

Suiform Soundings

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

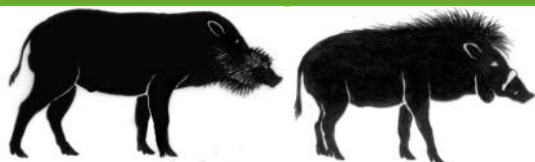


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White-lipped peccary (*Tayassu pecari*). Photo: Sean Keuroghlian-Eaton.

Please email all contributions to future issues to Thiemo Braasch, email: salvanus@gmail.com. Articles, photos and comments are welcome and appreciated. **Please follow the guidelines for authors**, which can be found on the website listed above.





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Editorial



Dear fellow reader,

it is a great pleasure to present you this issue of Suiform Soundings!



It has taken a while to collect and review all the articles presented in this issue. Therefore, I want to thank our editorial team and all the authors for their efforts to submit the articles!

Together with the articles about wild pigs, peccaries and hippos, the book reviews and the collection of scientific abstracts from articles about Suiformes this issue of Suiform Soundings offers an overview about the scientific investigations and conservation of these marvelous animals and how they are shown in the media.

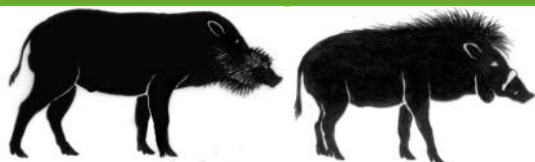
Enjoy reading!

With warm wishes

Thiemo Braasch

Chief Editor Suiform Soundings





Testing wild boar traps to evaluate the actual efficiency and animal welfare

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Abstract

The wild boar is arguably one of the most problematic species globally. The growth in numbers, coupled with the detrimental impact on natural ecosystems, agriculture and human activities, has prompted the implementation of intensive population control measures. Reducing wild boar numbers has become even more pressing because of the continental-wide diffusion of African Swine Fever (ASF) in Europe and Asia as well as its reappearance in the Americas. This has resulted in an increased demand to effectively address population reduction while ensuring cost-effectiveness also with regard to animal welfare.

In 2024, we initiated a study in the Preserve of Castelporziano (Italy) based on a specific study design, which aims to evaluate and compare the efficiency and animal welfare of three different trapping systems (modular trap, stationary trap, and a new type of net trap: the Pig Brig® Trap System) which represent the most frequently used type of traps for wild boar.

Bearing in mind the principle of adaptive management, we defined a study design consisting of the appropriate distribution of traps in the study area and a protocol for carrying out and monitoring live trapping. We conducted a pilot study to test the feasibility and quality of the protocol and then we used the results to fine-tune the subsequent long-term experimentation. We used camera traps to monitor each trap and determine the number of wild boar available for capture and group composition. The total and by sex and age class efficiency of each trap is determined by calculating the ratio of wild boar captured to the total number of wild boar available in the trapping area. To investigate the welfare conditions of wild boar captured in the 3 trap types, we considered the level of external injuries and the percentage of recaptured animals.

The first results indicate that there are significant differences in efficiency and in the level of welfare among the three trap types: the net trap has shown the best performance in capturing family groups and not causing harm to wild boar. Nevertheless, further data is required to reinforce our results and consolidate functional protocol to enhance the efficacy of live trapping.

Key words: wild boar, live trapping, pilot study, camera traps, actual efficiency, animal welfare.

Introduction

Wild boar can have a huge negative impact on biodiversity (Risch et al. 2021) and the natural environment (Bartasona et al. 2024), on human activities (Fatterbert et al. 2017; Amici et al. 2012; Lombardini et al. 2017; Gren et al. 2019; McKee et al. 2024) and health (Keuling et al. 2013; Rosell et al. 2013; Desvars-Larrive et al. 2024). Urban wild boar cause car accidents or injuries to people in many cities around the world, leading to even harsh social conflicts (Basak et al. 2022). Most recently, African Swine Fever (ASF, Guberti et al. 2022) has caused severe economic





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damage to the pig industry in many European countries and in China (Niemi 2020; Han et al. 2022) and it is also put further pressure on the population viability of endemic wild pig species in Southeast Asia, most of which are already threatened (International Union for Conservation of Nature [IUCN] 2021; Luskin et al. 2021). So, effectively addressing population control while ensuring cost-effectiveness and alignment with animal welfare concerns has become even more pressing. This is attempted using a variety of different techniques (hunting, with or without trained dogs, sharpshooting, poisoning and trapping), usually used in synergy to maximize the removal efficiency (Williams et al. 2011; McCann and Garcelon 2008; Gentle et al. 2022; Licoppe et al. 2023).

Among these techniques, trapping is primarily used for research, population monitoring and/or translocation purposes. Trapping also appears to be the most effective method of controlling wild suid populations (Conejero et al. 2022; Kilgo et al. 2023). Moreover, the successful use of wild boar trapping as part of a swine fever management strategy has been demonstrated in Bulgaria (Alexandrov et al. 2011) and Belgium, where trapping contributed up to 24 percent of the depopulation target (Licoppe et al. 2020, 2023).

The current critical situation of the progressive spread of ASF makes evaluating trap efficiency particularly important for management purposes. The European Union's guidelines state that trapping is the least destructive way of removing animals from the population and allows for capturing whole family groups (females and juveniles, which are the main drivers of population growth). Effective trapping in the buffer zone around the infected area would, therefore, be a major contribution to the eradication of ASF.

Whatever the purpose of the captures, trapping poses several problems that need to be addressed: trapping of non-target species, empty shots or failure to capture the entire sounder.

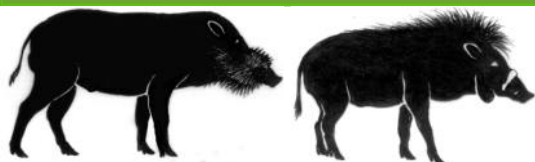
If trapping does not capture all the animals present, it may induce trap-avoidance responses in those that escape capture, making it more difficult to achieve the goal of the complete removal of animals from an area. As a workaround, smart traps (with remote control of the trigger) enable targeted capture of animals (individuals or groups) entering traps and are therefore considered more effective than traps triggered by animals themselves (Gaskamp et al. 2021). Unfortunately, these trapping systems require good GSM (Global System for Mobile telecommunications) coverage, which is often unavailable in wild areas, and personnel are always ready to check alarms. Furthermore, the types available on the market are often bulky or heavy or difficult to move and install, and usually expensive.

As trapping is a widely used system in wild boar management, little literature is available about the effectiveness, the costs and the amount of effort required to carry out a wild boar trapping campaign aimed at effectively reducing the local number of animals by being careful about animal welfare.

The availability on the market of a new trapping system (Pig Brig® Trap System) that is simple to use, light and easy to handle and move, and that appears to allow trapped animals to avoid injuries once they are caught, prompted us to start an experimental research to evaluate the effective efficiency of different trapping systems (common cage traps and a this new designed net trap) and the welfare consequences of trapping.

Capture success is usually estimated according to the percentage of successful capture events (number of captures/100 trap nights) or to the number of captured individuals per unit of capture effort (number of traps or number of nights the traps were active; Pawlina & Proulx 1999). However, these indices do not consider the trap's ability to capture all wild boar visiting the trap





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site, which is the objective when trying to remove these animals from an area. To overcome this, camera traps can be efficiently used to check how many animals visit the trap site and when. The ratio of the number of animals caught to the number of animals seen gives a good indication of the trap's effectiveness, allowing a more reliable assessment and comparison of the true efficiency of different trapping systems.

However, to obtain high-quality results, a research study with relevant experimental design and accurate execution is required. In this respect, pilot study is the first step in the overall research protocol and is often a smaller study that helps to plan the main study. Analysing the feasibility of the study design and field protocol prior to conducting the main study (i.e. the long-term study) can be very beneficial in identifying and addressing any potential problems or challenges and in making managers/researchers aware of the procedures that will help in selecting the most appropriate method to answer the research question of interest.

So we designed a protocol to monitor the effectiveness of three different trap systems: net trap, modular trap, stationary trap, and to evaluate the level of injuries on animals caught. Then, we started a pilot study to the feasibility and the quality of our study design and used the results to fine-tune the subsequent experimentation to carry out in the long-term.

Materials and methods

Trapping activities have been conducted in the Presidential Estate of Castelporziano (Rome, Italy), a 60 km² fenced area characterized by a Mediterranean environment and large biodiversity (Focardi et al. 2015). Different species of Ungulates are present (wild boar, roe, red and fallow deer) together with a pack of wolves, foxes, badgers, pine martens, porcupines, hares, hedgehogs, and a very diverse community of birds. We carried out a pilot study during June 2024 and then the main study between August and September 2024.

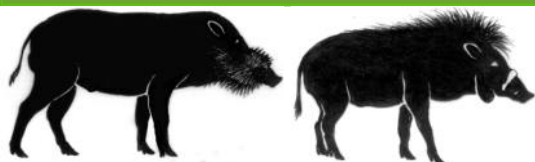
We started the evaluation of different trapping systems using only two types initially: 4 stationary traps, which have been used in the area since 1982 (Focardi et al. 2008), and 4 new Pig Brig® Trap System net traps. (Fig.1)



Fig.1: Images of the trapping systems used in the study project: stationary trap (a) and Pig Brig® Trap System net trap (b).

Initially, the experimental design consisted of dividing the study area into 4 sub-zones (of approximately the same surface), which served as experimental replications. In each sub-zone, we randomly select 4 stationary traps, spaced at least 900 m apart. We then randomly selected a further 4 sites to place the net traps, also spaced at least 900 m apart from each other and from





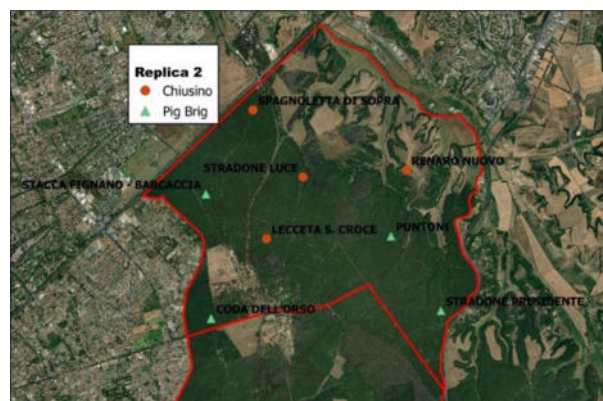
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Fig. 2a. Locations of the four subzones.



b. Locations of all the trapping sites in the sub-area 2 and 4.



stationary traps. The minimum distance between traps was determined to ensure that a trap site was within the average home range of a wild boar in this study area (Ronchi 2000; Pucci 2002).

We used a total of 2 subzones (4 and 2) to conduct the pilot study with a total of 16 trapping sites across the 2 replications (Fig.2).

Before the main study began, we added a third type of trap, a modular trap (Fig 3) and we modified the sample design to have larger sub-zones (n=3) in which more traps could be placed while maintaining a minimum distance of 900 m among traps (Fig.4).



Fig. 3. Images of the third trapping system used in the study project: modular trap.



Fig. 4. Locations of all the trapping sites in the final sampling design.





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Fig. 5. "Constriction box cage". In the picture, an adult female has been trapped and moved to the cage. Here, the animal is blocked by the wall movement, allowing safe marking and handling.

Once captured, wild boars were tagged, weighed, checked for the presence of injuries, and then released at the trapping site.

The handling procedure included the use of a "constriction box cage" to take the larger animals out of the trap, mark and weigh them. (Fig.5). This is a 1m x1.5m metal box with a movable wall that is used to constrict and block the animal inside, allowing it to be handled safely even without sedation. The box trap is placed in front of the trapping system and the door is opened (or the net lifted in case of a net trap), to allow the individuals to move spontaneously from the inside of the trap into the constriction box cage.

This box cage has proved to be an essential tool for handling wild boar, particularly adult animals, allowing work to be carried out whilst maintaining safety standards, even when handling non-sedated animals. Piglets are easily and safely handled directly by trained operators without using the constriction box cage.

For each trapping site, we followed 3 operational steps:

Pre-baiting stage: at each new capture site, bait (dry corn) is provided daily to attract wild boar to the selected site without the trapping system in place.

Conditioning stage: the bait is placed to attract wild boar from the outside to the inside of the structure.





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Activation stage: when all the animals present in the area routinely enter the trap for 2 days in a row, the trap is activated.

We used the same baiting protocol for every trapping system.

The pilot study showed that to get a reliable picture of what is happening at the trap site, it was essential to move from using a single camera trap to 3 camera traps per trapping site. Placing multiple cameras with different orientations at the same trap site allowed the entire site to be monitored, increasing the chances of correctly estimating the number of animals available for capturing, determining the composition of groups, and also recording the behavior of wild boars.

The efficiency of each trap was then determined by calculating the ratio of wild boar caught to the total number of wild boars estimated present in the area. This ratio represents the actual ability of the trap to successfully capture all the animals that visited the site during the conditioning stage.

To investigate the differences in animal welfare among the 3 trap types, we combined two different items that we considered to be proxies for stress, representing two different effects of the trapping event on trapped animals: external damages and recapture probability. The external damage score can give us information about the direct effects of the capture event on the captured individuals, while the recapture frequency can provide a short-term stress index, as an animal highly stressed by a capture event is unlikely to return to the trapping site in the short term.

Experienced operators documented, assessed and classified external injuries into classes according to severity (Conejero et al. 2020; Fahlman et al. 2020). The assessment was carried out as soon as the team arrived at the trap site to avoid unnecessary stress on the trapped animals. We also collected photographs of each captured wild boar, where possible, to make the assessment replicable.

Considering that catches take place in summer (June-September) and that the peak of births in this area is generally between April and June, we used the following classes of age: piglets (< 6 months), sub-adults (6-18 months) and adults (> 18 months) for both males and females.

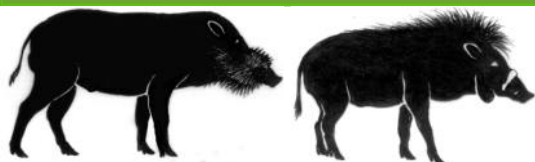
Results and discussion

The data show some differences between trap systems in the time taken to complete the conditioning phase and achieve a successful capture event. It took an average of 4.8 days (± 1.8 SD) for wild boar to be comfortable in entering and feeding in the stationary traps, about one more day for the modular traps (6.2 days ± 1.7 SD) and a little longer for the net traps (6.9 days ± 1.1 SD). Hence the difference in conditioning time between the fastest and slowest trapping system is 2 days.

The greater speed with which wild boars become accustomed to the stationary traps can be explained by the fact that these structures have been in the field for years, and the animals are likely to regard them as elements of their native environment. On the other hand, wild boars appear to be more cautious when approaching traps they have never seen before. This may justify the longer conditioning time required for modular and net traps.

The results show that the net trap is the trap that takes the wild boar more time to get used to. Due to its own particular design, the wild boars' confidence in directly interacting with the net appears to be a mandatory factor in achieving trapping success. Therefore, the conditioning process may take longer.





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A total of fifty successful trapping events were carried out between August and September 2024, resulting in a total capture of 154 wild boar (including 43 wild boar that were recaptured): 43 wild boars in the stationary trapping systems, 25 in the modular trapping systems and 86 in the net traps.

The net trap showed a higher actual efficiency ($0.90 \pm 0.10ES$) than the stationary trap ($0.48 \pm 0.14ES$) and the modular trap ($0.35 \pm 0.12ES$).

The incidence of injuries was recorded in 41.3% of the animals trapped in stationary traps, 78.3% in the modular traps, and 0.0% in the net traps.

A score was assigned to each individual captured in every single trapping event based on the number and the severity of the injuries that occurred (Fig.6).

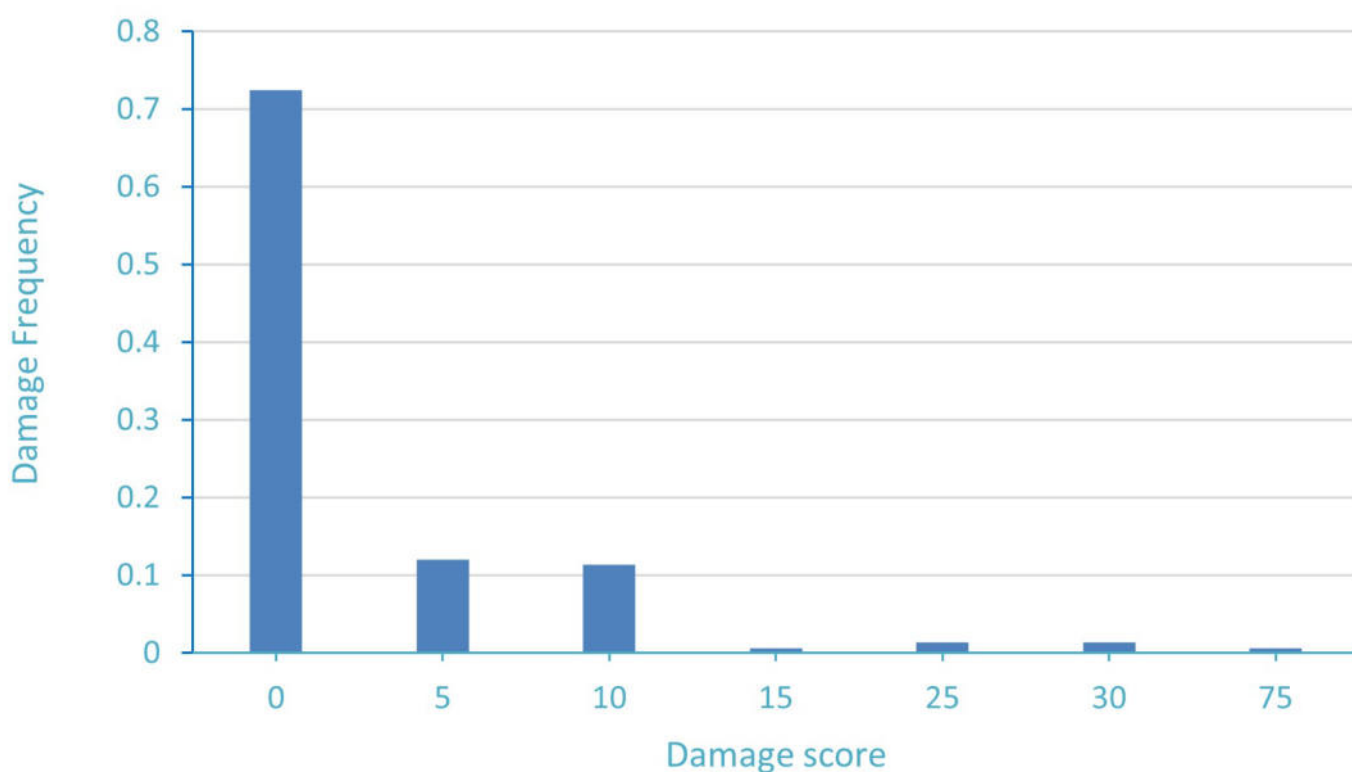


Fig. 6. Frequency distribution of damage severity scores assigned to wild boar injured during trapping.

