn or painted from life, or that photographs of them were taken. We did not attempt to systematically collect this information but noted its availability for further study as we progressed this investigation (see Tables).





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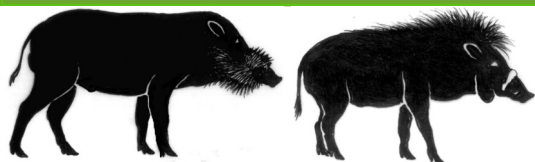


Tab. 4 continued

STUDBK ID	SEX	SIRE_ID	DAM_ID	LOCATION	SPECIES	ARRIVAL	DEATH	REFERENCE	COMMENT
	M			Antwerp	?	00.06.1938	20.01.1941	(photos in "Zoo" of 1938)	skull in Koninklijk Belgisch Instituut voor Natuurwetenschappen (KBIN), Brussels, Jan Tavernier curator of mammals)
	F			Antwerp	?	00.06.1938	20.01.1941	(photos in "Zoo" of 1938)	skull in Koninklijk Belgisch Instituut voor Natuurwetenschappen (KBIN), Brussels, Jan Tavernier curator of mammals)
9060	M	wild	wild	Paramount aquarium to Chicago Brookfield	?	~1938	?	International Studbook	(dissected by Davis 1940?)
	M			Rube to Paris-Vincennes	?	?	20.09.1938	(Urbain et al, 1938)	Ill with Fievre aphteuse (foot and mouth disease) on 28.11.1938
	F			Penatang to Paris-Vincennes	?	?	20.09.1938	(Urbain et al, 1938)	Ill with Fievre aphteuse (foot and mouth disease) on 28.11.1938
	F			Rome	?	09.05.1939	09.06.1944	From Hagenbeck (Rome zoo archives)	
	?			Penatang to Paris-Vincennes	?	?	24.05.1939	(Urbain et al, 1938)	Ill with Fievre aphteuse (foot and mouth disease) on 28.11.1938,
	F			Paris Vincennes	?	?	11.06.1939	(Urbain et al, 1938), (Urbain et al, 1939)	Ill with Fievre aphteuse (foot and mouth disease) on 28.11.1938, died of tuberculosis, (Urbain et al, 1939).
	M	?	?	Rotterdam to Hamburg-Hagenbeck	?	?	03.05.1939	after 00.05.1940	(is this the one in Mohr (private photo: 1958, 1960))
9055	F			Rotterdam to Hamburg-Hagenbeck	?		03.05.1939	after 03.10.1947	(is this the one in Mohr (private photo: 1958, 1960))
?	F			Adelaide	celebensis	00.01.1939	13.12.1944	(Craig, 1997)	
?	M	00.00.37	00.06.39	Adelaide	celebensis	13.08.1940	25.06.1942	(Craig, 1997)	
	F			Berlin HHempel	?	?	19.02.1944	(Klos, 1969)	evacuated to HHempel
	?	?	?	Surabaya	?	<06.1941	?	(Anonymous, 1941) (Sody, 1941b)	
	?	?	?	Surabaya	?	<06.1941	?	(Anonymous, 1941) (Sody, 1941b)	
	?	?	?	Surabaya	?	<6.1941	?	(Anonymous, 1941) (Sody, 1941b)	
	M	?	?	Dresden	?	28.03.1942	13.02.1945	(Ullrich, 1953)	Martin Clemens illustrated animals

Table 4 continues on page 30.





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Tab. 4 continued

STUDBK ID	SEX	SIRE_ID	DAM_ID	LOCATION	SPECIES	ARRIVAL	DEATH	REFERENCE	COMMENT
	M	?	?	Dresden	?	28.03.1942	18.02.1945	(Ulrich, 1953)	Martin Clemens illustrated animals
	M	?	?	Dresden	?	13.02.1945	14.02.1945	?	
	M	?	?	Dresden	?	13.02.1945	14.02.1945	?	
	M	?	?	Frankfurt to Berlin	?	?	?	?	
	?			Frankfurt	?	18.03.44	?	(125 years Frankfurt)	
	F	?	?	Berlin	?	23.11.1943	23.11.1943	Museum record	
	M			Berlin to H.Hempel	?	31.03.1944		(Klos, 1969)	evacuated to H.Hempel
				H.Hempel	?	06.04.1944	?	(Klos, 1969)	
	F			Frankfurt to Hamburg-Hagenbeck	?	01.01.1946		?	
				Hamburg-Hagenbeck	?	13.06.1946	21.01.1950	?	

We anticipate that when the historical information presented here is added to that already published in the International Studbook, a better-defined understanding will emerge of the transport of live babirusa from Indonesia to zoological collections around the world. It would be our hope that the framework we have provided in this investigation will enable future research to be conducted.

Acknowledgements

We gratefully acknowledge the helpful assistance provided to us by staff in the zoos, museums, libraries and archives that we have searched. We also acknowledge with gratitude the financial support for these studies provided by the University of Edinburgh and the Balloch Trust.

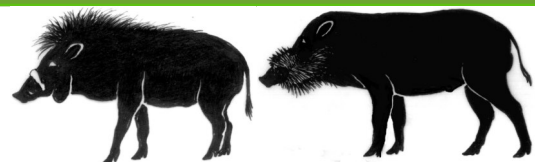
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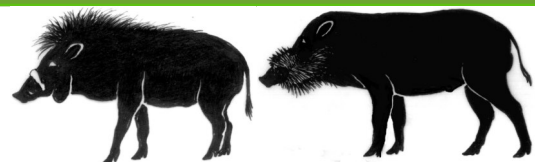


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DECLARACIÓN SOBRE VIGILANCIA SANITARIA Y CONTROL EN JABALIES Y CERDOS ASILVESTRADOS – SALTO, URUGUAY 2018

COMITÉ ORGANIZADOR Y GRUPO DE TÉCNICOS ASESORES

El jabalí está ampliamente distribuido a nivel mundial y es una de las 100 especies exóticas invasoras más dañinas. Fue introducido en Uruguay en la década de 1920 en el departamento de Colonia y se difundió al resto del país (cruzándose con el cerdo doméstico), llegando a Brasil a fines de la década de 1980. Por los perjuicios que ocasiona fue declarado plaga nacional en 1982.

La complejidad y antigüedad de esta problemática hizo que un Grupo de Trabajo interinstitucional e interdisciplinario transfronterizo (Brasil – Uruguay) comenzara a abordar esta temática en el año 2015, haciendo hincapié en la vigilancia sanitaria, el control de la especie y su potencial aprovechamiento productivo.

Continuando con las actividades en Uruguay fueron organizadas por el CENUR Litoral Norte, Educación Permanente y el Grupo Porcino de la UDELAR las jornadas sobre **VIGILANCIA SANITARIA Y CONTROL EN JABALIES Y CERDOS ASILVESTRADOS** en la ciudad de Salto, los días 4 y 5 de diciembre de 2018. Recibieron el apoyo logístico y financiero de la representación del USDA/APHIS en México, IICA, Dirección General de Servicios Ganaderos del

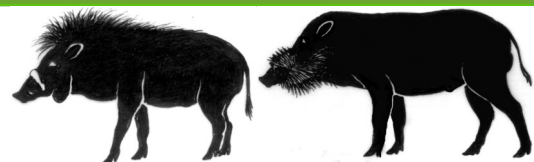


Ponentes





Ecology and Conservation



Ponentes

MGAP, Facultad de Veterinaria, Gobierno Departamental de Salto, Asociación Agropecuaria de Salto, Asociación de Cazadores del Uruguay, Asociación de Controladores de Jabalí de Artigas y las empresas privadas Veterinaria Bortagaray, Reproducción del Norte, Petrobras Turigal S.A. y CALSAL.

Disertaron profesionales provenientes de Argentina, Brasil, España y Uruguay, que pertenecen a Servicios Veterinarios Oficiales, Ministerios de Medio Ambiente, Universidades, Institutos de Investigación, Gobiernos Municipales, Parques Nacionales y Organizaciones de cazadores. Hubo un amplio espectro de concurrentes nacionales y extranjeros, compuesto por profesionales de distintas áreas (médicos, veterinarios, biólogos, ingenieros), productores, cazadores y estudiantes, que aportaron su visión del problema.

En las jornadas se abordaron las actividades, cada vez más necesarias en la región, de vigilancia sanitaria de estos animales, repasando algunas enfermedades zoonóticas (Tuberculosis, Hepatitis E, Toxoplasmosis, Leptospirosis, Rabia, Triquinellosis) así como también





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Necropsia

otras que causan impacto económico en los países, como Peste Porcina Africana y Clásica, Enfermedad de Aujeszky, PRRS y Fiebre Aftosa. A su vez, a ofrecimiento del Dr. Luis Barcos (Representante Regional de la OIE para las Américas) se realizó una videoconferencia con el Dr. Francisco Reviriego (DG SANCO, Unión Europea), abordándose las medidas que está realizando ese bloque en relación a la Peste Porcina Africana.

Técnicos de la región disertaron sobre diferentes formas para disminuir el impacto que producen y alternativas de control de los jabalíes y cerdos asilvestrados. Sobre el final de las jornadas se efectuó una necropsia de un ejemplar de jabalí, en el cual participaron técnicos de los distintos países intervinientes.

Se reafirmaron los impactos negativos que causan estos animales como por ejemplo en:

- Sector agrícola: daños a los cultivos como maíz, arroz, sorgo o frutales.
- Sector pecuario: predación en ovinos y bovinos.
- Medio ambiente: aumento de la erosión,

destrucción de humedales y pantanos, disminución de la calidad del agua, destrucción del tapiz natural, pérdida de la regeneración de bosques.

- Fauna Silvestre: desplazamiento y depredación de especies nativas.
- Trasmisión de enfermedades: tanto zoonóticas como de impacto económico y que afectan a la producción animal de las diferentes especies involucradas.
- La seguridad vial: accidentes automovilísticos.
- La seguridad y el ornato públicos: invasión y destrucción de áreas verdes suburbanas y urbanas, ataques a la población.

Finalizadas las jornadas, los técnicos participantes acordaron emitir esta Declaración para recomendar a las autoridades de Agricultura, de Caza y Recursos Naturales y de Salud de los países de la región, así como a las asociaciones gremiales de productores de animales domésticos y silvestres, a las universidades y a los institutos de investigación, a las asociaciones de cazadores y a todos los especialistas involucrados en la problemática generada por los jabalíes y cerdos asilvestrados, que tengan a bien considerar lo siguiente:

El cerdo asilvestrado debe considerarse una plaga con amplios impactos negativos en diversos sectores. Sus poblaciones se encuentran en franca expansión geográfica y demográfica, lo que hace temer mayores impactos en el futuro.





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Necropsia

En consecuencia, es necesario:

Control Poblacional

Establecer trabajos entre países de la región con la participación de las distintas instituciones involucradas para un correcto manejo poblacional de esta plaga fomentando y apoyando a estudios poblacionales (densidad, uso de hábitat, comportamiento) para ser base de las estrategias de control y delinear la vigilancia sanitaria.

Capacitación y profesionalización a los cazadores asociados responsables.

Vigilancia sanitaria

Formalizar programas de vigilancia sanitaria integrada en todos los países de la región monitoreando las poblaciones animales y sus principales enfermedades, sean zoonóticas o de impacto económico.

Diseñar planes de contingencia para eventos sanitarios que involucren directa o indirectamente al cerdo asilvestrado.

Establecer y difundir procedimientos de bioseguridad en las acciones de control poblacional y vigilancia sanitaria.

Interrelacionar laboratorios regionales estandarizando métodos.





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Investigación

Fomentar y apoyar a los distintos grupos de investigación de la región para aumentar su capacidad de innovación respecto al seguimiento y control de los daños causados por el cerdo asilvestrado.

Promover la participación e intercambio de conocimientos y experiencias técnicas con Organismos Internacionales de reconocimiento, tales como la OIE, OMS, CVP, IICA y FAO, entre otras, así como con las Agencias Gubernamentales y las Instituciones de Enseñanza e Investigación de otras regiones, que cuentan con una amplia experiencia en la atención de esta problemática.

Difusión de la problemática

Implementar una correcta comunicación y difusión a todos los sectores: El cerdo asilvestrado como plaga.

Integrar especialistas de las ciencias de la comunicación y educación para el desarrollo de actividades de difusión y educación comunitaria.

Salto, Uruguay, miércoles 5 de diciembre de 2018.

JORNADAS DE VIGILANCIA SANITARIA Y CONTROL EN JABALÍES Y CERDOS ASILVESTRADOS
4 Y 5 DE DICIEMBRE DE 2018
CENUR LITORAL NORTE (Salto, Rivera 1950)

Dr. Christian Cortázar Universidad de Castilla-La Mancha, España	Dr. Luis Lecuona USDA APHIS, México	Dra. Mabel Ribicich Universidad de Buenos Aires, Argentina	Dra. Juliane Webster SEMAPS, Brasil	Dr. Bernardo Todeschini Ministerio de Agricultura, Pecuaria e Abastecimiento, Brasil
Aldo Delaloye Guardaparque Parque Nacional El Palmar Entre Ríos, Argentina	Dr. La Hira Mendina Filho Equipe Javali no Pampa, Brasil	Ing. Agr. Javier Frade Secretariado Uruguayo de la Lana, Uruguay	Dr. Rodolfo Rivero Ministerio de Ganadería, Agricultura y Pesca, Uruguay	Dra. Virginia Santiago Empresa Brasileira de Pesquisa Agropecuária, Brasil
Dr. Santiago Mirazo Facultad de Ciencias, Uruguay	Dra. Dinora Satragno Facultad de Veterinaria, Uruguay	Lic. Carlos Prigioni Intendencia de Treintay Tres, Uruguay	Felipe Pedrosa UNESP, Brasil	Dr. Juan Martín Dabezies UDELAR CURC, Uruguay

ORGANIZAN



AUSPICIAN





Behaviour



An observation of a bearded pig (*Sus barbatus*) consuming a long-tailed macaque (*Macaca fascicularis*) in Bako National Park, Sarawak

by Melvin Gumal^{1,2}, Daniel Kong¹ and Elizabeth L. Bennett³

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Bearded pigs are found throughout most forest types in Borneo and are the main source of protein for many rural indigenous populations (Bennett et al., 2000). They are widely known as omnivores, eating a variety of food from seeds to plants and invertebrates as well as scavenging on dead animals (Luskin et al., 2017; Phillipps & Phillipps, 2018).

On 26th October 2018, a male bearded pig was observed with a small-sized long-tailed macaque in its mouth at Bako National Park (Lat, N 1.7166638; Long, E110.4666648, Fig. 1), Sarawak, Malaysia. According to canteen operator at Bako National Park, the long-tailed macaque was caught by a bearded pig behind the accommodation blocks (Forest Hotel A) in the park (Fig. 2). The operator also said that this was the second time that a bearded pig had caught a long-tailed macaque. No records were made of the first observation.

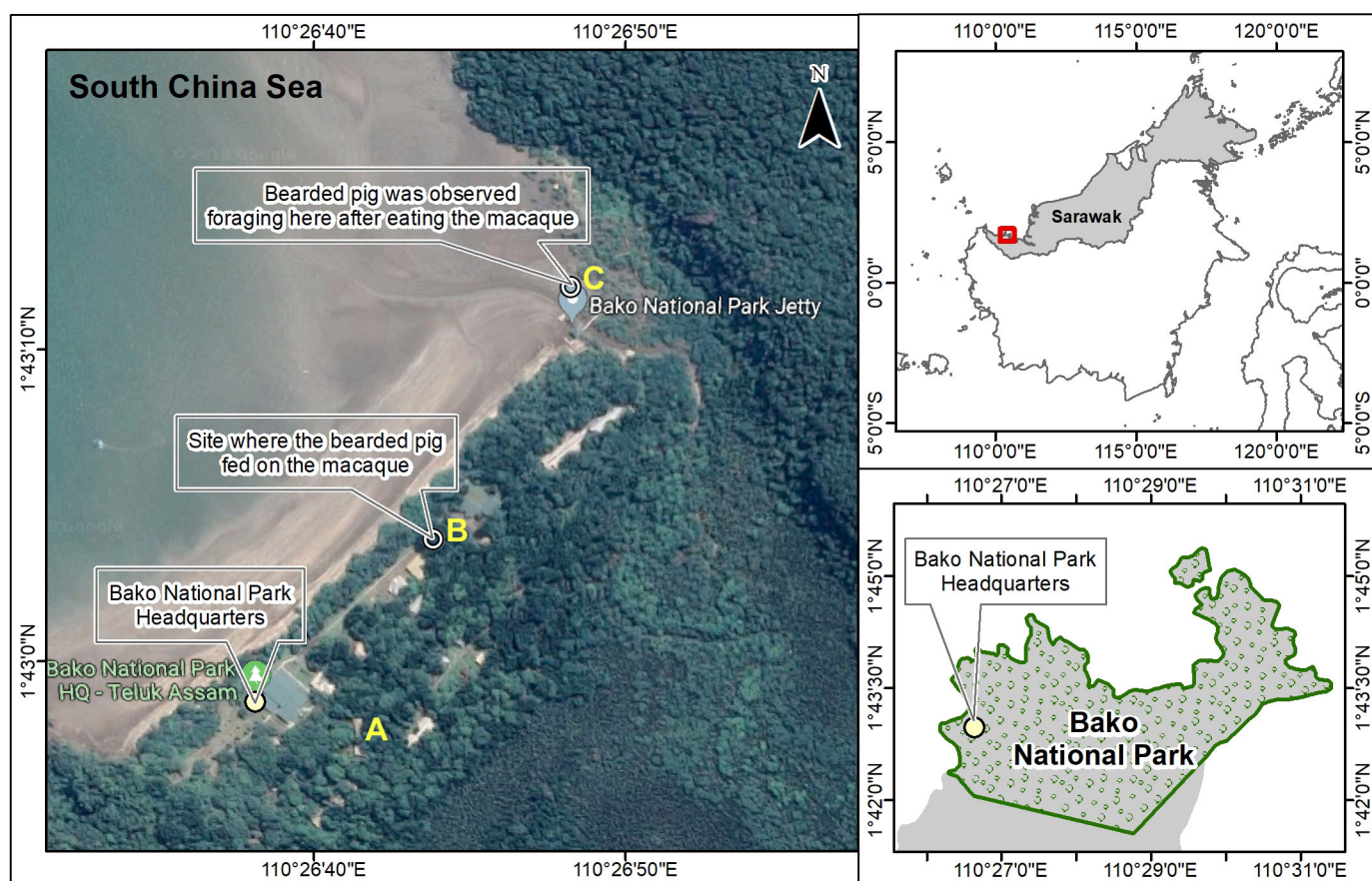


Fig. 1: Map of Bako National Park in Sarawak. The location A was where the long-tailed macaque was caught by the bearded pig. Location B was where the macaque was eaten and C, where the bearded pig was found foraging for two hours after consuming the macaque.





Behaviour



Fig. 2: The location where the long-tailed macaque was caught.

Photo: M. Gumal

Photographs and videos were taken of the male bearded pig consuming the monkey; the video can be seen at the following url (https://youtu.be/PQ2cw_FTQyg). As can be seen from Figures 3 and 4, the small long-tailed macaque was at least 3-4 months old as brown fur had replaced its black, infant pelage. The bearded pig consumed most of its quarry. This included the skin, most of the head and its bones. The pig could be seen stripping the macaque from its skin as well as moving parts of the long-tailed macaque to the back of its mouth. Bone-crushing sounds were also heard. During the feeding period, two other male pigs were seen loitering close to the feeding site, although neither came in to fight with the male over the caught macaque.

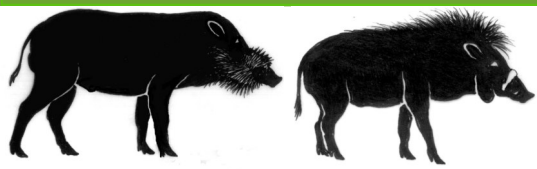


Fig. 3: Long-tailed macaque torso under the front, left hoof of the bearded pig. Photo: D. Kong

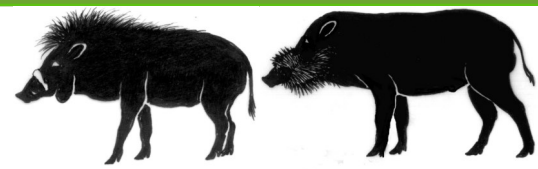
The feeding ended at 09.34, i.e. 24 minutes after the capture. After consuming the long-tailed macaque, five remnant pieces of the macaque were found, i.e. a small piece of fur, a piece of cartilage, the top of the skull case, a piece of unidentifiable red body-part and a piece of unidentifiable bone (Fig. 5). After the feed, the two other male bearded pigs moved in to examine the feeding site, but did not remove the remnant five pieces. Two hornets were then seen feeding on the red body-part at 11.30, and none of the remnant pieces were removed by the other pigs or other animals.

After the meal, the male bearded pig that caught the macaque crossed the main trail and walked towards the beach and crossed the tidal river at Telok Assam. He was seen foraging there at 09.51 and for about two hours afterwards (Fig. 1). We were able to monitor this bearded pig as it had identifiable white markings/scrapes on its right shoulder.





Behaviour



It is uncertain whether this is the first observed and published record of a bearded pig catching and consuming a primate. However, given that a previous observation of such behaviour had been noted in the park and that two other pigs were following, the culture of catching a primate in Bako is possibly not new.



Fig. 4: Faceless long-tailed macaque and its right hand below the nose of the bearded pig. Photo: M. Gumal

Fig. 5: Remnant pieces of the long-tailed macaque. Photo: D. Kong

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Fig. 6: Bearded pig that killed the long-tailed macaque at the river bank at Telok Assam, 30 minutes later. Photo: M. Gumal





Physiology and Genetics



Pyogenic multisystemic abscesses in collared peccary (*Pecari tajacu*) caused by *Escherichia coli* and *Streptococcus* spp.

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Abscess is a pathological response to an inciting stimulus. During this process, enzymes and neutrophil inflammatory mediators form the pus (Cullen & Stalker, 2015). Abscess contain pus in the centre and is delimited by a cell wall of healthy tissue (capsule) (Ackerman, 2017). Abscesses have two origins: sterile and septic. Sterile abscesses can originate from foreign bodies, malabsorption of an injected medication and complications during artery or vein cannulation (Ackerman, 2017). In the other hand, septic abscesses originate from bacterial, parasitic or viral infections (Quinn et al., 2011). A wide variety of pathogenic aerobic and anaerobic bacteria can form septic abscesses in different organs of the body (Quinn et al., 2011). Abscess content varies in consistency (serous, purulent, caseous) and colour (yellow, green, white, red) (Ackerman, 2017). The most common bacteria isolated in animal abscesses are *Bacteroides* spp., *Clostridium* spp., *Corynebacterium* spp., *Escherichia coli*, *Pasteurella* spp., *Pseudomonas aeruginosa*, *Rhodococcus equi*, *Serratia marcescens*, *Staphylococcus* spp., *Streptococcus* spp. and *Trueperella pyogenes* (Quinn et al., 2011; Ackerman, 2017).

All bacterial diseases documented in members of the family Tayassuidae have the ability to form abscesses in different organs of the thoracic and abdominal cavities (*Borrelia burgdorferi*, *Brucella* spp., *Clostridium perfringens*, *Erysipelothrix rhusiopathiae*, *Escherichia coli*, *Leptospira* spp., *Mycoplasma hyopneumoniae*, *Pasteurella multocida*, *Salmonella* spp., *Staphylococcus aureus* and *Yersinia pestis*) (Gruver & Guthrie, 1996; Mayor et al., 2006; Shender et al., 2009; Freitas et al., 2010; Coutinho et al., 2012; Batista et al., 2014; de Castro et al., 2014). Abscesses can form in one or more organs depending on the severity of the septicaemia and the type of bacteria involved (Ackerman, 2017). Multiple abscess formation has previously described in domestic animals (Uzal et al., 2016). However, as far as we know in wild animals is less frequent and in Tayassuids has never been reported before. For this reason, we consider important to report this case, since the two bacteria (*E. coli* and *Streptococcus* spp.) isolated in the abscesses of this collared peccary (*Pecari tajacu*) are potentially zoonotic.

