

Suiform Soundings

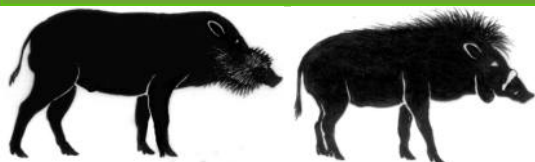


Newsletter of the IUCN / SSC Wild Pig, Peccary and Hippo Specialist Groups



Volume 21(2)
February 2023
ISSN: 1446-991-X





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

This newsletter is electronically available at:
<https://www.iucn-wpsg.org/newsletter>

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Photo front page:

Young female elephant chasing a giant forest hog (*Hylochoerus meinertzhageni*) in a forest clearing of Dzanga-Sangha National Park, Central African Republic.

This clearing - Dzanga Bai - is a vast open area famous for the exceptional concentration of forest elephants who gather in large numbers to dig holes, bath and indulge in drinking the mineral rich waters that bubble up in places in this Bai.

This special place, like other Bais in the middle of that rain forest attract many other shy forest species like Lowland Gorillas, Giant Forest Hog, Red River Hog, Bongo, Sitatunga and Forest Buffalo.

The occurrence and fascinating social behavior of visiting mammals has been monitored for many years by Andrea Turkalo¹.

She noted that groups of Giant Forest Hogs visit the Bai mostly during the dry season and were composed of 1 to 16 individuals with 19% of solitary males.

Dzanga-Sangha is among the few protected areas in the Congo Basin where the subspecies *Hylochoerus meinertzhageni rimator* is widespread and locally abundant, while it is rare and threatened outside.

© Miguel Bellosta, WWF Dzanga-Sangha Conservation and Development Project.

Permission to reproduce thanks to Luis Arranz and Jean-Pierre d'Huart.

¹In: Reyna Hurtado, R., d'Huart, J.P. & Turkalo, A. 2017. Forest Hog (*Hylochoerus meinertzhageni*). pp 114-121.

in: Melletti, M. & Meijaard, E. (eds). Ecology, Conservation and Management of Wild Pigs and Peccaries. Cambridge University Press.

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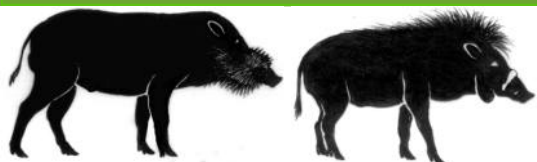


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Dear fellow reader,

It is my great pleasure to present to you the latest issue of *Suiform Soundings*.

We usually take a photograph that belongs to one of the articles for the front cover of each issue of *Suiform Soundings*. In this issue we make an exception. Dr. Jean-Pierre d'Huart, a member of the IUCN/SSC Wild Pig Specialist Group, recently sent me a photograph of a giant forest hog (*Hylochoerus meinertzhageni*) being chased by a young female forest elephant (*Loxodonta cyclotis*). I wanted to share this marvellous photo with you!



The photograph reminds me of these two beautiful species. African forest elephants are Critically Endangered and highly threatened by poaching. Despite being Least Concern, giant forest hogs are almost unknown to the public due to their secret lives that are spent in the rainforests of Central and Western Africa. There are some scientists like Rafael Reyna-Hurtado, editor of *Suiform Soundings*, who are enlightening us to the mysteries and secrets surrounding these hogs. Again and again, it is interesting how little we know about the biggest wild pig species.

Thank you to all of the authors who have contributed to this issue of *Suiform Soundings*!

Enjoy reading!

Thiemo Braasch
Chief Editor *Suiform Soundings*





Ecology and Conservation



13th International Symposium on Wild boar and other Suids in Spain

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Background

The International Symposium on Wild boar and other Suids (IWBS) has been taking place every other year since 1984. The meeting brings together scientists and practitioners from all over the world to discuss and share latest scientific insights and results on wild boar and other suids. Not least with regards to new challenges and threats, such as African Swine Fever (ASF), this exchange is becoming increasingly important.

Due to the COVID-19 pandemic, the 13th Symposium in Spain could not take place as planned in 2020. Therefore, everyone was even more pleased that in 2022 we could meet in person for the first time since the last IWBS in 2018 in the Czech Republic.



Fig. 1: Forest in the Montseny UNESCO Biosphere Reserve in Catalonia, Spain, where wild boar is common.

Location of the 13th International Symposium on Wild Boar and other Suids. Photo: A. Klamm.





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Overview

From the 6th to the 9th of September 2022, with two years delay, the 13th IWBS was held in the Montanyà Hotel & Lodge in the Montseny Biosphere Reserve (Fig. 1) in Seva (Catalonia, Spain).

The IWBS was organised by a designated special Scientific Committee and in collaboration with a local team from the University of Barcelona. The organizers and lead sponsors were the Catalan Government, Barcelona City Council, minuartia consultancy and the University of Barcelona. In an exhibit area, several companies presented their products (telemetry, trapping, bioacoustics, and camera equipment, as well as books).

With 225 participants from 25 countries, there was great interest in the symposium (Fig. 2). Apart from Europe other continents were also represented, e.g. North America (USA), Africa (Madagascar, South Africa) and Asia (India, Philippines).

Before the actual IWBS, 46 scientists attended a EUROBOAR meeting on Monday the 5th September. EUROBOAR is a European scientific network for data and knowledge sharing on Wild boar (for more details: www.euroboar.org).

The symposium's scientific programme was varied: 61 oral presentations and 56 posters focussed on wild boar *Sus scrofa*. For suids other than wild boar, there was 1 plenary talk, 1 full session with 4 oral presentations, as well as 3 posters. Considering the number of "other suids" (16) that include many threatened species (9) the amount of contributions on those species has potential to grow in next years.

After an opening ceremony on the 6th September, Dr. Ferran Jori (CIRAD and Animal Health Coordinator of the IUCN-WPSG) gave the first of three plenary talks on the topic "African Swine Fever and wild pig reservoirs: A moving target". This was followed by the three sessions "ASF-management", "Spatial behaviour" and "Ecology & damage mitigation".

On the second conference day, several fieldtrips were offered:

URBANBOAR: Mitigation of wild boar presence and capture techniques in urban areas (46 attendees)

DRONEBOAR: Use of drones for wild boar census and management (46 attendees)

WINEBOAR: Measures to reduce damages (38 attendees)

ROADBOAR: Fauna passages. Census by camera trapping (26 attendees)

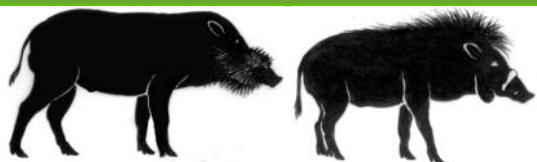
The field trips were followed by an intensive poster session for the 56 posters.

On the third conference day, with his plenary talk "Hunting wild boar: How, why and to which costs?", Dr. Oliver Keuling (University of Veterinary Medicine Hannover, Germany, and IUCN-WPSG Member) initiated the sessions "Population control", "Methods to estimate abundance", "Other Suids ecology and management" and "Diseases & One health".

Dr. Giovanna Massei (Animal and Plant Health Agency, UK) started the last conference day with her plenary talk "What we don't know about wild boar: knowledge gaps and research priorities for an overcrowded world", followed by the sessions "Wild boar in urban habitats" and "Human dimensions".

During the symposium it became clear that there are four outstanding topics related to wild suids: Wild boar populations are increasing across their entire range and this often causes conflict, in particular the management of wild boar in urban areas is a challenging and growing problem, ASF is currently the biggest threat in suid management and conservation and the large demand





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Fig. 2: A total of 225 participants from 25 countries attended the 13th International Symposium on Wild boar and other Suids in Seva (Spain) from 6–9 September 2022. Photo: P. Fourmann.

for research on suids. Therefore, as part of the closing ceremony on Friday the 9th, the Scientific Committee of the IWBS 2022 presented a “Final declaration” on how the different stakeholders should deal with the increasing wild boar population and their impacts worldwide. Two specific points of this declaration were also relevant for other suids, included in point 10 as, *“Improve wild pig surveillance worldwide to achieve a more integrated disease monitoring and management approach”* and point 11 as: *“Since wild pigs in Africa are the only species resistant to ASF and a potential reservoir for ASF, promote research on their ecology and mechanisms of resistance.”*

Besides the very exciting scientific agenda, the social programme with a post-conference dinner or discussions during the various coffee breaks were important for professional and personal exchange, especially after a long period of no face-to-face meetings. In the evening of the second conference day, a small IUCN-WPSG evening-meeting was held, involving the WPSG members Dr. Ferran Jori, Dr. Johanna Rode-White, Dr. Stefano Focardi, Dr. Oliver Keuling, Jörg Beckmann, Fernando Garcia Gil, Markus Handschuh and Alisa Klamm.

Overall, the 13th IWBS was a very successful conference and offered a great platform for fruitful exchanges between experts from different countries and disciplines in the field of research and practice focussed on wild boar and other suids. There were diverse lessons learned from scientific studies in wild boar implemented in developed countries that may be very useful and applicable to other wild suids.

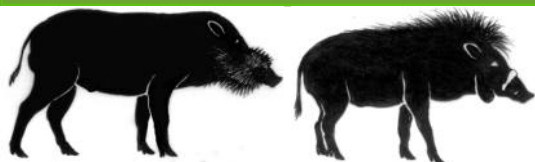
Further information and outlook

Detailed information on the 13th IWBS, the book of abstracts and the final declaration can be found at <https://wildboarsymposium.com/>.

The 14th IWBS is scheduled to take place in 2024. For the coming meetings, we encourage all researchers and practitioners working on suids other than the widespread wild boar – especially rare and threatened species - to consider participating and contributing to this extremely helpful and exciting symposium.

The location for the next symposium is being discussed. There are several options, e.g. Japan, Israel and Belgium. The decision will be taken. In any case, we hope to see you there next time!





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Contributions on the ecology, biogeography and ethnobiology of White-lipped peccaries *Tayassu pecari* (Link, 1795) of the Ecuadorian Amazon

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Abstract

In Ecuador, many research projects have been conducted addressing the conservation status of medium and large fauna using camera traps, working alongside with local communities. From the cloud forest to the Amazonian lowland of Ecuador, we chose some places to study the fauna and its interaction with human population. One of the studied species is the White-lipped peccary (*T. pecari*), and the most important highlights of our observations found in our research about its ecology, distribution and ethnobiology is presented in this article. Therefore, this document is a summary of some of our research concerning the ecology, biogeography and ethnobiology of White-lipped peccaries of the Ecuadorian Amazon, aiming to better understanding the threats and changes that this species is facing to improve the management and conservation strategies in the local communities.

Introduction

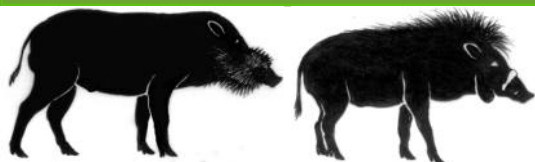
The White-lipped peccary (*T. pecari*) is a pig-like wild species distributed along the neotropics, from southeast Mexico throughout northern Argentina and southern Brazil (Keuroghlian et al. 2013; Reyna-Hurtado et al. 2008) (Figure 1). They are a highly social species creating large herds of many individuals (Keuroghlian et al. 2013). The species is considered an ecosystem engineer in tropical forests, as they generate new habitats for species to live in by creating and maintaining wallows given their behavior, influencing the dynamics of tropical forests (Taber et al. 2011; Taber et al. 2008).

In Ecuador, White-lipped peccaries inhabit coastal and Amazonian forests (Tirira, 2021). Coastal populations correspond to the subspecies *T. p. aequatoris* (Link, 1795), while Amazonian populations correspond to *T. p. pecari* (Link, 1795). According to the red list of mammals of Ecuador the species is classified as endangered (EN)(Tirira 2021).



Fig. 1: Individuals of *T. pecari* in a defensive attitude towards the flash of a camera trap in a Kichwa community in the southern area of Yasuní National Park, in the Ecuadorian Amazon. Photo: L. Guarderas Flores





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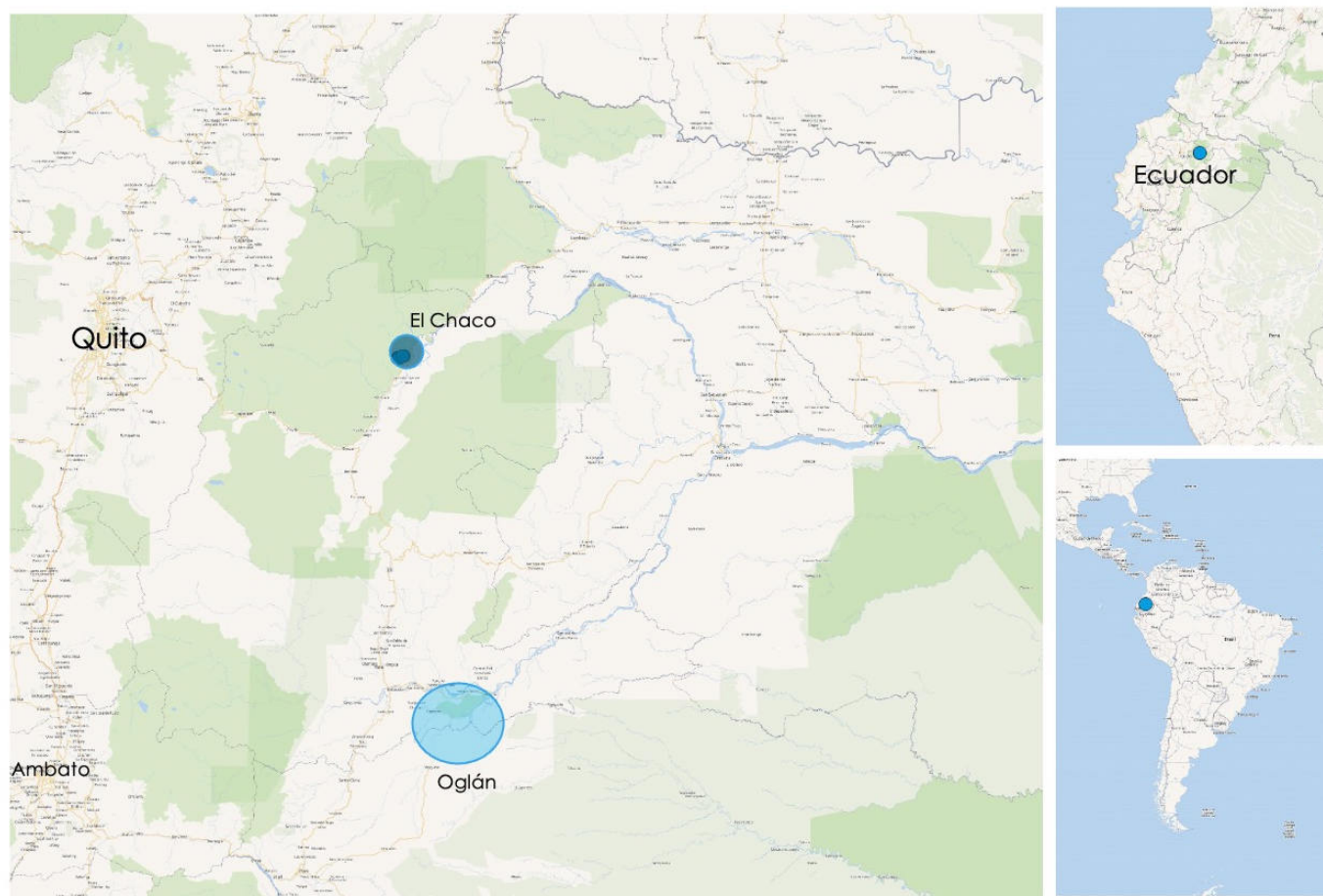


Fig. 2: Map showing the study sites for our research, in the Ecuadorian Amazon. El Chaco, with one study site and in the area of Oglán, three study sites (the local communities of Oglán, Elena Andi and Pambayacu).

Since 2017 different projects have been undertaken by our research team in four study areas in the Ecuadorian Amazon (Figure 2) using camera traps. Which have provided important information regarding the distribution, ecology and conservation status of this species; alongside these projects we have gathered information regarding common threats, ethnozoology and socioecological interactions with local communities.

One study site is located in El Chaco in Napo Province, and the other three sites (Oglán, Pambayacu and Elena Andi) are located in the area of Arajuno, in Pastaza province.

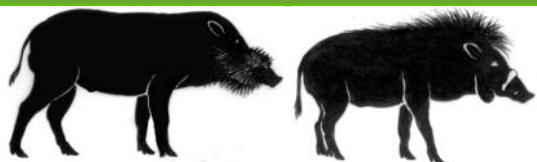
Distribution

One of the most remarkable findings was an increase in the elevational distribution for White-lipped peccary, from 1.600 masl reported by (Tirira 2017) to 2.000 m a.s.l. (Torres and Gavilánez 2019). This record was reported in the higher Amazonian locality of El Chaco. Furthermore, this record is higher than the one reported by IUCN for the species (1900 masl) (Keuroghlian et al. 2013). Another records have been reported, for example in Peru, a small herd of *T. pecari* was recorded by camera traps at 2.173 masl (Mena and Hiyo-Bellido 2016).

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We wrote years ago an article about the threats that peccaries populations are facing in the





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Ecuadorian Amazon, overall related with the land use change of the banks of the Napo river, mainly caused by deforestation (Torres et al. 2009). Also, we showed the importance of the Napo river as a key zone for peccaries crossing from one side of the river to the other (Torres et al. 2009), which is extremely vital for connecting populations and promoting genetic exchange. This connectivity is also in danger due to not sustainable practices around river banks, as a consequence of anthropogenic activities (Torres et al. 2009). Since this report was made, every year sightings of peccaries crossing this kind of Amazonian rivers is less common, mainly due to fluvial traffic from oil extraction activities, transportation of supplies and human mobilization, especially considering the significant increase in the density of local populations along the Napo river. This indicator of a possible loss of connectivity among populations is worrisome as it may impact resource availability as well as a reduction of genetic variability.

Furthermore, our camera trap records evidence that herds of peccaries are likely getting smaller. In average, the recorded herds have 15 individuals in the highland (Torres and Gavilánez 2019) and more than 300 in the lowlands (Tirira 2017). However, our last records show reductions in these numbers, with small groups, below 50 individuals to even none registered in places where they were abundant before. In the past, in other places of its distribution, herds of White-lipped peccaries were reported having more than 500 individuals (Fragoso 2004; Kiltie and Terborgh 1983; Taber et al. 2011). This reduction, or possible subdivision of herd size, may indicate a reduction in the carrying capacity of tropical ecosystems due to a decrease in resource availability, increase in forest fragmentation and other human caused threats. The reported increase of elevational range in Ecuador (Torres and Gavilánez 2019) may also indicate a range shift as a response to anthropogenic threats in lower areas as well as an increase in range size as a response to resource scarcity. All of this observations are being recorded and tested to be presented in future articles.

In this sense, we are studying the decrease of abundance of peccaries in our study sites due to non-natural causes such as, commercial over hunting and other human activities. These studies will shine a light into the conservation status of this important mammal species in Ecuador, as well as provide relevant information to implement conservation strategies to be undertaken alongside local communities, government, and decision makers.

Ethnozoology of the White-lipped peccary in the Ecuadorian Amazon

Ancestral names - White-lipped peccaries inhabiting Amazonian indigenous territories have been given different names according to the location of the communities and their native language. For example, the Kichwa people of the northern and central Amazon call this species Wankana (unified Kichwa) or Huangana (traditional Kichwa), while the Shuar nationality call them Unt-paki or Yankimki and the Waoranis' local name for the species is Ore or Ode.

Tab. 1: Ancestral classification according to the local knowledge of Kichwa people. Pastaza Province, Ecuador.

Ethnobiology categories. (Berlin et al. 1973; Santos Fita et al. 2009)	Kichwa ethnozoological classification system	Taxonomical categories (Linneus)
Unique starter	<i>Aycha</i> (animal)	Animal kingdom
Life form	<i>Wilmayuk aycha</i> (flurry animal = mammal)	Class: Mammalia
Intermediate	<i>Wankana Ayllu</i> (grouping for "forest pigs")	Family: Tayassuidae
Generic 1	<i>Wankana</i> o <i>Huangana</i>	<i>Tayassu pecari</i>
Generic 2	<i>Lumukuchi</i> o <i>Lumucuchi</i>	<i>Dicotyles tajacu</i>





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Ancestral taxonomical classifications

Indigenous communities have also developed a system of classification of species according to common morphological and ecological characteristics, as well as uses. The classification for peccaries given by the Kichwa community of the Curaray region in the Pastaza province of Ecuador is shown in Table 1.

Hunting techniques in the Ecuadorian Amazon

White-lipped peccaries (*T. pecari*), as well as Collared peccaries (*Dicotyles tajacu* (Linnaeus, 1758)), are hunted during the day, preferably early in the morning or afternoon, as those are the times when they are more active. Currently, most local hunters use firearms, mainly 16-gauge cartridge shotguns as well as 22-gauge carbines, known locally as “U bullet”. Other weapons used for hunting this species include blowpipes, palm lances (Figure 3), “chuzo” (a sharp machete blade attached with wire to a hardwood handle) or simply a stick of about 3 meters with a sharp point. Usually, the hunted animal seeks refuge under tree roots where they are easily speared.

The hunting procedure for peccaries, according with the information gathered in the communities directly by us, is as follows: the hunter locates recent traces of animals in the forest, with cues such as fresh tracks or pungent onion like odors.

Then, the trail is followed until the herd is sighted. As peccaries are making noises, as they move through the forest, the hunter quietly approaches the place where the peccaries are heard. When sensing human presence, peccaries tend to chatter their teeth, generating a sound that can be clearly heard more than 200 meters away. Hunters may also use trained dogs to hunt peccaries. Once dogs locate the herd, they follow them, and it often happens that one or some individuals seek refuge under large tree roots or holes in the ground, where dogs corral them until the hunter arrives and uses firearms, a spear, a stick, or a machete to kill the animal. In forests where hunting peccaries is not common, white-lipped peccaries often surround humans forcing them to seek refuge climbing small trees to avoid attacks.



Fig. 3: Traditional Waorani spears for hunting peccaries from the Pompeya Museum, Ecuadorian Amazon.





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Uses of the peccaries

There are four ancestral uses registered for White-lipped peccaries among the indigenous Amazonian people of Ecuador. The main uses are the following:

Pets: The White-lipped peccary occasionally, when captured young, is taken to the hunter's house, and given to the wife to raise it as a pet. They tend to be very faithful and jealous with their owners. Likewise, in some zoos in the region, captive peccaries are kept for exhibition (Figure 4).



Fig. 4: Male adult of white-lipped peccary and a calf kept in captivity at the Coca City Zoo, Orellana, Ecuador.

Food: The meat from peccaries is traditionally used to prepare at least five culinary preparations called “chaquichishca” (smoked meat), broth (light soup with pieces of meat and cassava or cooked plantain), “locro” (thick soup with pieces of cassava or another local tuberculum with pieces of meat), “cato” (shredded green plantain soup with pieces of meat) and the typical “fritada” (cuts of meat fried in oil or lard). It should be noted that the description of these culinary preparations comes from the Kichwa cuisine.

Artisanal use: Peccary fangs are used mainly for the manufacture of necklaces. Likewise, some indigenous artisans with carving skills use the teeth of peccaries to carve figures called “mermaids”. The skin is also occasionally used as a lining for drums.





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Ritual use: When a peccary is hunted, the hunter cuts off the penis of the recently butchered animal and smoothly lashes the legs of his young children with this organ as a ritual act, transferring the power that peccaries have, to withstand very long walks in the forest. Therefore, the hunter's sons will be good walkers and runners.

A myth associated with peccaries

The best-known myth in the Ecuadorian Amazon region that includes peccaries is the Kichwa myth known as “wankana kuraka” or “wankana supay”, the spirit of the peccaries (Figure 5). In summary, this myth is about a hunter who was chasing a peccary that was carrying a red bugle with him. The hunter chases the herd where this peccary was, until he got lost in a swamp forest. At night, an old man appears to him in a dream to tell him that now he will become the protector of the squadron of peccaries and invites him to live with the squadron. He starts living with them, protecting them, and little by little, the hunter becomes a peccary. Everything went well, until he feels nostalgic for his home and his family and decides to return home.



Fig. 5: Recreation of the kichwa myth; the “spirit of peccaries”. Drafted by I. Jácome

The peccaries allow him to do that, and in gratitude, they gave him the red bugle and told him that when hungry, he must blow the red bugle only three times. After the three calls they will arrive, so, he can hunt one or two of them to feed his family. Before leaving him, they warned him that he and only he can blow the bugle, it is strictly forbidden for others to blow on it. The years go by without any troubles, he kept his word, and the herd of peccaries did the same.

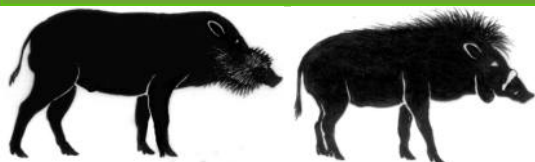
One day the hunter left the bugle at his house and his relatives took it

without his permission. They played it many times until peccaries appear everywhere, they were even coming out from under the ground, by hundreds, enraged, to take the bugle back with them. Since he did not respect the commitment, the man must now go looking for them in the forest, walking kilometers to be able to hunt peccaries.