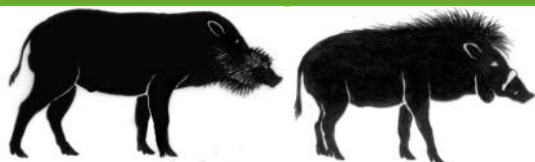
Of the 43 wild boars recaptured (corresponding to 28% of all wild boars caught), 22 were recaptured once, 17 were recaptured twice, and 4 were recaptured three times during the study period.

In the stationary trap we had a total of 10 recaptures (which corresponds to 23% of all the 43 wild boars caught in stationary traps). Six animals were recaptured once (13.6% of the total wild boars captured) and 4 (9.3%) were recaptured twice.

In the modular trap, we only had 1 recapture event, corresponding to 4% of all the 25 wild boars caught in this trap system.

Finally, in the net traps 32 recaptures have been recorded (which corresponds to 37% of all the 86 wild boars caught in net traps). Fifteen animals were recaptured once (17.4 % of the total wild boar trapped), 13 twice (15.1 %) and 4 three times (4.7 %).





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The used measure of efficiency represents, at best, the actual trapping power of each trap system because it considers the actual wild boar presence in the area and obtains information on the different trapping successes in the different classes of sex and age (Tab.1).

Tab. 1. The different actual efficiency rates for Adults (A), Adult Males (AM), Adult Females (AF) and Piglets (P) in the different trapping systems. A value is >1 indicates that more animals are captured than observed by camera traps.

| TRAPPING SYSTEMS | Actual efficiency rates | | | |
|------------------|-------------------------|--------------------|--------------------|--------------------|
| | A | AM | AF | P |
| Stationary Traps | 0.34 ± 0.36 SD | 0.45 ± 0.47 SD | 0.16 ± 0.23 SD | 0.55 ± 0.44 SD |
| Modular traps | 0.36 ± 0.37 SD | 0.50 ± 0.67 SD | 0.26 ± 0.39 SD | 0.50 ± 0.41 SD |
| Net traps | 0.79 ± 0.53 SD | 1.06 ± 0.39 SD | 0.52 ± 0.47 SD | 0.94 ± 0.44 SD |

The promising results on net trap efficiency are also confirmed in terms of selectivity. This type of system shows the best performance for each sex and age class compared to the other traps.

However, further analysis is needed to further investigate and discuss these preliminary results.

The better performance shown by the net trap is probably due to the special operating characteristics and design of this trapping system, which allows the animals to keep coming into feeding. With other capture systems, the presence of one or more wild boar in the trap, which triggers the closing of the entrance door, self-limits the chances of capturing other animals that have visited the trap site and remained outside. These animals may then learn to mistrust the trap, avoid entering it in the future, and restrict themselves from feeding outside. This has the potential to further reduce the capture efficiency of these systems.

The animal welfare aspects need to be considered to ensure that trapping is perceived by the public as a humane mean of intervention and, therefore, more likely to be accepted by those concerned with animal welfare.

Our first-year results suggest that net traps represent an efficient and humane approach to managing wild boar populations in terms of the absence of external injuries and less stress related to the trapping activity despite the handling and marking carried out on the wild boar.

However, more data is needed to confirm these statements and establish a working protocol to improve the efficiency of live trapping. Moreover, the same experimental protocol should also be tested under conditions in which the removal of captured subjects is applicable in order to estimate the true efficiency of removal.

Finally, during both the pilot study and the main sampling, the crucial role of camera trapping became clear. The unique ability of this tool to record wildlife without affecting animal behavior provides essential information about the actual presence of target animals at the trap site and their behavior in relation to the trap and bait. Camera traps have been essential to understanding any problems that arose during the pre-capture phase and those that occurred during capture (how the animals were injured or how they managed to escape), to improve operations and work efficiency. However, we also found that it was not possible to get a clear picture of what was





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going on around and inside the trap with just one camera trap. Only additional images from different angles from other cameras monitoring the same spot provided a complete and comprehensive view of the current situation at the site, also allowing a reliable assessment of the number of animals that visit the site regularly and of the actual trapping efficiency. Actual trapping efficiencies, obtained using camera traps to monitor the trapping success, can also be used to estimate the potential removal costs at a specific site or, if the trapping area needs to be extended, and plan removal activities accordingly.

Although it is not always possible to install multiple cameras in the same location, it is highly recommended that at least one camera trap be deployed per trapping site, as one of the key factors to increase the efficiency and success of a removal plan. It is also strongly recommended that one tries to carry out a pilot study to learn more about how traps work in a particular location and how to make their use more effective.

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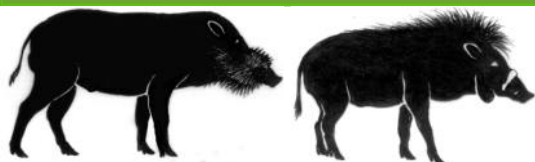


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Can we use genomes from museum specimens to assist the conservation of babirusa?

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Abstract

With the advances in molecular technologies and declining costs, the sequencing of museum specimens is becoming an invaluable tool for conservationists. By sequencing historical samples, we gain insights into the recent past, providing baseline data to better understand the trajectory of change in a species through indices such as levels of inbreeding and genetic diversity. These insights can aid and guide conservation actions. Here we discuss the use of museomics in the context of the endangered babirusa (*Babyrousa* spp.) found across Sulawesi and some of the surrounding smaller Wallacean islands in Indonesia. As an iconic flagship species, it is important that we apply all available tools to better understand the reason(s) behind this population decline. We assess the DNA preservation in 52 babirusa specimens from different sample types and our results show that nearly half of the screened samples would have sufficient DNA to generate whole genomes. Petrous bone specimens yielded the highest amount of endogenous (host) DNA, consistent with prior studies. Overall this study highlights how these techniques can be used to aid conservation.

Abstrak

Teknologi molekuler saat ini memungkinkan para peneliti biologi konservasi merunut genom utuh dari spesimen museum spesies-spesies konservasi. Hal ini memungkinkan kita melihat ke periode lampau bagaimana suatu spesies mengalami penurunan populasi, peningkatan perkawinan sekerabat, dan perubahan keragaman genetik, aspek-aspek yang penting untuk kelulushidupan spesies tersebut pada masa mendatang. Dalam studi ini, kami mengkaji penggunaan pendekatan 'museomic' di babirusa (*Babyrousa* sp.) yang hidup di Sulawesi dan kepulauan di sekitarnya di kawasan Wallacea, Indonesia. Sebagai spesies ikonik kawasan tersebut, penting untuk menggunakan semua pendekatan yang ada untuk memahami penyebab kerentanan populasi babirusa. Kami menguji kelimpahan DNA asli babirusa dalam 52 spesimen babirusa dari berbagai jenis sampel dan menunjukkan bahwa hampir separuh dari sampel yang kami pindai memiliki cukup DNA untuk menghasilkan sekuen genom utuh. Spesimen tulang petrous memberikan kelimpahan DNA endogen tertinggi sebagaimana studi sebelumnya. Dalam artikel ini, kami lebih lanjut menguraikan bagaimana teknik-teknik museomic dapat bermanfaat untuk konservasi.

Keywords

Babirusa, conservation, genome screening, museums, DNA preservation, Wallacea





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Introduction

The babirusa (*Babirusa* spp.) is an evolutionarily distinct suid, with no recent living relatives, (Frantz et al., 2016, Figure 1), and is the only member of the subfamily Babyrousinae (Frantz et al 2016). Found only on some of the smaller islands in Wallacea, a biodiversity hotspot in Indonesia, these taxa are a key conservation flagship species for the region (Leus et al., 2016a). The Wallacean archipelago harbours unprecedented biodiversity and endemism and is a biogeographical transition zone; distinctive communities of species are found on either sides of the Wallace line to the west and the Lydekker line to the east (Struebig et al., 2022). Babirusa are found on the largest island of the archipelago, Sulawesi, along with small populations on the surrounding small islands such as Buru and Togean. Babirusa species are listed as Vulnerable on the IUCN red list (Leus et al., 2016b; Macdonald et al., 2008) except for Togean Islands babirusa which is listed as Endangered (Macdonald et al., 2016), making these species of conservation importance.



Fig. 1. A. Living male babirusa (left, source: Chester Zoo, 2015) and B. Male babirusa skull archived at Natural History Museum, London, UK, documented as *Babirusa celebensis* collected in Minahasa, North Sulawesi (right, source: SGA, 2022)

Considering small and declining populations of babirusa, determining the potential of future survival of the current wild individuals is of utmost importance. Whole genome sequencing (WGS) technology has become an increasingly important tool in conservation. WGS is the sequencing of an individual entire genome, not just targeting short DNA barcodes for example, and as a result generates comprehensive individual-based genetic information. As each genome contains a wealth of information, using only a handful of individuals allows us to analyse genetic diversity, ancestry, population structure, inbreeding and relatedness, metrics which can directly influence conservation decisions (Hohenlohe et al., 2021). In a previous study Aninta and Drinkwater et al., (2024) resequenced and reanalysed samples from Frantz et al., (2018) using WGS to assess deeper information on the current genomic status of babirusa populations. We showed that there is very strong population structure in the babirusa and crucially revealed that the southeastern Sulawesi population appears to be struggling with recent and high levels of inbreeding (Aninta and Drinkwater et al., 2024).

Anthropogenic pressures have been known to reduce the overall genetic variation of wild species (Leigh et al., 2019). This means that the genetic diversity we detect in the modern babirusa





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dataset (Aninta and Drinkwater et al., 2024) might be a snapshot of already declining genetic variation and not a representation of a stable population. This is particularly pertinent in the case of the babirusa which has seen rapid population loss concurrent with increased deforestation and development in the region (Supriatna et al., 2020). Determining the extent and duration of the population decline in the babirusa is crucially important to understand the extent of any genetic erosion, as this could affect their adaptive ability in the future (Jensen et al., 2022). To achieve this, we need a genomic baseline, preferably before the onset of human activities to act as a comparison. This is where we can leverage the power of museum specimens.

The potential of natural history collections to serve as a source of DNA has been long acknowledged and now growing in a field called 'museomics' (Lalueza-Fox, 2022). With the development of new sequencing and computational technologies we are now able to access degraded DNA from specimens, even when the optimum conditions for good DNA preservation are not being kept (Raxworthy & Smith, 2021). To complement the vast amount of research being undertaken in museums, genomic analysis can help address questions regarding evolution history and phylogenomics as well as issues surrounding conservation.

The intriguing features of the babirusa, with their distinctive tusks (Figure 1) means that they had been among the animals prized by natural history collections in the 19th century, and even a popular commodity of global trade (Coote et al., 2017). Consequently, babirusa skulls have been traded and exchanged across museums and collections across Europe, raising their availability in museums across the world as well as in private collections. For example, one such collection is the approximately 30 babirusa skulls from Goteborg Natural History Museum. These are related to an expedition in the early 1900s by a Swedish researcher who studied the distribution of babirusa in Sulawesi (Macdonald and Johansson, 2017).

Here we demonstrate that using aDNA methods we can extract sufficient DNA from museum specimens. We used small amounts of bone material and minimally destructive techniques to generate high quality genomes for conservation research. We firstly present initial screening results and then discuss future considerations for researchers and conservationists who are collecting samples and may wish to apply these techniques in the future.

Methods

Museum sampling

Using the comprehensive database of babirusa specimens held in European and North American museums from an earlier study of Frantz et al (2018), we sourced the bone fragments that had already been sampled from the original specimens of 52 individuals. We sampled an additional 15 specimens from Naturalis Museum in Leiden. Here, we applied a minimally destructive method of extracting the petrous bone from the skull where possible. This involves "popping" the petrous bone out by applying a small amount of pressure down the ear canal, while the skull remains intact (Scarsbrook et al., 2025). The petrous bone is a very dense bone of the inner ear and is the target for many ancient DNA and museomic studies. It is known to preserve DNA (Pinhasi et al., 2015), maximising the chance of generating high quality genomes. In addition, we used a loose tooth for one of the samples; taking small samples from the tooth root can also provide sufficient DNA. All these methods and sampling were conducted in the museums under the supervision of the curator.

From all sample types (the bone fragments, petrous and tooth) bone powder needs to be removed from the sample, to maximise surface area and aid the DNA extraction process. For the





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bone fragments we did this using a very fine dentists or hobbycraft drill, and all laboratory work was carried out in the dedicated ancient DNA laboratory at the Natural History Museum London, UK (NHM). For the petrous and tooth root, a small piece is removed, and then powder was generated through mechanical grinding (e.g. Retsch ball mill, Germany) and all laboratory work was carried out in the palaeogenomics laboratory at Ludwig-Maximilian University Munich, Germany (LMU).

DNA extraction and library preparation

For all sample types, the molecular protocols were largely similar, with a few exceptions depending on where the samples were processed.

Sample processing at NHM

Using approximately 25 mg of bone powder per sample, the DNA extraction followed the protocol in Dabney et al. (2013), but using the large volume spin columns from the High Pure Viral Nucleic Acid Large Volume kit (Roche). Following the Meyer and Kircher (2010) protocol, unique double indexed libraries were generated, with different indexes applied at each end of the reads. These libraries were amplified using Amplitaq Gold polymerase for 15 cycles along with negative controls, and different specific indexes introduced on the forward and reverse read along for demultiplexing after screening. These libraries were purified using the Qiaquick PCR purification kit (Qiagen) and quantified using Tapestation with the high sensitivity protocol D1000 (Agilent). Based on this information the libraries were pooled in equimolar ratios for initial screening.

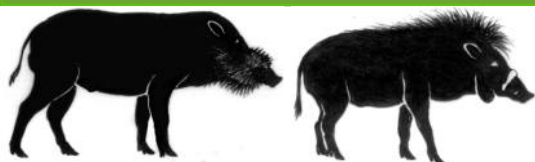
Sample processing at LMU

Here we aimed for between 50-100 mg of bone powder for the extraction which followed the magnetic bead protocol outlined in Rohland et al (2018). For the library generation for these samples, we used a modified version of the original Meyer and Kircher (2010) protocol adapted for automation on the Hamilton liquid handler robot, like that of Prendergast et al. (2019). In addition, new libraries were generated from six extracts from the NHM using this protocol. For the index PCR, unique double indexes were used for all samples. Twenty-eight un-amplified NHM libraries were also re-amplified at this stage. Uniquely indexed libraries were purified using a magnetic bead clean up protocol and DNA concentration for each library was subsequently measured on a fragment analyser (Q-Sep) or the Qubit plate reader. This provides the information needed to pool the samples together in an equimolar ratio for the initial screening.

Screening of genomic libraries

The pools were screened using Illumina paired-end sequencing at Macrogen (NHM samples) and at the LMU Gene Centre in Munich (LMU samples). This initial screening facilitated low coverage sequencing of each library to assess the quality and the quantity of endogenous DNA (the “target” or “host” DNA). As they were museum specimens there was a high amount of non-target DNA such as from bacteria and humans. Screening was an efficient way of checking how much of the babirusa DNA we had extracted and guided further sequencing efforts. The samples with the highest amounts of endogenous DNA were then selected for deep sequencing aiming for at least 5X coverage genomes. As a result of some of the repeat processes, 19 samples were subjected to multiple rounds of sequencing.





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Results and discussion

From all the collated and extracted samples we screened 67 babirusa from a total of five museums: Goteborg Natural History Museum (GNM), Naturalis Biodiversity Center, Netherlands (RMNH), Royal Museum of Scotland (NMS), Paris National Museum of Natural History (MNHN) and Oxford University Museum of Natural History (OUMNH) (Table 1, Figure 2). These were chosen as they had information on the provenance of the samples (either age, locality or both) and had sufficient remaining material for the DNA extraction. The oldest specimen we screened was from 1832 and the most recent was from 1991 (Figure 2). Three samples had unknown ages but had a locality associated with them. One sample had neither known age nor location for the specimen. 12 samples had an unknown region, but a known age. For these specimens it was possible to discover their original provenance either by revisiting the original source literature from the museums, or, if the genetic population was strong enough, through comparison with the whole dataset. However, where the signal is not strong enough the sample cannot be used. The provenance or locality for four of the specimens and where originally collected was also of note. Three specimens were recorded as being from Ternate, an island that is not within the native range of babirusa. These individuals were likely translocated from Buru or Sula and kept captive on Ternate, based on skull morphology and tooth wear (pers. comm A. Macdonald). The morphology of the skull of the young adult male from Seram suggests that it may have been brought from Sulawesi, possibly as a 'pet animal'. The museum record had also questioned its attribution to Seram.

