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White-lipped peccaries (*Tayassu pecari*). Photo taken by Rafael Reyna.

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Editorial

From the editor

Dear readers

In your hands (or on your screen) you hold the next great issue of Suiform Soundings. It's been 13 years now since we started the newsletter, first as Asian Wild Pig News and since 2005 as Suiform Soundings. I am really proud of that achievement. Suiform Soundings offers information on wild pigs, peccaries and hippos in an engaging way accessible to a wide readership in different languages. Ok, we are not the Times of India or Wall Street Journal, but some 1,800 times per year someone somewhere in the world decides they want to know more about hippos, pigs or peccaries and downloads Suiform Soundings. In the 3.5 years since we started measuring downloads, we have increased our readership about five-fold. So, I would think there are plenty of reasons to keep Suiform Soundings going, and to further improve the newsletter. One step in that direction is the assignment of a new editor-in-chief. Apart from myself, we have had Anne-Marie Stewart as editor-in-chief, and time has time come to pass on the editorial leadership once again. Thiemo Braasch has very competently coordinated most of the the newsletter layout and design for the past two years. I have therefore asked for Thiemo to take over as editor-in-chief. Thiemo has significant editorial experience, among others as the editor for four years of the ZGAP newsletter. From this issue onward he will lead Suiform Soundings. Myself and Rafael Reyna, as well as our team of regional and topical editors, will support Thiemo in his work, ensuring that at least twice a year a fresh edition of Suiform Soundings will be at your disposal, hopefully for many more years to come. Please join me in welcoming Thiemo in his new role.

With warm regards

Erik Meijaard

Dr Goutam Narayan wins award for conservation

The Assam Tribune

Editor's note
IUCN / SSC Wild Pig Specialist Group is glad to announce that Goutam Narayan received the Harry Messel Award for Conservation Leadership in September 2015. He was awarded for his outstanding conservation work for the critically endangered Pygmy hog.
The article below was published in The Assam Tribune.

GUWAHATI, Sept 25 2015 - Dr Goutam Narayan has become the first Indian conservationist to get the Harry Messel Award for Conservation Leadership announced during the IUCN Species Survival Commission Leaders' Meeting held in Abu Dhabi recently.
The citation mentions that Narayan has been given the award "in recognition of his pivotal role in leading the Pygmy Hog Conservation Programme in North Eastern India since 1995, thus saving a whole genus from extinction, and his long service to the SSC Wild Pig Specialist Group."

The Harry Messel Award recognises exemplary service to the IUCN Species Survival Commission, especially from individuals who have made a specific contribution to species

GoutamNarayan with a Pygmy Hog (*Porcula salvania*). Photo: S. de Trey-White.

conservation on the ground or through their leadership, as part of the work of an SSC Specialist Group or Task Force.

Dr Narayan has been instrumental in reviving the long-term survival prospects of the critically endangered pigmy hog through the Pigmy Hog Conservation Centre at Basistha in Guwahati that runs a captive breeding programme for the elusive animal.

Announced at an interval of two to four years, so far 18 individuals and an organisation have been given the award since its inception in 2004. The Pygmy Hog Conservation Programme (PHCP), a collaborative project of the Assam Forest Department, Ministry of Environment, Forest & Climate Change of the Government of India, IUCN-SSC, Wild Pig Specialist Group (WPSG) and the Durrell Wildlife Conservation Trust, is administered by EcoSystems-India, a local trust for biodiversity conservation.

Dr Narayan began his career in 1980 at the Bombay Natural History Society (BNHS) under Dr Salim Ali and after working in projects on the Bengal floricans, vultures and other threatened species, he became the BNHS Conservation Officer in 1991. In 1995, he joined Durrell Wildlife and established the PHCP in Assam with the then WPSG chair, William Oliver, to save the critically endangered pygmy hogs that were reduced to a single population on the verge of extinction. Over the past 20 years, the PHCP has secured the future of the species through conservation breeding and reintroduction in restored grassland habitats.

In 2014, he received the Royal Bank of Scotland Earth Heroes Awards under the 'Save the Species' category at the annual conference of the World Association of Zoos and Aquariums in New Delhi (see Suiform Soundings 13(2), 11-12).

Source

http://www.assamtribune.com/scripts/detailsnew.asp?id=sep2615/city050

Pygmy hogs (*Porcula salvania*). Photo: I. McCarthy

Analysis on the habitat use of bearded pigs in Sarawak

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Abstract

Bearded pigs can be found in a variety of habitats in Sarawak ranging from beaches to high elevation forests. A review of the literature suggests that their distribution is highly dependent on soil, fruiting and drainage. Bearded pigs have been considered as common in Bornean Malaysia but are now listed as 'Vulnerable' in the IUCN Red List. However, little is known about their habitat preferences. The main focus of this study is to understand the habitat utilisation of the bearded pigs in the protected forests of Sarawak. Five locations were investigated: Bako National Park, Kuching Wetlands National Park, Tanjung Datu National Park, Samunsam Wildlife Sanctuary, and a High Conservation Value Forest near Bintulu We used infra-red sensor cameras, a non-invasive method to gather information on bearded pigs over large survey areas and for several months at a time. Total of 32 camera-traps including models from Reconyx and Bushnell were used for 36 locations between March 2012 and November 2013. Occupancy analysis using PRESENCE 2.0 shows that Beach forest and Mixed Dipterocarp Forests are more likely to be inhibited, compared to Kerangas (Heath) forest. Additional sampling and effort is needed to further investigate the habitat preference between protected areas by increasing the number of camera trap locations in different habitats.

Keywords: Camera-trapping survey, habitat preferences, occupancy, Sarawak

Introduction

Sarawak has an area of about 124000 km^2, stretches over some 700 kilometres along the north-eastern coast of the island of Borneo. In general it is divided into three regions – coastal lowlands comprising peat swamp as well as narrow deltaic and alluvial plains, a large region of undulating hills ranging to about 300 metres, and the mountain highlands extending to the Kalimantan border.

The bearded pig can be found in Malaysia (Malay Peninsula, Sabah, and Sarawak), Brunei Darussalam, Indonesia (Kalimantan, and Sumatra), and the Philippines (Kawanishi et al., 2008). It is recorded throughout Borneo including offshore islands (Payne et al., 1985). Bearded pigs were fairly abundant until relatively recently (Caldecott et al. 1993). It is now listed as 'Vulnerable' (IUCN, 2014) because of a population decline, estimated to be more than 30% over the last twenty years. Indeed, it is the victim of heavy hunting, habitat degradation and fragmentation.

Sus barbatus (Figure 1) is an omnivorous mammal which primarily feeds on fruits, but also roots, nuts

Fig. 1: A bearded pig was detected by camera trap in Bako National Park, Sarawak. This individual was photographed probably while foraging for food on forest floor.

and insects. The adults can weigh 60 to 120 kg. This pig is known to utilize a wide variety of habitat types, although little is known about its habitat preference. For the majority part of the year, bearded pigs live in one location in a stable family group. However, migratory groups of more than hundreds of individuals have been observed, and this behaviour seems to be in response to mass fruiting events in the forest (Caldecott & Caldecott, 1985; Hancock et al., 2005; Wong et al., 2005). This species is active during the day except in times of migration or human disturbance, when they have been reported to being more active at night (Mohd-Azlan & Engkamat, 2006 & 2013). The ability of the bearded pig to utilize a variety of habitats makes them an interesting subject in understanding effects of habitat changes and disturbance on this species.

The aim of this study is to describe the habitat preference of bearded pigs through occupancy-based analysis which can provide insight to their conservation priorities and management strategies.

Materials and methods

Study areas

Deforestation has forced many species, including bearded pigs to seek refuge in increasingly isolated protected areas. The study focused on protected forest which consist of natural forests (<100 ha), National Parks and Wildlife Sanctuaries. Bearded pigs are allowed to be hunted outside of protected areas for personal consumption by the local community according to the Sarawak Wild Life Protection Ordinance 1998. Four habitat types in five areas were studied: Mixed Dipterocarp Forest (MDF), Beach forest, Kerangas forest, and Mangrove forest.

Bako National Park (01° 42' N, 110° 28' E): Gazetted in 1957, Sarawak's oldest National Park with an area of 27 km^2, which includes Beach Vegetation, Cliff Vegetation, Kerangas, Mangrove Forest, MDF and Peat Swamp Forest. This National park is one of the most visited places in Sarawak.

Kuching Wetland National Park (01° 37' N, 110° 15' E): Previously known as Sarawak Mangrove Forest Reserve and is located 30 km from Kuching. The national park was gazetted in 1992 on the estuarine reaches of the Sibu Laut and Salak rivers that covers an area of 66 km^2.

Tanjung Datu National Park (02° 03' N, 109° 38' E): It is one of the smallest of Sarawak's National Parks with only 14 km^2 in size and is one of the less accessible protected areas. The forest in this national park can be categorized as mixed-dipterocarp forest, which consist of lowland dipterocarp and hill dipterocarp forests. It is located near Samunsam Wildlife Sanctuary.

Samunsam Wildlife Sanctuary (01° 56' N, 109° 37' E): It is the oldest Wildlife sanctuary in Sarawak gazetted in 1979, and located at West of Sarawak, with an area of 228 km^2. The lowland rainforest within Samunsam Wildlife Sanctuary can be further subcategorised as riverine rainforest, kerangas, and MDF. Access to all Wildlife Sanctuaries is strictly prohibited except for research and educational purposes.

High Conservation Value Forest (HCVF), Saremas (03°27' N, 113°48' E): Itis located near to the city of Bintulu, and the fragmented forest within the oil palm plantation has a total forest area of 17 km^2. There is also a strict prohibition in access for the HCVF.

Data collection

Thirty-two remotely-operated digital cameras (Reconyx HC500 and Bushnell) were set up during the study. The cameras were set at a height of 25-30 cm, with no baits or lures used and away

Table 1: Study areas with their number of camera sites, sites with bearded pig detections, percentage of overall detections, forest types, and sampling efforts (camera trap nights – CTNs). (MDF: Mixed Dipterocarp Forest, NP: National Park, WS: Wildlife Sanctuary):

Locations	No. of camera sites	No. of sites with detections	% of overall detection	Forest types	Efforts (CTNs)
Bako NP	16	9	47	Kerangas, MDF, Beach	2306
Kuching Wetland NP	2	0	0	Mangrove	89
Tanjung Datu NP	5	3	16	MDF, Beach	277
Samunsam WS	4	2	10	Riverine, Beach, MDF	267
HCVF, Saremas	9	5	27	MDF	172
				Total effort	4062

from major trails. The time delays were set to two minutes between each photograph to reduce replication. Some cameras were set up in video mode with a recording time of 40s and a time delay of two minutes. A total of 36 locations were sampled between March 2012 and November 2013, with distance between cameras of 1 km. The camera-trap nights (CTNs) were calculated based on the number of recording nights (Mohd-Azlan & Engkamat, 2013). An average of 65 CTNs were obtained for each camera locations, giving a total effort of 4062 CTNs (Table 1).

Occupancy of bearded pig is taken into account, where it is defined as the proportion of area, patches or sites occupied by a species (Mackenzie et al., 2006). Occupancy modelling is a robust analysis that uses animals' detection/non-detection history to estimate the occupancy (Ψ) and detection probability (p), both of which can be affected by habitat and survey specific covariates (MacKenzie et al. 2005, 2006). In order to run an occupancy analysis in PRESENCE 2.0 software, data are organised in a binary matrix of detection and non-detection. PRESENCE software was developed to enable estimation of the probability to find an animal if a site is occupied (MacKenzie et al., 2002).

A series of seven day sampling period (called 'occasions') resulted in 27 repeat survey periods. The results for consecutive days at each site cannot be regarded as independent observations as an animal might stay a few days in the same place. The matrix gives two types of information for each location: the habitat type and the detection/non-detection of bearded pigs during each occasion.

Basically, species are not guaranteed to be detected even when present at a site, hence the naïve estimate of occupancy is given by:

The naïve estimate of occupancy typically underestimates the true occupancy. MacKenzie et al. (2002) suggest that by repeated surveying of the sites, the probability of detecting the species can enable unbiased estimation of naïve estimate of occupancy. For this study, a single season model is used with habitat as covariates.

Key assumptions of the single season model are that all parameters are constant across the sites and that the occupancy of the sites does not change for the duration of the survey. These assumptions are met as the surveys were conducted overfor a short period and no logging or hunting is allowed in the sites.

A two priori models was used to estimate bearded pig occupancy and detection probability. The best approximating models were selected based on the Akaike Information Criterion (AIC) adjusted for small sample sizes (MacKenzie, 2006).

Results and Discussions

Bearded pigs were photographed at 19 out of 34 camera-traps locations; yielding a naïve occupancy estimate of 56%. The naïve estimate assumes that bearded pigs were absent from the other 15 locations, although there is a chance that bearded pigs went undetected on some locations.

Table 2: Results of Ψ(habitat),p(.) and Ψ(.),p(.) models in PRESENCE

Model	AIC	deltaAIC	AIC wgt	Model Likelihood	no.Par.	-2*LogLike
Ψ(habitat),p(.)	370.43	0.00	0.7291	1.0000	4	362.43
Ψ(.),p(.)	372.41	1.98	0.2709	0.3716	2	368.41

In order to study the occupancy of bearded pigs in concordance to their habitat, another model was included: habitat as covariates. The result from PRESENCE (Table 2) shows that Ψ(habitat),p(.) model is lower than Ψ(.),p(.) model, with AIC of 370.43 and 372.41 respectively. Model with large AIC values showed strong evidence of a lack-of-fit, which may cause parameter estimates to be biased (MacKenzie and Bailey, 2004).

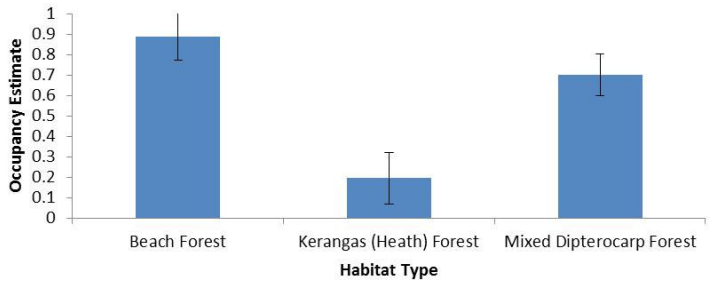

Fig. 2: Occupancy of bearded pigs with the habitat types.

The top ranking model revealed a bearded pig occupancy estimate of 0.66 across the four study areas. The probability of detection (p) is relatively low, with p = 0.20 refers to the detection probability of a bearded pig at least once in one week if the site is occupied. By using single season model with habitat as covariate, the results (Fig. 2) revealed that bearded pig preferred Beach forests (Ψ = 89%) and MDF (Ψ = 70%) over Kerangas forests (Ψ = 19%).

From the result, MDFs and Beach forests seem to offer various natural resources for the bearded pigs. The oil rich dipterocarp seeds are a significant source of food for a number of opportunistic species, which include bearded pigs as one of the major consumers. Throughout their range, pigs are known to eat large quantities of fruits and seeds when available (Ickes et al., 2001).

Even though a higher occupancy was expected for MDF as this forest type has a higher vegetation density and heterogeneity, the bearded pigs were observed most in Beach forest. The importance of Beach forest for foraging is greatly magnified especially for the pigs in Bako National Park. Bearded pigs are often found foraging in Beach forest as it is also influenced by higher detection in Bako National Park (Table 1). Moreover, the location of Beach forests within a protected area may offer additional habitat for foraging.

Seasonal movement of bearded pigs to Beach forest when there is fewer seed and fruit production in MDF may have contributed to this finding. There is a link found between seasonal fruiting patterns and bearded pig movements (Davies and Payne, 1982; Caldecott, 1988). According to Davies and Payne (1982), bearded pig populations migrate to particular location where food is abundant.

Katagiri et al. (1991) showed that the richness of tree species of Kerangas forest in Bako National Park is less than that of its MDF, with small tree size and low above ground biomass. These characteristics are due to the poor soil conditions because of poor nutrient accumulation and leaching. This suggests that Kerangas may not be a suitable habitat for wild pig's foraging activities.

There are evidences of direct influence between bearded pigs and dipterocarp canopy tree species and several hundred other species across several plant families (Curran et al., 1999; Curran & Leighton, 2000; Curran & Webb, 2000; Meijaard et al., 2005). Therefore, long-term research regarding the effects of isolation and fragmentation on bearded pigs is needed to differentiate habitat changes and other effects such as hunting and seed dispersion. This information will help in developing successful and long-term approaches to sustainable management and protection towards Bornean ecosystems.

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We are thankful to Yannick Outreman (Agrocampus Ouest Centre de Rennes) for advice. The authors would also like to thank the Faculty of Resource Science and Technology, UNIMAS (Universiti Malaysia Sarawak), Sarawak Forestry Corporation, and Forest Department Sarawak, especially Mr Engkamat Lading and Ms Dayang Nuriza.

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Nangoeihs (bearded pigs)

freely translated from Dutch by Erik Meijaard.
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Source
Boogaarts, M. 1938. Nangoeih's. De Nederlandsch-Indische Jager 1 Dec 1938: pages 305 and 308.

It was on my arrival in Teluk Panji [ed., N 2.04; E 100.22, in North Sumatra], situated near Kota Pinang, 50 km as the crow flies to the coast, on 20 August 1936, that I first came across "nanngoeihs" [ed., hereafter Bearded Pigs]. During an inspection in my district which borders on swampy damar areas [ed., Dipterocarps from which gum is harvested], I heard to my great surprise the sniffing and clattering of a large group of animals moving through the forest.
In anticipation of what was going to happen I stood stock-still and listened intensely to what I thought was an elephant herd. To be honest I was not very scared, because a deep drainage ditch of about 3 meters wide separated me from the forest edge, and in the worst case I would have plenty of time to run for safety.
Imagine my surprise when just in front of me pigs appeared of incredible size. And not just one, but troops, entire herds, who paid no attention at all to us in our white suits, so that I started to believe I was suffering from hallucinations or at least had a dose of malaria.
By the dozen they stood closely packed together at the edge of the deep drain, until one summed up the courage to slide in, swim across and climb out on the other side. And after one had crossed the rest followed, with those in the back pushing the ones upfront forward. In no time, the entire herd had crossed the obstacle. At the beginning I had still tried to count the animals, but this turned out to be impossible. Without exaggerating it can be assumed that there were over 300 pigs together.
It had immediately drawn my attention that this was a special type of pig. Firstly, it appeared much larger than the normal pigs, because their legs were clearly longer. Furthermore, their snout is very long with a large pink snout disc. Especially in the males do the lumps on the snout stand out. These are thickly haired, while in specimens that I shot, the meat of the cheeks had grown into a very thick and heavy layer. In addition, the neck is extraordinarily heavy making the males looks rather frightening.
That same evening I went out with my Mauser 9.3 and hunted only the biggest boars. It was noticeable that the pigs were not shy at all; after my shots rang out, I could be certain that near me several pigs would come to investigate what that loud noise meant. When I collected a wounded pig in the forest with some of my helpers, looking for it with a torch, I had to more or less edge my way among its congeners, who boldly stood their ground and only fled if the light was aimed at them for very close by.
The Bearded Pigs have frightful canines, which tend to be completely black because of rooting in the damar areas. At night I heard the pigs fight and mate under ghastly noises, so that one's hairs stood on end and cold sweat broke out. Because of this unusual pig migration, I was confused for a couple of days, because I had never experienced anything like it before.
To give a few example of how unusual it was, the tree trunks that were lying across the drainage ditches in a few places were worn down completely because of the large number of pigs passing

across it. In shallower places in the ditch the walls had completely collapsed and a deep path had been worn into them down to the bottom of the ditch through which the pigs passed. Also, some pig trails in the forest had been worn down to a foot (30 cm) deep.

Not only the Bearded Pigs had drawn my attention, the “striped” pig took part too [ed. Probably *Sus scrofa vittatus* -- the Banded Pig]. We found three specimens which had been taken by tigers, and from which these had only removed the most desirable bits of meat. Monitor lizards and bears had removed the remainder of the carcasses. Judging the signs, two canine bites in the skull and claw wounds, all pigs had been taken by the same tiger.

The pig invasion lasted about four weeks and in that time they never moved onto white mineral clay soils. In those few weeks, I often surprised Bearded Pigs who together had collected young rubber trees and piled these into one large mount, below which they sheltered or slept with ten or more animals together.

I have not been to prove that the Bearded Pigs are more dangerous than ordinary ones. As noted, they were not timid at all, but once shot they could become ferocious. This is not surprising, because several of the shot specimens could barely be lifted by four assistants.

According to the notes in my hunting diary, this same group returned on April 17th, 1937, thus 7 months later, and I think this was related to water levels. According to me, Bearded Pig meat tastes better than that of other pig species. Also, I noticed that a number of pregnant sows did not follow the migration, and stayed behind to farrow, because I saw several sows with piglets in my district, which, when the large herd returned, then followed it.

Here I include a photo of some of the male pigs I shot (Figure 1).

Fig 1: Scanned photo from the article by Boogaarts. Note the size of the boar on the right.

Editorial note

This historic account is interesting because unlike Borneo, there are few accounts of Bearded Pig migration from Sumatra. I noted that this record is right at the north-western extreme boundary of the presently known distribution of *Sus barbatus* on Sumatra as shown on the IUCN distribution map. This raises the question whether Bearded Pigs once ranged further north in Sumatra.

The account from Mr Boogaarts provides tentative glimpses as to why Bearded Pigs migrate. There seems to be some relationship with the reproductive cycle as Boogaarts noted the mating behaviour after which the females stayed behind to farrow while the migration herd moved on. It is interesting to note the forced nature of the migration with animals hardly heeding any dangers or showing fear of people. Similar observations have been made about Bearded Pig migrations on Borneo, but the reasons for this apparent behaviour change remain unclear.

Direct observations on the behaviour and group patterns of Bawean warty pigs (*Sus blouchi*) on Bawean island, Indonesia

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Abstract

The Bawean warty pig (*Sus blouchi*) is endemic to Bawean island, Indonesia, and Endangered on the IUCN Red List (covered under *S. verrucosus*). In August and November 2015, during the dry season, we conducted 12 direct observation sessions of warty pig groups at a dry wallow located in a half-open community forest. We aimed to confirm group sizes found by camera trapping, investigate group composition, activity budgets and cohesiveness between group members. For behaviour observations, we used instantaneous scan sampling with an interval of 2 minutes. We used standard non-parametric statistics. We collected 480 single observation points for a total of more than 3 hours. Animals only appeared around 17:00 and returned to the protected forest around 18:00. Average group size was 4.6 ± 1.8 (1-7), with 0-2 males, 1-2 females, and on average 2.3±1.3 juveniles (14) and 2.5±1.2 piglets (14). One solitary male was observed. Animals were feeding and foraging for 2/3 of the observations, and showing social behaviours for 10%. Immatures spent significantly more time playing, and group size was positively related to time spent feeding and foraging. This group of 7 animals was observed for cohesiveness. Groups were relatively cohesive with an average distance of 0.54 meters to the nearest animal. Our results show that group sizes are higher than recorded by camera trap studies, possibly due to seasonal and methodological effects. Half-open community forests and wallow areas seem to be important for feeding, foraging and social activities. These data can be used in the management of captive conservation breeding programmes of the related Javan warty pigs (*S. verrucosus*).

Introduction

Bawean warty pigs (*Sus blouchi*) are a member of the Suidae family that is endemic to the Indonesian island of Bawean in the Java Sea. The species was recently elevated to full species status by Groves and Grubb (2011). Bawean warty pigs are still included as a sub-species of the Javan warty pig (*S. verrucosus*) on the IUCN Red List and are likely to be Endangered, due to a low population size of about 200 to 400 animals and a low area of occurrence (Rademaker et al., in review). They live in the forested protected areas on Bawean, but prefer the half-open habitat of community forests at the transition between the protected areas and surrounding agricultural land (Rademaker et al., in review). Javan and Bawean warty pigs are not protected under Indonesian law. Hunting and habitat loss form the main threats to both species.

The presented study was based on direct observations and has been part of the first study on the behaviour and ecology of Bawean warty pigs. The study included a full year of camera trapping

from November 2014 until December 2015. As camera traps are unlikely to always capture all individual members of a social group, the direct observations aimed to provide additional data on group size. Next to this we aimed to investigate group composition (sex and age classes), activity budgets, and provide some data on the cohesiveness between group members.

Methods

Study site

The island of Bawean is a 192 km^2 -large volcanic remnant situated in the Java Sea approximately 120 km north of East Java and 250 km south of Kalimantan, Indonesia. Forest now largely remains within five protected areas spread over the island and totalling 46.6 km^2 (Semiadi & Meijaard, 2013; Figure 1). The weather on the island is seasonal with heavy rains from mid-October to March and extremely dry weather from April to November (Mantra, 1998; Payeur, 2015). Bawean's approximately 90,000 inhabitants mainly depend on fishing and farming (Nijman, 2004). Despite being protected, small scale illegal logging and burning continues to occur due to a lack of clear protected area boundaries and a lack of resources to ensure enforcement (Nijman, 2006; Nursyamsi, pers. comm.).

Data collection

We collected data during direct observations in early August and in November 2015, which is around the middle until the end of the dry season on Bawean. As warty pigs have regularly been observed in a single location during the camera trap surveys (description see results), we decided to enter this location in the afternoon at 16:00 and wait for the animals to appear. Observation points were chosen at strategic locations amongst vegetation or on trees. Once a group of warty pigs appeared the following data was collected: Group size, number of males, females, juveniles and piglets. We used an ethogram adapted from Rademaker et al. (2015) with the behaviours feeding and foraging, resting, moving, aggressive behaviour, play with conspecifics, wallowing, allogroom and being alert / running away. We noted down the behaviour of each pig every two minutes. Although observation data are likely to be dependent, we used this short interval because of short total observation periods. During one observation, we also noted down the distance to the closest animal and its sex and age class, distance to the mother (in case of juveniles and females), to the dominant male and to the next male.

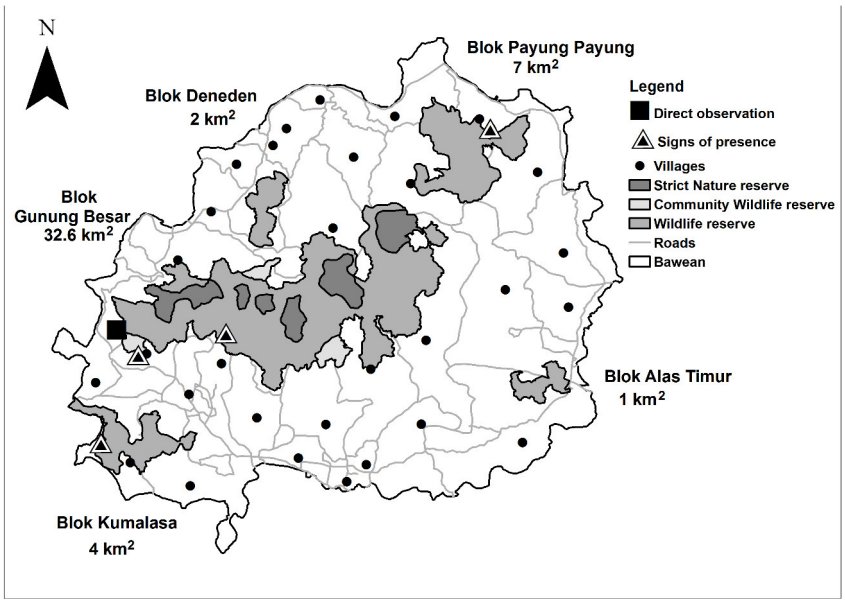

Fig. 1: Bawean island with the locations where direct observations were performed or attempted.

Analysis

We report mean group sizes, and mean numbers of each sex and age class, including standard deviations. We used two ways of analysing behaviour. First, we used each individual and its behaviour as a single data point ("analysis 1"), calculated percentages and conducted Chi-Square tests in order to see if there are relations between behaviour and sex or age class. Second, in order to account for data dependence within the group, we calculated percentages of each behaviour category in the group for each time interval ("analysis 2"). For this analysis only observations from groups with four or more animals were used. For both analyses, the age class was grouped into adult and immature, and all first and last data points of the observation were excluded to avoid a bias towards behaviour associated with arriving and leaving at the area. We correlated the percentages from each behaviour with the group size using non-parametric Spearman's Rank Correlations. We report mean distances between animals in one group with seven animals and compared distances to the dominant male between the mother of dependent piglets and the second female using a Mann Whitney U test. All tests were performed in SPSS 23.0 and used the significance level 0.05.

Results

We observed a total of 12 groups during 8 days (Figure 2), with a total observation time of more than three hours (between 4 and 53 minutes per group), leading to a total of 480 single observation points during 89 intervals. Although 3 hours is not much, it is the first time this species has been directly observed in the wild, and thus worth a report. Warty pigs always appeared and left between 17:00 and 18:10. On two dates several groups have been observed: on 1st November two different groups, and on 7 November 2016 four different groups, including a single male, entered the area. These groups entered and left the area at different places and different times.

Fig. 2: Bawean warty pig, photographed from a tree (Photo by Dinda Rahayu Istiqomah, BEKI)

All observations have been made at a single location (called Cengkeh-cengkeh) just outside the Wildlife Reserve (area Gunung Besar) in a community forest of clove (*Syzygium aromaticum*, Indonesian: Cengkeh) (Figure 3). The habitat consisted of grassland with bushes and a monoculture of single or patches of clove trees, and a few trees of Acacia and Coconut trees. Wallows (called red soil, Indonesian: Tanah merah) are formed mainly in the rainy season and are used by warty pigs as well as domestic cattle (Figure 4), but were dry during our observations. Observations have been attempted at several other locations (Figure 1), but animals ran away or only foot prints were found. In several of these places guard or stray dogs are roaming, possibly scaring off warty pigs.