Local perceptions about the conservation of peccaries

After the application of a projective survey to 20 Amazonian communities located in the northeast of Ecuador in the year 2022 (5 Shuar communities from the road to Dayuma, 4 Waorani communities from the Yasuní National Park, 7 Kichwa communities from the middle basin of the Napo River and 4 Kichwa communities located in the vicinity of the city of Coca) it was possible to determine that there are still remnant populations of the white-lipped peccary in all the aforementioned communities, according with their experience and perception. According to the





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interviewees, peccaries' populations in the communities surrounding the city of Coca, have fewer individuals than the ones located inside the Yasuní National Park, which is correct according to our observations. Moreover, the interviewees affirmed peccaries prefer floodplain forests on the banks of large rivers, plain forests, and morete swamps (*Mauritia flexuosa*) when this palm bears fruit. In all cases, the interviewees said the reduction in populations is mainly due to intensive hunting for commercial purposes.

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Spatially targeted hippopotamus survey and monitoring in the southern part of the Gamba Complex of Protected Areas, Gabon

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Abstract

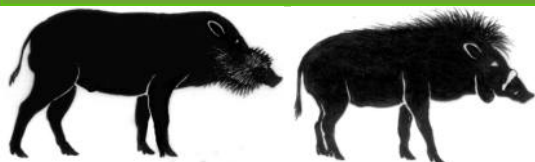
Common hippopotamus (*Hippopotamus amphibius*; hereafter hippo) populations are declining in many African countries, with West African populations most at risk. In Gabon, population numbers are largely unknown, but are believed to be in decline despite national protected status, mainly due to poaching due to poor law enforcement. The Gamba Complex of Protected Areas (GCPA), in south-west Gabon, has been identified as an important area for hippo conservation. However, the last hippo survey in this area was conducted in 2011, making the current status of the hippo population in this area uncertain. Our study aimed therefore to estimate present-day numbers and occurrence of hippos in the southern part of the GCPA and to resample some of the locations of the 2011 survey in order to compare population trends in these selected areas. The results of our spatially targeted hippo survey indicate that hippos are still widely distributed in the southern part of the GCPA, especially along the coast. However, population numbers are rather low, with the exception of the Nyanga region (Nyanga and Mouambi rivers), which revealed stable population numbers (61 individuals) since the last survey in 2011 (56 individuals) and thus remains a key area for hippo conservation in the GCPA.

Introduction

The common hippopotamus (*Hippopotamus amphibius*; hereafter hippo) is a megaherbivore found in many countries throughout sub-Saharan Africa in suitable wetland habitats. Its conservation status was reviewed by Lewison & Pluháček (2017) and it is classified as vulnerable on the IUCN Red List of Threatened Species. These authors noted that there are clear regional differences in population size and distribution across the range, with Eastern and Southern African countries considered as a conservation stronghold for this species. In contrast, hippos are less widely distributed and typically occur at low densities in West Africa. Recent data suggest that populations in West and Central Africa are at the highest level of risk due to the fragmented nature of their distribution, the high frequency of hippo-human conflicts and unregulated hunting (Lewison & Pluháček, 2017).

In line with reports for West and Central Africa, hippo populations in Gabon are limited in their distribution and occur at low densities (Lewison & Pluháček, 2017). They are reported to reside in the National Parks of Ivindo and Pongara, the hunting reserve Wonga Wongué, and in the Gamba Complex of Protected Areas (GCPA), including Loango and Moukalaba Doudou National Parks (Christy et al., 2008; Eltringham, 1999; Michez, 2006; Rietmann, 2014). The most recent IUCN population estimate for Gabon is 250 individuals (Lewison and Pluháček, 2017). However,





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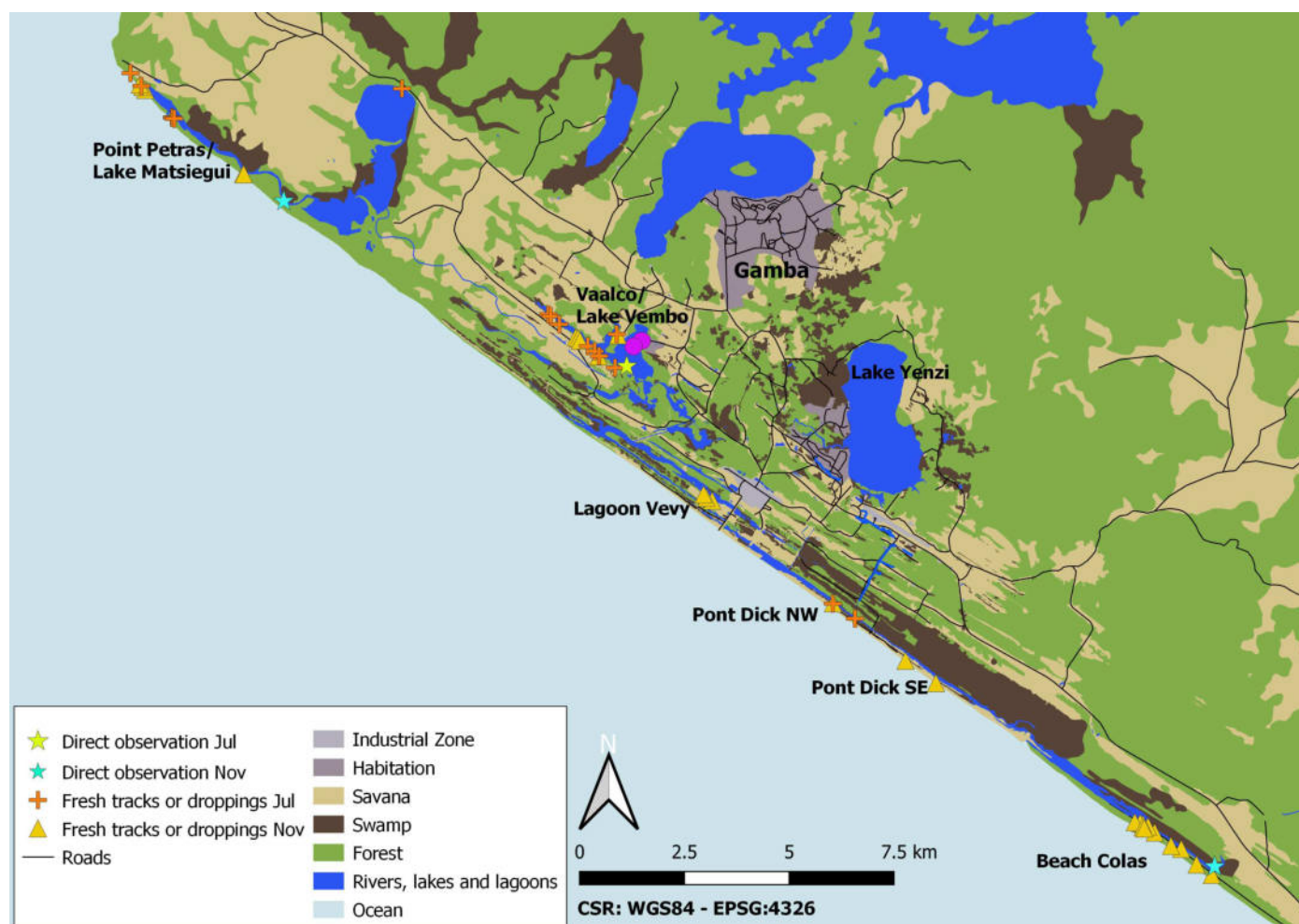


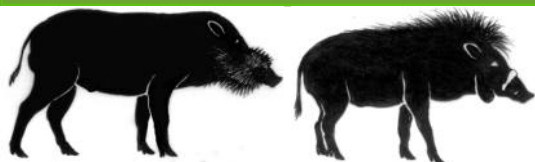
Fig. 1: Direct and indirect hippo presence signs found during the surveys on foot and by boat in July and November 2022 in and around the town of Gamba (Gamba area).

to our knowledge, there has been no systematic assessment of population numbers in Gabon, so this number should be regarded with caution.

In Gabon, the GCPA is thought to hold a significant portion of Gabon's hippo population (Lee et al., 2006; Rietmann, 2014). However, in the last 16 years there have been only two surveys in the GCPA, one in the southern part of the Loango National Park, along the river Mouena Mouélé in 2006 (Michez, 2006) and more recently a more extensive survey in spatially selected areas within the GCPA in 2010 and 2011 (Rietmann, 2014). The latter study recorded the sighting of 75 and 111 individuals in the GCPA in 2010 and 2011, respectively.

Hippos have been legally protected in Gabon since 1982, but the level of law enforcement is considered to be poor. Population numbers are thought to be declining due to poaching for meat and tusks (Christy et al., 2008; Rietmann, 2014). Hippo poaching is an ongoing reality in the GCPA and was observed in Pont Dick near the town of Gamba (Fig. 1), where poachers were arrested with a fresh hippo carcass (M. Navarro, pers. comm.). Older signs of poaching (hippo bones) were also found at the same site (G. Moussavou, pers. obs.). To our knowledge the development of the hippo population in the GCPA has not been investigated since the 2010/11 survey. However, up-to-date information on the population and distribution is needed to inform





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hippo conservation. Furthermore, some suitable habitats along the coast close to the town of Gamba, which are part of the southern concessions of Assala Gabon, were not included in the last hippo survey within the GCPA. Accordingly, our study aimed to 1) estimate current numbers and occurrence of hippo populations along the coast and in lakes and lagoons near Gamba and 2) resample some of the locations of the 2010/11 survey that lie outside the Loango National Park, in order to compare population trends in these selected areas.

Material and Methods

Study area

The GCPA is situated in southwestern Gabon at latitude 1°50'- 3°10'S and longitude 9°15'- 10°50'E (Lee et al., 2006). The Gamba Complex is an 11,320 km² protected area on the southwest coast of Gabon that supports significant habitat and species diversity, as well as the country's largest onshore oil reserves (Dallmeier et al., 2006; Lee et al., 2006). The GCPA includes two of the 13 national parks of Gabon, Moukalaba-Doudou and Loango which are separated by an industrial corridor in which oil and logging concessions are found. Assala Gabon holds several onshore oil concessions in the industrial corridor which include Gamba and the surrounding area, including the coast. The GCPA contains a diverse mosaic of terrestrial and aquatic habitats, including mangrove forests, littoral forest, savannas, wetlands, lagoons, rivers and the Atlantic Ocean (Lee et al., 2006). The hydrologic landscapes in which hippos occur are formed by three main watersheds and a complex network of minor rivers, streams and lagoons (Lee et al., 2006; Rietmann, 2014).

Focusing on areas in and around Gamba (Gamba area), six sites were surveyed in the southern concessions of Assala Gabon that were considered suitable hippo habitat and where hippos have already been seen or reported in the past. These sites are Lake Vembo/Vaalco, Lagoon Vevy, the beach around Pont Dick north-west, Pont Dick south-east, Beach Colas and Point Petras/Lake Matsiegui (Fig. 1). Among the surveyed sites in the Gamba area, Point Petras represents the most distant site in the northwest and Beach Colas the most distant site in the southeast. These

Tab. 1: Number of direct and indirect hippo presence signs and survey effort and means per site in the dry and wet season.

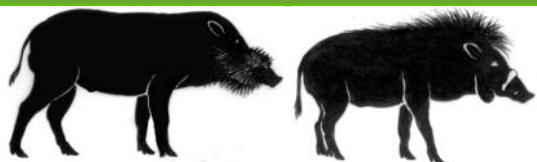
Sites	Direct observation		Droppings				Tracks				Survey effort (km)		Survey means	
	dry	wet	dry		wet		dry		wet		dry	wet	dry	wet
			fresh	old	fresh	old	fresh	old	fresh	old				
Vaalco, Lake Vembo	1	0	4	12	2	7	4	1	3	0	4.8	4	foot	foot
Pont Dick NW	0	0	0	6	0	1	2	1	1	2	3.6	3.3	foot	foot
Pont Dick SE	0	0	0	8	0	1	0	0	2	0	2.9	4.6	foot	foot
Lagoon Vevy	0	0	0	5	1	0	0	0	3	0	3	2.8	foot	foot
Colas Beach	0	4	0	3	2	0	0	0	9	0	4.3	2.8	foot	foot
Point Petras, Lake Matsiegui	0	1	3	11	0	1	3	1	3	0	5	7.9 (1.5 + 6.4)	foot	foot + boat
Nyanga	47	23									55.7	43.6	boat	boat
Mbissi	0	0									8.9	NA	boat	boat
Mouambi	14	4									27.3	27.4	boat	boat
Lake Yenzi ^x	0	3									NA	NA	camera trap	camera trap
Vaalco, Lake Vembo ^y	NA	6									NA	NA	NA	camera trap
Total	62	41	7	45	5	10	9	3	21	2	115.5	96.4		

NW = north-west, SE = south-east

^x camera trap data from July (dry) and November (wet)

^y camera trap data from December (wet) 2022





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two locations are 33 km apart. With the exception of Lake Vembo, which was part of the 2010/11 survey, none of these sites has ever been systematically surveyed for hippos to our knowledge. Additionally, we included surveys in the Nyanga, Mbissi and Mouambi rivers close to the Moukalaba Doudou National Park, which were also part of the 2010/11 survey. Three other regions in the GCPA that were surveyed in 2010/11, such as the lagoons Ngove and Ndougou (both in and near Loango National Park) and the Moukalaba river (eastern part of Moukalaba Doudou National Park), were not included in our surveys.

Another site with suitable hippo habitat is Lake Yenzi (Fig. 1). However, Lake Yenzi was not included in the Gamba area surveys on foot and by boat because we have been monitoring the hippos at Lake Yenzi with camera traps (Reconyx PC800 Hyperfire) since 2020, so already know the number of hippos there. In November 2022, following the wet season survey results, we installed additional camera traps at two sites (Vaalco and Lagoon Vevy) to identify the number of hippos. The results of the camera trap records at these sites are reported along with the results of the surveys on foot and by boat to provide a more complete report on the total number of hippos in the greater Gamba area in 2022. At the other sites, we rely on surveys on foot and by boat, as installing cameras is too risky due to the risk of theft and disturbance from human activities, as well as logistical constraints.

Data collection

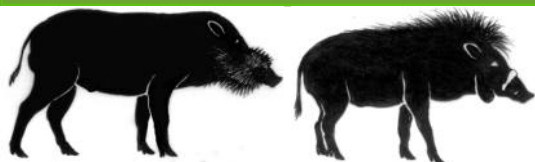
Hippos are expected to be more widely distributed in the wet season than in the dry season due to changing water levels (Fritsch et al., 2022; Karstad & Hudson, 1986; Stommel et al., 2016). Therefore, surveys were conducted in both the dry (July) and wet (November) season in 2022. For sites in the Gamba area, surveys were mainly conducted on foot. On one occasion in the wet season, the survey at Point Petras/Lac Matsiegui was conducted on foot and by motorized boat (aluminum boat, length = 4 m). For areas not accessible on foot, such as the rivers Nyanga, Mbissi and Mouambi, we conducted hippo count surveys by motorized boat (fiberglass boat, length = 7.5 m) exclusively, which was also the main survey method used by Rietmann (2014). All sites were surveyed once in the dry and once in the wet season.

On every survey day, a minimum of two observers walked around the aquatic habitat to search for the presence of and signs of hippos, from morning to afternoon (09h00 - 15h00). We recorded direct observations of hippos as well as indirect presence signs, such as droppings, tracks, feeding lawns and frequently-used paths. Droppings and tracks were marked as fresh (one to three days) or old (four days and more). When hippos were spotted, we waited, if possible, for 15-20 minutes at a safe distance (minimum 30 m) to see if there were others nearby. During direct observations we counted all visible individuals and if possible, recorded age classes (adult, subadult or juvenile). At a sighting, all observers counted independently and then discussed the numbers until agreement was reached on numbers and corresponding age and sex classes. We recorded the GPS coordinates of all indirect and direct presence signs and tracked the survey efforts using a Garmin GPSmap 62s. Maps were created using QGIS software (Version 3.22.2).

Results

Eight sites were surveyed for direct and indirect signs of hippo presence once in July (dry season) and once in November (wet season), resulting in a total survey length of 211.9 km over 16 days





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Fig. 2: A group of hippos encountered in the Mouambi river in July 2022.

(Tab. 1). At the non-river survey sites, where surveys were mainly on foot, one adult hippo was counted in the dry and five hippos in the wet season (a single adult and a group of three adults and one juvenile). During surveys on rivers conducted by boat, we encountered nine groups with a median size of 4.5 individuals (range 2 – 15) and one single individual in the dry season in the Nyanga river, and two groups with two and ten individuals and twice single individuals in the Mouambi river (Fig. 2). This resulted in a count of 47 and 14 hippos in the Nyanga and Mouambi rivers, respectively (Tab. 1). In the wet season, 23 hippos of four groups with a median size of 2.5 individuals (range 2-16) were counted in the Nyanga river (Fig. 3), and four hippos, a group of three individuals and a single individual, were counted in the Mouambi river (Tab. 1).

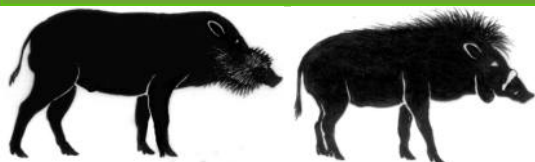


Fig. 3: Hippo feeding on the Nyanga riverbank at noon. The hippo immediately jumped into the water when it noticed the boat passing by.

We identified three hippos (adult male, adult female and subadult male) in November 2022 at Lake Yenzi from camera trap data (three camera traps, 93 trap-days); none were recorded in July 2022 (three camera traps, 86 trap-days). At Vaalco/Lake Vembo in December 2022 (two camera traps, 62 trap-days) six hippos (adult male, two adult females with juveniles and a subadult) and one adult at lagoon Vevy (one camera, 31 trap-days) were recorded. Overall, we counted 62 hippos in the dry and 44 in the wet season.

The results of the surveys in the dry season, but not in the rainy season, on





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Tab. 2: Comparison of the number of hippos counted in 2010/11 by Rietmann (2014) with counts in July and November 2022 at the same locations.

River/Lake	2010	2011	Jul 2022	Nov 2022
	Rietmann	Rietmann	GBP	GBP
Mbissi/Lake Cachimba	6	8	0	NA
Nyanga	33	45	47	23
Mouambi	NA	11	14	4
Lake Vembo	2	3	1	0 (6*)
Total	41	67	62	27 (33)

GBP = Gabon Biodiversity Program

*counted from camera trap data obtained in December 2022

the Nyanga and Mouambi rivers, revealed a comparable number of hippos to the numbers counted by Rietmann (2014) in 2011. As the 2010 and 2011 surveys were conducted in the dry season only, a comparison of numbers in the dry season is most relevant. Both dry season surveys in 2011 and 2022 counted the most hippos in the Nyanga River: 45 animals in 2011 and 47 in 2022 (Tab. 2).

We were not able consistently to record age classes during boat surveys, due to hippos reacting strongly to the boat presence by hiding in and under water and moving away quickly, which made it difficult to compare sizes among the group members (the only means we had to distinguish between adults and subadults). However, we detected four and two juvenile hippos in the Nyanga river in the dry and wet season, respectively and two juveniles during the dry season survey in the Mouambi river.

Indirect signs of hippo presence were only collected during surveys on foot. At all sites prospected, indirect signs were found. During the dry season, we found fresh signs of hippo presence at three of the six survey sites, while during the wet season we found fresh signs at all six sites (Fig. 1, Tab. 1). The number of fresh droppings found was relatively low and comparable for dry and wet season surveys, while we found more fresh tracks during the wet (21) than the dry season (nine). The number of signs found that were older than three days (old) was generally higher in the dry season than in the wet season, likely due to the fact that rain in the wet season washes away droppings and tracks relatively quickly. We found fresh tracks of individuals of different sizes walking together at two beach survey sites, which allowed us to estimate a minimum number of hippos at these sites. At Point Petras we found single tracks and twice tracks of two individuals (adult + subadult and adult + juvenile) indicating a minimum number of four hippos (two adults, one subadult, one juvenile). At Colas Beach we found tracks of single individuals and twice tracks of two individuals (adult + subadult and adult + juvenile) indicating a minimum number of four hippos (two adults, one subadult and one juvenile). We found single tracks only at the other beach sites at Pont Dick and at the non-beach sites Lagoon Vevy and at Vaalco/Lake Vembo.

Discussion

The results of our spatially targeted hippo survey in the Gamba area and within the Assala Gabon concessions indicate that hippos are still widely distributed in this part of the GCPA, especially along the coast. However, our data suggest that population numbers in the Gamba area are low. Within the southern part of the GCPA, our survey results confirm that the Nyanga region remains an important area for hippo conservation, as the largest population of hippos was found there.





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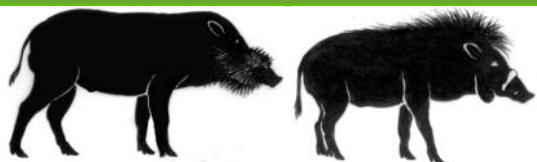
We found hippo signs at all six sites prospected in the Gamba area, but the number of signs found per site was quite low, often indicating the presence of one or two individuals only. Vaalco/Lake Vembo was the only site where signs indicated a relatively larger number of hippos (more than two individuals), which we later confirmed using camera traps (recording six different hippos). The fact that we had only observed one hippo in the dry season and none in the rainy season at this location during the surveys demonstrates the difficulty to make direct observations of hippos in the Gamba area. The overall low number of hippos encountered on foot during the surveys is most likely a result of the elusive nature of the hippos in the Gamba area due to their low numbers, but also to the inaccessibility of potential wetland areas. For the surveys planned in 2023, we will try to use the boat to reach more aquatic habitats and thus increase the probability of encountering hippos during the surveys in the Gamba area.

In contrast to the surveys in the Gamba area, surveys by boat on the Nyanga and Mouambi rivers revealed many encounters with hippos. With the dry season counts in the Nyanga and Mouambi rivers it can be confirmed that this area can still be considered as key for hippo conservation in the GCPA, eleven years after the last survey in 2010/11 by Rietmann (2014). The 2010/11 surveys included the Mbissi river, which was difficult for us to access in the dry season due to low water levels. We were not able to include it in the wet season due to time constraints. The current number of hippos in the Mbissi river and Lake Cachimba has therefore yet to be determined. Overall, our results indicate that the hippo population in the Nyanga and Mouambi region seems to be stable since the last published survey in 2011.

The large difference in numbers of individuals counted between the dry and wet seasons during the river surveys is most likely due to the much higher water levels in the rivers, which increases the inundated areas around the two rivers. This allows the hippos to disperse more widely, thus reducing the likelihood of encountering them in the river (Fritsch et al., 2022; Karstad & Hudson, 1986; Stommel et al., 2016). The smaller group sizes found in the wet season compared to the dry season also support this assumption (Fritsch et al., 2022; Stommel et al., 2016). Thus, dry season surveys by boat in the Nyanga region are preferable over wet season surveys, since they lead to more realistic population size estimates.

Almost all the hippos we encountered by boat or on foot were disturbed by our presence and reacted promptly by retreating to deeper waters, if possible, or moving away from us quickly. Similar behavioral observations were reported for hippos in the Nyanga region but not in the Ngove and Ndougou region in 2010/11 (Rietmann, 2014). Various animal species have been reported to alter their behavioral responses to threats when exposed to human disturbances such as hunting (e. g. Croes et al., 2007). The shy behavior of the hippos towards boats and humans in the study areas probably indicates that poaching or disturbance is a constant threat to the hippos in the southern part of the GCPA. This assumption is supported by recent poaching incidents of hippos in the region (M. Navarro, pers. comm.; G. Moussavou, pers. obs). Hippos are fully protected in Gabon, but law enforcement is low. Therefore, assessing the current size and distribution of the hippo population and monitoring population trends is important to inform and raise awareness among local authorities in order to increase hippo conservation and law enforcement efforts. We will therefore plan to continue spatially targeted surveys to contribute to a





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better understanding and protection of the current hippo population in the southern part of the GCPA and within the southern concessions of Assala Gabon. Knowing more about the hippo population in the concessions will also be useful in evaluating the oil company's biodiversity conservation efforts.

Acknowledgements

This work was carried out under research permit (No. AR031/22/MESRSTTCA/CENAREST/CG/CST/CSAR). We would like to thank Assala Gabon for support. Thanks to Elie Tobi and Gabriel Koumba (GBP) for helping with survey organization and to Cedric Paga (local NGO KUSSU) for providing useful information and participating in the hippo surveys on the Nyanga and Mouambi rivers. Alonso Alfonso provided helpful comments on the manuscript. This is contribution # 207 of the Gabon Biodiversity Program.

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Articles in the news



‘Incredibly intelligent, highly elusive’: US faces new threat from Canadian ‘super pig’

<https://www.theguardian.com/us-news/2023/feb/20/us-threat-canada-super-pig-boar>

Adam Gabbatt, 20 Feb 2023

Northern states on alert for invasion of cross-bred pig that threatens flora and fauna – and is difficult to stop.