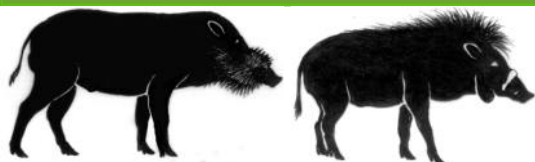
Tab. 1. Summary of the babirusa samples which were screened for whole genome sequencing. This includes the location and amount of endogenous DNA with the provenance (region) of the specimens, median age, average amount of endogenous DNA (mapped DNA), and the code of the museums these were sourced from. GNM = Goteborg Natural History Museum, RMNH = Naturalis Biodiversity Center, NMS = Royal Museum of Scotland, MNHN = Paris National Museum of Natural History and OUMNH = Oxford University Museum of Natural History.

| Region | Total number of specimens | Median age of specimen | Average % mapped DNA | Museum |
|-----------------------|---------------------------|------------------------|----------------------|-----------------|
| North Sulawesi | 24 | 1917 | 24.4 | GNM, RMNH, MNHN |
| West central Sulawesi | 9 | 1918 | 23.5 | GNM, RMNH |
| East Sulawesi | 3 | 1919 | 19.1 | GNM |
| Togean | 1 | 1939 | 12.4 | RMNH |
| Buru | 12 | 1921 | 45.5 | OUMNH, RMNH |
| Sula | 2 | 1918 | 48.7 | RMNH |
| Seram | 1 | 1925 | 28.8 | RMNH |
| Ternate | 3 | 1886 | 41.9 | RMNH |
| Unknown | 12 | 1941 | 33.8 | GNM, RMNH, NMS |

Screening results

We find almost half the samples (33/67) screened had over 30% of endogenous DNA, this is enough to efficiently generate high quality genomes. Just over half of the specimens (38/67) had 25% endogenous DNA (Figure 3). We found no correlation between the amount of endogenous DNA and the age of the specimens ($r = 0.08$, $df = 61$, $p = 0.53$) (Figure 3B). In fact, some of the older specimens yielded more endogenous DNA than younger ones (Figure 3B). This is not





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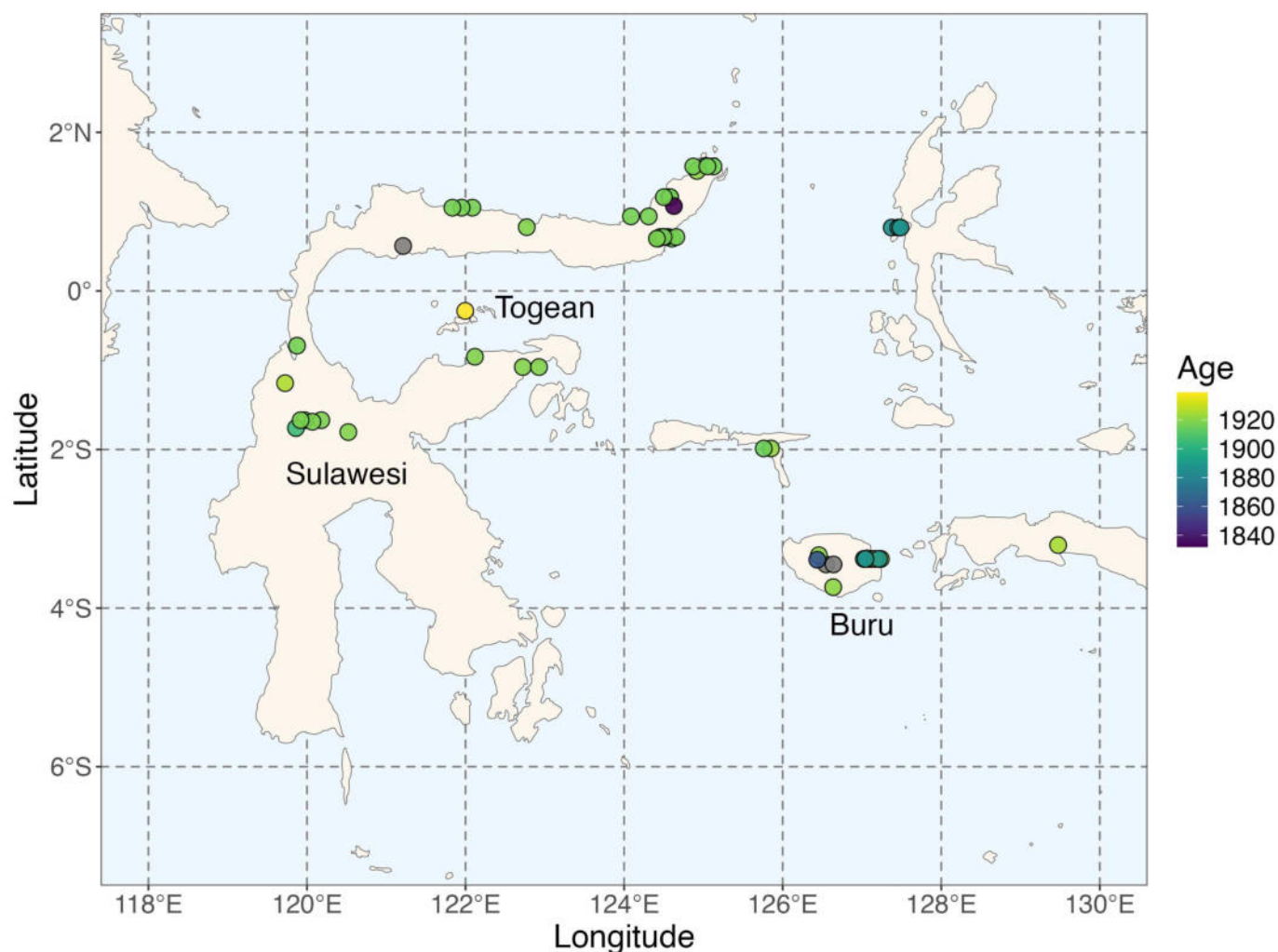


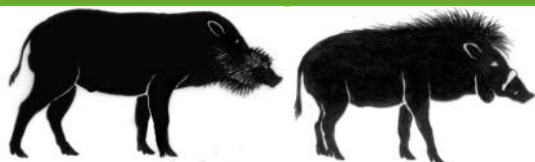
Fig. 2. Map of Wallacea and specimen provenance. Points show the original location of each of the screened babirusas, coloured by the specimen age. Grey points are the four specimens with unknown age. Samples with unknown localities were removed. The islands important for the babirusa populations have been labelled.

surprising however, as we would not expect such differences within the scope of about 200 years. The impact of time only starts to affect very old samples such as archaeological ones. These results indicate that successful genomes can be generated from the range of aged specimens within natural history collections allowing flexibility in the sampling regime available. However, we did find that the petrous bone generated a higher and more consistent amount of DNA ($t = -5.05$, $df = 27.22$, $p < 0.05$) in line with the petrous preserving greater amounts of DNA (Figure 3C). This contrasts with the drilling of bone powder conducted on the bone fragments, which showed a greater variation in the amount of babirusa DNA recovered (Figure 3C). This would highlight the benefits of extracting DNA from features in the skull that would not disturb the more taxonomically important morphological features, while increasing the yield of endogenous DNA.

Considerations

While much has been written on the best practices of museum sampling (Raxworthy and Smith, 2021), here we note some considerations, specific to our experiences with generating genomes for babirusa.





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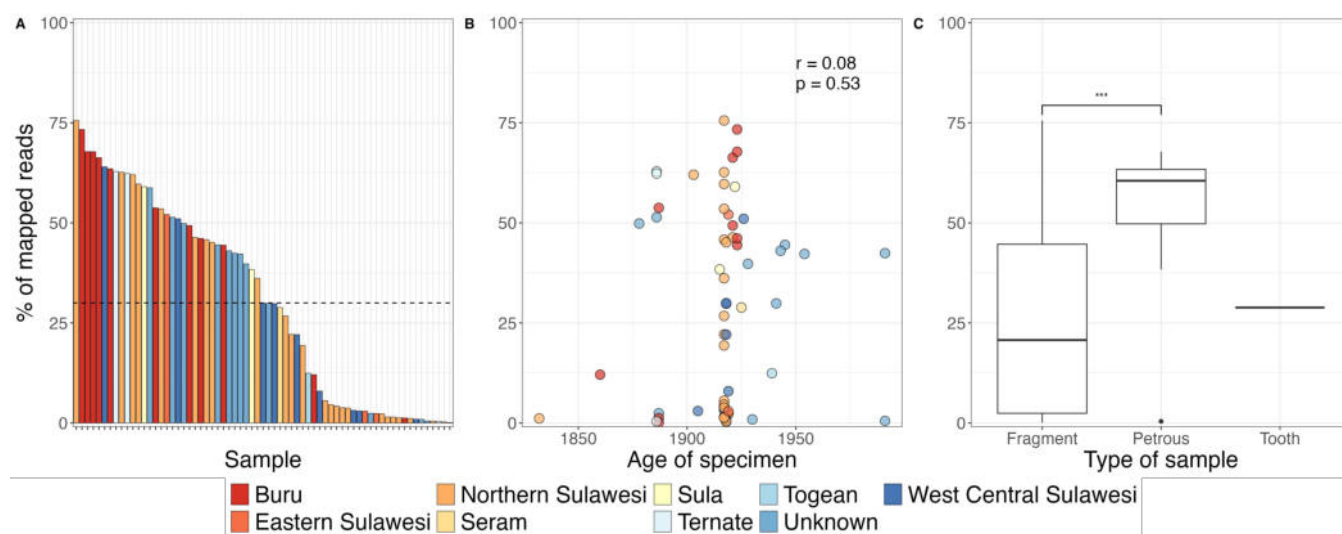


Fig. 3. A. Percentage of mapped reads for each specimen. The dashed line marks the 30% threshold of endogenous DNA. Each bar represents a specimen and is coloured by region. B. Correlation between age of specimen and endogenous DNA where each point shows the amount of endogenous DNA for each sample, coloured by region. The Pearson correlation coefficient and the p-value show there was no significant correlation. C. Correlation between type of sample and endogenous DNA. The stars show the significant difference between the bone fragment and the petrous sample type.

1. Engaging and informing museums

Museomics generally requires some form of destructive sampling. We need to remove pieces of bone, tissue, or drill small holes for bone powder. This meant that there can often, understandably, be reluctance on the part of museum curators for this to take place. Therefore, the first step in overcoming this was to fully engage and involve the museum curators and collection managers in the process (Freedman et al., 2018). Project proposals should be discussed and compromises made when selecting the samples to minimise the risk to the specimens and thus preserve them for future generations. For example, was there any benefit to our research question by having ten samples from the same location or can fewer individuals be sampled? Additionally, the results of the study should be clearly communicated back to the museum, to demonstrate the benefits of genomic analyses.

2. Optimising aDNA yield through lab protocol and bioinformatics

Additionally, we should always attempt to optimise DNA yield from museum specimens so that our destructive sampling manages to provide as much information as possible. This can usually be done in two ways: (1) minimally destructive sampling, or (2) maximising data obtained. As part of our research group, we have been developing new minimally destructive sampling methods. This includes the effective removal of the petrous bone through the ear canal (Scarsbrook et al., 2025), and the swabbing of feathers for avian specimens (adapted from Campana et al. 2017). Continual development of new sampling and laboratory methods will present greater benefits with less destruction to the specimens in question. There is also the improvement of molecular protocols, often requiring less starting material for generating genomes of the same quality (Freedman et al., 2018; Rohland et al. 2018) or by generating lower-coverage genomes and using a computational method called imputation to fill in the gaps (Ausmees et al., 2022).





3. Collecting and archiving metadata

A sample without accurate metadata may not be very useful for sequencing. If the data were not recorded at the initial acquisition by the museum or on the expedition, then the metadata is often lost. A minimum of recorded information regarding where and when the sample was collected, what type of tissue or bone was sampled, and which museum it came from, would help to ensure usable and reproducible data. This echoes similar calls being made for the preservation of data from ancient DNA samples (from much older, archaeological samples) (Bergström, 2024). Furthermore, results including the accurate metadata, from museum genomic studies should be properly archived on large genomic repositories e.g. ENA (Burgin et al., 2022) or community driven initiatives i.e. SPAAM (Fellows Yates et al., 2021). This will allow us to correctly reuse genetic data generated from the sample, thereby reducing the need to acquire new samples which could be costly in terms of logistics and conservation.

4. Screening before sequencing

As we have shown, some of our samples would be prohibitively expensive or implausible to generate genomes of sufficient quality for the conservation genetic analyses required (Figure 3A). This was apparent from the initial screening data generated. Screening data therefore permits a balance between maximising throughput and budgets. Though allowing the freedom to evaluate important samples e.g. in this study we had only one historical sample from the Togean islands. This region is crucial for the conservation of babirusa both genetically and spatially (Jati et al., 2024, Aninta and Drinkwater et al., 2024). In this case, based on our screening of this sample, which did not meet the minimum coverage, we were able to adapt and optimise through the generation of additional DNA libraries to attempt to harness greater diversity and “top up” the current sample.

5. Collaborating and material reuse

In terms of reuse, as sequencing technologies advance, we can hope to obtain additional information from the same sample. Take for example the babirusa (and anoa) which were analysed using mitochondrial and microsatellite data in Frantz et al. (2018). We have re-sequenced and analysed the original DNA extracts for Aninta and Drinkwater et al (2024) but using whole genome sequencing methods. The results from the study analysed alongside newly sequenced museum specimens, generating further benefits from a single destructive sampling event. Therefore, we would like to encourage collaborations in museomics, as well as fair and equitable sharing of resources generated. We propose collaborations to follow not only the internationally ratified Nagoya Protocol but also all national regulations regarding genetic research so that trust and goodwill is maintained sustainably, furthering efficient reuse of research materials.

Conclusion

The sequencing of museum specimens can have direct benefits to understanding the evolutionary history of an endangered species, such as the babirusa, as well as leading to conservation actions. However, we advocate that researchers be responsible with the sampling, archiving and reuse of the material, try to engage all stakeholders in the process and maximise the scientific outputs we can generate from a single sample.





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Wallowing and potential seed dispersal by the Togean babirusa

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Seed dispersal is a critical process for forest regeneration and plant population persistence. Dispersal allows seeds to germinate and grow in areas with better environmental conditions. By dispersing, plants can minimize competition for resources with individuals of the same species. Plants can also avoid contracting species-specific diseases or parasites by growing away from each other. Moreover, dispersal helps plants expand their range, colonize vacant areas, or replace other species that are essential in ecological succession (Howe and Smallwood, 1982). Various mechanisms of seed dispersal exist, but in this article, we will discuss the role animals play in this process. By examining camera trap videos from our study in 2022 (Jati et al., 2024a), we will explore how the Endangered Togean babirusa (*Babyrousa togeanensis*) potentially shape the Togean Archipelago ecosystem by dispersing seeds.

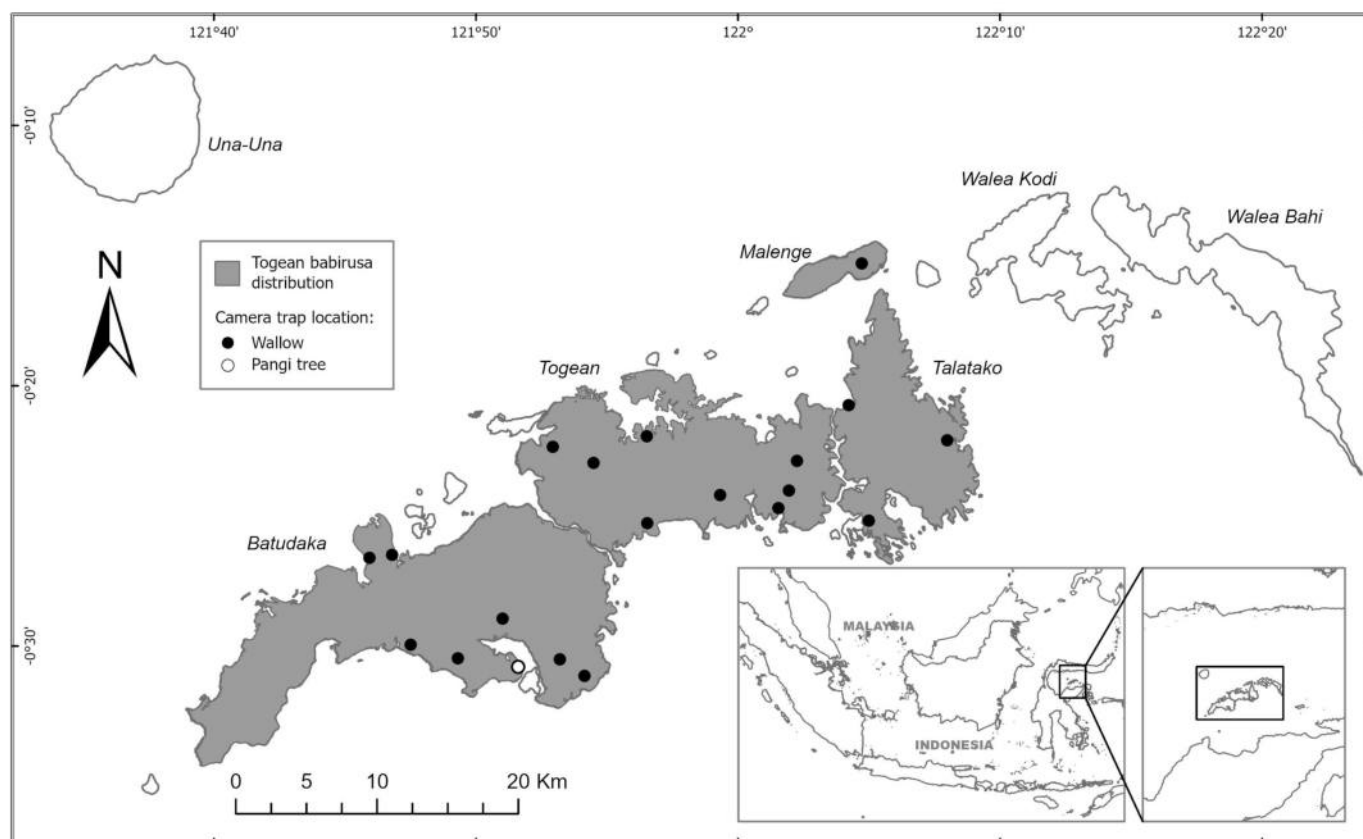


Fig 1. The Togean Archipelago, showing its seven major islands. Grey color indicates islands where the Togean babirusa is present. Camera trap placement was indicated by black (in front of wallow) and white dot (in front of fruiting pangki tree, *Pangium edule*). Island names are italicized and printed next to each island. Inset maps show the position of the archipelago in Indonesia.





Behaviour



To understand how the Togean babirusa can disperse seeds, it is important to first examine their ecology, behavior, and the environment they inhabit. The Togean babirusa is endemic to the Togean Archipelago, Central Sulawesi, Indonesia, and is found on four of the archipelago's seven main islands (Ito & Melletti, 2017; Fig 1). Our camera trapping study (Jati et al., 2024b) revealed that the Togean babirusa is the only large mammal on most of the archipelago, except on the 13 km² Malenge Island where it shares the area with the Tonkean macaque (*Macaca tonkeana*). Although some literature mentions the Sulawesi warty pig (*Sus celebensis*) as inhabiting the archipelago (Burton and Macdonald, 2006), we have not found any evidence of its presence, suggesting it does not coexist with the babirusa here. The Togean babirusa distribution is closely tied to forest availability, even though they are capable of exploring all types of land cover across the islands (Jati et al., 2024a). The babirusa exhibits wallowing, a behavior shared among Suidae species for thermoregulation and parasite protection (Bracke, 2011). When exploring the archipelago, we observed numerous wallowing sites (hereafter wallow) in the forests with noticeable characteristics that we will describe below.