On 19 December 2014 in Chiapas, Mexico, an adult captive collared peccary was found dead in its exhibitor. This individual lived with five conspecifics and in previous days none showed clinical signs of disease. After external examination (looking for wounds or snake bites) a necropsy was performed following the technique described by King et al (2013). We opened the carcass and exposed the organs of the thoracic cavity, finding a liquid compatible with hydrothorax, also we encountered multiple white abscesses of different sizes (between 1 and 3.5 cm) on the lungs, intercostal muscles and diaphragm (Fig. 1 and 2). Then we opened the abdominal cavity and observed that the liver present two ulcerated abscesses that were spilling purulent exudate to the rest of the organs (Fig. 3). We separated the organs and observed the same type of abscesses in





Physiology and Genetics

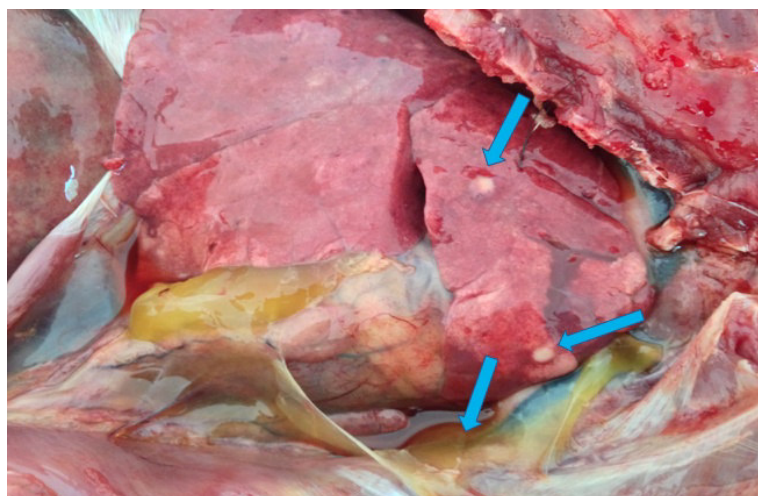


Fig. 1: Yellow liquid in the thoracic cavity and multiple pyogenic abscesses of different size in the lungs of a collared peccary (*Pecari tajacu*).

different bacterium growth medium including Blood Agar 5%, McConkey Agar, Mannitol Salt Agar, Brilliant Green Agar, and Salmonella- Shigella agar. The inoculation and incubation of the plates, as well as the morphological and microscopic analysis of the bacteria were performed following the method described in Pérez-Flores et al (2011). The identification of the Gram-negative bacteria was performed with biochemical tests tubes (Kämpfer et al., 1991; MacFaddin, 2000). These reactions were compared with the characteristics obtained in the primary identification and using biochemical reference tables (Cowan & Steel, 1974; Quinn et al.,

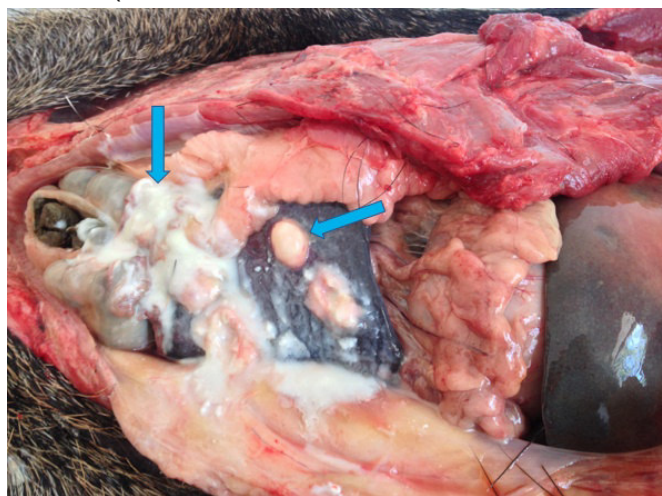


Fig. 3: Pyogenic abscesses ulcerated and perforated spilling purulent exudate to the abdominal cavity of a collared peccary (*Pecari tajacu*).

all the lobes of the liver, spleen and intestines (Fig. 4). Samples of the abscesses exudate were taken by passing a sterile culture swab (BBLTM Culture SwabTM Plus). Swabs were then preserved at 2 to 8°C in AMIES transport mediums, ideal for aerobic and anaerobic bacteria, and were send for analyses to the Laboratories of Diagnostic Animal Pathology of Villahermosa, Tabasco (Authorized by SAGARPA no. 224).

Bacterial cultures were made using

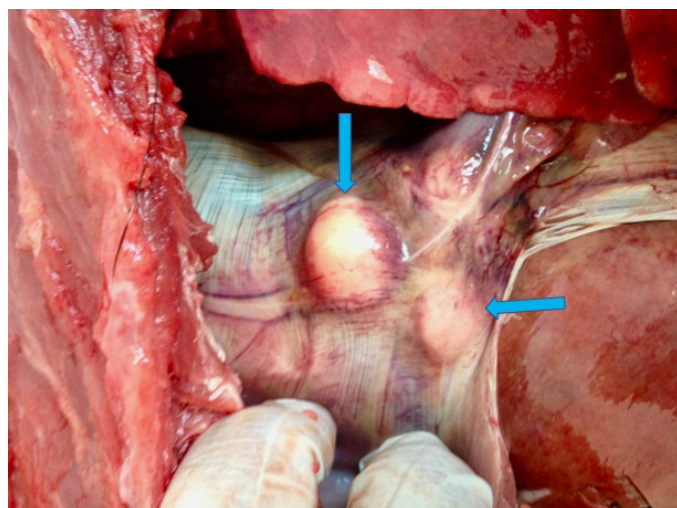


Fig. 2: Pyogenic abscesses of different size in the diaphragm of a collared peccary (*Pecari tajacu*).

2011; Murray et al., 1999). A miniaturized method to identify Gram-positive and Gram-negative bacteria was performed using the BBL CrystalTM Identification Systems Enteric/Non-fermenter Id Kit and BBL CrystalTM Identification Rapid Gram-positive Id Kit (Killian & Bulow, 1976; MacFaddin, 2000).

Bacteria isolated in lungs, intercostal muscles and diaphragm abscesses was *E. coli*; while in the intestines, liver and spleen were *E. coli* and *Streptococcus* spp. *Escherichia coli* is a gram-negative and facultative anaerobic bacterium that is commonly found in the intestine of





Physiology and Genetics

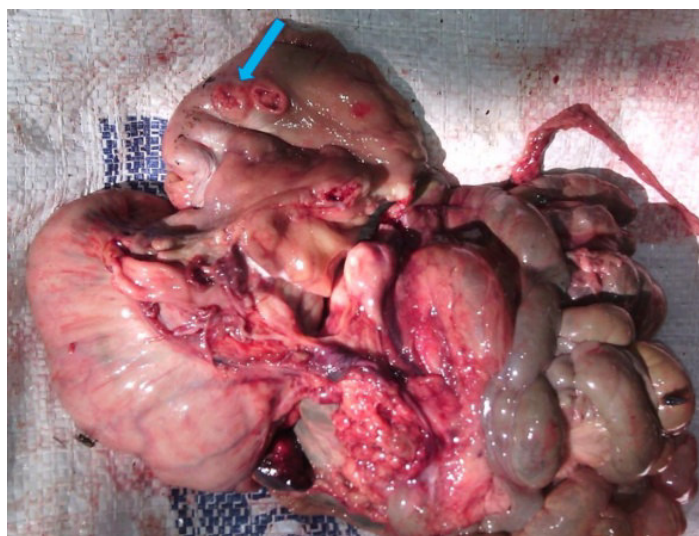


Fig. 4: Ulcerated and perforated pyogenic abscesses in the intestines of a collared peccary (*Pecari tajacu*).

endocarditis and toxic shock (Patterson, 1996). Once bacteria were identified, we started an antibiotic therapy to the rest of the peccaries. We gave orally sulfamonomethoxine and trimethoprim 10 mg/kg (Daimetoprim @Sanfer) every 12 hours for 10 days and no other animal died.

We hypothesize that the principal cause of the sudden death was a septic shock. Probably, this sepsis develops from an infection in the biliary system, since the most affected organ was the liver (Fig. 5). Most cases of septic shock are caused by the exotoxins and endotoxins of gram-positive and gram-negative bacteria. In this case, both bacteria isolated are capable to deliver toxins, so the infection may have started in the liver and extend into the hepatic veins and spread to the lungs, diaphragm and intercostal muscles via the caudal vena cava. Infection of the adjacent organs to the liver (intestines and spleen) could be through the portal and renal veins.



Fig. 5: Severely damaged liver with multiple ulcerated and perforated pyogenic abscesses of a collared peccary (*Pecari tajacu*).

Escherichia coli and *Streptococcus* spp. are important zoonotic diseases. Therefore, it is necessary to document this cases, since Tayassuids are species that are hunted and consumed frequently by local people in the regions where they are distributed geographically. Additionally, is important to improve research to understand the ecology of diseases and health status of wild and captive populations of Tayassuids in Mexico.

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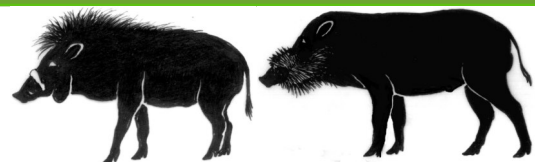


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Veterinary, Genetic and Physiological Studies

The effect of carcass weight on chemical characteristics and fatty acid composition of Longissimus dorsi and Semimembranosus muscles of European wild boar (*Sus scrofa scrofa*) meat.

Batorska, M., J. Wiecek, M. Kunowska-Slosarz, K. Puppel, J. Slosarz, M. Golebiewski, B. Kuczynska, B. Popczyk, A. Rekiel and M. Balcerak

Canadian Journal of Animal Science 98(3), 557-564. <https://doi.org/10.1139/cjas-2017-0090>

The objective of this study was to investigate the effect of carcass weight on chemical characteristics and fatty acid composition of m. longissimus dorsi and m. semimembranosus of European wild boar (*Sus scrofa scrofa*) meat. The research was carried out on 50 wild boars shot during four battues at hunting reserves in the central part of Poland. The carcasses were divided into three groups: ≤ 30 kg (G1), 31-45 kg (G2), and >45 kg (G3). The protein concentration increased with carcass weight ($P \leq 0.01$). The concentration of saturated fatty acids was influenced by carcass weight and was higher when weight increased. A significantly higher level of monounsaturated fatty acids (MUFA) was found in the carcasses of wild boars from G3 compared with G1 group ($P \leq 0.01$). The content of C18:2n-6 was significantly lower in the lightest carcasses compared with the heaviest ($P \leq 0.05$). Statistical analysis confirmed that carcasses weight significantly affected polyunsaturated fatty acids (PUFA) n-3 content. The lightest carcasses contained a significantly higher concentration of PUFA n-3 ($P \leq 0.01$). In addition, in G3, the amount of C22:5n-3 was two-fold lower ($P \leq 0.01$) than in G1. The research has shown that the meat quality was affected by the carcass weight, resulting better parameters in the lighter than in the heavier carcasses. Therefore, most of the culled wild boars should be squeakers and young boars after the first year of life.

Management of hunting waste as control measure for tuberculosis in wild ungulates in south-central Spain.

Cano-Terriza, D., M. A. Risalde, S. Jimenez-Ruiz, J. Vicente, J. Isla, J. Paniagua, I. Moreno, C. Gortazar, J. A. Infantes-Lorenzo and I. Garcia-Bocanegra

Transboundary and Emerging Diseases 65(5), 1190-1196. <https://doi.org/10.1111/tbed.12857>

In recent decades, habitat change and the intensive management of wild ungulates for hunting have led to an increase in their populations in south-central Spain. This implies a higher generation of hunting waste, which can favour the transmission of infectious diseases, including tuberculosis (TB). The aim of this study was to assess the usefulness of the proper disposal of hunting waste as TB control measure in wild boar (*Sus scrofa*) and red deer (*Cervus elaphus*) during the 2008/2009 to 2016/2017 hunting seasons. Blood samples from 664 wild boar and 934 red deer were obtained in 14 game estates in two provinces in Andalusia (Area 1), where the disposal of hunting waste was implemented since the 2012/2013 hunting season. Besides, six game estates in the province of Ciudad Real, in Castilla-La Mancha (Area 2), an adjacent region where this management measure was not implemented during the studied period, were used as controls, sampling 277 wild boar and 427 red deer sera. The Mycobacterium tuberculosis complex (MTC), seroprevalence detected in wild boar from Area 1, was significantly higher before the disposal of big game hunting by-products (82.8%; 2008/2009-2012/2013) compared to the second period (61.8%; 2013/2014-2016/2017) ($p < .001$), after this control measure became established. By contrast, no significant differences between periods were found in wild boar





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(41.3% versus 44.8%; $p=.33$) and red deer (14.9% versus 11.6%; $p=.19$) from Area 2 as well as in red deer (10.8% versus 10.5%; $p=.48$) from Area 1. The proper disposal of hunting waste contributed to achieve a 25% reduction in MTC seroprevalence in wild boar. These results are of particular relevance regarding wild boar in the current context of re-emerging and emerging diseases such as TB and African Swine Fever in Europe. Further studies are needed to assess the effect of this measure on the health status of livestock and other wildlife species.

The avoidable (?) hunting accident-fatal thigh injury caused by a wild boar.

Dokter, M., K. P. Philipp and B. Bockholdt

Rechtsmedizin 28(5), 442-445. <https://doi.org/10.1007/s00194-018-0267-1>

During a battue a 50-year-old hunter searching for wild boar in a reed belt, suffered a severely bleeding injury to the left thigh from which he died shortly afterwards. The exact sequence of events was initially unclear. The forensic autopsy revealed the cause of death to be exsanguination due to a traumatic rupture of the femoral artery and the accompanying vein. The injuries could be attributed to a frontal attack from a wild boar. A few days after the battue the wounded boar was killed and discovered to be a full-grown wild boar with razor-sharp tusks.

First report of wild boar susceptibility to Porcine circovirus type 3: High prevalence in the Colli Euganei Regional Park (Italy) in the absence of clinical signs.

Franzo, G., C. M. Tucciarone, M. Drigo, M. Cecchinato, M. Martini, A. Mondin and M. L. Menandro

Transboundary and Emerging Diseases 65(4), 957-962. <https://doi.org/10.1111/tbed.12905>

The genus Circovirus includes one of the most relevant infectious agents affecting domestic pigs, Porcine circovirus type 2 (PCV-2). The wild boar susceptibility to this pathogen has also been demonstrated although the actual epidemiological role of wild populations is still debated. In recent times, a new circovirus, Porcine circovirus type 3 (PCV-3), has been discovered and reported in the presence of several clinical conditions. However, no information is currently available about PCV-3 circulation and prevalence in wild boar. To fill this gap, 187 wild boar serum samples were collected in the Colli Euganei Regional Park (Northern Italy) and screened for PCV-3, demonstrating a high viral prevalence (approximately 30%). No gender differences were demonstrated while a lower infection prevalence was observed in animals younger than 12 months compared to older ones, differently from what described in commercial pigs. Almost all sampled animals were in good health conditions and no association was proven between PCV-3 status and clinical syndromes in wild animals. The genetic characterization of selected strains enlightened a relevant variability and the absence of closely related strains originating from domestic pigs. Therefore, the observed scenario is suggestive of multiple introductions from other wild or domestic swine populations followed by prolonged circulation and independent evolution. Worldwide, this study reports for the first time the high susceptibility of the wild boar to PCV-3 infection. The high prevalence and the absence of association with clinical signs support the marginal role of this virus in the wild boar population ecology. However, its epidemiological role as reservoir endangering commercial swine cannot be excluded and will require further investigations.





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Wild Boar: A Reservoir of Foodborne Zoonoses.

Fredriksson-Ahomaa, M.

Foodborne Pathogens and Disease. <https://doi.org/10.1089/fpd.2018.2512>

Wild boar populations around the world have increased dramatically over past decades. Climate change, generating milder winters with less snow, may affect their spread into northern regions. Wild boars can serve as reservoirs for a number of bacteria, viruses, and parasites, which are transmissible to humans and domestic animals through direct interaction with wild boars, through contaminated food or indirectly through contaminated environment. Disease transmission between wild boars, domestic animals, and humans is an increasing threat to human and animal health, especially in areas with high wild boar densities. This article reviews important foodborne zoonoses, including bacterial diseases (brucellosis, salmonellosis, tuberculosis, and yersiniosis), parasitic diseases (toxoplasmosis and trichinellosis), and the viral hepatitis E. The focus is on the prevalence of these diseases and the causative microbes in wild boars. The role of wild boars in transmitting these pathogens to humans and livestock is also briefly discussed.

Serological survey of influenza A viruses in domestic and wild Suidae in Corsica (France), a Mediterranean island environment.

Grech-Angelini, S., S. Herve, N. Rose, N. Barbier, F. Casabianca, O. Maestrini, A. Falchi and G. Simon

Preventive Veterinary Medicine 157, 94-98. <https://doi.org/10.1016/j.prevetmed.2018.06.004>

Corsica is a mountainous French island in the north-western Mediterranean Sea. It is a rural area, where pig farming is a major economic activity. Although no acute respiratory outbreaks due to swine influenza A viruses (swIAVs) have ever been reported in this free-ranging pig breeding system, influenza A viruses (IAVs) could be circulating within this pig population. A serological study was conducted as a first approach to domestic pigs and wild boars. Serum samples from 543 pigs raised on 91 different farms were collected during the 2013-2014 slaughtering season, and 279 sera from wild boars were obtained over four hunting seasons (between 2009 and 2014). They were first analysed by ELISA and then IAV positive and doubtful sera were subjected to haemagglutination inhibition tests using antigens representative of the four major enzootic swIAV lineages in Europe, i.e. avian-like swine H1N1 (H1(av)N1), pandemic-like swine H1N1 (H1N1pdm), H1N2 and H3N2. According to the ELISA results, 26.4% (CI95%: 17.7-36.7%) of herds had at least one positive animal (positive or doubtful by ELISA) and 12.4% (CI95%: 7.8-19.8%) of the pigs tested positive. Using the test characteristics (sensitivity and specificity), the true seroprevalence among Corsican pigs was estimated to be 16.4% (95% CI: 9.9-26.3). Antibodies directed against two different viral lineages were identified: H1N1pdm (in 66.2% and 45.8% of the IAV positive pigs and farms respectively) and H1avN1 (15.0% and 20.8% respectively). Evidence of exposure to viruses from two distinct lineages were detected on a single farm but in two different animals. Among the wild boars, 1.4% (CI95%: 0.4-3.6%) tested positive by ELISA and antibodies against the same two viruses were detected. Altogether, these results suggest that swIAVs from at least two different lineages are circulating among Corsican pigs, i.e. the H1N1pdm virus, probably introduced during the 2009 pandemic, and the H1(av)N1 virus, which is the most frequent swIAV in Europe. The low frequency of positive results observed in the Corsican wild boars hunted suggests that they would not play a major role in IAV dispersion dynamics on the island.





Suitability of Japanese wild boar tooth enamel for use as an Electron Spin Resonance dosimeter.

Harshman, A., S. Toyoda and T. Johnson

Radiation Measurements 116, 46-50. <https://doi.org/10.1016/j.radmeas.2018.07.001>

The objective of this study was to determine the suitability of Japanese wild boar tooth enamel to evaluate lifetime radiation doses using Electron Spin Resonance Dosimetry (ESR). The opportunity to utilize tooth enamel of Japanese wild boar as a dosimeter is of particular interest due to their importance in the ecosystem within the Fukushima Exclusion Zone. Relevant characteristics were investigated which included the degree of linearity and variability in dose response of wild boar tooth enamel in the range of 1.2-12 Gy. The tooth enamel was found to have a linear dose response in this range. Teeth harvested from the same boar exhibited a variation in dose response ranging from 3.4 to 79.9%. Tooth enamel from deciduous teeth of young boar exhibited greater uniformity in radiation dose response than permanent tooth enamel taken from old boar. This finding suggests that the additive dose method would be more appropriate for performing precise dose reconstructions using tooth enamel of old boar. Preliminary results for retrospective doses varied between 0.2 and 1.4 Gy. Critical level and decision level doses were calculated for the samples used in this study, and values suggest that this methodology would be best utilized for wild boar with estimated absorbed doses exceeding 1 Gy. Information obtained during this study will be used with data collected in future studies to determine the suitability of wild boar tooth enamel for use with ESR dosimetry.

Spatio-temporal kriging analysis to identify the role of wild boar in the spread of African swine fever in the Russian Federation.

Iglesias, I., F. Montes, M. Martinez, A. Perez, A. Gogin, D. Kolbasov and A. de la Torre

Spatial Statistics 28, 226-235. <https://doi.org/10.1016/j.spasta.2018.07.002>

The current situation of African Swine Fever (ASF) epidemic in continental Europe represents a serious economic risk for the European pig industry. It is well known that both domestic pigs and wild boar are involved in the ASF spread, but the exact mechanism of the domestic-wildlife interface remains under research. A spatio-temporal kriging analysis was carried out to estimate the most possible source of infection (domestic pigs or wild boar) for 1,323 notifications of ASF reported in the Russian Federation (RF) from 2013 to 2017. Results for the whole period of study showed that domestic pigs and wild boar were the potential source of infection for 55% and 45% of notifications, respectively. The analysis stratified by year showed fluctuation in this tendency through time. At the early stages of the ASF epidemic in the Southern regions of the RF in 2007-2008 wild boar appears to be the main source of infection, while the following stage of the epidemic in 2009-2012 may be more related to a domestic source of infection. At the latter stage of the epidemic (2013-2017) both, domestic and wild boar, play a similar role as a source of the disease in the newly infected areas but differences by geographical locations can be observed matching with the epidemiology of the disease. This paper provides useful information for better understanding of the ASF mechanism and domestic-wildlife interactions in the RF and describes a new spatio-temporal approach that can be easily applied to other similar animal diseases with a domestic-wildlife interface.





High prevalence and intensity of *Stephanurus dentatus* in a population of wild boar (*Sus scrofa*) in south western Spain.

Moratal, S., R. R. de Ybanez, P. Barroso, J. E. Granados, U. Hofle, C. Martinez-Carrasco, P. Acevedo and J. Vicente

Veterinary Journal 240, 47-49. <https://doi.org/10.1016/j.tvj1.2018.09.004>

In the period from October 2016 to February 2017, the urinary tracts of 390 wild boar (*Sus scrofa*) from four areas of south central Spain (102 from Donana National Park; 150 from Sierra Morena and the Toledo Mountains; 84 from Sierra Nevada; 54 from Sierra de Cazorla, Segura y Las Villas Natural Park) were examined for the presence of adult specimens of *Stephanurus dentatus* (Nematoda: Strongyloidea). This parasite was only detected in the wild boar population of Donana National Park, with high prevalence (76.5 +/- 4.2%; 78/102), mean intensity (43.2 +/- 4.4) and mean abundance (33.1 +/- 3.8). Juvenile wild boar had significantly lower prevalence and abundance than subadult and adult wild boar. The intensity of infestation was significantly higher in male than in female wild boar. The detection of a focus of *S. dentatus* infestation in the wild boar population in Donana National Park will provide further opportunities for understanding the epidemiology of this parasite.

Carriage of antibiotic-resistant bacteria in urban versus rural wild boars.