Fig. 3: Bawean warty pigs and domestic cattle sharing habitat, image extracted from camera trap video (BEKI).

Fig. 4: Half-open community forest with clove trees, where direct observations have been made. Photo: S. Leo, BEKI.

Total group sizes have been between 1 and 7 animals, with a mean of 4.6 ± 1.8. Groups had on average 1±0.8 males (0-2), 1.3±0.5 females (0-2), 2.3±1.3 juveniles (1-4) and 2.5±1.2 piglets (1-4). One of these groups consisted of a single male. While some groups observed in August had juveniles and piglets from different litters, the groups observed in November contained only piglets. Piglets were estimated to be around 8 months old (Bulk, pers. comm.), leading to a birth season between November and March. Males were present in four of eleven groups (2 times 2 males) and one single male was observed.

The activity budgets, according to two different ways of analysis, are presented in Table 1. If combining aggressive behaviour, playing and allogrooming into a single "social behaviours" category, animals spent about 10% of their time with social activities (analysis 1: 11.4%, analysis 2: 10.1%). Using analysis 1, there were no significant differences between sexes in adult pigs (χ^2=5.282, df = 6, p=0.608, n=189) but immatures spent significantly more time playing compared to adults (χ^2=21.801, df = 7, p=0.003, n=377). Correlating group size with the percentage spent per behaviour, only feeding and foraging correlated positively with group size (Spearman's rho = 0.370, p=0.004) and playing correlated negatively with group size (Spearman's rho = 0.260, p= 0.048). In general, Bawean warty pigs were relatively bold; they approached the observers up to 3 meters.

We were able to record distances between individuals for one group of seven warty pigs (2 males, 2 females, 3 piglets) that we could observe for about one hour. The group was relatively cohesive (Table 2). There was no

Table 1: Activity budgets of Bawean warty pigs, according to two types of analysis (analysis 1 = single data points, analysis 2 = percentages of behaviours in the group during one observation interval).

Behaviour category	Analysis 1	Analysis 2	
	%	Mean (%)	SD (%)
Feeding and foraging	69	67,4	33,3
Moving	6,4	7,2	18,1
Alert or running away	6,9	6,8	21,7
Resting and motionless	5,3	1,7	5,4
Aggressive behaviour	5,6	5,6	14,3
Play with conspecifics	5,3	4	13,4
Wallow	1,1	1,4	10,5
Allogroom	0,5	0,5	2,6
N	377	58	

significant difference in distance to the dominant male between the mother of piglets and the second female (Mann Whitney U = 121.500, p=0.924, n=41).

Table 2: Distances between animals in a group of seven Bawean warty pigs during an approximate hour of behaviour observation. All distances were measured in metres (m).

	Mean	SD	Min.	Max.	N
Distance to closest animal	0,54	0,61	0	4	137
Distance to mother	1,24	1,65	0	6	66
Distance to dominant male	1,96	1,78	0	7	128
Distance to next male	1,89	1,46	0	7	39

Discussion

Bawean warty pigs could be directly observed in 12 occasions, but only in one location (Cengkeh-cengkeh) where they behaved rather bold and were not afraid of human observers. The bold behaviour at Cengkeh-cengkeh is in contrast to very shy behaviour of wild-caught animals, for example at the Cikananga Conservation Breeding Centre (CCBC) in West Java (Rademaker et al. 2015). Captive-bred warty pigs seem to adapt to captivity by becoming bolder (Rademaker et al. 2015).

The animals at Cengkeh-cengkeh seem to prefer this half-open location, such as community forests (Rademaker et al., in review), that include wallows during the wet season as a feeding and foraging ground and for social activities, including gatherings between groups. A preference of community forests may thus be explained by food availability. A comparison of group numbers and individuals between the dry and wet season may give more clues. Even though the wallow was dry during the observation months, it still seemed to be an important place for the warty pigs. Camera trap videos (unpublished data) confirm the high frequency of multiple groups that show a lot of social behaviour at similar locations .

Animals always came out of the adjacent protected forest during the evening after 17:00 and always disappeared after 18:00. Unpublished data on recce surveys conducted by the authors in deed confirm that warty pigs can be encountered in the interior of the protected forest during the day and in the community forests in the mornings and evenings (see also Rademaker et al., in review).

The mean group size of 4.6 reported here differs from a mean group size of 2.6 reported from the camera trapping being conducted by the same team on Bawean island during November 2014 until January 2015 (Rademaker et al. in review). The group size of 2.6 in that study was averaged between videos at locations with wallows and without wallows. Thus, the difference might indicate an influence of wallows on group size. Multiple social groups come together at wallows, which increases the observed group size. In the presented results we were able to distinguish separate groups by observing their arrival and leaving patterns. A further reason for lower numbers in a camera trapping study may be related to methodological difference as as a shorter video length may cause missing of group members. Additionally, group sizes in the wet season may be lower than in the dry season for example due to the absence of offspring in the group. This is supported by the absence of small piglets in the videos of the camera trapping study. Group size was also positively related to amount of time spent on feeding and foraging. Possibly bigger groups have to

be less alert and can spend more time on feeding.

With an average of 2.5 piglets litter sizes were relatively small and comparable to Javan warty pigs (Tritto, Bulk, pers. comm). Calculated birth months indicate births between November and March. According to local people, piglets are first seen around April. An absence of small piglets on camera trap videos captured between November 2014 and January 2015 points to births occurring at the beginning of the year. In summary, most births seem to occur at the beginning at the year, during the rainy season, but timing may be flexible. In captivity, females can become pregnant later in the year if they did not conceive in the first part of the year (Bulk, pers. comm.). Juveniles seem to stay in the group even if a new litter is born. The sex of juveniles could not be determined, but this may have an influence on whether animals stay with the group. Males may join groups or roam alone. One male was seen alone while other groups contained dominant males or even a second male, thus, males may join groups or live solitary.

This study shows the importance of half-open community forests as feeding grounds and for social activities of Bawean warty pigs. This information can be integrated into conservation planning. Data on group sizes, structure and behaviour may assist in the management of captive conservation breeding programmes for the Javan warty pig.

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Crop raiding by *Sus scrofa* leads to pig fighting arenas in West Java

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Introduction

Crop raiding by wild animals is a considerable threat to the lives of independent agricultural workers throughout the world (Pienkowski et al., 1998). Economic losses suffered from crop raiding can be relatively high in developing countries, as farmers rely heavily on their crops and are rarely compensated for their losses (Sekhar, 1998; Rao et al., 2002). Such losses can make agricultural communities intolerant towards wildlife, which can result in the targeted hunting of problem species (Nyhus, Tilson & Sumianto, 2000).

Across a number of countries, European wild pigs (*Sus scrofa*) are known as crop raiders (Singer et al., 1984, Groot Bruinderink & Hazebroek, 1996) and are hunted for sport and as a source of meat (Keuling, 2008, Vieira-Pinto, 2011). In the village of Cipaganti located in West Java, Indonesia, European wild pigs (*Sus scrofa*) frequently descend from forested areas in higher altitudes to raid local farms. To combat this threat to the livelihood of the local community and as a form of sport, informal hunting parties are established in an effort to reduce wild pig numbers. In West Java, as in most areas of Indonesia, the dominate religion is Islam (Woodward, 2010) and the eating of pork products is prohibited (haram).

In this study we aim to identify the methods used and economic gains from the hunting of European wild pigs in the Cisurupan district. Additionally, as this area of study lies within the historical range of the Critically Endangered Javan warty pig (*Sus verrucosus*; Olivier, 1925) and a reintroduction program is in place to re-establish wild populations (Semiadi & Nugraha, 2009), we aim to assess if pig hunting practices in West Java pose a threat to the current and future Javan warty pig population.

Methods

This study was carried out in cooperation with the Little Fireface Project in June 2015. The Little Fireface project is an ongoing research and conservation project based in Cipaganti, West Java. Since 1993 The Little Fireface Project has carried out non-invasive research in the Cisurupan district of West Java. The research focus for the project has been the Critically Endangered Javan Slow Loris (*Nycticebus javanicus*), though other nocturnal species have been included in various studies (Musang, 2014, Rode-Margono et al., 2014).

Local wild pig hunters were identified and invited to take part in semi-structured interviews, with subsequent hunters identified using a chain referral or 'snowball' method (Newing, 2010). Interviews ceased when a 'saturation point' was reached (Glaser & Strauss, 1967) and interviews produced no new information. In total five interviews with hunters took place, each lasting between 1-2 hours. Impromptu interviews of varying length were also carried out with farmers during other field work (n =3). Interviews were conducted in a mixture of Sundanese and

Indonesian by native speakers and then transcribed in Indonesian, then translated into English with key phrases or terminology explained.

Results

Motivation for Hunting

All the hunters interviewed saw hunting as a service to the community. The primary purpose of hunting wild pigs (*Sus* spp.) was to reduce the population of wild pigs in the area to limit the destruction of crops. A number of interviewees (n=5) classified wild pigs as pests (hama). Rats, caterpillars, cockroaches are also considered hama. Pig hunting was also viewed as a fun hobby. Farmers named a number of animals; lasun (collared mongoose, *Herpestes semitorquatus*), civet (Asian palm civet, *Paradoxurus hermaphroditus*) as eating crops, but wild pigs were identified as the 'worst' crop raiding animal, as they caused the most damage (n=8).

Methods of Hunting

A number of hunting methods were mentioned by pig hunters, including the use of specialist firearms (babaalor), snares (eurad), pit traps (piruang) and trained dogs (boro). In Cipaganti, the favoured method of pig hunting was pit traps and trained dogs. Pit traps, typically one and a half meters squared by four meters deep, were dug on known pig trails and were covered in vegetation to disguise their presence. These traps were not 'spiked' or intended to cause harm to the pigs, but only to capture them. Three to five hunters noted the use of eight to ten dogs for hunts. When and where to launch hunts was determined by the occurrence of pig trails or signs of foraging in farm lands by pigs. Farmers would alert one another, especially those who also hunted if any signs of a pig had been seen during the day, then a pig hunt would ensue. Hunting with dogs would typically take between 30 minutes to 4 hours, and typical success rates was measured as 1 in 5 (n= 4). All hunters were presented with pictures of various pig species and asked to identify the species which they hunted. All hunters (n=5) identified the single image of European wild pig Sus scrofa. All the hunters interviewed mentioned that there was more hunting in the past (n=5).

Use of caught pigs

Each interviewee said that the primary use for pigs was for pig fighting, where wild pigs would be place in an arena to fight trained dogs. Pig fight organizers, would charge admission, and observers regularly participated in betting on the outcome of the fights.

Whilst Cipaganti used to have its own arena for such spectacles, it no longer does at the request of the local imam. All those interviewed (n = 8) mentioned that funds from pig fighting arenas were used to help with the development of local infrastructure (schools, bridges, etc.) Currently, pigs caught by hunters are either sold to owners of arenas in adjacent villages and towns to fight (katukang ngadu) or to specialist butchers (paedaging). Wild pigs are sold for between 200,000 rupiah ($15) and 1,000,000 rupiah ($75) depending on their size, the 'average' price mentioned by hunters was 500,000 rupiah ($37) (n=3). Profits from selling of pigs were spent on the purchasing of additional dogs for training (n=4), or on small items for the community (football shirts, n=1). When asked if hunting was for profit, one hunter remarked;

"I wouldn't hunt for that, just to work is better. Hunting is just luck, a past-time. It's good for the farmer, it's not for money."

Discussion

For the hunters of Cipaganti, pig hunting was seen as a service to the local community and to the benefit of the livelihoods of their village.

No hunters or farmers saw the use of captured wild pigs in fighting areas as 'revenge' or in any way related to punishment for crop raiding behaviour. However, pig fighting arenas were used to generate income (in the recent past in Cipaganti). It could be argued that this is a form of income that replaces the income generated from the sale of more conventional meat products that stem from hunting in other areas. Alternatively, the income generated from selling pigs to pay for community projects (building of bridges, schools etc.) could be viewed as a fair distribution of wealth as a form of recompense for the loss of funds from crop raiding. Assigning monetary value to losses suffered by individual farmers is problematic, whereas providing funds for community projects is unbiased.

Whilst the practice of 'pig fighting' may seem barbaric to some, it would be good to remember that many practices involving the large-scale production and consumption of pork in western countries are arguably as much an animal welfare issue .

Javan warty pig in Cikananga Conservation Breeding Center. Photo: T. Braasch

Javan Warty pig (*Sus verrucosus*) has seen dramatic population declines in recent years (Semiadi & Meijaard, 2006). It was feared by the researcher that pig hunters in Cipaganti would be unable to identify different pig species and would hunt indiscriminately, which may have hampered the success of any future reintroduction attempts of Javan warty pigs. However, all the hunters in this study successful identified Sus scrofa. Prior to reintroduction events simple notifications may be deterrent enough to prevent pig hunters from capturing Javan Warty pigs. In Cipanganti it is interesting to note that the use of pig fighting areas was halted at the request of the local imam. In this particular instance, religious respect superseded the desire for entertainment. Many Islamic scholars share the perspective that Islam provides a comprehensive system for teaching the fundamental aspects of environmental care (Mangunjaya and McKay, 2012). Future conservation projects, including those involving the Javan Warty Pig, may note the potential in harnessing religious communication networks in enhancing conservation education techniques.

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ISLAND DWELLERS
A mixed exhibit of Visayan Warty Pigs (*Sus cebifrons negrinos*) and Spotted Deer (*Rusa alfredi*) at Colchester Zoo, UK

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Introduction

Colchester Zoo had housed a herd of Visayan Spotted Deer in a quiet corner of the collection for a number of years. The enclosure wasn't particularly popular and received little attention from our visitors but we were still excited to be working with such an important species so persisted with the exhibit. Then, during a TAG meeting at an EAZA conference a few years ago my interest was piqued when it was highlighted how important it was to find new holders for Visayan Warty Pigs and that one way of housing them could be in a mixed exhibit with the Spotted Deer. A short time later an article appeared in Zooquaria again asking for new holders and this time I pushed forward with the idea of bringing this charismatic pig species to Colchester Zoo.

In discussion with the European coordinator at the time we felt it would be best to start with a bachelor group of pigs as there were a large number of surplus males and although the idea of a mixed exhibit sounded great we didn't really know whether it would actually work so we wanted to keep it simple. There were obviously concerns about mixing these two species and in particular the injuries they may inflict upon each other but also how we would manage housing, diets and breeding and of course what the pigs would do to the lush grass paddock.

With these concerns in mind but also the excitement of trying something new and working with critically endangered species we went ahead and brought in four male Visayan Warty Pigs from Newquay Zoo UK and the creation of the Island Dwellers began!

The creation of island dwellers

Without a doubt the design of the exhibit is what is key to the success of this mix. Our enclosure wasn't specifically designed to house both species but had been made very flexible so that surplus deer could be managed and stags in rut could be avoided by keepers if needed. This left us with a main exhibit, a side paddock and a race with additional housing that could all be opened up into one or separated so there were individual areas.

The four Warty Pigs started their time in the race part of the enclosure with their own house and visual and olfactory access to the deer. A month later we started the mixing, keepers having

spent a lot of time working in with the pigs and recall training them so we could have as much control as possible when the time came to introduce the two species.

Initially the mixes were supervised at all times and only lasted 1-2 hours. As expected the deer 'spooked' at first and one hind in particular would run around in 'panic' but this soon calmed down. The pigs showed some interest in the deer and initially did snap at them if they got too close but it was the deer who actually tried to bite first and would often nip at the pigs back ends.

Another month later and gradual increased time spent together the two species started to settle and very little interaction was seen between them. We did have to tweak some of our management of them such as giving the pigs access to their housing at all times as they would otherwise push the deer out of their area and changing the way we fed each species as inevitably one would always eat the others food rations!

Also if the weather was very wet and the ground slippery we would hold off mixing just to prevent the possibility of injuries if chasing ensued and the deer were spooked. We always separated at night as a precaution and could call the pigs back into their area with ease due to the training that had previously been put in place.

Three months down the line and with no problems to speak of we were leaving them together for 5-6 hours per day completely unsupervised. They would feed from browse piles together and both deer and pigs would be seen lying down and relaxing in each other's company.

We did see a slight change in the Stag's behaviour during the rutting season and he would behave more aggressively towards the pigs but they simply moved out of his way and didn't retaliate at all. During these short spells we simply don't mix if we feel there's a concern – the joy of having such a flexible enclosure.

Three years down the line and we still haven't had a single problem between the two species. We are even at the point now where the pigs will lie down in front of the deer and roll over hoping for a much sought after 'belly rub'! Not unsurprisingly the deer do not accommodate this request and simply walk away with what you can almost imagine is a look of disgust on their faces!!

We do still separate the animals at night, more so because we can than because we feel the

need to. It does also allow us to feed them separately which helps with maintaining the correct diets and managing their weight.

The pros

The exhibit is now a completely different experience for our visitors. The pigs have brought it alive and wherever you now look there are animals moving around, interacting with one another and exploring the enclosure. We completely re-vamped the entrance and relaunched it as a brand new exhibit and introduced a talk and feed by the keepers to further encourage visitors down to that corner of the Zoo. From an education and conservation point of view it's a great exhibit to talk about. Most visitors are surprised to see the two species together and so it opens up a narrative about the Visayan Islands and the plight of these species in the wild. From the animals point of view it's definitely enriching. Both species are more active since being mixed and we do see a lot of positive interactions.

The cons

Even with the encouraging words from the coordinator that 'these pigs don't do as much damage as some other species' we always knew there was a good chance they would destroy the grass paddock and we weren't wrong! This of course causes a number of problems. Firstly it destroys any grazing for the deer which is less than ideal. Thankfully again to our lucky design of the exhibit we have a separate paddock that we can keep the pigs out of and this is left for grazing just for the deer. The second problem is the damage to the ground and concerns over the deer hurting themselves. We rectified this by covering the ground in bark chippings. This evened out the ground and helped with the third problem which was the aesthetics of the enclosure. It will never look as nice as it did as a lush green paddock but considering the improvement of the exhibit as a whole for visitors it's definitely worth the sacrifice.

Conclusion

Without a shadow of a doubt our mixing of Visayan Warty pigs and Spotted Deer has been a resounding success! I am not however under any illusion that it could also have gone terribly wrong. Personally I think there are a few factors that made it so easy for us. As I mentioned right at the very beginning the set up and design of the enclosure is absolutely key and I don't believe we would have the success we do now without the ability to separate the animals as and when

we want to. I also feel that we made things much easier by being able to work in with both species. This way of working may of course be quite controversial and not a possibility for some collections, but it gave us a lot of control that we wouldn't have had if we'd always been on the outside of the enclosure. Our close interactions with both species have also made them much calmer and I believe this has also helped with the introductions.

Certainly having a bachelor rather than breeding group of Warty Pigs has meant they are easier to manage and we've had limited success with breeding the Deer so these are aspects that we will need to consider for the future. We will be changing our animals within the deer herd soon so we do get into a breeding situation and we will have to change our management of the mixing once again, but I'm confident that with our set up we won't have any real problems. I'm uncertain as to whether breeding both species in the same exhibit would work and as is often the case success probably has a lot to do with the individual animals but certainly from our experience I wouldn't hesitate to suggest giving it a go.

Even if these mixed exhibits just make use of bachelor groups of Visayan Warty Pigs they will still be massively beneficial to the European breeding programme as there is such a male surplus and real concerns over long term management plans.

So all said and told I would consider Island Dwellers a success and a real positive experience for the animals, the staff and our visitors at Colchester Zoo, but even more importantly this mixed exhibit has created a talking point on a number of occasions in the Zoo community, has raised a lot of interest in these two critically endangered species and has other collections considering bringing in Visayan Warty Pigs whereas before they may not have.

Hog wild in a cradle of evolution

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Sulawesi is a statistician's delight!

Fourth largest in Indonesia's chain of 1,700 islands, its slightly eccentric 'L' shape gives it a coastline of 6,000 kms with diverse marine life ranging from the living fossil coelacanth in deep inter-island canyons to sharks and giant clams (six species) about its reefs. Dugongs in its sea grass meadows and nesting turtles just above the surf line add further interest. But it is the location of Sulawesi's dramatic 17.46 million ha terrestrial area that really puts it on the map.

The island is in Wallacea, a unique part of the world where both Asian and Australasian species meet and co-exist.
On land the statistics really run wild. The volcanic topography sustains eighteen different forest ecosystem types, most tropical alpine, montane, upland or hill, and over 5,076 species of vascular plants. The percentage of endemic species is exceptionally high. Some 34% of Sulawesi's nearly 1,500 recorded bird species (almost twice the number occurring in the entire US) are endemic. Of 127 known mammal species, 72 are endemic (62%). If one excludes bats, that figure rises to 98%! Mammals include two wild cattle species and if you are playing Scrabble with Species names the lowland anoa (*Bubalus depressicornis*) is one not to miss! Also found here are crested black macaques (*Macaca tonkeana*), Sulawesi palm civet also of use in Scrabble with Species (*Macrogalidia musschenbroeckii*) and two endemic wild pigs; NT Sulawesi warty pig (*Sus celebensis*) and VU Sulawesi babirusa (*Babyrousa celebensis*). There are supposedly three species of babirusa, but the other two occur on different islands. Of the 17 extant pig species in the Suidae family, 11 occur in Asia and all but one (*Sus scrofa*, Eurasian wild boar) are threatened with extinction.

A visit to a Sulawesi mountain market offers clear reasons for why the Sulawesi hogs are in trouble. The island is not just Indonesia's fourth largest but is also Indonesia's third most populated (17 million at last census). There is active bushmeat trade in Sulawesi. On sale in the markets I visited were dogs, rats, bats, snakes and other reptiles, fish, crustaceans, insects, birds... and pigs of dubious origin.

Sulawesi might have become as famous as the Galapagos had Darwin not beaten natural historian Alfred Russel Wallace to the finishing line with research and conjecture on evolution. The island now stands not just on an Australasian/Asian line but on the frontline of potential extinctions.

Sulawesi still remains unexplored to a degree - there are unquestionably more unknown species in them thar hills and this is just one of many reasons why conservation here really deserves global priority status. Conservationists are active. Many ideas are being employed. One of note is the E-PASS – Enhancing Protected Area System in Sulawesi, and of particular relevance to

readers of this publication. This UNDP supported Global Environment Facility (GEF) financed initiative embraces the territory of Sulawesi's endemic wild pigs. And babirusa (current population circa 4,000), while not the prettiest or most fluffy of flagship species, has been noted as a key indicator of ecosystem health and decline.

E-PASS with $ 6.265 million from the GEF and $ 43.7 million co-financing from the government 'P's. PAs (protected areas), People, Policy, Practice, Performance and Pigs!

The project works towards a number of outcomes that support strengthening of the PA system. These include: (i) increasing coverage of under-represented vegetation types within Sulawesi's terrestrial PA network increasing the PA areas and establishing corridors; (ii) establishment of an island-wide plan for biodiversity, key species and habitat condition monitoring systems; (iii) emplacement of intelligence-based poaching and wildlife trade surveillance procedures; and (iv) development and operationalization of the Sulawesi PA system financing plan, articulating PA financing needs and providing for concrete steps for meeting the financing needs.

The project provides targeted on the ground support for three target PAs, namely Lore Lindu National Park (217,991 ha), Bogani Nani Wartabone National Park (285,105 ha), and Tangkoko Batuangus Nature Reserve (3,196 ha). Support encompasses a range of interventions to improve management effectiveness of these PAs including support for local community livelihood diversification and enhancement for improving local people's attitude towards wildlife and fostering their stewardship.

Sounds good?

If E-PASS works the future will look almost as interesting as Sulawesi's past for people and pigs both. And who could argue with the choice of a babirusa as a flagship ambassador for the island! Not the management of Singapore Zoo's night safari for sure! The babirusa enthralls all who see it. The most popular pig in captivity in the zoo. Harness that appeal and Sulawesi will understand that its future might just rely on four trotters.

Banded mongooses grooming warthogs

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The banded mongooses (*Mungo mungo*) at the Mweya Peninsula in Queen Elizabeth National Park, Uganda, have been habituated and studied for over 20 years (bandedmongoose.org; Cant, Vitikainen & Nichols, 2013) and were recently featured in a BBC series called “Band of Brothers”. The warthogs there are also very habituated to people, because of the presence of tourists, which means that you can see the unusual behaviour of grooming between the two species fairly frequently. The warthogs deliberately lie down when the mongooses are around and lift their legs to allow access to the ticks.

A BBC video of the grooming can be seen at http://www.bbc.co.uk/nature/life/Warthog#p006gjbr. It makes you wonder whether it also occurs in the wild but is very rarely seen because of the need to be close to the animals. I think this is one of the few cases of a mammal grooming another mammal species although it occasionally occurs between different primate species but I have not seen any analysis of this behaviour written up anywhere. It would be interesting to know what the frequency of grooming is and whether there are certain situations where it occurs. Giant Forest Hogs also occur in the same place but as far as I know the mongooses have not been seen grooming this species, despite some of the family groups being semi-habituated by Hans Klingel for research.

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Banded mongooses grooming a warthog in Queen Elisabeth National Park Uganda.

Photos: A. Plumptre / WCS

Encounters with common warthogs along the B1 highway in north-central Namibia

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Introduction

Common warthog (*Phacochoerus africanus*) occur throughout Namibia except the far south, southeast, arid west (i.e., Namib Desert), and the densely populated north-central communal areas. Their Namibian conservation and legal status lists warthog as "secure and huntable game" (Griffin & Coetzee, 2005). Although seemingly ubiquitous, often alongside major roads where they are viewed as a nuisance to drivers, little has been published regarding their local ecology and/or numbers.

During 2013, Namibia experienced a widespread drought with warthog lured to road verges with better grazing. Their numbers seemed astounding at times – e.g. 391 individuals on a 146 km stretch of the B1 highway between Okahandja and Otjiwarongo in central Namibia on 7 October 2013 between 17h00 and 19h00 (this study). Mean average annual rainfall for this area varies from 300 mm in the south (Okahandja area) to 450 mm in the north (Otjiwarongo area) mainly between January and April. Coefficient of variation in rainfall of 30-40% (Mendelsohn et al., 2002) mainly between January and April. During the 2012/2013 rainy season these areas received between 100-200 mm.

Whilst travelling this route for other purposes, I kept note of warthog numbers along this section of the B1 Highway, including anthropomorphic activities potentially affecting warthog distribution. This note highlights some of these findings and although not attempted as a formal scientific study it does raise interesting questions.

Methods

The Okahandja and Otjiwarongo route is termed the B1 Highway and is a tarmac road linking the north of Namibia to the capital – Windhoek – and the rest of the country.

Warthog were counted, group size documented, and groups classified as adults, sub-adults and juveniles (although not sexed).

This section of the B1 highway is freehold (commercial) cattle farming and fenced accordingly. A number of game farms with game proof fencing – jumping game – are also located along this route. The fences were classified as cattle fencing (either side); game fencing (game proof fencing either side), and mixed fencing (cattle and/or game proof fencing).

As grass is often cut and baled by some farmers alongside the road the habitat was classified as cut, uncut, and road verge. Road verge was the ca. 2 m strip alongside the tarmac road. This was usually with short grass and maintained by local authorities to increase visibility to prevent wildlife related accidents.

Data were collected on 8, 14 and 16 July; 8 and 9 September; 7 and 10 October, and 9 and 11 December 2013. The data were grouped as winter (July), spring (September and October), and summer (December). Observations were conducted either during early morning (07:00-09:00 h) or late afternoon (17:00-19:00 h).

The road strip count formula of Bothma (1989) was used to determine warthog numbers – i.e. N = Nh/h, where N = number of warthog estimated in area, n = number of warthog on the strip, H =

surface area, and h = surface area of the counted strip.
Strip length was 146 km and the strip width was 100 m. Strip width includes tarmac, road verge, boundary between road, and fence and visible area into veld. As the area is bush thickened (encroached), the strip width is small. The speed travelled was 120 km/h.
Mean daily foraging distance for the common warthog in the Eastern Cape, South Africa, is 1,690 ± 347.5 m (Somers et al., 1994) while Clough & Hassam (1970) indicate 7 km as the distance travelled per day in the Queen Elizabeth National Park, Uganda. These are however not straight lines. To determine warthog numbers, I used the surface area (H) (which is usually the size of a farm/ranch) as an arbitrarily 2.5 km strip along the length of the tarmac as the distance warthog potentially travel to the roadside foraging area during a drought (i.e. 36,500 ha) and within the range of the above mentioned authors. The surface area of the strip (h) was 1,460 ha (i.e. 146 km x 100 m).

Results

The total number of warthog sightings during this study was 1,020 individuals in 534 groups or sounders. Adult warthog sightings increased from 68.1% of all warthogs sighted during winter (July) to 94.4% of all warthogs sighted during summer (December), while juveniles decreased from 18.9% during winter to 0 during summer (Figure 1).