For decades, wild pigs have been antagonizing flora and fauna in the US: gobbling up crops, spreading disease and even killing deer and elk.

Now, as fears over the potential of the pig impact in the US grow, North America is also facing a new swine-related threat, as a Canadian “super pig”, a giant, “incredibly intelligent, highly elusive” beast capable of surviving cold climates by tunneling under snow, is poised to infiltrate the north of the country.

The emergence of the so-called super pig, a result of cross-breeding domestic pigs with wild boars, only adds to the problems the US faces from the swine invasion.

Pigs are not native to the US, but have wrought havoc in recent decades: the government estimates the country’s approximately 6 million wild, or feral, pigs cause \$1.5bn of damage each year. In parts of the country, the pigs’ prevalence has sparked a whole hog hunting industry, where people pay thousands of dollars to mow down boar and sow with machine guns. But overall, the impact of the pigs, first introduced to the US in the 16th century, has very much been a negative, as the undiscerning swine has chomped its way across the country.

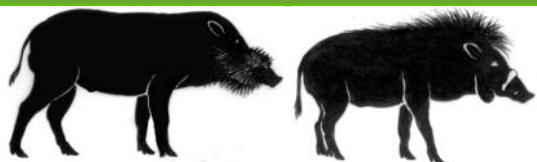
“We see direct competition for our native species for food,” said Michael Marlow, assistant program manager for the Department of Agriculture’s national feral swine damage management program. “However, pigs are also accomplished predators. They’ll opportunistically come upon a hidden animal, and the males have long tusks, so they’re very capable of running and grabbing one with their mouth. “They’ll kill young fawns, they’re known to be nest predators, so they impact turkeys and potentially quail.”

The wild pigs are also responsible for a laundry list of environmental damages, ranging from eating innocent farmers’ crops to destroying trees and polluting water. They also pose “a human health and safety risk”, Marlow said. A pig is a “mixing vessel”, capable of carrying viruses, such as flu, which are transmittable to humans. National Geographic reported that pigs have the potential to “create a novel influenza virus”, which could spread to humankind. The first record of pigs in the continental US was in 1539, when the Spanish explorer Hernando De Soto landed in Florida with an entourage which included 13 swine. During the four-year expedition, which saw De Soto order the slaughter of thousands of Native Americans, declare himself “an immortal ‘Son of the Sun’”, and then die of a fever, the number of pigs grew to about 700, spread across what is now the south-eastern US.

But it is only relatively recently that the pigs have become a problem. “They lived a benign existence up until, you know, probably three or four decades ago, where we started seeing these rapid excursions in areas we hadn’t seen before,” Marlow said. “Primarily that was the cause of intentional releases of swine by people who wanted to develop hunting populations. They were drugged and moved around, not always legally, and dropped in areas to allow the populations to develop. And so that’s where we saw this rapid increase.”

The number of pigs in the US has since grown to more than 6 million, in some 34 states. The pigs weigh between 75 and 250lbs on average, but can weigh in twice as large as that, according to





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the USDA. At 3ft tall and 5ft long, they are a considerable foe. Marlow said his team had managed to eradicate pigs in seven states over the past decade, but with little realistic hope of getting rid of the swine completely, there are also fears over the potential impact of pig-borne disease, particularly African swine fever.

The disease is always fatal to pigs, and in China, which is home to more than 400 million pigs – half of the world's pig population – African swine fever wiped out more than 30% of the pig population in 2018 and 2019. African swine fever has presented in Europe, too, but Marlow said it has not yet been detected in the Americas.

That's something that Ryan Brook, who leads the University of Saskatchewan's Canadian wild pig research project, hopes to maintain.

In Canada, like in the US, wild pigs are a relatively recent problem. Up until 2002 there were barely any wild pigs in the country, but Brook said the population has exploded in the past eight years. The animals are now spread across 1m sq km of Canada, predominantly in Alberta, Manitoba and Saskatchewan.

"Wild pigs are easily the worst invasive large mammal on the planet," said Ryan Brook. "They're incredibly intelligent. They're highly elusive, and also when there's any pressure on them, especially if people start hunting them, they become almost completely nocturnal, and they become very elusive – hiding in heavy forest cover, and they disappear into wetlands and they can be very hard to locate." Brook and others are particularly troubled by the emergence of a "super pig", created by farmers cross-breeding wild boar and domestic pigs in the 1980s. The result was a larger swine, which produced more meat, and was easier for people to shoot in Canadian hunting reserves.

These pigs escaped captivity and swiftly spread across Canada, with the super pig proving to be an incredibly proficient breeder, Brook said, while its giant size – one pig has been clocked at more than 300kg (661lbs) – makes it able to survive the frigid western Canada winters, where the wind chill can be -50C.

"All the experts said at that time: 'Well, no worries. If a wild pig or a wild boar ever escaped from a farm, there's no way it would survive a western Canadian winter. It would just freeze to death.'

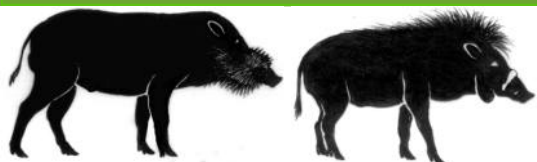
"Well, it turns out that being big is a huge advantage to surviving in the cold."

The pigs survive extreme weather by tunneling up to 2 meters under snow, Brook said, creating a snow cave. "They'll use their razor-sharp tusks to cut down cattails [a native plant], and line the bottom of the cave with cattails as a nice warm insulating layer. "And in fact, they're so warm inside that one of the ways we use to find these pigs is to fly first thing in the morning when it's really cold, colder than -30, and you will actually see steam just pouring out the top of the snow."

Given the damage the pigs have wrought, a range of attempts have been made to get rid of them. Scientists and researchers in the US and Canada have had some success with catching whole sounders of pigs in big traps, while in the US attempts have been made – sometimes unsuccessfully – at poisoning wild pigs.

One method that has worked in the US, Brook said, is the use of a "Judas pig". A lone pig is captured and fitted with a GPS collar, then released into the wild, where hopefully it will join a group of unsuspecting swine. "The idea is that you go and find that collared animal, remove any pigs that are with it, and in ideal world then let it go again and it will just continue to find more and more pigs," Brook said. Brook said a variety of methods are required to tackle the pig problem. But the efforts are more about managing the damage caused by these non-native mammals, rather than getting rid of the pigs completely. In Canada, that chance has gone. "Probably as late





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as maybe 2010 to 2012, there was probably a reasonable chance of finding and removing them. But now, they're so widespread, and so abundant, that certainly as late as 2018 or 19 I stopped saying that eradication was possible. They're just so established," Brook said. "They've definitely moved in, and they're here to stay."

Greece detects African swine fever in a wild boar

<https://www.news24.com/news24/world/news/greece-detects-african-swine-fever-in-a-wild-boar-20230123>

Reuters 23 January 2023

Greece has detected African swine fever in a wild boar in the north of the country, the World Organisation for Animal Health (WOAH) said on Monday.

The disease, harmless to humans but highly contagious among pigs, was found in a dead wild boar in a forest in the Serres region, which borders Bulgaria and North Macedonia, WOAH said, citing a report from the Greek authorities. WOAH said the case was the first since early 2020, when Greece faced its first-ever outbreak of African swine fever.

Greece's agriculture ministry also announced the new outbreak in a statement, saying measures were being taken to avert the spread of the disease.

African swine fever is often deadly for pigs and has disrupted pork production and trade in recent years after outbreaks among farm herds in Asia and Europe.

In Europe, the disease has spread from the east of the continent to reach countries including Germany and Italy.

Tales of killer wild boar in UK are hogwash, say environmentalists

<https://www.theguardian.com/environment/2022/dec/30/tales-of-killer-wild-boar-in-uk-are-hogwash-say-environmentalists>

Helena Horton, 30 Dec 2022

Branded 'farmland pests' and a risk to humans, boar are breathing life back into the countryside. Read the coverage about the wild boar that have made their home in Scotland and you'd be forgiven for thinking the country had become overrun with mutant, dangerous, sheep-eating feral pigs. According to the Telegraph, they "eat anything" and "attack humans", and local press in Scotland refers to them as a "farmland pest" that "fights back". Farming unions have told the BBC that the animals are frequently seen killing and eating sheep, though there has been little evidence of this. In the UK, a nature-depleted country where one is unlikely to stumble on a wild animal larger than a squirrel in most areas, it is perhaps unsurprising that the appearance of wild pigs has caused so much fear and loathing. But speaking to those in the Highlands,



Boar were first confirmed to be roaming Scotland in the early 00s, and now number about 5,000 across the UK. Photograph: FLPA/Alamy





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where the populations are, tells a different story.

Boar became extinct in the UK hundreds of years ago as a result of hunting and habitat degradation. Populations have been reestablished, most notably in the Forest of Dean, where they are a draw for nature enthusiasts who particularly enjoy seeing their humbug-striped young – and for hunters. The creatures were first confirmed to be roaming Scotland in the early 00s, thought to have either escaped from private collections or been deliberately released by guerrilla rewilders. Now, their population is estimated by some to be about 5,000, and they breed very successfully. This means it is very unlikely they will be eradicated from Scotland's landscape any time soon. When a crofter working on Steve Micklewright's Highlands estate first saw a large, tusked creature looming up out of the dark, he was terrified. But the wild pigs have since been welcomed by Micklewright and his estate workers and tenants, who have found them relatively easy to coexist with.

"We were surprised when they appeared on our estate," he said, "but we've grown to appreciate them." He has found them scary. "They can be quite frightening if you come across them. I've come across them in enclosed areas and they've been fine, they haven't done anything. But they are quite scary, particularly if they have young. Unless a mother is protecting her young, it is extremely unusual for them to attack. In other parts of Europe it's just taken for granted that they are out there; there are very few cases where they hurt people." Micklewright runs the woodland charity Trees for Life and says he has been pleasantly surprised by the impact the boar have had on his woods. "In woodlands they do an amazing job. They rootle around, they disturb the ground, they make it more diverse and in more of a natural state," he said.

Though they can cause hassle on agricultural land by digging it up, he said the "cat is out of the bag in Scotland" when it comes to wild boar, so they need to be managed properly and shot under licence if causing nuisance. "Scotland should bite the bullet on this, recognise them as a native species, give them the protections a native species has, and give those who have a problem with wild boar the ability to manage them properly," he said. "At the moment, people can just go out and shoot them. They need intelligent management. As time goes on and the population increases, there is a huge opportunity for sustainable hunting. In Italy, for example, there is a whole culture of sustainable boar hunting over there."

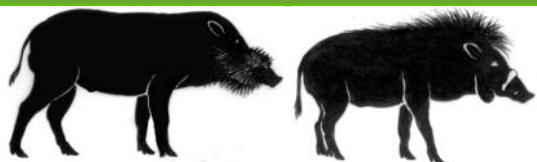
He said they could be enjoyed as a "wild food" and become a Scottish delicacy like venison. Hugh Raven, who for years has managed estates in Scotland, lives near some wild boar that have recently arrived near his family estate in the Highlands. He said that although he "loves the idea" of having them, policy needs to be developed so there is local consent.

"My own feeling is that they will only survive in Scotland in the long term if there is public consent for them," he said. "That includes being able to control them if they are causing too much damage. Otherwise, public opinion will be turned against them. There are enough people in Scotland who own and know how to use rifles that the population could easily be exterminated if there is not public consent." The lurid warnings about attacks on humans have been overblown, he added. "I have never heard of them hurting anyone but I have heard of someone in the Black Forest in Germany who was chased by a female boar and had to climb up a tree. The idea of them attacking humans is highly improbable. There needs to be a public information campaign as there is a widespread misapprehension about their behaviours."

Chantal Lyons, an environmental science policy expert who is writing a book on wild boar, has been studying their interactions with humans around the Forest of Dean.

She said boar were less dangerous than many pet dogs. "Wild boar have now been back in the





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UK for more than 30 years, and we have just two recorded incidents of injury,” she said. The injuries were minor: one was some bruising after being charged by a female sow, and the other was a man who had a fingertip pad bitten off. It would be good to have boar back more widely, she said, as they are ecosystem engineers that can breathe life back into our woodlands. “By rooting, boar can break up monocultures like bracken, create more favourable soil conditions, and allow a greater diversity of vegetation to grow. In the Forest of Dean, I sometimes notice oak seedlings growing in old boar rootings, and I wonder if jays have planted them there, because the soil is so good, so easy to plant acorns in.” Boars will not rampage around eating sheep, she said. “They will certainly eat sheep they find dead, as they are omnivorous and enthusiastic carrion-eaters. However, I think it is extremely unlikely that they have actively killed sheep, which are big animals – I suspect they were already dead. If the sheep-killing was happening with the frequency it appears to from the claims made, you’d think someone would’ve been able to get footage of it by now.”

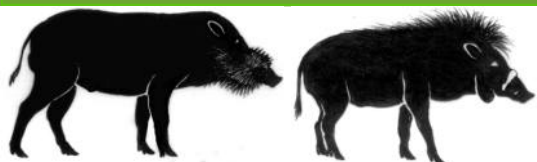
Wild boars are wreaking havoc in Europe, spurring creative solutions

<https://www.nationalgeographic.com/animals/article/wild-boars-are-wreaking-havoc-in-europe-spurring-creative-solutions>

Agostino Petroni, 9 November 2023

In Italy, the destructive herbivores can cause up to \$22 million of agricultural damage a year. Rome. On a cool night in late September, zoologist Andrea Monaco walks silently through the sandy shrublands of the Presidential Estate of Castelporziano, a protected area just outside of Rome, toward a family of trapped wild boars. Upon seeing him, the eight bristly piglets and their hundred-pound mother try to break through the circular trap’s soft net, only to bounce back to the center. Monaco and his colleagues free the sow and one piglet, then enter the 20-foot-wide enclosure to catch the other youngsters for study. Amid the strong smell of wet boar, mud, and feces, one researcher announces with a smile that the baby he was holding had urinated on him. Several Mediterranean ecosystems thrive in this 23-square-mile estate, such as wetlands, dense pine and oak forests, and sand dunes. Its beauty once attracted Roman emperors and aristocrats who built elaborate villas, which are now reduced to bricks poking out of the loamy soil. Today the area is home to the country’s oldest wild boar population—one that Monaco and others are researching in an urgent quest to control the seemingly unstoppable herbivore. An estimated one million boars, a native species that can weigh up to 300 pounds, now roam the country, destroying crops and causing at least 2,000 car accidents each year, Monaco estimates. And in early 2022, African swine fever was discovered in an Italian boar, raising fears that the wild animals could spread the fatal virus to domestic pigs raised for the meat industry. The problem is not unique to Italy, either. Due largely to urbanization and forest regrowth, wild boar populations are expanding across Europe, with sightings and close encounters on the rise in many European metropolises, from Berlin to Madrid to Warsaw. “It is a species that is exceptional from an ecological point of view—super-adaptable and with an enormous reproductive potential,” said Monaco, who has been studying the country’s wild boars for more than 20 years at the Italian Institute for Environmental Protection and Research (ISPRA) in Rome. Working with him this evening are 10 other scientists and wildlife experts from around Italy, eager to learn new interventions to stall the boars’ advance. The trap that caught the sow and piglets, for instance,





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had just arrived from the U.S.: Called a PigBrig, it is lightweight, anchored to the ground like a tent, and can catch up to 60 boars at a time. Such nets could potentially slow the population's growth, particularly if many reproductive females are caught, Monaco says. In many cases, the animals are humanely euthanized on the spot, then sold or donated as meat. Tonight, though, the whole family will survive their encounter, with seven of the piglets outfitted with an ear tag that will allow Monaco to track where they go and how long they live, valuable data for understanding the estate's boar population. As the team walks back to their cars in the darkness, Barbara Franzetti, coordinator of the wild boar program in Castelporziano and a biologist at ISPRA, sums up the challenge. "If we don't change radically the way we manage [wild boars], the population will continue to grow," she says.

Boars rebound

Wild boars originated in Southeast Asia and began colonizing the European continent about five million years ago, becoming a favorite food of many civilizations. The animals live in family groups of various sizes, generally consisting of one or more related females and their offspring, as well as other juveniles. At the beginning of the 20th century, human pressure from deforestation and agriculture drove the species nearly to extinction. Only a few populations remained in Tuscany, southern Italy, and the Alps. However, after World War II, as Italy's economy boomed and its population urbanized, forests slowly healed and wildlife returned. Wild boars, opportunistic animals that feed on many foods, including human crops, rebounded—particularly in the absence of the gray wolf, their main predator. What's more, starting in the late 1950s, Italian hunting groups pushed cities and regional governments to transfer boars from fenced or protected areas such as Castelporziano—and in some cases from Eastern European countries—to stock empty forests. Hunters also privately repopulated their shooting grounds. This practice continued until 2015, when it was banned. But by then, boars had already become a widespread problem.

Pigs in the city

In Italy, boars now cause up to \$22 million in agricultural damage every year, and though regional governments compensate farmers, often the payment is partial or arrives too late to preserve the crop. Marco Massera, a farmer in the city of Genova who cultivates vegetables such as zucchini, eggplants, and bell peppers, has been struggling to deter wild boars on his 19-acre farm for the past 15 years. As the pigs forage for roots and grubs, they dig deep underground. "A boar doesn't eat; it disintegrates. With its muzzle, it pulls up the plants. So once the boar enters, the part it uproots is lost," says Massera, who has received government funds to create fences around his fields. In the past few years, Massera has also noticed a sharp increase in boars entering his fields close to town, after walking along streets full of people and cars. Indeed, boars are embracing urban areas thanks to plentiful amounts of unsecured trash and people who are eager to feed them, says Monaco. According to his recent study, wild boars are now a familiar presence in 105 Italian cities, compared with only two a decade ago. To show just how comfortable boars are in the city, he references a viral video taken in Rome in March, which shows two sows calmly nursing their piglets in the middle of a road.

"The moment of breastfeeding in nature is when animals are most delicate and exposed to predation and risks," Monaco says. (Learn how wild boars are making a home in Hong Kong.)

Carme Rosell, an expert in wildlife management and head of the environmental consulting firm Minuartia in Spain, has observed similar boldness in Spanish boars. In her country, the wild boar population has doubled in two decades to about a million animals. "They have accessed a gigantic pantry: our farm fields and organic urban waste. Nothing has been effective at curbing





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their population growth—they have no predators; their natural habitat, the forest, is expanding; and winters are less cold,” she says. “But there is another essential factor: They have lost their fear of human beings.”

Does hunting work? It’s complicated.

In 2005, in an ultimately unsuccessful attempt to solve the wild boar crisis, Italian government regulators called in hunters. Though Italian boar hunters kill about 295,000 boars annually, the animals reproduce at a faster rate: Every year, their population can grow as much as 150 percent, according to Monaco. Part of the problem, he says, is that about 30 to 40 percent of Italy’s 500,000 hunters practice *caccia in braccata*, a communal form of hunting in which a few hunters with dogs herd boars toward other hunters at particular stations, where the animals are then killed. It’s an opportunity to meet friends, be in nature, and have a drink afterward. Yet this tradition has had a downside: Hunters mostly go after the larger boars, disintegrating the family nucleus and scattering smaller females that will begin their reproductive cycle earlier. Instead, the government should hire hunters to selectively target reproductive females, which would drastically reduce the population, Monaco says. But many traditional hunters oppose this idea, both because of its solitary nature and because it would limit boars available for the much-loved *braccata*. Massimo Buconi, the president of *Federcaccia*, Italy’s historic hunters’ association, is aware of the importance of selective hunting, but says that it would not be enough. He says he believes that only hunters, who can catch dozens of boars at once during a *braccata*, can solve the problem, and that they should be allowed more autonomy to intervene in protected areas. Antonino Morabito, an ethologist for *Legambiente*, a Rome-based environmental nonprofit, notes that hunters and hunting groups often hold political influence in local governments. “For these people, hunting means a lot, so it affects them when they have to choose who to vote for,” Morabito says. “This is the reason why the Italian public administration remains clearly conditioned by this choice.”

Elsewhere, little success

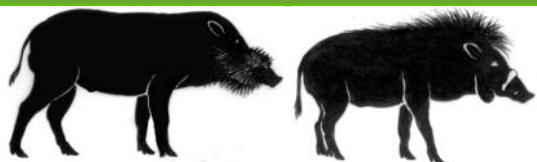
Other countries have also not seen much benefit from widespread hunting. In Poland, since 2017, wild boar can be hunted year-round. According to the Polish Hunting Association, in 2021 there were over 4.6 million hunts with 269,000 wild boars shot. Yet the animal is increasingly encroaching into the largest metropolitan areas—it’s estimated there are over a thousand animals in Warsaw, for instance. Although 400,000 boars are hunted per year in Spain, that country’s population could still double by 2025, according to data from the country’s Institute of Hunting Research. Uri Shanas, a biologist at Israel’s University of Haifa, recently created a promising experiment that kept boars out of the city of Kiryat Tiv’on.

“Since boars like to wallow in mud to cool off and to get rid of parasites, and to burrow in the mud for food, we set up wading pools for them in natural areas, and it was very successful. They came to the pools, splashed around, played, and had fun, and their excursions into [Kiryat Tiv’on] decreased.” One of Shanas’ conditions for the duration of the study: No boar culling. In addition to the ethical and safety considerations, “shooting wild boars does not solve the problem, and in many cases this practice increases reproduction, a phenomenon also found among wolves,” he says.

Fear of virus sparks solutions

In Italy, more than 200 boars have been confirmed with African swine fever, and Italians are deeply concerned about the virus’ spread, Monaco says. Each year, Italian farmers raise 8.5 million pigs that sustain a \$3 billion pork industry. After a particularly devastating outbreak in





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2018, farmers in China were forced to kill hundreds of millions of pigs to stop the virus' spread. This September, Monaco attended the 13th International Symposium of Wild Boars and Other Suids in Barcelona, where, for the first time, a consensus emerged that wild boars need to be contained across the continent. "People are not worried; they are terrorized by swine fever," says Franzetti, who also attended the symposium. Researchers shared some wins: The German government, for example, has killed off scores of wild boars using 400 of the American traps Italian researchers tried out in Castelporziano. In Brandenburg, Germany, for instance, "hog damage is down, and hog sightings on the cameras are down," says Carl Gremse, part of a team working to control African swine fever in the city. Rosell and her team have collaborated on a guide of deterrent measures for Spanish municipalities, such as making garbage cans and outdoor cat feeders boar-resistant, and populating urban green areas with plants that boars dislike.

In Rome, wildlife officials have installed nets around garbage cans or substituted them with boar-proof models, with some success. Some animal welfare groups advocate sterilizing females instead of killing them. For instance, Massimo Vitturi, an activist for the Rome-based nonprofit Anti-Vivisection League (LAV) suggests that wildlife officials can inject sows with a drug that renders them infertile. However, Vitturi admits this approach is limited by the logistics and costs of manually injecting all the female boars one by one. Furthermore, Monaco says that the effects of such treatments vanish after a few years, making sows free to reproduce once again.

Reducing the damage

Back in Italy, Maria Luisa Zanni has been leading a science-driven approach against boars in Italy's northern Emilia-Romagna region, where she leads their wildlife planning committee.

She and her team subdivided the area into about 40 square-mile plots, allocating a specific value to each in terms of its impact from wild boars. By identifying where the boars caused more disruption, the team could suggest where local governments should focus stronger eradication efforts and monetary paybacks to farmers. "With this system, we can reduce the damage a little," says Zanni. However, it's unknown if this strategy is limiting the boars' population in her region. "We are trying hard, but I do not know if we are succeeding," she says. "If there are better solutions outside of Italy, we'll welcome them."

Pig aggression reduced when a bystander pig steps in, study finds

<https://www.sciencedaily.com/releases/2022/11/221108082629.htm>

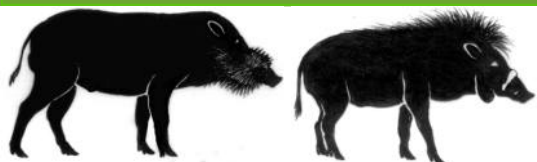
Springer, 8 November 2022

A small study suggests that when two pigs are fighting, a bystander pig can intervene to either reduce the number of attacks by the aggressor or to help reduce the anxiety of the victim. The study of 104 domestic pigs, published in the journal *Animal Cognition*, reveals the complex social groups that pigs form and how they may resolve conflict.

In social animals, conflict resolution involves either the reunion of former opponents -- an aggressor and victim -- after an aggressive event (known as reconciliation), or the introduction of a third-party bystander to reduce further aggression or anxiety (known as triadic contacts). These conflict-resolution strategies are important to maintain balance in social animal groups and reduce victim anxiety, but it is unclear how this applies to domestic pigs.

Giada Cordoni, Ivan Norscia and colleagues from the University of Torino (Turin, Italy) observed





how a group of 104 pigs housed at the ethical farm Parva Domus (Turin, Italy) resolves conflict after fighting. The authors could identify most generations of pigs based on their breed, size and markings but also genetically tested 31 pigs across different generations to determine relatedness across the whole group. They observed and recorded interactions between the pigs from June to November 2018 and noted aggressive behaviours such as head-knocking, pushing, biting and lifting of the victim pig. The authors watched behaviour for three minutes after each aggressive conflict and noted gender, kinship, and age.