Wallows are very distinctive features in the forest. An active wallow contains a small pond of mud or murky water, often formed as a small ditch (Fig 2; Supplementary Video 1). One or more smooth soil walls are usually found adjacent to the pond. This formation occurs because during wallowing, babirusas scratch their bodies against the soil, effectively polishing it. Locals told us that the absence of vegetation is one indication that a wallow is active, because babirusas frequently rub their bodies on the area, removing and preventing any vegetation from growing. Should this be considered a disturbance? In what way could wallowing be beneficial to the

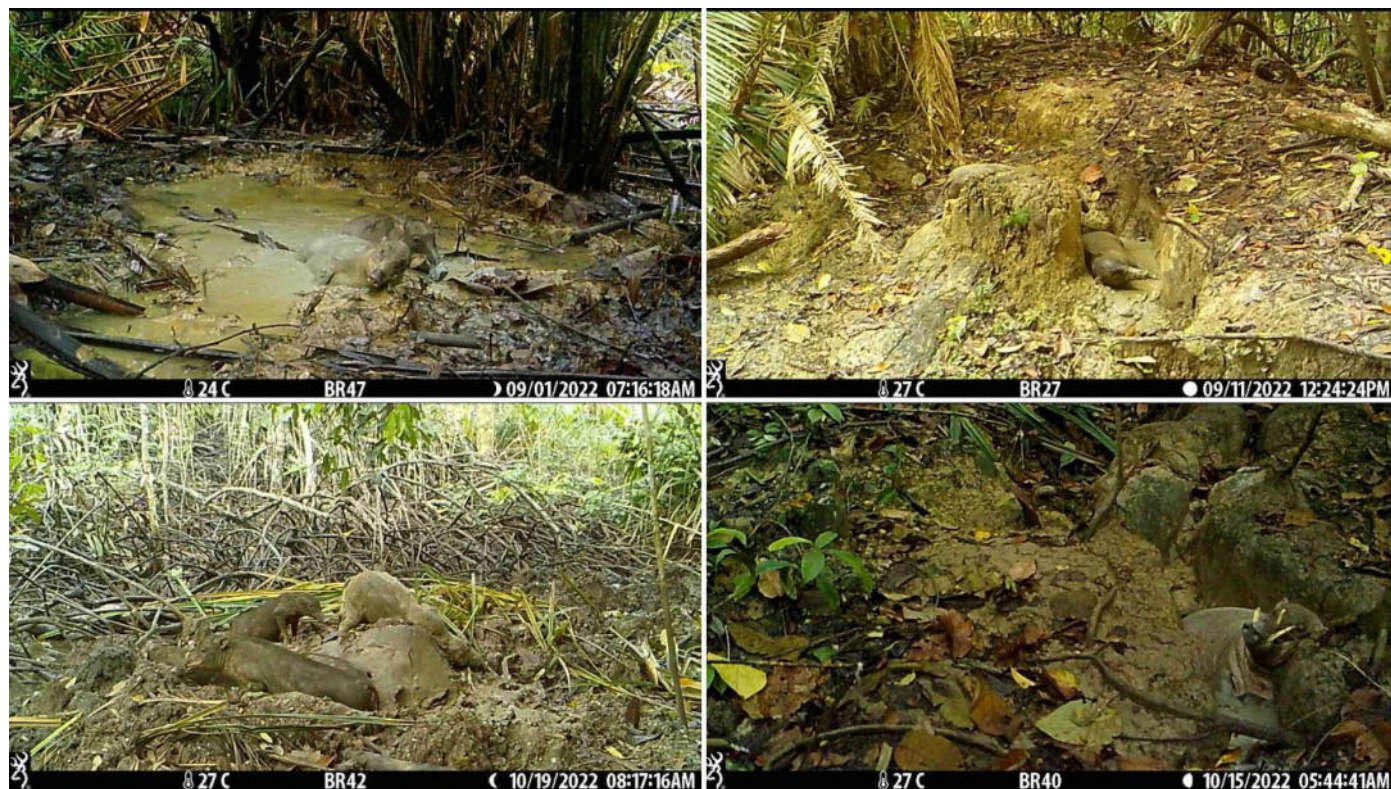


Fig 2. Characteristics of babirusa's wallowing sites in the Togean Archipelago. A wallow is usually a small pond of mud or murky water, often formed as a small ditch, with one or more smooth soil walls that were formed by frequent rubbing of babirusa's body. Wallowing can be a group activity as well as individual, and usually lasts for less than two minutes.





Behaviour



ecosystem? This question led us to review our camera trap videos and observe how babirusas engage in wallowing behavior.

In 2022, we had camera traps deployed in front of 19 wallows across the Togean babirusa range (Fig 1). The cameras were set to record 20-second videos with a 1-second interval for 15 to 21 days. This setup allowed us to continuously document wallowing behavior and observe the entire process in detail. Over this period, we recorded 210 independent wallowing events (defined as one video within one hour), enabling us to create a Kernel Density curve to visualize the timing patterns of this behavior. Most wallowing occurred during the day, peaking in the early morning (Fig 3). The wallowing activities can be described as follows (Fig 2; Supplementary Video 1). The behavior was relatively brief, typically lasting only about two minutes or less. Solitary babirusas wallowed alone, while groups wallowed together. While wallowing, the babirusa coated their bodies with mud or soil, often rubbing against the soil wall, before walking away. In a different location, they rubbed their bodies against tree trunks, removing the excess mud or soil, which became a sign of their presence.

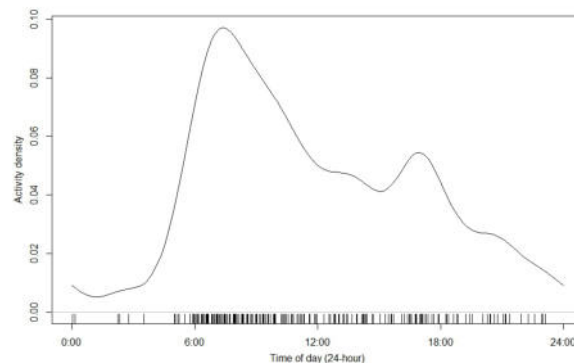


Fig 3. Kernel density curve showing the Togean babirusa's wallowing time pattern. X-axes show time of day in 24-hour format and Y-axes show wallowing density. Small tick marks along the X-axes indicate the data (observation time; 210 observations) used to create this curve.

A study on wallowing by wild boars (*Sus scrofa*) revealed that sites where they rub their bodies are seed banks for numerous understory plant species (Heinken et al., 2006), indicating that wild boars deposit diaspores during this activity. Sharing a similar behavior, the Togean babirusa could potentially disperse seeds in a similar way. Many diaspores are adapted for epizoochory (Howe and Smallwood, 1982), allowing them to become attached to the babirusa's bodies when the animals pass through. Because babirusas can move through multiple habitat types, they can carry seeds from various successional stages, from pioneer to mature forest species. At some point during the day, babirusas wallow in the forest and deposit the diaspores on the wallow. Unless abandoned, the seeds may not grow on the wallow, but other babirusas that wallow on the same site, may carry the seed through the mud covering their body, then redepositing the seeds to different locations when they rub their body elsewhere. The deposition of different types of seeds throughout the forest in this way is essential for forest succession. For instance, when a disturbance creates a gap in the forest, pioneer vegetation can grow from seeds originated on the forest edge, ensuring the continuation of succession. These processes illustrate how Togean babirusa potentially disperse seed in the Togean Archipelago by wallowing. Our observations highlight the need for a more focused study on babirusas as seed dispersal agents to provide more concrete evidence and a deeper understanding of this mechanism.

In addition to the 19 cameras placed in front of wallows, we deployed a camera in front of fruiting pangi trees (*Pangium edule*). Pangi fruit, measuring approximately 16-24 by 12-16 cm, is buoyant and known to disperse by water, which explains its concentration around coasts and riverbanks





Behaviour



(Quigley et al., 2019). However, to establish populations further inland, pangli seeds need a means of dispersal into the forest interior, and this is where the Togean babirusa plays a key role. Pangli fruit, despite being poisonous, is an important part of babirusa's diet (Ito and Melletti, 2017). In one of our videos, a babirusa is seen eating a pangli fruit and carrying the fruit away (Supplementary Video 2), clearly demonstrating the seed dispersal process. What is particularly interesting is that in most parts of the Togean Archipelago, the Togean babirusa is the only animal large enough to carry the pangli fruit. This suggests that, on this archipelago, the pangli tree relies solely on the babirusa to disperse inland. If this hypothesis holds true, we would expect to find fewer pangli trees in the interior of islands where the Togean babirusa is absent (Fig 1). A vegetation analysis would provide a valuable test of this hypothesis.

As the dominant large mammal in the Togean Archipelago, the Togean babirusa may have played a significant role in shaping the Togean forest through seed dispersal. Wallowing and the consumption of fruits are two potential ways the babirusa engage in this process. An empirical assessment is needed to better understand this mechanism and its benefit to the ecosystem. The Togean babirusa is often considered as a pest by local communities, so understanding the ecosystem services this species provides will help promote its conservation.

Supplementary Video 1: <https://doi.org/10.6084/m9.figshare.28094021.v1>

Supplementary Video 2: <https://doi.org/10.6084/m9.figshare.28094099.v1>

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Redescoberta do queixada (*Tayassu pecari*) e presença do cateto (*Pecari tajacu*) na Reserva Biológica Estadual de Araras e implicações para a conservação das espécies

Rediscovery of the White-lipped Peccary (*Tayassu pecari*) and Presence of the Collared Peccary (*Pecari tajacu*) in the Araras State Biological Reserve and Implications for Species Conservation

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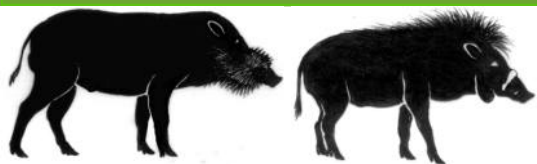
Abstract

The white-lipped peccary (*Tayassu pecari*), a keystone species in the ecological dynamics of the Atlantic Forest, has been locally extinct in Serra dos Órgãos National Park (PARNASO) (approximately 20,000 ha), located in the state of Rio de Janeiro, Brazil, with the last known records dating back more than 80 years. However, camera trap records obtained in 2022 from Araras State Biological Reserve (REBIO Araras)—a state park located approximately 25 km away—confirmed the species' presence after many years of apparent absence of 80 years from the region. Small groups of 20 to 60 individuals were recorded, suggesting the existence of remnant populations connected by ecological corridors. Meanwhile, the collared peccary (*Pecari tajacu*) was widely recorded, reflecting its greater adaptability to fragmented environments. This study highlights the importance of ecological corridors and systematic monitoring for the conservation of mammalian fauna. The need to implement strategies to strengthen environmental connectivity within the Serra do Mar ecological corridor, in the state of Rio de Janeiro, is emphasized as an essential measure to ensure the survival of these remnant populations.

Resumo

O queixada (*Tayassu pecari*), uma espécie-chave na dinâmica ecológica da Mata Atlântica, está considerado localmente extinto no Parque Nacional da Serra dos Órgãos (PARNASO) (com aproximadamente 20.000 ha), localizado no estado do Rio de Janeiro, Brasil, com os últimos registros conhecidos datando de mais de 80 anos atrás. No entanto, registros de armadilhas fotográficas obtidos em 2022 na Reserva Biológica Estadual de Araras (REBIO Araras) — uma unidade de conservação localizada a aproximadamente 25 km de distância — confirmaram a presença da espécie após muitos anos de aparente ausência na região. Pequenos bandos de 20 a 60 indivíduos foram registrados, sugerindo populações remanescentes conectadas por corredores ecológicos. Simultaneamente, o cateto (*Pecari tajacu*) foi amplamente registrado, refletindo sua maior adaptação a ambientes fragmentados. O presente estudo evidencia a importância dos corredores ecológicos e do monitoramento sistemático para a conservação da mastofauna. Destaca-se a necessidade de implementar estratégias para o fortalecimento da





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conectividade ambiental no corredor ecológico da Serra do Mar, no estado do Rio de Janeiro, como medida essencial para a manutenção das populações remanescentes.

Palavras-chave: Monitoramento, Rio de Janeiro, Tayassu pecari, Pecari (Dicotyles) tajacu, Corredores ecológicos, Mata Atlântica, Conservação da biodiversidade.

Keywords: Monitoring, Rio de Janeiro, Tayassu pecari, Pecari (Dicotyles) tajacu, Ecological corridors, Atlantic Forest, Biodiversity conservation.

Introdução

No estado do Rio de Janeiro, estima-se que restam aproximadamente 21% da cobertura original do bioma Mata Atlântica (SOS Mata Atlântica, 2021). Rezende et al. (2018) apontaram que cerca de 30% da vegetação remanescente encontra-se protegida dentro de unidades de conservação, um dado que se alinha com as análises do Map Biomas (2020), que indicaram uma cobertura florestal de 29,65% para o estado. Apesar da redução expressiva da vegetação original, a Mata Atlântica permanece fundamental para a oferta de serviços ecossistêmicos, desempenhando um papel essencial na manutenção da biodiversidade e na qualidade de vida humana (Pires et al., 2021). As Unidades de Conservação (UC) são essenciais para proteger os remanescentes florestais e a diversidade biológica da Mata Atlântica, desempenhando um papel crucial na preservação da biodiversidade e dos recursos ambientais, principalmente por evitar a destruição do habitat.

O monitoramento ambiental é uma ferramenta essencial para a gestão da biodiversidade e a busca por soluções para sua conservação (ICMBio, 2018). Este estudo visa revisar a dinâmica histórica dessas espécies, descrever os métodos de monitoramento, os registros das espécies e discutir as implicações para a conservação na região. Na Reserva Biológica de Araras, pesquisas do Jardim Botânico do Rio de Janeiro registraram a presença de diversos mamíferos, como jaguatirica (*Leopardus pardalis*), suçuarana (*Puma concolor*), cachorro-do-mato (*Cercopithecus thous*), cateto (*Pecari tajacu*), paca (*Cuniculus paca*), quati (*Nasua nasua*), bugio (*Alouatta guariba*) e macaco-prego (*Sapajus nigritus*) (INEA, 2010). O Plano de Manejo da RBA também apresenta uma lista detalhada de espécies ameaçadas registradas na área, conforme a Portaria IBAMA nº 1.522-N, de 1989 (INEA, 2010).

Inventários de mamíferos de médio e grande porte são especialmente relevantes, pois descrevem a comunidade faunística e auxiliam na gestão e na conservação dessas espécies, contribuindo para o combate à caça ilegal e incentivando novas pesquisas (Galetti et al., 2017; Cronemberger et al., 2019). Esses animais, geralmente de hábitos noturnos e baixa densidade populacional, influenciam a paisagem e desempenham funções ecológicas estratégicas, como a dispersão de sementes e o controle populacional de outras espécies (Pardini et al., 2006; Terborgh, 1992; Carvalho et al., 2014; Mendoza & Camargo, 2019).

Para registrá-los, recomenda-se o uso de diferentes métodos, como caminhadas em trilhas pré definidas (Cullen Jr & Rudran, 2006; Bender et al., 2018; Costa et al., 2019) e armadilhas fotográficas, que permitem observação não invasiva dos animais em seu habitat natural (Silveira et al., 2003; Srbek-Araujo & Chiarello, 2005; Carvalho et al., 2023).





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Reserva Biológica Estadual de Araras

A Reserva Biológica Estadual de Araras (RBA), localizada nos contrafortes da Serra do Mar, na Região Serrana do estado do Rio de Janeiro, abrange áreas dos municípios de Petrópolis e Miguel Pereira. Criada em 1977 e ampliada em 2010 para 3.837,81 hectares, a RBA integra o bioma Mata Atlântica, destacando-se pela proteção de importantes ecossistemas florestais e rupícolas. (Figura 1) Administrada pelo Instituto Estadual do Ambiente (INEA), a reserva tem como principais objetivos a preservação da biodiversidade, a proteção de nascentes estratégicas e o fomento à pesquisa científica.

A área caracteriza-se por apresentar um relevo acidentado, com altitudes que variam de 920 a 1.770 metros, e declividades acentuadas (50% a 70%). Os principais cursos d'água incluem os rios Araras, Vargem Grande, Ponte Funda e Córrego Cidade, que integram a bacia do rio Piabanha, afluente do rio Paraíba do Sul.

A vegetação da RBA está sob o domínio da Floresta Ombrófila Densa, com formações que variam de montana a alto-montana. Espécies emblemáticas incluem quaresmeiras, canelas (*Ocotea* spp. e *Nectandra* spp.), jequitibás-rei, cedros e bromeliáceas. A área de maior densidade florestal é encontrada no vale do Rio França e na vertente oposta ao Rio Araras, onde se destacam espécies como curimatã (*Prochilodus lineatus*), copaibeira (*Copaifera langsdorffii*) e jacaré (angico - *Piptadenia gonoacantha*). A presença de espécies endêmicas, como o rabo-de-galo (*Worsleya rayneri*), reforça a singularidade ecológica da RBA. Em áreas mais degradadas, predominam espécies exóticas como eucalipto (*Eucalyptus globulus* Labill), caqui (*Diospyros kaki*), abacate (*Persea americana*), pereiras (*Pyrus communis*) e ameixa-amarela (*Eriobotrya japonica*), que refletem o histórico de uso humano da região como horto hortifrutícola.

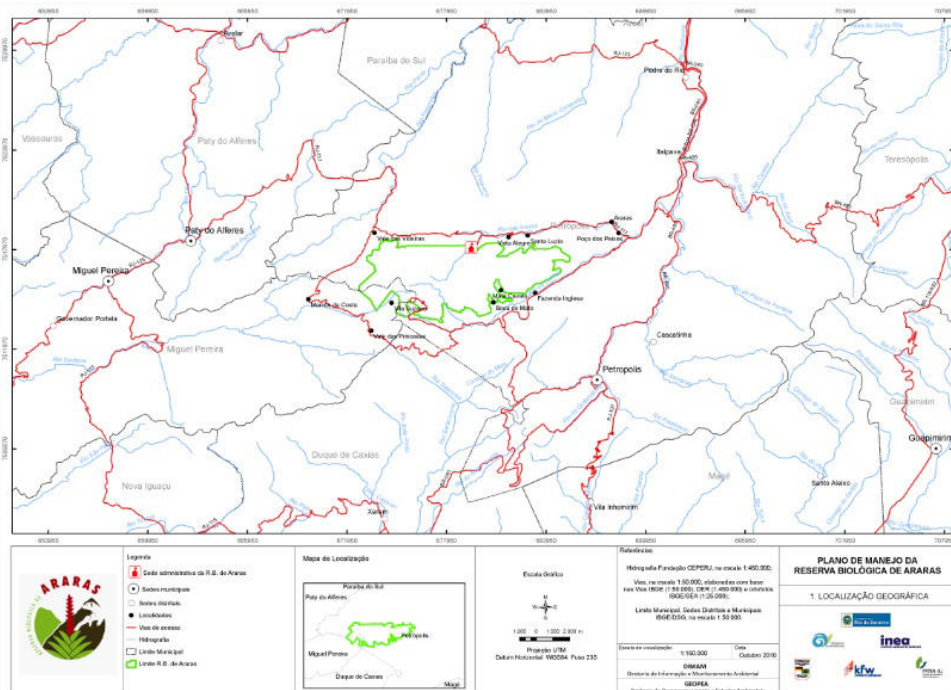
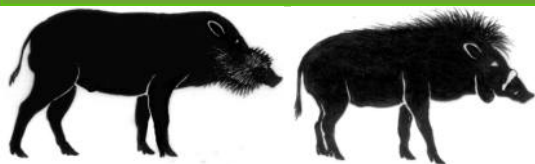


Fig. 1: Localização geográfica da Reserva Biológica Estadual de Araras. Plano de Manejo da Reserva Biológica de Araras. Rio de Janeiro: INEA, 2010.