Navarro-Gonzalez, N., R. Castillo-Contreras, E. Casas-Diaz, N. Morellet, M. C. Porrero, G. Molina-Vacas, R. T. Torres, C. Fonseca, G. Mentaberre, L. Dominguez, S. Lavin and E. Serrano
European Journal of Wildlife Research 64(5). <https://doi.org/10.1007/s10344-018-1221-y>

The Western European population of wild boar (*Sus scrofa*) has increased its distribution over the past several decades, and some populations have colonized areas strongly influenced by human activity. Wild boars are known carriers of antibiotic-resistant bacteria acquired from the environment, and urban populations of wild boars may be more exposed than their rural counterparts. In this work, we compared the frequency of antibiotic resistance in indicator bacteria (*Escherichia coli*, *Enterococcus faecalis*, *Enterococcus faecium*) isolated from urban wild boars with that from rural wild boars in NE Spain. We further assessed whether bacterial isolates from the urban wild boars had a higher probability of showing antibiotic resistance when their host was highly associated to urban features. Seventy-two and 100 bacterial isolates from urban and rural habitat, respectively, were screened for antibiotic resistance against a set of antibiotics (13 per bacterial species). We found a significantly higher frequency of *E. faecium* showing resistance to tetracycline (70.0% vs 36.4%) and high-level resistance to streptomycin (30.0% vs 4.5%) in urban wild boars compared to rural wild boars ($p < 0.05$). *E. faecalis* was more frequently resistant to trimethoprim in urban than rural wild boars (33.3% vs 0.0%, $p < 0.05$). In isolates from urban origin, 55.6% of the likelihood of detecting antibiotic resistance depended only on the bacterial species, being more likely in the enterococci than in *E. coli*. These results suggest that urban wild boars may be more exposed to certain antibiotic-resistant bacteria or antibiotic resistance genes that they may acquire from the urban environment, although implications are uncertain.

Penetrating Anorectal Injury Caused by a Wild Boar Attack: A Case Report.

Okano, I., Y. Midorikawa, N. Kushima, Y. Watanabe, T. Sugiyama, K. Mitachi, K. Shinohara, T. Sawada and K. Inagaki

Wilderness & Environmental Medicine 29(3), 375-379. <https://doi.org/10.1016/j.wem.2018.02.007>
Wild boar attacks have rarely been reported in the medical literature. This is the case of an 83-





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year-old male farmer who was assaulted from behind by an injured adult wild boar. He presented with hemorrhagic shock after sustaining injuries to the right profunda femoris artery and right sciatic nerve as well as significant soft-tissue injuries, bilateral iliac wing fractures, an open pneumothorax, and an anorectal injury. The anorectal injury was treated with fecal diversion but was complicated by soft-tissue infection in the surrounding dead space. The patient needed multiple operations, including removal of the distal rectum and creation of a permanent colostomy. In this report, we highlighted the characteristics of anorectal trauma caused by a wild boar attack. We conclude that penetrating anorectal injuries caused by this type of attack can be associated with extensive soft-tissue damage despite externally appearing to be simple puncture wounds. Anorectal combat injuries have demonstrated similar extensive surrounding soft-tissue injuries and propensity for infection; therefore, this case supports adopting a similar treatment strategy, that of serial and radical debridement, to treat certain wild boar injuries.

African swine fever (ASF) in wild boar.

Pejsak, Z., M. Truszczynski and K. Tarasiuk

Medycyna Weterynaryjna-Veterinary Medicine-Science and Practice 74(12), 743-746.

<https://doi.org/10.21521/mw.6148>

This paper contains main points of the scientific opinion prepared by EFSA in 2018 on the request of the European Commission on the ASF epidemic in wild boar in Eastern-Central Europe, which started in 2014 and is existing and increasing until the present time. The first point is providing an estimate of the wild boar density in the European Union (EU). The next item is presenting the opinion on the latest epidemiological data to identify thresholds in wild boar density that do not allow sustaining the disease in different settings. The third question and answer concerns wild boar and feral pigs depopulation methods or population reduction methods. The fourth chapter is reviewing fencing methods demonstrating to temporarily protect crops from damage, caused by wild boar or feral swine. Currently there is no evidence, that large-scale fences have been effective for the containment of wild boar or feral pigs. The answer to the fifth question on surveillance strategy contains information on sample size, frequency of sampling and identification of possible risk groups for early detection of ASFV in naive wild boar population. Passive surveillance is according to the opinion of EFSA the most effective and efficient method of surveillance for early detection of ASF in wild boar. For early detection through passive surveillance, the aim is to test as many "found dead" animals as possible. Based on current knowledge and experiences for an intervention to be successful, there is a need to detect an ASF incursion while it is spatially contained. The sixth topic of the EFSA scientific opinion requests to review successful methodologies used in the past, as for example the mentioned passive surveillance. It is recommended that this should be done in discussion among specialists from the UE countries. Good collaborations with hunters is recommended.

Contact rates in wild boar populations: Implications for disease transmission.

Podgorski, T., M. Apollonio and O. Keuling

Journal of Wildlife Management 82(6), 1210-1218. <https://doi.org/10.1002/jwmg.21480>

Inter-individual contacts in wildlife populations are usually highly heterogeneous. This variation translates into differential disease transmission rates between individuals, which have vital consequences for the spread, persistence, and control of infectious diseases. Wild boar (*Sus scrofa*) is an abundant game species across Europe that poses serious health threats to wildlife,





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livestock, and humans. However, factors shaping contact rates and structure in wild boar populations, key parameters in disease ecology, remain poorly studied. We quantified dyadic association rates, as a proxy of contacts, and individual-based network centrality measures using telemetry data from 3 wild boar populations across Europe. Next, we examined the effect of sex, age, group membership, and space use on association rates and individual centrality. Contact rates depended strongly on the distance between individual home ranges; the most frequent associations occurred at distances of 0-1km (mostly within groups), less frequent at 1-3km (mostly between groups), and sporadic at >4km. Association rates were an order of magnitude higher within social groups than between them. Between-group association rates were only dependent on the distance between groups, with no apparent effect of animal sex or age. At the social network level, young animals (0.5-2 yr) showed greater between-group connectivity and a more central position in the network than adults. Our results highlight substantial contact heterogeneities in wild boar populations, which should be considered in epidemiological modeling and disease control actions. First, wild boar contact rates are strongly constrained socially and spatially. Hence, management measures reducing these constraints, such as supplementary feeding and intensive hunting, may lead to increased disease transmission rates. Second, young wild boars show exceptional connectivity within the population, highlighting their high capacity for disease transmission. Therefore, targeted removal of yearlings should be considered to optimize disease control efforts.

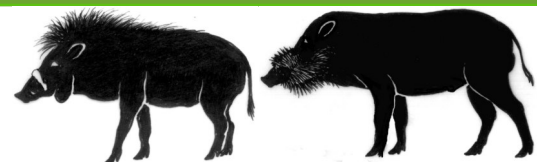
Do wild boar movements drive the spread of African Swine Fever?

Podgorski, T. and K. Smietanka

Transboundary and Emerging Diseases 65(6), 1588-1596. <https://doi.org/10.1111/tbed.12910>

The spatial behaviour of hosts can seriously affect the transmission of pathogens and spatial spread of diseases. Understanding the relationship between host movements and disease dynamics is of prime importance for optimizing disease control efforts. African swine fever (ASF), a devastating disease of wild and domestic suids, has been spreading continuously through eastern Europe since 2007. The wild boar (*Sus scrofa*) has been implicated in the epidemiology of this disease, but the role of wild boar movements in ASF dynamics and spread has not been studied and remains largely speculative. Here, we examined whether monthly parameters of wild boar movements (dispersal distance of yearlings, home range size of adult males and females) can explain variation in the spatio-temporal dynamics of the ASF outbreak in the wild boar population in north-eastern Poland, 2014-2015. We expected to observe a positive relationship between host mobility and disease spread. Contrary to our expectations, we found that movements of wild boar, despite their seasonal variation, were poor predictors of ASF dynamics in space and time. During the 2 years of the study, ASF spread gradually at a steady pace of 1.5 km/month without significant changes across seasons. None of the analysed movement parameters explained variation in the measures of ASF occurrence and spread (i.e., number of cases, prevalence, size and expansion rate of the outbreak area). We believe that the factor limiting the influence of host movements on ASF dynamics is the severity of the disease, which quickly hampers extensive movements and restricts disease transmission to only the most immediate individuals. Three natural factors constrain direct disease transmission: wild boar social structure, the short duration of low-level virus shedding and high virus-induced lethality, followed by indirect transmission through infected carcasses. These most likely shape the gradual spread of ASF in space and its persistence in already infected areas.





Molecular identification of *Trichinella* spp. in wild boar, and serological survey of high-risk populations in Iran.

Rostami, A., H. Khazan, E. B. Kia, M. Bandehpour, G. Mowlavi, B. Kazemi and N. Taghipour
Food Control 90, 40-47. <https://doi.org/10.1016/j.foodcont.2018.02.016>

After half a century, *Trichinella* infection has been reported in humans following ingestion of wild boar meat hunted in Northern Iran. We have performed a cross-sectional study to evaluate the prevalence of *Trichinella* spp. infections in wild boar and prevalence of anti-*Trichinella* antibodies among at-risk individuals for the first time in Iran. Muscle and sera samples were collected from 79 wild boars and 364 at-risk individuals. *Trichinella* infection has been investigated by artificial digestion and molecular identification (in wild boar muscles) and by serology (in humans). *Trichinella* larvae were isolated from three wild boars (3,7%; 95% CI, 2.9-4.3). The isolated larvae were identified as *T. britovi* using CO1 and 5S rRNA gene primers amplification. The percent identity regarding to 5S rRNA gene (98.7-100%) and divergence (0-1.9%) further confirmed the isolates as *T. britovi*. Of the 364 participants, anti-*Trichinella* IgG were detected in 8 (2.2%; CI 95%, 1,9-2.4). Risk factors associated with *Trichinella* infection seropositivity in humans, were hunter being (OR, 13.5; 95% CI, 3.1-59.4; $P = 0.003$) and high consumption (more than 7 time in a year) of wild boar meat (OR, 17.5; 95% CI, 3.2-93.6; $P < 0.001$). In conclusion, results of this study emphasized that consumption of wild boar meat could be important source of human trichinellosis as a completely neglected infection disease in Iran. We suggest that the additional studies should be performed in different parts of Iran to further clarify the prevalence of trichinellosis in wild animals to guide the development of appropriate public health interventions.

A systematic review and meta-analysis on the global seroprevalence of *Trichinella* infection among wild boars.

Rostami, A., S. M. Riahi, R. Ghadimi, H. Hanifehpour, F. Hamidi, H. Khazan and H. R. Gamble
Food Control 91, 404-411. <https://doi.org/10.1016/j.foodcont.2018.04.028>

Trichinellosis, caused by the parasitic nematode *Trichinella* spp. is a widespread foodborne zoonotic disease and is a public health concern in many countries. Wild boar is the second most important source of trichinellosis for humans. We conducted a systematic review and meta-analysis to evaluate the global seroprevalence of *Trichinella* infection among wild boar. We searched five major databases for studies reporting *Trichinella* spp. seroprevalence in wild boar between January 1995 and January 2018. Inclusion and exclusion criteria were applied. A random-effects model was used to estimate the pooled seroprevalence of *Trichinella* in wild boar. A total of 21 studies involving 16,327 wild boar from 15 countries were included in this meta-analysis. The pooled seroprevalence for *Trichinella* infection in wild boar was 6% (95% CI: 3-10%; 1084/16327). The estimated seroprevalence in North America was 9% (95% CI, 1-25%), in Europe 7% (95% CI, 3-13%), in Asia 3% (95% CI, 0.0-11%) and in Oceania 3% (95% CI, 2-4%). Geographical location, gender and age were not significantly associated with seropositivity. In sub-group analysis, the pooled seroprevalence of *Trichinella* infection in wild boar when ELISA was used as the diagnostic test (16%; 95% CI, 4-34%) was significantly higher when compared to western blot (4%; 95% CI, 0-12%). These results emphasize that wild boars are a potential source for acquisition of *Trichinella* infection in humans, and surveillance programs should be implemented in high-risk countries.





Classical swine fever in India: current status and future perspective.

Singh, V. K., K. K. Rajak, A. Kumar and S. K. Yadav *Tropical Animal Health and Production* 50(6), 1181-1191. <https://doi.org/10.1007/s11250-018-1608-5>

Classical swine fever (CSF) is a globally significant disease of swine caused by classical swine fever virus. The virus affects the wild boars and pigs of all age groups, leading to acute, chronic, late-onset or in-apparent course of the disease. The disease causes great economic loss to the piggery industry due to mortality, stunted growth, poor reproductive performance, and by impeding the international trade of pig and pig products. In India, CSF outbreaks are reported from most of the states wherever pig rearing is practiced and more frequently from northeast states. In spite of the highly devastating nature and frequent outbreaks, CSF remained underestimated and neglected for decades in India. The country requires rapid and sensitive diagnostic tests for an early detection of infection to limit the spread of the disease. Also, effective prophylactics are required to help in control and eradication of the disease for the development of the piggery industry. This review looks into the economic impact; epidemiology of CSF highlighting the temporal and spatial occurrence of outbreaks in the last two decades, circulation, and emergence of the virus genotypes in and around the country; and the constraints in the disease control, with the aim to update the knowledge of current status of the disease in India. The article also emphasizes the importance of the disease and the need to develop rapid specific diagnostics and effective measures to eradicate the disease.

Microbiological Evaluation of Carcasses of Wild Boar Hunted in a Hill Area of Northern Italy.

Stella, S., E. Tirloni, E. Castelli, F. Colombo and C. Bernardi

Journal of Food Protection 81(9), 1519-1525. <https://doi.org/10.4315/0362-028x.jfp-18-077>

This study evaluated the prevalence of potential pathogenic bacteria (mainly *Campylobacter* spp., but also *Listeria monocytogenes* and *Salmonella*) in wild boar (*Sus scrofa*) and the hygiene of carcasses of wild boar hunted in a hill area of northern Italy during a hunting season (October to December). In total, 62 animals were submitted to microbiological analyses of the tonsils (detection of *Listeria* spp. and *Listeria monocytogenes*), caecal content (detection of *Salmonella* and *Campylobacter* spp.), mesenteric lymph glands (detection of *Salmonella*), and carcasses. In addition to analyzing pathogen prevalence and carcass hygiene of these animals, we performed an enumeration of total viable count (TVC), *Enterobacteriaceae*, *Escherichia coli*, coagulase-positive staphylococci, and spores of sulfite-reducing clostridia. Influencing factors considered were sex, weight, and age of the animals and environmental temperature on the day of hunting. A high prevalence was observed for *L. monocytogenes* in tonsils (35.3%) and for *Campylobacter* spp. in caecal content (51.8%), whereas *Salmonella enterica* strains (mainly serovar Thompson) were only occasionally isolated (7% in caecal content and 3.5% in lymph glands). The prevalence of *L. monocytogenes* was influenced by animal age and environmental temperature. *Campylobacter* spp. were the only pathogens detected on the carcasses (16.7%). Carcasses were characterized by low levels of contamination: TVC, 3.21 +/- 0.80 log CFU/cm(2), *Enterobacteriaceae*, 1.32 +/- 0.89 log CFU/cm(2); *E. coli*, 1.31 +/- 0.93 log CFU/cm(2); and occasional detection of low counts of staphylococci and clostridia. TVC was positively influenced only by high environmental temperature, and higher *Enterobacteriaceae* counts were detected on heavy male carcasses than on females. The results confirmed the potential role of wild boars as reservoirs for the most important foodborne pathogens. But a low carcass contamination level is





achievable if hunters are properly trained about hygienic carcass management and slaughtering procedures.

Identification and Genetic Characterization of Astrovirus in Wild Boar (*Sus scrofa*) in China.

Zhang, F. F., Y. X. Tang, Y. Ye, N. N. Guo, M. Zhang, H. Li, D. Lei, Q. Wu, D. Y. Huang and D. P. Song

Kafkas Universitesi Veteriner Fakultesi Dergisi 24(6), 899-903.

<https://doi.org/10.9775/kvfd.2018.20139>

Porcine astrovirus (PAstV) is a frequently detected virus in pigs suffering from diarrhea worldwide. Here, we report the first identification and complete genome sequence of astrovirus in wild boar (*Sus scrofa*) in Jiangxi, China. The complete genome sequence of a representative astrovirus, WBastV/CH/2015, was amplified and determined. Sequence homology analysis showed that WBastV/CH/2015 had 40.8% to 79.7% homology with PAstVs worldwide, and shared the highest homology (79.7%) with another wild boar astrovirus (WBastV) strain WBastV-1/2011/HUN from Hungary. Phylogenetic analysis showed that WBastV/CH/2015 was closely related to WBastV-1 2011/HUN and located in the cluster of PAstV 4.

Molecular detection and genotyping of *Toxoplasma gondii* in free-ranging pigs in Northeastern China.

Zhang, X. X., R. L. Jiang, N. Z. Zhang, C. R. Wang, W. F. Tao, P. Xu, C. F. Ma, G. Y. Hou and H. B. Ni

Infection Genetics and Evolution 63, 110-115. <https://doi.org/10.1016/j.meegid.2018.05.019>

Pig is the well-known intermediate host of *T. gondii*, a ubiquitous and obligate intracellular zoonotic pathogen. However, information about prevalence and genotypes of *T. gondii* infection in free-ranging pigs is scarce. Therefore a total of 186 hilar lymph nodes specimens were collected from free-ranging pigs from rural regions from Jilin (n = 119) and Liaoning (n = 67) provinces, northeastern China, and were investigated from *T. gondii* infection by semi-nested PCR of the B1 gene. Positive testing samples were genotyped by using polymerase chain reaction followed by restriction-fragment length polymorphism technology (PCR-RFLP) applied to 11 loci. The overall prevalence of *T. gondii* in investigated free-ranging pigs was 18.3% (34/186), with 16.4% (11/67) in Liaoning Province and 19.3% (23/119) in Jilin Province. Moreover, two genotypes, namely ToxoDB #9 and ToxoDB #10, were detected in investigated pigs. The present study showed a high *T. gondii* prevalence in free-ranging compared to farmed pigs as reported in previous studies by others, raising a major public health concern. It is essential to establish efficient strategies to prevent and control *T. gondii* infection in free-ranging pigs, other animals and humans in investigated regions.

Gaps in African swine fever: Analysis and priorities.

M. Arias, C. Jurado, C. Gallardo, J. Fernández-Pinero, J. M. Sánchez-Vizcaíno

Transboundary and Emerging Diseases. Vol 65 (S1). Pages 235-247

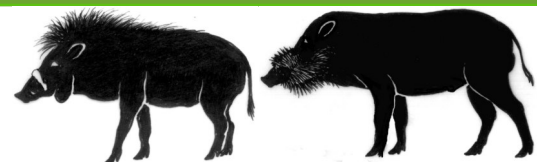
<https://doi.org/10.1111/tbed.12695>

African swine fever (ASF) causes greater sanitary, social and economic impacts on swine herds than many other swine diseases. Although ASF was first described in 1921 and it has affected more than fifty countries in Africa, Europe and South America, several key issues about its





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pathogenesis, immune evasion and epidemiology remain uncertain. This article reviews the main characteristics of the causative virus, its molecular epidemiology, natural hosts, clinical features, epidemiology and control worldwide. It also identifies and prioritizes gaps in ASF from a horizontal point of view encompassing fields including molecular biology, epidemiology, prevention, diagnosis and vaccine development. The purpose of this review is to promote ASF research and enhance its control.

Collection of oral fluid samples from wild boar in the field conditions to detect African swine fever virus (ASFV)

Männistö, Hanna Eveliina

Thesis in Estonian University of Life Sciences

African swine fever (ASF) is a contagious viral disease that causes a lethal, hemorrhagic fever in domestic pigs and wild boar. The virus has been circulating in Eastern European Union countries since 2014. The aims of the study were to investigate the practical feasibility of non-invasive ropein-a-bait (pSWAB) oral fluid sampling method for collection of oral fluid samples from wild boar in field conditions, and its suitability for detection of African swine fever virus (ASFV) infection in wild boar population in infected area. The study was conducted in five different feeding grounds in County of Tartu, Estonia. Oral fluid samples were collected with two different pSWABs, loose and fixed baits. Samples were examined in Estonian Veterinary and Food Laboratory for wild boar specific deoxyribonucleic acid (DNA) and ASFV DNA by real-time polymerase chain reaction (RT-PCR). 24 loose bait samples (13%) were obtained out of 183 exposed baits. With fixed baits, 17 samples were obtained with 11 baits. All the fixed bait samples and 71% of the loose bait samples were positive to wild boar DNA. In addition, all the samples were negative to ASFV DNA. Oral fluid sampling with pSWABs is possible, but it is laborious and therefore not very practical. In the present study, no ASFV was detected in wild boar, although the virus was circulating in the wild boar population in the immediate vicinity during the period when the study was conducted. More studies are needed to investigate if pSWABs could be used in field to detect other infectious diseases.

Quality characteristics of Warthog (*Phacochoerus africanus*) meat.

Monlee Rudman, Alison J. Leslie, Marietavan der Rijst, Louwrens C. Hoffman

Meat Science, Volume 145, November 2018, Pages 266-272

<https://doi.org/10.1016/j.meatsci.2018.07.001> Get rights and content

Warthogs are hunted for trophies and damage reprisal whilst the meat is consumed. Little is known about the quality profile of the meat, therefore, this study investigated the effect of age (yearlings and adult) and sex on the sensory, physical, and chemical attributes of cooked meat. The meat was high in protein (~32%) and low in total fat (< 2%), while the meat from yearlings tended to be tenderer than adults. Age appeared to have a more pronounced influence than sex on the sensory attributes. Warthog meat had a pork aroma and flavour. Undesirable odours and flavours were described as sour/sweaty and fishy, and adults differed from yearlings regarding sour/sweaty ($P = .025$) and fishy aromas ($P = .006$), and fishy flavours ($P = .045$). Small differences (< 0.5 mg/g) in palmitoleic ($P = .047$) and arachidonic ($P = .038$) acids were found between adults and yearlings. Warthog meat can be regarded as a lean and healthy source of protein.





Seroprevalence of *Mycobacterium bovis* infection in warthogs (*Phacochoerus africanus*) in bovine tuberculosis-endemic regions of South Africa.

E. O. Roos, F. Olea-Popelka, P. Buss, L.-M. de Klerk-Lorist, D. Cooper, P. D. van Helden, S. D. C. Parsons, M. A. Miller

Transboundary and Emerging Diseases, Volume 65 (5), pages 1182-1189

<https://doi.org/10.1111/tbed.12856>

Bovine tuberculosis (bTB), caused by *Mycobacterium bovis* (*M. bovis*), has been reported in many species including suids. Wild boar are important maintenance hosts of the infection with other suids, that is domestic and feral pigs, being important spillover hosts in the Eurasian ecosystem and in South Africa, warthogs (*Phacochoerus africanus*) may play a similar role in *M. bovis* endemic areas. However, novel diagnostic tests for warthogs are required to investigate the epidemiology of bTB in this species. Recent studies have demonstrated that serological assays are capable of discriminating between *M. bovis*-infected and uninfected warthogs (Roos et al., 2016). In this study, an indirect ELISA utilizing *M. bovis* purified protein derivative (PPD) as a test antigen was used to measure the prevalence and investigate risk factors associated with infection in warthogs from uMhkuze Nature Reserve and the southern region of the Greater Kruger National Park (GKNP). There was a high overall seroprevalence of 38%, with adult warthogs having a higher risk of infection (46%). Seroprevalence also varied by geographic location with warthogs from Marloth Park in the GKNP having the greatest percentage of positive animals (63%). This study indicates that warthogs in *M. bovis* endemic areas are at high risk of becoming infected with mycobacteria. Warthogs might present an under recognized disease threat in multi-species systems. They might also serve as convenient sentinels for *M. bovis* in endemic areas. These findings highlight the importance of epidemiological studies in wildlife to understand the role each species plays in disease ecology.