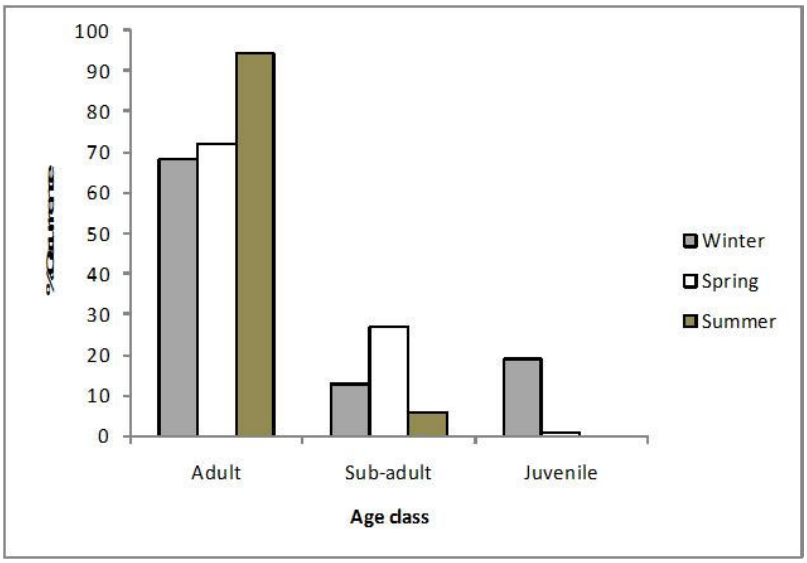

Fig. 1. Warthog age classes during winter, spring and summer (n = 1,020 individuals in 534 sounders).

Solitary individuals accounted for 46.4% of all sightings with the highest during summer (73.8%), while during winter and spring they accounted for 31.3% and 43.1% of the warthogs sighted, respectively (Figure 2).

Mean group size varied between 2.2 individuals during winter (July 2013) to 1.3 individuals during summer (December 2013) (Table 1). The largest group was 12 individuals observed on 7 October 2013 at 18h24 (10 adults and 2 sub-adults).

The majority of the warthog were seen in association with cattle farming practices – i.e. cattle fences on either side of the road or on one side – compared to purely game farming practices (Figure 3). There is a highly significant differences between warthog associated with cattle fences compared to game fences (p=0.006), cattle fences compared to mixed fences (p=0.19), and game fences compared to mixed fences (p=0.073) during spring than during winter and summer.

Warthog spent more time on areas that had been cut during spring (64.5%) and on uncut areas during winter (65.35) and summer (59.4%) (Figures 4 to 6). Time spent on the road verge – i.e. within 2 m of the tarmac on short grass – increased from 15.4% during winter to 24.5% during

spring and 34.3% during summer. There is a highly significant difference between warthog associated with cut areas compared to uncut areas (p=0.003) during spring (September/October), and no significant differences during winter and summer.

Density estimates were highest during spring (September/October) with 4.05 warthog/km followed by 1.95 warthog/km during July and lowest during December with 0.97 warthog/km.

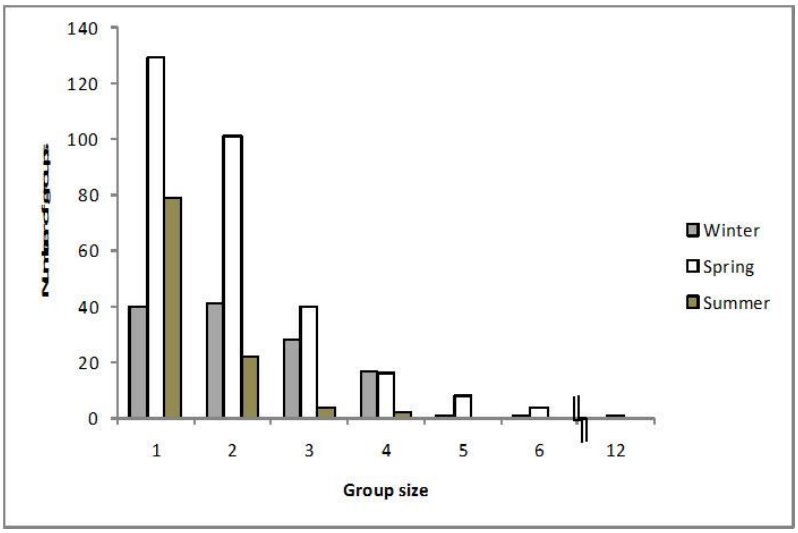

Fig. 2. Distribution of group size during winter (n = 128 sounders), spring (n = 299 sounders) and summer (n = 107 sounders).

Table 1 Mean group size of warthogs during winter, spring and summer in central Namibia (n = 534 sounders).

	Mean group size	SE	Range	n
July	2.22	0.09	1 to 6	128
Sep/Oct	1.98	0.07	1 to 12	299
Dec	1.33	0.06	1 to 4	107

Table 2 indicates warthog numbers using the road strip count formula by Bothma (1989) – i.e. N = Nh/h (See methods). The maximum number of warthog in the 2.5 km strip along the route is 14,800 during spring (September/October) and 1,075 during summer (December).

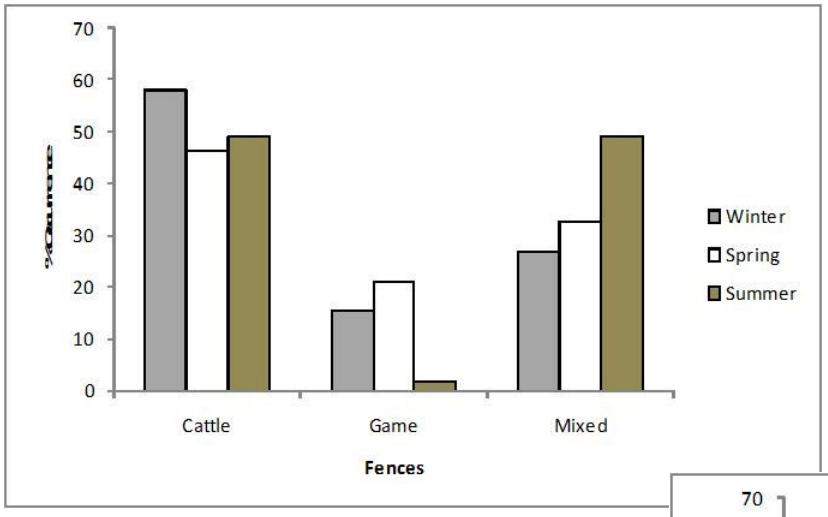

Fig. 3. Warthog association with land use – i.e. fencing – in central Namibia.

Discussion

The major decrease in juvenile sightings from 54 individuals during winter (July) to 6 individuals during spring (September/October) – i.e. 2-3 months later – and none during summer (December) are probably due to the majority having succumbed as a result of the drought and associated decline in female body condition during this period

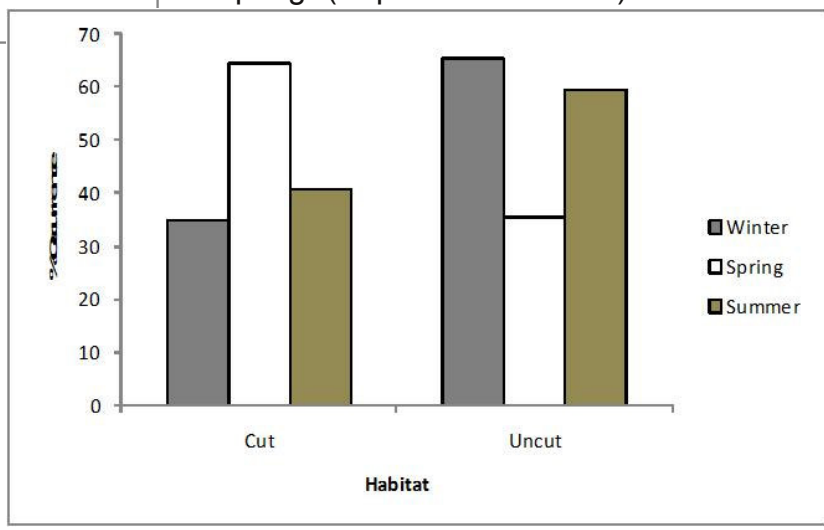

Fig. 4. Warthog association with habitat in central Namibia.

Fig. 5. Warthog grazing on cut area adjacent a game proof fence.

(pers. obs.) rather than them moving into the next age class. Mason (1990) found drought-associated mortality to be between 80-90% in KwaZulu-Natal in South Africa. Bradley (1968) reports a mortality rate of 50% during the first 6 months of life in Kenya. Having probably been born during early 2013, the overall dry conditions experienced in central Namibia during the rainy season probably led to considerable mortality among juvenile warthog with limited recruitment.

Group include up to 16 warthogs, but typically number 5 or less (Estes, 1995). This is similar to the findings of this study. Sightings of solitary warthog during this study accounted for 46.4% of all sightings (n = 534 sounders). This is similar to the Eastern Cape (Somers et al. 1995) with 45% although differs from Zimbabwe with 27% (Cumming, 1975). Groups of 1 or 2 individuals accounted for 77.2% of all sightings with only one group having more than 6 individuals. Mean group size of 2.22 during winter (July) is similar to that by Somers et al. (1995) in the Eastern Cape (2.2), but less than the 3.3 given by Mason (1982) in KwaZulu-Natal in South Africa. Mean group sizes of 1.33 and 1.98 during summer (December) and spring (September/October) is less, but probably as a result of the drought conditions experienced during this study.

Fig. 6. Uncut area with cattle fence in the background. Note the road verge with short grass.

The strong association of warthog with cattle farming rather than purely game farming is interesting. This is probably a result of trophy hunting on game farms, especially during winter, or actively being targeted as “problem animals” due to their burrowing under game proof fences allowing access to potential predators (e.g. cheetah, leopard) that in turn target high value trophy species (e.g. roan, sable, etc.). This would, however, have to be investigated as cattle farmers also shoot warthog, albeit throughout the year, for staff rations. Warthog could also be

Table 2. Warthog numbers using an arbitrary strip along the B1 highway in central Namibia.

	N	n	H (ha)	h (ha)
July	7,125	285	36,500	1,460
Sep/Oct	14,800	592		
Dec	1,075	143		

favouring cattle farms because of the mineral licks (and supplementary feed) farmers supply their cattle during the dry season – i.e. winter months. Warthog scavenge around troughs during this period (pers. obs.). Another reason could be the difference in veld condition of game farms versus cattle farms with the first mentioned often visibly more over-grazed than the latter (pers. obs.). This is probably due to poor management practices.

The reason warthog favour cut areas to uncut areas, especially during spring (September/October), can probably be ascribed to the drought conditions with "better" forage associated with the cut areas as this typically stimulates regrowth. As warthog favour short fresh green grass (Mason, 1982; Skinner & Chimimba, 2005) the cut areas also serve as an attraction during adverse conditions. This can be problematic as wildlife associated vehicle accidents – e.g. warthog and kudu – are rife in Namibia. The cost-benefit of short grass attracting warthog but increasing visibility along a highway is weighed. Grass cutting is viewed as diversification and an addition source of income to many farmers in this area. Denying them this opportunity would also seem unreasonable. Road signs indicating warthog as a potential threat (See Figure 7) do not seem to be effective in reducing accidents, but then neither do the speed limit signs. As warthog densities along this section of the B1 highway increase during spring, especially on cut grass along cattle fences, increased awareness and vigilance should be encouraged to avoid warthog related accidents.

Fig. 7. Warthog warning sign used along roads in Namibia. Note the short road verge and cut area towards the fence which is obscured by dense Acacia bush.

The maximum population estimates of 14,800 individuals (or 1/2.47 ha) during spring (September/October), 7,125 individuals (or 1/5.12 ha) during winter (July), and 1,075 individuals

(or 1/34 ha) during summer (December) are probably over-estimates due to the high number of animals lured to the roadside during this dry period. Stein et al. (2013) estimated warthog density as 2/km² on farmland in the Otjiwarongo area. Using this estimate, a total of 1,460 individuals (or 1/25 ha) occur in the area. Although home range was not determined during this study, this varies between 23.8±7.8 ha in the Eastern Cape (Somers et al., 1994) and 176.1±91.5 ha in Zimbabwe and KwaZulu Natal (Cumming, 1975; Mason, 1982). Home ranges overlap widely. Cumming (1975) found that home ranges tend to be larger and population densities lower during droughts. Using the maximum density of 4.05 warthog/km to estimate maximum numbers result in 591.3 warthog over the 146 km (the actual highest count was 391 individuals). Determining wildlife numbers is complex and tricky, with trend typically a rather more cost-effective and time-effective tool for management than actual numbers.

Using the B1 highway, and other similar routes, to determine trends in warthog densities during different seasons and/or annually would be an easy way to assist farmers, managers, and authorities on determining the effect of rainfall as well harvesting quotas for hunting purposes without negatively affecting the population dynamics of the species.

Acknowledgements

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Proyecto Huangana: Assessing health related aspects of an Amazon keystone species at Tambopata National Reserve, Madre de Dios, Peru.

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White-lipped peccary [WLP] (*Tayassu pecari*) population fluctuations have been reported throughout all their distribution range (Fragoso, 2004; Altrichter et al., 2012; Richard-Hansen et al., 2013). Although the causes of these fluctuations are still not fully understood, their main threats include habitat degradation and hunting pressure, (Keuroghlian et al., 2013). Some authors suggest that diseases could play a role in the decline of their populations (Fragoso, 1997; Fragoso, 2004; Altrichter et al., 2012).

Fig. 1. Fresh fecal material for non-invasive peccary sampling at Tambopata National Reserve.

There is an urgent need to conduct research on health related aspects due to the possible occurrence of disease outbreaks that can affect peccary populations (Taber et al., 1997; Altrichter et al., 2012; Keuroghlian et al., 2013) and to consider disease transmission from domestic animals on peccaries (Briceño-Méndez et al., 2014; Fragoso, 1997).

Over the last years, WLP disappearance have been reported from different areas (Altrichter et al., 2012), including Manu National Park, in Perú, where WLP populations disappeared from 1978 to 1990 (Silman et al., 2003), and where their absence was noted again in 2015. Changes were also observed in Pacaya Samiria National Reserve, where strong population declines have been reported at Samiria River basin since 2010 (Bodmer et al., 2014). In early 2014, a possible die-off event came to public around the Tambopata Research Center in Tambopata National Reserve (TNR), in Madre de Dios, Perú. A research team was sent to the area, remaining in the field for five weeks in order to confirm the die-off event and to look for evidence and to understand its causes.

Possible reasons of the die-off could be biotoxicity, a condition related to environmental stress (food availability – weather fluctuations), a dense-dependent condition as diseases (natural epizootic or introduced), or a combination of more than one stressor. The causes of mortality were not determined (see Carlos & Alcazar 2016 this issue), but the situation showed the lack of information of WLP health status and other ecological aspects like population fluctuations on the area (Carlos & Alcázar, 2014).

Therefore, on May 2015, we started a project to raise a baseline information on WLP health at an

ecosystem scale that include non-invasive sampling of peccaries (Fig.1), and the collection of environmental samples (Fig.2) in a gradient of human disturbance within Tambopata National Reserve. Due to their foraging habits animals could get infected by domestic animal excreta, waste or contaminated soil and then transmit them through food chain to predators and humans. They could also be infected by the environment through their excreta, with the potential of retransmission by geophagia, with implications for wildlife - ecosystem conservation, and public health. Although we understand the difficulties related to non- invasive sampling, we decided to use this approach, considering a method that can be performed during regular wildlife surveys by park rangers in a near future trained on biosecurity and sampling techniques in possible disease introduction scenarios.

We hope this first sampling will provide us insights in microparasites and emerging contaminants found in the environment before emergencies have occurred. The survey will include the assessment of antimicrobial resistance genes as indicators of human disturbance, and disease agents, considering those with the potential of affecting peccary and eventually other wildlife populations.

The project includes other components such as the health assessment of domestic animals from human settlements related to the Reserve; the start of an Environmental & Health Education Program at “Infierno” Community, and for 2016, the evaluation of “clay lick” sites or “saladeros” use and activity (seasonality, frequency and behavior) by WLP.

Fig. 2. Environmental sampling at Tambopata National Reserve, Madre de Dios.

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Notes from the field

Fig. 3. White-lipped peccary with poor body condition at Tambopata National Reserve.

On July 2015, at the surroundings of TRC, a group of WLP was seen with very poor body condition, some of them with areas of poor bristle coverage (Fig.3), similar to the ones reported by Bodmer et al., (2014) in the northern of Perú, while animals from other, larger groups were seen in apparently normal condition. At this time, researchers and nature guides told us of the presence of an "albino huangana", or an albino WLP showing a picture that proved to be an animal with a marked lack of bristles (Fig.4).

If the observed conditions of a single group or individuals are typical or if these conditions are part of a process that affect other groups, they deserve attention. That would reinforces the need to study the health of WLP, promoting surveillance mechanisms against the potential introduction of domestic agents in a highly biodiverse and increasingly threatened region.

Fig. 4. Animal showing a lack of bristles at Tambopata National Reserve. Photo: naturalist guide Yuri Torres

Outstanding record of the white-lipped peccary *Tayassu pecari* (Artiodactyla: Tayassuidae) in Northern Andean montane forests of Peru

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Tayassu pecari is a species widely distributed across the Neotropical region, from southern Mexico to northern Argentina, currently found primarily in the tropical rainforest; however, it is also found in seasonally and xeric environments (Mayer & Wetzel, 1987; Emmons & Feer, 1997). *Tayassu pecari* has an elevational range from sea level to over 2000 m on the eastern slopes of the Andes (Altrichter et al., 2012), but their preferred habitat is the tropical rainforest lowland (Mayer & Wetzel, 1987; Gasparini et al., 2014). This peccary species is considered by IUCN as Vulnerable due to an ongoing population reduction due to habitat loss, illegal hunting, competition with livestock, and epidemics (Keuroghlian et al., 2013). In many areas throughout its range it has disappeared locally (Ayala et al., 2009; Tirira, 2007; Peres, 1996; Keuroghlian et al., 2013; Altrichter et al., 2012), this being attributed to over hunting or epidemics (Fragoso, 1997; Fragoso, 2004).

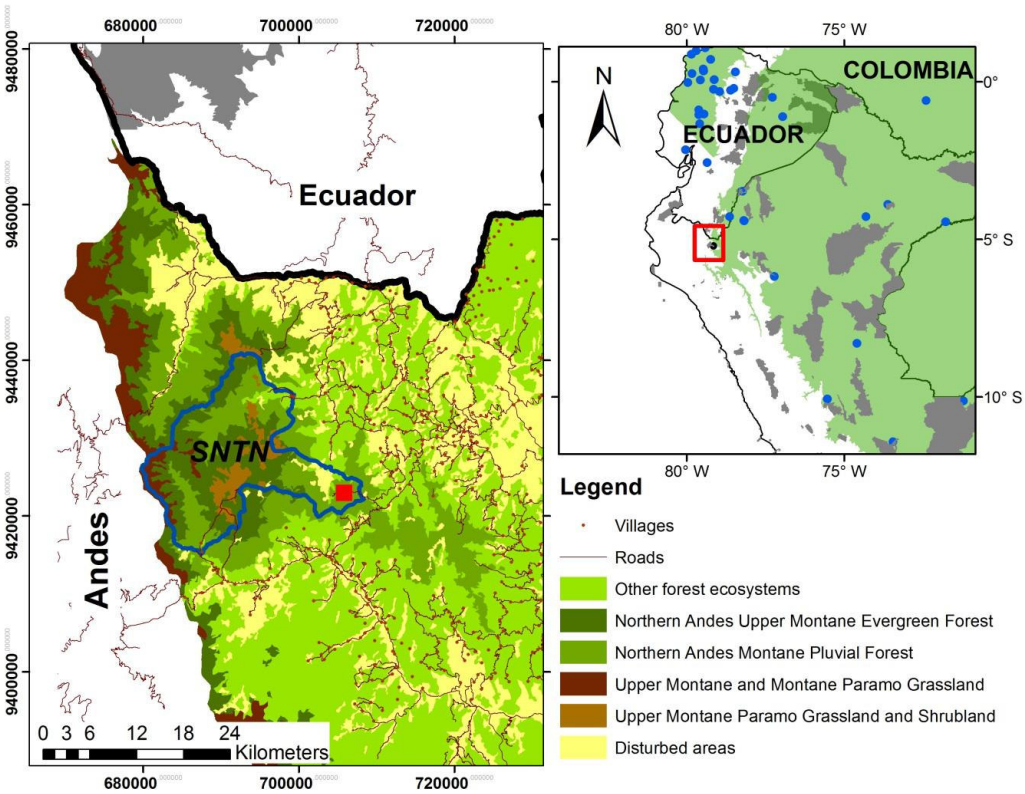

Fig. 1. Records of *Tayassu pecari* (blue circles, Source: Global Biodiversity Information Facility GBIF) along their geographical range, including protected areas (grey) and, record of the Tabaconas Namballe National Sanctuary (red square).

In Peru, the white-lipped peccary has been reported to occur along the Amazon forest up to 900 m along the eastern slope (Bodmer et al., 1997), but the highest elevation record in the country (≈1800 m) was published a century ago (Osgood, 1914). The species has been registered in the Amazon forests of Loreto, Amazonas, Ucayali, San Martín, Huánuco, Pasco, Junín, Madre de Dios, Cusco and Puno departments (Fang et al., 2008) and several protected areas from Loreto, Ucayali and Madre de Dios (Solari et al., 2006; Bodmer et al., 2014; Quintana et al., 2009) (see Fig. 1). Their hunting is considered sustainable in several areas on the Peruvian Amazon (Bodmer et al., 1997) but in other areas overexploitation has extinguished some local populations

(Aquino et al., 2007). This species is considered as Near Threatened in Peru (DS 004-2014-MINAGRI). Subsistence hunting of peccaries is permitted in Peru and pelts are sold as a by-product and have an economic value to local hunters; in fact, there is a CITES permit to export white-lipped peccary pelts for the leather industry, and there is a quota established for trading (Fang et al., 2008; Keuroghlian et al., 2013).

We report the first record of the white-lipped peccary for the Tabaconas Namballe National Sanctuary in Northern Peru (Cajamarca department) (Fig. 1). The Sanctuary is the only Peruvian protected area that preserves representative samples of the paramo and montane forests of the Northern Andes (Riveros et al., 2010). As part of an assessment focused on occupancy of threatened species such as Spectacled Bear (Tremarctos ornatus) and Mountain tapir (*Tapirus pinchaque*) we placed camera-traps (Bushnell Trophy Cam HD) in 60 trap-stations in the Sanctuary, with a density of 1 camera/km^2. Camera-traps were on 24 hours/day. The camera traps were attached to tree trunks at approximately 40 cm above the ground. Cameras were operative from September to November, 2015. We recorded a small herd of white lipped peccary in one station at 2173 m, in two events (October 11, and November 15). This herd consisted of at least 10 individuals, including a female with offspring (2 piglets) (Fig. 2). With this record the range for this peccary is extended ≈100 km west in Peru (Fig. 1) and is the higher elevation for this species along their distribution. In Tabaconas, T. pecari is sympatric with *Tremarctos ornatus*, *Tapirus pinchaque*, *Dasyprocta fuliginosa* and *Nasua nasua*.

An issue of concern is the extremely disturbed landscape where this population of *T. pecari* was recorded, despite of it being inside the Sanctuary (Fig.1). Since this is a large mammal that hardly

Fig. 2. Herd of *T. pecari* recorded at the Tabaconas Namballe National Sanctuary.

goes unnoticed, our record is great finding for this region. According to interviews with local people, this species is resident in this part of the Sanctuary and it is well known by locals. They point out that white-lipped peccary there form herds of approximately 20 individuals, but are difficult to see. Sometimes, herds have been seen outside the sanctuary, in the buffer zone, near the village of Ihuamaca (Fig. 1).

Along their range, white-lipped peccary need large areas to accomplish their ecological requirements, up to 200 km^2 (see Keuroghlian et al. 2013). Due to their gregarious behavior, peccary herds need plenty of food, so in their search of these, they can travel long distances, where there preferences by fruit and palm seeds have been largely recognized (Kiltie, 1982; Bodmer, 1989). These resources are typically found in floodplain forests, so that this species has a strong preference for this habitat (Tobler et al., 2009), but this habitat is absent in Tabaconas; so that, it remains as a study question the food preferences of *T. pecari* in an atypical habitat for the species, such as the one provided by the Sanctuary. In addition, it is important to know if the habitat there is sufficient to maintain a viable population of this species.

Forests below 2000 m within the Sanctuary are protected; however, outside the protected area, forests are threatened by illegal logging of valuable Neotropical conifer species (e.g. *Podocarpus* and *Prumnopitys*) and by forest fragmentation due to land use change, so that available habitat for *T. pecari* is strongly limited. Northern montane forests are one the more threatened ecosystems in Peru (Young & León, 1995) and measures to ensure their long term conservation are insufficient. Despite of this problematic situation this unexpected record highlights the importance of the Tabaconas Namballe National Sanctuary as a key element for ungulate conservation in Northern Peru, especially to provide habitat for, possibly, one of the few populations of white lipped peccaries living in this part of the country.

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¿Evento de mortalidad de pecarí de labios blancos (*Tayassu pecari*) en el Centro de Investigación Tambopata Madre de Dios, Perú?

A white lipped peccary (*Tayassu pecari*) mortality event in The Tambopata Research Center, Madre de Dios, Peru?

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Abstract
Recent mortality events of white-lipped peccaries (*Tayassu pecari*) recorded in Tambopata Peru initiated a monitoring effort to document a potential massive died off of the populations of this species in this Amazonian forest. However, no evidences of massive mortality were found and the few carcasses investigated were in an advanced decompossed status and gave no evidence of disease or any apparent mortality cause during necropsy. More research including a close monitoring program of the health of the populations and sanitary vigilance in key sites are needed to elucidate the causes of the possible die offs of white-lipped peccary.

El Centro de Investigación Tambopata (Tambopata Research Center- TRC) es un albergue turístico ubicado en el sureste del Perú en el departamento de Madre de Dios en la Reserva Nacional Tambopata. Presenta una gran biodiversidad, con mamíferos de gran importancia ecológica como el pecarí de labios blancos o huangana (*Tayassu pecari*), los cuales se observan frecuentemente en las trochas ubicadas en zonas de terra firme y bosque sucesional del Centro. Durante el 2014, investigadores y trabajadores del Centro observaron un incremento en el número de individuos de huangana (*T. pecari*) en zonas aledañas al Centro, así como múltiples apariciones en la Colpa Colorado. Sin embargo también durante los primeros meses (enero y febrero) del año 2014, se registró el hallazgo de cinco individuos muertos de *T. pecari* en las inmediaciones del Centro, cuatro de ellos en avanzado estado de descomposición (restos), y solo uno en condiciones para realizar una necropsia parcial. El animal no presentó signos de depredación, y al examinar los órganos internos se evidenció lesiones compatibles con neumonía.

Esta situación generó una alerta en investigadores y operadores turísticos de la zona, preocupados por la posibilidad de ocurrencia de un evento de mortalidad masiva. Debido a esto se formó un equipo de monitoreo encargado de realizar el levantamiento temprano de información sobre un posible evento de mortalidad. Durante cinco semanas se recorrieron las trochas en busca de individuos muertos, así como de grupos o manadas para su seguimiento. Adicionalmente, se observó la condición corporal de los individuos, se enfatizó la observación de posibles signos clínicos y se realizó la colecta de muestras de materia fecales. Se determinó que los animales no excedían una condición corporal de dos, en escala del uno (pobre condición) al 5 (obesidad), lo cual podría estar relacionado con la época y escasez de recursos de la zona.

A pesar de observar algunos individuos con signos clínicos inespecíficos; como dos hembras subadultas que mostraron decaimiento, menor número de hozamientos y escasa interacción con el resto del grupo, y otra hembra subadulta con una leve claudicación de apoyo en miembro

posterior izquierdo; no se apreció otros signos como secreciones, estornudos, diarrea, etc. que se pudieran relacionar con alguna condición más específica o enfermedad que pudiera relacionarse con el evento de mortalidad. Las 20 muestras fecales colectadas se analizaron mediante distintas técnicas parasitológicas (Método directo, de flotación, sedimentación, Ritchie y tinción Ziel Neelsen modificado). El 70% de las muestras fue positivo a por lo menos una estructura parasitaria: el 45% fue positivo para Ascaris sp., el 10% a Ancylostomatidae, 5% a Spiruroideo y 5% a Trichuris sp., mientras que en el 20% de las muestras se apreciaron huevos de Tremátodo, resultados compatibles con la información reportada previamente para esta especie en el departamento de Madre de Dios (Carlos et al., 2008).

Durante el monitoreo, se detectaron 05 individuos muertos (carcasas), cerca de las trochas del Centro (Fig. 1). Los individuos se encontraron en dos diferentes grados de descomposición, principalmente “restos” caracterizado por la presencia de cartílagos, piezas óseas y ausencia de tejidos blandos (Fig. 2). Solo uno de ellos se encontraba en putrefacción activa con licuefacción de tejidos y liberación de fluidos descompuestos, que dificultó realizar una necropsia. La condición de las muestras no permitió la realización de estudios histopatológicos.

Fig. 1: Individuo muerto de pecari de labios blanco.

No se cuenta con información que respalde la evolución de los procesos de descomposición en animales muertos bajo las condiciones ambientales de la zona; sin embargo por la naturaleza de las carcasas se asume que los restos corresponden a individuos cuya mortalidad haya ocurrido por lo menos dos semanas antes de su hallazgo, exceptuando el animal al que se realizó la necropsia parcial, cuya muerte podría haber ocurrido 3 a 5 días con anterioridad. El hallazgo de cinco individuos no permitió corroborar si se tratara de un evento de mortalidad masiva ni permitió hacer una asociación de mortalidad por edad o sexo. Al no tener información sobre la talla poblacional, resulta difícil inferir la significancia que puedan tener esta información a nivel poblacional.