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O histórico de uso antrópico da região resultou na introdução de espécies frutíferas exóticas, ainda encontradas em alguns setores da reserva. Essas plantas, além de constituírem um recurso alimentar para a fauna local, refletem a regeneração contínua da área desde a conversão do antigo horto florestal em Unidade de Conservação. No entanto, a UC enfrenta desafios como caça predatória, especulação imobiliária e incêndios florestais.

Metodologia

O monitoramento foi realizado na Trilha do Caneco, principal unidade amostral da REBIO Araras. Utilizou-se o Protocolo Avançado do Programa Monitora, instalando armadilhas fotográficas (modelos Trophy Cam HD e MINI 301) em pontos espaçados a cada 300 metros ao longo de um transecto de 3.000 metros. As armadilhas foram configuradas para capturar vídeos de 15 segundos em alta resolução e operaram continuamente durante 12 meses.

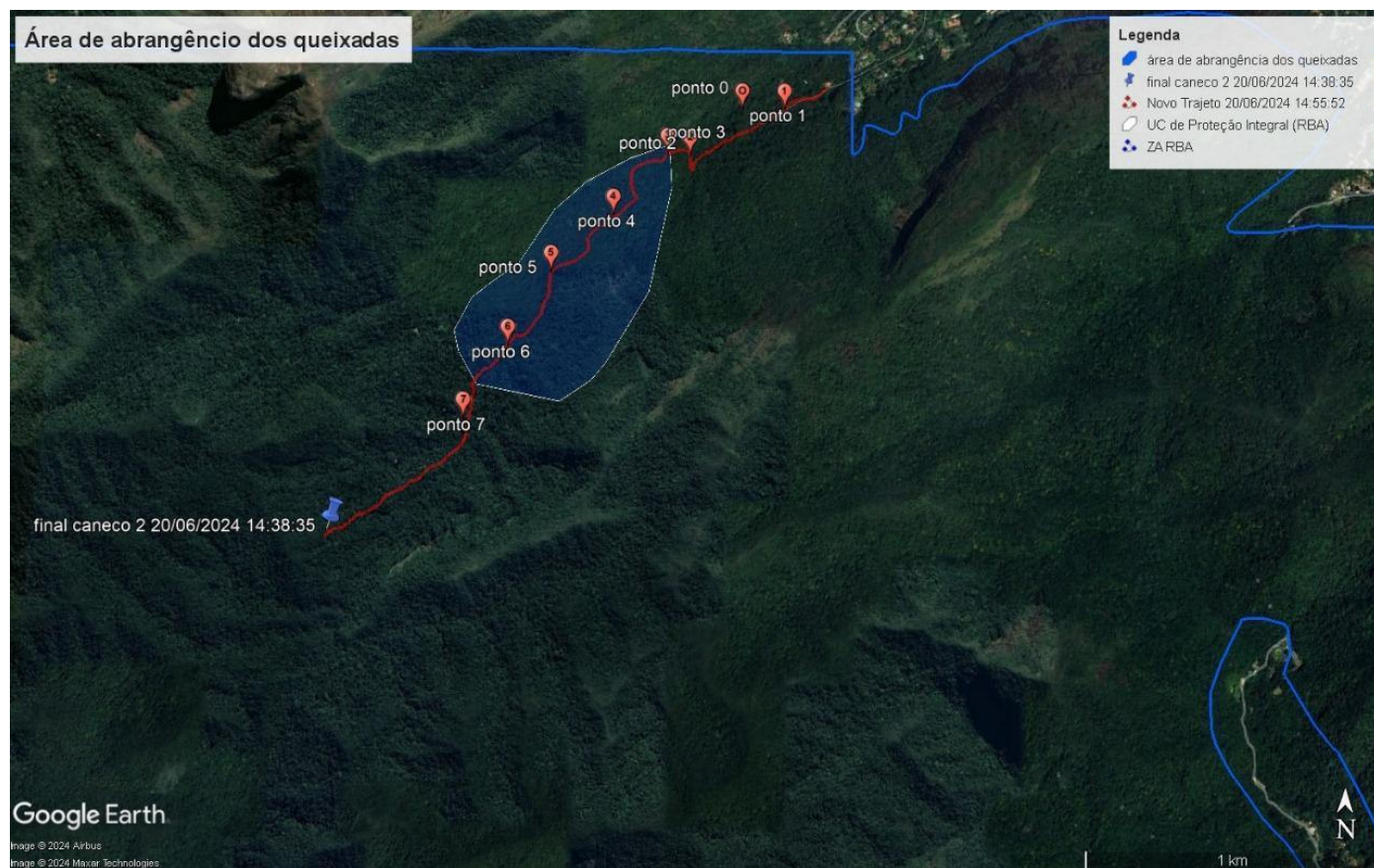


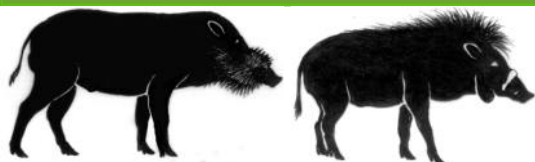
Fig. 2: Mapa com a distribuição de armadilhas fotográficas e área de abrangência de Tayassu pecari e Pecari tajacu na Trilha do Caneco na REBIO Araras. Fonte: Google Maps Criado por: Mateus Teva

Os dados foram coletados mensalmente para substituição de pilhas e download das imagens, sendo posteriormente analisados quanto à presença de espécies, data, horário e local de captura. Complementarmente, foram realizados registros indiretos, como avistamentos, pegadas e sinais deixados pelos animais.

Resultados

Antes da implementação do monitoramento sistemático em 2022, um registro avulso de





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queixada foi capturado por uma armadilha fotográfica em 2021. Este equipamento, cedido à REBIO Araras como parte de iniciativas pontuais, não fazia parte de uma metodologia estruturada. Ainda assim, o registro inaugural indicou a possível presença de populações remanescentes e motivou esforços para a realização de monitoramentos mais abrangentes. Os registros fotográficos subsequentes, realizados em 2022, confirmaram a presença de *Tayassu pecari* em diversos pontos da REBIO Araras e em áreas adjacentes. (Figura 4). Bandos compostos por 20 a 60 indivíduos foram documentados, sugerindo populações remanescentes conectadas por corredores ecológicos formados por unidades de conservação. (Figura 3). Além disso, Cateto (*Pecari tajacu*) foi amplamente registrada, com maior densidade populacional, refletindo sua adaptação a ambientes fragmentados. (Figura 5).

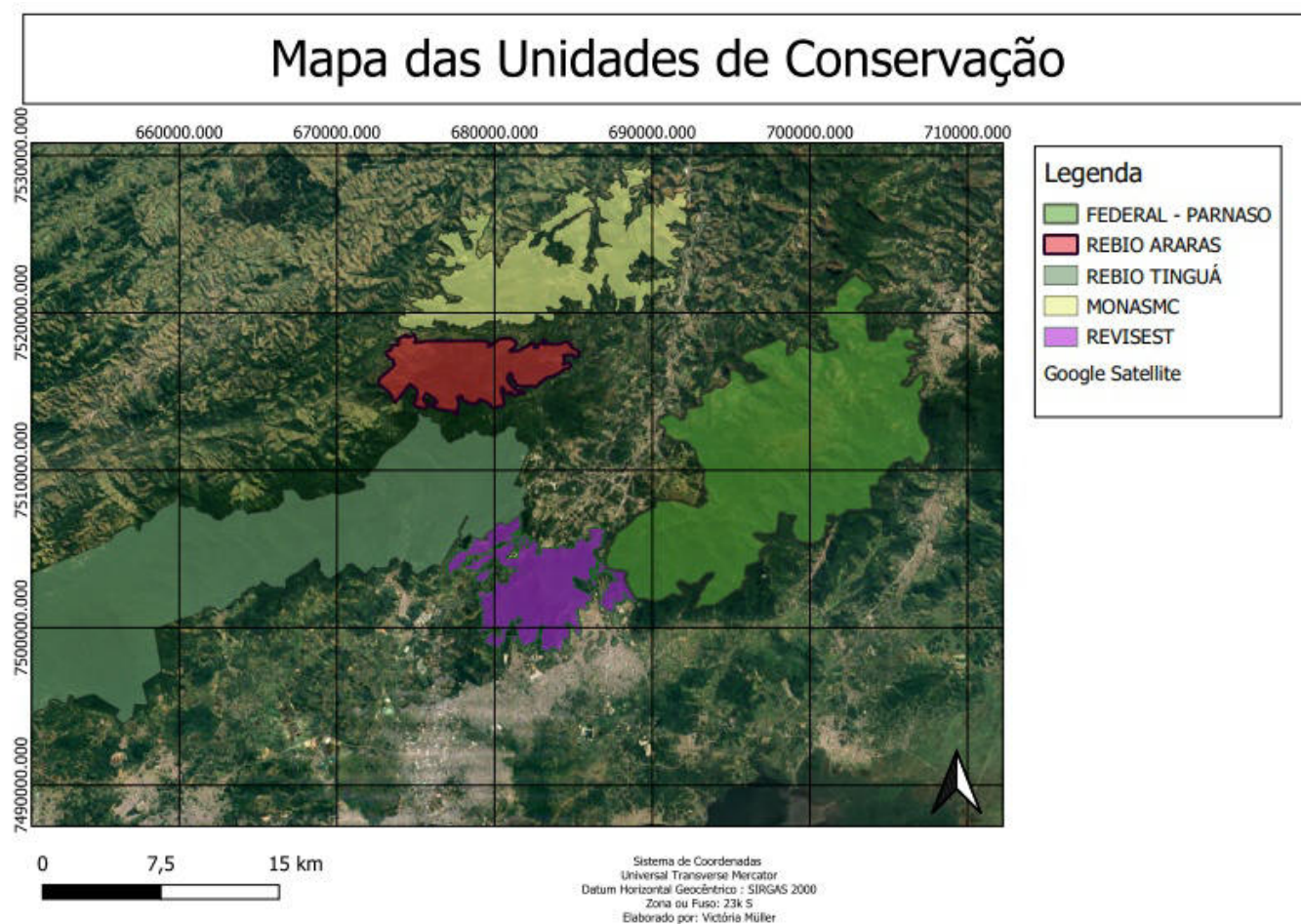
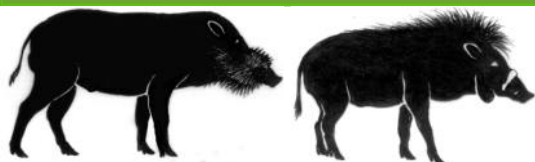


Fig. 3: Mapa das Unidades de Conservação Estaduais e Federal da Serra do Mar, do Estado do Rio de Janeiro.

Fonte: Arcgis criado por: Victoria Muller

Os pontos exatos de registros das espécies, obtidos por armadilhas fotográficas na trilha do Caneco, incluem:





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Tab 1. Coordenadas e altitude dos pontos das armadilhas fotográficas e registros de *Tayassu pecari* e *Pecari tajacu* na REBIO Araras.

| Área | Local | UTM | UTM-X | UTM-Y | Altitude |
|--------------|--------|-----|-----------|------------|----------|
| REBIO ARARAS | Caneco | 23k | 679018.83 | 7517847.61 | 1054m |
| REBIO ARARAS | Caneco | 23k | 678790.45 | 7517646.39 | 1067m |
| REBIO ARARAS | Caneco | 23k | 678575.08 | 7517432.58 | 1096m |
| REBIO ARARAS | Caneco | 23k | 678422.82 | 7517177.96 | 1153m |
| REBIO ARARAS | Caneco | 23k | 678248.56 | 7516933.69 | 1163m |
| REBIO ARARAS | Caneco | 23k | 678091.98 | 7516671.73 | 1201m |

Esses registros reforçam a importância dos corredores ecológicos para a conectividade entre fragmentos florestais, permitindo a coexistência de ambas as espécies. Mapas detalhados (Figuras, 2 e 3) ilustram a distribuição espacial dos registros e a sobreposição de habitats utilizados por queixadas e catetos.

Cateto (*Pecari tajacu*):



Fig. 4: Registro de catetos (*Pecari tajacu*) capturados por armadilha fotográfica na REBIO Araras (2021, 2022, 2023).

Queixada (*Tayassu pecari*):



Fig. 5: Registro de queixadas (*Tayassu pecari*) capturadas por armadilha fotográfica na REBIO Araras (2021, 2022, 2023).

A coexistência de ambas as espécies em simpatria indica condições ecológicas favoráveis para mamíferos de médio porte na região. Esses resultados contradizem a classificação anterior de extinção local do queixada no PARNASO e reforçam a importância dos corredores ecológicos para a conservação da biodiversidade. Estudos semelhantes também destacam a importância da conectividade para a manutenção de populações em paisagens fragmentadas (Laurance et al., 2011; Saucier et al., 2019).





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Discussão

Os achados demonstram que a Reserva Biológica Estadual de Araras (RBA) protege 3.837,81 hectares de áreas montanhosas, na região serrana do Rio de Janeiro, sendo um importante refúgio para a biodiversidade da Mata Atlântica. Históricos de ocupação antrópica deixaram marcas no ecossistema local, como a presença de espécies exóticas frutíferas — abacateiro (*Persea americana*) e ameixeira (*Prunus doméstica*), que hoje desempenham um papel ecológico significativo, sendo amplamente consumidas por mamíferos como Queixadas (*Tayassu pecari*) e Catetos (*Pecari tajacu*).

O registro avulso de *Tayassu pecari* em 2021, ainda que isolado, desempenhou um papel crucial como indicador preliminar da presença da espécie na região. Apesar de não ter sido obtido em condições metodologicamente controladas, serviu de base para a adoção de estratégias de gestão e monitoramento mais robustas desenvolvidas em 2022 ao presente ano. Esse caso evidencia a importância de registros ocasionais na identificação de lacunas de conhecimento e na formulação de hipóteses nas investigações futuras sobre a conservação dessas espécies.

A preservação de espécies em paisagens fragmentadas, como observado na REBIO Araras, reflete tendências documentadas em estudos de longo prazo. Além disso, é crucial fortalecer políticas de conservação, incluindo a manutenção de corredores ecológicos e o combate à caça e à perda de habitat.

Estudos anteriores indicavam que o queixada (*Tayassu pecari*) estava provavelmente extinto no Parque Nacional da Serra dos Órgãos (PARNASO), com os últimos registros conhecidos datando de mais de 80 anos atrás (Schirch, 1932; Davis, 1947; Barth, 1957; Ávila-Pires & Gouvêa, 1977). A ausência dessa espécie por tantas décadas reforçava a hipótese de sua extinção local, evidenciando os impactos históricos da caça e da fragmentação do habitat sobre populações de mamíferos de médio e grande porte na Mata Atlântica.

A distribuição histórica do queixada (*Tayassu pecari*) na Mata Atlântica incluía amplas áreas do estado do Rio de Janeiro, onde a espécie era encontrada em grandes grupos em ambientes florestais contínuos. Entretanto, devido à caça intensa e à fragmentação do habitat, a população da espécie sofreu declínios severos, sendo considerada extinta em diversas regiões, incluindo o Parque Nacional da Serra dos Órgãos (PARNASO) (Cunha, 2007; Keuroghlian et al., 2023). Estudos indicam que a perda de habitats adequados e a pressão cinegética foram fatores determinantes para essa extinção local, fenômeno observado em outras unidades de conservação da Mata Atlântica (Keuroghlian et al., 2023). A recente redescoberta da espécie na Reserva Biológica de Araras ressalta a importância dos corredores ecológicos e da conectividade florestal para a recolonização e manutenção de populações viáveis na Serra do Mar. A presença de grupos menores reforça a necessidade de estratégias eficazes de conservação, incluindo o combate à caça ilegal e a preservação de fragmentos florestais essenciais para a mobilidade e sobrevivência da espécie (Keuroghlian et al., 2023). A Mata Atlântica abriga uma rica fauna de mamíferos, incluindo o queixada (*Tayassu pecari*) e o cateto (*Pecari tajacu*), ambos essenciais para a dispersão de sementes e a manutenção das estruturas ecológicas das florestas. Contudo, o queixada é uma espécie altamente suscetível a impactos antrópicos, como por exemplo a perda de habitat e a caça, sendo classificado anteriormente, como localmente extinto em diversas áreas, incluindo o PARNASO, conforme o último levantamento de fauna em 2018 (Cronemberger et al., 2019). Por outro lado, o cateto demonstra maior resiliência, permanecendo em remanescentes florestais menores. Com a adaptação do Programa Monitora do ICMBio





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(ICMBIO, 2017) para a REBIO Araras em 2022. A conectividade entre fragmentos florestais, essencial para a sobrevivência de populações viáveis, é amplamente discutida na literatura como estratégia-chave para mitigar os impactos da fragmentação de habitat (Haddad et al., 2015; Beier et al., 2012).

Conclusão

A redescoberta do Queixada (*Tayassu pecari*) na Reserva Biológica Estadual de Araras representa um marco significativo para a conservação da biodiversidade na Mata Atlântica, especialmente diante do histórico de declínio populacional da espécie na região. O registro obtido por armadilhas fotográficas em 2022 contesta a classificação anterior de extinção local e reforça a importância dos corredores ecológicos na manutenção da conectividade entre fragmentos florestais. Além disso, a presença simultânea do cateto (*Pecari tajacu*) indica que a REBIO Araras desempenha um papel estratégico na conservação de espécies de médio e grande porte, fornecendo abrigo e suporte ecológico essencial.

A confirmação da presença de *Tayassu pecari* destaca a relevância de Unidades de Conservação na mitigação dos impactos da fragmentação florestal e na manutenção de populações viáveis. No entanto, a persistência da espécie depende diretamente da implementação de estratégias eficazes de manejo, incluindo o fortalecimento de políticas de combate à caça, a restauração de habitats e a ampliação de corredores ecológicos para garantir a conectividade entre áreas protegidas, como a REBIO Tinguá e o Parque Nacional da Serra dos Órgãos.