African swine fever: A re-emerging viral disease threatening the global pig industry.

P.J. Sánchez-Cordón, M. Montoya, A.L. Reis, L.K. Dixon

The Veterinary Journal, Volume 233, March 2018, Pages 41-48

<https://doi.org/10.1016/j.tvjl.2017.12.025> Get rights and content

African swine fever (ASF) recently has spread beyond sub-Saharan Africa to the Trans-Caucasus region, parts of the Russian Federation and Eastern Europe. In this new epidemiological scenario, the disease has similarities, but also important differences, compared to the situation in Africa, including the substantial involvement of wild boar. A better understanding of this new situation will enable better control and prevent further spread of disease. In this article, these different scenarios are compared, and recent information on the pathogenesis of ASF virus strains, the immune response to infection and prospects for developing vaccines is presented. Knowledge gaps and the prospects for future control are discussed.

The African swine fever epidemic in West Africa, 1996–2002.

A.-A. Brown, M. L. Penrith, F. O. Fasina, D. Beltran-Alcrudo

Transboundary and Emerging Diseases. Vol 65(1), pages 64-76

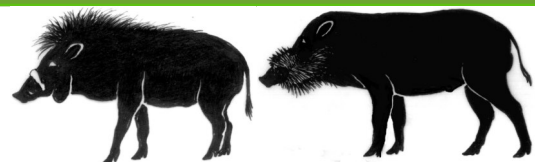
<https://doi.org/10.1111/tbed.12673>

African swine fever (ASF) is a contagious, highly fatal, haemorrhagic viral disease that only affects members of the Suidae family. Currently, no vaccine or treatment exists, so the disease has potentially devastating consequences for the pig industries, availability of affordable protein





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livelihoods and trade. This study aimed to consolidate historical information generated by working towards the control and eradication of ASF in previously unaffected countries in West Africa during 1996–2002. This descriptive analysis entailed the evaluation and review of archived records and reports of outbreaks, data from veterinary services, veterinary consultants and peer reviewed publications. Specifically, the analysis focused on establishing the sequence of events in the spread of the disease throughout the region, as well as the possible sources and pathways (mostly human driven, i.e., movement of pigs and swill feeding). The socio economic aspects of the epidemic were also assessed. Finally, the prevention and control measures applied were described and evaluated. Major challenges for control that were identified involved lack of capacity to respond to an outbreak of animal disease and the nature of the pig sector in the affected countries. Most of the pigs were produced in low biosecurity subsistence husbandry systems. Actions taken by producers to limit economic losses due to the epidemic (e.g., illegal selling of pigs and infected pork, hiding of outbreaks) increased the risk of spread and frustrated control efforts. The disease has persisted in an endemic state ever since and has negatively affected pig production and marketing in most of these countries. The analysis of this information will allow a better understanding of the disease dynamics in a region infected for the first time, and learning how the prevention and control interventions that were implemented worked or failed. This will help the development of better tailored, sustainable and locally sound interventions. The authors provide a set of recommendations for ASF prevention and control.

Terrestriality and bacterial transfer: a comparative study of gut microbiomes in sympatric Malagasy mammals

Amanda C. Perofsky, Rebecca J. Lewis & Lauren Ancel Meyers

The ISME Journal volume 13, pages 50–63 (2019)

DOI <https://doi.org/10.1038/s41396-018-0251-5>

The gut microbiomes of mammals appear to mirror their hosts' phylogeny, suggesting host-driven microbial community assembly. Yet, much of this evidence stems from comparative studies of distinct wild or captive populations that lack data for disentangling the relative influences of shared phylogeny and environment. Here, we present phylogenetic and multivariate analyses of gut microbiomes from six sympatric (i.e., co-occurring) mammal species inhabiting a 1-km² area in western Madagascar—three lemur and three non-primate species—that consider genetic, dietary, and ecological predictors of microbiome functionality and composition. Host evolutionary history, indeed, appears to shape gut microbial patterns among both closely and distantly related species. However, we also find that diet—reliance on leaves versus fruit—is the best predictor of microbiome similarity among closely related lemur species, and that host substrate use—ground versus tree—constrains horizontal transmission via incidental contact with feces, with arboreal species harboring far more distinct communities than those of their terrestrial and semi-terrestrial counterparts.

NOTAS SOBRE *Pecari tajacu* (L., 1758) Y *Tayassu peccari* (LINK, 1795) (ARTIODACTYLA: TAYASSUIDAE) COMO HOSPEDEROS DE GARRAPATAS DURAS (ACARI: IXODIDAE) EN PANAMÁ

Sergio Bermúdez C, Ninon Meyer, Ricardo Moreno, Adolfo Artavia

Tecnociencia, 2018, vol. 20, no 1, p. 61-70.

Durante los años 2010 a 2017, ocho saínos (*Peccari tajacu*) capturados en la Cuenca del Canal





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de Panamá se encontraron parasitados por las garrapatas *Amblyomma pecarium*, *Haemaphysalis juxtakochi*, *Amblyomma* ci. *oblongoguttatum*, *Amblyomma naponense* y *Amblyomma tapirellum*. Por otro lado, a saínos en cautiverio de esta misma región se les extrajeron las especies *Amblyomma mixtum* y *A. ci. oblongoguttatum*. En 2016 dos puercos de monte (*Tayassu pecari*) capturados en el Parque Nacional Darién, se hallaron parasitados por *A. pecarium* y *Dermacentor imitans*. Los datos son complementados con material depositado en Acervo de Ectoparásitos de la Colección Zoológica “Dr. Eustorgio Méndez” del ICGES. Estas asociaciones son coincidentes con preferencias de hábitats reportadas para entre ambos grupos, además de las condiciones propias del confinamiento.

Collared peccary (*Pecari tajacu*) are susceptible to porcine reproductive and respiratory syndrome virus (PRRSV)

Ramón Molina Barrios , José Luevano Adame , Yuly Alexandra Henao Díaz , Luis Giménez Lirola , Pablo Piñeyro , Ronaldo Magtoto , Jesús Cedillo Cobián , Concepción Díaz Rayo
Transboundary and emerging diseases, 2018, vol. 65, no 6, p. 1712-1719.

<https://doi.org/10.1111/tbed.12944>

Collared peccary (*Pecari tajacu*) and pigs (*Sus scrofa*) are two members of superfamily Suoidea that coexist in the Americas and share some of the same viral infections. Although porcine reproductive and respiratory syndrome virus (PRRSV) is among the most impactful pathogens of swine on a worldwide basis, the susceptibility of peccaries to PRRSV has not been investigated. In this study, three peccaries were intramuscularly inoculated with a PRRSV 2 field virus. One PRRSV inoculated pig served as a positive control and two pigs and one peccary as negative controls. Serum samples were collected at regular intervals over a 23 day observation period and tested by PRRSV rtRT-PCR and isotype specific (IgM, IgA, IgG) PRRSV ELISAs. The detection of viremia (DPI 3–23) and a PRRSV specific humoral immune response (\geq DPI 10) supported the conclusion that collared peccary are susceptible to PRRSV. The results raise questions regarding the natural history of PRRSV in non *Sus* members of superfamily Suoidea and, more broadly, their role in the evolution and ecology of PRRSV.

NEOSPORA CANINUM–SPECIFIC ANTIBODIES IN FREE-RANGING WHITE-LIPPED PECCARIES (*TAYASSU PECARI*) FROM THE PERUVIAN AMAZON: DETECTION OF ANTIBODIES IN SERUM AND EVALUATION OF INDIRECT FLUORESCENT ANTIBODY TEST WITH HETEROLOGOUS SECONDARY ANTIBODY

Marcos Gomes Lopes, M.S., Ph.D., Monica Romero Solorio, M.S., Ph.D., Herbert Sousa Soares, M.V., Ph.D., Gereon Schares, M.V., Ph.D., Alfonso Zúñiga Hartley, M.V., M.S., Paloma Alcázar, M.V., M.S., Fernando Ferreira, M.S., Ph.D., Maria Cecilia Gibril Oliveira Camargo, M.V., Ph.D., Fabio Gregori, M.S., Ph.D., and Solange Maria Gennari, M.S., Ph.D.

Journal of Zoo and Wildlife Medicine, 2018, vol. 49, no 3, p. 656-661

<https://doi.org/10.1638/2017-0084.1>

Neospora caninum is a coccidian parasite originally reported in dogs and widely prevalent in numerous species of wild and domestic animals and has as definitive hosts some species of canids. The white-lipped peccary (WLP) (*Tayassu pecari*) is a Tayassuidae mammal, found from Mexico to south of Brazil and north of Argentina. It is a game species with great economic importance in the Peruvian Amazon. Blood samples from 101 WLPs were collected from near or within three different conservation reserves located in the southeastern region of the Peruvian





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Amazon. For the detection of antibodies against *N. caninum*, indirect fluorescent antibody tests (IFAT) were performed using collared peccary (*Pecari tajacu*) and swine (*Sus scrofa domesticus*) heterologous secondary antibodies. For both IFAT tests, the cutoff was 1:50. Positive samples were titrated by a two fold serial dilution. In addition to IFAT, samples were also analyzed using an immunoblotting test (IB) with anti-swine conjugate. To confirm the viability of the anti-swine conjugate, the results of these samples previously tested by a modified agglutination test (MAT) for *Toxoplasma gondii* were used as reference. From the total of 101 samples tested, 5 (4.9%) were *N. caninum* positive by the three tests and an extra sample was positive by both IFATs and negative in the IB. Comparing both IFATs and considering IB as the gold standard, the relative sensitivity of IFATs was 100%, the specificity was 98.9%, the positive predictive value was 83.3%, and the negative predictive value was 100%. The agreement between tests was characterized by a κ value of 0.904 (95% confidence interval, 0.717 to 1.0) and an SE of 0.095. This is the first report of *N. caninum* antibodies in free-ranging *T. pecari*, and swine and collared peccary conjugate can be used as a secondary antibody for detection of antibodies in *Tayassu* species.

100 Reproductive cycle and pregnancy monitoring in the common hippopotamus (*Hippopotamus amphibius*) through salivary steroid analyses and transabdominal ultrasonography

J. Wojtusik A , I. M. C. Brandicourt A , W. Rice A and T. L. Roth A

Reproduction, Fertility and Development 31(1) 176-176 <https://doi.org/10.1071/RDv31n1Ab100>

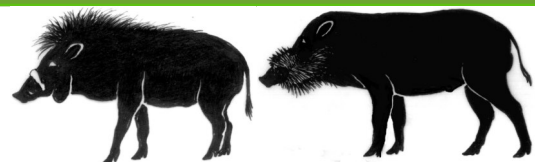
Published online: 3 December 2018

The common hippopotamus (*Hippopotamus amphibius*) is listed as vulnerable to extinction by the IUCN due to a significant decrease in population size, caused by habitat loss and poaching. Ex situ populations can help ensure against species loss, but careful reproductive management is essential to maintain sustainable populations. Hormone monitoring allows for characterisation of the reproductive cycle and gestation, offering insight into timing of receptivity and conception and facilitating pregnancy diagnosis and estimation of parturition date. Fecal steroid analysis has been validated for measuring progesterogens in hippos. However, hippos are often housed in groups and frequently defecate in the water, making sample collection and source identification difficult. Salivary steroid analysis has been employed for monitoring reproductive activity in several species, but has not been tested in hippos. Additionally, transabdominal ultrasonography has proven valuable in diagnosing and monitoring pregnancy in many large mammals, but efficacy in the common hippo is unknown. The goals of this project were to (1) validate the use of an enzyme immunoassay to monitor progesterogens in hippo saliva, (2) confirm that salivary progesterogen profiles accurately reflect reproductive activity, (3) determine if transabdominal ultrasonography can be used to diagnose pregnancy, and, if so, (4) monitor and characterise fetal development via weekly examinations. Saliva (4-7 per week) and fecal (2-7 per week) samples were collected from 7 adult female hippos housed at 3 USA facilities over 3-7 months. Saliva and fecal samples were extracted in ethanol and extracts diluted (1:2 to 1:10 and 1:25 to 1:500, respectively) before evaluation by enzyme immunoassay (Progesterone mini-kit; Arbor Assays). Parallelism was confirmed between serially diluted fecal ($r^2 = 0.993$) and saliva ($r^2 = 0.990$) samples and the standard curve. Inter- and intra-assay coefficients of variation were maintained at <10%. Comparison of fecal and saliva progesterogen concentrations revealed a strong correlation between the 2 sample types ($r^2 = 0.848$) and suggested that saliva offers a comparable alternative. Both fecal and saliva extracts exhibited elevated progesterogens during





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luteal phases and gestation. One nulliparous female housed at the Cincinnati Zoo & Botanical Garden (Cincinnati, OH, USA) was trained for voluntary transabdominal ultrasound exams. An Ibox Pro portable ultrasound machine (E.I. Medical Imaging, Loveland, CO, USA) with curvilinear probe (5-2.5 MHz) was used at a scanning depth of 17.8 and 23.4 cm. Intrauterine fluid and possible fetal tissue were observed 79 days following the last confirmed mating. Spine, rib cage, and beating heart were clearly visible at ~156 days of gestation. Ultrasound procedures were continued until the premature birth of a calf at ~181 days (normal hippo gestation ~231 days). Salivary progesterone monitoring and transabdominal ultrasonography appear suitable for tracking reproductive activity and diagnosing and monitoring pregnancy in the common hippo.

ESTADO ACTUAL DE LOS HIPOPÓTAMOS (*HIPPOPOTAMUS AMPHIBIUS*) EN COLOMBIA: 2018

Santiago Monsalve Buriticá, Alejandro Ramírez Guerra

Medicina veterinaria y zootecnia vol13 (3)

En el año 1985, el narcotraficante Pablo Escobar ingresó a Colombia entredos y seis ejemplares juveniles de hipopótamos que, con el paso de dosdécadas, se reprodujeron y movilizaron por la zona geográfica del MagdalenaMedio. En la actualidad se cree que podría haber entre diez y treintaejemplares libres en inmediaciones del río Magdalena y unos sesenta individuosen total en el país. Los hipopótamos en Colombia son animalesexóticos e introducidos, y con el tiempo fueron clasificados como especieinvasora ya que su presencia representa riesgos ambientales al competircon especies nativas. Algunos de los efectos comprenden la alteración dehábitat, la perturbación de los procesos ecosistémicos y la desestabilizaciónde los sistemas ambientales. Las medidas para su control que requierena destinación de grandes presupuestos para la captura, control denatalidad, mantenimiento en cautiverio; o acciones socialmente cuestionablescomo la eutanasia, deberían ser establecidas de manera inmediatapues los recursos biológicos nativos, hidrobiológicos y pesqueros podríanverse afectados por culpa de esta especie invasora.

Taxonomic, Biogeographic and Evolutionary Studies

Genetic relationships of wild boars highlight the importance of Southern Iran in forming a comprehensive picture of the species' phylogeography.

Ashrafzadeh, M. R., H. R. Rezaei, O. Khalilipour and S. Kusza

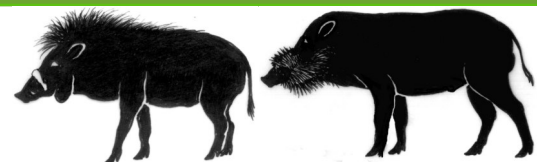
Mammalian Biology 92, 21-29. <https://doi.org/10.1016/j.mambio.2018.04.001>

Genetic relationships between wild boar populations in the southern regions of Iran still remain unclear. Therefore in the present study our aim was filling this gap and providing preliminary knowledge about the phylogenetic status of Iranian wild boar based on two datasets of the mtDNA control region (the 402-bp and 605-bp segments as the first and second datasets, respectively). Altogether 1063 and 490 sequences were used in the shorter and longer sequences, respectively (29 own samples and 1034 and 461 Genbank sequences from previous studies in the first and second datasets, respectively). Our findings revealed that the wild boars living in Southern Iran belong to the previously described three clades: Asian, Near Eastern 1(NE1) and Near Eastern 2(NE2)clades. The NE1 and NE2 clades sympatrically occupy a wide range across the southeast to southwest of Iran, whereas the Asian clade is restricted to a small area in the southeastern part of Iran. Our results propose the existence of a contact zone





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between the Near Eastern clades and the Asian clade in the studied area. The fixation index (F_{st}) and the analysis of molecular variance (AMOVA) demonstrated significant genetic structure among the identified clades. Some identified haplotypes have a wide distribution, which suggests that they are probably ancestral haplotypes or are likely to be a result of recent population expansion. Overall, current research demonstrates that Iranian wild boars have an important phylogenetic position among the others in the world. In other words, Iran is a very important region for addressing some of the topical questions about phylogenetic relationships among the Eurasian wild boar clades.

Unmasking the invader: Genetic identity of invasive wild boar from three minor islands off Sardinia (Italy).

Canu, A., M. Apollonio and M. Scandura

Mammalian Biology 93, 29-37. <https://doi.org/10.1016/j.mambio.2018.07.008>

Introduced invasive species such as the wild boar (*Sus scrofa*) represent a huge threat to the biodiversity of small islands, in that they may lead to ecological disequilibria and taxa extinctions. Additionally, if introduced populations with an alien or admixed genetic origin disperse from islands, they may jeopardize the endemic genetic diversity of mainland conspecifics through introgressive hybridization. Despite past hybridization with local domestic pigs and introduced continental wild boar, the wild boar population of Sardinia (Italy) maintained a significant amount of genomic diversity and was thus classified as a distinct subspecies (*Sus scrofa meridionalis*) as it clustered separately from all other European *S. scrofa*. In the past few decades, however, wild boar populations of uncertain origin have appeared on three islands off the Sardinian coast. We accordingly investigated the genetic composition of these three island wild boar populations by using a panel of 16 autosomal microsatellites and a reference dataset including domestic pig and wild boar populations from Sardinia, mainland Italy and other European regions, in order to reconstruct the history of each colonization and the possible origin of colonizers. The genetic make-up of the three populations was found to diverge from that of Sardinia to such an extent that they could not be classified as Sardinian wild boar. In fact, their genome bore traces of multiple introductions from different source populations, as well as introgression from the domestic pig, followed by the effects of relative isolation and genetic drift. Thus, besides impacting on island biodiversity and human activities, these admixed populations can represent a threat to the endemic subspecies (*S. s. meridionalis*) inhabiting the major island on account of their proximity to the Sardinian coasts. We thereby argue for a strict control of these populations or, whereby feasible, their eradication.

Hotspots of recent hybridization between pigs and wild boars in Europe.

Iacolina, L., C. Pertoldi, M. Amills, S. Kusza, H. J. Megens, V. A. Balteanu, J. Bakan, V. Cubric-Curic, R. Oja, U. Saarma, M. Scandura, N. Sprem and A. V. Stronen

Scientific Reports 8. <https://doi.org/10.1038/s41598-018-35865-8>

After a strong demographic decline before World War II, wild boar populations are expanding and the species is now the second-most abundant ungulate in Europe. This increase raises concerns due to wild boar impact on crops and natural ecosystems and as potential vector of diseases. Additionally, wild boar can hybridize with domestic pigs, which could increase health risks and alter wild boar adaptive potential. We analysed 47,148 Single Nucleotide Polymorphisms in wild boar from Europe (292) and the Near East (16), and commercial (44) and local (255) pig breeds,





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to discern patterns of hybridization across Europe. We identified 33 wild boars with more than 10% domestic ancestry in their genome, mostly concentrated in Austria, Bosnia and Herzegovina, Bulgaria and Serbia. This difference is probably due to contrasting practices, with free-ranging vs. industrial farming but more samples would be needed to investigate larger geographic patterns. Our results suggest hybridization has occurred over a long period and is still ongoing, as we observed recent hybrids. Although wild and domestic populations have maintained their genetic distinctiveness, potential health threats raise concerns and require implementation of management actions and farming practices aimed at reducing contact between wild and domestic pigs.

Inferring the evolution of the major histocompatibility complex of wild pigs and peccaries using hybridisation DNA capture-based sequencing

Carol Lee, Marco Moroldo, Alvaro Perdomo-Sabogal, Núria Mach, Sylvain Marthey, Jérôme Lecardonnell, Per Wahlberg, Amanda Y. Chong, Jordi Estellé, Simon Y. W. Ho, Claire Rogel-Gaillard, Jaime Gongora

Immunogenetics, June 2018, Volume 70, Issue 6, pp 401–417

<https://doi.org/10.1007/s00251-017-1048-9>

The major histocompatibility complex (MHC) is a key genomic model region for understanding the evolution of gene families and the co-evolution between host and pathogen. To date, MHC studies have mostly focused on species from major vertebrate lineages. The evolution of MHC classical (Ia) and non-classical (Ib) genes in pigs has attracted interest because of their antigen presentation roles as part of the adaptive immune system. The pig family Suidae comprises over 18 extant species (mostly wild), but only the domestic pig has been extensively sequenced and annotated. To address this, we used a DNA-capture approach, with probes designed from the domestic pig genome, to generate MHC data for 11 wild species of pigs and their closest living family, Tayassuidae. The approach showed good efficiency for wild pigs (~80% reads mapped, ~87× coverage), compared to tayassuids (~12% reads mapped, ~4× coverage). We retrieved 145 MHC loci across both families. Phylogenetic analyses show that the class Ia and Ib genes underwent multiple duplications and diversifications before suids and tayassuids diverged from their common ancestor. The histocompatibility genes mostly form orthologous groups and there is genetic differentiation for most of these genes between Eurasian and sub-Saharan African wild pigs. Tests of selection showed that the peptide-binding region of class Ib genes was under positive selection. These findings contribute to better understanding of the evolutionary history of the MHC, specifically, the class I genes, and provide useful data for investigating the immune response of wild populations against pathogens.

Stabbing Slinkers: Tusk Evolution Among Artiodactyls.

Doreen Cabrera, Theodore Stankowich

Journal of Mammalian Evolution Pp. 1-8 (2018)

<https://doi.org/10.1007/s10914-018-9453-x>

Combat weaponry, including elaborate horns and antlers and complex dentition, evolved independently several times among mammals. While it is evident that tusk and tusk-like dentition have emerged primarily among males for intrasexual combat, it is unclear what ecological factors favor the retention or re-evolution of tusks. We investigated patterns of tusk evolution in artiodactyls while exploring specific ecological factors that might favor their use over other cranial





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weapons (e.g., antlers, horns). We show that among males, small (<15 kg), solitary species tend to retain well-developed canines, and more solitary species live in more closed habitats. These results suggest that tusks are a better weapon option for smaller, slinking artiodactyls in forested environments with low visibility, whereas larger taxa living in more open environment can bear the cost of elaborate headgear and are better served by communicating across distances an honest signal of fighting ability. Small species in dense habitats may also be more likely to be ambushed by predators and have a need to defend themselves; small, slicing daggers may be a better defensive weapon and allow more maneuverability and faster escape than cumbersome headgear in densely vegetated habitats.

Dietary variability of extinct tayassuids and modern white-lipped peccaries (*Tayassu pecari*) as inferred from dental microwear and stable isotope analysis.

Jennifer L. Bradham, Larisa R.G. DeSantis, Maria Luisa S.P. Jorge, Alexine Keuroghlian
Palaeogeography, Palaeoclimatology, Palaeoecology, 2018, vol. 499, p. 93-101.