The authors observed that both the aggressor and victim showed reconciliation behaviour such as nose-to-nose contact, sitting in physical contact with one another and resting their head on the other. They found that both the aggressor and the victim initiated reconciliation behaviours equally after fighting. However, they found that the proportion of reconciliations was significantly higher in more distantly related pigs compared to closely related pigs.

The authors propose that pigs may value different relationships based on what they can provide, such as social support. The damage to social groups caused by fighting closely-related kin (half or full siblings) may be less because these could be considered as more secure relationships. However, distantly related pigs may be more likely to engage in reconciliation behaviour after fighting to ensure they still have social support and access to food within the group.

When observing conflict resolution involving a third party pig, the authors noted behavioural differences depending on who the bystander pig approached and engaged with after the fight. If the bystander approached and engaged with the victim, the number of aggressive behaviours did not change, but the mean hourly frequency of anxiety-related behaviours observed in the victim was significantly lowered. Anxiety-related behaviours included shaking, scratching, chewing with an empty mouth and yawning. However, if a bystander pig approached the aggressor, the number of aggressive behaviour attacks directed towards the victim was significantly reduced.

A higher proportion of bystander pigs intervened if the conflict involved either an aggressor or victim they were closely related to. The authors suggest this indicates that pigs value certain relationships and may support closely-related kin.

The victim pig attempting to approach and engage with a bystander after conflict had no effect on reducing post-conflict anxiety behaviour or the likelihood of being attacked again. This may be due to 95.2% (42 cases) of the bystander pigs not reciprocating the union when a victim approached them. The authors caution that this study involves only one group of adult, domestic pigs, and therefore may not represent all pig groups. Future research could investigate if these conflict-resolution strategies are seen in other situations. Pigs were found to engage in reconciliation and triadic contacts after conflict, which suggests pigs might possess some socio-emotional regulation abilities to change their own or others' experience in group conflict, according to the authors.

Journal Reference:

Giada Cordoni, Marta Comin, Edoardo Collarini, Carlo Robino, Elena Chierto, Ivan Norscia. Domestic pigs (*Sus scrofa*) engage in non-random post-conflict affiliation with third parties: cognitive and functional implications. *Animal Cognition*, 2022;

DOI: 10.1007/s10071-022-01688-4





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The only pig species known to migrate: the bearded pig

<https://news.mongabay.com/2022/09/the-only-pig-species-known-to-migrate-the-bearded-pig/>
Romina Castagnino, 16 September 2022

Camera traps bring you closer to the secretive natural world and are an important conservation tool to study wildlife. In this episode we're meeting the only pig species known to migrate: the bearded pig. The bearded pig (*Sus barbatus*), also known as the Bornean bearded pig, lives in Southeast Asia. It is well adapted to life in tropical rainforests, however, it also inhabits beaches, mangroves, and montane cloud forests. Bearded pigs are recognized by their prominent beard with hairs up to 15 cm long. In males, the beard hides two pairs of small facial warts. Bearded pigs are very social and live in groups that consist of mothers and their young. These groups often join up and form big herds of up to several hundred individuals. Adult males are usually solitary and come to groups only during the breeding season.

Although for most of the year, bearded pigs live in one location in a stable family group, once a year, hundreds of them come together to partake in a large migration, sometimes swimming between islands. During migration, bearded pigs shift to nighttime activity to travel at night and take shelter in the woods during the day. These large-scale movements, which may cover between 30 to 600 km, seem to respond to mass fruiting events in the forest. Due to their lack of shyness during migration and predictable times and routes of migrations, bearded pigs are easily hunted by humans for their meat. Other threats include the conversion of forests for logging and agriculture, particularly oil palm and rubber, and fragmentation of remaining habitat. The bearded pig is classified as vulnerable by the IUCN. Watch the video to learn more about this species!

Deforestation piles pressure on South America's elusive Chacoan peccary

<https://www.theguardian.com/environment/2023/jan/31/chacoan-peccary-gran-chaco-deforestation-south-america-aoe>
Patrick Greenfield, 31 Jan 2023

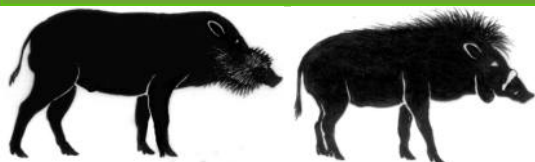
With just 3,000 of the pig-like animals still roaming the Gran Chaco region, a community conservation effort in Argentina is fighting for its future .

The Chacoan peccary is so elusive that scientists believed it was extinct until its "discovery" in 1975. Today, only 3,000 remain in the inhospitable forests and lagoons of the Gran Chaco region, which stretches across northern Argentina, Paraguay and southern Bolivia, and comprises more than 50 different ecosystems.

Micaela Camino, who works with the Indigenous Wichí and Criollo communities to protect the animals and their land rights in Argentina, knows how difficult to find they can be. She has only seen one Chacoan peccary, or quimilero, in 13 years since she set up her NGO, Proyecto Quimilero, but has fallen in love with the critically endangered mammal, which looks like a peculiar cross between a boar and a hedgehog.

"I was told that the Chacoan peccary was extinct outside protected areas when I first started," says Camino. "So when we found it, I thought it was great. We set up monitoring to find more in one of the most isolated parts of the dry Chaco. But then the loggers started to come." The Gran Chaco, South America's second-largest forest after the Amazon, is one of the most deforested





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Research shows that the Chacoan peccary could become extinct within 30 years. Photograph: Dmitry/2020 Whitley Awards

places on Earth. Every month, more than 133 square miles is lost, cleared for vast soya farms and cattle ranches that export to markets in the US, China and Europe – including UK supermarkets, according to a joint Guardian investigation in 2019. However, the loss is largely ignored on the international stage, receiving little conservation money or celebrity attention in comparison with the Amazon. In the area where Camino works, the land clearing was turbocharged by Argentina's 2001 economic collapse. Tree loss highlighted by Global Forest Watch shows

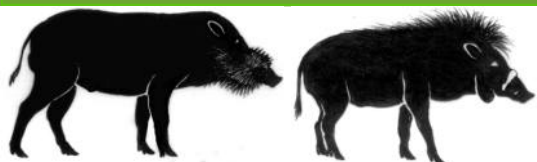
the extent of the damage over the past 20 years. The area is home to charismatic species such as the maned wolf, the giant armadillo and the jabiru, many of which are not found anywhere else on Earth.

At current rates of deforestation, the mosaic of life in the Gran Chaco could collapse entirely. The loss of the Chacoan peccary would be guaranteed this time. Unlike the Amazon, there are few academic studies on tipping points and the forest's waning ability to support itself as the climate changes and land is cleared, but people who live here are seeing the changes.

"The Chacoan peccary cannot survive with such a rapid advance of deforestation. It doesn't exist anywhere else. Locally, the animal is a good flagship. Jaguars and pumas are charismatic but nobody really likes these animals in the forest," says Camino. More than 140 countries, including Argentina and Paraguay, signed an international agreement at the Cop26 climate summit in Glasgow in 2021 to halt and reverse deforestation by 2030. However, economic realities have complicated the picture. Argentina's economy is collapsing once again, with the annual inflation rate in 2022 hitting its highest level in 30 years, and the country is desperate for dollars, which can be earned by trading commodities such as soy and beef. In Paraguay, the success of Mennonite communities has transformed the country into one of the most important beef producers in the world, largely at the expense of the forest, dubbed "the green hell" by early settlers from Canada. "The Gran Chaco has been at a crossroads for a long time," says Gastón Gordillo, a professor of anthropology at the University of British Columbia. "The 2007 forest law in Argentina did manage to slow some deforestation, but it also created the paradox by establishing legitimate ways of destroying the forest."

Before the Covid pandemic, civil society organisations teamed up to launch the 2030 initiative to protect what is left of the Gran Chaco in Argentina, the part most affected by land clearing. They called for a change in the economic model of the region, urging local and national governments to move away from extraction, and pushed for greater compliance with forest law. However, a new motorway in Paraguay appears likely to open up more of the region to ranching. "The agribusiness sector in Argentina is very powerful," says Gordillo. "We are going through a profound economic crisis. There is a lot of anxiety about what is going to happen. The major concern for the government right now is to get US dollars, and exports from the agribusiness sector are the main source. That means there's a strong incentive to continue. "The dichotomy is clear. You either continue destroying forests and the environment or you don't. But this is an





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uneven confrontation, unfortunately.” For the Chacoan peccary, research indicates there are only 30 years left to save the species, with current deforestation rates meaning all of its habitat outside protected areas will have gone by 2051.

Camino’s conservation efforts, for which she won a 2022 Whitley prize, will focus on priority areas for saving the mammal and helping local people to resist corporate land grabs and stay in their Indigenous lands. She hopes the mammal can become a flagship species to protect the region. “The only way we can save the Chacoan peccary is by protecting the forest. It represents a unique evolutionary path. It’s an umbrella species for working with the whole ecosystem,” she says.

Human activities degrade hippopotamus homes at Bui National Park, Ghana, researchers find

<https://www.sciencedaily.com/releases/2022/12/221220113034.htm>

Pensoft Publishers, 21 December 2022

The Bui National Park is one of the few areas where the common hippopotamus resides in Ghana. The combined resources of the Black Volta River and the abundance of grasses make the area very suitable for hippopotamus. However, in an attempt to solve the electricity crisis the country faced in 2007, the government of Ghana constructed a hydroelectric dam in the heart of their home. Knowing the consequence of dam creation on aquatic species, scientists Godfred Bempah, Martin Kobby Grant, Changhu Lu, and Amaël Borzée from Nanjing Forestry University, China, wanted to understand how the hippopotamus, a mega semi-aquatic species, was impacted by this project. The results have been published in the journal *Nature Conservation*. Assessing the impact of the dam construction can advise policy and decision making in future projects like this.

The researchers spent 24 days (2 days per month for 12 months) at the Bui National Park to estimate the number of hippopotamus individuals and understand local migratory activities, as well as to assess changes in land cover in the area after the dam was constructed. They then compared this information with historical data to understand the ecological changes within the area. To complement the field surveys, the researchers spoke to local people familiar with the reserve before and after the dam construction. These included fishermen, canoe operators and park rangers. During the interactive discussion, all of them stated that the numbers of hippopotamus have declined compared to periods before the dam construction. They attributed the decline to poaching and habitat destruction.

The results indicated a decline in hippo numbers of about 70%: from 209 individuals in 2003 to 64 individuals in 2021. The study revealed noticeable changes in land cover after the dam construction, and, most importantly, a decline in forest cover, as well as destruction of riparian grasses, the habitat preferred by the hippopotamus. The increase in water levels flooded the areas where the animals used to reside, forcing them to disperse to other suitable areas. As they dispersed, the animals became vulnerable to poaching, which combined with habitat loss eventually led to a decline in hippopotamus numbers. It is possible that some of the animals might have successfully moved to other areas outside the reserve.

The hippopotamus is listed as Vulnerable to extinction by the IUCN Red List of Threatened Species.





In conclusion, the authors note that the number of common hippopotamus individuals in the park has declined following the dam construction, in connection with habitat destruction and poaching. Once these threats are removed, the hippopotamus can survive in the medium to long term, when effective management plans are implemented.

Journal Reference:

Godfred Bempah, Martin Kobby Grant, Changhu Lu, Amaël Borzée. The direct and indirect effects of damming on the *Hippopotamus amphibius* population abundance and distribution at Bui National Park, Ghana. *Nature Conservation*, 2022; 50: 175 DOI: 10.3897/natureconservation.50.87411

Charlie the hippo was raised with rhinos and had to learn how to love the water he needs to survive

<https://www.news24.com/you/news/local/charlie-the-hippo-was-raised-with-rhinos-and-had-to-learn-how-to-love-the-water-he-needs-to-survive-20221212>

Janice Beckett-Msiza, 12 December 2023

He was only two days old when he was abandoned by his herd. Charlie the baby hippo was premature, weak, stressed and traumatised when he was rescued by workers from Ezemvelo KZN Wildlife in KwaZulu-Natal. But what a difference a few years and some TLC can make – Charlie (6) is healthy as a horse and will soon be released into the wild.

But boy, did he have plenty obstacles standing in his way.

For the first few years of his life, Charlie believed he was a rhinoceros because he was raised

with rhinos in a rhino orphanage. But to stand any chance of surviving he had to learn how to be the hippo that he is. After he was found abandoned, he was taken to Thula Thula Rhino Orphanage for intensive care, but his new home specialised in caring for rhinos and he was the only hippo there. Charlie was introduced to another orphan, a white rhino named Makhosi, and the unlikely duo quickly became fast friends, playing, cuddling and snuggling at bedtime.

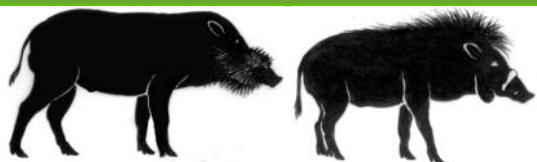
“When I first met him, he definitely had some character to him,” says Simon Jones, founder and CEO of Helping Rhinos, an international non-profit organisation that works to save rhinos from extinction. “As he got older, he really started to think that he was rhino. There were more rhinos who he spent time with and Charlie was trying to keep up with them,” he says.

Simon recalls a time when Charlie was still small. “He was trying to eat hay out of an old tyre and Makhosi came up to him and almost, like, told him off a little because she wanted to eat it. “When people told me that he could sulk, I thought they were being silly, but he really did sulk that day.



Charlie and Isomiso the white rhino meet for the first time.





Articles in the news



The carers tried to console him, but he turned his back on them, really like a spoiled child, sulking,” he laughs. In 2017 Charlie and his rhino family were moved to a new home when Thula Thula Rhino Orphanage closed its doors after it was attacked by poachers who brutally killed two rhinos for their horns. The animals were relocated to Zululand Rhino Orphanage for their safety and the bond between Charlie and Makhosi only grew stronger and stronger. But their friendship had unintended negative consequences – Charlie didn't spend time in water as he needed to. But hippos need to spend time in water to prevent dehydration and sunburn, which he was experiencing, so his caretakers had to hose him throughout the day.

Because he'd spent the first two years of his life with rhinos, Charlie needed to interact with other hippos to get ready for release in the wild and workers at the orphanage found a female hippo at a private reserve who would be a good match for him. “He had to learn how to be a hippo because the ultimate aim for all of our orphans is to try and return them into the wild when they are big and strong enough to do so,” Simon says. His caretakers drove 1 000km to fetch a female hippo named Moomin. Moomin was brought into a smaller area in Charlie's pen and it took some time for him to get used to her. A few days after her arrival, she was submerged in a small dam when Charlie was able to meet her face to face without a barrier. His curiosity got the better of him and he finally got into the water with her. The pair were later moved from the pen and started spending time in a bigger dam.

As time went by, his caretakers kept him away from the rhinos, who Charlie still spent time with, because they knew it was important for the two species to live and grow separately.

In 2020 Makhosi was released into the wild, but long before her release caretakers kept her and Charlie apart in preparation for her leaving the sanctuary. Charlie still lives at the orphanage with Moomin, but he no longer interacts with the rhinos. Simon, who lives in the UK, visited the pair in February this year to check on their development. “He's a very different Charlie from the last time I saw him when he was a baby. He seemed to have enjoyed having humans in the area, but if we came too close, he definitely let us know who's boss,” he says. “He has a lot of hippo behavioural traits and he's very protective over Moomin, which is good,” Simon says. The orphanage is currently preparing to release Charlie and Moomin into the wild. “He definitely knows that he's a hippo now.”

Ten African countries accuse EU of failing to protect hippos

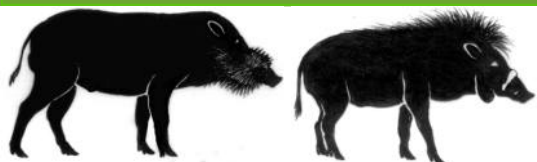
<https://www.theguardian.com/environment/2022/nov/08/ten-african-countries-accuse-eu-of-failing-to-protect-hippos>

Arthur Neslen, 8 Nov 2022

Brussels' plan to oppose a total international ban on trade in hippopotamus products puts species at risk, says letter signed by states, including Mali, Niger and Senegal.

Ten African countries have accused the EU of jeopardising the survival of the common hippopotamus by not supporting a proposed commercial trade ban, in documents seen by the Guardian. Illegal hunting for meat and ivory is thought to have wiped out hippo populations in five African states: Algeria, Egypt, Eritrea, Liberia and Mauritania. But Brussels is planning to oppose a bid to ban the global trade in hippo products at a Convention on International Trade in Endangered Species of Wild Fauna and Flora (Cites) conference in Panama from 14 November. That in turn has sparked “grave concerns about the future of this species” from 10 states – Benin,





Articles in the news



Burkina Faso, Central African Republic, Gabon, Guinea, Liberia, Mali, Niger, Senegal and Togo – which have co-authored a letter to the European Commission.

“By openly opposing our proposal, the EU is jeopardising the chances of the west and central Africa region, which are range states of more than half of the hippo populations, to adequately ensure the survival of the species,” the letter, dated 20 September, says. “Hippos have been silently dying for 30 years. We must act quickly before they become extinct.”

Hippo teeth are prized by ivory hunters, and were among the mammal parts most commonly seized in 2020, according to a European Commission report. Between 2009 and 2018, products from nearly 14,000 hippos were globally traded or shipped as hunting trophies, according to the Cites trade database.

Despite an estimated global population of 115,00-130,000, the semi-aquatic mammals have suffered an overall population decline of between 30% and 50% over the last decade.

In 2016, they were classed as vulnerable to extinction in the wild on the International Union for the Conservation of Nature (IUCN)’s red list, which said that population trends in about two-thirds of range states were declining or unknown. Hippos, the third-largest land mammals after elephants and rhinos, are threatened by illegal hunting, habitat loss and degradation, climate crisis and by conflict with expanding human settlements. Jan Pluháček and Rebecca Lewison, co-chairs of the IUCN’s hippo specialist group, said that hippo populations were “not experiencing these threats equally. More substantial declines were observed in west and central African countries versus stable and in some places increasing populations ... in eastern and southern African strongholds. A new [assessment] is planned for 2024 or 2025.” An IUCN analysis for the Panama conference said that because global hippo numbers have not fallen by more than 50% over the last decade, the species “would not therefore appear to meet the biological criteria for inclusion in Appendix 1”, which lists species that cannot be internationally traded due to extinction risks. The commission is discussing its final stance on the issue with EU countries. Officials say that neither illegal trade volumes nor population declines among hippos are sufficient to justify a trade ban. “The commission takes its commitments to preserving biodiversity very seriously,” a spokesperson said. “The EU’s ambition is to shape global efforts to halt and reverse the continued decline of biodiversity.” Twelve conservation NGOs argue, however, that the EU’s position on hippos and other species is at odds with its own precautionary principle and biodiversity strategy. “Many of the commission’s positions reflect a very narrow interpretation of the Cites listing criteria,” they say in a letter signed by groups including Humane Society International, Born Free and Pro Wildlife. “The commission has ignored the precautionary principle by pointing to limitations on available scientific data as justification to not support listing proposals, even when those species would benefit from monitoring to ensure international trade is legal and non-detrimental.”

Slow-reproducing species like hippos only have offspring every other year, while crocodiles can lay 60 eggs in a clutch, resulting in an “absurd” situation where the current Appendix I rules may one day support animals that could quickly recover from population declines but not those that could be wiped out, the letter said. In September, the European parliament called on the commission to take a more ambitious position in Panama and support Appendix 1 status for hippos and other species.





General articles about Suiformes

Wild boar rooting impacts soil function differently in different plant community types

Barrios-Garcia, MN, Gonzalez-Polo, M, Simberloff, D and AT Classen 2023

Biological Invasions 25: 583–592, doi: 10.1007/s10530-022-02936-x

While numerous studies focus on the ecosystem effects of invasive mammals, few explore the causal mechanisms of such effects. Wild boar is one of the most widely introduced invasive mammal species in the world. By overturning extensive areas of vegetation and soil to feed on belowground resources, wild boar alter the soil food web and thus many microbial-mediated soil processes. Here, we take advantage of a long-term, 8-year, wild boar exclosure experiment across three plant community types in Patagonia, Argentina to explore how wild boar impact soil communities and their potential function. Previous work in this experimental system found that wild boar significantly impacted litter decomposition in the field, but it remained unclear if this effect was mediated through changes in abiotic or biotic soil properties. To explore both the abiotic and biotic drivers of decomposition, we measured soil moisture, soil temperature, soil bulk density, and soil respiration as well as soil micro-arthropod richness and abundance, earthworm abundance, and microbial biomass inside and outside of 10 exclosures in each of three plant community types. To assess potential microbial activity, we measured potential decomposition rates, substrate-induced respiration, and soil microbial enzyme activity. Rooting decreased soil moisture by 18% across plant communities, and soil respiration by 30% in *Nothofagus* and *Austrocedrus* forests. Additionally, rooting decreased soil microarthropod richness and abundance by similar to 80% in shrublands. However, rooting had no effect on soil potential microbial activity. Together, our results suggest that changes in both abiotic and biotic soil factors likely mediate observed wild boar impact on decomposition rates. Overall, we show that wild boar rooting alters soil functioning, but the pathway of impact varies by plant community, suggesting that wild boar impacts on native ecosystems can be difficult to predict.

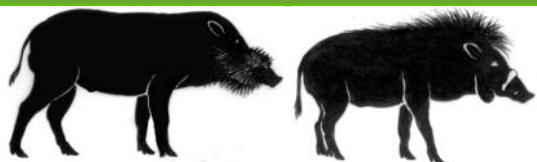
Behavioural syndromes going wild: individual risk-taking behaviours of free-ranging wild boar

Broggi, R, Apollonio, M, Brivio, F, Merli, E and S Grignolio 2022

Animal Behaviour 194: 79-88, doi: 10.1016/j.anbehav.2022.09.013

Behavioural syndromes theory predicts animals will exhibit sets of correlated risk-taking behaviours, with individuals displaying a constant willingness to take risks across different situations. Because this phenomenon has mostly been investigated under artificial experimental conditions, we aimed to establish whether wild animals spontaneously exhibit correlated risk-taking behaviours. We merged a large data set of spatial positions from 43 wild boar, *Sus scrofa*, with the spatial distribution of risks, modelling their risk-induced resource selection. Elaborating these data by means of a resource selection analysis (step selection functions) and focusing only on periods when individuals were active represents an innovative approach to the study of spontaneous risk-taking behaviour exhibited across different situations. We sampled wild boar from two populations in southern Europe living in extremely different environmental conditions (mountainous versus Mediterranean area). We used model coefficients and parameters as quantitative measures of four different risk-taking behaviours (human avoidance, site fidelity, selection for covered habitat and mobility), for both the population and the individual level. A risk-taking syndrome was detected within both populations, with wild boar clustering in two groups





sharing homogeneous sets of risk-taking behaviours. Contrary to the theoretical expectation which predicted individual use of consistent strategies, we observed a compensation among pairs of risk-taking behaviours, with individuals that could be considered risk avoiders on account of strong site fidelity and human avoidance being risk prone in terms of a low selection for covered habitats and a high mobility. Our results suggest that wild animals may adaptively exhibit strategies trading off different risk-taking behaviours. The similarities of risk-taking strategies in the two monitored populations suggested that the observed syndrome was not shaped by biotic or abiotic factors, but rather unintentionally caused by humans.

Endangered animals and plants are positively or neutrally related to wild boar (*Sus scrofa*) soil disturbance in urban grasslands

Cabon, V, Bui, M, Kuhne, H, Seitz, B, Kowarik, I, von der Lippe, M, and S Buchholz 2022
Scientific Reports 12(1): 16649, doi: 10.1038/s41598-022-20964-4

Wild boar is increasingly establishing populations in the outskirts of European cities, with the largest German urban population occurring in Berlin. Related soil disturbance in grasslands is common and often considered as damage to biodiversity. However, it is unknown how animal and plant species in urban grasslands respond to wild boar activity - an important limitation for conservation management. We sampled plants, grasshoppers and sand lizards in 22 dry grasslands and measured wild boar activity. We show that plant diversity decreased with rooting intensity, but not species richness, endangered or specialist species. Relationships with animals were mostly positive. Grasshopper diversity, total richness and richness of endangered and specialist species were positively related to rooting, as was sand lizard abundance. These relationships contrast to mostly negative effects in the wild boar's non-native range. This first multi-taxa study in a large city suggests that soil disturbance by wild boars is not necessarily a threat to biodiversity. An implication for conservation is to consider the context-dependence of biodiversity responses to wild boar activity. For dry grasslands, disturbed patches should be accepted in management plans rather than re-vegetated by seeding.