Diante dessas evidências, recomenda-se a reclassificação de *Tayassu pecari* para "presente com populações reduzidas" na região, além da continuidade do monitoramento sistemático para acompanhar a dinâmica populacional e avaliar a efetividade das estratégias de conservação. A integração entre pesquisa científica e gestão ambiental é essencial para garantir a longo prazo a preservação dessa espécie-chave e dos processos ecológicos associados à sua presença na Mata Atlântica.

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Dartmoor wild boar sightings prompt suspicions of guerrilla rewilding

Helena Horton, 25 Feb 2025

<https://www.theguardian.com/environment/2025/feb/25/dartmoor-wild-boar-sightings-prompt-suspicions-of-guerrilla-rewilding>

Dog walker's close encounter prompts debate over whether the animals, once native to UK, should remain.

Sightings of wild boar on Dartmoor have raised suspicions a guerrilla rewilder has been releasing them – and prompted a debate over whether they should be allowed to remain.

Videos of a group of boar on the moors in Devon were posted online earlier this month, and a dog walker has recently complained of a close encounter with one of them, which frightened his pet.

Experts suspect the boar could have been illegally reintroduced, possibly by people who want to repopulate the moors with the once indigenous species. Boar used to roam Dartmoor but were later hunted to extinction in Britain by the 17th century.

Matt Larsen-Daw, the CEO of the Mammal Society, said: "There is a possibility that the boar captured on video earlier in February, and the individual animal blamed for a recent attack on a dog, are present due to a more recent illegal release of animals in the landscape. Sightings of animals in daylight, and in an area that is fairly devoid of woodland, could suggest that these animals have been introduced suddenly and are unfamiliar with their new surroundings."

It is also possible the animals migrated from other populations as there have been sighting of the wild pigs in Devon over the years. It is thought about 2,600 are now living wild across the UK, with the largest colony in the Forest of Dean. They are also present in parts of south-east and south-west England, south-east Wales and north-west Scotland.

Dog walker Richard Blight told Devon Live last week that a wild boar knocked his cocker spaniel over before chasing it down a path. He said anyone who had released the boar was a "bloody moron", adding "I dread to think what would happen if a child were to come face to face with a boar on a path. Before this happened I would have said properly managed boar wouldn't be a problem on Dartmoor. But not now. This is a national park and it can get very busy, especially in summer."

But some think they should be allowed to stay, as they were once native to the UK.

Larsen-Daw said: "Boar are very adaptable and acclimatise very quickly. And it doesn't need to be a straightforward 'leave them be or kill them all'. The population could be closely managed to ensure they're kept in a suitable population size, governed by the carrying capacity of the land available. That carrying capacity would be the key thing to ascertain through study and modelling."

The Dartmoor national park authority (DNPA) has heard rumours of boar on the moors for some time, but they have not caused disturbances until now. The animals tend to be secretive and are primarily nocturnal, and mostly run away from humans when approached. Proponents of their return say they have a regenerative effect on the soil as they root through it, dispersing seeds with their sensitive snouts.

"As for human-wildlife conflict, the danger posed by wild boar is generally overstated," said Larsen-Daw. "Their potential to cause harm due to their size and weight should be held up against the fact that they are secretive and non-aggressive except when provoked. Some education and sensitisation of visitors to an area with wild boar can ensure that conflict is





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avoided, and for some wildlife lovers the prospect of seeing wild boar or signs of their presence could enhance their enjoyment of a visit.”

Natural England, the government’s nature watchdog, pointed out that boar were once native to Dartmoor, and said it was working closely with DNPA to provide advice and guidance. Its experts have said dogs should be kept on leads in areas where there are wild boar.

The Wildlife Trusts, who have reserves on Dartmoor, have been closely monitoring the situation. A spokesperson said people should keep dogs on leads on their reserves: “We are aware of reports of boar on Dartmoor national park and will be working with the Dartmoor national park authority and others over the coming weeks to understand more about any local population. As always, we recommend that visitors in the countryside keep dogs on a lead to safeguard livestock and to avoid nature disturbance. We ask that dogs are kept on a lead on our nature reserves.”

More evidence is needed before the return of boar to Dartmoor can be assessed as a positive or negative thing, Larsen-Daw added: “The fate of the wild boar on Dartmoor should not be a kneejerk response based on a black and white view of wild boar being good or bad in the modern UK landscape. The first step should be to ascertain what is happening and what it could mean for nature and people.”

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Rangers corral feral pigs thought to have been released in Cairngorms

Libby Brooks, 11 Feb 2025

<https://www.theguardian.com/world/2025/feb/11/rangers-search-for-feral-pigs-thought-to-have-been-released-in-cairngorms>

Animals suspected of being illegally left in ‘extremely harsh’ environment near where lynx were found last month.

A herd of feral pigs believed to have been illegally released in the Cairngorms have been successfully corralled by estate workers who are now attempting to trap them.

The animals were first spotted near the Uath Lochans area, close to the village of Insh and only 5 miles from where four lynx were illegally released last month. The sighting of the pigs has prompted further concerns about rogue activists intent on rewilding the Highlands by stealth, with local farmers suggesting the area was becoming “a dumping ground”.





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As efforts continued during the day to trap the animals, which appeared to be fairly tame, the Cairngorms national park authority said it condemned any illegal release of animals “in the strongest possible terms”.

The group of nine was corralled into a fenced-off 20-hectare (50-acre) field in the late afternoon after being lured by a trail of maize. A small team of estate and Forestry and Land Scotland (FLS) workers will now try to trap the animals.

Four Eurasian lynx were humanely captured by experts from the Royal Zoological Society of Scotland (RZSS) in early January after they were abandoned near Kingussie, where temperatures plunged as low as -14C, but one subsequently died.

The RZSS said the lynx would have been under great stress after being abandoned in the “extremely harsh” environment.

Wild boar were native to Scotland, but hunted to extinction about 700 years ago. Over the past 10 years, populations of free-roaming feral pigs numbering in the low thousands have become established in Dumfries and Galloway and the Highlands.

These include animals that have escaped from farms, as well as those illegally released into the wild, and hybrids of wild boar and domestic pigs. While not usually aggressive towards humans, a feral pig can weigh up to 100kg and may pose a risk to livestock, wildlife and farmland.

Robert MacDonald, a beef and sheep farmer on the edge of Grantown-on-Spey and chair of the Cairngorms Crofters and Farmers Community, credited FLS for acting quickly but said that the latest illegal release raised serious concerns about “this new phenomenon” of guerilla rewilding and potential copycat incidents.

“I am concerned that the Cairngorms is now seen as a dumping ground from any wild animal. These people are on a mission, but are acting with no consultation with the local people who have to live and work in that landscape and ignorance of the animals themselves.”

Local farmers were particularly concerned about the potential for disease spread, given the unknown provenance of the animals, said MacDonald. He also said that feral pigs regularly damage fences, allowing sheep and cattle to escape, while their rooting behaviour destroys pasture, hay fields, and crops such as barley and oats, with newly planted fields being especially vulnerable.

Scottish Land and Estates (SLE), which supports rural businesses, condemned the “reckless” release, and encouraged anyone with information to contact the police as it coordinated the trapping efforts.

Tom Cameron, Forestry and Land Scotland’s north region area wildlife manager, said the corral trapping system was “for their own welfare and because we don’t know their origin or whether there is the potential for them to spread any disease across domesticated livestock in the area”.

Cameron asked local people to stay away from the area in the meantime. “As we work to do this, we are asking anyone not involved with the operation to stay away from the area so trained staff can do their job and the animals are not unduly stressed or startled.”

The three surviving lynx remain in quarantine in Edinburgh zoo. Last week, the first minister, John Swinney, speaking at the NFU Scotland conference, ruled out the legal reintroduction of lynx.

But conservationists working on a partnership project to set up an approved programme to restore lynx in the region said there was no reason why there could not be a “carefully managed” reintroduction.





Boosting evolution: How humans unintentionally altered the skulls of pigs

Martin-Luther-Universität Halle-Wittenberg, Germany, February 10, 2025

<https://www.sciencedaily.com/releases/2025/02/250210132910.htm>

Summary:

Short snouts and a flat profile -- within a span of 100 years, humans have significantly changed the shape of the skulls of German domestic pigs. This is likely down to new breeding practices introduced at the beginning of the 20th century. The researchers analyzed 3D scans of 135 skulls of wild boars and domestic pigs from the early 20th and 21st centuries. Surprisingly, the same effects can even be observed in species that were kept separately.

Short snouts and a flat profile -- within a span of 100 years, humans have significantly changed the shape of the skulls of German domestic pigs. According to a team from Martin Luther University Halle-Wittenberg (MLU), this is likely down to new breeding practices introduced at the beginning of the 20th century. Their findings have been published in the journal Royal Society Open Science. The researchers analysed 3D scans of 135 skulls of wild boars and domestic pigs from the early 20th and 21st centuries. Surprisingly, the same effects can even be observed in species that were kept separately.

Humans have been keeping pigs as livestock for several centuries.

During this time, the animals have changed considerably. For example, they have become larger and have lost their black and brown bristles and darker skin tone.

"The demand for pork in Germany increased significantly at the beginning of the 20th century and breeders were encouraged to optimise their animals. They needed them to grow quickly, provide good meat, and be fertile," explains Dr Renate Schafberg, Head of the Domestic Animal Collection at MLU.

For the current study, she and Dr Ashleigh Haruda from Oxford University analysed 135 skulls from three different breeds: Deutsches Edelschwein, Deutsches Landschwein -- and wild boars, who acted as a control group.

The skulls were either from the early 20th century or were only a few years old.

The two domestic pig breeds exhibited significant changes: the animals' snouts became significantly shorter and flatter, while the skulls of the more contemporary animals no longer had a slightly outwardly curved forehead.

"We didn't expect such pronounced differences to appear within a span of only 100 years," says Schafberg.

Remarkably, both breeds of domestic pig underwent the same changes, despite being kept separately.

"These changes occurred even though breeders did not select the animals specifically for their skull shape, as this trait was not important for breeding. Instead, the changes appear to be an unintended by-product of selecting the desired traits," says Schafberg.

Another reason for the alterations could be related to changes in the animals' diet.

Nutrition is known to influence the growth and development of animals.

Today, pigs are mainly fed pellets that are high in protein.

In contrast, the skulls of wild boars, who remain omnivores, have not undergone such changes.

The findings demonstrate how strongly humans can influence the evolution of animals.





"Charles Darwin assumed that long periods of time -- millions of years -- are required for major changes to take place. Our work is further proof that humans can greatly accelerate this process through selective breeding," says co-author Dr Frank Steinheimer, Head of the Central Repository of Natural Science Collections at MLU.

Journal Reference:

A. Haruda, A. Evin, F. Steinheimer, R. Schafberg. Evolution under intensive industrial breeding: skull size and shape comparison between historic and modern pig lineages. Royal Society Open Science, 2025; 12 (2) DOI: 10.1098/rsos.241039

Wild boars could be a potential source of hepatitis E transmission to humans in the Barcelona metropolitan area

University of Barcelona, November 26, 2024

<https://www.sciencedaily.com/releases/2024/11/241126135455.htm>

Summary:

Over the last few decades, wild boar populations have increased in the urban areas of Barcelona and in other parts of Catalonia. This wild animal is an important reservoir of the hepatitis E virus. Now, a team has identified a relevant molecular similarity between the hepatitis E virus (HEV) strains of wild boars in the metropolitan area of Barcelona and the citizens of this area. According to the researchers, these data suggest that these animals could be a source of human hepatitis E infections in the metropolitan region.

Over the last few decades, wild boar populations have increased in the urban areas of Barcelona and in other parts of Catalonia. This wild animal is an important reservoir of the hepatitis E virus, the disease causative agent that affects more than 20 million people every year, according to the World Health Organization (WHO). Now, a team from the Faculty of Biology, the Institute for Research on Biodiversity (IRBio) of the University of Barcelona and the Faculty of Veterinary Medicine of the Universitat Autònoma de Barcelona (UAB) has identified a relevant molecular similarity between the hepatitis E virus (HEV) strains of wild boars in the metropolitan area of Barcelona and the citizens of this area. According to the researchers, these data suggest that these animals could be a source of human hepatitis E infections in the metropolitan region.

Jordi Serra-Cobo, lecturer at the UB's Faculty of Biology and researcher at IRBio, has co-lead the study with Maria Isabel Costafreda, lecturer at the Department of Genetics, Microbiology and Statistics, and researcher at the UB Nutrition and Food Safety Institute (INSA) and the Liver and Digestive Diseases Networking Biomedical Research Centre (CIBEREHD). Jordi Serra-Cobo warns that "the results should serve to take preventive measures and be watchful against possible transmission of the hepatitis E virus from wild boars to the citizens of the Barcelona metropolitan area." The study, published in *Science of The Total Environment*, also involved Abir Monastiri and Marc López-Roig (IRBio), and Maria Costafreda, along with other researchers from the Banc de Sang i Teixits (Blood and Tissue Bank of Catalonia), the Vall d'Hebron Research Institute (VHIR), the University of Lleida and the Wildlife Ecopathology Service (UAB).

An endemic virus in the wild boar population

The metropolitan area of Barcelona is made up of thirty-six municipalities, spread over 636 km² and populated by around 3.2 million people. This area, which includes the Collserola natural park





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-- a peri-urban Mediterranean forest of 8,000 hectares, surrounded by urban centres -- has a wild boar population density of between five and fifteen individuals per square kilometre.

In the study, the researchers analysed the faeces of 312 wild boars collected in this region between 2016 and 2021, seven of which tested positive for the presence of the virus. The comparison of these samples, together with six additional samples from a previous study, has made it possible to establish "a close phylogenetic relationship" -- that is, evolutionary kinship and genetic similarity -- with the HEV strains from blood donors in this area. Serra-Cobo, a member of the UB's Department of Evolutionary Biology, Ecology and Environmental Sciences, notes that "all the isolated viruses were classified within genotype 3 of HEV."

Moreover, the wild boar samples with the virus belonged to non-adult individuals, which, according to the researchers, indicates the endemic -- that is, habitual and permanent -- maintenance of HEV in the wild boar population of the metropolitan area by young individuals. In this sense, they explain that "the lack of HEV detection in adult wild boars suggests that young animals are exposed to infection by the virus in the first years of life, while adults have already overcome the infection and are protected from reinfection." "This suggests that the virus is endemic in the wild boar population in this region," add the researchers.

A global public health problem

The growing presence of wild boars in the urban areas of Barcelona (but also in other cities such as Lugo, Rome, Berlin, Genoa or Hong Kong) is mainly due to factors such as the loss of natural habitats induced by human activities. "Given that the synurbization -- the presence and adaptation of wild boar in urbanized environments -- of wild boar is a global phenomenon, which is increasing and expanding, the results of this study should be useful to develop and establish programmes for monitoring, surveillance and, eventually, control of HEV both in the metropolitan area of Barcelona and in other urban areas of the world," says Serra-Cobo.

In the article, the experts explain that "although most human cases of hepatitis E are mild, HEV infection causes approximately 50,000 human deaths each year, and is particularly serious in pregnant women, with mortality rates of up to 30%, and can be transmitted to infants."

Prevention and information measures

Among the measures to prevent transmission of the hepatitis E virus to the public, the researchers stress the importance of avoiding "contact with wild boars, as well as not eating their raw or undercooked meat." In cases where contact has occurred, such as with hunters or forestry agents, they recommend washing hands with soap and water. "This practice removes the lipid envelope of the virus and inactivates it," they note.

They also highlight other measures related to pets. "Wild boars can invade the streets of central Barcelona, where they find food in rubbish bins or urban gardens. These spaces are frequented by dogs and cats, which can become infected with wild boar faeces and can contribute to spreading the infection to citizens," warns Jordi Serra-Cobo.

In this regard, they recommend preventing household pets from coming into contact with wild animal faeces and installing systems to prevent wild boars from knocking over waste containers. The researchers also note that "it is also important to tell the public about the risk factors for the transmission of hepatitis E from wild boars, either to humans or to pets."

Long-term monitoring of wild boars

The IRBio research group at the UB has another study underway to determine the dynamics of hepatitis E virus infection in the wild boar population in the metropolitan area of Barcelona. The researcher also stresses the "fundamental importance" of a long-term follow-up and monitoring of





the health status of the wild boar population, "especially at a time when the structure and functioning of ecosystems are changing at an unprecedented rate, as a result of climate change and anthropogenic factors."

Journal Reference:

Laia Ruiz-Ponsell, Abir Monastiri, Marc López-Roig, Sílvia Saulea, Marta Bes, Gregorio Mentaberre, María Escobar-González, Maria I. Costafreda, Jorge R. López-Olvera, Jordi Serra-Cobo. Endemic maintenance of human-related hepatitis E virus strains in synurbic wild boars, Barcelona Metropolitan Area, Spain. *Science of The Total Environment*, 2024; 955: 176871 DOI: 10.1016/j.scitotenv.2024.176871

Genetics help combat illegal movement of feral swine

Gail Keirn and Tim Smyser, USDA Wildlife Services, May 21, 2024

https://wildlife.org/genetics-help-combat-illegal-movement-of-feral-swine/?utm_medium=email&_hsenc=p2ANqtz-9_12cCqB11A_2-b_ly4Nw1t3975JiMO0mL-RXgj2x9I6t1wJIYOKI3RdbUcDA205c3Y3WOitDayObanJnYKyoVQ1ZrQ&_hsmi=308427077&utm_content=308427077&utm_source=hs_email

When the gate swings open on a trailer, it doesn't take long for wild pigs to pour out into their new environment. Experts are not sure how often people move wild pigs, but they know it is contributing to the spread of invasive wild pigs (*Sus scrofa*) across the United States.

The illegal transportation of wild pigs (also known as feral swine) for hunting purposes has contributed to the rapid expansion of this invasive species across to the United States over the past 40 years. They are now reported in at least 35 states. To help curb the spread of these invasive animals, multiple states have passed laws prohibiting their possession or transport. However, the similarities between domestic pigs and invasive wild pigs pose a challenge to enforcing these regulations.

"Sometimes it can be difficult to distinguish a domestic pig from an invasive wild pig just by looking at them," said NWRC geneticist Dr. Tim Smyser. But genetic analysis shows that about 97% of invasive wild pigs (*Sus scrofa*) in the U.S. are hybrids of wild boars and domestic pigs, Smyser said.