<https://doi.org/10.1016/j.palaeo.2018.03.020> Get rights and content

Prior geochemical work documents dietary shifts coincident with climate change in extinct peccaries, with taxa typically shifting between browsing and mixed-feeding. This study employs dental microwear texture analysis (DMTA) and stable carbon isotopes to interpret the diet of extinct peccaries in Florida, specifically *Platygonus*, *Mylohyus*, and *Protherohyus* from the late Miocene throughout the Pleistocene, to evaluate how dietary behavior has fluctuated over time. When *Mylohyus* and *Protherohyus* coexisted in the Hemphillian, *Mylohyus* consumed C3 food sources with harder textures, consistent with the consumption of woody browse, while *Protherohyus* consumed a greater proportion of C4 vegetation (likely grass). During the Blancan, both *Platygonus* and *Mylohyus* can be considered primarily C3 browsers, based on both DMTA and stable isotope data. However, during the Irvingtonian, both *Mylohyus* and *Platygonus* consumed a larger proportion of C4 vegetation than during previous North American Land Mammal Ages (NALMAs). *Platygonus* consumed predominantly C3 vegetation during the Rancholabrean, while *Mylohyus* consumed a mixture of C3 and C4 vegetation in more open environments. Independent of NALMA, *Platygonus* consumed predominantly tough vegetation, (e.g., tough leaves and/or grass) while *Mylohyus* consumed harder food items, consistent with morphological differences in their teeth. In contrast, extant *Tayassu* peccaries are obligate C3 feeders and show no evidence of C4 consumption. Further, *Tayassu* are indistinguishable in all dental microwear textural properties from both of their extinct relatives, suggesting that while extant peccaries eat primarily foods from forested environments, those foods are highly variable in textural properties. Collectively, these data suggest that extinct peccaries, *Mylohyus* and *Platygonus*, altered their diet over time and possibly in response to changing climates.

Ecological, Behavioural and Conservation Studies

The Effect of Combined Herbivory by Wild Boar and Small Ruminants on the Regeneration of a Deciduous Oak Forest.

Abraham, E. M., P. Sklavou, A. Loufi, Z. M. Parissi and A. P. Kyriazopoulos
Forests 9(9). <https://doi.org/10.3390/f9090580>

The multiple agroforestry land uses of oak forests are of great ecological and economic interest as they contribute to the improvement of animal husbandry, wildlife, and environment. However,





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herbivory by wildlife and livestock highly affects the structure and the dynamic of forest ecosystems including its regeneration. The aim of this study was to investigate the comparative effect of wild boar and small ruminants herbivory on the regeneration of a deciduous oak forest in northern Greece. Eight sites were selected in an even aged stand of similar canopy cover and forest site quality: four sites with long-time use mainly by wild boar and four sites with long-time grazing by sheep and browsing by goats. A plot of 150 m² in each of the sites was fenced in order to be protected from herbivory. The plant cover and number of oak seedlings and acorns was measured in both grazed and protected plots for four consecutive years. The plant cover increased in the protected plots independent of the type of animals. The seedling cover decreased about 29% and 9% in sites where small ruminants and wild boars foraged respectively. Similarly, the number and the weight of acorns significantly decreased in the sites grazed by small ruminants mainly during the mast year of the oaks. Forest management has to control the small ruminants grazing in terms of intensity, timing, and duration in order to ensure the sustainability of the ecosystem.

Estimating densities of large herbivores in tropical forests: Rigorous evaluation of a dung-based method.

Ahrestani, F. S., N. S. Kumar, S. Vaidyanathan, L. Hiby, D. Jathanna and K. U. Karanth
Ecology and Evolution 8(15), 7312-7322. <https://doi.org/10.1002/ece3.4227>

When sighting-based surveys to estimate population densities of large herbivores in tropical dense forests are not practical or affordable, surveys that rely on animal dung are sometimes used. This study tested one such dung-based method by deriving population densities from observed dung densities of six large herbivores (chital, elephant, gaur, muntjac, sambar, and wild pig) in two habitats, dry deciduous forests (DDF) and moist deciduous forests (MDF), within Nagarhole National Park, southern India. Using the program DUNGSURV, dung pile counts, decay rates estimated from field experiments, and defecation rates derived from literature were analyzed together by a model that allows for random events affecting dung decay. Densities of chital were the highest, followed by sambar. Wild pig densities were similar in the two habitats, sambar densities were higher in DDF, and densities of the other species were higher in MDF than in DDF. We compared DUNGSURV estimates with densities estimated using distance sampling in the same season. DUNGSURV estimates were substantially higher for all species in both habitats. These differences highlight the challenges that researchers face in computing unbiased estimates of dung decay rates and in relying on defecation rates from literature. Besides the elephant, this study is the first to rigorously test the efficacy of using a dung-based approach to estimate densities of large herbivore species in Asia, and based on this evaluation, we provide specific recommendations to address issues that require careful consideration before observed dung densities are used to derive animal densities. Our results underline the need for an experimental study of a known population in a fenced reserve to validate the true potential of using dung-based approaches to estimate population densities.

Stochastic assessment of management strategies for a Mediterranean peri-urban wild boar population.

Gonzalez-Crespo, C., E. Serrano, S. Cahill, R. Castillo-Contreras, L. Cabaneros, J. M. Lopez-Martin, J. Roldan, S. Lavin and J. R. Lopez-Olvera
Plos One 13(8). <https://doi.org/10.1371/journal.pone.0202289>





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Wild boar (*Sus scrofa*) population spread into urban and periurban areas has exacerbated conflicts with humans. There is a need for planned wild boar management strategies, and Population viability analysis (PVA) combined with perturbation analyses allow the assessment of the management effort of control methods. Our study aims to develop stochastic predictive models of the increasing wild boar population of the 80 km² peri-urban Mediterranean area of Collserola Natural Park (CNP), located near Barcelona, Spain, as well as assessing specific management measures (including reduced food availability, selective harvest, and reduction in fertility). Population parameters were estimated from previously published census and hunting data provided by the CNP and the local hunting administration. The results revealed that under the current conditions the CNP wild boar population will continue to increase. The most efficient strategy to reduce wild boar abundance was a combination of reducing supplementary anthropogenic food resources and selective removal of juvenile (<1 year) and yearling (1-2 years) wild boar. These strategies will probably be also the most efficient ones in other oversupplemented increasing wild boar populations in similar situations, although specific studies will be needed to fine-tune the best management option for each context. PVA allows the prediction of future population trends and the assessment of the efficacy and efficiency of potential management strategies before implementing management measures.

Evaluating wildlife management by using principles of applied ecology: case studies and implications.

Hone, J., V. A. Drake and C. J. Krebs

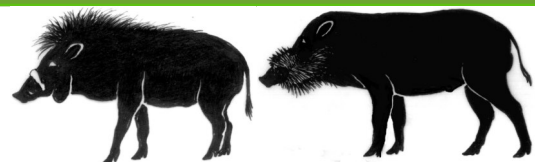
Wildlife Research 45(5), 436-445. <https://doi.org/10.1071/wr18006>

Context. The broad concepts and generalisations that guide conduct of applied ecology, including wildlife management, have been reviewed and synthesised recently into 22 prescriptive and three empirical principles. Aims. The aim of this study was to use these principles to evaluate three on-ground wildlife management programs and assess the utility of the principles themselves. Key results. Case studies of long-term management of national park biodiversity impacted by feral pigs (*Sus scrofa*), and of conservation and harvest of red kangaroos (*Macropus rufus*) and mallards (*Anas platyrhynchos*), were selected to provide a representative range of management objectives, spatial scales and land tenures, and to include both native and introduced species. Management documents and a considerable scientific literature were available for all three programs. The results highlight similarities and differences among management activities and demonstrate the 25 principles to differing degrees. Most of the prescriptive principles were demonstrated in both the management and the scientific literature in all three programs, but almost no use was made of the three empirical principles. We propose that use of the prescriptive principles constitutes evidence that these programs meet both societal and scientific expectations. However, the limited use of the empirical principles shows gaps in the three programs. Conclusions. The results suggest that evaluating other wildlife management programs against the principles of applied ecology is worthwhile and could highlight aspects of those programs that might otherwise be overlooked. Little use was made of the empirical principles, but the Effort-outcomes principle in particular provides a framework for evaluating management programs.





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Camera trapping of terrestrial animals in Tanjung Datu National Park, Sarawak, Borneo.

Mohd-Azlan, J., H. Nurul-Asna, T. S. Jailan, A. A. Tuen, L. Engkamat, D. N. Abdillah, R. Zainudin and J. F. Brodie

Raffles Bulletin of Zoology 66, 587-594.

Information on distribution is useful for determining global conservation status of species and for prescribing sound management practices for taxa of conservation importance. Therefore, an attempt to understand the distribution of terrestrial animals using infra-red camera traps in Tanjung Datu National Park, Borneo, was carried out from July 2013 to October 2015 (28 months). A total of 23 camera locations set in various microhabitats and elevations accumulated 2,490 camera days, which resulted in 1,189 independent animal images comprised of 21 mammals, two birds, and one reptile species. The cameras revealed a total of 20 medium to large mammals (excluding treeshrews & small rodents), with the most common species photographed being the pig-tailed macaque (independent images $n = 278$) and bearded pig (271), while the masked palm civet (1) and Sunda pangolin (1) were only represented by singletons. Most of the common species are listed as Protected (33.64%) in the Sarawak Wild Life Protection Ordinance 1998, while 2.02% species have Totally Protected status. Less than 1% of the species are considered Critically Endangered and Endangered, 3.57% are considered Near Threatened, and 74.3% are considered Vulnerable under the IUCN Red List of Threatened Species. In addition, this survey has provided detailed information on activity patterns of some cryptic species. The absence of larger carnivores suggests that species such as the Sunda clouded leopard and Bornean sun bear may have been extirpated from this small, isolated, and fragmented protected area. We emphasise that regular monitoring of wildlife in National Parks should not be neglected, especially when the surrounding area is experiencing accelerated and unprecedented rates of habitat conversion.

Assessing agricultural damage by wild boar using drones.

Rutten, A., J. Casaer, M. F. A. Vogels, E. A. Addink, J. Vanden Borre and H. Leirs

Wildlife Society Bulletin 42(4), 568-576. <https://doi.org/10.1002/wsb.916>

In Flanders (northern Belgium), wild boar (*Sus scrofa*) returned in 2006 after 50 years of absence and the population is increasing, both in abundance and geographic extent. In the absence of wild boar, Flanders' landscape structure changed into a dense, mosaic-like pattern of agricultural, natural, and urban areas. The return of the wild boar increasingly leads to human-wildlife conflicts, mainly linked to damage in agriculture. Hence, there is a growing need for a time-efficient, standardized, and accurate method to assess crop damage. We present an Unmanned Aerial Vehicle-based method, using Geographic Object-Based Image Analysis and Random Forests to estimate the damaged area and associated yield losses, between 2015 and 2017, due to wild boar in individual fields in Flanders. Our approach resulted in an 84.50% overall accuracy in calculating damaged area for maize fields and 94.40% for grasslands. Damage levels ranged between 14.3% and 20.2% in maize fields and 16.5% to 25.4% in grasslands. Our method can provide objective base data for compensation schemes and guide management strategies based on damage assessments.

Status distribution and feeding habit of Wild Boar *Sus scrofa* (Mammalia: Artiodactyla: Suidae) in Pench Tiger Reserve, Madhya Pradesh, India

Shaheer Khan and Orus Ilyas

Journal of Threatened Taxa Vol. 10, No. 11, Pages: 12459-12463





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The Wild Boar *Sus scrofa* is omnivorous, serves as the prey base for large carnivores, performs the role of a natural scavenger, and is often involved in crop raiding. The species is included in Schedule V of the Indian Wildlife (Protection) Act, 1972, meaning hunting of the species may be allowed by the Chief Wildlife Warden in instances where individuals of the species are considered dangerous to human life or property. Faecal samples of Wild Boar in Pench Tiger Reserve, Madhya Pradesh, India, were collected from January to June 2013 to assess the distribution of Wild Boar in Karmajhiri range. The density of Wild Boar in Sapath and Tikadi beat was 25.5 ± 0.29 and 23.9 ± 0.33 per hectare, respectively, and was the lowest in Teliya at 1.6 ± 0.05 per hectare. Sixteen different beats were sampled and surveyed to understand the diet of Wild Boar during the winter season. Ingested items included stones, roots, grass, fruits and seeds, hairs, earthworms, flowers, and green plant material. Out of these, the most frequent item was grass, followed by roots and stones

Population ecology of the giant forest hog, *Hylochoerus meinertzhageni* in Chebera Churchura National Park, Ethiopia.

Aemro Mekonnen, Afework Bekele, Mundantra Balakrishnan

African Journal of Ecology Vol 56(2), pages 272-278, <https://doi.org/10.1111/aje.12446>

Population, feeding habit, distribution and activity patterns of the giant forest hog (*Hylochoerus meinertzhageni*) were studied in Chebera Churchura National Park (CCNP), Ethiopia, using line transect sample counts. Population estimate of the hogs was 845 individuals. Among the counted individuals, 42.4% were males and 57.6% were females. Among them, 32.8% were adults, 26.9% were subadults, and 40.3% were piglets. Large sounders of up to 20 individuals were seen during the wet season. They were seen in all habitat types in CCNP with higher abundance in the riverine vegetation. Availability of food, green vegetation cover and water were factors governing distribution of forest hogs in the study area. Grass was the major food item of the hogs (90%), mainly of *Panicum* sp., *Acalypha psilostachya*, *Cissapelos rigidifolia*, *Psilotrichum gnaphalobryum* and *Abutilon ceclii*. Feeding was the major activity for which 49.7% of the active daytime was used. Resting (lying down, standing and wallowing) was the next major activity, for which they spent 38.8% of the daytime, followed by other activities (11.5%). Morning and late afternoon activity peaks were more intensive during the dry season. This female biased giant forest hog population is expected to sustain in CCNP.

Ecocorrelates of pelage coloration in pigs and peccaries.

Tim Caro, Caroline Newell, Theodore Stankowich

Journal of Mammalogy, Volume 99, Issue 5, 10 October 2018, Pages

1093–1100, <https://doi.org/10.1093/jmammal/gyy107>

We scored pelage coloration of pigs and peccaries and matched them to socioecological variables to assess the relative strengths of protective coloration and signaling in driving coat coloration. Using phylogenetically controlled analyses, we found that faces, bellies, and perhaps flanks are lighter in larger species; ear coloration is lighter in less-shady environments and in more-social species; white facial spots are associated with less shade and with nighttime activity; and white body spots are associated with greater sociality. There is a marginal association between striped natal coats, a classically cryptic pelage, and litter size. These findings indicate that the body coloration of Suiformes has been selected to match overall background lighting conditions in both adults and neonates, but that specific areas and color patches on the body are





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associated with signaling. Our study suggests that small areas of contrasting pelage coloration are superimposed on classically cryptic body plans to allow both protective coloration and signaling to operate simultaneously.

Habitat Preferences of the Bohor Reedbuck (*Redunca redunca*) and Common Warthog (*Phacochoerus africanus*) in Arsi Mountains National Park, South-eastern Ethiopia.

ZERIHUN GIRMA

International Journal of Ecology and Environmental Sciences 44 (3): 227-237, 2018 ISSN: 2320-5199

The habitat preferences of two ungulates mammals were studied in Galama mountains of Arsi Mountains National Park. A stratified random sampling design established around four dominant habitat types (dry evergreen Afro-montane forests, mixed plantation forests, Erica shrub lands and the Afro-alpine) was used to study the habitat preferences of the Bohor reedbuck and common warthog. Intensive-Modified Whitaker (I-MW) nested plot design was used to sample vegetation ground percent cover and scat of the Bohor reedbuck, warthog and livestock across the study area. The highest habitat preference indices for Bohor reedbuck (0.28) and common warthog (0.55) were recorded in the Afro-alpine habitat and mixed plantation forest respectively during dry season. There was significant difference in mean scat count of both Bohor reedbuck ($H = 9.27$, $df = 3$, $p = 0.026$) and warthog ($H = 11.32$, $df = 3$, $p = 0.010$) among habitat types. For warthog, livestock abundance was a good negative predictor of habitat use during the dry season, while both livestock abundance (negative predictor) and herb species percent cover (positive predictor) accounted for the wet season. Livestock abundance and slope were good negative predictors of Bohor reedbuck habitat use during the dry season, while livestock, slope average percent cover (positive predictor) accounted more in the wet season. Herb abundance used for forage and livestock encroachment determines the habitat preferences of the two mammals. Livestock encroachment abundance has been found to significantly limit the abundance of both warthog and Bohor reedbuck in Galama Mountains of Arsi Mountains National Park. As a result, to save the animals there is a need for urgent halting of livestock encroachments and other human disturbances.

Assessment of Crop-Raiding in and Around the Bale Mountains National Park, Ethiopia.

Israel Sebsbie, Mesele Yihune

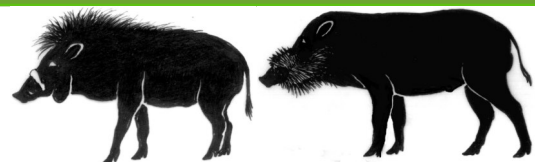
International Journal of Ecology and Environmental Science, Volumen 44 (3)

The present study focused on human-herbivores conflict in around the Bale Mountain National Park, Ethiopia. Data were collected from selected sites between July, 2016 and April, 2017, by using questionnaire survey of sample households, direct observation on crop damage by different herbivores and key informant interview. Descriptive statistics was used to analyze socio-economic status of respondents. Chi-square test, correlation and one-way ANOVA were also used to investigate the relationship between different variables. Majority of respondents (82.6%) had reported crop damage by different vertebrates. Olive baboon (*Papio anubis*), warthog (*Phacochoerus aethiopicus*), common mole rat (*Tachyoryctes splendens*), porcupine (*Hystrix cristata*), grey duiker (*Sylvicapra grimmia*), mountain nyala (*Tragelaphus buxtoni*) and bohor reedbuck (*Redunca redunca*) were mentioned as important crop raiders. Many (73.65%) of the respondents reported olive baboon and warthog together as major crop raider. Significant number (80%) of respondents reported the loss of barley. There was also (16.1%) the damage of oat,





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barley, wheat and bean in together. There was positive correlation between distance from the Park and degree of crop damage ($r = 0.71$, $P < 0.05$) so that the conflict was not occurred for local people are lived in or near to the Park. The conflict is highly due to the wildlife live outside the parks' range. Therefore, outside the park border, the population status and distribution of crop-raiders is recommended to be studied so that the management plan would be made easy.

Abundance and distribution of ungulates in the buffer zone of old Oyo national park, Nigeria

S.O. Adedoyin

Journal of Research in Forestry, Wildlife and Environment

Vol 10, No 3 (2018)

The buffer zones of Nigerian protected areas are neglected and under-managed. The study examined the abundance and distribution as well as the population structure of ungulates species in Old Oyo National Park buffer zone. Five 3×2 km transects were laid in the buffer zone of all the ranges (Ogun-Tede, Marguba, Sepeteri, Oyo-Ile, and Yemoso) of the Park. The transects were traversed for a period of 12 months. Observations were based on direct censusing techniques only. The wet season results showed that Marguba range had the highest relative abundance of ungulate species $0.67 \pm 0.0057/\text{km}^2$, while Sepeteri range had the least relative abundance of ungulate species $0.33 \pm 0.0023/\text{km}^2$. *Sylvicapra grimmia* had the highest number of individuals in a group per square kilometer 0.0043 ± 0.0012 , while *Kobus kob* had the least number of individuals in a group per square kilometer 0.0011 ± 0.0004 . Adult males and adult females constituted the highest proportion of ungulate species mean population structure which ranged between 0.75 and 25.0%. In the dry season, however, Ogun-Tede range had the highest relative abundance of ungulate species $1.50 \pm 0.0092/\text{km}^2$, while Yemoso range had the least $0.17 \pm 0.0011/\text{km}^2$. *Hippotragus equinus* had the highest number of individuals in a group per square kilometer 0.0033 ± 0.0012 , while both *Potamochoerus porcus* and *Sylvicapra grimmia* had the least number of individuals in a group per square kilometer 0.0017 ± 0.0005 . Adult males, adult females and sub-adult males constituted the highest proportion of ungulate species mean population structure which ranged between 0.8 and 22.22%. Based on these findings, a buffer zone of Old Oyo National Park should be given more attention in terms of policing, monitoring and effective protection.

Comparison of Three Methods to Assess the Potential for Bushpig-Domestic Pig Interactions at the Wildlife—Livestock Interface in Uganda.

Ariane Payne, Peter Ogweng, Alfred Ojok, Eric Etter, Emmanuelle Gilot-Fromont, Charles Masembe, Karl Ståhl, and Ferran Jori

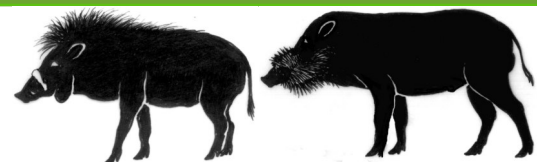
Front Vet Sci. 2018; Vol 5: 295, doi: 10.3389/fvets.2018.00295

Bushpigs (*Potamochoerus larvatus*) are considered a nuisance to farmers because of their crop raiding habits. Through their incursions into farmlands, they may interact with free-ranging domestic pigs and potentially cause transmission of infectious diseases such as African Swine Fever (ASF). The role of the bushpig in the epidemiology of ASF is poorly known and one of the gaps of knowledge is precisely the nature of interaction between bushpigs and domestic pigs. Thus, in this study, we investigated the frequency of bushpig visits to crop fields in rural communities where ASF is endemic, at the edge of a wildlife protected area in northwestern Uganda, to better understand the potential for interaction and disease transmission. We used





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three methods (questionnaires, camera traps, and observations for tracks) to assess bushpig visits to farmland. These methods were implemented concurrently in 28 farms during rainy and dry seasons. The results obtained by each of the three methods were analyzed by generalized linear mixed models. Potential risk factors including crop type, season, and landscape characteristics related to bushpig ecology were tested as explanatory variables. A generalized linear model and the Kendall test were used to compare the results and consistency of the frequency values obtained by the three methods. A high percentage (75%) of interviewed farmers reported visits from bushpigs in 29.6% of assessed crops ($n=145$), and a frequency of 0.014 ± 0.05 visits per night was obtained through camera-trapping. Bushpig tracks were detected in 36% of sessions of observation. Cassava (*Manihot esculenta*) and groundnut (*Arachis hypogaea* L.) crop fields were the most visited, and these visits were more common during the rainy than the dry season. Distances from crop sites to the boundary of the protected area and to the river also influenced visit frequency. Camera-trapping was the least sensitive method while questionnaires and track observations presented consistent and complementary results to characterize spatial and temporal visits of bushpig into the crop fields. Evidence from our study shows that when used in combination, these methods can provide useful data to improve our understanding of the interactions between bushpigs and domestic pigs at the wildlife-domestic interface.

Diversity and conservation status of ungulates in the Mono Transboundary Biosphere Reserve, Togo (West Africa).

Gabriel H. Segniagbeto, Komina H. Atsri, Délagnon Assou, Koudzo D. Koda, Giovanni Amori, Jan Decher, et al.

Journal of Tropical Zoology, Volume 31, Issue 3, Pages 118-130

<https://doi.org/10.1080/03946975.2018.1477248>

Ecological data on ungulate mammals are poorly available for Togo (West Africa), also with regard to the populations inhabiting the various protected areas. To provide preliminary data on the ecology of Togolese ungulates, several field missions were carried out between September 2014 and August 2017 in the various ecological units considered as key areas for large mammals of the Mono Transboundary Biosphere Reserve (MTBR). MTBR, located along the Mono River, has several ecological units of varying sizes, with the Togodo Protected Areas Complex being the largest within the biosphere reserve (25,500 ha). A total of 12 species belonging to four families were recorded on the basis of direct observations and/or signs of presence. These include: *Tragelaphus eurycerus*, *Tragelaphus gratus*, *Tragelaphus phaleratus*, *Syncerus brachyceros*, *Kobus kob*, *Philantomba walteri*, *Cephalophus rufilatus*, *Cephalophus sylvicultor*, *Sylvicapra grimmia*, *Hippopotamus amphibius*, *Potamochoerus porcus*, *Phacochoerus africanus*. Another species (*Kobus ellipsiprymnus*) has been reported from hunter surveys. The field sightings of ungulates were especially concentrated in the Togodo protected area complex, but also the smaller ecological units (such as the Afito pools, the Avéve forest and the Akissa forest) seemed to play an important role in consolidating the ecological functioning of the biosphere reserve. Indeed, groups of *T. gratus*, *T. phaleratus* and *H. amphibius* are reported by hunters to seasonally move between the complex of protected areas of Togodo and its units.