Ante este escenario surge la pregunta de si en realidad se trató de un evento de mortalidad masiva, y de serlo si es un evento de mortalidad episódica, por un suceso eventual (brotes de enfermedad, efectos estocásticos o climáticos) o crónica, por pérdidas graduales o constantes en el tiempo (como efectos por predación o

Fig. 2. Cartilago de pecari de labios blanco.

enfermedades de baja morbilidad). La información obtenida no permite elucidar un patrón definido. Además, para la evaluación de los patrones de mortalidad crónica, se deberá tener en cuenta la evaluación de factores como cambios graduales en la vegetación, agentes infecciosos, efectos de predación, entre otros. Mientras que para la evaluación de patrones de mortalidad episódica, se debería considerar a agentes de enfermedad y aspectos relacionados al clima. Es de importancia evaluar si algún factor adicional (actividad antrópica) podría estar involucrado.

Es necesario considerar causas de mortalidad denso dependientes, recomendándose realizar estudios que permitan correlacionar episodios de mortalidad con tamaños poblacionales a fin de cuantificar su efecto en la población, como lo propuesto en otros estudios (Cassaigne et al., 2010). Sobre este tema, Fragoso (2004), sugiere que la disminución observadas en poblaciones de *T. pecari* pueden estar relacionados a brotes de enfermedad causados por agentes endémicos o exóticos (introducidos por animales domésticos). Adicionalmente, se considera que las poblaciones de *T. pecari* se vuelven más vulnerables a las enfermedades cuando sus poblaciones exceden la capacidad de carga del ambiente. Existen métodos analíticos para comprender las causas de mortalidad no independientes, la cual requiere la evaluación continua de los factores de riesgo antes del eventos (Joly et al., 2009). Además, se debe considerar que las mortalidades pueden ser de origen multifactorial, donde un factor incremente la probabilidad de mortalidad por otro factor. Es así que eventos estocásticos o estresantes ambientales, pueden servir de base para el desarrollo de una enfermedad, inclusive a partir de agentes propios de los animales.

Es necesario resaltar que el seguimiento de grupos y búsqueda de cadáveres representa un esfuerzo económico elevado, con posibilidades reducidas de encontrar animales en condiciones adecuadas para su análisis. A pesar de esto se necesitan mayores investigaciones para conocer patrones de mortalidad basal, y dilucidar si este tipo de eventos corresponden a causas de mortalidad crónica o episódica. Por lo cual, se recomienda la implementación de programas a largo plazo orientados a conocer el estado de salud de especies clave como *T. pecari*, los cuales incluyan una vigilancia sanitaria en sitios clave, o el uso de especies centinelas que permitan conocer los agentes que pudieran estar ingresando al área natural protegida mediante actividades humanas. Así como el levantamiento de información sobre factores que puedan alterar o modificar la composición y dinámica de agentes infecciosos dentro de sus poblaciones y valoración de los factores de riesgo que puedan favorecer la introducción de agentes infecciosos de origen humano-doméstico. Además, sería de gran utilidad generar una red de observadores que permitan servir de referencia para evaluar y atender tempranamente eventos de esta naturaleza.

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Suiform photos

Pig hunt in East Kalimantan in 2005. Left: head of Sunda bearded pig. Photo: R. Dennis

Photo taken somewhere in the Ardennes forest, Belgium.

Source: https://fr-fr.facebook.com/UneArdeurDAvance/

Photo taken in Laos by Clinton Rivers.

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Ministère de l'Agriculture,
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Petiton
Wild boars in India

Dear Animal Lovers,
Your action is needed today; to protect the Wild Boar from being added to the vermin list.
The recent announcements by the Union environment , forest and climate change govt of India minister Mr.Prakash Javedekar that animals like Wild Boar and Blue Bull (Nilgai) would be soon added to the list of vermin continues to post threat for the ecology. With farmers particularly from South Indian states demanding the culling of boars that stray in to paddy fields the policy makers have started thinking about the welfare of farmers ignoring the animal rights and have also failed to understand the Concept of prey predator biology.

Wild boar status

Wild boar is protected under wildlife protection act 1972 and is covered under schedule 3 of the act. This timid species are often misunderstood. This controversial species also needs further specific legislation to protect very own survival. For the fact that they are disturbing the crops a total government nod to treat them as vermin will only result in elimination of this species from our polluted forests and its buffer zones. Further there is no major scientific study on the hapless animal which is usually ignored during wildlife census due to their large presence.

Indian wild boar. Photo: Jayapradha Centre for Endangered Species Conservation and Natural History.

Wildlife activists and biologists have already termed the concept of vermin elimination as a disaster to ecosystem, but farmers opine the move would help them to enhance the crop yield in Tamil Nadu, Kerala and North India where the crop damages are high due to these animals.

Why wild boar needs to be protected:
Big predators like Tiger and leopard at times rely on wild boar and removal of them from the protected list will result in hunting affecting the food chain of predators. The old animals or lactating felines at times require more feed and during such times the wild boar is easy prey for such animals. Even for sub adult leopards, tigers, wild boar and jackal they need boar as a alternate died in their food chain.
The state governments are already providing compensation for the framers if wild animals including elephant and boar damage their crops and this system should be continued with more

early release of compensation. Passing orders to farmers will entertain hunting and boar will end in the plates of meat consumers.
Reports of wild boar damaging forests and agricultural fields have to be understood in details. These animals stray into agricultural lands due to depleting forests. Further reduction in predator populations also influxes the breeding of boar. This is a scientific issue and needs to be addressed with ecological solutions.
While the economical damage of the boar are only taken they play the role of ingesting crops dropping waste that are rich in nutrient which increase the soil richness, which is otherwise polluted through pesticides and insecticides.
Please write to the Ministry right now and ask them to stop the Wild Boar will be added to the list of vermin in India.

For Animal Rights,
Director
SCAN FOUNDATION
Jayapradha Centre for Endangered Species Conservation and Natural History.

Editor's note
Wild boars in India have been scientifically described as subspecies of the Eurasian wild boar. According to Meijaard et al (2011) there are three wild boar subspecies in India: *Sus scrofa affinis, S.s. cristatus* and *S.s.davidi*.
Considering its distinciveness *S.s.affinis* should be treated as a distinct species (Meijaard, pers. comm.).

To sign this petition, please visit

http://www.ipetitions.com/petition/wanted-alive

Reference
Meijaard, E., d'Huart, J.P. and Oliver, W. (2011) Family Suidae (Pigs). Pp. 248-291 in: Wilson, D.E. & Mittermeier, R.A. Eds (2011), Handbook of the Mammals of the World. Vol. 2. Hoofed Mammals, Lynx Edicions, Barcelona, Spain.

Funding opportunities for scientific research in and conservation projects about wild pig species

IUCN/SSC Wild Pig Specialist Group has gathered informations about funding opportunities for scientific research in and conservation projects about wild pig species.

These informations can be downloaded on:

https://sites.google.com/site/wildpigspecialistgroup/iucnssc-wild-pig-specialist-group/research-and-conservation-priorities/funding-opportunities

Any requests about funding should be sent directly to the addresses mentioned in the list.

Veterinary, Genetic and Physiological Studies

Prevalence of *Yersinia enterocolitica* and *Yersinia pseudotuberculosis* in wild boars in the Basque Country, northern Spain.
Arrausi-Subiza M, Gerrikagoitia X, Alvarez V, Ibabe JC, Barral M
Acta Vet Scand. 2016 Jan 20;58(1):4. doi: 10.1186/s13028-016-0184-9.
Background:
Yersiniosis is a zoonosis widely distributed in Europe and swine carry different serotypes of *Yersinia enterocolitica* and *Y. pseudotuberculosis*. The aim of this study was to determine the prevalence of *Y. enterocolitica* and *Y. pseudotuberculosis* in wild boars in northern Spain. The blood of wild boars (n = 505) was sampled between 2001 and 2012. Seroprevalence was determined in 490 serum samples with an indirect enzyme-linked immunosorbent assay. Seventy-two of the animals were also examined for the presence of *Y. enterocolitica* or *Y. pseudotuberculosis* in the tonsils with real-time polymerase chain reaction. All the tonsils were analysed twice, directly and after cold enrichment in phosphate-buffered saline supplemented with 1 % mannitol and 0.15 % bile salts.
Results:
Antibodies directed against *Y. enterocolitica* and *Y. pseudotuberculosis* were detected in 52.5 % of the animals. Yersinia enterocolitica was detected with real-time polymerase chain reaction in 33.3 % of the wild boars and *Y. pseudotuberculosis* in 25 %. Significant differences were observed according to the sampling year, and the highest prevalence was during winter and spring. The highest antibody levels and *Y. enterocolitica* prevalence were observed in mountainous areas at altitudes higher than 600 m, with very cold winters, and with the highest annual rainfall for each dominant climate. Areas with low and medium livestock populations were associated with the highest seroprevalence of *Yersinia* spp. in wild boars, whereas areas with high ovine populations had the highest prevalence of *Y. enterocolitica*.
Conclusion:
This study shows that Y. *enterocolitica* and *Y. pseudotuberculosis* are highly prevalent among wild boars in the Basque country, with *Y. enterocolitica* most prevalent. The risk of infection among wild boars is influenced by the season and the area in which they live.

Effect of including sweet potato (*Ipomoea batatas* Lam) meal in finishing pig diets on growth performance, carcass traits and pork quality.
Pietrosemoli S, Moron-Fuenmayor OE, Paez A, Villamide MJ.
Anim Sci J. 2016 Jan 20. doi: 10.1111/asj.12546.
The partial replacement of a commercial concentrate at 10-20% and 15-30% (the first percentage of each dietary treatment corresponded to weeks 1-3 and the second to weeks 4-7 of the experiment, respectively) by sweet potato meal (SPM; 70% foliage: 30% roots) was evaluated for growth performance, carcass yield, instrumental and sensory pork quality using 36 commercial crossbred pigs (56.8 ± 1.3 kg initial body weight). Three dietary treatments were compared in a randomized complete block design. Most growth, carcass traits and pork quality variables were not affected by the SPM inclusion. Growth performance averaged 868 g/day and feed efficiency 0.24 kg/kg. However, feed intake increased 2.2% (P = 0.04) in pigs fed the 10-20% SPM diets, in a similar order of magnitude as the decrease in dietary energy. Despite an increase in

gastrointestinal tract as a percent of hot carcass weight (+14.7%) (P = 0.03) with SPM inclusion, carcass yield averaged 69.4%. Conversely, decreases in loin yield (-4.2%) (P = 0.05), backfat thickness (-6.0%) (P < 0.01) and pork tenderness (-13%) (P = 0.02) were observed with 15-30% SPM inclusion. Results suggest that up to 20% SPM inclusion is a viable feed strategy for finishing pigs, easily replicable in small farm settings.

African swine fever virus transmission cycles in Central Europe: Evaluation of wild boar-soft tick contacts through detection of antibodies against Ornithodoros erraticus saliva antigen.

Pietschmann J, Mur L, Blome S, Beer M, Pérez-Sánchez R, Oleaga A, Sánchez-Vizcaíno JM
BMC Vet Res. 2016 Jan 4;12(1):1. doi: 10.1186/s12917-015-0629-9.

Background:

African swine fever (ASF) is one of the most complex viral diseases affecting both domestic and wild pigs. It is caused by ASF virus (ASFV), the only DNA virus which can be efficiently transmitted by an arthropod vector, soft ticks of the genus Ornithodoros. These ticks can be part of ASFV-transmission cycles, and in Europe, O. erraticus was shown to be responsible for long-term maintenance of ASFV in Spain and Portugal. In 2014, the disease has been reintroduced into the European Union, affecting domestic pigs and, importantly, also the Eurasian wild boar population. In a first attempt to assess the risk of a tick-wild boar transmission cycle in Central Europe that would further complicate eradication of the disease, over 700 pre-existing serum samples from wild boar hunted in four representative German Federal States were investigated for the presence of antibodies directed against salivary antigen of Ornithodoros erraticus ticks using an indirect ELISA format.

Results:

Out of these samples, 16 reacted with moderate to high optical densities that could be indicative of tick bites in sampled wild boar. However, these samples did not show a spatial clustering (they were collected from distant geographical regions) and were of bad quality (hemolysis/impurities). Furthermore, all positive samples came from areas with suboptimal climate for soft ticks. For this reason, false positive reactions are likely.

Conclusion:

In conclusion, the study did not provide stringent evidence for soft tick-wild boar contact in the investigated German Federal States and thus, a relevant involvement in the epidemiology of ASF in German wild boar is unlikely. This fact would facilitate the eradication of ASF in the area, although other complex relations (wild boar biology and interactions with domestic pigs) need to be considered.

Porcine hokovirus in wild boar in Portugal.

Miranda C, Coelho C, Vieira-Pinto M, Thompson G.
Arch Virol. 2015 Dec 28.

Porcine hokovirus (PHoV), also referred to as porcine parvovirus 4 (P-PARV4), a recently discovered parvovirus of swine that is closely related to human parvovirus 4/5 (H-PARV4/5), was first described in Hong Kong. To evaluate the occurrence of P-PARV4 in Portuguese wild boars in the hunting season of 2011/2012, liver and serum samples were tested. P-PARV4 was detected in 24 % of the wild boars analyzed. Phylogenetic analysis showed a close relationship between the P-PARV4 isolates and other P-PARV4 reference strains. This virus appears to be emerging,

with yet unknown implications for public health.

Evolution and molecular epidemiology of Classical swine fever virus during a multi-annual outbreak among European wild boar.
Goller KV, Gabriel C, Le Dimna M, Le Potier MF, Rossi S, Staubach C, Merboth M, Beer M, Blome S J Gen Virol. 2015 Dec 18. doi: 10.1099/jgv.0.000376.
Classical swine fever (CSF) is a viral disease of pigs with tremendous socio-economic impact. In outbreak situations, genetic typing is carried out for the purpose of molecular epidemiology in both domestic pigs and wild boar. These analyses are usually based on harmonized partial sequences. However, for high resolution analyses towards the understanding of genetic variability and virus evolution, full-genome sequences are more appropriate. In this study, a unique set of representative virus strains was investigated that was collected during an outbreak in French free-ranging wild boar in the Vosges-du-Nord Mountains between 2003 and 2007. Comparative sequence and evolutionary analyses of the nearly full-length sequences showed only slow evolution of CSFV strains over the years, and no impact of vaccination on mutation rates. However, substitution rates varied among protein genes and furthermore, a spatial and temporal pattern could be observed whereby two separate clusters were formed that coincided with physical barriers.

Genome-wide association study reveals novel loci for litter size and its variability in a Large White pigpopulation.
Sell-Kubiak E, Duijvesteijn N, Lopes MS, Janss LL, Knol EF, Bijma P, Mulder HA.
BMC Genomics. 2015 Dec 9;16(1):1049. doi: 10.1186/s12864-015-2273-y.
Background:
In many traits, not only individual trait levels are under genetic control, but also the variation around that level. In other words, genotypes do not only differ in mean, but also in (residual) variation around the genotypic mean. New statistical methods facilitate gaining knowledge on the genetic architecture of complex traits such as phenotypic variability. Here we study litter size (total number born) and its variation in a Large White pig population using a Double Hierarchical Generalized Linear model, and perform a genome-wide association study using a Bayesian method.
Results:
In total, 10 significant single nucleotide polymorphisms (SNPs) were detected for total number born (TNB) and 9 SNPs for variability of TNB (varTNB). Those SNPs explained 0.83 % of genetic variance in TNB and 1.44 % in varTNB. The most significant SNP for TNB was detected on Sus scrofa chromosome (SSC) 11. A possible candidate gene for TNB is ENOX1, which is involved in cell growth and survival. On SSC7, two possible candidate genes for varTNB are located. The first gene is coding a swine heat shock protein 90 (HSPCB = Hsp90), which is a well-studied gene stabilizing morphological traits in Drosophila and Arabidopsis. The second gene is VEGFA, which is activated in angiogenesis and vasculogenesis in the fetus. Furthermore, the genetic correlation between additive genetic effects on TNB and on its variation was 0.49. This indicates that the current selection to increase TNB will also increase the varTNB.
Conclusions:
To the best of our knowledge, this is the first study reporting SNPs associated with variation of a trait in pigs. Detected genomic regions associated with varTNB can be used in genomic selection

to decrease varTNB, which is highly desirable to avoid very small or very large litters in pigs. However, the percentage of variance explained by those regions was small. The SNPs detected in this study can be used as indication for regions in the Sus scrofa genome involved in maintaining low variability of litter size, but further studies are needed to identify the causative loci.

Assessment of reproductive and growth performances of pig breeds in the peri-urban area of Douala (Equatorial Zone).
Kouamo J, Tankou WF, Zoli AP, Bah GS, Ongla AC
Open Vet J. 2015;5(1):64-70.
The aim of this study was to evaluate the reproductive and growth performances of pig breeds in Douala, Cameroon. The reproductive performance of gilts and multiparous sows (38 per group) from 8 selected farms were monitored and controlled. Thereafter, piglets were controlled from birth to weaning age. The age at first service (AFS), fertility index (FI), fecundity, age at first farrowing (AFF), weight at first farrowing (WtFF) and litter size (LS) of gilts were 179.97 ± 25.40 days; 1.76 ± 0.77; 100 ± 0.00; 350.47 ± 40.58 days; 107.26 ± 31.85 kg and 7.18 ± 1.93 piglets, respectively. In sows, the FI, fecundity, LS and farrowing interval (FarI) were 1.13 ± 0.34; 100 ± 0.00; 9.03 ± 2.14 piglets and 179.63 ± 25.14 days, respectively. FI and LS were better in sows compared to gilts (P = 0.000). The sex ratio was 0.63. Local breed animals reared in semi-modern farms and fed mixed feed showed the lowest WtFF. In piglets, the average birth weight (kg), the average weaning weight (kg), age at weaning (days) and survival rate (%) until weaning were 1.32 ± 0.20, 10.60 ± 1.41, 56.86 ± 8.24 and 48.43, respectively. These results indicated that reproductive performance is strongly influenced by breed, feed and farm type.

Fluctuating asymmetry as a proxy for oxidative stress in wild boar.
Canovas, M., G. Mentaberre, et al. (2015). Mammalian Biology 80(4): 285-289.
The study of fluctuating asymmetry (FA) in living organisms has produced contradictory results over the past few decades of research. Though the protocol for measuring FA is firmly established, the sources of FA remain unclear in many cases. Our goal is to examine the relationship between FA and both the concentration of biomarkers of reactive oxygen species (ROS) and body condition in a medium-sized mammal, the European wild boar (Sus scrofa). Using a Partial Least Squares regression (PLSr), we found a positive significant relationship (Stone-Geisser test) between oxidative stress and FA but a negative relationship between oxidative stress and body condition. Our results suggest that FA can be used to assess the physiological costs associated with oxidative stress in mammals.

The control of classical swine fever in wild boar.
Moennig V. Front Microbiol. 2015 Nov 6;6:1211. doi: 10.3389/fmicb.2015.01211. eCollection 2015.
Classical swine fever (CSF) is a viral disease with severe economic consequences for domestic pigs. Natural hosts for the CSF virus (CSFV) are members of the family Suidae, i.e., Eurasian wild boar (sus scrofa) are also susceptible. CSF in wild boar poses a serious threat to domestic pigs. CSFV is an enveloped RNA virus belonging to the pestivirus genus of the Flaviviridae family. Transmission of the infection is usually by direct contact or by feeding of contaminated meat products. In recent decades CSF has been successfully eradicated from Australia, North

America, and the European Union. In areas with dense wild boar populations CSF tends to become endemic whereas it is often self-limiting in small, less dense populations. In recent decades eradication strategies of CSF in wild boar have been improved considerably. The reduction of the number of susceptible animals to a threshold level where the basic reproductive number is R 0 < 1 is the major goal of all control efforts. Depending on the epidemiological situation, hunting measures combined with strict hygiene may be effective in areas with a relatively low density of wild boar. Oral immunization was shown to be highly effective in endemic situations in areas with a high density of wild boar.

Widespread detection and characterization of porcine parainfluenza virus 1 in pigs in the United States.
Palinski RM, Chen Z, Henningson JN, Lang Y, Rowland RR, Fang Y, Prickett J, Gauger PC, Hause BM
J Gen Virol. 2015 Nov 17. doi: 10.1099/jgv.0.000343.
Porcine parainfluenza virus 1 (PPIV1) was first identified in 2013 in slaughterhouse pigs in Hong Kong, China. Here, two near complete genomes were assembled from swine exhibiting acute respiratory disease that were 90.0-95.3% identical to Chinese PPIV1. Analysis of the HN gene from 10 additional PPIV1-positive samples found 85.0-95.5% identity, suggesting genetic diversity between strains. Molecular analysis identified 17 out of 279 (6.1%) positive samples from pigs with respiratory disease. Eleven nursery pigs from a naturally infected herd were asymptomatic, however, nasal swabs from six pigs and the lungs of a single pig were qRT-PCR positive. Histopathology identified PPIV1 RNA in the nasal respiratory epithelium and trachea. Two serological assays demonstrated seroconversion of infected pigs and further analysis of 59 swine serum samples found 52.5% and 66.1% seropositivity, respectively. Taken together, the results confirm the widespread presence of PPIV1 in the United States swineherd.

Why are most EU pigs tail docked? Economic and ethical analysis of four pig housing and management scenarios in the light of EU legislation and animal welfare outcomes.
D'Eath RB, Niemi JK, Vosough Ahmadi B, Rutherford KM, Ison SH, Turner SP, Anker HT, Jensen T, Busch ME, Jensen KK, Lawrence AB, Sandøe P.
Animal. 2015 Nov 2:1-13.
To limit tail biting incidence, most pig producers in Europe tail dock their piglets. This is despite EU Council Directive 2008/120/EC banning routine tail docking and allowing it only as a last resort. The paper aims to understand what it takes to fulfil the intentions of the Directive by examining economic results of four management and housing scenarios, and by discussing their consequences for animal welfare in the light of legal and ethical considerations. The four scenarios compared are: 'Standard Docked', a conventional housing scenario with tail docking meeting the recommendations for Danish production (0.7 m2/pig); 'Standard Undocked', which is the same as 'Standard Docked' but with no tail docking, 'Efficient Undocked' and 'Enhanced Undocked', which have increased solid floor area (0.9 and 1.0 m2/pig, respectively) provision of loose manipulable materials (100 and 200 g/straw per pig per day) and no tail docking. A decision tree model based on data from Danish and Finnish pig production suggests that Standard Docked provides the highest economic gross margin with the least tail biting. Given our assumptions, Enhanced Undocked is the least economic, although Efficient Undocked is better economically and both result in a lower incidence of tail biting than Standard Undocked but higher

than Standard Docked. For a pig, being bitten is worse for welfare (repeated pain, risk of infections) than being docked, but to compare welfare consequences at a farm level means considering the number of affected pigs. Because of the high levels of biting in Standard Undocked, it has on average inferior welfare to Standard Docked, whereas the comparison of Standard Docked and Enhanced (or Efficient) Undocked is more difficult. In Enhanced (or Efficient) Undocked, more pigs than in Standard Docked suffer from being tail bitten, whereas all the pigs avoid the acute pain of docking endured by the pigs in Standard Docked. We illustrate and discuss this ethical balance using numbers derived from the above-mentioned data. We discuss our results in the light of the EU Directive and its adoption and enforcement by Member States. Widespread use of tail docking seems to be accepted, mainly because the alternative steps that producers are required to take before resorting to it are not specified in detail. By tail docking, producers are acting in their own best interests. We suggest that for the practice of tail docking to be terminated in a way that benefits animal welfare, changes in the way pigs are housed and managed may first be required.

The high prevalence of hepatitis E virus infection in wild boars in Ibaraki Prefecture, Japan.

Motoya T, Nagata N, Komori H, Doi I, Kurosawa M, Keta T, Sasaki N, Ishii K.

2016 Jan 1;77(12):1705-9. doi: 10.1292/jvms.15-0173. Epub 2015 Aug 2.

Hepatitis E virus (HEV) is known as a causative agent of zoonosis and food poisoning. Pigs and some species of wild animals, including wild boar, are known to be a reservoir of HEV. In this study, we investigated the situation regarding HEV infection in wild boars in Ibaraki Prefecture, Japan. Serum, liver and feces samples from 68 animals J Vet Med Sci.were collected, and the presence or absence of HEV genomic RNA and HEV antibodies were analyzed. The viral genome was detected in samples from 7 (10.3%) animals, with all HEVs classified as genotype 3, subtype 3b. HEV antibodies were detected in samples from 28 (41%) animals. This report demonstrates for the first time the high prevalence of HEV infection in wild boars in Ibaraki Prefecture.

The complete sequence of the mitochondrial genome of Lantang pig (*Sus scrofa*).

Ran ML, Liu Z, Yang AQ, Li Z, Chen B.

Mitochondrial DNA. 2016 Mar;27(2):1376-7. doi: 10.3109/19401736.2014.947588. Epub 2014 Aug 11.

Lantang pig is a native breed of Guangzhou Province in China. It is the first time that the complete mitochondrial genome sequence of Lantang pig is reported in this work, which is determined through the PCR-based method. The total length of the mitognome is 16,709 bp, which contains 2 ribosomal RNA genes, 22 tRNA genes, 13 PCGs and 1 conntrol region (D-loop region, Table 1). The total base composition of Lantang pig mitochondrial genome is 34.69% for A, 26.18% for C, 25.82% for T and 13.31% for G, in the order A>C>T>G. The complete mitochondrial genome of Lantang pig provides an important data in genetic mechanism and the evolution genomes.

The complete mitochondrial genome sequence of Diannan small-ear pig (*Sus scrofa*).

Wang LY, Xu D, Xiao DF, Ma HM.

Mitochondrial DNA. 2016 Mar;27(2):1309-10. doi: 10.3109/19401736.2014.945570. Epub 2014

Aug 4.
In this study, the complete mitochondrial genome sequence of Diannan small-ear pig in Yunnan Province was firstly reported, which was determined through polymerase chain reaction (PCR) method. The total length of mitochondrial genome of Diannan small-ear pig was 16720 bp, including 34.77% A, 26.18% C, 25.81% T and 13.24% G, and in the order A > C > T > G. Mitochondrial genome contained a major non-coding control region (D-Loop region), 2 ribosomal RNA genes, 13 protein-coding genes (PCGs) and 22 transfer RNA genes. The mitochondrial genome of Diannan small-ear pig provides an important data set for the study on genetic mechanism.

The complete sequence of the mitochondrial genome of Rongchang pig (*Sus Scrofa*).
Wang LY, Xu D, Ma HM.
Mitochondrial DNA. 2016 Mar;27(2):1279-80. doi: 10.3109/19401736.2014.945555. Epub 2014 Aug 4.
Rongchang pig is one of the native breeds in Sichuan province in China. The total length of mitochondrial genome of Rongchang pig is 16,710 bp, including 34.67% A, 26.18% C, 25.82% T and 13.33% G, and in the order A > C > T > G. Mitochondrial genome contains a major non-coding control region (D-Loop region), 2 ribosomal RNA genes, 13 protein-coding genes (PCGs) and 22 transfer RNA genes. This is the first report of the complete mitochondrial genome sequence about Rongchang pig. The mitochondrial genome of Rongchang pig subsequently provides an important information in genetic mechanism and the evolution genomes.

Using non-invasive faecal hormone metabolite monitoring to detect reproductive patterns, seasonality and pregnancy in red river hogs (*Potamochoerus porcus*)
Bryant J, Wielebnowski N, Gierhahn D, Houchens T, Bellem A, Roberts A, Daniels J
Journal of Zoo and Aquarium Research 2016 Vol 4(1):14-21
Few studies have been conducted on red river hog (*Potamochoerus porcus*) reproductive biology in zoos. Furthermore, in spite of regular breeding efforts in zoos, reproductive success has been relatively poor for this species, particularly in the North American population. In this study, we used faecal hormone metabolite monitoring to analyse near daily samples from two males and three females over several years to gain insight into their patterns of reproductive hormone secretion. Both a progesterone and a testosterone enzyme immunoassay (EIA) were validated and subsequently used to monitor reproductive patterns, seasonality, ovulatory activity and a successful pregnancy. The findings indicate that female red river hogs are seasonally polyoestrous. Regular cycles were observed from approximately December through August and an annual period of anoestrous was observed from approximately September until December. Average cycle length for all females was 23 days ± 1.19, range 13–30 days. Androgen excretion patterns of the two males did not show clear seasonal patterns. Only one male experienced an increase in androgen levels (141.53 ± 45.55 ng/g) corresponding with the female seasonal oestrous period. There was, however, some evidence of possible androgen suppression between the two males, and a potential 'boar effect' on a young female upon first introduction to a male. Ultimately, this information may increase our understanding of this species' reproductive biology and serve as a baseline for more in-depth follow-up studies to identify specific patterns associated with reproductive success.