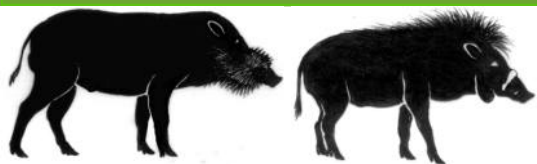
That has allowed NWRC researchers and partners to exploit the wild boar ancestry found in most invasive pigs to differentiate them from domestic pigs. Approximately 1,400 samples from 33 domestic breeds and 16 wild boar populations were genotyped and sorted into five genetically cohesive reference groups: mixed-commercial breeds, Durocs, heritage breeds, primitive breeds and wild boars.

Then, researchers used well-established genetic clustering techniques to evaluate the likelihood that some level of wild boar hybridization took place.

"The technique we developed basically allows wildlife managers and law enforcement officials to collect a genetic sample from a captured pig, genotype it and determine how likely it is that the pig descended from one of the domestic breed lineages, a pure wild boar lineage or a hybrid of the two," Smyser said.

Researchers evaluated the discriminatory power of this approach using simulated genotypes and real data from an additional 29 breeds of domestic pigs and more than 6,500 invasive wild pig samples. All the simulated and real data from domestic pigs fell within the statistical distribution of





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the domestic pig reference groups, while 74% of the wild pig data exceeded the maximum threshold for the domestic pig reference groups and could be statistically classified as having wild boar ancestry.

“The ability to curtail illegal translocations of invasive wild pigs is an important part of reducing their spread and damage to the economy and the environment,” Smyser said. “This new genetic and statistical approach will aid in the enforcement of prohibitions on wild pig movement and introduction.”

Has the Moo Deng craze helped wild pygmy hippos at all?

Jeremy Hance, 3 Feb 2025

<https://news.mongabay.com/2025/02/has-the-moo-deng-craze-helped-wild-pygmy-hippos-at-all-analysis/>

Moo Deng, a baby pygmy hippo, became an overnight sensation online. Videos of her were watched by millions.

But conservationists say that popularity hasn’t resulted in any change on the ground for wild pygmy hippos, which are down to fewer than 2,500 animals in the wild.

The Khao Kheow Open Zoo, where Moo Deng is housed, says it is working on a partnership with a conservation group to support research in the wild.

2024 was a chaotic year. The year was, once again, the warmest on record globally, according to the World Meteorological Organization, with multiple climate disasters around the globe. The year was also the third since Russia had invaded Ukraine, it saw 12 months of bombing in Gaza by Israel and 10 million were displaced in Sudan due to war. The year also saw hugely important elections in many nations, including Indonesia, France, India, the U.K. and the U.S. Is it any wonder that millions of people turned to a pugnacious baby pygmy hippo for a little relief?

Moo Deng was born July 10, 2024, at the Khao Kheow Open Zoo in Bang Phra, Thailand. In September, the baby went viral, becoming famous for her playful, no-holds-barred attitude. She appears to enjoy mouthing the boots of her keeper, chasing water from a hose and, of course, like all babies, sleeping. And, yes, she’s even cute when she does that. Moo Deng became such a phenomenon that zoo attendance doubled and the Khao Kheow Open Zoo has said they plan to copyright her cute image. The phenomenon was international: She even appeared in a Saturday Night Live skit in the U.S. and got her own theme song in Thai. The Moo Deng story hasn’t been without some controversy, but in a chaotic year it was largely a wholesome treat for world-weary viewers.

But there is another side to this story. After all, Moo Deng is a pygmy hippo (*Choeropsis liberiensis*), an endangered species with fewer than 2,500 surviving in the world (in other words, there are 3.5 million people in the world for every single pygmy hippo left). The species is currently decreasing and in very real danger of disappearing altogether. Only a few conservation groups are working directly with the pygmy hippo. So, that begs the question: Has the Moo Deng phenomenon helped wild pygmy hippos at all? Has it increased awareness? Or, far more importantly, has it increased funding for wild pygmy hippos?

“Not yet,” says Elie Bogui, a coordinator for the Taï Hippo Project in Côte d’Ivoire. The project, a partnership of the Swiss Center for Scientific Research and the Institute for Breeding Rare and Endangered African Mammals (IBREAM), involves research and monitoring the pygmy hippos in





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Tai National Park in the West African country as well as working with local communities.

“Pygmy hippos are not very popular,” says Neus Estela, a technical specialist with Fauna & Flora in Liberia. Fauna & Flora works with pygmy hippos across six parks or proposed protected areas in Liberia and Guinea by aiding the government in managing the ecosystems and monitoring pygmy hippo populations among other species. Given that Liberia likely has the largest populations of pygmy hippos in the world, Fauna & Flora’s work covers more pygmy hippos than any other group.

Yet, Estela says, due to their lack-of-popularity globally, pygmy hippos don’t receive targeted funding, unlike elephants, chimpanzees and pangolins in the region, but instead “benefit more from general conservation efforts.”

Bogui and Estela say the same thing: They have seen no material funding or support, as yet, from the Moo Deng phenomenon, highlighting how fame for an individual animal in our Meme Age doesn’t necessarily mean aid for its species.

However, Khao Kheow Open Zoo says it is putting together a plan to help wild pygmy hippos. Wanlaya Tipkantha, the head of the zoo’s Animal Health, Research and Conservation Institute, says the team is currently working with IBREAM to develop a partnership to “promote and support” the Tai Hippo Project on the ground. They hope to help the group purchase GPS collars that could track the movements of wild pygmy hippos for the first time.

Tipkantha says they will share “details” once an agreement is reached.

“Animals in zoos and aquariums can act as ambassadors for their counterparts in the wild,” says the CEO of The World Association of Zoos and Aquariums (WAZA), Martín Zordan, adding, “by housing them in zoos, we have the opportunity to raise awareness about the species’ struggles in the wild while also offering visitors a chance to connect with the hippos.”

Wild pygmy hippo plight

The pygmy hippo is the only other surviving species in the Hippopotamidae family aside from the much better known common hippo (*Hippopotamus amphibius*). Unlike its big, impossible-to-miss relative, the pygmy hippo lives a reclusive life deep in the rainforest.

Another population of pygmy hippo, potentially comprising a distinct subspecies — Heslop’s pygmy hippo (*C. liberiensis heslopi*) — used to inhabit the Nigerian Delta, but it has not been seen since the 1940s and many believe it extinct. Our planet used to contain numerous other species of small hippos on Mediterranean islands, such as Sicily and Crete, before humans likely hunted them to extinction.

While the IUCN estimates fewer than 2,500 individual pygmy hippos remain in the wild, Estela says this number may be wrong.

“These statistics are very simple,” she says. “We don’t really know.”

Across the pygmy hippo’s full range, deforestation is the biggest concern. According to the IUCN, remaining forests are often fragmented, isolating hippos and leading to less gene flow.

“There is now very little, if any, undisturbed forest in the region safe for wildlife,” reads the IUCN Red List status. Forests are falling for agriculture and mining.

In Tai National Park, Bogui says the biggest threat is illegal gold mining inside the park, which is destroying forests and polluting waterways.

Estela says they have also “confirmed high levels of mercury” in Sapo National Park’s waterways — the only national park so far in Liberia — due to gold mining.

Poaching is another problem, but Estela says it’s largely opportunistic, as pygmy hippos are hard to hunt given their nocturnal lifestyle and low density. However, snaring remains a concern.





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Given how few people are working on this species, Gabriella Flacke, a veterinarian with the IUCN SSC Hippo Specialist Group, says one “major threat” to the species is the lack of “financial and logistical resources (manpower, infrastructure, supplies) to provide appropriate protection for the minimal remaining tracts of protected habitats ... throughout [the pygmy hippo’s] range.”

She adds that “burgeoning local human populations are another threat, in that this leads to habitat loss.”

Raising awareness

Zordan, the CEO of WAZA, says the group has not analyzed the impact of the Moo Deng phenomenon, but “we do know that moments like these, where people form connections with individual animals, can have a profound effect on raising awareness.”

But has it actually raised awareness, or are people just watching cute animal videos without learning a thing? Anecdotally, the sudden popularity of Moo Deng has seemed to raise some awareness among the public — if only of the species’ existence in the first place.

“The only thing it seems to have done is to generally make more people aware that pygmy hippos actually exist (most people don’t, or didn’t, know that there are two types of hippos),” Flacke says. Estela agrees, saying she doesn’t think most people know where pygmy hippos live, even if they have enjoyed Moo Deng videos. But Fauna & Flora says it has received an uptick in the number of visitors at its pygmy hippo page.

Even Tipkantha says the zoo hasn’t seen rising awareness “for now.” But the zoo is planning “to monitor the public awareness” after it announces its partnership with the Tai Hippo Project.

Flacke says Moo Deng has led several media outlets to do interviews with her in which she attempted to “highlight the plight of the species.” But, she says, “I don’t think the average citizen is more concerned or more involved in conservation efforts as the result of Moo Deng.”

Should zoos have some responsibility for wild conservation?

All this raises the question: How responsible should zoos be for conservation of wild species? It’s a debate that’s been ongoing for decades, but increasingly zoos are putting money into conservation projects in the wild. That said, Moo Deng is a distinct phenomenon; most zoo animals don’t garner such a rapid and intense following or one that has brought such sudden success, and spotlight, to the zoo.

“Our member zoos are expected to make meaningful contributions to conservation of wild species and wild places as outlined in our conservation strategy,” says WAZA CEO Zordan.

WAZA is a global organization that sets standards for member zoos and aquariums, including around animal welfare and conservation, both in captivity and supporting outside conservation projects. Khao Kheow Open Zoo is a member of WAZA.

Zordan says members have recently agreed on a new resolution in line with the Convention on Biological Diversity aimed at “actively and increasingly contributing to halting extinctions, reversing declines, restoring populations and securing a future for threatened species as well as reporting on these.”

It’s been just over six months since Moo Deng was born — and no one expects a miracle overnight. But if Moo Deng’s global and stunning popularity can go some way toward aiding her brethren in the wild, it would be a major win for a long-neglected species. The question is: Will it happen?





‘I set a goal to make her famous’: the baby pygmy hippo who became a giant online

Rebecca Ratcliffe, 13 Sep 2024

<https://www.theguardian.com/world/2024/sep/13/moo-deng-hippo-tiktok-khao-kheow-open-zoo-thailand-viral>



Moo-Deng Photograph: khamoo.andthegang/ instagram

Moo-Deng from Khao Kheow Open Zoo in Thailand has amassed a legion of fans thanks to her viral fame across TikTok, Facebook and Instagram.

A two-month-old pygmy hippo has become an internet sensation across Thailand and beyond after footage went viral online of her wobbling around her enclosure, nibbling her zookeeper and being sprayed with water.

Moo-Deng has captured hearts

across Asia. Fans have made cakes in her image and artworks showing off her cartoonish rosy cheeks and bright eyes. One cosmetics chain even jumped on the trend, telling social media users to “wear your blush like a baby hippo” in posts promoting products in pink and peach tones. In a reflection of her growing global clout, Time magazine’s website named her an “Icon” and “Legend”, saying “She Is the Moment”.

Her fame stems from a TikTok account with 2.5 million followers dedicated to the hippos and other species at Khao Kheow Open Zoo in Chonburi, Thailand. Hundreds of thousands of people also follow accounts documenting their daily life on Facebook and Instagram.

Atthapon Nundee, 31, a zookeeper at Khao Kheow Open Zoo, said he began posting clips of animals on social media during the pandemic, when he found he had more spare time on his hands. Moo-Deng, whose name means “bouncy pork”, also the name of a Thai dish, has attracted the most attention by far.

“The moment I saw Moo-Deng born, I set a goal to make her famous, but I never expected it would spread abroad. I thought she could be famous in Thailand but not internationally,” he said.

Tourists’ social media videos have helped her achieve fame online, but so too has her character, he said. “She is called ‘bouncy’ and she is quite ‘bouncy’ too,” Atthapon said. Her siblings are also called variations of pork dishes: her half-sister is called Moo Wan (Thai sweet pork), her other half-sister is called Pha Lor (pork belly stew), and her brother is called Moo Tun (stewed pork).

Her popularity has created a surge in visitors to the zoo, which has raised concerns about her welfare. Tourists were accused of throwing water and seashells at Moo Deng to wake her, apparently because they wanted to take photos.

The zoo authorities have condemned those who have tried to disturb Moo-Deng. Atthapon said CCTV has been installed and an officer is present to watch over her.

“Most of the time she is sleeping,” said Atthapon, who added her behaviour is similar to a human baby, with playful outbursts and lots of rest. “She only has milk from mom, she doesn’t eat anything else besides milk.” At two months old, she already weighs more than 20kg, and it is





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possible that she will begin to eat grass next month.

Adult pygmy hippos also like to sleep a lot during the day. "Mostly they just sleep and soak in the water because it gets quite hot," Atthapon said.

Pygmy hippos are listed as endangered on the IUCN Red List. A 1993 study suggested there were between 2,000 to 2,5000 pygmy hippos remaining in the wild. They are native to West Africa, where they live in swamps and near rivers, but are threatened by habitat loss due to human activities such as logging, mining, as well as hunting.

Edwin Wiek, founder of Wildlife Friends Foundation Thailand, questioned the need for more pygmy hippos to be kept in zoo settings, where they have already been bred successfully, saying the focus should be on keeping them in the wild. "They are very endangered, but actually, with the proper enforcement and conservation plan in the wild – leave them alone, they can do really well." Atthapon said the zoo keeps Moo-Deng and other animals as close to nature as possible, and that zoos contribute to conservation work.

"I hope that the cuteness of Moo-Deng will raise awareness for people to come and learn about [the species]," Atthapon said.

Hippos 'vulnerable' as gaps in data hinder conservation efforts

University of Leeds, December 13, 2024

<https://www.sciencedaily.com/releases/2024/12/241213125255.htm>

Summary:

A new database of African hippo populations has revealed huge gaps in our knowledge of where the megaherbivores live and thrive, with populations fragmented and reliant on protected areas.

A new database of African hippo populations has revealed huge gaps in our knowledge of where the megaherbivores live and thrive, with populations fragmented and reliant on protected areas.

Hippos are classified as "vulnerable to extinction" by the International Union for the Conservation of Nature (IUCN) Red List and have been called the "neglected megafauna," with a lack of scientific attention and much less research into their lives and habitats than other large mammals. University of Leeds School of Biology Postgraduate Researcher Hannah Lacy has developed a spatial database of distribution and population estimates for common hippos across southern Africa. She has uncovered gaps in data on where hippos are present across the region, with some areas lacking population estimates altogether.

On top of this, different survey methods used across countries and regions has made monitoring less reliable, with different levels of funding across African states causing a lack of consistency. In some cases, hippo populations were noted as an incidental finding while researchers were focusing on other species, meaning the data is not comprehensive.

Ms Lacy said: "Without reliable information on where hippos live, and the state of their populations, it is challenging to effectively plan to protect them.

"We need a centralised spatial database and coordinated surveys to improve the conservation of common hippos -- who are important ecosystem engineers -- across southern Africa."

As semi-aquatic animals, hippos play a significant and unique part in the ecosystems that support other animals in their surroundings.

She added: "Their feeding habits shape vegetation patterns along water courses, and their dung





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contributes to aquatic food webs, supporting species like fish and invertebrates. In many regions, they are also an important attraction for eco-tourism, which contributes to local economies and livelihoods. However, despite their ecological, social, and economic importance, common hippos face numerous threats, primarily from human activities."

Over the last century hippo populations have been hit hard by habitat loss, poaching and conflict with humans. Overall crude population estimates vary from 60,000 to 87,000 in southern Africa, so accurate data on where the animals live and thrive -- including geographic range maps and population estimates -- is crucial for effective conservation efforts.

The research found that where hippo populations are known to exist, they often rely on cross-border protected areas known as Transfrontier Conservation Areas (TFCAs), which shows just how important and impactful international collaboration is for successful conservation efforts.

While these protected areas provide an important home for hippos, populations that are cut off from other hippos and only able to breed within a small gene pool are at risk of becoming genetically isolated.

Ms Lacy's research, published in the journal *Biological Conservation*, was carried out by studying nearly 200 records from across nine countries in southern Africa -- Angola, Zimbabwe, Zambia, Malawi, Mozambique, Botswana, Namibia, South Africa and Eswatini -- including records from other research literature, reports from government bodies and charities, websites, and aerial surveys, dating from 2003 to 2023.

Now she is calling for coordinated surveys and a centralised database to improve hippo conservation efforts and outcomes across the region. A similar African Elephant Database managed by the IUCN African Elephant Specialist Group has become an important tool for protecting elephant populations across the continent.

PhD supervisor Dr Lochran Traill backed Ms Lacy's research, saying: "The work provides an update on the distribution of common hippo populations across southern Africa, and highlights the extent of population fragmentation and isolation. Hopefully, this information will be useful to conservation decision makers."

Journal Reference:

Hannah Lacy, Maria Beger, Lochran W. Traill. Present distribution of common hippopotamus populations in southern Africa, and the need for a centralised database. *Biological Conservation*, 2025; 301: 110878 DOI: 10.1016/j.biocon.2024.110878

Unravelling an ancient European extinction mystery: Disappearance of dwarf megafauna on palaeolithic Cyprus

Flinders University, September 17, 2024

<https://www.sciencedaily.com/releases/2024/09/240917195402.htm>

Summary:

Scientists have unravelled a mystery about the disappearance of dwarf hippos and elephants that once roamed the picturesque landscape on the Mediterranean island of Cyprus before palaeolithic humans arrived. Cyprus only had two species of megafauna present during the Late Pleistocene -- the 500-kg dwarf elephant (*Palaeoloxodon cypriotes*), and the 130-kg dwarf hippo (*Phanourios minor*), but both species disappeared soon after humans arrived around 14,000 years ago.





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Scientists have unravelled a mystery about the disappearance of dwarf hippos and elephants that once roamed the picturesque landscape on the Mediterranean island of Cyprus before palaeolithic humans arrived.

Cyprus only had two species of megafauna present during the Late Pleistocene -- the 500-kg dwarf elephant (*Palaeoloxodon cypriotes*), and the 130-kg dwarf hippo (*Phanourios minor*), but both species disappeared soon after humans arrived around 14,000 years ago.

In examining the reasons behind the extinction of these prehistoric animals, research funded by the European Regional Development Fund and the Republic of Cyprus through the Research and Innovation Foundation for project MIGRATE found that palaeolithic hunter-gatherers on Cyprus could have first driven dwarf hippos, and then dwarf elephants to extinction in less than 1000 years. The research was led by Flinders University's Professor Corey Bradshaw.

These findings refute previous arguments that suggested the introduction of a small human population on the island could not have caused these extinctions so quickly.