Factors influencing pregnancy, litter size, and reproductive parameters of invasive wild pigs

Chinn, SM, Schlichting, PE, Smyser, TJ, Bowden, CF, and JC Beasley 2022
Journal of Wildlife Management 86(8): e22304, doi: 10.1002/jwmg.22304

Reproduction is the most energetically expensive life stage with the demands of productivity representing a balance between physiological requirements and environmental conditions. Wild pigs (*Sus scrofa*) throughout most of North America are genetic hybrids of feral domestic pigs and wild boar and have the highest reproductive potential of any wild ungulate. The phenology of reproduction, extent of multiple reproductive events per year, how individual and extrinsic factors contribute to variability in productivity, and impact of genetic lineage on these parameters is not well understood in wild pigs. We quantified reproductive parameters in wild pigs relative to a suite of individual and environmental attributes across seasons and multiple years in South Carolina, USA, from March 2017 and May 2020. We hypothesized that individual attributes (mass, age class, number of teats, rump fat, relative genetic association to wild boar vs. domestic pigs) and extrinsic factors (mast availability) would influence probability of pregnancy and fetal litter size. Wild pigs produced offspring throughout all months with peaks in conception corresponding to a seasonal pulse in food availability. The likelihood of pregnancy was influenced by female mass





and nutritional condition and was greatest during years with abundant resources. Similarly, litter size increased with female mass and age, implying larger and older females represent the most important group for population recruitment. In evaluating the relationship between reproductive output and ancestral associations to domestic pigs versus wild boar, the proportion of wild boar ancestry was not an important influence on productivity in our population. We determined juveniles reach a physiological threshold of sexual maturity at approximately 30 kg. Average litter size was comparable to other populations, and wild pigs maintain an average fetal litter size of 5.43 offspring despite 13.6% embryonic mortality. A thorough understanding of biotic and extrinsic factors influencing reproduction are important for realistic population models, which are necessary for identifying areas to focus management needs and implementation.

Local-scale habitat configuration makes a niche for wildlife encroaching into an urban landscape: grubbing sites of wild boar *Sus scrofa* in a city matrix

Ciach, M, Tetkowski, P and I Fedyn 2022

Urban Ecosystems, doi: 10.1007/s11252-022-01310-y

Urban environments may offer certain species diverse and abundant food resources of natural and anthropogenic origin. However, the local-scale configuration of habitats and urban infrastructure may influence foraging decisions regardless of the availability of food. In recent years, the expansion of wild boar *Sus scrofa* into areas significantly transformed by humans has been observed in many parts of its range. Grubbing (rooting) is a major foraging mode of the species, during which disturbance of the upper soil layers enables these animals to find and consume food items. However, the factors that determine the selection of grubbing sites in the urban landscape, where the balance between food availability and the avoidance of humans may influence foraging decisions, are not known. Our aim was to identify local-scale factors that influence grubbing site selection and the size of grubbed patches in an urban landscape. The characteristics of 108 wild boar grubbing sites in the city of Krakow (Poland) were compared to randomly selected control sites. The probable presence of a grubbing site was positively correlated with the proportion of meadows and fallow land in the vicinity and with increases in both canopy cover and distance to pavements. The size of a grubbed patch was positively correlated with the percentage of meadows in the vicinity, increasing distance to buildings and decreasing distance to pavements. We found a non-random pattern of grubbing sites in the urban landscape and indicated that the local-scale configuration of vegetation and urban infrastructure contribute to foraging site selection by wild boar. Our study highlights that the encroachment of wildlife into the urban landscape is a complex process, driven by both resource availability and the avoidance of human-related disturbances.

Assessing mammal trapping standards in wild boar drop-net capture

Conejero, C, Lopez-Olvera, JR, Gonzalez-Crespo, C, Raez-Bravo, A, Castillo-Contreras, R, Tampach, S, Velarde, R and G Mentaberre 2022

Scientific Reports 12(1): 15090, doi: 10.1038/s41598-022-17407-5

Applying contemporary trapping standards when managing wildlife should no longer be an option, but a duty. Increasing wild boar populations originate a growing number of conflicts and hunting is the only cost-effective management option in most cases. However, new scenarios where hunting is unfeasible emerge and trapping necessities cope with lacking regulatory frameworks and technical guidelines. In this research, we evaluated drop nets, a capture method not considered





by the international trapping standards, to capture Eurasian wild boar (*Sus scrofa*), a wildlife species not included in the list of mammal species under the scope of the Agreement on International Humane Trapping Standards (AIHTS). Less than 20% of the captured wild boars presented moderate or severe injuries attributable to the capture method, hence fulfilling the acceptance thresholds of the outdated AIHTS. Based on the new standards thresholds of acceptance, the humaneness of drop-nets in our study ranged 66-78%, under the 85% required. The capture success and selectivity were 100%, as ensured by operator-driven triggering, which should be considered the main strengths of this method, together with the minimization of animal suffering owing the short duration of the stressful situation. Additionally, in spite of the socially adverse environment, with people contrary to wild boar removal, no disturbances against the capture system or operations occurred. This is the first assessment of a drop-net capture method according to internationally accepted mammal trapping standards, with inconclusive results. However, there is a need for adapted procedures and thresholds of acceptance aimed at non-mechanical traps in general, and specifically at drop-nets. Compared to other live-capture methods, drop-nets minimize the duration of the stressful situation -at the expense of a strong adrenergic acute response-, maximize the probabilities of capturing entire sounders of prosocial species, which may be also considered as more humane, and has the ability to coordinate higher values of capture success, absolute selectivity and adaptability to difficult environments.

Seasonal variation in testicular biometry of wild boar in the game preserve

Drimaj, J, Kamler, J, Reckova, Z and O Mikulka 2022

Journal of Vertebrate Biology 71: 22059, doi: 10.25225/jvb.22059

The increase in wild boar numbers in recent decades is partly due to the involvement of most young females in reproduction as early as their first year of life. After the rut of adult females is over, young females are still entering oestrous as they attain maturity, prolonging the rutting period by several months. This study aimed to evaluate the effect of seasonality on the growth rate of male wild boar bodies, the growth of piglet and yearling male wild boar gonads, and sperm concentration in the epididymides. We found that yearlings' weight and body length were almost constant in summer and autumn, with a sharp increase in winter. Seasonality was also reflected in the body condition index, which rose by more than 41% between summer and winter. In terms of seasonality, the testimetric dimensions again differed significantly only in winter. Sperm were recorded in piglets weighing more than 15 kg. Regardless of the time of capture, 41% of piglets were examined as juveniles, only 6%, resp. 8% of piglets reached low or medium concentration values. While 10% of all yearling males were azoospermatic (juvenile), regardless of weight, there was evidence of seasonality in the proportion of males with measurable concentrations. These concentrations gradually increased from 62.5% in summer to 78.6% in winter. No sterile male over two years of age was noted. The results show that even in wild boars, there is a culmination not only of physical characteristics in winter but also a culmination of testimetric dimensions. Sperm already occur in 15 kg of piglets, which means they can theoretically participate in the fertilisation of female piglets.

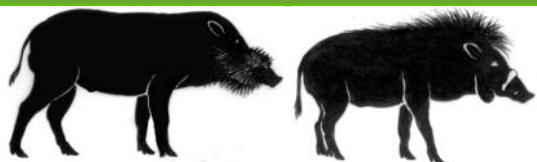
Assessing the precision of wild boar density estimations

Guerrasio, T, Brogi, R, Marcon, A and M Apollonio 2022

Wildlife Society Bulletin 46(4): e1335, doi: 10.1002/wsb.1335

Effective management of wild boar (*Sus scrofa*) populations has to be based on precise estimates





of local densities. The development of an effective and cost-efficient technique to cope with this need has always represented a challenge for wildlife managers and researchers. Drive counts, hunting bags, and Random Encounter Model (REM) are among the most frequently used techniques, with the latter recently gaining wide recognition. We sought to compare the 3 methods in terms of their suitability for management, precision, and effort required. Moreover, we evaluated the uncertainty of REM results when all sources of error were considered. In our study, the 3 methods were applied to a wild boar population of the Italian Apennines in 2013. We used the delta method to assess the total uncertainty of REM density estimates on the basis of the errors associated to all the parameters involved. Notably, the 3 methods tested showed consistent mean density estimates, though none of them reached fully satisfying levels of precision for management purposes. Since the low precision of REM was mostly due to the high variability of the group-size parameter, we propose simple technical improvements aimed at reducing the variability of this parameter and, thus, of REM. Although all the methods tested still need to be further developed to be effective for wild boar management, REM seems to be the most promising one in terms of both potential precision and effort required. The limited effort required by REM is particularly relevant in the current wildlife management scenario, where funds are often lacking and the number of hunters acting as volunteers is decreasing.

Identification and analysis of areas prone to conflict with wild boar (*Sus scrofa*) in the vineyards of Malayer County, western Iran

Karami, P and S Tavakoli 2022

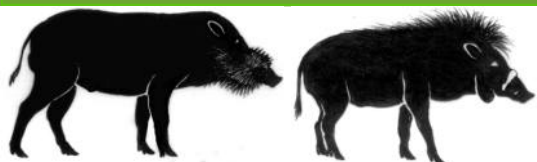
Ecological Modelling 471: 110039, doi: 10.1016/j.ecolmodel.2022.110039

Boars with high reproduction, wide distribution, and adaptability have great potential to conflict with human interests. Malayer County, in Hamedan Province, is one of the economic hubs of grape production and related products in Iran. Considering that the county's economic growth is based on this horticultural product, this study was conducted to detect conflict-prone areas in different land use/cover (LULC) types and landforms. The ensemble model of attack risk was developed using single tree and regression models and 10 topographic, vegetation, and human variables. The significant difference between conflict/non-conflict points in the LULC and landform maps was checked using the Chi-square test. The results showed a significant difference in the occurrence of conflict in different LULC classes ($P < 0.05$). The NDVI, the distance from spring, and the distance from vineyards were the three variables with the greatest effect in all models. The widest niche-breadth conflict in the LULC and landform types belonged to gardens and u-shaped valleys ($B1 = 0.60$, $B2 = 0.95$; $B1 = 0.35$, $B2 = 0.91$, respectively). Those gardens in deeply incised streams and u-shaped valleys have the highest potential for conflict (65.68%). Based on the findings, in the event of a conflict, those arrangements of structural elements of the land landscape are effective, which increase the species' accessibility to the vineyards while providing security. In this study, long and permanent vegetation such as groves can increase the vulnerability of marginal orchards and agricultural lands. Programs to reduce the conflict with wild boars should be based on local adaptations, prey relations, the improvement of traditional cultivation, and securing the vineyards in Malayer County.

State-space model combining local camera data and regional administration data reveals population dynamics of wild boar

Kasada, M, Nakashima, Y, Fukasawa, K, Yajima, G, Yokomizo, H and T Miyashita 2023





Population Ecology 65(1): 80-92, doi: 10.1002/1438-390x.12138

Recent increases in wildlife cause negative impacts on humans through both economic and ecological damage, as well as the spread of pathogens. Understanding the population dynamics of wildlife is crucial to develop effective management strategies. However, it is difficult to estimate accurate and precise population size over large spatial and temporal scales because of the limited data availability. We addressed these issues by first fitting a random encounter and staying time (REST) model based on camera trap data to construct an informative prior distribution for a capture rate parameter in a harvest-based Bayesian state-space model. We constructed a Bayesian state-space model that integrated administration data on the number of captured wild boar with the prior distribution of capture efficiency estimated by camera trap data. The model with informative prior distribution from the REST model successfully estimated population dynamics, whereas the model using only the administration data did not, owing to a lack of parameter convergence. We identified areas where (1) wild boars exhibit a high potential population growth rate and a high carrying capacity, (2) current trapping efforts are effectively suppressing local populations, and (3) trapping reinforcement is required to control populations in the whole region. The model could be used to predict future trends in populations under the assumptions of ongoing trapping pressure. This will help identify spatially explicit trapping efforts to achieve target population levels.

Impacts of the Wild Boar (*Sus scrofa*) on the Livelihood of Rural Communities in Pakistan and Understanding Public Attitudes towards Wild Boars

Khattak, RH, Teng, LW, Mehmood, T, Ahmad, S and ZS Liu 2022

Animals 12(23): 3381, doi: 10.3390/ani12233381

Simple Summary For minimizing Human Wildlife Conflicts" (HWCs), it is important to understand the interactions of wildlife with human activities-especially in non-protected areas. The wild boar (*Sus scrofa*) is one of the most widely spread and highly adaptable ungulate species-referred to as a pest species. The increase in wild boar numbers and ranges is linked to the increasing economic and ecological impacts. In Pakistan, wild boar numbers are rapidly multiplying because, generally, it is hunted neither for meat nor for trophies by locals because of strict religious prohibitions. However, in some rural areas, wild boars are killed by the farmers-mostly using firearms-yet, the rate of these kills does not match this animal's overall reproductive rate. Moreover, a decline in the numbers of apex predators is also adding to the ever-increasing wild boar population. Being a pest species with huge numbers, the wild boar is one of the chief reasons for HWCs in Pakistan. In addition to the economic losses (crop damage and orchard damage) caused by wild boars, a hostile attitude in local communities has developed towards wildlife, in general. In the current study, we investigated the economic effects of the wild boar on pastoral communities' livelihoods and on locals' attitudes towards wild boars in northwestern Pakistan. The results revealed that the major crops raided by wild boars were maize, wheat, and vegetables. Most respondents considered the wild boar to be a very common species and wished for its complete elimination from the area. We believe that properly monitoring and controlling the wild boar population, coupled with compensation schemes, can be very promising for minimizing this kind of HWCs. Conservation goals can only be best achieved when there is firm support and cooperation from locals, especially in emerging economies where poor communities often bear most of the cost of human-wildlife conflicts (HWCs). In this study, we explored the economic losses caused by wild boars in two districts, i.e., the Peshawar district and the Nowshera district,





in north-western Pakistan. Between May and June 2022, 589 respondents from 53 villages were interviewed. The results revealed that the wild boar was chiefly involved in crop raiding, causing an annual economic loss of USD 12,030 (USD 20.42/household). The highly raided crops included maize (40.24%), followed by wheat (24.95%), vegetables (22.65%), and sugarcane (6.29%). Wild boars were also held accountable for orchard damages. Most people consider the wild boar a common species in the area and want it completely eliminated. We believe that the increasing wild boar population is alarming and should be noticed. The government should collaborate with the local communities to use innovative methods to deter wild boars. Compensation schemes for crop damages should be launched. Moreover, the regular investigation of the wild boar population size and their carrying capacities should be enlisted as integral parts of wildlife management in the area."

Simulating Hunting Effects on the Wild Boar Population and African Swine Fever Expansion Using Agent-Based Modeling

Ko, C, Cho, W, Hwang, B, Chang, B, Kang, W and D Ko 2023

Animals 13(2): 298, doi: 10.3390/ani13020298

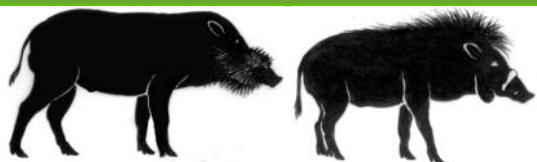
Simple Summary African swine fever (ASF) has caused significant damage to wildlife and domestic pig production. Since the first confirmed case in South Korea, the number of infected wild boars has continued to increase despite various management operations. Hence, this study developed the ASF expansion model based on an agent-based modeling approach to simulate management strategies for assessing the effective control of ASF. In our model, the agents' (wild boars) behavior and daily movement range based on their ecological and behavioral characteristics by applying annual hunting scenarios from the past three years (2019.09-2022.08). Our results represented that the higher the hunting intensity, the smaller the ASF expansion area (24,987 km²) at 0% annual hunting rate; 3533 km²) at 70%). Furthermore, the complete removal of agents during the simulation period was shown to be possible through the annual hunting rate above 70%. In conclusion, an annual hunting intensity of 70% is needed to control ASF effectively. African swine fever (ASF) is a viral hemorrhagic fever fatal to animals of the Suidae family. It has spread from Africa to Europe and Asia, causing significant damage to wildlife and domesticated pig production. Since the first confirmed case in South Korea in September 2019, the number of infected wild boars has continued to increase, despite quarantine fences and hunting operations. Hence, new strategies are needed for the effective control of ASF. We developed an agent-based model (ABM) to estimate the ASF expansion area and the efficacy of infection control strategies. In addition, we simulated the agents' (wild boars) behavior and daily movement range based on their ecological and behavioral characteristics, by applying annual hunting scenarios from past three years (2019.09-2022.08). The results of the simulation based on the annual changes in the number of infected agents and the ASF expansion area showed that the higher the hunting intensity, the smaller the expansion area (24,987 km²) at 0% vs. 3533 km²) at 70%); a hunting intensity exceeding 70% minimally affected the expansion area. A complete removal of agents during the simulation period was shown to be possible. In conclusion, an annual hunting intensity of 70% should be maintained to effectively control ASF.

Beauty and the beast: multiple effects of wild boar rooting on butterfly microhabitat

Labadessa, R and L Ancillotto 2023

Biodiversity and Conservation, doi: 10.1007/s10531-023-02545-7





Wild boar is among the most abundant ungulates in Europe and its spread is locally creating concerns as a major threat to biodiversity. However, through their rooting activity, wild boars could play an effective role in the creation of specific microhabitat resources for plants and animals. Here, we tested the hypothesis that wild boar affects the habitat suitability to threatened butterflies, by evaluating the influence of rooting on multiple key aspects of the biology and ecology of the Mediterranean endemic *Zerynthia cassandra*. Namely, we used *Z. cassandra* as a model to test the effects of wild boar rooting on adult foraging opportunities, host plant occurrence, and oviposition site selection. We found that herbaceous communities disturbed by wild boar rooting have a higher proportion of plants representing nectar resources for early-flying butterflies. We also discovered that wild boar rooting positively influences the occurrence and abundance of the larval host plant of *Z. cassandra*, as well as the butterfly site selection for egg-laying. Our results indicate that wild boars may locally prove beneficial to endangered butterflies by favoring habitat quality and availability, and their role as ecosystem engineers should thus be further investigated to improve species and habitat management and conservation actions.

Experience of the prefecture with hunting management influences the effectiveness of wildlife policy

Okuda, K., Hayashi, Y. and K. Kaji 2022

Wildlife Society Bulletin 46(5), doi: 10.1002/wsb.1387

Overabundant ungulate populations have impacted forestry and agricultural systems, as well as natural ecosystems, worldwide. To effectively control the sika deer (*Cervus nippon*) and wild boar (*Sus scrofa*) populations, which are currently under limited hunting pressure in Japan, we evaluated the prefectures' past management experiences with 2 wildlife laws: a prefecture-determined management system for relaxing hunting regulations implemented in 2000 and municipality-determined damage control system for subsidized culling implemented in 2008. Time series data (1990-2014) of sika deer and wild boar harvest per hunter for each prefecture were grouped using dynamic time warping clustering analyses. All groups of both ungulates demonstrated significant increases in harvest per hunter after implementing both laws. The prefectures with the most experience in deer management could control sika deer populations through management planning, culling supported by subsidies, and enforcement of antlerless deer harvest. The strategies are likely ineffective for controlling wild boar populations because of the lack of effective selective harvesting and limited survey methods for population monitoring. Our findings suggest that prefectures' experience in hunting management influences the success of population reduction actions for sika deer.

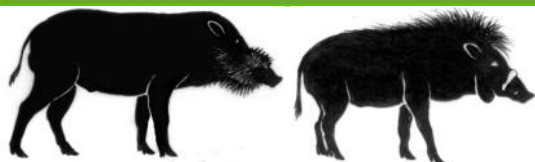
Effect of Wild Boar (*Sus scrofa*) Rooting on Soil Characteristics in a Deciduous Forest Affected by Sedimentation

Pitta-Osses, N., Centeri, C., Feher, A and K Katona 2022

Forests 13(8): 1234, doi: 10.3390/f13081234

Forest soils are shaped by various processes, like runoff, erosion, sedimentation and bioturbation. A better understanding of the interactions between abiotic and biotic soil-forming processes, including wild boar (*Sus scrofa*) rooting (i.e., subsurface foraging), enhances adequate management of forest ecosystems. We hypothesized that intense soil sedimentation influences wild boar rooting occurrence and that wild boars modify the outcome of the sedimentation process by redistributing soil layers. This study was conducted in the Babat Valley,





Hungary. We estimated the availability of sedimented and non-sedimented patches and the occurrence of boar rooting. Surveys and samplings were done along transects, over consecutive months, where the impact of rooting on the physical and chemical characteristics of soil was measured by comparing them between control and rooted sites. We found that non-sedimented, steep areas were preferred areas for rooting. Sedimentation processes have a higher impact on soil chemical characteristics and soil layer composition than wild boar rooting. We conclude that mitigation of soil degradation can be more effective by reducing adverse abiotic processes rather than wild boar population control.

Environmental drivers of seasonal shifts in abundance of wild pigs (*Sus scrofa*) in a tropical island environment

Risch, DR, Honarvar, S and MR Price 2022

Ecological Processes 11(1): 55, doi: 10.1186/s13717-022-00395-9

Background Non-native wild pigs (*Sus scrofa*) threaten sensitive flora and fauna, cost billions of dollars in economic damage, and pose a significant human-wildlife conflict risk. Despite growing interest in wild pig research, basic life history information is often lacking throughout their introduced range and particularly in tropical environments. Similar to other large terrestrial mammals, pigs possess the ability to shift their range based on local climatic conditions or resource availability, further complicating management decisions. The objectives of this study were to (i) model the distribution and abundance of wild pigs across two seasons within a single calendar year; (ii) determine the most important environmental variables driving changes in pig distribution and abundance; and (iii) highlight key differences between seasonal models and their potential management implications. These study objectives were achieved using zero-inflated models constructed from abundance data obtained from extensive field surveys and remotely sensed environmental variables. **Results** Our models demonstrate a considerable change in distribution and abundance of wild pigs throughout a single calendar year. Rainfall and vegetation height were among the most influential variables for pig distribution during the spring, and distance to adjacent forest and vegetation density were among the most significant for the fall. Further, our seasonal models show that areas of high conservation value may be more vulnerable to threats from wild pigs at certain times throughout the year, which was not captured by more traditional modeling approaches using aggregated data. **Conclusions** Our results suggest that (i) wild pigs can considerably shift their range throughout the calendar year, even in tropical environments; (ii) pigs prefer dense forested areas in the presence of either hunting pressure or an abundance of frugivorous plants, but may shift to adjacent areas in the absence of either of these conditions; and (iii) seasonal models provide valuable biological information that would otherwise be missed by common modeling approaches that use aggregated data over many years. These findings highlight the importance of considering biologically relevant time scales that provide key information to better inform management strategies, particularly for species whose ranges include both temperate and tropical environments and thrive in both large continental and small island ecosystems.

Revisiting wild boar spatial models based on hunting yields to assess their predictive performance on interpolation and extrapolation areas

Ruiz-Rodriguez, C, Fernandez-Lopez, J, Vicente, J, Blanco-Aguilar, JA and P Acevedo 2022

Ecological Modelling 471: 110041, doi: 10.1016/j.ecolmodel.2022.110041





While reliable estimates of species abundance distribution are required for wildlife management and are greatly needed at broad spatial scales, such information is scarce. In this context, the usefulness of spatial modelling as a tool for predicting game species relative abundance and distribution from hunting yield data was studied. Hunting yield data is affected by several factors related to species management, hunting regulations, and hunting efficacy and some doubts have been raised about the use or reliability of this data for large-scale modelling. Some years ago, Acevedo et al. (2014) calibrated five spatially explicit models (one per bioregion) by using hunting yield data for wild boar *Sus scrofa* (from hunting seasons 2006 to 2009) for approximately 60% of mainland Spain. After internal validation, the models were extrapolated to produce predictions of species relative abundance for the whole mainland country. Here, we reviewed these previous models to evaluate their predictive performance on new data (from hunting seasons 2014 to 2018) in areas where the models had been calibrated (interpolation areas) and also when projected into new ones (extrapolation areas). Our results showed that the previous models were able to forecast current general patterns of wild boar relative abundance with population growth rates equivalent to those reported by other authors, although differences between bioregions were observed. Performance on interpolation areas was higher than that obtained on extrapolation areas. Accuracy of model predictions decreased when fine resolution assessment at hunting ground level was carried out. Our results suggest that spatial models calibrated on hunting yields could be a good option to predict general wild boar relative abundance distribution patterns, although critical assessment is needed, since models can fail when they are extrapolated to areas for which no information is available and at fine scale resolution. These results represent a step forward in the use of hunting yields for describing ranges of species relative abundance at large spatial scales.