Maxillary canine tooth growth in Babirusa (genus *Babyrousa*)
Macdonald A, Leus K, Hoare H
Journal of Zoo and Aquarium Research 2016 Vol 4(1): 22-29
Babirusa (genus *Babyrousa*), wild pigs from the Indonesian island of Sulawesi and neighbouring small islands, most obviously differ from other wild pigs in that the maxillary (upper) canine teeth of the males pierce through the skin of the nose and curl over the forehead. The females sometimes show small teeth piercing through the nasal skin. The process of anatomical growth of these maxillary canine teeth and the remodelling of the alveolar processes (tooth sockets) within which they grow is here illustrated and explained for the first time. Forty-four skulls in museum and private collections were studied. They represented all ages, from neonates to adult animals. The deciduous maxillary canine teeth of both sexes begin life by pointing rostrally and slightly ventrally into the oral cavity and then appear to be rotated dorsally and medially. The permanent teeth continue this process, rotating through approximately 90 degrees, from pointing rostrally to pointing dorsally through the nasal skin. The structure of the alveolar process is in the meantime modified and develops a bony flange caudally. We hypothesise that some form of connective tissue, stretching from the flange to the subcutaneous tissues of the forehead, exerts a caudally orientated pulling force that results in the gradual rotation of the alveolar process. The contributory role in this pulling force of bone growth at the facial sutures is also highlighted.

Management of toxic mastitis in a babirusa (*Babyrousa celebensis*).
Alexander AB, Hanley CS, Fischer MT, Padilla LR.
J Zoo Wildl Med. 2015 Dec;46(4):949-52. doi: 10.1638/2015-0129.1.
A 1 yr 8 mo-old, previously healthy, primiparous female babirusa (*Babyrousa celebensis*) presented acutely recumbent and minimally responsive approximately 36 hr after giving birth to a single piglet. Toxic mastitis was diagnosed based on physical examination and laboratory results. The mammary tissue was firm, discolored, and produced negligible amounts of milk. All of the teats were eventually affected, resulting in the inability to provide adequate nutrition to the piglet. Although toxic mastitis has a poor prognosis in domestic sows, this babirusa recovered completely with aggressive management, including antibiotics and supportive care.

The complete mitochondrial genome of Diqing wild boar (*Sus verrucosus* breed Diqing wild boar).
Wang YF, Lei T, Wang HJ, Wang KY, Yang J, Liu XM, Yao N, Du LN, Dong YY, Xu N, Ma JS.
Mitochondrial DNA. 2016 Mar;27(2):1030-1. doi: 10.3109/19401736.2014.926540. Epub 2014 Jun 27.
In the present study, the complete mitochondrial genome sequence of the diqing wild boar (*Sus verrucosus* breed diqing wild boar) was reported for the first time. The total length of the mitogenome was 16,506 bp. It contained the typical structure, including two ribosomal RNA genes, 13 protein-coding genes, 22 transfer RNA genes and one non-coding control region (D-loop region) as that of most other wild boars. The overall composition of the mitogenome was estimated to be 34.9% for A, 26.1% for T, 26.0% for C and 13.0% for G showing an A-T (61.0%)-rich feature. The mitochondrial genome analyzed here will provide new genetic resource to uncover wild boars' genetic diversity.

The complete mitochondrial genome of Celebes wild boar, *Sus celebensis*

(Cetartiodactyla: Suina: Suidae), and comparative mitochondrial genomics of the *Sus* species.
Hu XD, Li K, Gao LZ.
Mitochondrial DNA. 2016 Mar;27(2):1476-7. doi: 10.3109/19401736.2014.953099. Epub 2014 Aug 27.
In this study, the complete mitochondrial (mt) genome sequence of *Sus celebensis* was firstly determined. The total genome was 16,481 bp in length and its overall base composition was estimated to be 34.9% for A, 25.8% for T, 26.2% for C, 13.1% for G, respectively, indicating an A-T (60.7%)-rich feature in Celebes wild boar mitogenome. It harbored 13 protein-coding genes, two ribosomal RNA genes, 22 transfer RNA genes and a non-coding control region (D-loop region). Comparisons with other publicly available pig mitogenomes revealed abundant nucleotide diversity. This complete mitgenome sequence would accelerate further studies on pig evolution and domestication that will enhance germplasm preservation and breeding programs of the pig gene pool.

Genomic diversity and differentiation of a managed island wild boar population.
Iacolina L, Scandura M, Goedbloed DJ, Alexandri P, Crooijmans RP, Larson G, Archibald A, Apollonio M, Schook LB, Groenen MA, Megens HJ.
Heredity (Edinb). 2016 Jan;116(1):60-7. doi: 10.1038/hdy.2015.70. Epub 2015 Aug 5.
The evolution of island populations in natural systems is driven by local adaptation and genetic drift. However, evolutionary pathways may be altered by humans in several ways. The wild boar (WB) (*Sus scrofa*) is an iconic game species occurring in several islands, where it has been strongly managed since prehistoric times. We examined genomic diversity at 49 803 single-nucleotide polymorphisms in 99 Sardinian WBs and compared them with 196 wild specimens from mainland Europe and 105 domestic pigs (DP; 11 breeds). High levels of genetic variation were observed in Sardinia (80.9% of the total number of polymorphisms), which can be only in part associated to recent genetic introgression. Both Principal Component Analysis and Bayesian clustering approach revealed that the Sardinian WB population is highly differentiated from the other European populations (FST=0.126-0.138), and from DP (FST=0.169). Such evidences were mostly unaffected by an uneven sample size, although clustering results in reference populations changed when the number of individuals was standardized. Runs of homozygosity (ROHs) pattern and distribution in Sardinian WB are consistent with a past expansion following a bottleneck (small ROHs) and recent population substructuring (highly homozygous individuals). The observed effect of a non-random selection of Sardinian individuals on diversity, FST and ROH estimates, stressed the importance of sampling design in the study of structured or introgressed populations. Our results support the heterogeneity and distinctiveness of the Sardinian population and prompt further investigations on its origins and conservation status.

Evaluation of the genetic diversity of Laiwu pigs using twenty-seven microsatellite markers.
Jiang, W., Y. Wang, et al. (2015). Biochemical Systematics and Ecology: 1-5.
The Laiwu pig, an indigenous pig breed known for extremely high intramuscular fat content, is a well-preserved ancient breed due to long-term natural and artificial selections. In this study, using 27 microsatellite markers jointly recommended by the International Society of Animal Genetics (ISAG) and the Food and Agriculture Organization (FAO), we investigated the genetic diversity of

the Laiwu pig breed. The genetic diversity of Laiwu pigs is dramatically low, with the observed heterozygosity ranging from 0.067 to 0.767. Among the 27 microsatellite markers, 10 were high polymorphic loci, 10 were moderate polymorphic loci, six were low polymorphic loci, and no polymorphism was detected at one locus (IGFI). Further analyses with the 10 high polymorphic loci and five moderate polymorphic loci revealed that the Laiwu pig breed was inbred and heterozygous deficient to some extent, but not severely, and that the Laiwu pigs were relatively pure, with almost no hybridization with other breeds. Two subgroups of the current 13 Laiwu pig pedigrees were identified. These results suggest that the Laiwu pig breed has a low diversity and a conservation program must be developed to preserve the "Laiwu pig" gene pool.

***Onchocerca takaokai* n. sp (Nematoda: Filarioidea) in Japanese wild boars (*Sus scrofa leucomystax*): Description and molecular identification of intradermal females.**
Uni, S., M. Fukuda, et al. (2015). Parasitology International 64(6): 493-502.
Human zoonotic onchocercosis is caused by *Onchocerca dewittei japonica*, parasitic in wild boars (*Sus scrofa leucomystax*) in Japan. Previously, microfilariae longer than those of *Onchocerca dewittei japonica* were observed in skin snips from wild boars during the study of *O. dewittei* japonica. Moreover, the third-stage larvae (L3) of these longer microfilariae were obtained from the blackfly Simulium bidentatum after experimental injections. Based on morphometric and molecular studies, similar L3 were found in blackflies during fieldwork in Oita, Japan. However, except for *O. dewittei japonica*, adult worms of *Onchocerca* have not been found in wild boars. In this study, we discovered adult females of a novel *Onchocerca* species in the skin of a wild boar in Oita, and named it *Onchocerca takaokai* n. sp. Females of this new species had longer microfilariae and differed from *O. dewittei japonica* in terms of their morphological characteristics and parasitic location. The molecular characteristics of the cytochrome c oxidase subunit 1 and 12S rRNA genes of the new species were identical to those of the longer microfilariae and L3 previously detected, but they differed from those of *O. dewittei japonica* at the species level. However, both species indicated a close affinity among their congeners and *Onchocerca ramachandrini*, parasitic in the warthog in Africa, was basal in the Suidae cluster of the 12S rRNA tree.

Positive seroprevalence of wild boar cysticercosis in Way Kanan District, Lampung Province
Yulianto, H., F. Satrija, et al. (2015).. Seroprevalensi Positif Sistiserkosis pada Babi Hutan di Kabupaten Way Kanan, Provinsi Lampung." Jurnal Veteriner 16(2): 187-195.
Wild boar is also an intermediate host of *Taenia solium*, besides domestic pig which is the main source of Cysticercus infection in human. Cysticercosis in wild boar has not been reported in Indonesia. The aim of this study was to determine wild boar's cysticercosis in Way Kanan District. One hundred sera samples consisting of 41 male wild boars and 59 female wild boars were collected. Eighty seven of boars come from Banjit Subdistrict, while 13 of wild boars come from Blambangan Umpu Subdistrict in Way Kanan District. The serum were tested serologically to determine antigen of parasite cycles. The test used monoclonal antibody-base sandwich Enzyme-Linked Immunosorbent Assay (Moab-ELISA). There is a sero positive reaction of cysticercosis(1%) which is female wild boar from Banjit sub district. Controlling of meat inspection should be conducted to prevent cysticercosis transmission to human.

Estimating the fertilizing ability of collared peccaries (*Pecari tajacu*) sperm by analyzing its interactions with swine oocytes

L.B. Campos, A.L.P. Souza, A.F. Pereira, A.R. Silva

Proceedings of the 29th Annual Meeting of the Brazilian Embryo Technology Society (SBTE); Gramado, RS, Brazil, August 20th to 23rd, 2015, and 31st Meeting of the European Embryo Transfer Association (AETE); Ghent, Belgium, September 11th and 12th, 2015.

A015 Physiology of Reproduction in Male and Semen Technology

Conventional tests that evaluate sperm quality do not have the ability to measure the fertilizing potential of a sample. The aims of this study were to evaluate the binding capacity of collared peccaries (*Pecari tajacu*) sperm using the heterologous in vitro interaction test with swine oocytes from antral follicles, and stablish the relations between sperm parameters and the binding test. Thus, a total of 11 ejaculates from adult individuals collected by electroejaculation was evaluated for motility, vigor, viability, normal morphology, kinetic motility parameters by computerized assisted semen analysis (CASA), membrane functionality and integrity. Moreover, 11 samples were analyzed by the in vitro interaction test using swine oocytes at 38.5°C and 5% CO2 for 18 h. After this period, the oocytes were washed and labeled with Hoechst 33258 (10 µg/mL) and visualized by fluorescence microscopy. The estimated fertilizing capacity was analyzed according to the number of bound sperm and/or penetrated the zona pellucida. All the data were expressed as mean ± SD and a simple linear regression model was used to identify associations between sperm-oocyte interactions (dependent variables) and sperm parameters (independent variables). Thus, the mean values for semen parameters evaluated by conventional analysis and CASA were as expected for the species. In the in vitro interaction test, we verified that all the swine oocytes (100%) presented bound sperm to zona pellucida, but only 19.85 ± 5.5% oocytes presented penetrated sperm. Additionally, an average of 39.4 ± 4.6 bound sperm/oocyte and 2.5 ± 0.7 penetrated sperm/oocyte were found. Probably, the composition of the zona pellucida of swine oocytes is similar to the peccaries, thus suggesting its use as heterologous substrate for the evaluations of sperm penetration capability for peccary. Among the sperm parameters, only the straightness rating – STR presented association to the number of bound sperm ($R = 61.7\%$; $P < 0.05$). Such parameter is related to progressive sperm, indicating the hyperactivation, and it is related to the fertility. In conclusion, the in vitro interaction test at using swine oocytes do not present marked relations to sperm parameters currently evaluated in collared peccaries. Further studies are needed to enable the use of heterologous substrates as accurate indicator of fertility for the species

Hematological markers and biochemical profiles in terms of gender and age of captive collared peccaries (*Tayassu tajacu*) in eastern Amazon.

Jorge EM, Silva CJ, Ritter RA, Monteiro MV, Albuquerque NI, Kahwage PR, Monteiro FO, Costa CT, Rahal SC, Silva Filho E.

Genet Mol Res. 2015 Nov 25;14(4):14999-5007. doi: 10.4238/2015.November.24.7.

Complete blood counts and blood biochemical analyses are laboratory tests that allow the monitoring of physiological condition, nutrition, and health in free-living or captive wild animals. When interpreting these tests, it is essential to compare the results with reference ranges that are suitable for the species. Few studies have been conducted on the hematological and biochemical characteristics of *Tayassu tajacu*, particularly for animals raised in the Amazon biome. The objectives of this study were to evaluate the influence of age and gender on the hematological

and biochemical profiles of captive *T. tajacu*, and to establish reference intervals for these parameters. Complete blood counts and biochemical analyses were performed using manual methods and semi-automatic equipment, respectively. There were significant differences in relation to age in hematocrit and hemoglobin levels, and mean cell volumes, in captive *T. tajacu*. No basophils were observed, and the neutrophil:lymphocyte ratio was less than 1. Levels of total protein, urea, phosphorus, and alkaline phosphatase were significantly affected by age ($P < 0.05$). Gender did not affect any of the results. The hematological and biochemical parameters for this species were determined, and may be used as reference ranges for captive *T. tajacu*.

Action of proteases of the nematophagous fungi *Pochonia chlamydosporia* on *Ascaris suum* eggs of collared peccary (*Pecari tajacu*)

Filippe Elias de Freitas Soares, José Humberto de Queiroz, Jackson Victor de Araújo , Maria Gorete Ramos Rodrigues, Alexandre de Oliveira Tavela, Anderson Rocha Aguiar , Tracy Lacerda, Carolina Magri Ferraz, Maria Cristina Valdetaro Rangel, Thiago Senna, Andreia Luíza Araújo , Tarcízio de Paula Rego, Caio Colodette Sena and Fabio Ribeiro Braga

Vol. 9(31), pp. 1883-1886, 5 August, 2015 DOI: 10.5897/AJMR2015.7650 Article Number: 814381854839 ISSN 1996-0808

Among the parasites of domestic and wild swine, *Ascaris suum* stands out; a nematode that can lead to growth retardation and reduction in weight gain due to its action, especially in young animals. The objective of this study was to test the ovicidal action of proteases from *Pochonia chlamydosporia* (VC4) on A. suum eggs in an assay with Petri dishes. The fungus *P. chlamydosporia* (VC4) was grown in Erlenmeyers flasks with 50 ml of liquid minimal media supplemented with 0.2% gelatin for production of enzymes. In the present assay, 500 eggs were poured into Petri dishes of 4.5 cm in diameter and 5 ml of VC4 proteases were added in each Petri dish and incubated at 26°C in the dark for 14 days. After this period, the number of embryonated and destroyed *A. suum* eggs present in each plate from treated and control groups was counted. Significant difference ($p <0.01$) was found between the number of eggs from treated group compared to the control group. At the end of the experiment, the proteases of *P. chlamydosporia* (VC4) demonstrated efficacy in reducing embryonated eggs on the plates of the treated group (78.7%) compared to the control group (83.7%). The results presented in this study demonstrate that proteases of *P. chlamydosporia* (VC4) were effective in the destruction of *A. suum* eggs and therefore could be used as biological control of this nematode.

Use of Non-invasive Methods for Evaluating the Testicular Biometry in Collared Peccaries (*Pecari tajacu* Linnaeus, 1758).

Peixoto GC, Silva MA, Lima GL, Campos LB, Paiva AL, Paula VV, Ricarte AR, Silva AR

Anat Histol Embryol. 2016 Feb;45(1):60-6. doi: 10.1111/ahe.12171. Epub 2015 Jan 27.

The aim of this study was to compare the accuracy of two methods used to estimate testicular volume in the collared peccary. Calliper and ultrasonographic measurements of testicular dimensions (length, width and height) of both testes were taken on five adult collared peccaries. The testicular volume was calculated by Lambert's empiric formula: length (L) × width (W) × height (H) × 0.71, the formula of an ellipsoid L × W × H × 0.52, and Hansen's formula: L × W(2) × 0.52. The calculated volumes were then compared with the actual ones, which were estimated by water displacement. The mean of true testicular volume was 22.65 ± 1.52 ml. Lambert's formula estimated testicular volume more accurately when ultrasound measurements

were taken. However, when the calliper was the methodology used, the results were closest to the true volume, especially when Ellipsoid formula and Hansen's formula were applied, and underestimated the true volumes by 1.53 ± 1.75 ml and 1.53 ± 1.65 ml, respectively. This specific application of technologies in wild animals has the potential to revolutionize the selection process for the collared peccary entering artificial insemination or natural breeding programmes.

Sperm characteristics following freezing in extenders supplemented with whole egg yolk and different concentrations of low-density lipoproteins in the collared peccary (*Pecari tajacu*).

Souza AL, Lima GL, Peixoto GC, de Souza Castelo T, Oliveira MG, de Paula VV, Silva AR Reprod Biol. 2015 Dec;15(4):223-8. doi: 10.1016/j.repbio.2015.10.006. Epub 2015 Oct 29.

The aim of the current study was to compare sperm quality characteristics of the collared peccary (*Pecari tajacu*) following freezing in extenders supplemented with whole egg yolk and different concentrations of low-density lipoproteins (LDL). Semen from 11 adult males was obtained by electroejaculation and evaluated for sperm motility, vigor, morphology as well as membrane integrity analyzed by the hypo-osmotic swelling (HOS) test and a fluorescent staining. Moreover, the semen was diluted in a Tris-based extender containing 20% egg yolk (control group) or 5, 10 or 20% LDL (treatment groups). The semen samples were frozen in liquid nitrogen and thawed in a water bath for 60s at 37°C. The treatments did not affect ($p>0.05$) sperm vigor, morphology or membrane integrity analyzed by the HOS test. However, post-thaw sperm motility was significantly higher ($p<0.05$) in the extender supplemented with 20% LDL (36.4±5.3%) compared with the egg yolk extender and extender supplemented with 10% LDL. Furthermore, the percentage of membrane-intact frozen-thawed spermatozoa analyzed by the fluorescent staining was significantly higher ($p<0.05$) in the extender supplemented with 20% LDL (27.4±6.5%) than in the other groups. In conclusion, 20% LDL can be used to substitute the whole egg yolk as a cryoprotective additive for freezing semen of the collared peccary.

Organization of the sleep related neural systems in the brain of the river hippopotamus (*Hippopotamus amphibius*): A most unusual Cetartiodactyl species.

Dell LA, Patzke N, Spocter MA, Bertelsen MF, Siegel JM, Manger PR
J Comp Neurol. 2015 Nov 20. doi: 10.1002/cne.23930.

This study provides the first systematic analysis of the nuclear organization of the neural systems related to sleep and wake in the basal forebrain, diencephalon, midbrain and pons of the river hippopotamus, one of the closest extant terrestrial relatives of the cetaceans. All nuclei involved in sleep regulation and control found in other mammals, including cetaceans, were present in the river hippopotamus, with no specific nuclei being absent, but novel features of the cholinergic system, including novel nuclei, were present. This qualitative similarity relates to the cholinergic, noradrenergic, serotonergic and orexinergic systems and is extended to the GABAergic elements of these nuclei. Quantitative analysis reveals that the numbers of pontine cholinergic (259 578) and noradrenergic (127 752) neurons, and hypothalamic orexinergic neurons (68 398) are markedly higher than other large-brained mammals. These features, along with novel cholinergic nuclei in the intralaminar nuclei of the dorsal thalamus and the ventral tegmental area of the midbrain, as well as a major expansion of the hypothalamic cholinergic nuclei and a large laterodorsal tegmental nucleus of the pons that has both parvocellular and magnocellular cholinergic neurons, indicates an unusual sleep phenomenology for

thehippopotamus. Our observations indicate that the hippopotamus is likely to be a bihemispheric sleeper that expresses REM sleep. The novel features of the cholinergic system suggest the presence of an undescribed sleep state in the hippopotamus, as well as the possibility that this animal could, more rapidly than other mammals, switch cortical EEG activity from one state to another.

Methane production by two non-ruminant foregut-fermenting herbivores: The collared peccary (*Pecari tajacu*) and the pygmy hippopotamus (*Hexaprotodon liberiensis*).

Vendl C1, Frei S, Dittmann MT, Furrer S, Ortmann S, Lawrenz A, Lange B, Munn A, Kreuzer M, Clauss M.

Comp Biochem Physiol A Mol Integr Physiol. 2016 Jan;191:107-14. doi: 10.1016/j.cbpa.2015.09.021. Epub 2015 Oct 9.

Methane (CH4) production varies between herbivore species, but reasons for this variation remain to be elucidated. Here, we report open-circuit chamber respiration measurements of CH4 production in four specimens each of two non-ruminant mammalian herbivores with a complex forestomach but largely differing in body size, the collared peccary (*Pecari tajacu*, mean body mass 17kg) and the pygmy hippopotamus (*Hexaprotodon liberiensis*, 229kg) fed lucerne-based diets. In addition, food intake, digestibility and mean retention times were measured in the same experiments. CH4 production averaged 8 and 72L/d, 18 and 19L/kg dry matter intake, and 4.0 and 4.2% of gross energy intake for the two species, respectively. When compared with previously reported data on CH4 production in other non-ruminant and ruminant foregut-fermenting as well as hindgut-fermenting species, it is evident that neither the question whether a species is a foregut fermenter or not, or whether it ruminates or not, is of the relevance previously suggested to explain variation in CH4 production between species. Rather, differences in CH4 production between species on similar diets appear related to species-specific differences in food intake and digesta retention kinetics.

Comparative analyses of the chemical and sensory parameters and consumer preference of a semi-dried smoked meat product (cabanossi) produced with warthog (*Phacochoerus africanus*) and domestic pork meat

Monlee Swanepoela, b, Alison J. Lesliea, Louwrens C. Hoffman

The study compared the chemical and sensory characteristics and consumer preference of a semi-dried, cured meat product, cabanossi, produced with warthog meat and with domestic pork. The warthog and pork cabanossi had similar total moisture (59.0% ± 2.07 and 54.3% ± 1.26) and protein (26.3% ± 2.20 and 24.2% ± 2.15) contents, while the warthog cabanossi was lower in total fat content (6.9% ± 1.01) compared to pork cabanossi (13.7% ± 1.77, P = 0.007). Descriptive sensory analysis found that the warthog cabanossi appeared darker red (P = 0.001) and less fatty (P = 0.001), while the pork cabanossi had a higher overall pork flavour (P = 0.001). There were no differences in consumer preference of the appearance and taste between the two types of cabanossi, while the majority of consumers (91%) supported the use of game meat in meat products. The study concluded that warthog meat can be used in processed products without compromising the associated technical or organoleptic properties.

Taxonomic, Morphological, Biogeographic and Evolutionary Studies

Small hyotheriine suids (Mammalia, Artiodactyla) from the late early Miocene of Turkey and a short overview of early Miocene small suoids in the Old World.
Orliac, M. J., L. Karadenizli, et al. (2015). Palaeontologia Electronica 18(2): 30A.
Suoids are conspicuous components of late early Miocene faunas in Europe, Asia, and Africa. Strikingly, despite a rich fossil record at the Old World scale, no early Miocene suoid remains were known thus far from Anatolia, a region located at the crossroads between Africa, Arabia, Asia, and Europe. Here we describe a fragmentary cranium, mostly preserving the palate, and a dp4 of small suids from the Semsettin locality in the Cankiri-Corum Basin, north Central Anatolia. These remains document the first suoids ever recorded in the Early Miocene of Turkey. Both remains are attributed to the subfamily Hyotheriinae. The fragmentary cranium presents an original combination of characters and is attributed to *Nguruwe? galaticum* sp. nov. The isolated dp4, of much smaller size, is here attributed to another hyotheriine taxon of indeterminate genus and species. *Nguruwe? galaticum* sp. nov. shows equal affinity with both Asiatic and African Hyotheriinae.

A late Miocene mammalian fauna from Olba in the Sarrion Depression, eastern Spain
Sen, S., F. Fack, et al. (2015). Palaeontologische Zeitschrift 89(3): 545-562.
The Olba vertebrate locality, discovered in 1974, was mentioned in several publications, but its fauna has never been studied. The locality is situated in the Sarrion Depression, on the road from La Escaleruela to Olba, and it is included in the lower unit of this depression, which unconformably covers the Jurassic-Cretaceous basement and the early Miocene deposits of the Rubielos de Mora graben. This paper presents an exhaustive study of the remains of large and small mammals that were collected by E. Moissenet and preserved up to the present time in the Paleontology collections of the Paris Natural History Museum. The major taxa represented in this material are Ruminantia (Lucentia iberica and ? Micromeryx sp.), Suidae (Microstonyx cf. major), Equidae (Hipparion sp.), Erinaceidae (Parasorex ibericus), Ochotonidae (Prolagus crusafonti) and the muroids (Hispanomys cf. adroveri and Occitanomys sp). An age of early-middle Turolian can be assigned to this fauna based on the similarities of these species with Crevillente 2 and Los Mansuetos, both in Spain, which are respectively the reference localities of the Neogene mammalian zones MN11 and MN12. The composition of the fauna is comparable to that of Turolian localities in the Calatayud-Teruel Basin, indicating an open woodland environment.

A New Mammal Assemblage from the Late Pleistocene El Breal de Orocual, Northeast of Venezuela.
Solorzano, A., A. D. Rincon, et al. (2015). Natural History Museum of Los Angeles County Science Series 15: 125-150.
In the last decade, intensive paleontological fieldwork has been carried out in Venezuela, resulting in many new fossil vertebrate localities being found. Two sites of special significance are the fossil-rich tar pits of El Breal de Orocual and Mene de Inciarte. El Breal de Orocual is located in Monagas State in the northeast of Venezuela. Multiple individual pits have been identified and a fauna with 24 mammalian taxa was reported from an inactive tar pit (ORS16) with an estimated Plio[long dash]Pleistocene age. However, the fossils so far collected and described from this locality represent only a miniscule fraction of the total fossil material preserved there. Three hundred meters west of the original site is a still active tar pit from which we describe a new mammal assemblage named ORS20. This new mammal assemblage (ORS20) is chronologically

and taxonomically different from the previously reported fauna (ORS16). Our taxonomic identifications of the mammals from ORS20 and their known or inferred ages suggest a Late Pleistocene age for this fauna. The multiple pits in the area of El Breal de Orocual contain a diverse fauna which accumulated during distinctive episodes of deposition from the Late Pliocene/Early Pleistocene (ORS16) until the Late Pleistocene (ORS20), indicting that surface exposures of asphalt and the subsequent accumulation of vertebrate remains occurred over a long period of time (about 2 My?), a situation that to date has not been observed for other tar pits localities in North, Central, or South America. The presence of the peccary Platygonus sp. and the armadillo Pachyarmatherium leiseyi, in the Late Pleistocene of ORS20 represent the youngest appearances of these taxa in the fossil record of South America.

A phylogenomic analysis of the role and timing of molecular adaptation in the aquatic transition of cetartiodactyl mammals.

Tsagkogeorga G, McGowen MR, Davies KT, Jarman S, Polanowski A, Bertelsen MF, Rossiter SJ. R Soc Open Sci. 2015 Sep 30;2(9):150156. doi: 10.1098/rsos.150156. eCollection 2015.

Recent studies have reported multiple cases of molecular adaptation in cetaceans related to their aquatic abilities. However, none of these has included the hippopotamus, precluding an understanding of whether molecular adaptations in cetaceans occurred before or after they split from their semi-aquatic sister taxa. Here, we obtained new transcriptomes from the hippopotamus and humpback whale, and analysed these together with available data from eight other cetaceans. We identified more than 11 000 orthologous genes and compiled a genome-wide dataset of 6845 coding DNA sequences among 23 mammals, to our knowledge the largest phylogenomic dataset to date for cetaceans. We found positive selection in nine genes on the branch leading to the common ancestor of hippopotamus and whales, and 461 genes in cetaceans compared to 64 in hippopotamus. Functional annotation revealed adaptations in diverse processes, including lipid metabolism, hypoxia, muscle and brain function. By combining these findings with data on protein-protein interactions, we found evidence suggesting clustering among gene products relating to nervous and muscular systems in cetaceans. We found little support for shared ancestral adaptations in the two taxa; most molecular adaptations in extant cetaceans occurred after their split with hippopotamids.

Ecological, Behavioural and Conservation Studies

Islands of change vs. islands of disaster: Managing pigs and birds in the Anthropocene of the North Atlantic

Seth Brewington, Megan Hicks, Ágústa Edwald, Árni Einarsson, Kesara Anamthawat-Jónsson, Gordon Cook,5 Philippa Ascough, Kerry L Sayle, Símun V Arge, Mike Church, Julie Bond, Steve Dockrill, Adolf Friðriksson, George Hambrecht, Arni Daniel Juliusson, Vidar Hreinsson, Steven Hartman, Konrad Smiarowski, Ramona Harrison and Thomas H McGovern (2015)

The Holocene:1– 9, DOI: 10.1177/0959683615591714

The offshore islands of the North Atlantic were among some of the last settled places on earth, with humans reaching the Faroes and Iceland in the late Iron Age and Viking period. While older accounts emphasizing deforestation and soil erosion have presented this story of island colonization as yet another social–ecological disaster, recent archaeological and paleoenvironmental research combined with environmental history, environmental humanities,

and bioscience is providing a more complex understanding of long-term human ecodynamics in these northern islands. An ongoing interdisciplinary investigation of the management of domestic pigs and wild bird populations in Faroes and Iceland is presented as an example of sustained resource management using local and traditional knowledge to create structures for successful wild fowl management on the millennial scale.