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Occupancy and habitat use by six species of forest ungulates on Tiwai Island, Sierra Leone.

Kathryn R. McCollum, Emily Belinfante, April L. Conway; John P. Carroll.

Koedoe vol.60 n.1 Pretoria 2018

<http://dx.doi.org/10.4102/koedoe.v60i1.1484>

Forest ungulates in West Africa are common bushmeat species and are subject to habitat degradation through deforestation. Based on historical data, there are possibly 12 species of forest Bovidae and Tragulidae found in eastern Sierra Leone. We used camera trapping to assess occupancy by forest ungulates on and around a small protected area, Tiwai Island, Sierra Leone. We then assessed habitat over two field seasons during 2008-2011 for those species where we had sufficient numbers of detections. We detected 6 of 12 potential species and obtained enough data to further assess the habitat of two species. Species detected included the black duiker (*Cephalophus niger*), bongo (*Tragelaphus eurycerus*), bushbuck (*Tragelaphus scriptus*), Maxwell's duiker (*Philantomba maxwellii*), water chevrotain (*Hyemoschus aquaticus*) and yellow-backed duiker (*Cephalophus silvicultor*). Among detected species, the bongo is considered near threatened. Several of the species not detected might be extirpated from the region, but for several species we found no records of them in the area. For the two species with sufficient detections for analysis, we found that Maxwell's duikers were common throughout woody and swamp habitat and yellow-backed duikers preferred old growth forests with open understory. Despite widespread deforestation in Sierra Leone, a recent civil war and continued bushmeat trade, it appears that small wildlife refuges such as Tiwai Island continue to provide sanctuary for many of the forest ungulates of the region.

Conservation implications: The Guinea Rainforest ecosystem of West Africa has undergone significant human impact and deforestation, negatively impacting all aspects of the biodiversity of the region. In addition, a long-standing civil war in Sierra Leone further exacerbated conservation concerns of many wildlife species. There are some recognised reserves in Sierra Leone, but small reserves managed by local people and conservation organisations have a role to play. Our work on Tiwai Island, along the Moa River in Sierra Leone, demonstrated that a significant proportion of the forest dwelling ungulate biodiversity of the region has been maintained in a small reserve despite isolation and effects of the war. Our work also suggests that Tiwai Island continues to have significant ecological value for ungulate conservation in the region and should be considered a model for establishment of other small reserves to help maintain the region's biodiversity.

Evidence for current presence of a collared peccary (*Pecari tajacu*) in Guanajuato, Mexico.

Juan F. Charre-Medellín, J. Manuel Rangel-Rojas, Gloria Magaña-Cota, Tiberio C. Monterrubio-Rico, Joel L. Charre-Luna

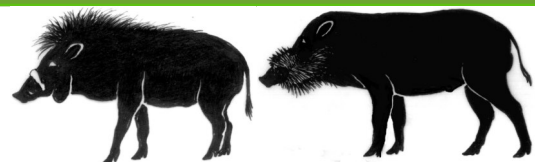
Western North American Naturalist: Vol. 78: No. 1, Article 10.

On the basis of 86 photographic records, we report the presence of a relatively stable collared peccary (*Pecari tajacu*) population in the state of Guanajuato, Mexico. These records complement geographical and ecological information for the species along the Gulf of Mexico. The species' predominant habitat is submontane scrub, which corresponded to 54.6% of the records. Family groups (herds) were observed with 3.9 ± 2.9 (mean \pm SD) individuals on average. The presence of young indicated 2 reproductive periods per year (March and August). The presence of collared peccaries in the region of greatest biological diversity in Guanajuato





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provides additional value to the protected areas of the state. This herbivorous species plays a fundamental ecological role as a preferred prey of this area's main predators, such as the jaguar (*Panthera onca*) and the cougar (*Puma concolor*). It is important to continue monitoring wild fauna with the purpose of delimiting distributions and estimating populations at the local level.

Genetic evidence of promiscuity in a mammal without apparent sexual dimorphism, the white-lipped peccary (*Tayassu pecari*).

Dalila Alves Leite, Alexine Keuroghlian, Danilo Aqueu Rufoc, Cristina Yumi Miyakic, Cibele Biondo.

Mammalian Biology Volume 92, September 2018, Pages 111-114

<https://doi.org/10.1016/j.mambio.2018.05.005> Get rights and content

Polygyny in mammals, as in other groups, is related to sexual dimorphism, with males being larger than females or with elaborate weaponry as a response to sexual selection. However, sexual selection can also act on females, leading to cases where dimorphism is reversed or absent and females mate with several males, leading to a promiscuous mating system. In this study, we analyzed the mating system of a monomorphic mammalian species, the white-lipped peccary (*Tayassu pecari*), using microsatellite molecular markers and parentage tests. The white-lipped peccary mating system is predicted to be polygyny, but so far, no systematic study exists. To verify their mating behavior, 131 individuals of a herd from the Brazilian Pantanal were genotyped for 11 microsatellite loci and parentage tests were performed for all the sampled young. We determined that both males and females had offspring with more than one partner which is compatible with a promiscuous mating system. Promiscuity in this species could be related to competition among females as a result of the female-biased sex ratio leading to sexual and/or natural selection not only on males but also females.

Niche centrality and human influence predict rangewide variation in population abundance of a widespread mammal: The collared peccary (*Pecari tajacu*).

P. G. Martínez Gutiérrez, E. Martínez Meyer, F. Palomares, N. Fernández

Diversity and Distributions, 2018, vol. 24, no 1, p. 103-115, <https://doi.org/10.1111/ddi.12662>

Aim: (1) To evaluate whether geographic variation in population abundance of a widespread mammal (*Pecari tajacu*) is related to its location with respect to the centroid of its ecological niche or to the centroid of its geographic range. (2) To assess whether the abundance–niche centrality relationship defines the maximum expected abundance at any location, rather than the realized abundance. (3) To test whether including human impacts improves the abundance–niche centrality relationship, and therefore the prediction of geographic variation in population abundance.

Location: The Americas.

Methods: We modelled the ecological niche of the species using occurrence and environmental data and created spatial models of distance to the niche centroid (DNC) and to the geographic centroid (DGC). We tested the relationships between population abundance and DNC and between abundance and DGC. We evaluated whether the rate of change in the abundance–DNC relationship was steeper near the upper boundary of quantile regressions. We tested whether the human influence index (HII) contributed to improve niche based predictions of population abundance. Finally, we generated broad scale predictions of collared peccary population abundances.





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Results: We found a negative relationship between abundance and DNC and a non significant relationship between abundance and DGC. The abundance–DNC relationship was wedge shaped, steeper in the upper quantile boundary than in the median. HII also had a negative effect on abundance. The model including DNC and HII was best supported for predicting the median abundance, while DNC alone was the best to predict the upper boundary of population abundances.

Main conclusions: Population abundances are associated with the structure of the ecological niche, especially the maximum abundance expected in an area. Thus, the DNC approach can be useful in obtaining a spatial approximation of potential abundance patterns at biogeographic extents. To achieve a better prediction of realized abundances, it is critical to consider the human influence.

The paradoxical situation of the white-lipped peccary (*Tayassu pecari*) in the state of Mato Grosso, Brazil.

Mendelson Lima, Carlos Augusto Peres, Mark Ilan Abrahams, Carlos Antonio da Silva Junior, Gerlane de MedeirosCosta, Reginaldo Carvalho dos Santosa
Perspectives in Ecology and Conservation, 2018.

<https://doi.org/10.1016/j.pecon.2018.12.001> Get rights and content

Populations of white-lipped peccaries, *Tayassu pecari*, have already been extirpated or drastically reduced in much of the Neotropics, but are still relatively abundant in the Brazilian state of Mato Grosso, the country's largest maize and soy producer. This article synthesises over a decade of experience both visiting farms which experienced crop damage and working with hunters, farmers and technicians who live in areas of conflict with *T. pecari*. These social ungulates feed within maize plantations bordering forest fragments during the entire cultivation cycle and farmers in Mato Grosso vociferously protest the severe economic losses they cause. To protect their crops from damage, farmers slaughter white-lipped peccaries using firearms, traps and mass poisoning. We also draw attention to the need to mitigate the damage caused in agricultural frontiers by this ecologically important species, such that it is not decimated as it has been in the Caatinga and Atlantic Forest biomes.

OCORRÊNCIA DE QUEIXADA (*TAYASSU PECARI*), CAITITU (*PECARI TAJACU*) E JAVAPORCO (*SUS SCROFA*) (MAMMALIA, CETARTIODACTYLA) EM JOÃO PINHEIRO, CERRADO DE MINAS GERAIS, BRASIL.

Adriano Lima Silveira, Sandro Aparecido Pacheco

Revista Brasileira de Zootecias, 2018, vol. 19, no 1.

A partir de amostragens em campo com os métodos de busca ativa e armadilha fotográfica são apresentados registros de porcos silvestres no Município de João Pinheiro, uma área de Cerrado no Noroeste de Minas Gerais. O estudo foi conduzido em paisagens de várzea, campina, mata seca e chapada, compostas por remanescentes de diversas fitofisionomias e áreas de uso agropecuário. Grupos de *Tayassu pecari* (queixada), Em Perigo em Minas Gerais, foram registrados em 14 localidades em uma mesma região de grande planície de interflúvio com extensos remanescentes conservados, ocorrendo possivelmente em uma estrutura de metapopulação. Grupos de *Pecari tajacu* (caititu), Vulnerável em Minas Gerais, foram registrados em 20 localidades, exibindo maior distribuição geográfica, e ocorreram em remanescentes com





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distintos estados de conservação. Grupos estabelecidos de *Sus scrofa* híbridos (javaporco), espécie invasora, foram registrados em uma área. São apresentadas observações de história natural, destacando-se o consumo de diversos frutos do Cerrado e movimentos sazonais em função de frutificação exercido por *T. pecari*, e formação de grandes grupos e possível comportamento de piscivoria por *P. tajacu*. Os registros de *T. pecari* correspondem às primeiras ocorrências confirmadas da espécie em áreas externas a Unidades de Conservação recentemente em Minas Gerais. São discutidas ameaças locais a *T. pecari* e *P. tajacu*, destacando-se a destruição e fragmentação de habitats no contexto do histórico de ocupação do solo no município, distintas modalidades de caça e, potencialmente, a intervenção gerada por *S. scrofa*. Com base nos registros obtidos, nas relevantes ameaças identificadas e na conhecida maior susceptibilidade de *T. pecari* a extinções locais, suspeita-se que a população de queixada de João Pinheiro esteja fadada à extinção, a menos que grandes remanescentes naturais sejam efetivamente protegidos em Unidades de Conservação.

Achieving optimal welfare for the Nile hippopotamus (*Hippopotamus amphibius*) in North American zoos and aquariums

Kaylin S. Tennant, Valerie D. Segura, Megan C. Morris, Kristen Denninger Snyder, David Bocian, Dan Maloney, Terry L. Mapleabe

Behavioural Processes, Volume 156, November 2018, Pages 51-57,

<https://doi.org/10.1016/j.beproc.2017.07.009>

Compared to other megafauna managed in zoos and aquariums, the current state of welfare for the Nile hippopotamus (*Hippopotamus amphibius*) is poorly understood. Complex behavior and physiological characteristics make hippos a difficult species to manage. Thus, hippos in managed care are currently at risk for a decreased state of welfare. In an effort to assess and improve conditions for this species, a survey was administered to North American institutions housing Nile hippos. This assessment utilized a multiple-choice format and consisted of questions relating to group structure, behavior, and exhibit design, allowing for the creation of cross-institutional, welfare-based analysis. Responses were gathered from 85.29% of the institutions to which the survey was distributed. Despite recommendations for maintaining groups of at least five individuals (Forthman, 1998), only 34.25% of hippos in North America were housed in groups of three or more. The survey also highlighted that 39.29% of institutions secure their hippos in holding areas overnight, despite their highly active nocturnal propensities. A better understanding of hippo behavior and environmental preferences can be used to inform wellness-oriented management practices to achieve a state of “optimal welfare”.

Underwater click train production by the hippopotamus (*Hippopotamus amphibius*) suggests an echo-ranging function.

Maria Maust-Mohl, Joseph Soltis and Diana Reiss

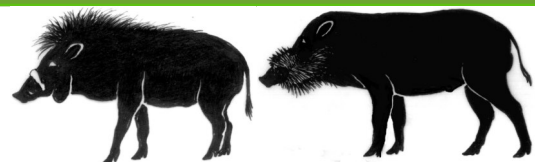
Behaviour, Volume 155: Issue 2-3, <https://doi.org/10.1163/1568539X-00003484>

Common hippos (*Hippopotamus amphibius*) live in murky waters and produce a variety of acoustic signals including underwater click trains considered to be social in function. We tested the hypothesis that click trains may function for underwater detection. We used observational and experimental methods involving 16 captive hippos to document the occurrence of click trains in different contexts and describe the acoustic parameters of the clicks. Male and female hippos produced click trains correlated with searching underwater for food items placed in their pools. Males produced click trains when alone supporting the hypothesis that these signals function for





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detection and are not only social in function. The frequency bandwidth of individual clicks varied and most were below 10 000 Hz. Click train production by hippos during underwater searches suggests a rudimentary form of echo-ranging that may function when other sensory systems are limited in their aquatic environment.

Ethnozoological uses of common hippopotamus (*Hippopotamus amphibius*) in Benin.

Republic (Western Africa)

Dossou, Etienne M., Lougbegnon, Toussaint O., Houessou, Laurent G., Codjia, Jean T. Claude
Indian Journal of Traditional Knowledge (IJTK), Vol 17 (1). 2018, pages 85-90.

Hippopotamus amphibius is the 3rd largest and heaviest terrestrial mammal after elephants (*Loxodonta africana*) and white rhinos (*Ceratotherium simum*) in Africa. This investigation conducted in the Benin Republic aims to assess the local inhabitants' traditional knowledge associated with hippo in different use categories (medicinal, cultural and spiritual). Data were gathered using ethnozoological questionnaires. One hundred and fifty informants from 13 ethnic groups in Benin were randomly selected and interviewed. Chi square test was used to analyze the answers given regarding the uses categories of hippo. Principal Correspondence Analysis was used to describe traditional beliefs associated with hippo according to the ethnic groups. Results revealed seven use categories for hippo. A significant difference was observed between age groups ($\chi^2 = 27.537$; $p = 0.027$; $dF = 2$) regarding use categories. But no significant differences were found between ethnic groups ($\chi^2 = 16.437$; $p = 0.057$; $dF = 12$) for the use categories. The Principal Component Analysis revealed differences in traditional beliefs associated with hippo. For example, the male adult Yoruba and Adja regard hippo as cruel and diabolic animal. The Fon and old men from Idatcha, Aïzo, Mahi, Goun, Holly and Cotafonethnic groups have considered hippo as saviour, protector and fetish.

Effects of the hippopotamus on the chemistry and ecology of a changing watershed.

Keenan Stears, Douglas J. McCauley, Jacques C. Finlay, James Mpemba, Ian T.

Warrington, Benezeth M. Mutayoba, Mary E. Power, Todd E. Dawson, and Justin S. Brashares
PNAS May 29, 2018 115 (22) E5028-E5037; published ahead of print May 14,
2018 <https://doi.org/10.1073/pnas.1800407115>

Cross-boundary transfers of nutrients can profoundly shape the ecology of recipient systems. The common hippopotamus, *Hippopotamus amphibius*, is a significant vector of such subsidies from terrestrial to river ecosystems. We compared river pools with high and low densities of *H. amphibius* to determine how *H. amphibius* subsidies shape the chemistry and ecology of aquatic communities. Our study watershed, like many in sub-Saharan Africa, has been severely impacted by anthropogenic water abstraction reducing dry-season flow to zero. We conducted observations for multiple years over wet and dry seasons to identify how hydrological variability influences the impacts of *H. amphibius*. During the wet season, when the river was flowing, we detected no differences in water chemistry and nutrient parameters between pools with high and low densities of *H. amphibius*. Likewise, the diversity and abundance of fish and aquatic insect communities were indistinguishable. During the dry season, however, high-density *H. amphibius* pools differed drastically in almost all measured attributes of water chemistry and exhibited depressed fish and insect diversity and fish abundance compared with low-density *H. amphibius* pools. Scaled up to the entire watershed, we estimate that *H. amphibius* in this hydrologically altered watershed reduces dry-season fish abundance and indices of gamma-level diversity by 41% and 16%,





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respectively, but appears to promote aquatic invertebrate diversity. Widespread human-driven shifts in hydrology appear to redefine the role of *H. amphibius*, altering their influence on ecosystem diversity and functioning in a fashion that may be more severe than presently appreciated.

Spatio-temporal epidemiology of anthrax in *Hippopotamus amphibius* in Queen Elizabeth Protected Area, Uganda.

Margaret Driciru, Innocent B. Rwego, Benon Asiimwe, Dominic A. Travis, Julio Alvarez, Kimberly, VanderWaal, Katharine Pelican

PLoS ONE 13(11): e0206922. Published: November 28, 2018

<https://doi.org/10.1371/journal.pone.0206922>

Background: Anthrax is a zoonotic disease primarily of herbivores, caused by *Bacillus anthracis*, a bacterium with diverse geographical and global distribution. Globally, livestock outbreaks have declined but in Africa significant outbreaks continue to occur with most countries still categorized as enzootic, hyper endemic or sporadic. Uganda experiences sporadic human and livestock cases. Severe large-scale outbreaks occur periodically in hippos (*Hippopotamus amphibius*) at Queen Elizabeth Protected Area, where in 2004/2005 and 2010 anthrax killed 437 hippos. Ecological drivers of these outbreaks and potential of hippos to maintain anthrax in the ecosystem remain unknown. This study aimed to describe spatio-temporal patterns of anthrax among hippos; examine significant trends associated with case distributions; and generate hypotheses for investigation of ecological drivers of anthrax.

Methods: Spatio-temporal patterns of 317 hippo cases in 2004/5 and 137 in 2010 were analyzed. QGIS was used to examine case distributions; Spearman's nonparametric tests to determine correlations between cases and at-risk hippo populations; permutation models of the spatial scan statistics to examine spatio-temporal clustering of cases; directional tests to determine directionality in epidemic movements; and standard epidemic curves to determine patterns of epidemic propagation.

Key findings: Results showed hippopotamus cases extensively distributed along water shorelines with strong positive correlations ($p < 0.01$) between cases and at-risk populations. Significant ($p < 0.001$) spatio-temporal clustering of cases occurred throughout the epidemics, pointing towards a defined source. Significant directional epidemic spread was detected along water flow gradient (206.6°) in 2004/5 and against flow gradient (20.4°) in 2010. Temporal distributions showed clustered pulsed epidemic waves.

Conclusion: These findings suggest mixed point-source propagated pattern of epidemic spread amongst hippos and points to likelihood of indirect spread of anthrax spores between hippos mediated by their social behaviour, forces of water flow, and persistent presence of infectious carcasses amidst schools. This information sheds light on the epidemiology of anthrax in highly social wildlife, can help drive insight into disease control, wildlife conservation, and tourism management, but highlights the need for analytical and longitudinal studies aimed at clarifying the hypotheses.

Diverse effects of the common hippopotamus on plant communities and soil chemistry.

Douglas J. McCauley, Stuart I. Graham, Todd E. Dawson, Mary E. Power, Mordecai Ogada, Wanja D. Nyingi, John M. Githaiga, Judith Nyunja, Lacey F. Hughey, Justin S. Brashares
Oecologia, Volume 188, Issue 3, pp 821–835





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The ecological importance of the common hippopotamus (*Hippopotamus amphibius*) in aquatic ecosystems is becoming increasingly well known. These unique megaherbivores are also likely to have a formative influence on the terrestrial ecosystems in which they forage. In this study, we employed a novel enclosure design to exclude *H. amphibius* from experimental plots on near-river grasslands. Our three-year implementation of this experiment revealed a substantial influence of *H. amphibius* removal on both plant communities and soil chemistry. *H. amphibius* significantly reduced grassland canopy height, increased the leafiness of common grasses, reduced woody plant abundance and size, and increased the concentrations of several soil elements. Many of the soil chemistry changes that we experimentally induced by exclusion of *H. amphibius* were mirrored in the soil chemistry differences between naturally occurring habitats of frequent (grazing lawns) and infrequent (shrub forest) use by *H. amphibius* and other grazing herbivores. In contrast to existing hypotheses regarding grazing species, we found that *H. amphibius* had little effect on local plant species richness. Simultaneous observations of enclosures designed to remove all large herbivores revealed that *H. amphibius* removal had ecologically significant impacts, but that the removal of all species of large herbivores generated more pronounced impacts than the removal of *H. amphibius* alone. In aggregate, our results suggest that *H. amphibius* have myriad effects on their terrestrial habitats that likely improve the quality of forage available for other herbivores. We suggest that ongoing losses of this vulnerable megaherbivore are likely to cause significant ecological change.

Habitat suitability analysis for hippopotamus (*H. amphibius*) using GIS and remote sensing in Lake Tana and its environs, Ethiopia.

Fentanesh Haile Buruso

Environmental Systems Research, 6:6

This research was carried out from October 2013 to May 2014. *Hippopotamus amphibius* is a mammalian species distributed in different lakes and rivers where ecological requirements are fulfilled for its survival. Lake Tana and its environs are home to *Hippopotamus amphibius*. The species is identified as vulnerable worldwide due to habitat loss and poaching. However, despite its vulnerability, there is no research conducted regarding the species, and its environmental requirements in Ethiopia. Therefore, the main objective of this study was to carry out habitat suitability analysis and find out suitable habitat sites of hippopotamus within the Lake Tana and its environs using the integration of GIS and remote sensing techniques. The softwares such as, Arc GIS10.2, ERDAS IMAGINE2010, and Virtual satellite image downloader were used in this research. The data used were SPOT image of 2012 of the study area, bathymetric data of Lake Tana, DEM, Google Earth data and GCP. Running a suitability model requires estimation of weights by expertise for each individual criterion on GIS software. Thus, the habitats in Lake Tana and its environs ranging from most suitable to not suitable for hippopotamus were identified. It was shown that 50.88% of the areas under study was highly disturbed and became unsuitable to hippopotamus, 42.29% of the areas were moderately disturbed, and only 1.81% of the areas were revealed to be undisturbed. As the study result showed that in and around Lake Tana, a human factor was considered to be outweighing the physical factors to minimize the habitat for the aforementioned animal. The results revealed that only 22.54% of the study areas were identified as most suitable for the animal under study of which the large portions of the areas are located at the backside of settlements which are not easily accessible by the species, while 40.5% of the areas were found to be moderately suitable, and 36.96% were unsuitable habitats

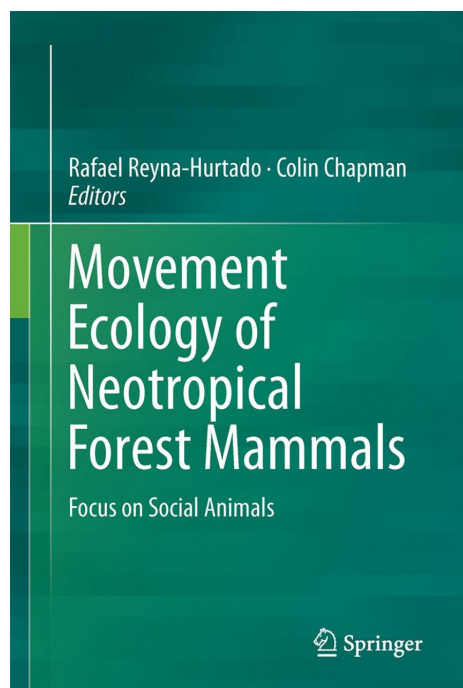




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for hippopotamus. Based on the findings of the present study it was concluded that there was high interference of human being in the habitats of hippopotamus especially at the shores of the lake since the land were looked-for agricultural activities. Therefore, too much proximity of human activities in identified hippopotamus habitats have to be protected and conservation buffer surrounding the Lake has to be developed.