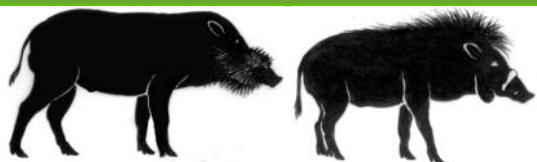
Dry and unwary are best conditions for baiting wild pigs (*Sus scrofa*)

Snow, NP, Glow, MP, Lavelle, MJ, Fischer, JW, Cook, SM, Lutman, MW, Foster, JA and KC VerCauteren 2022

Applied Animal Behaviour Science 257: 105777, doi: 10.1016/j.applanim.2022.105777

Wild pigs (*Sus scrofa*) are a highly destructive invasive species throughout North and South America, Australia, and many island nations. Where invasive, their populations are targeted for control to reduce damage. Con-trolling wild pigs often involves baiting to draw them into traps or entice them to consume a toxic bait. However, baiting can have mixed success in congregating wild pigs to focal areas long enough for control measures to ultimately be implemented. We sought to evaluate how environmental conditions (i.e., precipitation) and negative stimuli (i.e., proxy for exposure to previous control efforts) influenced use of bait sites by wild pigs. We compared visitation to bait sites during dry (2019-2020) and wet (2021) years, and between wild pigs that had been previously trapped and released in southcentral Alabama and northcentral Texas, USA. We found that drier years substantially increased use of bait sites by wild pigs (i.e., 119-136 % increase over 17 days). Similarly, wild pigs that did not experience negative stimuli had increased use of bait sites (i.e., 30-31 % increase over 17 days). We recommend that managers intensify their control efforts during drier periods to take advantage of susceptible behaviors of wild pigs during these times. We also recommend that control efforts focus on eliminating the potential for surviving wild pigs which may experience negative stimuli (e.g., narrow misses during trapping, shooting some wild pigs from a group, sub-lethal doses from toxic baits) and become educated against future efforts.





Stress Assessment of Wild Boar (*Sus scrofa*) in Corral-Style Traps Using Serum Cortisol Levels

Westhoff, KM, Fetzer, A, Buttner, K, Schuler, G, Lang, J and M Lierz 2022

Animals 12(21): 3008, doi: 10.3390/ani12213008

Corral-style traps for wild boar are used to reduce the number of wild boars. However, many people criticise these traps because of animal welfare issues such as stress and panic. While previous studies focused on behaviour and injuries, this study focused on the so-called stress hormone cortisol. Cortisol levels from trapped animals were compared with levels from animals shot during other hunting methods. Inside traps animals were killed by headshot within 2 h and 17 min after trapping and blood samples were directly taken. Cortisol levels were higher in wild boar killed in traps than in driven hunts and single hunts. Wild boar caught in groups of five or more showed lower cortisol levels than single animals or animals in smaller groups. Therefore, the time animals spend inside the trap and the time of culling all animals should be as short as possible. To reduce stress, it is better to capture larger groups of animals instead of single animals. For the evaluation of harm and stress for wild boar in live traps, cortisol levels alone are not sufficient. Additional information about the behaviour and injuries must be integrated. Capture of wild boar in corral-style traps with subsequent culling is increasingly used for population management. The method is debated due to animal welfare concerns making welfare studies in traps necessary. While previous studies focused on behaviour and injuries, this study dealt with the physiological aspect. Cortisol levels in wild boar caught in corral-style traps (50-90 µg/L, n = 138) were compared with those killed during single (n = 37) and driven hunts (n = 90). Collected sera were purified by solid phase extraction (SPE) and analysed via radioimmunoassay. Cortisol levels in blood samples were stable under cooled (4-7 degrees C) conditions for a storage time of up to 87 h before centrifugation. Cortisol levels were significantly higher in wild boar killed in corral-style traps than during driven hunts and single hunts. Wild boar caught in groups of five or more showed lower cortisol levels than single animals or in smaller groups. Therefore, time span inside the trap and of culling should be reduced to a minimum, and capturing groups of animals should be preferred to reduce stress. For animal welfare assessment of wild boar live-trapping, additional data from behavioural analyses and pathological examinations must be integrated.

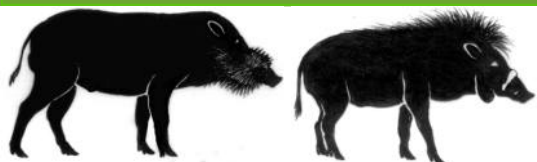
Factors influencing the activity ranges of feral pigs (*Sus scrofa*) across four sites in eastern Australia

Wilson, C, Gentle, M and D Marshall 2023

Wildlife Research, doi: 10.1071/wr22095

Context: Understanding the home-range size and the ecological drivers that influence the spatial distribution of feral pigs is of paramount importance for exotic-disease modelling and the improvement of pest management programs. Aims: To investigate various factors affecting home- and core-range size and test selection of habitat, to better inform disease modelling and pest management programs. Methods: In this study, 59 GPS-collared feral pigs were tracked over four sites in eastern Australia between 2017 and 2021. Using minimum convex polygon (MCP) and the nearest-neighbour-local convex hull (k-LoCoH) as home-range estimators and foliage projective cover (FPC) as an estimator of landscape-scale shelter, we investigated the influence of sex, site, season, year and body weight on range size and tested selection of habitat by using chi-squared and Jacob's index tests. Key results: Home-range sizes were highly variable, with k-





LoCoH90 (home) ranges between 0.08 and 54.97 km² and k-LoCoH50 (core) ranges between 0.01 and 7.02 km². MCP90 ranged between 0.15 and 242.30 km², with MCP50 being between 0.07 and 60.61 km². Sex and site both significantly ($P < 0.001$) influenced home range size, but season and year did not. Home-range size was shown to increase with body mass for both sexes ($P = 0.001$). Importantly, the data indicated that feral pigs prefer habitat within 20-40% FPC (woodland), whereas open forests (51-80% FPC) and closed forests ($> 80\%$ FPC) were actively avoided. Typically, use of open vegetation (1-10% FPC) was also avoided, but this behaviour varied and was dependent on site. Conclusion: Feral pig ranges are influenced by sex, site and body mass but not by season and year. Broad-scale selection for shelter indicated that feral pigs prefer habitat between 20% and 40% FPC. Implications: Targeting or avoiding such areas respectively for control or monitoring tool placement may result in improved, efficient outcomes to monitor or manage feral pig populations. Feral pig distribution modelling may also find benefit in the consideration and further study of the above factors and the influence of food and water sources on the activity ranges and behaviour of feral pigs.

An Approach for Investigating Sexual Maturity in Wild Boar Males: Testosterone and 17 beta-Estradiol Analysis

Maistrelli, C, Schmicke, M, Hoedemaker, M and U Siebert 2022

Animals 12(17): 2295, doi: 10.3390/ani12172295

Analyses of sexual steroid hormones in wild boars are rarely described. Testosterone (T) and 17 beta-estradiol (E2) concentrations are useful to recognize sexual maturation. As threshold values for this species are unknown, additional parameters are required. A total of 127 blood samples from wild boar males were collected to measure T and E2. Age and weight were recorded. Thirty-one epididymides were sampled too. Males were sorted into pre-and postpubertal groups based on the absence/presence of spermatozoa in epididymides and on morphological data following previous results. Forty-four males were prepubertal: the mean age and weight were 10 months and 23 kg, respectively. They showed no spermatozoa. The mean concentrations of T and E2 were 1.2 ± 1.2 ng/mL and 39.7 ± 120.3 pg/mL, respectively. Sixty-six males were postpubertal, twenty-nine of which presented spermatozoa. Their mean concentration of T was 7.6 ± 6.3 ng/mL and E2 was 664.3 ± 250.4 pg/mL. Seventeen samples could not be defined; the hormone concentrations between the two groups suggested a transitional phase consistent with puberty. Wild boars before 12 months of age had high hormone levels like older boars, indicating that they could attempt to reproduce. Hormones at the end of the mating season (January) were high so that reproduction could occur thereafter, shifting farrowing from spring to summer.

Introduced, Mixed, and Peripheral: Conservation of Mitochondrial-DNA Lineages in the Wild Boar (*Sus scrofa* L.) Population in the Urals

Markov, NI, Ranyuk, MN, Babaev, EA, Seryodkin, IV, Senchik, AV, Bykova, EA, Esipov, AV, Nurtazin, ST, Pavlova, OS and VA Matrosova 2022

Diversity-Basel 12(11): 916, doi: 10.3390/d14110916

Translocations and introductions are important events that allow organisms to overcome natural barriers. The genetic background of colonization success and genetic consequences of the establishment of populations in new environments are of great interest for predicting species' colonization success. The wild boar has been introduced into many parts of the world. We analyzed sequences of the mitochondrial-DNA control region in the wild boars introduced into the





Ural region and compared them with sequences from founder populations (from Europe, the Caucasus, Central Asia, and the Far East). We found that the introduced population has high genetic diversity. Haplotypes from all the major phylogenetic clades were detected in the analyzed group of the animals from the Urals. In this group, no haplotypes identical to Far Eastern sequences were detectable despite a large number of founders from that region. The contribution of lineages originating from Eastern Europe was greater than expected from the proportions (%) of European and Asian animals in the founder populations. This is the first study on the genetic diversity and structure of a wild boar population of mixed origin at the northern periphery of this species' geographical range.

Pigs as Pets: Early Human Relations with the Sulawesi Warty Pig (*Sus celebensis*)

Brumm, A 2023

Animals, 13, 48. <https://doi.org/10.3390/ani13010048>

The Sulawesi warty pig (*S. celebensis*) is a wild and still-extant suid that is endemic to the Indonesian island of Sulawesi. It has long been theorised that *S. celebensis* was domesticated and/or deliberately introduced to other islands in Indonesia prior to the advent of the Neolithic farming transition in the region. Thus far, however, there has been no empirical support for this idea, nor have scientists critiqued the argument that *S. celebensis* was a pre-Neolithic domesticate in detail. Here, it is proposed that early foragers could have formed a relationship with *S. celebensis* that was similar in essence to the close association between Late Pleistocene foragers in Eurasia and the wild wolf ancestors of domestic dogs. That is, a longstanding practice of hunter-gatherers intensively socialising wild-caught *S. celebensis* piglets for adoption into human society as companion animals ('pets') may have altered the predator-prey dynamic, brought aspects of wild pig behaviour and reproduction under indirect human selection and control, and caused changes that differentiated human-associated pigs from their solely wild-living counterparts

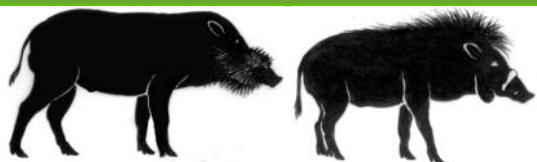
African Suid Genomes Provide Insights into the Local Adaptation to Diverse African Environments

Xie, H-B, Yan, C, Adeola, AC, Wang, K, Huang, C-P, Xu, M-M, Qiu, Q, Yin, X, Fan, C-Y, Ma, Y-F, Yin, T-T, Gao, Y, Deng, J-K, Okeyoyin, AO, Oluwole, OO, Omotosho, O, Okoro, VMO, Omitogun, OG, Dawuda, PM, Olaogun, SC, Nneji, LM, Ayoola, AO, Sanke, OJ, Luka, PM, Okoth, E, Lekolool, I, Mijele, D, Bishop, RP, Han, J, Wang, W, Peng, M-S and Y-P Zhang 2022.

Molecular Biology and Evolution 39 (12):1-18, doi: <https://doi.org/10.1093/molbev/msac256>.

African wild suids consist of several endemic species that represent ancient members of the family Suidae and have colonized diverse habitats on the African continent. However, limited genomic resources for African wild suids hinder our understanding of their evolution and genetic diversity. In this study, we assembled high-quality genomes of a common warthog (*Phacochoerus africanus*), a red river hog (*Potamochoerus porcus*), as well as an East Asian Diannan small-ear pig (*Sus scrofa*). Phylogenetic analysis showed that common warthog and red river hog diverged from their common ancestor around the Miocene/Pliocene boundary, putatively predating their entry into Africa. We detected species-specific selective signals associated with sensory perception and interferon signaling pathways in common warthog and red river hog, respectively, which contributed to their local adaptation to savannah and tropical rainforest environments, respectively. The structural variation and evolving signals in genes involved in T-cell immunity,





viral infection, and lymphoid development were identified in their ancestral lineage. Our results provide new insights into the evolutionary histories and divergent genetic adaptations of African suids.

Effects of environmental factors on the distribution of flagship species in Bomfobiri Wildlife Sanctuary, Kumawu, Ghana: Implications for conservation and ecotourism development

Acquah, E, Nsor, CA, Boadi, S and EA Owusu 2022.

African Journal of Ecology 00: 1-14, doi: 10.1111/aje.13077.

Sustainable ecotourism development and conservation depend on understanding factors that affect flagship species. This study analysed environmental factors and their effects on flagship species: African buffalo (*Syncerus caffer*), red-river hog (*Potamochoerus porcus*), olive baboon (*Papio anubis*), duiker (*Cephalophus* spp.), and crocodile (*Crocodylus niloticus*) distribution in Bomfobiri Wildlife Sanctuary (BWS). Secondary data (camp reports 2017–2019) showed flagship species distribution across four vegetation types in 14 sites. Field observations were used to reconstruct camp report information using GPS coordinates to show animal distribution. Environmental factors were assessed based on the scope and severity of their threats to the species. PAST ver.3.06 was used to analyse animal and vegetation data. A total of 995 individual animals were recorded. Riverine forest (n = 325) had the highest, followed by semi-deciduous (n = 316), and woodland Savanna (n = 192). Bushfire was the major predictive factor on animal distribution, followed by grazing pressure, farming activities, elevation, and erosion. These findings imply that an increased scale of disturbances reduces the chance of sighting flagship animals. A higher concentration of these species in riverine and semi-deciduous forests calls for increased patrols as a conservation measure. Constructing viewing platforms and hiking trails in areas of higher animal activity would improve ecotourism development.

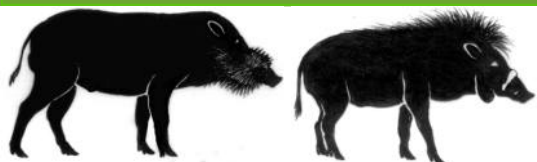
Large Felid and Peccary Habitat Use in Isolated and Contiguous Forest in Panama: Implications for Conservation

Fort, JL, Suriyamongkol, T, Nielsen, CK, Carver, AD, Moreno, R, Meyer NFV and JW Groninger 2022.

Tropical Conservation Science 15:1-18, doi: 10.1177/19400829221138009.

Wildlife research in Panama has focused primarily on protected areas along the Central Cordillera, where much of the remaining mature rainforest habitat is located. Information on large felid and prey habitat use in isolated habitats in Panama is therefore limited. Here, we estimated occupancy and detection probabilities, as affected by habitat and anthropogenic influences, for 2 felid species (jaguars [*Panthera onca*] and pumas [*Puma concolor*]), and 2 prey species (whitelipped peccaries [*Tayassu pecari*] and collared peccaries [*Pecari tajacu*]). Camera trap surveys were conducted during 2014–2015 at Cerro Hoya National Park (CHNP), an isolated remnant of tropical rainforest habitat, and Darien National Park (DNP), a large tract of continuous rainforest habitat. We used single-season, single-species occupancy modeling to estimate probabilities of detection and habitat use of our focal species. Three of the 4 focal species were detected at both sites, excluding white-lipped peccary at CHNP. Detection of jaguars and white-lipped peccaries at DNP was highest in February, while detection of collared peccaries at DNP and pumas at CHNP was highest in May and April, respectively. Peccary habitat use was uniform across sites and unaffected by habitat covariates. Both felids preferred habitat further away from





anthropogenic disturbance, and jaguars preferred habitat at higher elevations than pumas. We further confirm the presence of jaguars and likely local extirpation of white-lipped peccaries in CHNP. Temporal variations influenced detections of focal species. Habitat use of felids was negatively affected by anthropogenic disturbance and elevation. Implications for Conservation Habitat fragmentation and human activities negatively influenced habitat use of felids at both study areas. Given that CHNP serves as one of the last remnants of forest habitat outside the Central Cordillera, we recommend that CHNP be considered a top priority area for wildlife conservation in Panama.

Effect of free-ranging cattle on mammalian diversity: an Austral Yungas case study

Cuyckens, G, Gonzalez Baffa Trasci, N, Perovic, P. And L Malizia 2022.

Oryx 56(6):877-887, doi:10.1017/S0030605321001538.

Extensive cattle ranging is an important economic activity in mountains, with diverse effects on native mammal communities. The effects of cattle *Bos taurus* can be negative, positive or neutral, mostly depending on the stocking rate. We examined the effect of cattle on the diversity and abundance of native mammalian species in the Austral Yungas region of Argentina, considering environmental variables, land protection status, and human influence. Using 12,512 trap-nights from 167 camera-trap stations over 11 years (2009–2019), we calculated a relative abundance index using camera events and used generalized linear models to estimate the effect of cattle on small mammals, large herbivores, species of conservation concern and felids. Cattle had different effects on each group of native mammals. We observed a lower abundance of large native herbivores and the absence of small mammals in areas with high cattle abundance. The tapir *Tapirus terrestris*, jaguar *Panthera onca* and white-lipped peccary *Tayassu pecari* are rare in the Yungas and therefore potentially vulnerable to extinction there. Conservation of small felids and low cattle abundance could be compatible, but felids are threatened by other anthropogenic influences. Native mammalian diversity and richness were related to land protection status. The entire ecoregion is potentially suitable for cattle, suggesting the potential for further threats, and that cattle should be excluded from strictly protected areas. To ensure extensive cattle ranging is compatible with wildlife conservation in areas where exclusion is not possible, we recommend improved management of cattle and moderate stocking rates.

Are white-lipped peccaries from Argentinean Yungas looking to a promising future?

Reppuccia, JI, de Bustosb, S, Caruso, F, Fleitas Quintanac, RS and PG Perovic 2022.

Neotropical Biodiversity 8 (01):365–370, doi: <https://doi.org/10.1080/23766808.2022.2148434>.

The white-lipped peccary (*Tayassu pecari*) is considered a key species for its role as an ecosystem engineer. Given their important ecological function, there is a great concern in the scientific community regarding the many reports of disappearances or great abundance reductions throughout its distribution (from southern Mexico to northern Argentina). Based on an extensive survey effort, we report new data of presence of WLP after a period of no detections in the Argentine Yungas. The study was conducted in the Yungas ecoregion, provinces of Jujuy and Salta, Argentina. Data was collected from camera trap, direct sightings and footprints during 2013–2021. From a total of 30,186 trap nights, we obtained 8 WLP detections. There were no detections before 2017, while as of 2018 there was at least one camera trap record in each of the years. Additionally, opportunistic records were obtained yearly from 2019 to 2021. The period without detections could be related to a period of a population cycle, as suggested in different





regions of America during the last century, being disease the most likely cause. These cycles generally follow a pattern of a rapid population decline, a period of absence or low abundance followed by slow population growth. We believe that if the trend continues and the number of detections increases, we could be facing the early stages of the increase phase in the WLP population cycle in the Argentine Yungas. This type of report is important to document and contribute to a better understanding of the WLP population cycle process.

Dieta de queixadas (*Tayassu pecari*) por DNA metabarcoding de fezes na região do Parque Nacional das Emas (Goiás, Brasil)

Lima, L.H.A, Butti, M, Miotto, R.A, Silva, RR and CN Berlinck 2022.

Ambiências 1(1):1-18.

Tayassu pecari is an endangered species that has the Emas National Park as an important refuge in the Cerrado biome. In this region, *T. pecari* is identified as a problem species due to the damage caused to crops, especially in maize farming. This work used DNA metabarcoding in scats to identify the composition of the white-lipped peccaries diet. Eighty plant species in 47 families were found among 16 scat samples by using the trnL barcode. It was observed that there is a distinct food constitution for each five sampled areas, two inside the Park and three outside and that the diversity in the diet is greater in the samples collected inside the Park. The presence of soybean, sugar cane, brachiaria, and, in a larger proportion, corn, stands out. The results allowed us to identify 21 species that can respond positively to fire, either at the genus or family level, indicating that prescribed burning at the correct time can increase the food availability for peccaries within the Park.

Taxonomia e tafonomia dos remanescentes ósseos de ungulados da coleção awá-guajá do estado do Maranhão, Brasil

Figueiredo, GF, Chahud, A and M Okumura 2022.

Revista Etnobiologia 20(2):84-99.

The Awá-Guajá community is one of the last hunter-gatherer communities that have hunting as a traditional sub-sistence activity. The material analyzed refers to a faunal assemblage composed of vertebrates from the discarded community located in the Caru Indigenous Land, in the State of Maranhão, northeastern Brazil. The present study examined from a taxonomic and taphonomic point of view with the purpose of gathering data for interpretation of the processes acting in its genesis, using qualitative and quantitative methods. The main target of the research were the ungulates, families Cervidae, Tayassuidae and Tapiridae, which showed a large amount of bones in different types of preservation and evidence of human activity, resulting in bones with cut and burning marks, in addition to indicating the food preference of the community by Tayassuidae of the *Pecari tajacu* species, but there was no preference for some species of Cervidae and Tapiridae. There was no cultural activity involving ungulate remains (such as bone tools or ornamentation) and cuts and marks are related to preparation and consumption.

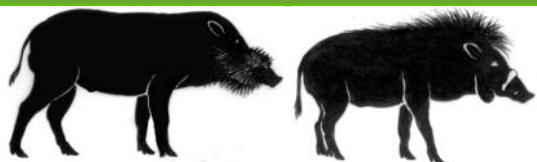
Competencia de interferencia entre *Pecari tajacu* y *Odocoileus virginianus*

Sánchez-Pinzón, K and NA Domínguez 2022.

MammalogyNotes 8(1):1-5, doi: <https://doi.org/10.47603/mano.v8n1.302>.

Sympatric species, having similar requirements, tend to compete for resources, especially in places where these are limited. Through monitoring with camera traps in waterholes in the





Calakmul Region, two competition events were recorded due to interference between the collared peccary (*Pecari tajacu*) and the white-tailed deer (*Odocoileus virginianus*), confirming this antagonistic behavior as a strategy to access a shared and limited resource in this zone.

Riqueza, abundancia relativa y actividad de los mamíferos de una reserva en restauración en Costa Rica

Pacheco, PM, Cambronero, AV, López, LI and JM Mora 2022.

UNED Research Journal 14 (2):1-17, doi: <https://doi.org/10.22458/urj.v14i2.4210>.

“Richness, relative abundance and activity of medium and large mammals of a reserve under restoration in Costa Rica”. Introduction: Private protected areas are a valuable complement to national systems of protected areas. The Sierra Zapote Reserve in Abangares, Costa Rica, established in 2000, protects 70 ha of advanced secondary forest, regenerating secondary forest and primary riparian forest. It is expected to favor faunal communities, like medium and large mammals, which are among the species most threatened by habitat loss and fragmentation; nevertheless; there is a lack of recent faunal assessments at Sierra Zapote. Objective: To assess the richness, relative abundance and activity patterns of these mammals in the reserve. Methods: From May 2020 to July 2021, we kept five camera-traps at strategic sites and programmed them to be active 24 hours a day (0,3 seconds between shots). We checked the cameras every one or two months and also extracted temperature and moon phase data. Results: We obtained 758 independent records of mammals with a 2 135-day photo-trapping effort. The most abundant species were *Nasua narica* (relative abundance index RAI = 14,6, N= 312) and *Didelphis marsupialis* (RAI = 6,1, N= 130). The least abundant were *Herpailurus yagouaroundi* and *Procyon lotor* (RAI = 0,05, N= 1). Most species are nocturnal and only the peccary (*Pecari tajacu*), the coati (*Nasua narica*) and the agouti (*Dasyprocta punctata*) have mostly diurnal activity. The puma (*Puma concolor*) occurs at the reserve. Conclusion: The activity patterns were as expected; for the reserve size, a richness of 19 species is comparatively high. The presence of the puma, an indicator of good ecosystem health, hints at the importance of the reserve’s restoration process.

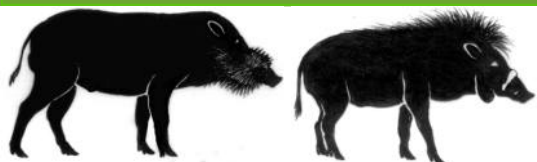
Consumption of Diets Based on Native Forages, Pumpkin and Corn by Collared Peccary (*Pecari tajacu*)

Montes-Perez, RC, Mukul-Yerves, JM and L Sarmiento-Franco 2022.

Advances in Research 23 (6):15-20, doi: [10.9734/air/2022/v23i6916](https://doi.org/10.9734/air/2022/v23i6916).

The study was carried out to evaluate the effect of the consumption of corn-based diets mixed with *Brosimum alicastrum* or pumpkin (*Cucurbita* sp) forage, on live weight, in the number of erythrocytes, leukocytes and serum urea nitrogen, in collared peccaries (*Pecari tajacu*) in captivity. A four-treatment longitudinal comparative experiment with a repeated measures design was applied. Xmatkuil Wildlife Conservation Management Unit, in Mérida, Yucatán, Mexico, for three months. Nine adult female collared peccaries (*Pecari tajacu*) were subjected to voluntary consumption of the following diets: T1: Diet with 60% of corn and 40% dry *B. alicastrum* forage, T2: Diet with 40% corn and 60% dry *B. alicastrum*, T3: Diet with 60% corn and 40% fresh pumpkin on dry matter basis, T4: Diet with 40% corn and 60% fresh pumpkin, for 14 days for each treatment. The dry matter intake of each treatment, live weight, number of leukocytes, erythrocytes and serum urea nitrogen in each of the specimens were measured. Response variables in each treatment were compared with repeated measures ANOVA or Friedman's test if parametric analysis requirements were not met. There was no significant difference between live





weights in each treatment ($P=0.05$) but there was a significant difference in dry matter intake between treatments. There was no significant difference in erythrocyte levels between treatments. There was no difference in leukocyte levels between treatments ($P=0.05$), but there was a difference in the means of urea nitrogen between treatments. Pumpkin diets with corn show higher levels of dry matter intake, higher levels of urea Nitrogen and a greater number of erythrocytes than diets with corn and dry *B. alicastrum*, so it is suggested that diets with pumpkin and corn are more suitable than with corn and dry *B. alicastrum*.