Photographic estimation of wild boar damage to alpine grazing pastures in the Carpathian Mountains of central Romania

Engeman R, Cattaruzza R, Cattaruzza M, Fischer J. (2016) Environ Sci Pollut Res Int. 2016 Jan 18.

Observations of wild boar damage to alpine grazing pastures in Romania's Carpathian Mountains were collected using photographs of the slopes from vantage points. We mapped the rooted areas and then used GIS software to estimate the relative proportions of the total grazing areas visible in the photographs that were damaged by wild boar. The amounts of damage from our two demonstration pastures were 11.2 and 13.5 %. Pastures are rented for summer grazing with grazing density monitored. Wild boar damage essentially decreases the economic benefit received for the cost of the grazing rights. This paper appears to be the first documentation of the very direct costs to livestock owners from significant wild boar rooting within rented pastures. The photographic method we present provides a quick and efficient means to quantify damage to alpine grazing pastures and may have broad application for mountainous areas where swine damage (or other disturbance) occurs and there is sufficient visibility of the damaged habitat.

Reducing Wildlife Damage with Cost-Effective Management Programmes.

Krull CR, Stanley MC, Burns BR, Choquenot D, Etherington TR. (2016)

PLoS One. 2016 Jan 15;11(1):e0146765. doi: 10.1371/journal.pone.0146765. eCollection 2016.

Limiting the impact of wildlife damage in a cost effective manner requires an understanding of how control inputs change the occurrence of damage through their effect on animal density. Despite this, there are few studies linking wildlife management (control), with changes in animal abundance and prevailing levels of wildlife damage. We use the impact and management of wild pigs as a case study to demonstrate this linkage. Ground disturbance by wild pigs has become a conservation issue of global concern because of its potential effects on successional changes in vegetation structure and composition, habitat for other species, and functional soil properties. In this study, we used a 3-year pig control programme (ground hunting) undertaken in a temperate rainforest area of northern New Zealand to evaluate effects on pig abundance, and patterns and rates of ground disturbance and ground disturbance recovery and the cost effectiveness of differing control strategies. Control reduced pig densities by over a third of the estimated carrying capacity, but more than halved average prevailing ground disturbance. Rates of new ground disturbance accelerated with increasing pig density, while rates of ground disturbance recovery were not related to prevailing pig density. Stochastic simulation models based on the measured relationships between control, pig density and rate of ground disturbance and recovery indicated that control could reduce ground disturbance substantially. However, the rate at which prevailing ground disturbance was reduced diminished rapidly as more intense, and hence expensive, pig control regimes were simulated. The model produced in this study provides a framework that links conservation of indigenous ecological communities to control inputs through

the reduction of wildlife damage and suggests that managers should consider carefully the marginal cost of higher investment in wildlife damage control, relative to its marginal conservation return.

Cooperation improves the access of wild boars (*Sus scrofa*) to food sources.
Focardi, S., Morimando, F., Capriotti, S., Ahmed, A, Genov, P. (2015)
Behavioural Processes Volume: 121, Pages: 80-86, DOI: 10.1016/j.
Wild boar is a highly polycotous ungulate species, characterized by a complex and dynamical social organization based on the maintenance of long-term bonds between mother and daughters. The roots of this social organization have to be researched at the individual level, considering adaptations that improve fitness in hostile environments. We used information collected by camera-traps at artificial feeding sites, in two contrasting environments in Bulgaria (mountain habitat) and Italy (sub-Mediterranean habitat). We recorded 417 and 885 distinct groups on 7 and 11 foraging sites in Bulgaria and Italy, respectively. We computed (controlling for time range, study area and supplementary feeding site) an index of effective foraging time of the different social groups. We observed a positive and significant effect of the number of conspecifics of the same social group on the effective foraging time. The impact of the other social classes on effective foraging time is also positive, and males, yearlings, and juveniles benefited more from the presence of other social classes, while females were less affected. The access of the different social groups to foraging sites is not random. Males and yearlings play producers (i.e., search for food) and are prone to attend foraging sites before adult females and subadults, so attaining a larger foraging efficiency with respect to a situation where other groups are already present on the feeding site. Wild boars exhibit a more complex social organisation than previously believed, where cooperation prevails largely on competition. A rough division of labour is also present: yearlings, males, and juveniles use to play producers and assume a significant amount of risk determined by the presence of predators or hunters.

Beyond standard wildlife management: a pathway to encompass human dimension findings in wild boar management.
Frank, B., A. Monaco, et al. (2015). European Journal of Wildlife Research 61(5): 723-730.
Around the Regional Nature Reserve Nazzano-Tevere-Farfa in Central Italy, wild boar ecological and economic impacts have increased over the last decade, creating the need for an integrated wildlife management approach. Since 2006, park authorities have used an average of 17 % of the yearly protected area budget for compensation and 5 % for preventive measures. Additionally, 14 wild boar/km2 were culled in 2009. While the management tools used in the protected area were effective in reducing the species' impacts, they did not decrease human-wild boar controversies. To understand the reasons behind such conflicts, user opinions toward the wildlife management approaches used (i.e., preventive measures, compensation, capture, and removal) and planned (i.e., culls) in Nazzano-Tevere-Farfa were explored. Face-to-face interviews were carried out with the general public (n = 288), hunters (n = 57), and farmers (n = 107) in 2009-2010. Differences in attitudes toward preventive measures ([chi] 2 (8) = 40.35, p < .001), compensation ([chi] 2 (8) = 34.11, p < .001), capture and removal ([chi] 2 (8) = 98.23, p < .001), and culls ([chi] 2 (8) = 77.10, p < .001) were highlighted by Chi-square analysis. The Potential for Conflict Index showed that, overall, park users supported preventive measures and compensation, but not capture and removal and culls. Workshops organized with hunters and

farmers in 2010 highlighted that park authorities had not considered user expectations when planning wild boar management. If decision makers want to address conflicts, they need to go beyond standard management by tailoring their practices to the specific social context in which they work. Effective management is not only about reducing impacts, it is also about listening to people living with wildlife.

Evidence for litter differences in play behaviour in pre-weaned pigs
Brown, SM, Klaffenbock, M, Nevison, IM, Lawrence, AB (2015)
Applied Animal Behaviour Science, Volume: 172 Pages: 17-25
The aim of this study was to analyse spontaneous play behaviour in litters of domestic pigs (*Sus scrofa*) for sources of variation at individual and litter levels and to relate variation in play to measures of pre and postnatal development. Seven litters of commercially bred piglets (n = 70) were born (farrowed) within a penning system (PigSAFE) that provided opportunities for the performance of spontaneous play behaviours. Individual behaviour was scored based on an established play ethogram for 2 days per week over the 3 week study period. We found strong evidence of litter differences in play behaviour (F-(6,F-63) = 27.30, p < 0.001). Of the variance in total play, 50% was attributable to differences between litters with a lesser proportion (11%) to between piglets within litters. We found similar evidence of litter differences when we analysed the separate play categories (e.g. for locomotor play: F-(6.63) = 27.50, p < 0.001). For social and locomotor play the variance was partitioned in a broadly similar way to total play; however for object play the variance was distributed with a more even balance across and within litters. In terms of explanatory factors we found little evidence that at the litter level differences in play were associated with differences in general activity. Of the prenatal factors measured, we found that birth weight was positively associated with total play and the play categories (e.g. with total play: F-(1,F-64) = 12.8, p < 0.001). We also found that postnatal piglet growth up to weaning (as a percentage of birth weight) had a significant positive association with total play and the play categories (e.g. with object play: F-(1.66) = 20.55,p < 0.001). As found in other studies, on average males engaged in more social play (e.g. non-injurious play fighting: F-(1,F-63) = 39.8, p < 0.001). Males also initiated more play bouts on average than females (F-(1,F-62) =4.41, p = 0.040). We conclude that the study of differences between litters and individuals provides a robust approach to understanding factors potentially influencing play behaviour in the pig. This work also provides support for the use of play as a welfare indicator in pre-weaned piglets as the litter differences in play we observed were associated positively with physical development.

Understanding feeding patterns in growing pigs by modelling growth and motivation.
Boumans, IJMM, Bokkers, EAM, Hofstede, GJ, de Boer, IJM (2015)
Applied Animal Behaviour Science, Volume: 171 Pages: 69-80
Feeding is an essential behaviour for body maintenance in pigs and closely related to their growth and productivity performance. Mechanisms underlying feeding behaviour in pigs are still unclear. Understanding these mechanisms can provide valuable insights into the complex interactions among various factors affecting feeding behaviour and help to improve growth and productivity of pigs. The aim of this study was to increase our understanding of internal causation and development of short-term feeding patterns in a pig, and the relation between feeding patterns and productivity of a pig during the growth period. We developed a mechanistic simulation model that represents an individually housed growing pig. The model integrates

knowledge from physiology and ethology, and combines growth with a behavioural decision model based on motivation. Combining growth with behaviour allowed exploring the development of a pig over time, in particular the causation of growth and feeding patterns over a 24h period and during the entire growing period. Physiological factors, affected by pig and feed characteristics, are important internal factors controlling feeding behaviour. Model output included short-term feeding behaviours in pigs (e.g. meal size, meal frequency and meal duration), and growth characteristics (e.g. energy use, body weight gain). The model yielded feeding patterns that were validated against empirical data. This modelling study provided insight in how growth and motivation explain the development of feeding patterns of an individually housed pig over time. Pig and feed characteristics affected the motivation to reach a desired level of daily feed intake. Without feeding restrictions, pigs adapted feeding patterns to reach this daily feed intake without affecting growth. The developed model is suitable to further study mechanisms underlying feeding behaviour and performance of group-housed pigs.

Marginal Functional Regression Models for Analyzing the Feeding Behavior of Pigs
Gertheiss, J, Maier, V, Hessel, EF, Staicu, AM (2015)
Journal of Agricultural, Biological and Environmental Statistics, Volume: 20 Issue: 3 Pages: 353-370
We observe a group of pigs over a period of about 100 days. Using high frequency radio frequency identification, it is recorded when each pig is feeding, leading to very dense binary functional data for each pig and day. One aim of the data analysis is to find pig-specific feeding profiles showing us the typical feeding pattern of each pig. For modeling the data, we use a marginal functional logistic regression approach, allowing us to model the densely observed binary measurements by assuming an underlying smooth subject-specific profile. The method also allows to incorporate additional covariates such as temperature and humidity that may influence the pigs' behavior. To account for correlation of measurements, we use robust standard errors and corresponding pointwise confidence intervals. Before analyzing the feeding behavior of pigs, the method employed is evaluated in simulation studies. As our approach is rather general, it may also be applied to other types of generalized functional data with similar characteristics as the pig data.

Modeling ecological traps for the control of feral pigs.
Dexter, N, McLeod, SR (2015)
Ecology and Evolution, Volume: 5 Issue: 10 Pages: 2036-2047
Ecological traps are habitat sinks that are preferred by dispersing animals but have higher mortality or reduced fecundity compared to source habitats. Theory suggests that if mortality rates are sufficiently high, then ecological traps can result in extinction. An ecological trap may be created when pest animals are controlled in one area, but not in another area of equal habitat quality, and when there is density-dependent immigration from the high-density uncontrolled area to the low-density controlled area. We used a logistic population model to explore how varying the proportion of habitat controlled, control mortality rate, and strength of density-dependent immigration for feral pigs could affect the long-term population abundance and time to extinction. Increasing control mortality, the proportion of habitat controlled and the strength of density-dependent immigration decreased abundance both within and outside the area controlled. At higher levels of these parameters, extinction was achieved for feral pigs. We extended the

analysis with a more complex stochastic, interactive model of feral pig dynamics in the Australian rangelands to examine how the same variables as the logistic model affected long-term abundance in the controlled and uncontrolled area and time to extinction. Compared to the logistic model of feral pig dynamics, the stochastic interactive model predicted lower abundances and extinction at lower control mortalities and proportions of habitat controlled. To improve the realism of the stochastic interactive model, we substituted fixed mortality rates with a density-dependent control mortality function, empirically derived from helicopter shooting exercises in Australia. Compared to the stochastic interactive model with fixed mortality rates, the model with the density-dependent control mortality function did not predict as substantial decline in abundance in controlled or uncontrolled areas or extinction for any combination of variables. These models demonstrate that pest eradication is theoretically possible without the pest being controlled throughout its range because of density-dependent immigration into the area controlled. The stronger the density-dependent immigration, the better the overall control in controlled and uncontrolled habitat combined. However, the stronger the density-dependent immigration, the poorer the control in the area controlled. For feral pigs, incorporating environmental stochasticity improves the prospects for eradication, but adding a realistic density-dependent control function eliminates these prospects.

Priority threat management of invasive animals to protect biodiversity under climate change

Firn, J, Maggini, R, Chades, I, Nicol, S, Walters, B, Reeson, A, Martin, TG, Possingham, HP, Pichancourt, JB, Ponce-Reyes, R, Carwardine, J (2015)

Global Change Biology, Volume: 21 Issue: 11 Pages: 3917-3930

Climate change is a major threat to global biodiversity, and its impacts can act synergistically to heighten the severity of other threats. Most research on projecting species range shifts under climate change has not been translated to informing priority management strategies on the ground. We develop a prioritization framework to assess strategies for managing threats to biodiversity under climate change and apply it to the management of invasive animal species across one-sixth of the Australian continent, the Lake Eyre Basin. We collected information from key stakeholders and experts on the impacts of invasive animals on 148 of the region's most threatened species and 11 potential strategies. Assisted by models of current distributions of threatened species and their projected distributions, experts estimated the cost, feasibility, and potential benefits of each strategy for improving the persistence of threatened species with and without climate change. We discover that the relative cost-effectiveness of invasive animal control strategies is robust to climate change, with the management of feral pigs being the highest priority for conserving threatened species overall. Complementary sets of strategies to protect as many threatened species as possible under limited budgets change when climate change is considered, with additional strategies required to avoid impending extinctions from the region. Overall, we find that the ranking of strategies by cost-effectiveness was relatively unaffected by including climate change into decision-making, even though the benefits of the strategies were lower. Future climate conditions and impacts on range shifts become most important to consider when designing comprehensive management plans for the control of invasive animals under limited budgets to maximize the number of threatened species that can be protected.

The Influence of Wild Boars on the Growth of Forest Trees and Stands: A Case Study of a

Wild Boar Game Preserve.
Lebocky, T. and R. Petras (2015). Acta Silvatica and Lignaria Hungarica: 65-75.
This research investigated methods for determining and quantifying the impact of wild boars on the increment and growth of forest trees and stands. The influence of wild boars on stand variables was observed in a wild game preserve established in central Slovakia in 2000 practicing intensive wild boar management. Long-term measurements obtained from two long-term research plots of sessile oak trees established in 1969 were used to monitor stand growth. Increments of trees were observed on tree ring cores coming from trees surrounded by differently damaged soil surfaces. Wild boars rooting the soil surface proved to have neither a positive nor negative influence on the mean diameter and height of the forest stands. Analysis of radial increments in 9 trees growing on sites with more intense, deeper, and permanent rooting in the soil profile located near a larger mud bath was also carried out. A more distinctive increment depression was found on one oak near the mud bath and on one beech where deeper soil surface rooting occurred.

Causes and consequences of ground disturbance by feral pigs (*Sus scrofa*) in a lowland New Zealand conifer-angiosperm forest.
Parkes, JP, Easdale, TA, Williamson, WM, Forsyth, DM (2015)
New Zealand Journal of Ecology, Volume: 39 Issue: 1 Pages: 34-42
The ecological impacts of feral pigs (*Sus scrofa*) are of concern in many places around the world. One noticeable impact is soil disturbance, although the causes and consequences are often unclear. We measured the effect of ground disturbance by feral pigs on seedling recruitment and soil ecology over 25 months on a forested riparian terrace at Waitutu, south Fiordland, New Zealand, and assessed the diet of pigs from the area from stomach contents of animals shot by hunters. Foraging by feral pigs for below-ground food disturbed between 7.4% and 12.4% of the soil. Pigs were seven times more likely to redisturb a site than to disturb a new site. Below-ground food items constituted a third of pigs' diet and were dominated by stag beetle larvae. Sites disturbed by feral pigs had shorter seedlings compared with undisturbed sites, but this was due to pigs' choice of sites rather than a consequence of the disturbance. Net temporal changes in density and height of seedlings were similarly slow in both disturbed and undisturbed sites. The basal respiration of microbes in soils recently disturbed by pigs was significantly higher than that for undisturbed soils. There was a suggestion that disturbed soils had higher ratios of fungi to bacteria than undisturbed soils ($P = 0.06$). This may reflect either disturbance favouring fungi over bacteria or selection of sites with more fungi or more of their main prey, the fungivorous stag beetle Dorcus helmsii. Our results indicate that pigs disturb soil primarily to forage for food and that the consequences of disturbance for seedling regeneration and soil ecology are limited or neutral. The consequences of ground disturbance and predation for populations of animal prey, such as the stag beetles, require further investigation.

Consumption of crops by feral pigs (*Sus scrofa*) in a fragmented agricultural landscape.
Gentle, M, Speed, J, Marshall, D (2015)
Australian Mammalogy, Volume: 37 Issue: 2 Pages: 194-200
Feral pigs (*Sus scrofa*) consume and damage crops and impact the environment through predation, competition and habitat disturbance, although supporting dietary data are lacking in agricultural landscapes. This study was undertaken to determine the relative importance of food

items in the diet of feral pigs in a fragmented agricultural landscape, particularly to assist in predicting the breadth of likely impacts. Diet composition was assessed from the stomach contents of 196 feral pigs from agricultural properties in southern Queensland. Feral pigs were herbivorous, with plant matter comprising >99% of biomass consumed. Crops were consumed more frequently than non-crop species, and comprised >60% of dietary biomass, indicating a clear potential for direct economic losses. Consumption of pasture and forage species also suggests potential competition for pasture with domestic stock. There is little evidence of direct predation on native fauna, but feral pig feeding activities may impact environmental values. Seasonal differences in consumption of crop, pasture or animal food groups probably reflect the changing availability of food items. We recommend that future dietary studies examine food availability to determine any dietary preferences to assist in determining the foods most susceptible to damage. The outcomes of this study are important for developing techniques for monitoring the impacts of feral pigs, essential for developing management options to reduce feral pig damage on agricultural lands.

Cognitive bias in pigs: Individual classification and consistency over time.
Carreras, R, Mainau, E, Rodriguez, P, Llonch, P, Dalmau, A , Manteca, X, Velarde, A (2015)
Journal of Veterinary Behavioural-clinical Applications and Research, Volume: 10 Issue: 6 Pages: 577-581
The aim of the study was to ascertain if the cognitive bias (CB) test can be used to assess pigs' emotional state and classify them individually. Moreover, the test was repeated over time to assess its consistency. Thirty-six male pigs were individually trained during 14 training sessions to discriminate between a bucket with (A) or without (NA) access to chopped apples depending on its position (left or right) in a test pen. Once pigs were able to discriminate between both positions, each animal was subjected to 2 A and 2 NA reminder sessions before performing the CB test session, where the bucket was placed on a central position with access to 2 pieces of apple. The trial was repeated after 5 weeks, reducing the number of training sessions to 4. Time to contact the bucket, time to eat (or try to eat in the case of NA sessions), number of vocalizations, number of times pigs were reluctant to move, number of escape attempts, and number of urination and defecation events were recorded. In the first trial, time to contact the bucket and time to eat was significantly lower in A than in NA from session 10 ($P < 0.0012$), indicating that pigs were able to discriminate between both positions. In the second trial, both variables were significantly lower in A compared to NA from session 2 ($P < 0.005$) onward, confirming the pigs' capacity to remember the task. Pigs were individually classified as having positive, negative, or neutral CB, according to the time to contact the bucket during the CB test session in comparison with the time taken during the remainder sessions. A large percentage of pigs were classified as positive CB in both trials (84.85% and 94.29%, respectively). However, there was no consistency between the results of both trials, suggesting that during the second CB test session animals were able to remember the content of the bucket of the first CB test session. Alternatively, other factors such as the time of the day that pigs were tested, the age of the animals, or their hunger state could have an effect on the results.

Food plots as a habitat management tool: forage production and ungulate browsing in adjacent forest.
Mansson, J., J.-M. Roberge, et al. (2015). Wildlife Biology 21(5): 246-253.

A key challenge for wildlife management is to handle competing goals. High ungulate densities may be desirable from hunting and recreational perspectives, but may come in conflict with needs to limit or reduce browsing damage. Since browsing intensity is negatively related to forage availability it may be possible to mitigate damage on forest by increasing forage availability within the landscape. A commonly used method to increase the attractiveness of a localized part of the landscape is to establish food plots. In a multiyear setup using enclosures, wildlife observations, field surveys, and controlled biomass removal, we studied food plots to document forage production, utilization by ungulates, and browsing on adjacent forests in southern Sweden. The fenced parts of the food plots produced on average 2230 to 5810 kg ha. 1 marrow-stem kale, second-year clover mix or early-sown rapeseed. The biomass of target crops was generally higher within ungrazed (exclosures) compared to grazed (controls) quadrats on the food plots, which demonstrates that the crops were used as forage by ungulates. Browsing on deciduous trees in the adjacent forest was higher within 70-135 m from the food plots compared to areas further away. For wildlife management, our study shows that establishment of food plots provides substantial amounts of forage both during growing season and at the onset of the dormant season, and that a large share of this food is consumed. Finally, our study documents that forage availability for ungulates at the onset of the often-limiting dormant season can be increased by fencing food plots throughout the growing season.

Do Collared Peccaries Negatively Impact Understory Insectivorous Rain Forest Birds Indirectly Via Lianas and Vines?

Michel, N. L., W. P. Carson, et al. (2015). Biotropica 47(6): 745-757.

Tropical rain forest understory insectivorous birds are declining, even in large forest reserves, yet the mechanisms remain unclear. Abundant large mammals can reshape forest structure, which degrades foraging microhabitat. We used six sites in Nicaragua, Costa Rica, and Panama with varying collared peccary (*Pecari tajacu*) density to test three linked hypotheses: (1) locally declining understory insectivores forage preferentially in liana tangles; (2) vine and liana density, cover, and frequency of dense tangles are lower in the presence of abundant collared peccaries; and consequently (3) abundant collared peccaries are associated with reduced understory insectivorous bird abundance. Three insectivores that declined at La Selva preferentially foraged in liana tangles: Checker-throated Antwren (*Epinecrophylla fulviventris*), Dot-winged Antwren (*Microrhopias quixensis*), and Ruddy-tailed Flycatcher (*Terenotriccus erythrurus*). Vine density, liana cover, liana tangle frequency, and forest cover were lower in the presence of collared peccaries relative to experimental mammal exclosures, with the greatest differences at La Selva Biological Station, Costa Rica. Across sites, five of seven vine and liana measures showed negative, curvilinear relationships with peccary densities. Vine and liana measures peaked at sites with intermediate peccary density, and were low at La Selva. Structural equation models suggest negative indirect effects of the collared peccaries on focal bird densities, mediated by vine and liana density, cover, or tangle frequency. Forest area and rainfall affected both lianas and birds, but collared peccaries also contributed to the reduced abundance of understory insectivores. Indirect effects such as that suggested here may occur even in large, protected forest reserves where large mammal communities are changing.

How Rainfall Variation Influences Reproductive Patterns of African Savanna Ungulates in an Equatorial Region Where Photoperiod Variation Is Absent

Ogutu, J. O., N. Owen-Smith, et al. (2015). PLoS ONE 10(8): e0133744.
In high temperate latitudes, ungulates generally give birth within a narrow time window when conditions are optimal for offspring survival in spring or early summer, and use changing photoperiod to time conceptions so as to anticipate these conditions. However, in low tropical latitudes day length variation is minimal, and rainfall variation makes the seasonal cycle less predictable. Nevertheless, several ungulate species retain narrow birth peaks under such conditions, while others show births spread quite widely through the year. We investigated how within-year and between-year variation in rainfall influenced the reproductive timing of four ungulate species showing these contrasting patterns in the Masai Mara region of Kenya. All four species exhibited birth peaks during the putative optimal period in the early wet season. For hartebeest and impala, the birth peak was diffuse and offspring were born throughout the year. In contrast, topi and warthog showed a narrow seasonal concentration of births, with conceptions suppressed once monthly rainfall fell below a threshold level. High rainfall in the previous season and high early rains in the current year enhanced survival into the juvenile stage for all the species except impala. Our findings reveal how rainfall variation affecting grass growth and hence herbivore nutrition can govern the reproductive phenology of ungulates in tropical latitudes where day length variation is minimal. The underlying mechanism seems to be the suppression of conceptions once nutritional gains become insufficient. Through responding proximally to within-year variation in rainfall, tropical savanna ungulates are less likely to be affected adversely by the consequences of global warming for vegetation phenology than northern ungulates showing more rigid photoperiodic control over reproductive timing.

Assessment of temperament traits of white-lipped (Tayassu pecari) and collared peccaries (*Pecari tajacu*) during handling in a farmed environment.
Nogueira, S. S. C., J. F. Macedo, et al. (2015). Animal Welfare 24(3): 291-298.
White-lipped (*Tayassu pecari*) and collared (*Pecari tajacu*) peccaries can be farmed as an alternative to subsistence hunting in Neotropical countries. The animals often show high reactivity to handling, usually involving capture with a net, which is a cause for concern because it poses risks to both animals' and keepers' welfare. We aimed to assess the temperament of both peccary species, evaluating animals' reactions during handling, providing an emotional indicator and a new animal selection criterion for peccary farms. Three indicators were used to assess the temperament of 17 white-lipped and 19 collared peccaries: qualitative behaviour assessment (QBA, by using 12 behavioural adjectives); time to drive each animal through a corridor into a chute (TD, s); and flight speed (FS, m s-1). A Principal Components Analysis was performed for the QBA data to define a temperament index (TI). White-lipped peccaries showed TI scores associated with worse temperament traits than collared peccaries. White-lipped peccaries showed higher TD and FS means than collared peccaries. We found a correlation between TD and FS, but not between TD and TI, nor between FS and TI. The lack of correlation between all temperament indicators occurred, probably, because they measure different aspects of peccaries' reactions toward humans and the farm environment during handling. A wide phenotypic variability was found among individuals within both species' populations. The results provide an opportunity to address the role of temperament assessment, improving handling procedures and exploring the possibility of including temperament as a selection criterion in captive breeding programmes.

Disturbance impacts on large rain-forest vertebrates differ with edge type and regional

context in Sulawesi, Indonesia.
Froese, G. Z. L., A. L. Contasti, et al. (2015). Journal of Tropical Ecology 31(6): 509-517.
Anthropogenic edge effects, whereby disturbance strength increases in proximity to ecotone boundaries, are known to strongly affect individual species but we lack a general understanding of how they vary by species, disturbance type and regional context. We deployed 46 camera-trap stations for a total of 3545 trap-days at two sites in Sulawesi, Indonesia, obtaining 937 detections of five vertebrate species. Anoa (*Bubalus* spp.) were more abundant near edges, booted macaque (*Macaca ochreata*) and red jungle fowl (*Gallus gallus*) were less abundant near edges, and edges did not impact Sulawesi warty pig (Sus celebensis) or Malay civet (*Viverra tangalunga*). But the relative importance of habitat disturbance from agriculture, roads and villages differed for each species, and edge-induced disturbances varied not only in magnitude but also in direction between the study areas. In the strongest instance, macaque local abundance was 3.5 times higher near villages than it was 3 km into the forest in one reserve, but 2.8 times higher 3 km into the forest than near villages in the other reserve. Our results suggest that responses to habitat edges among species and edge types are idiosyncratic, and that landscape-level context can strongly alter the influence of local disturbance on biodiversity.

Influence of human activities on the activity patterns of Japanese sika deer (*Cervus nippon*) and wild boar (*Sus scrofa*) in Central Japan.
van Doormaal, N., H. Ohashi, et al. (2015). European Journal of Wildlife Research 61(4): 517-527.
Human ageing and population decline in Japan are causing agricultural field abandonment and providing new habitats for Japanese sika deer and wild boar. These species have expanded their distribution and increased in abundance across Japan and are causing increased agricultural damage. Effective countermeasures must factor in the behavioural flexibility of sika deer and wild boar. The aim of this study was to examine the effects of hunting and indirect human activities on the activity patterns of sika deer in central Japan and compare these with previous findings on wild boar. Camera traps were used to observe activity patterns of both species and that of humans. Sika deer and wild boar were most active at night during the non-hunting season. Hunting activities significantly reduced sika deer and wild boar activity patterns. In the non-hunting season, nocturnal activity of sika deer increased with decreasing distance to settlement. A similar, but weak response was also observed for wild boar. This study suggests that sika deer and wild boar avoid humans and human-dominated areas by being nocturnal. The recent introduction of night hunting might help to control wildlife populations, but monitoring will be necessary to confirm this expectation.