Movement ecology has become an important part of scientific ecological investigations and is also essential for the conservation of species. Due to the fast progress in developing new tools like GPS collars and new data analysis tools, the understanding of animals and their movements has highly increased during the last years. Rafael Reyna-Hurtado and Colin A. Chapman as editors have compiled scientific studies about movement ecology of mammalian species living in Neotropical forests and focus on social animals.

After a short introduction by the editors the following chapter deal with investigations of social mammals ranging from Baird's Tapirs, Neotropical deer species and Jaguars to Tufted Capuchins and Howler Monkeys. Most importantly, there are four chapters about White-lipped peccaries:

The first of these peccary chapters is about their home range in the Maya Forest of Guatemala and Mexico. The authors of this chapter found that hunting had some influence of the size of White-lipped peccaries' home ranges. Furthermore, White-

lipped peccaries increased their home ranges in the rainy season and suggested that water availability is a key factor determining their movements in non-hunted areas, while for hunted areas the hunting pressure made them to keep moving even in the dry season. These results have implications for the conservation of this species in Central America. The second chapter about this species comprises an investigation about these peccaries' movements and range in agricultural lands in Central Brazil. The tracked White-lipped peccaries herds in this investigation traveled an average of almost 3.5 km per day (an underestimation of the real distances, as the authors write). Even this underestimated distance makes White-lipped peccaries one of the "highly mobile" species of the world. As White-lipped peccaries have a high diversity of resource requirements, deforestation has negative impacts on them in many different ways. Deforestation did affect long-term movements and monthly range size during wet season. The study demonstrated that these peccaries moved more and had larger ranges in agricultural landscapes due to the lack of fruits there. In the third White-lipped peccary chapter Richard-Hansen et al. investigated the movements of this species in French Guiana. They discuss the problems and biases of GPS tracking and remote retrieved data. Most importantly, they found that healthy populations of White-lipped peccaries can live near important human activities as long as hunting and habitat is properly managed. The spatial ecology of White-lipped peccaries in Darién, Panama, covers the fourth chapter about this species. This is the first investigation about this species in the moist tropical forests of Panama. Contrarily to the results presented in the chapter





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about White-lipped peccaries in the Maya Forest, peccaries in Darién did not show any significant change in home range sizes during dry season as water is available throughout the year. The investigators found several tunnels and large burrow-like holes White-lipped peccaries used and mostly prepared by them and are supposedly used as salt-licks (take a look on Plate 6.1 on page 88). The large herd size in this investigation was an indicator for the good health of this ecosystem in Darién. Nevertheless, there is hunting in this area. The authors emphasize the need of conservation actions on the landscape level and to include White-lipped peccaries on the conservation agenda in Panama.

In the final chapter Reyna-Hurtado and Chapman summarize the lessons learned from each chapter and put them into a wider context. Further investigations are needed to understand the extents of habitat changes and hunting pressures White-lipped can accept before becoming locally extinct.

Not only the results of the scientific investigations of White-lipped peccaries and all the other species in this book are important, but also the different methods, statistical analysis and spatial modeling described. Scientists interested in movement ecology should read this book.

There is a strong need to better understand the movements of species for understanding their ecology and to plan conservation actions. This book offers important new insights in this subject and will hopefully help to initiate further investigations in the movements of Neotropical animals and also of animals in other biogeographic realms.

Movement Ecology of Neotropical Forest Mammals: Focus on Social Mammals

by Rafael Reyna-Hurtado and Coli A. Chapman (Eds.)

284 pages

2019, Springer Verlag

Reviewed by Thiemo Braasch



There are several books that deal with the relationship between humans and pigs. While some of them look at this from a cultural point (see *Suiform Soundings* 14(1): pp. 76-77, *Suiform Soundings* 16(2) p. 59), a new book entitled 'Pig/Pork' by Pía Spry-Marqués, from the University of Cambridge, UK, takes a different approach. As indicated by the subtitle it covers archaeology, zoology and edibility. Pía Spry-Marqués has studied archaeology. She describes pig-human interactions around the world and through time.

After a short introduction about personal experiences with pigs and pork dishes and a summary of pig evolution (mentioning all extant wild pig species, except Palawan Bearded Pig and Mindoro Warty Pig from South-east Asia), she delves into the process of pig domestication, different domestication theories and the origins of the first domesticated pigs. Spry-Marqués writes about most recent investigations and ongoing debates on domestication. The





subsequent chapters deal with food waste and modern pig farming, the use of pigs in medical investigations to cure skin cancer and genetically modified pigs that glow in the night. One chapter is about pig parasites that can also infect humans, such as *Taenia solium* and *Streptococcus suis*, how humans can contract and also avoid them. Spry-Marqués writes about pork cooking science and different ways to cook and fry pork, the advantages and problems of these techniques and different ways to prepare famous traditional food made of pork like Parma ham or Ibérico. In addition, she discusses several theories explaining the origin of taboos towards consuming pork meat in Judaism and Islam, pigs and pork in politics and identities of different social groups. This includes information on how pigs were used in ancient warfare and the Pig War between the United States and Canada in the mid-1800s. After a final chapter with the author's personal impressions of pigs and the consumption of pork meat, seven pig breeds are briefly presented. Each chapter is followed by one or two cooking recipes, some traditional, some modern and descriptions how to prepare them and the stories behind these recipes. Pía Spry-Marqués uses a colloquial writing style, often with irony and sarcasm. This style is entertaining, especially in the first part, where she summarizes the latest outcomes of archaeological research and makes them easily understandable.

Pig/Pork: Archaeology, Zoology and Edibility
by Pía Spry-Marqués
264 pages
2017, Bloomsbury Sigma (Bloomsbury imprint)

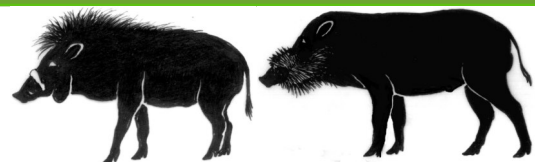
Reviewed by Thiemo Braasch

Planned wild boar cull in Poland angers conservationists

<https://www.theguardian.com/environment/2019/jan/11/planned-wild-boar-cull-in-poland-angers-conservationists>
Shaun Walker, Fri 11 Jan 2019

Mikołaj Golachowski describes plan as 'evil' and warns of environmental consequences
Conservationists have branded plans by the Polish government to cull almost the entire wild boar population of the country as "pointless, counterproductive and evil".
In a move to tackle an epidemic of African swine fever, the Polish government has ordered a series of hunts, beginning this weekend, with the aim of killing the vast majority of the country's population of around 200,000 wild boar.
Last year, the country's veterinary officials approved a plan to kill 185,000 wild boars this season, and the country's PZL hunting union said it had already killed 168,000 since last April. The government has recently decided to speed up the process by calling all licensed hunters to go out seeking wild boars, including pregnant females, over weekends this month.
Opponents of the cull said it is not only cruel but pointless, or possibly even counterproductive.
"The massacre of wild boar in large-scale hunts will not stop [African swine fever], it will only help the spread of the virus to western Poland," said an appeal by environmental organisations to the government to abandon the plan.





Mikołaj Golachowski, a biologist and conservationist who has been outspoken about the government's plans, agreed that the cull was merely likely to disperse the animals rather than eradicate them entirely, risking spreading the disease further afield.

Golachowski said killing the animals would also cause enormous damage to the country's ecosystem. When wild boars forage, they aerate the soil allowing seeds to germinate and also feed on rodents and insect larvae, meaning their absence could lead to an increase in these populations.

"They are a very important part of the ecosystem, and there is also the ethical question of slaughtering innocent animals for something that is not going to achieve any purpose. In every aspect it's a terrible idea, and it's also evil," he said.

Poland is a leading exporter of pork products, and African swine fever can prove deadly to pigs and wild boar, though it does not infect humans. It can also be spread by insects and can survive for several months in carcasses and processed meat. There are no known antidotes or vaccines. However, critics said proper biosecurity measures involving special sterilised clothing and mats at farms would be a more effective way to avoid the spread of the disease than mass slaughter.

"It's a political problem. Biosecurity is the only answer but it's hard and costly. The government, being such a populist one, wants to fight for the votes of farmers," he said.

Environmental groups, keen to show the government that there are other voters who strongly oppose the plans, have organised a series of street demonstrations and online protests against the cull.

Several thousand Poles have changed their Facebook profile picture to one of a wild boar, while an online petition to the government asking it to abandon the slaughter has received more than 300,000 signatures.

On Wednesday evening, hundreds of protesters took to the streets in Warsaw, some dressed as wild boar, holding signs that included "wild boar massacre" and "long live wild boars".

Genetically modified pigs resist infection with the classical swine fever virus

<https://www.sciencedaily.com/releases/2018/12/181213155604.htm>

Date: December 13, 2018

Source: PLOS

Summary: Researchers have developed genetically modified pigs that are protected from classical swine fever virus (CSFV), according to a new study.

Researchers have developed genetically modified pigs that are protected from classical swine fever virus (CSFV), according to a study published December 13 in the open-access journal PLOS Pathogens by Hongsheng Ouyang of Jilin University, and colleagues. As noted by the authors, these pigs offer potential benefits over commercial vaccination and could reduce economic losses related to classical swine fever.

CSFV is responsible for a highly contagious, often fatal disease that causes significant economic losses. Due to the economic importance of this virus to the pig industry, the biology of CSFV has been investigated extensively. Despite efforts by many government authorities to stamp out the disease from pig populations, it remains widespread, and it is only a matter of time before the virus is reintroduced and the next round of disease outbreaks occurs. There is an urgent need to develop effective approaches to eradicate CSFV. To address this challenge, Ouyang and





colleagues generated CSFV-resistant pigs by combining a gene-editing tool called CRISPR/Cas9 with RNA interference (RNAi), a technique that silences gene expression.

The researchers demonstrated that these pigs could effectively limit the replication of CSFV and reduce CSFV-associated clinical signs and mortality. Moreover, disease resistance could be stably transmitted to first-generation offspring. Currently, the researchers are conducting long-term studies to monitor the safety and effectiveness of this approach as these animals age. According to the authors, generating anti-CSFV pigs using a genome editing-based strategy could be a direct and effective approach to facilitate the permanent introduction of novel disease resistance traits into the mass population of production pigs via conventional breeding techniques. In addition, this antiviral strategy can be applied to other domestic species and could provide insights for future antiviral research.

Ouyang adds, "These transgenic pigs could effectively limit the replication of CSFV and reduce CSFV-associated clinical signs and mortality."

Journal Reference: Zicong Xie, Daxin Pang, Hongming Yuan, Huping Jiao, Chao Lu, Kankan Wang, Qiangbing Yang, Mengjing Li, Xue Chen, Tingting Yu, Xinrong Chen, Zhen Dai, Yani Peng, Xiaochun Tang, Zhanjun Li, Tiedong Wang, Huancheng Guo, Li Li, Changchun Tu, Liangxue Lai, Hongsheng Ouyang. Genetically modified pigs are protected from classical swine fever virus. *PLOS Pathogens*, 2018; 14 (12): e1007193 DOI: 10.1371/journal.ppat.1007193

Deadly pig virus could hit US in a year, warn experts

<https://www.theguardian.com/environment/2018/dec/07/deadly-pig-virus-african-swine-fever-us-china>

Charlotte Middlehurst, Fri 7 Dec 2018

African swine fever has been spreading rapidly in China and has also travelled from Russia and Eastern Europe to Belgium. Experts fear it is only a matter of time before it reaches the US.

A global outbreak of African swine fever will reach the US within a year unless border protections are tightened and imports of high-risk pork products banned, warn biosecurity experts. It would cost the US economy \$16.5bn (£12.9bn) in the first year alone, it has been estimated.

An ongoing epidemic of the virus, which is deadly for pigs but cannot yet be transmitted to humans, has prompted the US Department of Agriculture to review and strengthen its border protections. After outbreaks in Belgium and China this year, the USDA has increased the use of sniffer dogs at major ports, airports, land borders crossings, and has also built quarantine stations and increased passenger and cargo inspections on flights from China and Russia, the worst hit countries.

However, scientists say these measures do not go far enough and call on the US government to make "immediate and radical" changes, including banning imports of soy products from infected countries. The arrival of the deadly swine virus could cost \$16.5bn in losses in the first year alone, according to research published in the *Public Library of Science*.

"If we continue to do business as usual then [the US] will probably get ASF in a year. If we change some of our practices, which we are trying to do, then there's a chance we can keep it out," said Dr Scott Dee, biosecurity specialist and chief scientist at one of the America's largest veterinary practices, Pipestone Applied Research.

"If it got into the wild pig population it would be a disaster. I don't even like to have the





Articles in the news



conversation about what we'd do if it got in because by that point we've already lost the war."

The virus is spread either through contact, or through contaminated meat products; it can survive in processed meat for several months, and in frozen meat for a number of years. In October, a packet of sausages confiscated at a Japanese airport was tested and found to contain the virus. At present it is not a danger to humans, but there are fears that it could mutate.

There is currently no vaccine or known cure. Once the virus is detected, the whole herd must be killed, creating severe financial consequences for producers.

In Poland, Lithuania, Latvia and Estonia, pork exports have fallen by \$961m, representing up to 50% of their total. An outbreak was reported in Belgium on 13 September, sparking fears that the virus will spread through western Europe.

Since August, the virus has swept through China, home to nearly half the world's pigs. More than 600,000 pigs have been culled since the first case was reported in the north-eastern province of Liaoning. In five months, ASF has spread to 21 provinces, causing severe losses to farmers and major disruptions to the domestic pork market. It has jumped vast distances in a short period of time, appearing in the north, Shenyang, and Sichuan within a three-month period.

Given the integrated nature of global supply chains, the virus could jump borders and enter the US, which could destabilise pork markets and international trade.

The risk to the US is high because of the large volumes of agricultural produce imported from China, according to biosecurity specialists, and due to the ASF's strong viral resilience; it can survive journeys of 30 hours or more and live in foodstuffs. "We are dealing with a very stable virus. It can live outside the host, outside the pig in all sorts of different conditions – low PH, high PH, dirt, meat," said Dr Dee.

In China, the government has shut down small farms, halted transport of live pigs and pork, and closed meat markets in towns and cities in an effort to contain the epidemic.

Yu Kangzhen, vice-minister of the Chinese Ministry of Agriculture and Rural Affairs, said in a press statement on 27 November that the risk of the fever spreading cannot be ignored as the country is still faced with a challenging situation of disease control. There are concerns that Chinese provincial governments are suppressing data and asking pork companies not to report new outbreaks.

The outbreak has "seriously affected small farmers who are suffering as a result," says Wanqing Zhou, an associate with Brighter Green, a public policy action tank based in New York, adding.

The counter measures "will almost certainly lead to a geographically more distributed system of meat processing and further expansion of the cold-chain and supermarket model. Such development seems to match the trend of closing down wet markets in large cities, like Beijing."

'Immoral': groups fight National Trust's wild boar cull

<https://www.theguardian.com/uk-news/2018/nov/22/immoral-groups-fight-national-trusts-wild-boar-cull>

Steven Morris, Thu 22 Nov 2018

Animal activists say Stourhead cull is misguided, with only one recent boar injury in the UK

Six animal rights groups have strongly criticised plans by the National Trust to cull wild boar on one of its most renowned estates as "misguided and immoral".

The groups, which include Animal Aid and Born Free, have written to the chair of the National Trust, Tim Parker, asking him to halt the cull at Stourhead in Wiltshire.





Articles in the news



They say the trust's argument – that the boar needed to be removed because people felt intimidated by them – is absurd, pointing out they had found only one recent example of a person in the UK being actually injured by a boar.

The letter, seen by the Guardian, said: "We feel that the cull is misguided and immoral, and goes against many of the purposes of the National Trust.

"To wipe out sentient beings because they apparently make a few feel uncomfortable is absurd. Wild boar are notoriously shy, making it difficult for even wildlife photographers to capture photos of them in the UK.

"They avidly avoid humans, and attacks in the UK are extremely rare. In fact, we have only been able to find a single report in the media about an injury caused by a wild boar in recent times. Such drastic action from the National Trust would suggest that there have been dozens of attacks, but the fact remains that confrontations are an extreme rarity."

The injury they referred to was that suffered by Clive Lilley, who reported that the tip of his finger was bitten off by a boar in the Forest of Dean in Gloucestershire.

The letter adds: "We call on the National Trust to end its plans for a boar cull, and instead redirect the funds that would be used on tragically bringing a premature end to the lives of these rare creatures, into educating both the public, and the National Trust's own staff about wild boar, understanding their behaviour and how to properly and safely interact with them."

The other groups that have signed the letter are: Humane Society International UK, International Fund for Animal Welfare (IFAW), People for the Ethical Treatment of Animals (PETA) and Viva!

Jade Emery, a wildlife campaigner for Animal Aid, said: "The last thing the rare wild boar needs is to be persecuted and demonised by a body that has previously vowed to try and help wildlife on its land."

Claire Bass, the executive director of Humane Society International UK, said: "As a National Trust member I'm extremely disappointed that they're looking for a solution to a perceived wildlife problem down the barrel of a gun."

Mark Jones, the head of policy at Born Free and also a trust member, said: "The trust cannot go killing wild animals just because they are regarded by some as an inconvenience."

A spokesperson for the National Trust said: "The decision is one that has not been taken lightly. Unfortunately, there are some instances where humane control is necessary – for instance where there are safety concerns for visitors, staff or volunteers; or to protect other species or habitats.

"In this instance, there have been several reports of members of the public being confronted and intimidated by wild boar, which we believe have been illegally released near the estate.

"We made this decision after carefully considering all alternatives and consulting with Natural England.

"Any cull will be carried out by an experienced and licensed marksman who conforms to National Trust standards of safety and animal welfare."

Wild boar sighted near Barcelona city centre looking for food

<https://www.theguardian.com/world/2018/nov/04/wild-boar-sighted-near-barcelona-city-centre-looking-for-food>

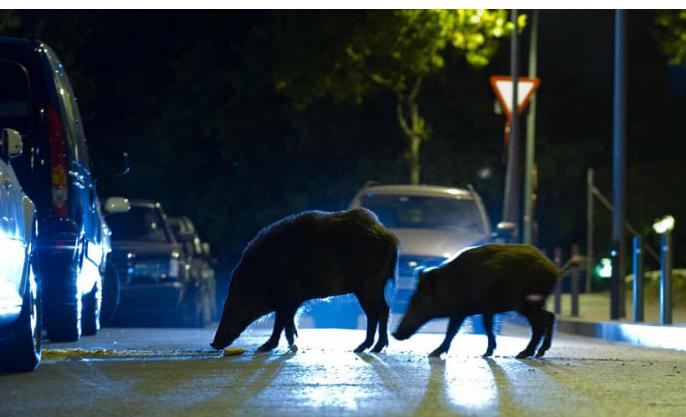
Stephen Burgen, Sun 4 Nov 2018

The animals, usually resident in nearby hills, are venturing close to the Sagrada Família





Articles in the news



Adult and young Wild boars searching for food on a street in Barcelona. Photo: Alamy Stock Photo

where they have no predators and there are few hunters. In recent years the city authorities have taken measures to control their numbers and claim that this year there have been only 369 reported sightings within the city, compared to 1,187 in 2016.

“In the areas closest to the Collserola we have blocked bins so they can’t get at food and we have also discouraged people from putting food out for cats as this attracts the boars,” said Carme Maté, head of the city’s animal rights and urban ecology department.

However, it appears that these very controls are part of what is driving the animals to seek food further afield.

The creatures, which can weigh as much as 113kg (250lbs), are generally harmless unless cornered or are females with their young. However, a study published earlier this year by researchers at the Universitat Autònoma de Barcelona found that wild pigs that had become accustomed to eating discarded human food were more likely to behave aggressively towards people.

What is African swine fever and how does it spread?

<https://www.theguardian.com/environment/2018/oct/24/what-is-african-swine-fever-and-how-does-it-spread>

Bibi van der Zee, Wed 24 Oct 2018

A contagious, untreatable and often fatal virus is sweeping the global pig population – and future mutations could affect humans

What is African swine fever?

ASF is a highly contagious viral pig disease. The most common symptoms of the virus in its acute form are a high temperature and loss of appetite; other symptoms include vomiting, diarrhoea, and difficulty with breathing and standing. There is no treatment for the disease, some versions can have a 100% mortality rate in certain circumstances. It is not the same as swine flu.

How does it spread?

ASF can be transmitted through direct contact with infected animals. Wild boar have been identified by some national governments as one of several possible culprits for the recent spread. It can also spread via insects such as ticks.

But the virus can also survive several months in processed meat, and several years in frozen





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carcasses, so meat products are a particular concern for cross-border transmission. It is believed that the disease was initially brought from east Africa to Georgia by contaminated pig products. Last week, a packet of sausages confiscated at a Japanese airport from a traveller arriving from China were found to contain the virus. Similar discoveries have been made in South Korea, according to reports.

What happens when it is found?

Cases must be reported to the authorities.

In most countries, this will trigger quarantine measures and a cull of the affected herd.

However, there is anxiety among experts that in some cases farmers – or even whole

countries – may cover up or delay reporting the illness. In May, for example, Belarus was accused of covering up ASF among its pigs. The Belarus government denied the claims.

Can it be caught by humans?

Humans cannot contract ASF. However the head of the Russian epidemiology service, chief state sanitary doctor Gennady Onishchenko, has warned that pig physiology is close to human physiology, and that future mutations of the virus may therefore become dangerous to human beings too.

Why are people worrying about it now?

For many years ASF was found mainly in Africa, although there was an outbreak in Europe in the 1950s which took several decades to eradicate. In 2007, however, the virus was detected in Georgia, and despite co-ordinated efforts it has since spread widely, initially through eastern Europe and Russia, and more recently into western Europe, when wild boar in Belgium were found to have the disease. The virus has now jumped to China, home to half the world's domestic pigs, and appears to be proliferating rapidly. According to one report there have been 41 outbreaks since the first notification in early August.

Is it likely to reach Britain or the US?

The UK government is monitoring the situation. Zoe Davies, head of the National Pig Association, has said that it may take years for ASF to reach the UK but points out that big jumps are possible. Earlier this year, she said: "I've had sleepless nights after seeing Polish lorry drivers barbecuing their supper in a layby. Pigs will eat anything – and in this country around 40% are reared outside. If those drivers had thrown their leftovers over the hedge, the consequences could have been disastrous."

There is great concern in the US, too, where the pig export market is worth \$6.5bn (£5bn) annually. Biosecurity measures are being stepped up and US government officials are drawing up a rapid response plan.

What other countries are concerned?

National governments around the world are now ramping up precautions in order to protect their domestic pig industries. Denmark has been planning to build a wall to keep out boar for some time now, and France is now also making plans for a wall along parts of the Belgian border.

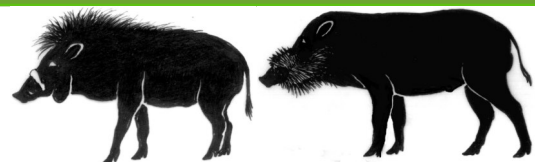


Wild boar are one of the transmission vectors for ASF. In August scientists and government officials workshopped a hypothetical outbreak in Germany. Photo: Carsten Rehder/Alamy Live News





Articles in the news



Germany has relaxed laws on wild boar hunting as part of its plans to prevent the disease breaking out.