Consumo de ensilajes de árboles forrajeros por pecarí de collar (*Pecari tajacu*)

Rubén, M-P, César, A-C, Fausto, M-C and A-C Armando 2022.

Abanico Veterinario 12:1-9, doi: <http://dx.doi.org/10.21929/abavet2022.35>.

The *Pecari tajacu* is considered a pseudo-ruminant, because it can digest vegetable fiber and produce fatty acids in its compound stomach. It has been proven that it consumes the fresh foliage of native trees; however, there is no information on the consumption of silage with chacá (*Bursera simaruba*), jabín (*Piscidia piscipula*), moringa (*Moringa oleifera*) and pixoy (*Guazuma ulmifolia*). The objective was to evaluate the preference of silage consumption by collared peccary based on moringa, pixoy, jabín and chacá with corn. Four adult male collared peccary specimens with an average weight of 17 ± 1.8 kg were used. Two experiments were carried out in the "Xmatkuil" Wildlife Management and Conservation Unit. In the first, the 4x4 Latin square design was applied for four hours, for four days with four silages. In the second experiment, the test was carried out with three silages using a 3x3 Latin square, the preferred silage from the first experiment was removed. The preferred silage in the first trial was *M. oleifera* ($P<0.05$) and *B. simarubain* the second ($P<0.05$). No significant relationship ($P>0.05$) was found between the nutrient levels and the dry matter intake of the silages.

Uso de fauna silvestre por comunidades campesinas en Plato, Magdalena, región caribe colombiana.

Gómez, R, Racero-Casarrubia, J and J Ballesteros-Correa 2023.

Acta Biológica Colombiana 28(1):1-24, doi: <https://doi.org/10.15446/abc.v28n1.94140>.

Wild fauna is of crucial importance in the social, economic and cultural construction of peasant communities, although its use can generate threats to the stability of the most exploited wild populations. This article determined from an ethnozoological point of view the uses received by wildlife in a rural town of Plato Magdalena. 70 structured interviews were carried out, using illustrated files of amphibian, reptile, bird, and mammal species with distribution for this region. 103 species were recognized (11 amphibians, 29 reptiles, 32 birds and 31 mammals), where 65% support different categories of use: food, trade, pet, handicrafts and medicine, uses that include 12 reptiles, 28 birds and 27 mammals. The species with the greatest use as food are *Dasypus novemcinctus*, *Dasiprocta punctata*, *Hydrochoerus h. isthmus*, *Mazama sanctaemartae*, *Pecari tajacu*, *Sylvilagus floridanus*, *Trachemys callirostris*, *Iguana iguana*, *Ortalis garrula*, *Dendrocygna autumnalis*. Commercial use falls on Caiman *Crocodylus fuscus*, *I. iguana*, *T. callirostris* and *Chelonoidis carbonarius*; and as pets *Ara araruana*, *A. macao*, *Eupsittula pertinax*, *Brotogeris jugularis*, *Amazona ochrocephala*, *Thraupis episcopus*, *Sicalis flaveola*, *Cebus versicolor*, *Notosciurus granatensis* and *C. carbonarius*. The skins of *Leopardus pardalis*, *Puma concolor*, *Panthera onca*, *Crocodylus fuscus*, *Boa constrictor*, and shells of *C. carbonarius* are used in crafts. Different species of birds, mammals and reptiles are important resources for the





survival of the peasant community, whose utilitarian value is closely related to sociocultural aspects and traditional knowledge, which is important to take into account in the design of conservation programs.

Factors influencing acceptance of hippopotamus at a large reservoir in Nigeria

Baker, RL, Radda, IA, Teneke, VN, Kadala, E, Sturdivant RX and GA Madwatte 2022.

Conservation 2: 662–681, doi: <https://doi.org/10.3390/conservation2040043>.

In a world increasingly affected by human presence and activities, achieving human– wildlife coexistence has become the goal of many wildlife conservation programs. Coexistence requires an understanding of factors that contribute to human tolerance and acceptance of problematic wildlife. In four communities in Nigeria, we used structured and semi-structured interviews to explore local people's acceptance of the river hippopotamus (*Hippopotamus amphibius*) at a large reservoir with high human impact and where other conspicuous, damage-causing species are absent. We collected data two years apart to evaluate whether acceptance changed over time. Acceptance was low among respondents (21%). Logistic-regression results showed that attitudes, beliefs related to benefits and risks, behaviors toward hippos, study period, and income source significantly influenced acceptance of hippos. Results from Woolf tests showed that hippo-caused human fatalities most notably modified the observed decline in acceptance between study years. The potential significant impact of rare, yet severe events (in this case, human fatalities) on acceptance of wildlife and thus human–wildlife coexistence was supported in this study, one of few focused on hippo-human relations. For conservation and development interventions to be effective at this site, they should, at a minimum, improve human safety around hippos, emphasize current and potential benefits of hippos, create avenues for off-farm income, and reduce crop losses owing to hippos.

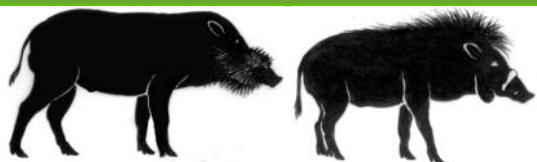
Human-hippos (*Hippopotamus amphibius*) interactions in villages adjacent to Lake Babati, Tanzania

Mmbaga NE 2022

Global Ecology and Conservation 40: 1-8, doi: <https://doi.org/10.1016/j.gecco.2022.e02316>.

Hippos (*Hippopotamus amphibius*) are herbivores and semi-aquatic feeding on farmlands mainly at night. Although human-hippopotamus interactions are known to occur, there is little information in the area surrounding Lake Babati. The study aimed to assess: the areas dominated by hippo visits; problems caused by hippos to the local communities'; major challenges to crops compared to hippos, crops preferred by hippos and seasonal variations in hippo visits across the study villages. Semi structured questionnaire, focused group discussions and direct observation methods were used in data collection. The findings reveal that the hippos mostly visit the farms and residential areas closer to the lake (>3 km) across the villages. Hippos were perceived as the major challenge to crops compared to drought and diseases. The respondents closer to the lake reported crop raiding as the major problem caused by hippos and the incidents reported to be severe during the rainy season. Maize crop was reported to be highly preferred by hippos compared to other crops. The study recommends to the key stakeholders to come up with proper management strategies giving priority to the areas within 3km adjacent the lake. This may include establishment of the buffer zone and growing alternative crops that are not preferred by the hippos so as to attain hippos' conservation and livelihoods development goals.





Diversity and Relative Abundance of Ungulates and Other Medium and Large Mammals in Flooded Forests in the Dahomey Gap (Togo)

Segniagbeto, GH, Akpamou, KG, Konko, Y, Gaglo, JKT, Ketoh, GK, Dendi, D, Fa, JF and L Luiselli 2022.

Animals 12 (3041): 1-12, doi: <https://doi.org/10.3390/ani12213041>.

“The Dahomey Gap” is a human-derived mostly savannah region that separates the GuineoCongolian rainforest block into two major units: the Upper Guinean and the Lower Guinean Forest blocks. Several forest patches are distributed throughout this savannah-dominated habitat. The mammal communities in the Dahomey Gap region have been poorly studied. In this paper we analyse the species richness and abundance of, as well as conservation implications for, medium and large mammals (especially ungulates) inhabiting a complex of flooded forests near the Mono river in south-eastern Togo. We use several field methods to describe the species richness of mammals in this area, including camera-trapping, recce transects, Kilometric Index of Abundance (KIA) estimates, examination of hunters’ catches and face-to-face hunter interviews. Overall, we directly recorded 19 species that coexist in these forests. Based on interviews, nine other species were confirmed as present in the study area. Only five species were common: *Cephalophus rufilatus*, *Tragelaphus scriptus*, *Chlorocebus aethiops*, *Atilax paludinosus* and *Herpestes ichneumon*. The area still contains various threatened species such as *Tragelaphus spekii* and *Hippopotamus amphibius*. We stress that to ensure the protection of the Dahomey Gap mammals, it is important to seriously consider protecting not only the forest patches but also the surroundings, mainly savannah landscapes.

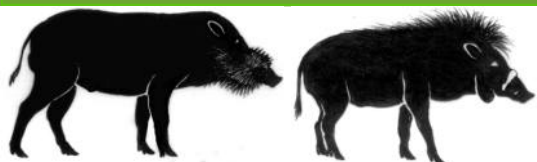
The direct and indirect effects of damming on the *Hippopotamus amphibius* population abundance and distribution at Bui National Park, Ghana

Bempah, G, Grant, MK, Lu, C and A Borzée 2022.

Nature Conservation 50: 175–201, doi: <https://natureconservation.pensoft.net>.

Landscape changes resulting from human activities have resulted in range restrictions and substantial reductions in population sizes of most animals. The construction of hydroelectric dams has the same effect on species, but the study of their impact on semi-aquatic megafauna species is limited. We examined the response of a *Hippopotamus amphibius* population to the inundation of their habitat after the construction of a hydroelectric dam in Bui National Park, Ghana. We conducted an abundance and distribution survey of *H. amphibius* and compared the population size from our results with a pre-dam construction survey to determine changes in the abundance and distribution of the species within the focal area. Furthermore, we conducted a landscape analysis to estimate land cover before and after the dam construction and determined if the changes in land cover were related to the changes in population of *H. amphibius*. Finally, we conducted selected interviews to understand additional threats to the species perceived by the local population, as indirect effects of the dam construction. Contrary to our original hypothesis on an increase in the abundance of *H. amphibius* in the medium term (within a decade) through population recovery after the disturbances caused by the construction of the dam, we found lower numbers of *H. amphibius* after the dam construction, compared to the pre-dam results. The results indicated a reduced abundance from 209 *H. amphibius* individuals in 2003 to 64 *H. amphibius* individuals in 2021. Some individuals may have migrated to areas outside the reserve during damming when their habitat was disturbed. The amount of land covered by water increased from 0.41% before damming to 19.01% after damming, which flooded the resting and





grazing sites of the *H. amphibius*. We conclude that the abundance and distribution of *H. amphibius* significantly and negatively decreased after the construction of the dam at the Bui National Park. We tentatively relate this decrease to the species' semi aquatic ecology and sensitivity to changes in both the terrestrial and aquatic environment. The activities of human settlement encroachment such as poaching, as well as associated land cover changes, affected the stability of the *H. amphibius* population. However, as the species can survive in the medium to long term when effective management plans are implemented, we recommend *H. amphibius* to be given high conservation priorities by enhancing strict laws for habitat protection.

Diseases

Effects of habitat fragmentation and hunting activities on African swine fever dynamics among wild boar populations

Salazar, LG, Rose, N, Hayes, B, Hammami, P, Baubet, E, Desvaux, S and M Andraud 2022

Preventive Veterinary Medicine 208: 105750, doi: 10.1016/j.prevetmed.2022.105750

African Swine Fever (ASF) has been slowly but steadily increasing its endemic range throughout Europe, posing an imminent risk to the pig industry. ASF transmission among wild boar occurs mainly through wild boar population movements, hence wild boar presence and density are important risk factors for introducing, maintaining, and spreading the disease. The understanding of wild boar population dynamics and their role in ASF transmission and persistence remains limited. It is crucial to gain knowledge in this area to improve wildlife management while minimizing the risks for ASF introduction and spread. We adapted an individual-based spatio-temporal stochastic model developed by Halasa et al. (2019) and tailored it to two regions in France. The model assessed yearly hunting activity, the carcass persistence seasonality, and the specific landscape characteristics of the Franco-Belgian border region and the Pyrenees-Atlantiques department. Following the establishment of local population dynamics through preliminary runs of the model, the model was run 100 iterations over 8 years in the two study areas where ASF was randomly seeded after the 2nd year of simulation. For each scenario, the model was initiated with 500 wild boar groups randomly spread across the study areas. Hunting activities were included and excluded to assess the impact on population growth and ASF spread. Results showed an ever-growing wild boar population for all scenarios, which was balanced when hunting activities were included. When introducing ASF, the wild boar populations were dramatically impacted in both areas with a decrease of 63 % of the population at the Franco-Belgian border and 86 % in the Pyrenees-Atlantiques department. Habitat fragmentation and landscape connectivity were highlighted as important factors shaping ASF propagation. The Franco-Belgian border, which had the most fragmented habitat with unsuitable areas for wild boars, was shown to limit wild boar movements, reducing the probability, and spread of ASF across the landscape. The lack of connectivity was reflected in a less effective transmission and lower number of infected groups (406 versus 467). In contrast, the epidemic duration was lengthened in the fragmented habitat compared to the homogenous area (2.6 years vs 1.6 years). This study provided information on defining and implementing control measures in case of an ASF incursion, since delimitation of the area via fences artificially induces landscape fragmentation, which is important for controlling ASF outbreaks.





Climate Change Influences the Spread of African Swine Fever Virus

Tiwari, S, Dhakal, T, Kim, TS, Lee, DH, Jang, GS and Y Oh 2022

Veterinary Sciences 9(11): 606, doi: 10.3390/vetsci9110606

Simple Summary This study aims to investigate the influence of climate change on the spread of the African swine fever virus (ASFV). ASFV data in wild boar outbreak locations were sampled and investigated using the Maxent model, with WorldClim bioclimatic data as the predictor variables. The future impacts of climate change on ASFV distribution were scoped with Representative Concentration Pathways (RCP) scenarios for 2050 and 2070. The results show that the precipitation of the driest month (Bio14) and annual mean temperature (Bio1) were contributable factors and indicate a higher possibility of spreading ASFV in the future. The Maxent model was best fitted with an area under curve (AUC) value of 0.99. The proposed Maxent model and the results of this study can be potentially applied to predict disease risks associated with climate change and provide guidance for prevention management. Climate change is an inevitable and urgent issue in the current world. African swine fever virus (ASFV) is a re-emerging viral animal disease. This study investigates the quantitative association between climate change and the potential spread of ASFV to a global extent. ASFV in wild boar outbreak locations recorded from 1 January 2019 to 29 July 2022 were sampled and investigated using the ecological distribution tool, the Maxent model, with WorldClim bioclimatic data as the predictor variables. The future impacts of climate change on ASFV distribution based on the model were scoped with Representative Concentration Pathways (RCP 2.6, 4.5, 6.0, and 8.5) scenarios of Coupled Model Intercomparison Project 5 (CMIP5) bioclimatic data for 2050 and 2070. The results show that precipitation of the driest month (Bio14) was the highest contributor, and annual mean temperature (Bio1) was obtained as the highest permutation importance variable on the spread of ASFV. Based on the analyzed scenarios, we found that the future climate is favourable for ASFV disease; only quantitative ratios are different and directly associated with climate change. The current study could be a reference material for wildlife health management, climate change issues, and World Health Organization sustainability goal 13: climate action.

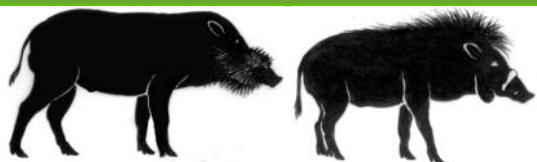
Mammary Adenoma Associated with Chronic Mastitis in a Wild Boar (*Sus scrofa*)

Baek, S.M., Lee, S.W. and J.K. Park 2022

Acta Veterinaria-Beograd 72(3): 388-396, doi: 10.2478/acve-2022-0031

Mammary gland tumor is rare and only a few cases have been reported in wild animals. Moreover, most etiologies of the known cases in veterinary medicine are related to age, diet, obesity, and excessive sex hormones in domestic animals while few etiologies are reported in wild animals. An unknown-aged female wild boar was presented to the Department of Veterinary Pathology, Kyungpook National University with a well-demarcated, and firm-to-elastic mammary gland mass. The cut-surface of the mass was pink-reddish, and homogeneous. Microscopically, the mass was mainly composed of well-differentiated neoplastic glandular epithelial cells characterized by a single-layer, columnar to cuboidal shapes, and small and central nuclei and nucleoli. Any evidence of invasiveness or metastases of the neoplastic cells were not observed. Interestingly, infiltration of chronic inflammatory cells such as plasma cells and macrophages was observed along with a large quantity of gram-negative and positive bacterial colonies in the mammary glands. Moreover, accompanied fibrosis of stroma was observed, as well. Based on the gross and microscopic findings, the present case was diagnosed as mammary simple adenoma caused by chronic mastitis progressing to fibrotic condition. To the authors' knowledge,





this is the first study describing the histopathological aspects of mammary gland tumors associated with chronic mastitis accompanied by fibrosis in wild animals.

Exemplifying the “wild boar paradox”: dynamics of cesium-137 contaminations in wild boars in Germany and Japan

Berendes, O and G Steinhauser 2022

Journal of Radioanalytical and Nuclear Chemistry 331: 5003–5012, doi: 10.1007/s10967-022-08528-2

Wild boars (*Sus scrofa*) are notorious for accumulating high contamination levels of Cs-137 in their meat. Publicly available data of Cs-137 contamination levels in wild boars from 2011 to 2019 were used to determine some radioecological characteristics in Germany (affected by Chernobyl-fallout, 1986) and Japan (affected Fukushima, 2011). The effective half-life of Cs-137 in wild boar meat was much longer in Germany (7.3 y) than in Japan (2.6 y), respectively. Wild boars in Germany thus show much more persistent contamination levels than other game or forest animals. This unusual behavior has been termed wild boar paradox." In German wild boars, the data sets reveal a distinct geographical and seasonal dependence with higher activity concentrations in winter than in summer. In Japan, contamination levels only exhibit a distinct decline behavior."

Rotavirus A in Domestic Pigs and Wild Boars: High Genetic Diversity and Interspecies Transmission

Brnic, D, Colic, D, Kunic, V, Maltar-Strmecki, N, Kresic, N, Konjevic, D, Bujanic, M, Bacani, I, Hizman, D and L Jemersic 2022

Viruses-Basel 14(9): 2028, doi: 10.3390/v14092028

Rotavirus A (RVA) is an important pathogen for porcine health. In comparison to humans, RVA in domestic animals and especially in wildlife is under researched. Therefore, the aim of the present study was to investigate the prevalence, genetic diversity, molecular epidemiology and interspecies transmission of RVA in domestic pigs and wild boars. During the three consecutive RVA seasons (2018-2021) we collected 445 and 441 samples from domestic pigs and wild boars, respectively. Samples were tested by real-time RT-PCR, and RVA-positive samples were genotyped in VP7 and VP4 segments. Our results report an RVA prevalence of 49.9% in domestic pigs and 9.3% in wild boars. Outstanding RVA genetic diversity was observed in VP7 and VP4 segments, especially in domestic pigs exhibiting a striking 23 different RVA combinations (G5P[13] and G9P[23] prevailed). Interspecies transmission events were numerous between domestic pigs and wild boars, sharing G3, G5, G6, G9, G11 and P[13] genotypes. Furthermore, our data indicate that such transmission events involved even bovines (G6, P[11]) and, intriguingly, humans (G1P[8]). This study contributes to the basic knowledge that may be considered important for vaccine development and introduction, as a valuable and currently missing tool for efficient pig health management in the EU.

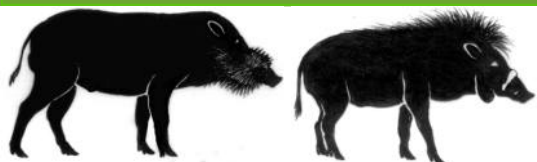
Gut microbiota reveals the environmental adaption in gastro-intestinal tract of wild boar in karst region of Southwest China

Cao, HQ, Yang, XW, Peng, CC, Wang, YY, Guo, QY and HJ Su 2022

Annals of Microbiology 72(1): 9, doi: 10.1186/s13213-022-01669-5

Background Gut microbes has become one of the research hotspots in animal ecology, playing





an important role in monitoring dietary adaptation and health status of host. However, there are few studies on the gut microbiota in the stomach, small intestine (ileum), and large intestine (cecum, colon, and rectum) of wild boar. Results Alpha diversity and Beta diversity showed there were significant differences in the abundance and distribution of microbes in gastrointestinal tract of wild boar. Firmicutes and Bacteroidetes were the most dominant phyla in stomach, cecum, colon and rectum of wild boar, while Proteobacteria and Firmicutes were the most dominant in ileum. At genus level, there were different leading genera in stomach (*Prevotella* and *Lactobacillus*), small intestine (*Escherichia-Shigella* and *Lactobacillus*), and large intestine (Ruminococcaceae UCG-005, Christensenellaceae R-7 group, and *Escherichia-Shigella*). PICRUST function predictive analysis suggested that there were significant differences in microbial metabolic pathways among five locations of wild boar. Conclusions This study comprehensively revealed the differences in composition of microbial community in gastrointestinal tract of wild boar. Future work links microbes with the metabolites to accurately reveal the health of wild boar.

Taking a Promising Vaccine Candidate Further: Efficacy of ASFV-G-Delta MGF after Intramuscular Vaccination of Domestic Pigs and Oral Vaccination of Wild Boar

Deutschmann, P, Carrau, T, Sehl-Ewert, J, Forth, JH, Viaplana, E, Mancera, JC, Urniza, A, Beer, M and S Blome 2022

Pathogens 11(9): 996, doi: 10.3390/pathogens11090996

African swine fever (ASF) is a pandemic threat to the global pig industry and wild suids. A safe and efficacious vaccine could monumentally assist in disease eradication. In the past years, promising live attenuated vaccine candidates emerged in proof-of-concept experiments, among which was ASFV-G- increment MGF". In our study, we tested the vaccine candidate in three animal experiments intramuscularly in domestic pigs and orally in wild boar. Further, a macrophage-grown vaccine virus and a virus grown on permanent cells could be employed. Irrespective of the production system of the vaccine virus, a two-dose intramuscular immunization could induce close-to-sterile immunity with full clinical protection against challenge infection. After oral immunization, 50% of the vaccinees seroconverted and all responders were completely protected against subsequent challenge. All nonresponders developed ASF upon challenge with two acute lethal infections and two mild and transient courses. The latter results show a lower efficiency after oral administration that would have to be taken into consideration when designing vaccination-based control measures. Overall, our findings confirm that "ASFV-G- increment MGF" is a most promising vaccine candidate that could find its way into well-organized and controlled immunization campaigns. Further research is needed to characterize safety aspects and define possible improvements of oral efficiency.

Environmental factors associated with the prevalence of ESBL/AmpC-producing *Escherichia coli* in wild boar (*Sus scrofa*)

Gunther, T, Kramer-Schadt, S, Fuhrmann, M and V Belik 2022

Frontiers in Veterinary Science 9: 980554, doi: 10.3389/fvets.2022.980554

Antimicrobial resistances (AMR) in bacteria, such as ESBL/AmpC-producing *E. coli*, are a burden to human and animal health. This burden is mainly driven by the consumption and release of antimicrobial substances into the environment. The pollution and contamination of habitats by AMR in bacteria and antimicrobial substances can lead to the transmission of bacterial AMR to





wildlife. Therefore, it is necessary to understand the transmission cycle of antibiotics and resistant bacteria between humans, and animals as well as their occurrences in the environment. Environmental factors associated with the occurrence of bacterial AMR in wildlife can lead to a better understanding of the distribution of bacterial AMR in humans and animals using One Health approaches. Here, we analyzed data gathered in the framework of the German zoonoses monitoring program in 2016 and 2020 using spatiotemporal statistics to identify relevant environmental factors (e.g., livestock density, climatic variables, and human density) in association with the spatial distribution of ESBL/AmpC-producing *E. coli*. For this purpose, we developed a generic data integration and analysis pipeline to link spatially explicit environmental factors to the monitoring data. Finally, we built a binomial generalized linear mixed model (GLMM) to determine the factors associated with the spatial distribution of ESBL/AmpC-producing *E. coli*. In 2016 and 2020, 807 fecal samples from hunted wild boar (*Sus scrofa* L.) were randomly taken in 13 federal states and selectively analyzed for ESBL/AmpC-producing *E. coli*. Forty-eight isolates were identified in 12 German federal states, with an overall prevalence of 6%. We observed an almost three times higher probability of ESBL/AmpC-producing *E. coli* isolates in wild boar in counties with high cattle densities (OR = 2.57, $p \leq 0.01$). Furthermore, we identified a seasonal effect in areas with high precipitation during the off-hunting seasons (OR = 2.78, $p = 0.025$) and low precipitation throughout the years (OR = 0.42, $p = 0.025$). However, due to the low amount of identified isolates, confidence intervals were wide, indicating a high level of uncertainty. This suggests that further studies on smaller scales need to be conducted with multiannual data and improved metadata, e.g., on the location, the hunting procedure, and species characteristics to be collected during field sampling.