Not eating like a pig: European wild boar wash their food
Sommer V, Lowe A, Dietrich T. (2016) . Anim Cogn. 2016 Jan;19(1):245-9. doi: 10.1007/s10071-015-0903-z. Epub 2015 Jul 21.
Carrying food to water and either dunking or manipulating it before consumption has been observed in various taxa including birds, racoons and primates. Some animals seem to be simply moistening their food. However, true washing aims to remove unpleasant surface substrates such as grit and sand and requires a distinction between items that do and do not need cleaning as well as deliberate transportation of food to a water source. We provide the first evidence for food washing in suids, based on an incidental observation with follow-up experiments on European

wild boar (*Sus scrofa*) kept at Basel Zoo, Switzerland. Here, all adult pigs and some juveniles of a newly formed group carried apple halves soiled with sand to the edge of a creek running through their enclosure where they put the fruits in the water and pushed them to and fro with their snouts before eating. Clean apple halves were never washed. This indicates that pigs can discriminate between soiled and unsoiled foods and that they are able to delay gratification for long enough to transport and wash the items. However, we were unable to ascertain to which degree individual and/or social learning brought this behaviour about.

Seed dispersal by ungulates as an ecological filter: a trait-based meta-analysis.
Albert, A., A. G. Auffret, et al. (2015). Oikos 124(9): 1109-1120.
Plant communities are often dispersal-limited and zoochory can be an efficient mechanism for plants to colonize new patches of potentially suitable habitat. We predicted that seed dispersal by ungulates acts as an ecological filter - which differentially affects individuals according to their characteristics and shapes species assemblages - and that the filter varies according to the dispersal mechanism (endozoochory, fur-epizoochory and hoof-epizoochory). We conducted two-step individual participant data meta-analyses of 52 studies on plant dispersal by ungulates in fragmented landscapes, comparing eight plant traits and two habitat indicators between dispersed and non-dispersed plants. We found that ungulates dispersed at least 44% of the available plant species. Moreover, some plant traits and habitat indicators increased the likelihood for plant of being dispersed. Persistent or nitrophilous plant species from open habitats or bearing dry or elongated diaspores were more likely to be dispersed by ungulates, whatever the dispersal mechanism. In addition, endozoochory was more likely for diaspores bearing elongated appendages whereas epizoochory was more likely for diaspores released relatively high in vegetation. Hoof-epizoochory was more likely for light diaspores without hooked appendages. Fur-epizoochory was more likely for diaspores with appendages, particularly elongated or hooked ones. We thus observed a gradient of filtering effect among the three dispersal mechanisms. Endozoochory had an effect of rather weak intensity (impacting six plant characteristics with variations between ungulate-dispersed and non-dispersed plant species mostly below 25%), whereas hoof-epizoochory had a stronger effect (eight characteristics included five ones with above 75% variation), and fur-epizoochory an even stronger one (nine characteristics included six ones with above 75% variation). Our results demonstrate that seed dispersal by ungulates is an ecological filter whose intensity varies according to the dispersal mechanism considered. Ungulates can thus play a key role in plant community dynamics and have implications for plant spatial distribution patterns at multiple scales.

Initial Assessment on Large and Medium Sized Terrestrial Mammal Assemblage Using Camera Trapping in Nangunhe Nature Reserve in Yunnan, China.
Bohnett, E., P. Riordan, et al. (2015). Journal of Resources and Ecology 6(5): 331-344.
During surveys for wild felids in Nangunhe Nature Reserve, Yunnan province, China, we conducted a wider mammal survey of the core nature reserve area, using camera trapping techniques. Forty motion-triggered digital camera traps had been set in oldest forest tract of protected area to conduct a species inventory. The total camera trapping effort of 2460 camera trap nights yielded 232 digital photographs of mammals represented by 17 species in five orders. The species photographed include rare and elusive species and those that are of high conservation value, such as IUCN endangered species Asiatic elephant (*Elephas maximus*), and

Phayre's leaf monkey (*Trachypit hecus phayrei*). In addition, IUCN vulnerable species including Asiatic black bear (*Ursus thibetanus*), sambar (*Rusa unicolor*), northern pig-tailed macaque (*Macaca leonine*), and marbled cat (*Pardofelis marmorata*), and more common species were found. All mammals were also listed as key protected wild animals by the State Forestry Administration of China. Of particular importance were the carnivores, with 7 different species recorded. Ungulates and other taxa forming a prey base for these predators, such as rhesus macaque (*Macaca mulatta*), red muntjac (*Muntiacus muntjac*), sambar, wild boar (*Sus scrofa*), and Chinese serow (*Capricornis milneedwardsii*), were found to be the most frequently photographed and most widespread species. Opportunities for local people to develop standardized monitoring designs for targeted species were identified by these initial assessment results. Local nature reserve staff lacked technical ability to produce standardized survey designs, yet a by product of this type of non-standardized data collection can be very informative and produce inventory information that gives a species richness analysis, as well as initial estimates for occupancy and detection probability for abundant species to drive future standardized survey designs and efforts.

Beyond standard wildlife management: a pathway to encompass human dimension findings in wild boar management.

Frank, B., A. Monaco, et al. (2015). European Journal of Wildlife Research 61(5): 723-730.

Around the Regional Nature Reserve Nazzano-Tevere-Farfa in Central Italy, wild boar ecological and economic impacts have increased over the last decade, creating the need for an integrated wildlife management approach. Since 2006, park authorities have used an average of 17 % of the yearly protected area budget for compensation and 5 % for preventive measures. Additionally, 14 wild boar/km2 were culled in 2009. While the management tools used in the protected area were effective in reducing the species' impacts, they did not decrease human-wild boar controversies. To understand the reasons behind such conflicts, user opinions toward the wildlife management approaches used (i.e., preventive measures, compensation, capture, and removal) and planned (i.e., culls) in Nazzano-Tevere-Farfa were explored. Face-to-face interviews were carried out with the general public (n = 288), hunters (n = 57), and farmers (n = 107) in 2009-2010. Differences in attitudes toward preventive measures ([chi] 2 (8) = 40.35, p < .001), compensation ([chi] 2 (8) = 34.11, p < .001), capture and removal ([chi] 2 (8) = 98.23, p < .001), and culls ([chi] 2 (8) = 77.10, p < .001) were highlighted by Chi-square analysis. The Potential for Conflict Index showed that, overall, park users supported preventive measures and compensation, but not capture and removal and culls. Workshops organized with hunters and farmers in 2010 highlighted that park authorities had not considered user expectations when planning wild boar management. If decision makers want to address conflicts, they need to go beyond standard management by tailoring their practices to the specific social context in which they work. Effective management is not only about reducing impacts, it is also about listening to people living with wildlife.

The Influence of Wild Boars on the Growth of Forest Trees and Stands: A Case Study of a Wild Boar Game Preserve

Lebocky, T. and R. Petras (2015). Acta Silvatica and Lignaria Hungarica: 65-75.

This research investigated methods for determining and quantifying the impact of wild boars on the increment and growth of forest trees and stands. The influence of wild boars on stand

variables was observed in a wild game preserve established in central Slovakia in 2000 practicing intensive wild boar management. Long-term measurements obtained from two long-term research plots of sessile oak trees established in 1969 were used to monitor stand growth. Increments of trees were observed on tree ring cores coming from trees surrounded by differently damaged soil surfaces. Wild boars rooting the soil surface proved to have neither a positive nor negative influence on the mean diameter and height of the forest stands. Analysis of radial increments in 9 trees growing on sites with more intense, deeper, and permanent rooting in the soil profile located near a larger mud bath was also carried out. A more distinctive increment depression was found on one oak near the mud bath and on one beech where deeper soil surface rooting occurred.

Food plots as a habitat management tool: forage production and ungulate browsing in adjacent forest

Mansson, J., J.-M. Roberge, et al. (2015). Wildlife Biology 21(5): 246-253.

A key challenge for wildlife management is to handle competing goals. High ungulate densities may be desirable from hunting and recreational perspectives, but may come in conflict with needs to limit or reduce browsing damage. Since browsing intensity is negatively related to forage availability it may be possible to mitigate damage on forest by increasing forage availability within the landscape. A commonly used method to increase the attractiveness of a localized part of the landscape is to establish food plots. In a multiyear setup using enclosures, wildlife observations, field surveys, and controlled biomass removal, we studied food plots to document forage production, utilization by ungulates, and browsing on adjacent forests in southern Sweden. The fenced parts of the food plots produced on average 2230 to 5810 kg ha. 1 marrow-stem kale, second-year clover mix or early-sown rapeseed. The biomass of target crops was generally higher within ungrazed (exclosures) compared to grazed (controls) quadrats on the food plots, which demonstrates that the crops were used as forage by ungulates. Browsing on deciduous trees in the adjacent forest was higher within 70-135 m from the food plots compared to areas further away. For wildlife management, our study shows that establishment of food plots provides substantial amounts of forage both during growing season and at the onset of the dormant season, and that a large share of this food is consumed. Finally, our study documents that forage availability for ungulates at the onset of the often-limiting dormant season can be increased by fencing food plots throughout the growing season.

The stress response and exploratory behaviour in Yucatan minipigs (*Sus scrofa*): Relations to sex and social rank.

Adcock SJ, Martin GM, Walsh CJ. (2015)

Physiol Behav. 2015 Dec 1;152(Pt A):194-202. doi: 10.1016/j.physbeh.2015.09.033. Epub 2015 Oct 8.

According to the coping styles hypothesis, an individual demonstrates an integrated behavioural and physiological response to environmental challenge that is consistent over time and across situations. Individual consistency in behavioural responses to challenge has been documented across the animal kingdom. Comparatively few studies, however, have examined inter-individual variation in the physiological response, namely glucocorticoid and catecholamine levels, the stress hormones secreted by the hypothalamic-pituitary-adrenal axis and the sympathetic nervous system, respectively. Variation in coping styles between individuals may be explained in part by differences in social rank and sex. Using 20 Yucatan minipigs (*Sus scrofa*) we: (1)

investigated the existence of consistent inter-individual variation in exploratory behaviour and the hormonal stress response, and tested for correlations as predicted by the coping styles hypothesis; and (2) evaluated whether inter-individual behavioural and hormonal variation is related to social rank and sex. Salivary stress biomarkers (cortisol, alpha-amylase, chromogranin A) were assessed in the presence and absence of a stressor consisting of social isolation in a crate for 10min. Principal components analysis on a set of behavioural variables revealed two traits, which we labelled exploratory tendency and neophobia. Neither exploratory tendency nor neophobia predicted the physiological stress response. Subordinate pigs exhibited higher catecholamine levels compared to dominant conspecifics. We observed sex differences in the repeatability of salivary stress markers and reactivity of the stress systems. The results do not provide support for the existence of behavioural-physiological coping styles in pigs. Sex is an important determinant of the physiological stress response and warrants consideration in research addressing behavioural and hormonal variation.

Assessments of occurrence and distribution of mammals in forests of the Garden Route National Park based on camera trapping.

Nicholas Hanekom; Rodney M. Randall (2015)

Eleven mammal census sites were selected in four different Afrotemperate Forest types in the Garden Route National Park, South Africa. At each site, an array of eight camera traps was deployed along trails for between 28 and 45 days. Based on accumulation curves, this was generally sufficient for recording most of the focal mammal species at each site. Only 12 mammal (≥ 1 kg) species were recorded, two of which were primarily wetland species. The most widely captured taxa were bushbuck, *Tragelaphus scriptus* (all 11 sites); and caracal, *Caracal caracal* (10 sites). The most frequently photographed species were bushbuck (40%) and chacma baboon, Papio ursinus (22%). The number of species and total capture rates did not differ ($P > 0.10$) between dry (scrub and high) forests and moist (medium-moist to wet) forests, or between small (< 41 km2) forests and a large forest complex. However, at species level, the capture rates of caracal and vervet monkey, *Chlorocebus pygerythus*; were significantly lower ($P \leq 0.05$) in the large forest complex than in small forests, whilst those of bushpig, *Potamochoerus larvatus*; were higher. Trapping cycles of between 28 and 45 days, which recorded the highest number of threatened and protected South African species, were from small forests.

Conservation implilations: The role of small forests in the conservation of mammals in the Garden Route National Park should be investigated further, because relatively high numbers of threatened and protected South African mammal species were recorded in these locations

How do human activities influence the status and distribution of terrestrial mammals in forest reserves

Sam Mugume, Gilbert Isabirye-Basuta, Emily Otali, Rafael Reyna-Hurtado, Colin A. Chapman (2015)

Tropical forests support a rich biodiversity of terrestrial mammals, yet our knowledge of the conservation of forest reserves is lacking. We investigate the relationship between human activities and the abundance of medium-sized terrestrial mammals within 4 forest reserves in Uganda. These reserves allow firewood collection, timber cutting, gardening, and pole cutting. Illegal hunting also takes place. We found a general decline in terrestrial mammal signs in the reserves compared to the better protected adjacent Kibale National Park. Signs of aardvarks,

bushbucks, bush pigs, duikers (blue and red), giant pangolin, giant forest hogs, porcupines, and jackals are still present in some of our reserves.

Tamaño, composición y patrones diarios de actividad de grupos de pecarí de labios blancos (*Tayassu pecari*) en el Parque Nacional Mirador-Río Azul, Guatemala.
José Fernando Moreira-Ramírez, Jorge Erwin López, Rony García-Anleu, Francisco Córdova y Tomás Dubón
Introduction: The white-lipped peccary is a highly social species that forms large, cohesive groups of 10 to over 300 individuals. They are vulnerable to human presence and habitat fragmentation because they require large extensions of undisturbed forest with sufficient availability of food to maintain their biological requirements. This species has disappeared in 84% of its historic range in Guatemala. In Guatemala, the only place containing a viable population of white-lipped peccary is the Maya Biosphere Reserve although it is possible that residual populations exist in Punta de Manabique Wildlife Refuge, Laguna Lachuá National Park and Maya Mountains Biosphere Reserve. The specific objectives of this study were to describe the size and composition of white-lipped peccary groups in Mirador-Rio Azul National Park,a protected area within the Maya Biosphere Reserve, and describe their daily activity patterns at waterholes using camera traps and direct observations.

What Ecological and Anthropogenic Factors Affect Group Size in White-lipped Peccaries (*Tayassu pecari*)?
Rafael Reyna-Hurtado, Harald Beck ,Mariana Altrichter, Colin A. Chapman,Tyler R. Bonnell, Alexine Keuroghlian, Arnaud L. Desbiez, Jose F. Moreira-Ramírez, Georgina O'Farrill, Jose Fragoso and Eduardo J. Naranjo (2015)
Group living among ungulates has evolved mainly in species living in open habitats, such as grasslands and savannas, whereas in the forest, few ungulate species form groups and these tend to be small. Therefore, the white-lipped peccary (*Tayassu pecari*), a Neotropical ungulate listed as Vulnerable by the IUCN, represents an almost unique social occurrence as it lives in large and cohesive groups, yet it inhabits dense tropical forests. Large variations in group sizes have been observed throughout the species range, with reports of herds with less than 10 to around 300 individuals. We examined factors that might cause variation in group size in white-lipped peccary, including ecological and anthropogenic variables. We conducted an extensive literature review and used our original data to compile information on white-lipped peccary's group size across its range. We built models to quantitate generalizations for group sizes distinguishing data from areas with high human influence, and areas that have not been significantly disturbed by humans for at least the last 20 years. We found that white-lipped peccary's group size for all sites was most strongly predicted by a combination of the distances to the nearest human settlement and rainfall and its seasonality. Results from the undisturbed sites indicated that group size is positively influenced by rainfall. Our results contribute to understand why group size varies in different environments that are subjected to different ecological and human conditions. Information on these relationships is a key to advance our understanding of the socio-ecological strategies of animal species living in groups.

Does Trapping Influence Decision-Making under Ambiguity in White-Lipped Peccary (*Tayassu pecari*)?

Selene Siqueira da Cunha Nogueira ,Iurianny Karla Fernandes, Thaise Silva Oliveira Costa, Sérgio Luiz Gama Nogueira-Filho, Michael Mendl. (2015)

Published: June 10, 2015

The white-lipped peccary (*Tayassu pecari*) is an endangered species whose bold anti-predator behaviour in comparison to related species may increase its vulnerability to hunting and predation. We used a judgement bias test to investigate whether captive peccaries that had recently experienced a trapping event made more 'pessimistic' decisions under ambiguity. If so, this would indicate (i) that the procedure may induce a negative affective state and hence have welfare implications, and (ii) that the species is able to adopt a cautious response style despite its bold phenotype. Eight individuals were trained to 'go' to a baited food bowl when a positive auditory cue (whistle; CS+) was given and to 'no-go' when a negative cue (horn A; CS-) was sounded to avoid a loud sound and empty food bowl. An 'ambiguous' auditory cue (bell; CSA) was presented to probe decision-making under ambiguity. Individuals were subjected to three tests in the order: T1 (control-no trap), T2 (24h after-trap procedure), and T3 (control-no trap). In each test, each animal was exposed to 10 judgement bias trials of each of the three cue types: CS+,CS-,CSA. We recorded whether animals reached the food bowl within 60s ('go' response) and their response speed (m/s). The animals varied in their responses to the CSA cue depending on test type. In all tests, animals made more 'go' responses to CS+ than CSA. During control tests (T1 and T3), the peccaries showed higher proportions of 'go' responses to CSA than to CS-. In T2, however, the animals showed similar proportions of 'go' responses to CSA and CS-, treating the ambiguous cue similarly to the negative cue. There were differences in their response speed according to cue type: peccaries were faster to respond to CS+ than to CS- and CSA. Trapping thus appeared to cause a 'pessimistic' judgement bias in peccaries, which may reflect a negative affective state with implications for the welfare and management of captive individuals, and also function to increase caution and survival chances following such an event in the wild environment.

Acoustic and behavioral repertoires of the hippopotamus (*Hippopotamus amphibius*).

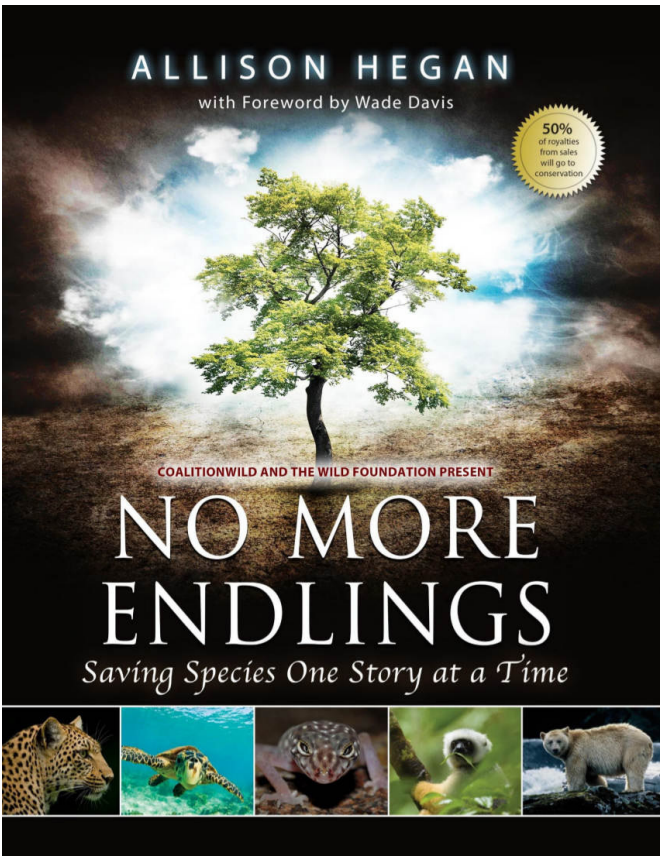
Maust-Mohl M, Soltis J, Reiss D.(2015) J Acoust Soc Am. 2015 Aug;138(2):545-54. doi: 10.1121/1.4923363.

This study describes the acoustic and behavioral repertoires of the common hippopotamus (*Hippopotamus amphibius*). Simultaneous audio and video recordings were collected of male and female hippos at Disney's Animal Kingdom(®). Visual inspection of spectrograms resulted in classifying signals into three main categories (burst of air, tonal, and pulsed) produced in-air, underwater, or simultaneously in both mediums. Of the total acoustic signals, most were produced underwater (80%), and the majority of the total signals were tonal (54%). Using multivariate analysis of the acoustic parameters, 11 signal types were described and differentiated. In the burst of air category, chuffs and snorts were distinguished by minimum and peak frequency, and bubble displays were described. In the tonal category, grunts, groans, screams, and whines were distinguished by several frequency measures (e.g., minimum, maximum, fundamental, peak frequency). Wheeze honks were tonal signals that often involved a chorus of overlapping calls. In the pulsed category, click trains, croaks, and growls were distinguished by frequency and duration. Video analysis demonstrated that chuffs, groans, and

whines were associated with submissive contexts, while snorts, grunts, and growls were associated with dominance contexts. These results provide further information about the acoustic signals and concurrent behavior of hippos.

Carnivory in the common hippopotamus *Hippopotamus amphibius*: implications for the ecology and epidemiology of anthrax in African landscapes.
Dudley, J. P., B. M. Hang'Ombe, et al. Mammal Review.
The common hippopotamus *Hippopotamus amphibius* ('hippo') is a keystone species whose foraging activities and behaviour have profound effects on the structure and dynamics of terrestrial and aquatic ecosystems within its habitat., 2. Although hippos are typically regarded as obligate herbivores and short-grass grazing specialists, field studies have demonstrated that hippos are facultative carnivores that consume flesh and intestinal tissues from the carcasses of other animals. Carnivory by hippos is not an aberrant behaviour restricted to particular individuals in certain localities, but a behaviour pattern that occurs within populations distributed in most of the hippo's current range in eastern and southern Africa. Carnivory is frequently associated with communal feeding involving multiple individuals or entire social groups of hippos., 3. The observed tendency of hippos to feed on carcasses, including those of other hippos, has important implications for the ecology and epidemiology of anthrax and other ungulate-associated zoonotic diseases in African landscapes. Scavenging and carnivory by hippos may explain why the spatiotemporal patterns and dynamics of anthrax mortality among hippos often differ markedly from those of other anthrax-susceptible herbivores within the same habitats, and why levels of hippo mortality from anthrax may be orders of magnitude higher than those of other anthrax-susceptible ungulate populations within the same localities., 4. Recognition of the role of carnivory as a key factor in modulating the dynamics of mass anthrax outbreaks in hippos can provide a basis for improved understanding and management of the effects of anthrax outbreaks in hippo and human populations.

No more Endlings – Saving Species One Story at a Time



More than 100 years have passed since Martha, the last passenger pigeon died in Cincinnati Zoo on 1st September 1914. Martha was an endling, „an individual that is the last of its species or subspecies. When the endling dies, the species becomes extinct“. There were many other endlings. Some like Martha or Lonesome George were given names and received some public attention, but many other species died without no or only few attention or were not even scientifically known. Who remembers when the Chinese river dolphin was declared extinct, when the last Western Black Rhino was seen alive? What about all the small tiny insects with a small geographical distribution which become extinct unnoticed every year when their ecosystems is destroyed?

When you talk about successful species conservation projects, about species which were on the way of going extinct and then their fate turned to a lighter future you have to talk about people. People like Don Merton or William Oliver who made the difference following their own agenda fighting against bureaucracy and many other odds and took species back from the brink of extinction.

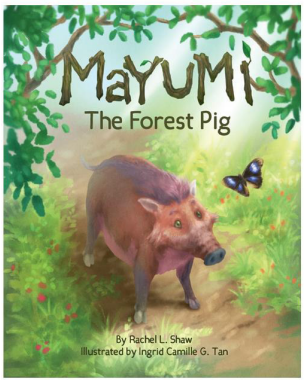
Allison Hegan has collected such stories about people who have dedicated their live to the survival of species. Have you ever heard of Nancy Power and her work to save the Californian black waltnut tree, about Claude Gascon's search for amphibians, about David Curnick and his hunt for mushroom corals (to mention just a few examples in the book)? After a well written forward by Wade Davis each conservationist introduces the species they have chosen to fight for and what is fascinating about it. Then the way she or he raised her or his interest in conservation and their strategies and ideas for conservation are mentioned. Finally a short species portrait follows. All the different species and all the different people fighting to save them are very interesting stories. These species are often not well known to the public. Therefore, it is even more important to draw attention to them. One chapter deals with Erik Meijaard, head of IUCN/SSC Wild Pig Specialist Group, and his interest in Bearded pigs and their mass migration. Although some aspects of Bearded pigs' ecology are known they „remain a bit of a mystery“. Erik also mentions the cultural importance of Bearded pigs for Bornean traditional societies. Not only Erik Mejaards chapter about Bearded pigs but all the chapters about passionate conservationists are well written raising more interest in species and nature conservation. Take a look on the different ways how people became fascinated by their species and enjoy the marvellous photos in every chapter. This is not a book written by conservationists for conservations but for all the people who are interested in nature and species conservation. Working in nature and species conservation can often be frustrating, seemingly endless fights against human ignorance, bureaucracy and short-dated economic interests while gaining only few success. Reading this book raises new motivation for this work. 50 % of royalties from sale will go to conservation

projects. I hope the book gets a broad distribution and that all the different stories about conservation and their fighters will help to raise more attention in conservation and might even push some people to follow the examples mentioned in this book.

No More Endlings – Saving Species One Story at a Time
By Allison Hegan (eds.)
430 pages
2015 Motivational Press, Melbourne

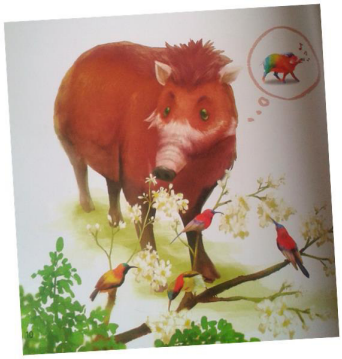
Reviewed by Thiemo Braasch

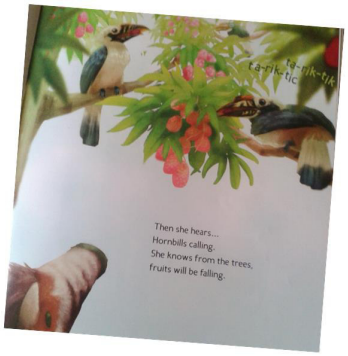
Picture books about endemic and endangered wildlife



Mayumi the Forest Pig

Mayumi is a Visayan Warty Pig. She is a curious young pig. She likes to play and explore the forest that is her home. She doesn't mind when she gets separated from her family until nightfall when the noises of the forest are scary and she realises she does need her family after all.
Pigs like Mayumi live on the islands of Negros and Panay in the Philippines.





Rachel L Shaw rachellshaw.wordpress.com
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Not something to snort at! A 'week' in the life of a pig lasts just FIVE DAYS proving different animals have varying body clocks

http://www.dailymail.co.uk/sciencetech/article-3387275/Not-snort-week-life-pig-lasts-just-FIVE-DAYS-proving-different-animals-varying-body-clocks.html

Analysis of growth rings in pigs' teeth shows they have a five day cycle
Larger mammals have a longer rhythm, smaller ones a shorter rhythm
Multidian internal clock controls cell division and other vital functions
By RUSS SWAN FOR MAILONLINE
PUBLISHED: 19:10 GMT, 6 January 2016 | UPDATED: 21:36 GMT, 6 January 2016

Pigs are generally regarded as lazy, spending their days eating, rolling in mud and sleeping, but researchers have actually found their natural 'rhythm' is faster than humans.
By studying growth rings in the teeth of the animals, the experts discovered their bodies run on a five-day cycle during which time their cells divide, and this rhythm also controls their sleeping patterns.
The researchers said this proves different sized mammals have different chronobiological rhythms.
In particular, the discovery backs up previous studies that found the smaller the animal, the shorter their 'cycle' - and it could lead to drugs designed to be deployed at specific times.
All life has some form of internal clock, according to paleoanthropologist Friedemann Schrenk of the Senckenberg Research Institute in Frankfurt – and it's often roughly 24-hours long.
These circadian - typically about a day - rhythm controls cell division, heartbeat, respiration, and sleep, among other important functions.
By studying fine lines etched into the tooth enamel of domestic pigs, Professor Schrenk and colleague professor Timothy Bromage, a professor at the New York University College of Dentistry, discovered an additional 'multidian', or multi-day cycle.
They put the teeth under the microscope to look at the fine daily growth lines as well as so-called striae of Retzius - thicker lines that occur at intervals of several days.
Thier method bears some resemblance to looking at the growth rings of trees.
Professor Bromage said: 'If you were to scale the tissue of a mouse to the size of a human, this human would not be viable,' Professor Bromage said.
'The mouse tissue contains a large number of metabolic cells to enable a fast rhythm of life.
'A larger mammal would have to ingest enormous amounts of food to sustain itself [with these cells]'.
'This begs the question how small rodents were able to grow into huge animals in the course of geological history'.
The two palaeoanthropologists understood that there had to be a mechanism that regulates the speed of cell division and therefore moderates the animals' growth.
They took blood samples from 33 pigs over 14 days, to find that a number of markers fluctuated on the same five-day cycle as seen in the striae on the teeth.
The teeth of additional groups of mammals reveal that the length of this newly discovered rhythm varies, depending on the animals' size.
Professor Schrenk added: 'For example, in small monkeys the intervals are shorter than in in the

great apes.'
The finding, published in the journal Plos One, supports their theory about the evolution of smaller mammals into larger ones.
The team of scientists hopes to be able to support this thesis in a further step through blood analyses of additional groups of animals. And the new discovery could have implications for human medicine.
'If we know the exact days when our cell production works at full blast, we could employ medications targeted toward the organs 'neglected' at this particular point in time,' he said.