Are there any vaccines or cures on the horizon?

The Roslin Institute is looking at gene editing to make pigs resistant to ASF. An international coalition of scientists is urgently investigating vaccines.

What is the long-term outlook?

The pig industry is certainly extremely anxious about ASF. If it is detected in another major pork-producing country like Denmark, Germany, Spain or the US, “the pig mortality will be the least of our worries”, according to US expert Dennis DiPietre. “The business disruption and profit losses from export cessation would range from big to staggering,” he says. DiPietre fears that, within a year or two, “we will be engulfed in a worldwide pandemic”.

Wild Boars in Hong Kong Prove Not Every Pig in the City Is Babe

<https://www.nytimes.com/2018/10/10/world/asia/wild-boar-hong-kong.html?smid=fb-nytimes&smtyp=cur>

By Mike Ives and Tiffany May, Oct. 10, 2018

HONG KONG — Three wild boars were spotted on Tuesday as they sauntered down a sidewalk near the Hong Kong equivalent of Times Square in New York.

They were trailed by police officers, shot with a tranquilizer gun and released into some parkland on the city’s rural fringes.

Oh, but they’ll be back.

Unbeknown to most visitors, the green hills surrounding Hong Kong’s skyscrapers are alive with swine: Wild boars regularly spook hikers and joggers on walking trails, and sometimes wander into dense urban areas to dumpster dive.

The authorities have tried for years to stabilize Hong Kong’s wild boar population through licensed hunting and other measures. Yet “wild pig nuisances,” as officials call porcine problems in this semiautonomous Chinese city, rose to 738 last year from 294 in 2013, and social media chatter about wild boar run-ins has become commonplace.

On Wednesday, a day after the boars were tranquilized in the Causeway Bay district, two people were hospitalized after a different wild boar attacked them at a public housing estate on the Kowloon peninsula.

One of the victims, a 65-year-old security guard who was bitten as she walked to a public toilet, later said that her assailant was as large as a human.

Yet by the time the police arrived, the boar had vanished.

Wild boars, also known as Eurasian wild pigs, are the largest terrestrial mammals in Hong Kong, a city of more than seven million people, according to the local Agriculture, Fisheries and Conservation Department. The pigs can grow to over 400 pounds, and their population soars here because they have no natural predators.

They are not generally violent toward humans, but they sometimes wander from Hong Kong’s countryside into nearby shopping malls, playgrounds and public barbecue sites in search of food, raising the potential for conflicts.

Some have even been spotted galloping down Hong Kong highways and swimming in the city’s main harbor.

In March alone, police officers carrying riot shields subdued a boar on the tarmac at Hong Kong





Articles in the news



International Airport, and footage of an enormous “emperor” boar sniffing around a Hong Kong dumpster made international headlines.

The government has tried to quietly control the population of wild boars and other wildlife in recent years with various strategies, to mixed reviews.

Notably, a program in which local officials allowed locals to hunt wild boars produced hundreds of kills — 281 from 2009 to 2013, according to government data. Hong Kong’s environment secretary, Wong Kam-sing, once called the hunts, which began in the 1970s, an “effective measure” for controlling the boar population.

Though the animals are not protected under Hong Kong law, the hunts were suspended last year after lawmakers and animal rights activists called them inhumane and impractical. The activists say the government should focus instead on managing the disposal of solid waste so that the boars do not eat it.

“We think hunting and killing — even eating in some cases — wild pigs is an outdated custom,” Leung Mei-po, an animal-rights activist, told Hong Kong Free Press, a local news site. “This practice should have no place in today’s Hong Kong.”

Wild boars are widespread in Hong Kong and normally live there in a “natural environment,” the agriculture department said in an email, adding that the animals can become accustomed to searching for food in residential areas if they are fed there or can easily find food in trash bins.

The department also said wild boar hunting had been suspended pending a review, and that it was using radio and television campaigns to urge the public not to feed boars.

In March, Hong Kong officials said they would spend two years trying to reduce the population of wild boars by trapping them, injecting them with contraceptives and outfitting them with GPS devices so that officers could track their movements.

Some Hong Kongers have sympathy for the boars’ predicament.

“It’s not fair to call these conflicts a ‘problem’ because it makes it seem like the responsibility of the animal,” said Roni Wong, a representative for the Wild Boar Concern Group, a Hong Kong advocacy group. He added that wild boars do not typically attack humans unless they are provoked or frightened.

Steve Corry, 44, says he regularly sees wild boars while running on Hong Kong’s hiking trails.

“Each time they are calm, and if you leave them alone they will leave you alone,” he said.

Others are losing patience, or living in fear.

This summer, for example, two administrators at the University of Hong Kong were hospitalized after being attacked by wild boars near campus, in an upscale residential area on the city’s main island.

The authorities later sedated and removed several boars from a nearby hillside. But Stephen Chan, a local lawmaker, blamed the agriculture department for not being tough enough and said that more should be done to prevent the animals from colonizing residential areas.

“I am not suggesting that we should kill all wild pigs,” Mr. Chan told the local news media. “But we should consider tougher actions to control the population.”

African swine fever: No known risk to consumers

Animal diseases are not food scandals: Pathogen cannot be transferred to humans

<https://www.sciencedaily.com/releases/2018/09/180926110907.htm>

Date: September 26, 2018

Source: BfR Federal Institute for Risk Assessment





Summary: The African swine fever (ASF) that is currently rife in Europe does not pose a health hazard to humans, according to new research.

The ASF pathogen is a virus which infects domestic pigs and wild boar and which leads to a severe, often lethal, disease in these animals. It is transferred via direct contact or with excretions from infected animals, or through ticks. The ASF virus is endemic to infected wild animals in Africa, but there have also repeatedly been outbreaks in southern Europe. The pathogen has been spreading north-westwards since 2007 from Georgia through Armenia, Azerbaijan and Russia. Cases of ASF have been registered in wild boar along with outbreaks in domestic pigs in the Baltic states since 2014. The virus has also been detected in Romania, Hungary, Poland and the Czech Republic. In September 2018, the pathogen was also found in wild boars in Belgium and thus for the first time in Western Europe.

The pathogen is very stable and can remain infectious in food over several months. If unheated food or food scraps from infected animals are fed to non-infected animals, the virus can therefore spread to previously ASF-free regions, thus infecting domestic pig herds too.

Although the ASF virus does not pose a hazard or a risk to humans, the meat of domestic pigs and wild boar should always be prepared under hygienic conditions, just like all other raw meats, as it can also contain other pathogens, advises the BfR. It should be kept refrigerated and prepared separately from other foods before cooking. When heating, a core temperature of 70 degrees Celsius or higher should be reached in the meat for at least two minutes, the BfR recommends.

Story Source:

Materials provided by BfR Federal Institute for Risk Assessment. Note: Content may be edited for style and length.

Devastated by war, this African park's wildlife is now thriving

A generation after civil war, more than 100,000 large animals populate Mozambique's Gorongosa National Park, a rare spot of good news.

<https://www.nationalgeographic.com/animals/2018/12/african-wildlife-is-rebounding-gorongosa-national-park/>

By David Quammen, PUBLISHED December 13, 2018

Gorongosa National Park, in central Mozambique, along the southeastern coast of Africa, is rising anew from the ashes and ruination of war. The latest numbers from its 2018 aerial wildlife count, just released, show that the park's populations of large mammals, devastated during the conflict, continue to rebound.

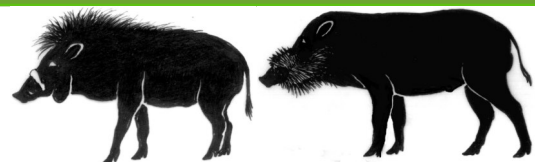
This is a place—rare in Africa, cause for jubilation—where most species of big fauna are vastly more numerous now than in 1992, at the end of the civil war. Surveys then found just 15 African buffalo, six lions, 100 hippo, and a handful of blue wildebeest. By the latest counts, the buffalo population is above one thousand head, hippo are at nearly 550, wildebeest above 600. Lions, though harder to count, are thriving too amid the expanded prey base.

Back in the early 1990s, after fifteen years of civil war, with two armies treating Gorongosa as a battlefield—and killing its wildlife for meat to feed soldiers and for ivory to buy arms—the place was in wreckage. It languished for more than a decade until, in 2004, the Gorongosa Restoration





Articles in the news



Project began, as a partnership between the Mozambican government and the U.S.-based Carr Foundation. What the Carr Foundation (and its founder, Greg Carr) brought to this challenge was not just financial resources and management acumen but a vision that Gorongosa could become a “human rights park.”

That meant tangible benefits for the local people roundabout it—in health care, education, agronomy, economic development—as well as protection for its landscape, its waters, its biological diversity in all forms. Progress has been steady and measurable. One metric is literacy among local women and young girls. Another is wildlife recovery. Counting wild animals is never easy, but on the open savannas, floodplains, and mixed forest terrain of Gorongosa it can be done systematically and reliably by helicopter.

Mike Pingo, a seasoned veteran of wildlife piloting, flew the Bell Jet Ranger helicopter for two weeks of intensive counts, roughly six hours each day, with Marc Stalmans, the park’s director for science, and two other colleagues in the heli’s other seats, spotting animals, counting them species by species, and recording data. Pingo choppered up and back along charted transects, spanning a 500-meter-wide strip with each passage, from an elevation of 50 meters, while he and the others enumerated every visible animal as large as a warthog. (Waterbuck were the exception: so abundant on the Gorongosa floodplains that they had to be counted from wide-angle photographs.) Try that yourself for a few hours and you’ll see: It’s a recipe for airsickness and headache as well as statistical rigor. But these guys were experienced, with iron stomachs and good eyes, and they got the job done.

In addition to the increases in buffalo and wildebeest populations—dramatic since the war’s end, and significant since just 2014—numbers of impala, kudu, and nyala (a handsome spiral-horned antelope) are strongly up too. More than five hundred hippos cool themselves in the waters of Gorongosa’s Lake Urema and its nearby rivers on a given afternoon. Warthogs are so plentiful that you might find two sleeping under your porch at the Gorongosa hotel. Waterbuck are way up, to more than 55,000 head, offering testimony on the quality of Gorongosa floodplain habitat and lots of potential food for lions, wild dogs, and leopards. Elephants have rebounded—more than 550 of them now, though Greg Carr and his colleagues aspire toward many more. (Read more about how Gorongosa’s elephants have evolved to be tuskless because of poaching pressure.)

As for the birdlife of Gorongosa, it’s wondrous and abundant: Egrets and ibises, darters and cormorants, lapwings and stilts, gray herons and spur-winged geese and African jacana are all doing well. Birds are especially difficult to count by helicopter because, of course, they keep spooking back and forth in great flocks. But the counters report seeing 229 active nests of marabou stork.

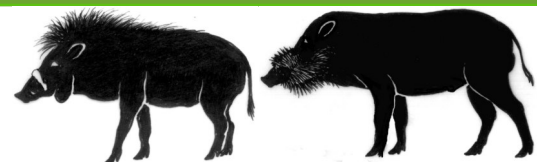
Marc Stalmans finds good news in the counts. “The results for wildebeest are particularly encouraging,” he says. Buffalo also—he was guardedly hopeful of that species reaching the 1,000-animal threshold and is gratified that it did. “Also, the degree of recovery of the warthog is quite spectacular”—they have almost doubled just since 2016.

All this wildlife recovery reflects fourteen years of smart, passionate effort by the team at Gorongosa, meaning not just Carr and the Park Warden and the conservation and science professionals but also those in operations, communications, and on the human development and enterprise sides. You can’t protect wildlife and its habitat for the long term, Carr and his colleagues know, by fencing out desperate people; if you want elephants and impala and kudu to thrive inside a park boundary, you need to ensure that humans who live just outside the boundary thrive too.





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Even a decent, generally law-abiding man or woman might set a snare for unsuspecting wildlife to feed his or her starving children. With that in mind, it's encouraging to consider the smallest number, but one of the most significant, reported from the 2018 wildlife counts at Gorongosa. Animals found in snares within the park: zero. The number is down, since the counts of 2014 and 2016, and the trend is good.

Peccary's disappearance foreboding for other Mesoamerican wildlife

<https://news.mongabay.com/2018/12/peccarys-disappearance-foreboding-for-other-mesoamerican-wildlife/>

by Mongabay on 20 December 2018

A multinational team of scientists met to discuss the current status and future of the white-lipped peccary, a pig-like mammal that lives in Central and South America.

White-lipped peccaries no longer live in 87 percent of their former range, driven out largely by hunting and habitat loss.

The scientists say the disappearance of this species, which requires large tracts of unbroken forest, could portend the extinction of other wildlife.

The white-lipped peccary (*Tayassu pecari*), a hairy, pig-like mammal that once lived throughout the forests of Central and South America, now only skitters around in 13 percent of its former range, according to a report released in November 2018.

More than two-thirds of white-lipped peccary populations are on the decline, said scientists who met to discuss the future of the species in an August 2016 meeting in Belize City, Belize. That's concerning, they warn, because peccaries are sensitive to hunting and deforestation. Thus, their disappearance could be a harbinger of the future loss of other wildlife.

"No species represents the plight of the forests like the white-lipped peccary, which is now teetering at the edge of existence due to habitat loss and hunting," Jeremy Radachowsky, an ecologist who directs the Wildlife Conservation Society's Mesoamerica program and participated in the assessment, said in a statement. "We need to take immediate action to save Mesoamerica's last wild places and their incredible wildlife."

The researchers, from the seven countries that still have white-lipped peccaries as well as the United States, surveyed biologists in their respective countries regarding the status of local white-lipped peccary populations. They then shared their findings with their colleagues in Belize, summarizing them in the November report.

The results suggest that the animal's current status as vulnerable on the IUCN Red List should be changed to endangered, according to the assessment. In Mexico and parts of Brazil, it's already treated as an endangered species under the law.

White-lipped peccary numbers are holding steady in only four locations, the researchers found. In one place, the Maya Mountains of Belize, the population is actually growing.

Elsewhere, in Costa Rica, Guatemala, Honduras, Nicaragua, Panama and Brazil, most populations are dwindling. (Scientists aren't sure how several populations in Belize and one in Mexico are doing.) Ranching and farming have chewed through large tracts of forest, and roads pave the way for new settlements. They also aid hunters in penetrating the difficult habitats, ranging from the dense forests of the Amazon to the thorny scrub of the Gran Chaco, where white-lipped peccaries live.





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Hunting is a major threat to white-lipped peccaries throughout their range. Image courtesy of Honduras's Institute of Forest Conservation (ICF) Moskitia.

biologist at Mexico's El Colegio de la Frontera Sur and the report's lead author, said in the statement.

But the researchers, all peccary experts who have spent countless hours tracking herds that can number up to 300 animals through rugged terrain, also argue that we should protect white-lipped peccaries for their own sake.

"No other animal in the world moves through forests in such large groups," Reyna-Hurtado said. "If we save it from extinction we not only protect the forest, we give our children the chance to witness a wild herd marching in a single file through the forest foraging for food, even escaping from a jaguar, just as they have done for thousands of years."

Citations

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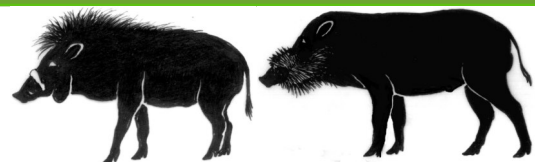
"Mesoamerica is home to five great forests and still harbors a miraculous spectrum of magnificent wildlife," Radachowsky said. "However, these forests and their wildlife are at grave risk."

The scientists involved say the report could guide governments and indigenous and local communities in protecting the remaining peccary habitat — and not just for the benefit of one species. They argue that the presence of white-lipped peccaries in a landscape is a sign that conservation efforts are working, since the species requires large stretches of intact forest to survive. And by protecting peccaries, land managers would also be securing the future of other mammals, such as Central American tapirs (*Tapirus bairdii*), jaguars (*Panthera onca*) and mountain lions (*Puma concolor*).

What's more, peccaries play important ecological roles, and some scientists postulate that they're ecosystem engineers.

"This amazing animal turns the soil, feed large cats and controls seedling growth, actually enhancing the diversity of the whole forest," Rafael Reyna-Hurtado, a





Human ancestors not to blame for ancient mammal extinctions in Africa New research finds grassland expansion drove the decline of giant mammals over the last 4.6 million years

<https://www.sciencedaily.com/releases/2018/11/181123135011.htm>

Date: November 23, 2018

Source: University of Utah

Summary: New research disputes a long-held view that our earliest tool-bearing ancestors contributed to the demise of large mammals in Africa over the last several million years. Instead, the researchers argue that long-term environmental change drove the extinctions, mainly in the form of grassland expansion likely caused by falling atmospheric carbon dioxide (CO₂) levels.

New research disputes a long-held view that our earliest tool-bearing ancestors contributed to the demise of large mammals in Africa over the last several million years. Instead, the researchers argue that long-term environmental change drove the extinctions, mainly in the form of grassland expansion likely caused by falling atmospheric carbon dioxide (CO₂) levels.

Tyler Faith, curator of archaeology at the Natural History Museum of Utah and assistant professor in the Department of Anthropology at the University of Utah, led the study. The research team also includes John Rowan from the University of Massachusetts Amherst, Andrew Du from the University of Chicago, and Paul Koch from the University of California, Santa Cruz.

The study is published today in the journal *Science*.

"Despite decades of literature asserting that early hominins impacted ancient African faunas, there have been few attempts to actually test this scenario or to explore alternatives," Faith says.

"We think our study is a major step towards understanding the depth of anthropogenic impacts on large mammal communities, and provides a convincing counter-argument to these long-held views about our early ancestors."

To test for ancient hominin impacts, the researchers compiled a seven-million-year record of herbivore extinctions in eastern Africa, focusing on the very largest species, the so-called 'megaherbivores' (species over 2,000 lbs.) Though only five megaherbivores exist in Africa today, there was a much greater diversity in the past. For example, three-million-year-old 'Lucy' (*Australopithecus afarensis*) shared her woodland landscape with three giraffes, two rhinos, a hippo, and four elephant-like species at Hadar, Ethiopia.

When and why these species disappeared has long been a mystery for archaeologists and paleontologists, despite the evolution of tool-using and meat-eating hominins getting most of the blame.

"Our analyses show that there is a steady, long-term decline of megaherbivore diversity beginning around 4.6 million years ago. This extinction process kicks in over a million years before the very earliest evidence for human ancestors making tools or butchering animal carcasses and well before the appearance of any hominin species realistically capable of hunting them, like *Homo erectus*," says Faith.

Taking a Closer Look

Faith and his team quantified long-term changes in eastern African megaherbivores using a dataset of more than 100 fossil assemblages spanning the last seven million years. The team also examined independent records of climatic and environmental trends and their effects,





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specifically global atmospheric CO₂, stable carbon isotope records of vegetation structure, and stable carbon isotopes of eastern African fossil herbivore teeth, among others.

Their analysis reveals that over the last seven million years substantial megaherbivore extinctions occurred: 28 lineages became extinct, leading to the present-day communities lacking in large animals. These results highlight the great diversity of ancient megaherbivore communities, with many having far more megaherbivore species than exist today across Africa as a whole.

Further analysis showed that the onset of the megaherbivore decline began roughly 4.6 million years ago, and that the rate of diversity decline did not change following the appearance of *Homo erectus*, a human ancestor often blamed for the extinctions. Rather, Faith's team argues that climate is more likely culprit.

"The key factor in the Plio-Pleistocene megaherbivore decline seems to be the expansion of grasslands, which is likely related to a global drop in atmospheric CO₂ over the last five million years," says John Rowan, a postdoctoral scientist from University of Massachusetts Amherst.

"Low CO₂ levels favor tropical grasses over trees, and as a consequence savannas became less woody and more open through time. We know that many of the extinct megaherbivores fed on woody vegetation, so they seem to disappear alongside their food source."

The loss of massive herbivores may also account for other extinctions that have also been attributed to ancient hominins. Some scientist suggest that competition with increasingly carnivorous species of *Homo* led to the demise of numerous carnivores over the last few million years. Faith and his team suggest an alternative.

"We know there are also major extinctions among African carnivores at this time and that some of them, like saber-tooth cats, may have specialized on very large prey, perhaps juvenile elephants" says Paul Koch. "It could be that some of these carnivores disappeared with their megaherbivore prey."

"Looking at all of the potential drivers of the megaherbivore decline, our analyses suggest that changing climate and environment played the key role in Africa's past extinctions," said Faith. "It follows that in the search for ancient hominin impacts on ancient African ecosystems, we must focus our attention on the one species known to be capable of causing them -- us, *Homo sapiens*, over the last 300,000 years."

Journal Reference: J. Tyler Faith, John Rowan, Andrew Du, Paul L. Koch. Plio-Pleistocene decline of African megaherbivores: No evidence for ancient hominin impacts. *Science*, 2018; 362 (6417): 938 DOI: 10.1126/science.aau2728

Oldest hippopotamus in captivity dies at 59 in Jerusalem zoo

<https://www.timesofisrael.com/oldest-hippopotamus-in-captivity-dies-at-59-in-jerusalem-zoo/>

By AFP, 16 August 2018

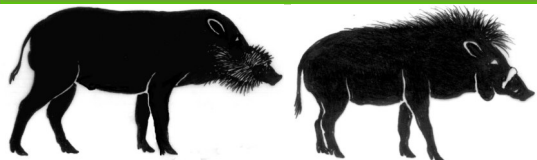
Biblical Zoo says it is 'a little like losing a friend,' after Tami dies in her sleep 'surrounded by lots of love and respect'

Tami, believed to be the oldest hippopotamus in captivity, died on Thursday at the age of 59 in her sleep at Jerusalem's Biblical Zoo, the zoo announced.

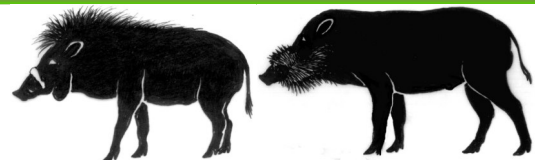
She was found dead in the lake of the African-themed area where she lived in the Israeli zoo, a statement said.

She was "the oldest hippopotamus living in a zoo," it said.





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“She died at an advanced age, surrounded by lots of love and respect.”

She was the only hippo at the zoo after the death of her partner Matti, a male, in 2006. Matti, 30, died after swallowing a tennis ball.

Tami had quickly established herself as dominant among the giraffes, zebras and rhinos in the African area, the zoo said.

“It is a difficult day for us,” zoo employee Gilad Moshe told the Israel Hayom newspaper. “A little like losing a friend.”

In July 2017, Bertha, believed at the time to be the world’s oldest hippopotamus in captivity, died aged 65 at Manila Zoo in the Philippines.

Prior to that, Donna, who died in 2012 at the age of 62 at the US Mesker Park Zoo and Botanic Garden in Evansville, Indiana, was said to be the world’s oldest hippo, according to media reports at the time.

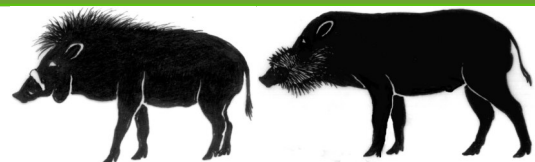
Hippos tend to live for 40-50 years. The mostly herbivorous and semi-aquatic animals are found in central and southern Africa.

Jerusalem’s Biblical Zoo was founded in 1939 and contains some 250 species, most of which are named in the Bible.



Tami the Hippo is pictured at the Biblical Zoo in Jerusalem on July 4, 2013. Photo: Yonatan Sindel/Flash90





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These groups consist of technical experts focusing on the conservation and management of wild pigs, peccaries and hippos.

The broad aim of these groups is to promote the longterm conservation of wild pigs, peccaries and hippos and, where possible, the recovery of their populations to viable levels.

Pigs, peccaries and hippopotamuses are nonruminant 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.