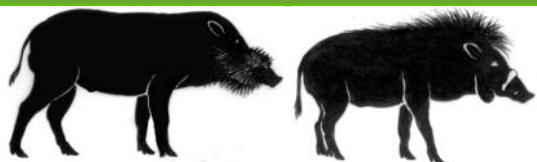
Detection of Porcine Circovirus 1/2/3 and Genetic Analysis of Porcine Circovirus 2 in Wild Boar from Jiangxi Province of China

Hu, XF, Chen, Z, Li, Y, Ding, Z, Zeng, QH, Wan, T and HS Wu 2022

Animals 12(16): 2021, doi: 10.3390/ani12162021

Since PCV2 is currently the primary viral agent in intensive pigs, the cost of immune suppression and preventative measures has resulted in severe economic losses. It has been claimed that PCVs infect wild pigs in a number of nations, including South Korea, Germany, and Italy. Jiangxi province in China is a heavily populated area with an extremely intensive pig production industry, but data on the transmission of PCVs in wild boar are poor. In order to ascertain the incidence of PCV1/2/3 and the genetic characteristics of PCV2 circulating in wild boar in Jiangxi province, an epidemiological investigation was conducted. We discovered a medium prevalence of PCVs, notably PCV2, which indicated that wild boar in Jiangxi province were exposed to PCVs. Our findings highlight the need for the pig sector to actively prevent the contact between livestock and wild boar, which have a high risk of PCVs infection. A number of disorders that harm pig production are linked to porcine circoviruses, including PCV2. PCV2 infection is a substantial contributor to porcine-circovirus-associated illnesses (PCAS) and the post-weaning multi-systemic wasting syndrome (PMWS), which have a significant negative economic impact on pig production. Additionally, PCV infection has been labeled as a global concern to cattle and wildlife. This study's objectives were to examine the prevalence of PCV1/2/3 in Jiangxi Province, China, and to clarify the epidemiological significance of wild boar in PCV epidemiology. The 2020 hunting seasons resulted in the collection of 138 wild boar samples for PCV1/2/3 detection, which was followed by the genetic clarification of PCV2 strains. According to our data, 21.7% (30/138) of the





population had PCV1 positivity, 22.5% (31/138) had PCV2 positivity, and 5.8% (8/138) had PCV3 positivity. Additionally, 10 out of 138 wild boar samples had PCV1 and PCV2 co-infections, while 5 out of 138 wild boar samples had PCV2 and PC3 co-infections. Nineteen full-length PCV2 genomes measuring 1767 nt were recovered from various animal tissues using conventional PCR. Eighteen out of nineteen PCV2 strains were identified as PCV2b by phylogenetic tree analysis, which was completed by the reference strain HLJ2015 obtained from domestic pigs in 2015. Additionally, one genotype of PCV2d JX11-2020 (MW889021) shared a sub-branch with the referenced strain TJ (AY181946), which was isolated in domestic pigs in 2002. This finding raises the possibility that domestic pigs could contract PCV2 strains from wild boar, posing a serious threat to the Jiangxi province of China's pig production industry.

Spatio-Temporal Epidemiology of the Spread of African Swine Fever in Wild Boar and the Role of Environmental Factors in South Korea

Ito, S, Bosch, J, Jeong, H, Aguilar-Vega, C, Park, J, Martinez-Aviles, M and JM Sanchez-Vizcaino 2022

Viruses-Basel 14(12): 2779, doi: 10.3390/v14122779

Since the first confirmation of African swine fever (ASF) in domestic pig farms in South Korea in September 2019, ASF continues to expand and most notifications have been reported in wild boar populations. In this study, we first performed a spatio-temporal cluster analysis to understand ASF spread in wild boar. Secondly, generalized linear logistic regression (GLLR) model analysis was performed to identify environmental factors contributing to cluster formation. In the meantime, the basic reproduction number (R_0) for each cluster was estimated to understand the growth of the epidemic. The cluster analysis resulted in the detection of 17 spatio-temporal clusters. The GLLR model analysis identified factors influencing cluster formation and indicated the possibility of estimating ASF epidemic areas based on environmental conditions. In a scenario only considering direct transmission among wild boar, R_0 ranged from 1.01 to 1.5 with an average of 1.10, while, in another scenario including indirect transmission via an infected carcass, R_0 ranged from 1.03 to 4.38 with an average of 1.56. We identified factors influencing ASF expansion based on spatio-temporal clusters. The results obtained would be useful for selecting priority areas for ASF control and would greatly assist in identifying efficient vaccination areas in the future.

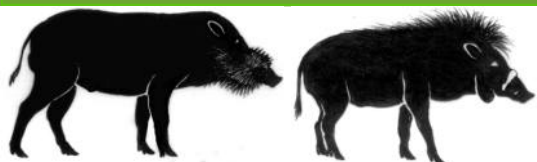
Complete genome analysis of the African swine fever virus isolated from a wild boar responsible for the first viral outbreak in Korea, 2019

Kim, G, Park, JE, Kim, SJ, Kim, Y, Kim, W, Kim, YK and W Jheong 2023

Frontiers in Veterinary Science 9: 1080397, doi: 10.3389/fvets.2022.1080397

African swine fever (ASF), a highly contagious and severe hemorrhagic viral disease in swine, is emerging as a major threat not only in Korea but also worldwide. The first confirmed case of ASF in Korea was reported in 2019. Despite the occurrence of ASF in Korea, only a few studies have genetically characterized the causative ASF virus (ASFV). In this study, we aimed to genetically characterize the ASFV responsible for the 2019 outbreak in Korea. The genome of the ASFV isolated during the first outbreak in Korea was analyzed. The Korea/YC1/2019 strain has 188,950 base pairs, with a GC content of 38.4%. The complete genome sequence was compared with other ASFV genomes annotated in the NCBI database. The Korea/YC1/2019 strain shared the highest similarity with Georgia 2007, Belgium 2018/1, and ASFV-wbBS01 strains. This study





expands our knowledge of the genetic diversity of ASFV, providing valuable information for epidemiology, diagnostics, therapies, and vaccine development.

A serological survey of porcine reproductive and respiratory syndrome virus in wild boar in Gifu Prefecture, Japan

Kitamura, Y, Saito, T, Tanaka, E and Y Takashima 2022

Journal of Veterinary Medical Science 84(10): 1406-1409, doi: 10.1292/jvms.21-0554

Porcine reproductive and respiratory syndrome (PRRS) is an infectious swine disease caused by the PRRS virus (PRRSV) that results in economic loss to the pig-rearing industry. To study PRRSV infection in wild boars and pigs, we conducted a serological survey in Gifu Prefecture, Japan, from 2020 to 2021. Three out of 453 (0.7%) wild boar sera were positive for PRRSV antibodies in a commercial ELISA. However, given that PRRSV RNA was not detected in these three wild boars and the specificity and sensitivity of the test kit, these are considered as false positives. Although seropositive pigs were found in multiple pig farms in the study area, the role of wild boars as a source of PRRS to pig farms appeared to be minimal.

Wild Boar (*Sus scrofa*)-*Fascioloides magna* Interaction from the Perspective of the MHC Genes

Konjevic, D, Erman, V, Bujanic, M, Svetlicic, I, Arbanasic, H, Strunjak, SL and A Galov 2022

Pathogens 11(11): 1359, doi: 10.3390/pathogens11111359

Fascioloidosis is a parasitic disease caused by a trematode *Fascioloides magna*. Since major histocompatibility complex (MHC) genes play an important role in the immune response, the aim of this study was to compare the potential differences in MHC class II SLA-DRB1 exon 2 genes between wild boar populations from infected (cases) and non-infected areas (controls). During the winter of 2021, a total of 136 wild boar tissue samples were collected, 39 cases and 97 controls. DNA was extracted and sequenced using the Illumina platform. Differences in distributions of allele combinations were calculated using the Chi-Square test for homogeneity and between proportions using the large-sample test and Fisher-Irwin test. Analysis revealed 19 previously described swine leucocyte antigen (SLA) alleles. The number of polymorphic sites was 79 (29.6%), with 99 mutations in total. Nucleotide diversity π was estimated at 0.11. Proportions of the alleles SLA-DRB1*12:05 ($p = 0.0008379$) and SLA-DRB1*0101 ($p = 0.0002825$) were statistically significantly higher in controls, and proportions of the SLA-DRB1*0602 ($p = 0.006059$) and SLA-DRB1*0901 ($p = 0.0006601$) in cases. Alleles SLA-DRB1*04:09, SLA-DRB1*0501, SLA-DRB1*11:09, and SLA-DRB1*1301 were detected only in cases, while SLA-DRB1*0404, SLA-DRB1*0701, SLA-DRB1*02:10, and SLA-DRB1*04:08 were present only in controls. We did not confirm the existence of specific alleles that could be linked to *F. magna* infection. Detected high variability of the MHC class II SLA-DRB1 exon 2 genes indicate high resistance potential against various pathogens.

Prevalence, Infection Intensity and Molecular Diagnosis of Mixed Infections with *Metastrongylus* spp. (Metastrongylidae) in Wild Boars in Uzbekistan

Kuchboev, AE and J Kruecken 2022

Pathogens 11(11): 1316, doi: 10.3390/pathogens11111316

The aim of the present study was to characterize the diversity of *Metastrongylus* spp. in wild boars and the earthworm intermediate host species contributing to the maintenance of the life





cycle. Here, wild boars were subjected to parasitological necropsies, and lungworm species were identified morphologically, followed by confirmation using ITS-2 sequencing and a phylogenetic analysis. Earthworms were collected from wild boar habitats and investigated for the presence of larvae. The prevalence of *Metastrongylus* spp. in wild boars was 78.8%, and many individuals were positive for all three detected species, *Metastrongylus pudendotectus*, *Metastrongylus salmi* and *Metastrongylus elongatus*. The phylogenetic analysis did not clearly resolve all species, except for *M. pudendotectus*. Age group and season had no influence on prevalence, while intensity was significantly higher in autumn than in spring and summer (Kruskal-Wallis followed by Dunn's test). Three out of six investigated earthworm species were positive for metastrongyloid larvae (prevalence of 10.4-16.7%), but neither their phylogenetic relationship nor ecological microhabitats were able to explain these differences. Further sequence data should be used to improve the resolution in phylogenetic trees to determine potential cryptic species in the genus, while the application of deep sequencing approaches might provide insights into species-specific epidemiology and pathology.

Monitoring of metal content in the tissues of wild boar (*Sus scrofa*) and its food safety aspect

Lenart, Z, Bartha, A, Abonyi-Toth, Z and J Lehel 2023

Environmental Science and Pollution Research 30: 15899–15910, doi: 10.1007/s11356-022-23329-6

The study was performed on 10 female and 10 male wild boars (*Sus scrofa*) after shooting during the regular hunting season to investigate the concentration of metals in the muscle and fat tissue. The concentrations of essential and non-essential elements were determined (arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), manganese (Mn), mercury (Hg), and zinc (Zn)) using inductively coupled plasma optical emission spectrometry. The concentrations of As, Hg, and Cd were below the limit of detection (As, Hg: < 0.5 mg/kg, Cd: < 0.05 mg/kg) in every tissue sample of both sexes. The lead was detected as 0.36 +/- 0.16 mg/kg and 0.22 +/- 0.06 mg/kg in the muscle of females and males, respectively, showing a significant difference between the sexes ($p = 0.0184$). The measured concentration of Cr was 0.14 +/- 0.08 mg/kg and 0.13 +/- 0.06 mg/kg, and that of copper was 1.22 +/- 0.14 mg/kg and 1.06 +/- 0.16 mg/kg in the muscle of females and males, respectively. The same tendency was observed in the case of copper content of fat tissues (female: 0.13 +/- 0.10 mg/kg; male: 0.13 +/- 0.04 mg/kg; $p = 0.2707$). Manganese concentration of muscle was 0.45 +/- 0.30 mg/kg (female) and 1.36 +/- 0.96 mg/kg (male), and that of fat tissue was 0.32 +/- 0.22 mg/kg (female) and 0.74 +/- 0.75 mg/kg (male). The Zn was detected as 56.75 +/- 7.86 mg/kg and 1.83 +/- 0.76 mg/kg in the muscle and fat of females and 52.12 +/- 11.51 mg/kg and 1.94 +/- 0.57 mg/kg in males, respectively. Based on data, the consumption of fat and muscle tissues of the wild boars tested can be food toxicologically objectionable, mainly due to the lead content, and thus pose a risk to frequent consumers of this type of game meat.

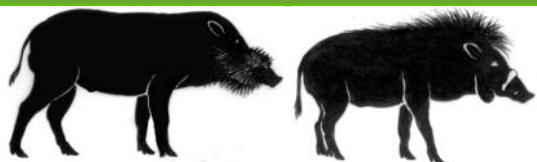
Radiation dose and gene expression analysis of wild boar 10 years after the Fukushima Daiichi Nuclear Plant accident

Morimoto, M, Kobayashi, J and Y Kino 2022

Scientific Reports 12(1): 18653, doi: 10.1038/s41598-022-21436-5

The Fukushima Daiichi Nuclear Power Plant accident led to contamination with radioactive





cesium in an extensive environment in Japan in 2011. We evaluated the concentration of radioactive cesium in the skeletal muscles of 22 wild boars and the expression of IFN-gamma, TLR3, and CyclinG1 in the small intestine and compared them with those of wild boar samples collected from Hyogo prefecture. The average Cs-137 radioactivity concentration in wild boars in the ex-evacuation zone was 470 Bq/kg. Most of samples still showed radioactivity concentration that exceeded the regulatory limit for foods, but the dose remarkably decreased compared with samples just after the accident. IFN-gamma expression was significantly higher in wild boars in the ex-evacuation zone than in samples from Hyogo prefecture. TLR3 expression was also upregulated. CyclinG1 expression also tended to be high. Hence, wild boars might have received some effects of low-dose radiation, and immune cells were activated to some extent. However, pathological examination revealed no inflammatory cell infiltration or pathological damage in the small intestine of wild boars in the ex-evacuation area. Long-term monitoring would be necessary, but we consider that the living body responds appropriately to a stimulus from a contaminated environment.

First Isolation and Identification of Homologous Recombination Events of Porcine Adenovirus from Wild Boar

Oba, M, Borjigin, S, Kikuchi, F, Oi, T, Takemae, H, Ishida, H, Murakami, H, Aihara, N, Shiga, T, Kamiie, J, Mizutani, T and M Nagai 2022

Viruses-Basel 12(11): 2400, doi: 10.3390/v14112400

Porcine adenoviruses (PAdVs) are distributed in pig populations and classified into five immunologically distinct serotypes (PAdV-1 to 5). In this study, a PAdV was isolated from a fecal sample of wild boar for the first time. Whole-genome analysis revealed that this strain (Ino5) has sequence homology (approximately > 93%) throughout the genome with the PAdV-5 strain HNF-70 that was isolated from a pig in Japan in 1987, except for the hexon, E3 612R, and fiber coding regions. Two possible recombination breakpoints were detected in the hexon and E3 612R regions, which were found to have reduced GC content. Structural prediction analysis showed that a part of the hexon protein corresponding to the tower region of Ino5 had structural differences when compared with HNF-70, suggesting antigenic heterogeneity between these strains. PAdVs were detected in 1.77% (2/113) and 12% (12/100) of the fecal samples from wild boars and pigs collected in Japan by PCR, respectively. Phylogenetic analyses of the hexon and fiber genes revealed that some samples showed different grouping in the hexon and fiber genes, suggesting that these viruses have recombination events. These findings suggest that the PAdV-5 has evolved with homologous recombination events in the same manner as human adenoviruses among not only pig populations, but also wild boars in Japan.

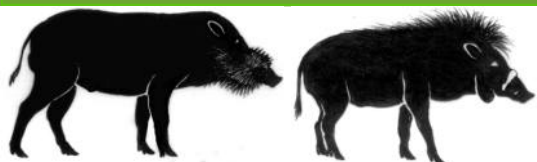
Optimising response to an introduction of African swine fever in wild pigs

Pepin, KM, Brown, VR., Yang, A, Beasley, JC, Boughton, R, VerCauteren, KC, Miller, RS and SN Bevins 2022

Transboundary and Emerging Diseases 69(5): E3111-E3127, doi: 10.1111/tbed.14668

African swine fever virus (ASFv) is a virulent pathogen that threatens domestic swine industries globally and persists in wild boar populations in some countries. Persistence in wild boar can challenge elimination and prevent disease-free status, making it necessary to address wild swine in proactive response plans. In the United States, invasive wild pigs are abundant and found across a wide range of ecological conditions that could drive different epidemiological dynamics





among populations. Information on the size of the control areas required to rapidly eliminate the ASFv in wild pigs and how this area should change with management constraints and local ecology is needed to optimize response planning. We developed a spatially explicit disease transmission model contrasting wild pig movement and contact ecology in two ecosystems in Southeastern United States. We simulated ASFv spread and determined the optimal response area (reported as the radius of a circle) for eliminating ASFv rapidly over a range of detection times (when ASFv was detected relative to the true date of introduction), culling capacities (proportion of wild pigs in the culling zone removed weekly) and wild pig densities. Large radii for response areas (14 km) were needed under most conditions but could be shortened with early detection (≤ 8 weeks) and high culling capacities ($\geq 15\%$ weekly). Under most conditions, the ASFv was eliminated in less than 22 weeks using optimal control radii, although ecological conditions with high rates of wild pig movement required higher culling capacities ($\geq 10\%$ weekly) for elimination within 1 year. The results highlight the importance of adjusting response plans based on local ecology and show that wild pig movement is a better predictor of the optimal response area than the number of ASFv cases early in the outbreak trajectory. Our framework provides a tool for determining optimal control plans in different areas, guiding expectations of response impacts, and planning resources needed for rapid elimination.

Pathology of African Swine Fever in Wild Boar Carcasses Naturally Infected with German Virus Variants

Sehl-Ewert, J, Deutschmann, P, Breithaupt, A and S Blome 2022

Pathogens 11(11): 1386, doi: 10.3390/pathogens11111386

In 2020, African swine fever (ASF) was first identified in German wild boar, reaching a case number of about 4400 to date. Upon experimental infection, pathology is well documented; however, data on field infections are scarce in domestic pigs and not available from wild boar, respectively. Although the ASF viral genome is considered exceptionally stable, a total of five lineages with 10 distinct virus variants of genotype II have emerged in Eastern Germany. To investigate the pathology in naturally infected wild boar and to evaluate virus variants II, III and IV for their virulence, wild boar carcasses were obtained from three different outbreak areas. The carcasses underwent virological and pathomorphological investigation. The animals revealed characteristic ASF lesions of the highest severity accompanied by bacterial infections in several cases. In particular, wild boar infected with variant IV from Spree-Neisse (SN) district showed lower viral genome loads and total viral antigen scores, but simultaneously tended to reveal more chronic lesions. Our findings indicate a protracted course of the disease at least after infection with variant IV, but need confirmation under standardized experimental conditions. There is a strong need to monitor differences in the virulence among variants to identify potential attenuation that might complicate diagnosis. In addition, veterinarians, hunters and farmers need to be made aware of less acute courses of ASF to consider this as an important differential to chronic classical swine fever.

First complete genomic sequence analysis of porcine circovirus type 4 (PCV4) in wild boars

Wu, HS, Hou, CY, Wang, ZR, Meng, PY, Chen, HY and HB Cao 2022

Veterinary Microbiology 273: 109547, doi: 10.1016/j.vetmic.2022.109547

Porcine circovirus type 4 (PCV4), a unique circovirus with a different classification from other





existing circovirus, was discovered in domestic pigs in several provinces of China. In this study, in order to investigate the epidemiology and genetic diversity of PCV4 in wild boars (*Sus scrofa*), a total number of 138 wild boar samples were collected from five different areas in Jiangxi Province of China, between January 2020 and December 2020. Taqman based real-time PCR were used to test PCV4 as well as PCV1, PCV2, and PCV3. Among 138 samples, 30 samples (21.7%) were positive for PCV1, 31 samples (22.5%) were positive for PCV2, 8 samples (5.8%) were positive for PCV3 and 27 samples (19.6%) were positive for PCV4, respectively. Some of the samples were coinfecting with multiple PCVs. In this study, we successfully sequenced the complete genome of two PCV4 strains, which shared 98.5-99.8% of their genomic nucleotide similarity with the other five PCV4 strains discovered in domestic pigs. Phylogenetic analysis showed that the two PCV4 strains derived from wild boars were located in a closed relative branch with other PCV4 strains derived from domestic pigs, but were distinguished from other circovirus. These results of this study not only expand our understanding of the prevalence of PCVs, especially PCV4, in wild boars in Jiangxi province of China, but also showed the molecular epidemiology of PCV4. Nevertheless, the impact of wild boars infected with PCV4 on intensive farmed pigs industry remains to be further explored.

Prevalence of Hepatitis E Virus (HEV) in Feral and Farmed Wild Boars in Xinjiang, Northwest China

Wu, JY, Meng, XX, Wei, YR, Bolati, H, Lau, EHY and XY Yang 2023

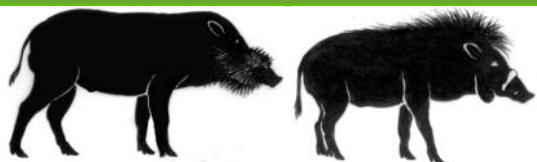
Viruses-Basel 15(1): 78, doi: 10.3390/v15010078

Hepatitis E virus (HEV) causes infections in humans and a wide range of animal hosts. Wild boar is an important natural reservoir of HEV genotypes 3-6 (HEV-3-HEV-6), but comparative analysis of HEV infections in both feral and farmed wild boars remains limited. In this study, samples from 599 wild boars were collected during 2017-2020, including 121 feral wild boars (collected 121 fecal, 121 serum, and 89 liver samples) and 478 farmed wild boars (collected 478 fecal and 478 serum samples). The presence of anti-HEV IgG antibodies were detected by the HEV-IgG enzyme-linked immunosorbent assay (ELISA) kit. HEV RNA was detected by reverse transcription polymerase chain reaction (RT-PCR), targeting the partial ORF1 genes from fecal and liver samples, and the obtained genes were further genotyped by phylogenetic analysis. The results showed that 76.2% (95% CI 72.1-79.9) of farmed wild boars tested anti-HEV IgG seropositive, higher than that in feral wild boars (42.1%, 95% CI 33.2-51.5, $p < 0.001$). HEV seropositivity increased with age. Wild boar HEV infection presented a significant geographical difference ($p < 0.001$), but not between sex ($p = 0.656$) and age ($p = 0.347$). HEV RNA in fecal samples was detected in 13 (2.2%, 95% CI 1.2-3.7) out of 599 wild boars: 0.8% (95% CI 0.0-4.5, 1/121) of feral wild boars and 2.5% (95% CI 1.3-4.3, 12/478) of farmed wild boars. Phylogenetic analysis showed that all these viruses belonged to genotype HEV-4, and further grouped into sub-genotypes HEV-4a, HEV-4d, and HEV-4h, of which HEV-4a was first discovered in the wild boar populations in China. Our results suggested that farms could be a setting for amplification of HEV. The risk of HEV zoonotic transmission via rearing and consumption of farmed wild boars should be further assessed.

The Potential Role of Wild Suids in African Swine Fever Spread in Asia and the Pacific Region

Oberin, M, Hillman, A, Ward, MP, Holley, C, Firestone, S and B Cowled 2023.





Viruses, 15, 61. [https://doi.org/ 10.3390/v15010061](https://doi.org/10.3390/v15010061)

African swine fever (ASF) in Asia and the Pacific is currently dominated by ASF virus transmission within and between domestic pig populations. The contribution made by wild suids is currently not well understood; their distribution, density and susceptibility to the virus has raised concerns that their role in the epidemiology of ASF in the region might be underestimated. Whilst in the Republic of Korea wild suids are considered important in the spread and maintenance of ASF virus, there is an apparent underreporting to official sources of the disease in wild suids from other countries and regions. A review of the current literature, an analysis of the official reporting resources and a survey of the World Organisation of Animal Health Member delegates in Asia and the Pacific were used to assess the potential role of wild suids in ASF outbreaks, and also to gain insight into what ASF management or control strategies are currently implemented for wild suids. Applying appropriate population control and management strategies can be increased in some areas, especially to assist in the conservation of endangered endemic wild suids in this region.

SARS-CoV-2 Infection in Captive Hippos (*Hippopotamus amphibius*), Belgium

Vercammen F, Cay B, Gryseels S, Balmelle N, Joffrin L, Van Hoorde K, Verhaegen B, Mathijs E, Van Vredendaal R, Dharmadhikari T, Chiers K, Van Olmen TJS, Agliani G, Van den Brand JMA and H Leirs 2023.

Animals 13(2):316, doi: <https://doi.org/10.3390/ani13020316>.

Two adult female hippos in Zoo Antwerp who were naturally infected with SARS-CoV-2 showed nasal discharge for a few days. Virus was detected by immunocytochemistry and PCR in nasal swab samples and by PCR in faeces and pool water. Serology was also positive. No treatment was necessary.





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

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

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