Facebook fans save runaway pig's bacon

2015-12-18 22:33
http://www.news24.com/World/News/facebook-fans-save-runaway-pigs-bacon-20151218

Stockholm - A pig that escaped from a Swedish abbatoir to avoid ending up on a Christmas dinner plate, won a stay on execution from its owner after an outpouring of solidarity on social media.
Determined to save its skin the 110kg sow took to its trotters on Monday in Mjallby, a village in Sweden's southern farming heartland.
On Friday, the farmer caught up with the fugitive, who was in fine fettle after her romp through the countryside.
"She's in great form, she must have stuffed herself with rotten fruit and other good things," the farmer, whose name was withheld, told SVT public broadcaster.
Having been raised on an organic farm she is used to roaming at her leisure, he said.
Moved by the hog's flight animal rights groups launched a Facebook campaign calling on the farmer to spare her from the slaughterhouse.
After 2 500 people signed the petition the farmer relented to let her live.
"Such a commotion! I've decided to let her live until further notice," he said.

Wild pig gives up 'boaring' life

2015-12-07 17:43
http://www.news24.com/Green/News/wild-pig-gives-up-boaring-life-20151207

Berlin - A wild pig in Germany has decided to give up its "boaring" life - leaving the forest to live with a small herd of cattle.
Farmer Dirk Reese told the dpa news agency on Monday the

boar, which he nicknamed "Banana," has been living with the eight cattle for more than two months on his property north of Hamburg, not far from the Danish border.
Reese says Banana has been effectively adopted by the cattle - "He's fully integrated into the herd, which is fascinating."
Reese says Banana has achieved something of a celebrity status in the area, so he's not worried that the boar's life in an open pasture might make it easy prey for a local hunter.
He says that "this pig has a special status."

Beat this! Uttarakhand villagers are using Yo Yo Honey Singh songs to scare wild boars

http://www.firstpost.com/india/beat-this-uttarakhand-villagers-are-using-yo-yo-honey-singh-songs-to-scare-wild-boars-2529884.html
Dec 2, 2015

This is not a joke.
Villagers in north India are actually blasting Yo Yo Honey Singh songs on loudspeakers to scare wild animals away, according to a report in The Times of India. (Yes, you read that right!)
It all started when wild boars started invading agricultural land in Uttarakhand. The boar menace was so widespread that the government was been forced to declare them as pests and sanction their killing, continues the report.
But the beasts are strong and a farmer can't really catch them. So they came up with an alternative solution — to scare them away. And how does on scare away a massive, wild beast? By blasting loud party songs, it seems.
Using sounds on loudspeakers to drive animals away is not unheard of, but these are usually sounds of people or even other animals. But dance numbers, especially Punjabi disco ones, is quite likely a first.
The Times of India quotes Bishan Jantwal, a farmer from Dhari village in Nainital saying, "I used to hear from elders in the house that wild animals avoid places where there is a human habitat. I thought of playing music to let them know of human presence. And it has worked."
"Apart from party songs with high musical notes and loud beats, we also play bhajans which have similar effects over wild boars and other species like jackal, nilgai and others," Jantwal added.
Soon, this idea spread in the surrounding villages and several loudspeakers were installed. In fact, farmers from neighbouring village have actually thanked Jantwal for sharing the idea.
Well, that farmer sure seems to be the local 'Desi Kalakaar'.

Warthogs invade South Texas

http://m.chron.com/sports/outdoors/article/Warthogs-invade-South-Texas-6671689.php
Shannon Tompkins | December 2, 2015

African warthogs, considered an invasive species with potential to negatively affect native wildlife and habitat, have established a small but reproducing population in South Texas.
Over its 46-year history, the Chaparral Wildlife Management Area has been the site of a long list of achievements that cemented its reputation as the premier state-owned wildlife and wildlife habitat research, education and public hunting complex in South Texas.

This year, the "Chap" added a new feat to that list. But it's not one the staff of the Texas Parks and Wildlife Department's 15,200-acre tract in Dimmit and LaSalle counties wanted or covets.

"I'm guess now we'll be known as the first public hunting area in North America where a hunter harvested a warthog," said Stephen Lange, Chaparral WMA manager.

And not just one warthog. During public deer hunts on the Chaparral WMA this autumn, hunters have taken four warthogs, wild swine native to Africa and cousins of the feral hogs whose booming population swarms like locusts over Texas' landscape causing millions of dollars of property damage and untold harm to native wildlife, habitat and other natural resources.

The Chaparral WMA is in the center of what evidence indicates is a growing, range-expanding, self-sustaining feral population of African warthogs, the first such population on this continent. And that worries state wildlife managers such as Lange, who see the non-native warthogs, which can weigh more than 200 pounds, as having the potential to negatively affect native wildlife and habitat.

"There certainly are some concerns," he said of evidence warthogs are gaining a cloven-hoofed hold in South Texas. "Any non-indigenous animal competes with native wildlife for resources."

While feral hogs have been in Texas for hundreds of years, exploding in population, range and damage only over the past 30 or so years, African warthogs are new players on the landscape.

Not unexpected

The first sighting of a warthog on the Chaparral WMA came in September 2014 when TPWD staff conducting aerial surveys of the area's deer population spotted a large boar, Lange said.

The sighting, while disconcerting, wasn't exactly unexpected. Private ranches in the region were, over the past few years, known to have imported or purchased African warthogs and released them on their properties. (A quick check online turns up multiple offers of live warthogs available for purchase, with some of them in Texas.)

Such actions are legal in Texas, where many species of exotic, non-native wildlife can be legally purchased or imported and considered private property, the same as domestic livestock.

While TPWD has regulatory authority over native wildlife and can set rules governing their possession and movement of those species, the agency has no authority over such exotic livestock, and can't prevent landowners from releasing the animals on their land. This has lead to Texas becoming home to self-sustaining populations of nilgai, oryx, blackbuck antelope, axis deer, sambar and other hoofed animals.

And, just as occurred with some of those non-native animals, some of the African warthogs escaped their release sites. Turns out, African warthogs are good at breaching fences and other enclosures designed to contain wildlife and livestock.

"They are very good at burrowing," Lange said.

That's how they found their way onto the Chaparral WMA which is enclosed by a high fence. And they liked what they found. South Texas, with its mild climate, sandy soil and diverse vegetation, is similar to warthog's native habitat in sub-Saharan Africa.

The African warthogs generally resemble feral hogs but are almost wholly hairless and have elongated, flattened snouts from which protrude four large, long, sharp tusks that are much longer than those on feral hogs. They have other differences with their feral hog cousins, including their habit of using burrows as homes and being most active during daylight hours.

But they share some behaviors with feral hogs, including, Lange said, a high reproductive potential, with sows able to reproduce before they are a year old and produce litters of two to eight piglets.

And they are reproducing. This summer, remote-sensing game cameras set on the Chaparral WMA captured images of a warthog sow with four piglets. And WMA staff captured a nursing sow in one of the hog traps set on the area.

"If they are reproducing here, they're reproducing in other areas, too," Lange said.

Good eating at least

There is no evidence the African warthogs are interbreeding with feral hogs, and that doesn't seem likely to occur, Lange said. The genetic differences between warthogs and feral hogs is significant enough that interbreeding is not likely to produce young, and, if hybrids are produced they are almost certain to be infertile, he said.

But a growing, reproducing, expanding warthog population is not something that would benefit Texas' native wildlife.

"I don't see any way it could be a good thing," Lange said.

Over the summer, TPWD staff captured and euthanized six warthogs on the Chaparral WMA as part of the agency's policy of eliminating non-native invasive species on its wildlife management areas. Staff also encouraged hunters who drew the coveted permits for public hunts on the Chaparral WMA to take any warthogs (or feral hogs) they saw while afield.

Several other warthogs have been reported taken this autumn by hunters in South Texas, with most coming from LaSalle, Dimmit and McMullen counties, but at least one coming from Duval County.

Experts, Lange said, suggest warthogs' range might be limited to South Texas, where climate and habitat conditions suit them. Warthogs, unlike feral hogs, don't appear to survive well in cold weather.

Feral, free-ranging African warthogs, like other non-native feral pigs, are not protected by Texas game laws and can be killed at any time in any number. And that's what Texas hunters are encouraged to do if they encounter one.

"I've been told they are very good to eat - just as good or better than feral hogs," Lange said.

And, just as with feral hogs, that's about the only positive thing to be said about African warthogs in Texas.

African wildlife: What it looked like 1000 years ago and why this is important

http://www.sciencedaily.com/releases/2015/11/151130130247.htm
Date: November 30, 2015
Source: University of the Witwatersrand

Summary:
A team of local scientists have wound back the clock by 1000 years to reconstruct wildlife populations across Africa to help us better understand how they have shaped the world we live in.

A team of local scientists have wound back the clock by 1000 years to reconstruct wildlife populations across Africa to help us better understand how they have shaped the world we live in.
This is important, because to understand the ecology of Africa, and much of the rest of the globe, you have to include animals -- and now we have the means to do so, says lead researcher Dr Gareth Hempson, postdoctoral researcher at School of Animal, Plant and Environmental Sciences at Wits University.
Hempson, together with Professor Sally Archibald (Wits University) and Professor William Bond (University of Cape Town), has published a paper inScience, an international journal, titled: A continent-wide assessment of the form and intensity of large mammal herbivory in Africa.
"Animals matter and ecologists across the world are starting to realise that many ecosystems cannot be understood without including animals and their impact into their thinking," says Hempson.
"The problem is that in most places, natural wildlife populations are extinct. The challenge that we took up was to try and bring them back."
Hempson says Africa is the only place left where they could conduct this study because there are fewer cases of extinction here. There are many protected areas where animal populations are still intact in Africa. The team focused on large mammal herbivores -- plant-eating animals like antelope, zebra, elephants, rhino and pigs. These mammals form an integral level in the food pyramid, both consuming vegetation and themselves being consumed by carnivores.
"We used wildlife census data from as many of these protected areas as possible, and then analysed how factors like rainfall, soil fertility and vegetation types influenced the abundance of different species.
"With that information and the knowledge about what rainfall, soils and vegetation used to be like -- we were able predict how many animals of each species there were in all the places that are now so radically transformed," Hempson explains.
The researchers recognised 'herbivory regimes' across Africa. Dry areas -- where there is not much food and very wet areas -- where the food is almost all out of reach in the forest canopy and had relatively few animals. The in-between areas, says Hempson, are really interesting. "They are your classic African savannas." The drier savannas are packed with a kaleidoscope of African wildlife, and the wetter savannas are dominated by elephants and fire.
"All those patterns are of themselves really interesting, and lend strong support to previous ideas about the large-scale ecology of Africa. But there is much more that we can do with this new information," says Hempson.
How does this help us?

- This research provides a platform for fitting animals into the global ecosystem models that are used to predict where planet Earth is headed.
- It allows us to look outside of Africa -- for example towards South America -- and compare the ecology of our continent with one that lost its big animals thousands of years ago. It raises questions such as: Did they help shape their own ecology, so that the world changed when they were lost, or were they merely passive users of ecosystems shaped by climate and soils?
- It also lets us explore the evolution of animal-associated groups like thorny plants, or dung beetles, because we can now make sense of their current distributions that were shaped by animals in the past.
- Back in Africa, livestock have replaced wildlife over vast areas. This research will bring us closer to answering where has this occurred? What are the implications of this shift? Are they

simply interchangeable, or are there consequences for how ecosystems work?

Journal Reference:
G. P. Hempson, S. Archibald, W. J. Bond. A continent-wide assessment of the form and intensity of large mammal herbivory in Africa. Science, 2015; 350 (6264): 1056 DOI: 10.1126/science.aac7978

Why do animals dig waterholes?

http://www.sciencedaily.com/releases/2015/11/151104125326.htm

Date: November 4, 2015
Source: Forschungsverbund Berlin e.V. (FVB)

Summary:
Animals in the Ruaha National Park in Tanzania, East Africa, already dig waterholes during dry seasons even if water is still available in the riverbed. When the river dries up and the water stops flowing, the water quality in the remaining pools deteriorates as they are contaminated with feces and bacteria. In order to gain clean drinking water the animals have to find new water sources.
Scientists from Berlin showed that animals in the Ruaha National Park in Tanzania, East Africa, already dig waterholes during dry seasons even if water is still available in the riverbed. When the river dries up and the water stops flowing, the water quality in the remaining pools deteriorates as they are contaminated with faeces and bacteria. In order to gain clean drinking water the animals have to find new water sources. The study has been published in the scientific journal "Mammalian Biology."
Researchers from the German Leibniz Institute for Zoo and Wildlife Research (IZW) examined the relation between the digging of waterholes by wild animals and the availability and quality of water in the Ruaha National Park in Central Tanzania. With its National Park and its adjacent sanctuaries, the Ruaha ecosystem covers 50,000 km² of the miombo woodlands in Eastern and Southern Africa. The observations took place along the Great Ruaha River during three dry seasons from June to November 2011 to 2013. They clearly demonstrated that wild animals not only dig waterholes when the river is completely dried up but already when the river stops flowing. The water in the remaining pools was highly contaminated by bacteria and faeces.
The scientists conducted the research along a 130 km stretch of the river. They were able to observe elephants, plains zebras, warthogs and yellow baboons digging waterholes. Other species also drank from these holes. The waterholes were used for up to two weeks. Sometimes they were the only available water source within a radius of five kilometres. The waterholes may enable some species to stay in areas they otherwise would have to leave during dry seasons.
Water is essential for life, which is why animals in the Ruaha National Park have to adapt in times of water shortage. The results indicate that digging waterholes is such an adaptation. By digging waterholes, wild animals probably reduce the risk of infections which is more likely with the ingestion of potential pathogens. Many germs including bacteria use water as a transmission path between different hosts.
The results emphasise the essential role of the Great Ruaha River as a key water source for wild animals in the Ruaha ecosystem during dry periods. The deterioration of the water quality during

dry season is on the one hand ascribed to the stagnation of the river; contaminations cannot drain off. On the other hand, remaining pools get contaminated with faeces and urine as they are highly frequented by wild animals. It is therefore important to maintain the water flow throughout dry seasons. Since the 1990s the Great Ruaha River has stopped flowing and dried out inside the National Park for a period of up to three months during dry seasons because its water has been used upstream of the National Park on a large-scale basis for agriculture.
Background information:
Evidence is increasing that water may have been overlooked as a path of transmission of pathogens. It is assumed that pathogens shed into water bodies gain a fitness advantage under optimal ecological settings by evolving traits permitting both the retention of their infectivity in water and a reduction of host specificity. The IZW is also a member of the Leibniz Research Alliance "Infections' 21" to combat infectious diseases in the 21st Century. Within the alliance, the IZW examines water as an aquatic viral vector for new emerging diseases (research project "AQUAVIR").

Journal Reference:
Claudia Stommel, Heribert Hofer, Mirjam Grobbel, Marion L. East. Large mammals in Ruaha National Park, Tanzania, dig for water when water stops flowing and water bacterial load increases. Mammalian Biology - Zeitschrift für Säugetierkunde, 2015;
DOI:10.1016/j.mambio.2015.08.005

Turtles Groom Warthog in Never-Before-Seen Behavior

http://news.nationalgeographic.com/2015/10/151008-turtles-warthogs-africa-animals-science/
By James Owen, National Geographic
PUBLISHED October 8, 2015

"I couldn't believe what I was seeing," says scientist who captured the rare pictures in South Africa.
It may not be the most fashionable salon on the savannah, but turtles were recently caught operating a grooming service for warthogs out of a muddy waterhole in South Africa.
In recent pictures taken in Hluhluwe-iMfolozi Park, two South African helmeted turtles (Pelomedusa galeata) pluck parasites from a warthog (Phacochoerus africanus)—a behavior that's never been documented before.
In fact, there are very few records of turtles cleaning other animals, either on land or in the ocean, according to a report in the September issue of Herpetological Review.
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Park, two South African helmeted turtles (Pelomedusa galeata) pluck parasites from a warthog (Phacochoerus africanus)—a behavior that's never been documented before.
In fact, there are very few records of turtles cleaning other animals, either on land or in the ocean, according to a report in the September issue of Herpetological Review.
Branch notes via email that the only previously recorded instances of freshwater turtles eating ticks or other parasites on larger animals involved Cape buffalo and rhinos.
“I can think of no other reptile that regularly cleans ticks off other large vertebrates,” he says.
The scarcity of such records may be partly due to the fact that oxpeckers and other birds regularly clean parasites from large African mammals, including warthogs, while they're on land. (Watch a video of fish cleaning a hippo.)
Specialist groomers, such as oxpeckers, cleaner fish, and cleaner shrimp, have evolved mutually beneficial partnerships with their host animals—the cleaners get a meal, while the host rids itself of pesky parasites.

Ham dunk! Stunned fishermen reel in a BOAR that had gone for a swim FOUR MILES off the Italian coast

http://www.dailymail.co.uk/news/article-3253638/Ham-dunk-Stunned-fishermen-reel-BOAR-gone-swim-FOUR-MILES-Italian-coast.html
By SARA MALM FOR MAILONLINE
PUBLISHED: 16:22 GMT, 29 September 2015 | UPDATED: 06:55 GMT, 30 September 2015

Wild boar spotted by Italian fishermen off the coast of southern Italy
The animal had swam out some four miles into the sea near Taranto
Fishermen managed to get close enough to lift the boar into the boat
A group of Italian fishermen quite literally managed to save the bacon when they rescued a wild boar from the Mediterranean.
The fishermen spotted the swimming boar some four miles off the coast of Taranto in Italy's southern Puglia region.
According to the one of the unknown men, who uploaded the video on YouTube, the animal put up quite a fight with its rescuers, despite their good Samaritan act.
The group came to the rescue of the exhausted boar after seeing it swimming in circles while they were on a fishing trip.
Determined to save it, they started trying to lure it close enough to lift it into the boat, but the animal put up a struggle.
'We tried to bring it back to the shore – and we eventually managed it – but the boar was very afraid and kept attacking our boat,' one of the men wrote according to TheLocal.it.
'Once we got it to dry land it ran off into the pine forest – it was amazing.'

Italian dog walker killed by a pack of boars outside his home after trying to protect his pets from being attacked

http://www.dailymail.co.uk/news/article-3191755/Italian-dog-walker-killed-pack-boars-outside-home-trying-protect-pets-attacked.html
By HANNAH ROBERTS IN ITALY
PUBLISHED: 00:31 GMT, 10 August 2015 | UPDATED: 07:42 GMT, 10 August 2015

Salvatore Rinaudo was set on by boars as he walked his dogs in Sicily
His wife, Rosa, was also hospitalised with injuries after she came to his aid
She said there was 'no words' to describe what she saw during the attack
Incident was a 'disaster waiting to happen' according to park president
A pensioner has been mauled to death by a pack of wild boars in Sicily, as he walked his dogs.
Salvatore Rinaudo, 77, was knocked to the ground by the group of boar outside the family home near Cefalu, northern Sicily, before being gored and bitten, as he tried to protect his pets from attack.
His wife, Rosa, was also hospitalised with injuries to the legs and abdomen, after rushing to his rescue, but survived.
The couple were found by their son who sounded the alarm and called an ambulance but tragically it was too late to save his father.
Mrs Rinaudo, who was released from hospital on Saturday afternoon, said she was 'devastated' by the loss of her husband.
She told investigators the pensioner heroically 'put himself between the boar and the dogs to save the dogs. But the boar went for him.'
She said: 'My husband went outside with the dogs this morning, as he always takes them for a walk. I saw that he had stopped because the dogs started barking at a group of wild boar.
'He tried to save the dogs by putting himself in the middle but was attacked by some of the wild boar and fell.'
After hearing the dogs barking, she rushed outside in an attempt to protect her husband and pull him into their home, but the boars charged her.
'I went outside and I tried to bring him back to the house. As I tried to get him and take him to the house I was attacked too.' She said there were 'no words to describe what I saw. I am devastated.'
Boar have soared in numbers in recent years prompting local authorities to call for a cull to limit the attacks on livestock and damage to crops.
The president of the park, il parco della Madonie, Angelo Pizzuto said the attack was a 'disaster waiting to happen'.
The mayor of Cefalu Rosario Lapunzina said: 'The danger of the boar has been reported many times with calls for a culling. But no action has ever been taken. '
A prosecutor has opened an investigation into manslaughter

Wild Pigs in India Beat It When Jackson Sings

http://articles.latimes.com/1995-04-04/news/mn-50629_1_wild-pigs
April 04, 1995| Reuters

NEW DELHI — Pop star Michael Jackson may draw huge crowds around the world, but Indian wild pigs are not among his fans.
A farmer in the southern state of Karnataka, troubled over the animals attacking his crops, found that playing Jackson's songs scared them away, Press Trust of India said Monday.

They're a bit big for hide and seek! Elephants wade underwater to cross a river unnoticed but their trunks are spotted by hippos who attack

http://www.dailymail.co.uk/news/article-3390229/They-bit-big-hide-seek-Elephants-wade-underwater-cross-river-unnoticed-trunks-spotted-hippos-attack.html
By GIANLUCA MEZZOFIORE FOR MAILONLINE
PUBLISHED: 12:05 GMT, 8 January 2016 | UPDATED: 20:02 GMT, 8 January 2016

Sneaky elephants creep underwater to reach other side of Zambezi River
But they are too big and their trunk is spotted by a pod of angry hippos
The hippos push the elephants out of the water
They finally reach the banana plantation after a big scare
This is the moment a herd of elephants huddled together for safety and hid beneath the water of an African river - until they were spotted by cheeky hippos who pushed them out.

The elephants started their crossing of the wide Zambezi River, Zimbabwe, to reach a banana plantation.
They get deeper into the water, in a bid to reach the other side unnoticed.
But the elephants were caught out when a pod of angry hippos spotted their trunk sticking up from the water.
It turns out the elephants were not really good at hiding themselves, likely due to their size.
The hippos get close to the elephants, attacking them and pushing them out of the water.
The herd hurries to the other side, finally reaching the banana plantation after the dangerous adventure.

The hippo that's pretty in pink! Rare animal suffering with pigment defect is spotted enjoying a swim with its friends in Kenya

http://www.dailymail.co.uk/news/article-3377260/Rare-pink-hippo-spotted-Kenya-leucism-condition.html
By ALEXANDRA GENOVA FOR MAILONLINE
PUBLISHED: 10:46 GMT, 29 December 2015 | UPDATED: 11:05 GMT, 29 December 2015

The hippo was spotted at Kenya's Masai Mara National Reserve

The pink colouring is caused by a condition called leucism, produced by a partial loss of pigmentation

Wild animals with leucism often don't survive past adulthood

This rare pink hippo may look out of place against its herd - but it has developed unique ways of surviving in the wild.

The hippo - which was pictured at a Kenyan nature reserve - is not an albino but is in fact leucistic, a condition where the pigmentation of cells in an animal fail to develop properly.

Leucism can often affect an animal's chances of survival as it makes them visible to predators - and also leaves them at risk of sunburn.

But hippos have an advantage in that they are big enough to defend themselves against attackers as well being able to use their sweat as sun screen.

Leucism is a condition in which there is only partial loss of pigmentation, which results in white, pale, or patchy colouration of the skin but unlike albinism does not affect the eyes.

It is caused by a reduction in multiple types of pigment not just melanin.

Leucism differs to albinism in that the latter is caused by the reduction of melanin production only and in mammals, results in white hair and pink eyes.

This particular hippo was seen in Kenya's Masai Mara National Reserve this winter and was photographed by French couple Laurent and Dominique Renaud.

Mr Renaud said: 'We knew the pink hippo was in a group of hippos in a bend of the river - people talked about it, but we were never sure whether it was real or a myth or not.

'So to see it in real life was an absolutely life changing experience.

'We checked the area every day and we were lucky enough to spot and to photograph it. I could barely get my camera out to take the photo, I was shaking so much!'

Could hippos be meat eaters?

http://www.sciencedaily.com/releases/2015/12/151207164343.htm
Date: December 7, 2015
Source: Wiley

Summary:
People often think hippos are herbivores with big smiling faces. Every now and then, reports of a hippo of hunting down prey, eating a carcass, or stealing prey from a crocodile are heard, but

they're typically considered 'aberrant' or 'unusual' behavior. Now, however, researchers demonstrate that carnivory, or eating meat, is not uncommon among hippos at all, and that this behavior may increase their susceptibility to mass mortality during anthrax outbreaks.

People often think hippos are herbivores with big smiling faces. Every now and then, reports of a hippo of hunting down prey, eating a carcass, or stealing prey from a crocodile are heard, but they're typically considered 'aberrant' or 'unusual' behaviour.
Now, however, a collaboration among researchers from 4 continents demonstrates that carnivory, or eating meat, is not uncommon among hippos at all, and that this behaviour may increase their susceptibility to mass mortality during anthrax outbreaks. Hippos, elephants, buffalo or antelope are often affected by anthrax epidemics, but anthrax outbreaks among hippos exhibit certain unusual characteristics that could be explained by consumption of the carcasses of infected animals -- especially those of other hippos.
"The phenomenon of carnivory by hippos is crucial to an understanding of their susceptibility to this disease," said Joseph Dudley, co-author of the Mammal Review study.
"These reports fit the fact that hippos are the closest living relatives of whales, which are all carnivorous," added co-author Marcus Clauss.

Story Source:
The above post is reprinted from materials provided by Wiley. Note: Materials may be edited for content and length.

Journal Reference:
1. Joseph P. Dudley, Bernard Mudenda Hang'Ombe, Fabian H. Leendertz, Leejiah J. Dorward, Julio de Castro, Amanda L. Subalusky, Marcus Clauss. Carnivory in the common hippopotamusHippopotamus amphibius: implications for the ecology and epidemiology of anthrax in African landscapes. Mammal Review, 2016; DOI:10.1111/mam.12056

New method to map poaching threats

http://www.sciencedaily.com/releases/2015/05/150522083323.htm
Date: May 22, 2015
Source: University of York

Summary:
Ecologists have developed a new method to better identify where poachers operate in protected areas. Analysing 12 years of ranger-collected data, different types of threats were monitored and recorded, including the commercial hunting of large mammals (elephants, hippos and buffalos), the setting of snares for smaller wildlife, harvesting of timber, illegal grazing, the collection of thatch and other products, and illegal fishing.

Ecologists from the University of York, together with the Wildlife Conservation Society (WCS) and the Uganda Wildlife Authority (UWA), have developed a new method to better identify where poachers operate in protected areas.
Published in Conservation Biology, the analysis provides spatial maps of illegal activities within

Queen Elizabeth National Park, one of Uganda's most important protected areas for elephant conservation.

Analysing 12 years of ranger-collected data, different types of threats were monitored and recorded, including the commercial hunting of large mammals (elephants, hippos and buffalos), the setting of snares for smaller wildlife, harvesting of timber, illegal grazing, the collection of thatch and other products, and illegal fishing.

Revealing that specific poaching locations do not vary significantly from year to year, the results will enable more efficient and effective ranger patrol in the future. Managers can now identify consistent poaching hotspots, even in areas where rangers rarely visit.

Previous research conducted by UWA in 1999 involved rangers collecting geo-referenced information on illegal activities at Murchison Falls National Park, which was then input to a software programme known as MIST. Recording when and where illegal activities occur and how these activities change over time, this system was subsequently extended to all protected areas in Uganda and other countries around the world.

Now, researchers have developed more accurate software known as SMART which is currently being used in Queen Elizabeth Park, allowing more detailed analysis of ranger-collected data than MIST.

Dr Rob Critchlow, Research Associate in the University of York's Department of Biology and lead author on the paper, said: "Ranger-collected data is very biased because rangers target areas where they expect to find illegal activities, making statistical analysis very complicated. It is only in recent years that methods have developed to allow us to make new, more detailed analyses."

Dr Colin Beale, Lecturer in the Department of Biology at York, said: "Our research shows that different threats often occur in very different parts of the park. This means there will now be trade-offs to make in deciding where to invest anti-poaching patrol effort. Managers must decide how important one threat is compared with another, for instance how much money should be used to combat elephant poaching versus snaring of wildlife in general, but we have also identified areas where several types of illegal activity occur but rangers rarely visit."

Dr Andrew Plumptre a WCS scientist who developed the idea for the study, said: "Protected area authorities in Africa typically invest 50-90 percent of their funding in law enforcement to tackle poaching, yet rarely do they measure the impact of their anti-poaching patrolling or evaluate its effectiveness. This new method will provide a tool that will enable that to happen."

Researchers hope future funding will allow the widespread adoption of SMART, enabling managers of national parks across the world to benefit from improved mapping of illegal activities.

Story Source:

The above post is reprinted from materials provided by University of York.Note: Materials may be edited for content and length.

Journal Reference:

1. R. Critchlow, A.J. Plumptre, M. Driciru, A. Rwetsiba, E.J. Stokes, C. Tumwesigye, F. Wanyama, C.M. Beale. Spatiotemporal trends of illegal activities from ranger-collected data in a Ugandan national park. Conservation Biology, 2015; DOI: 10.1111/cobi.12538

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The IUCN/SSC Wild Pigs, Peccaries and Hippos Specialist Groups (WPSG, PSG and HSG) are three of several Specialist Groups of the Species Survival Commission (SSC) developed by the IUCN to foster conservation, research and dissemination of information for species of conservation concern.

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

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

Pigs, peccaries and hippopotamuses are non-ruminant ungulates belonging to the Suborder Suiformes of the Order Artiodactyla (the even-toed ungulates).

Within the Suborder Suiformes, pigs belong to the Family Suidae, peccaries to the Family Dicotylidae and hippopotamuses to the Family Hippopotamidae.