The researchers built mathematical models combining data from various disciplines, including palaeontology and archaeology, to show that palaeolithic hunter-gatherers on Cyprus are most likely the main cause of the extinction of these species due to their hunting practices.

Professor Bradshaw, with Drs Theodora Moutsiou, Christian Reepmeyer, Frédéric Saltré, and Stefani Crabtree, used data-driven approaches to reveal the impact of rapid human settlement on driving the extinction of species soon after their arrival.

Using detailed reconstructions of human energy demand, diet composition, prey selection, and hunting efficiency, the model demonstrates that 3,000-7,000 hunter-gatherers predicted to have occurred on the island were likely responsible for driving both dwarf species to extinction.

"Our results therefore provide strong evidence that palaeolithic peoples in Cyprus were at least partially responsible for megafauna extinctions during the Late Pleistocene and early Holocene. The main determinant of extinction risk for both species was the proportion of edible meat they provided to the first people on the island," says lead author, Professor Corey Bradshaw of Flinders University.

"Our research lays the foundation for an improved understanding on the impact small human populations can have in terms of disrupting native ecosystems and causing major extinctions even during a period of low technological capacity."

Predictions in the model matched the chronological sequence of megafauna extinctions in palaeontological records.

Dr Moutsiou says that "Cyprus is the perfect location to test our models because the island offers an ideal set of conditions to examine whether the arrival of populations of humans ultimately led to the extinction of its megafauna species. This is because Cyprus is an insular environment and can provide a window back in time through our data."

Previous findings by Professor Bradshaw, Dr Moutsiou, and collaborators have shown that large groups of hundreds to thousands of people could have arrived on Cyprus in two to three main migration events in less than 1000 years.

Journal Reference:

Corey J. A. Bradshaw, Frédéric Saltré, Stefani A. Crabtree, Christian Reepmeyer, Theodora Moutsiou. Small populations of Palaeolithic humans in Cyprus hunted endemic megafauna to extinction. *Proceedings of the Royal Society B: Biological Sciences*, 2024; 291 (2031) DOI: 10.1098/rspb.2024.0967





The cocaine kingpin's wildest legacy: what can be done with Pablo Escobar's marauding hippos?

Joshua Hammer, 27 Aug 2024

<https://www.theguardian.com/world/article/2024/aug/27/cocaine-kingpin-wildest-legacy-pablo-escobar-marauding-hippos-colombia>

The Colombian drug lord's exotic menagerie fell apart after his death, and now wild hippos are breeding out of control.

In the steamy heat of the afternoon, Yamit Diaz Romero steered our motorised longboat around overhanging bamboo branches and islets in the Claro Cocorná Sur River in Colombia. Red howler monkeys swung from the cables of a footbridge and screeched in the jungle. Herons, snowy egrets, brown pelicans and parakeets darted across the coffee-coloured water and soared over our heads. The river is known as a destination for whitewater rafting. But these days it's also become the scene of a more unsettling natural phenomenon.

Joining me on the vessel was Alejandro Mira, a veterinarian from Medellín, and Joshua Wilson, an American jiu-jitsu champion and world traveller who had hitched a ride with Mira and me and was sharing the experience with his followers on social media. Fishers motoring from the opposite direction gave warnings to Romero about what lay ahead. After an hour, the Claro Cocorná spilled into the Magdalena River, the longest in Colombia, which originates in the Andes and flows north for 1,600km before emptying into the Caribbean Sea.

Romero, a solid man with black-framed spectacles and a pink camouflage shirt, scanned the river and pointed straight ahead. Near the opposite bank, about 250 metres away, three pairs of grey ears flicked, and beady eyes darted above the water line. The boatman circled cautiously, then winced when Wilson suddenly launched an aerial drone and banged on the boat's gunwale to get the animals' attention. One raised a gigantic, bulbous head and opened its mouth, exposing a sharp set of canines. "Tourists think this is cute," Romero told me in Spanish. "But it's a sign of aggression."

You might not expect to encounter wild hippopotamuses, the huge, semiaquatic mammal native to sub-Saharan Africa, in the rivers – and ponds, swamps, lakes, forests and roads – of rural Colombia. Their increasingly ubiquitous presence here is an unlikely legacy of Pablo Escobar, the infamous drug baron from Medellín. Decades ago, Escobar spent part of his vast fortune assembling a menagerie of exotic animals, including elephants, giraffes, zebras, ostriches and kangaroos, at his hacienda outside Doradal, a town about 10 miles west of the Magdalena. After he was shot dead in Medellín by Colombian police in 1993, local people poured on to the property and tore apart Escobar's villa in search of rumoured caches of money and weapons. Afterward, the hacienda sank into ruin. In 1998, the government seized the property and eventually transferred most of the animals to domestic zoos. But several hippos – most sources say three females and one male – were considered too dangerous to move. And that's how Colombia's current trouble began.

The hippos multiplied. (Once they reach maturity, female hippos can produce a calf every 18 months, and they can give birth 25 times during a lifespan of 40 to 50 years.) Males cast out of the herd by the dominant male migrated elsewhere, started their own herds and took over new territory. Today nobody knows how many hippos inhabit the rivers and lakes of the Magdalena





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Basin, which covers roughly 260,000 sq km and is home to two-thirds of Colombia's human population. As of late 2023, the official government count was 169. David Echeverri López, chief of the Biodiversity Management Office of Cornare, a regional environmental agency, says there could be 200. Colombian biologists recently predicted that by 2040, if nothing is done to control their breeding, the population will grow to as many as 1,400. The hippos will use the Magdalena River as their primary expansion route, says Francisco Sánchez, an environmental official in the riverside municipality of Puerto Triunfo, which includes Doradal. "They'll get all the way to the sea, because they will just follow the river." He calls the situation "completely out of control".

The presence of these beasts in the heart of South America, waddling at night down rural paths and staring into the headlights of jeeps and motorcycles, might be comical if it weren't so deadly. In Africa, hippos are thought to kill about 500 people a year, making them among the most dangerous animals to humans, according to the BBC and other sources. And while, for now, violent encounters in Colombia have been limited, unsettling incidents are increasing. The beasts have attacked farmers and destroyed crops. Last year, a car struck and killed a hippo crossing a highway. (Hippos tend to spend daytime hours in the water and move around land at night, adding to a menacing sense of danger striking in the dark.) This wasn't long after a hippo lumbered into the yard of a school, sending frightened teachers and children running for cover. The animal munched on fruit that had fallen from trees before shuffling off to nearby fields. Although nobody was hurt, the incident was widely covered in the Colombian media, increasing pressure on the authorities to do something.

The danger is hardly limited to people. Colombian scientists are sounding alarms about the impact on the region's ecosystem. For example, a single hippo produces up to 9kg of faeces a day. In Africa, the dung long provided nutrients for fish populations in rivers and lakes, but in recent years, perhaps as a consequence of warming temperatures, water-intensive agriculture and increasing drought, the dung has accumulated to toxic levels in stagnating pools, killing off the same aquatic life that once benefited from it. Experts fear the same thing could happen in Colombia. And competition for food and space could displace otters, West Indian manatees, capybaras and turtles. "If I lived in Colombia, I would be worried," Rebecca Lewison, an ecologist at San Diego State University's Coastal and Marine Institute, told me. "Colombia has great biodiversity, and this is not a system that has evolved to support a mega-herbivore."

This bizarre problem is compelling Colombian conservationists to search for unusual solutions, which is one reason I found myself with Mira on the Magdalena, staking out unsuspecting hippos. Mira is a member of a newly formed, first-of-its-kind animal control programme, which seeks not to capture or "cull" the hippos, but to sterilise them in the wild. The procedure, an invasive surgical castration, is medically complicated, expensive and sometimes dangerous for hippos, as well as for the people performing it. After successfully piloting the programme last year, the team sterilised seven hippos in three months – a considerable achievement, but short of the estimated 40 castrations a year that they believe will be necessary to control the population. "There have been sterilisations in zoos, but no information was available about doing this in the wild," Mira told me. "We basically had to learn it as we went along."

As we circled the hippos, Romero, the boatman, kept a judicious distance. Mira and I had come, during a hiatus in the castrations, to see for ourselves the growth of the population, but viewing hippos in the wild can be risky. Half an hour into our excursion, the boat engine abruptly died. Romero yanked on the pull cord. The motor responded with a sputter. He yanked again – nothing. With mounting frustration, and sweat pouring down his face, the boatman tugged and pulled the





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rope. Meanwhile, we drifted towards the hippo pod. The creatures turned toward us, watching. Wilson returned the stare. Then he muttered: “Uh-oh.” Finally, with a powerful jerk, Romero brought the engine back to life, and we slowly motored back in the other direction toward the Claro Cocomá.

When Pablo Escobar appeared in Puerto Triunfo in 1978, the government had just built a two-lane asphalt highway between Medellín and the Magdalena River, making the jungled region far more accessible. The 28-year-old Escobar identified himself as a “businessman” and announced that he was looking to buy property. “There was very good tree cover and good water resources,” Sánchez, the local environmental official, said, as we sat in Puerto Triunfo’s riverfront town hall, where he has worked for more than three decades. “It was the perfect place to build a retreat.” After a search, Escobar bought a 2,000-hectare property near Doradal.

The drug baron installed a runway, a villa, heliports, aircraft hangars, horse stables, 27 artificial lakes, a dinosaur theme park and a bull ring. He also hired a staff of more than 1,000 people to run the hacienda. In the early 1980s, inspired by other Latin American drug traffickers and drawn to the symbolic power of wild beasts, he reportedly paid exotic animal breeders in Dallas \$2m in cash for the first animals in his menagerie. Many more, including the hippos, were procured from other dealers and possibly zoos. Sánchez told me that he examined the records of Escobar’s transactions in the archives at the town hall, but the documentation was destroyed when the Magdalena River flooded the town in the 1990s.

Escobar was picky about his animals. “He would not buy lions, tigers or other big cats,” Sánchez said. “Taking care of carnivores is very complicated. Just keeping them fed is a tremendous amount of work.” Escobar had also decided to open his menagerie to the public, and he didn’t want predators roaming freely around the grounds. Giving ordinary Colombians access “was a way of making himself popular”, Sánchez said. In the early 80s, crowds stood in line for hours in the heat at the hacienda gates, waiting to board electric vehicles and bounce over the property past elephants, ostriches and other wild beasts. Sánchez did the tour himself in 1982. “There was a female elephant that would put her trunk inside the cars, and people loved her,” he recalled.

Escobar’s days at Hacienda Nápoles didn’t last long. After he was publicly identified as a leader of the Medellín cartel, he went into hiding. In 1984, he dispatched a hit squad to assassinate Colombia’s minister of justice. Five years after that, an unwitting courier carried a bomb on to a Colombian airliner, which blew up mid-flight, killing all 107 people on board. Escobar’s intended victim, presidential candidate César Gaviria Trujillo, had missed the flight; he was later elected president and made the capture or killing of drug traffickers a priority. As Colombia’s security forces hunted the narcotraficante, violence spread across the region. Rightwing death squads known as autodefensas formed an alliance with drug cartels – offering the cartel members protection in return for a cut of their profits – and declared war on the Revolutionary Armed Forces of Colombia (Farc), a Marxist guerrilla group, and its sympathisers. Puerto Triunfo became a centre of the violence, with many people kidnapped and murdered during the late 80s and 90s. After Escobar was shot dead and his property abandoned, the hippos survived on their own, eating the grass, fruits and other plants. Over the years, the population established new pods beyond the hacienda. Reports trickled in that the animals were trampling farmland, attacking cattle and menacing fishing boats.

By 2008, the population had reached about two dozen, and Colombia’s ministry of the environment decided it was time to act. Echeverri López, who had recently graduated from the University of Antioquia in Medellín with a botany degree, was hired to help search for solutions.





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One of his first initiatives was to seek advice from wildlife experts in South Africa, who visited Doradal to investigate. “They told me: ‘You have a problem,’” Echeverri López said, as we sat in a restaurant in Doradal, a lively tourist town four hours east of Medellín. “They said: ‘The only solution is to kill them.’”

The next year, the government hired a hunter to begin culling the hippos, but when a photograph circulated in the media showing the corpse of a male called Pepe, who had wandered 60 miles from Escobar’s hacienda, pro-hippo protests erupted across Colombia. Echeverri López found himself puzzled by the response. “I was saying to myself: ‘Think about how many people are murdered in Colombia every day.’” This was a time when the ongoing civil war was still claiming the lives of more than 1,000 civilians a year. “And then there’s this outpouring of sentiment to protect the hippo. I couldn’t explain it.” In the face of public outrage, the minister of the environment resigned, and hippo killings were put on hold.

Echeverri López was obliged to search for other methods. “I had nothing in my background to suggest I could handle this,” he admitted. Conservation teams prowled the region near Escobar’s hacienda at night, looking for hippos to shoot with tranquilliser darts while they grazed. But it took an hour for the tranquilliser to have an effect, by which time the animal had returned to the water. In 2011, veterinarians managed to anaesthetise and castrate one hippo named Napolitano, 50 miles from Escobar’s former ranch. A military helicopter then transported the unconscious beast in a cage back to the hacienda. But the helicopter’s engine overheated, and the pilot barely made it down safely.

To contain the hippos, Cornare tried cordoning off the hacienda with bushes, barbed wire and electric fences, but the animals kept finding escape routes. The agency approached zoos in India, the Philippines, Ecuador and other countries about adopting the animals, but the plan was criticised by the Hippo Specialist Group of the International Union for Conservation of Nature (IUCN), a Switzerland-based committee of biologists and animal conservationists. A zoo relocation programme, IUCN declared in 2023, “would be extremely costly, have no conservation benefit, and represents a poor use of conservation resources that are critically needed to protect common hippos” in Africa. Cornare’s initiative has yet to result in a single transfer.

“Most captive facilities can’t accommodate them,” says Lewison, the San Diego State University ecologist, who also serves as the co-chair of the IUCN hippo specialist group. “Hippos are difficult to keep, they’re huge, and water filtration” – necessary to account for all the poop – “is expensive. Most zoos that want a hippo have one already, and if they don’t, they don’t have the capacity for it.” Staffers also tried chemically castrating the animals with darts, a procedure used successfully in zoos around the world. But hippos require multiple shots, months apart from each other over two years, and it proved impossible to tag and track the free-ranging animals that had received the first dose. Inside the park near Doradal, they surgically castrated a dozen juvenile hippos, which are more docile and easier to manoeuvre than adults. But that still left an adult population scattered across the Magdalena Basin.

I followed Echeverri López in my vehicle through the gated entrance of Escobar’s former hacienda. In 2007, the Puerto Triunfo municipal government partnered with a private company to turn it into a zoo and safari park – with an all-new animal population – and it’s now Doradal’s main tourist attraction. Garishly painted statues of dinosaurs, hippos and other beasts, some left over from Escobar’s time, loomed along the shoulder of an asphalt road that wound through the rolling pastureland. We walked down a steep slope toward what was once one of Escobar’s artificial lakes, now located outside the grounds, where a dozen hippos lolled in a cluster. “They found a





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quiet habitat here, with plenty of food, and they settled in,” Echeverri López said. The hippos, on seeing us, moved closer to the shore. “Don’t worry,” he reassured me. “We are halfway up the slope, so we have a certain advantage if one attacks.”

The population in this lake, where the animals spend the daylight hours, had reached about 50 – the densest concentration outside the park, and became the initial target of the new surgical castration campaign. Echeverri López pointed to a corral a few dozen yards from the lake, one of three strategically placed enclosures built using a metal alloy that is all but unbreakable, even by huge, angry mammals. The team uses a trail of carrots, cabbages and fruit to lure hippos into the enclosure; a spring-trap door then slams shut. Once lured, the animals are shot with tranquilliser darts, allowing the scientists to castrate them where they rest. Cornare observers conduct spot checks every evening, and if they encounter a trapped hippo, they quickly summon the surgical team to the scene.

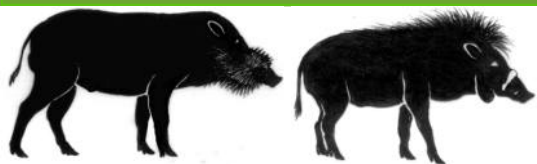
Alejandro Mira got the call to assist in his first surgical castration of a hippo last October. “I was nervous,” he told me one evening, as we were driving along a rural road, keeping a wary lookout for hippos on the highway. In the predawn darkness last year, Mira arrived at the lakeshore to confront a 350kg male – relatively junior-sized – pacing inside the enclosure. A team member fired three tranquilliser darts into the hippo’s buttocks. Then the group waited outside. After 45 minutes, the animal sank into a seated position – “like a dog,” Mira said – then rolled on to its side in a pool of mud.

Mira had castrated many horses, dogs and cats, but this was different from the usual neutering. “The surgery is taking place in a wild environment, with a dangerous animal, with the testicles hidden deep inside the body,” he told me. To verify that the hippo was in a deep state of unconsciousness, a team member tickled his ears. When they didn’t twitch, he signalled to the others. The veterinarians tied a rope around the animal’s feet, then dragged him a few yards to a sterile canvas sheet on which the surgery would take place. The team donned surgical scrubs and raised a canvas tent to shield themselves and the animal from the rising sun. Then they swabbed the hippo with sterile wipes and inserted intravenous drips – antibiotics, anti-inflammatories and anaesthetics – into the veins on his ears and tongue. Administering the anaesthetic is a dangerous part of the procedure. For unclear reasons, hippos, like other marine mammals, are highly sensitive to sedation and, in zoos, have sometimes had fatal reactions.

The lead veterinarian, Cristina Buitrago, knelt and palpated the hippo’s abdomen to feel for his testicles, located in the inguinal canal. Because they are retractable and can reside as deep as 40cm inside the body, they can be difficult to find. Buitrago made a 6cm incision, cutting with difficulty through thick skin and layers of fat. Mira knelt beside her, handing her surgical instruments. Then, slicing delicately around the blood vessels, she pulled out the mango-sized testicles, “about the size of a horse’s balls”, Mira told me. The vet snipped them off, sutured the wound and sewed the incision shut.

As the animal slept, the team hurriedly removed the equipment and exited the corral, monitoring the hippo until it returned to consciousness and shambled through the gate and into the lake. From darting to awakening, the procedure had lasted seven hours. The team had tagged the animal’s ears during the surgery, though it is difficult to monitor hippos in the wild. Still, they were confident it would recover well. “They have a strong immune system, and there’s no reason to believe that they can’t survive,” Mira told me. In fact, biologists have discovered a pigment in hippo skin that absorbs ultraviolet light and may prevent bacteria from growing; it’s a natural antibiotic, they theorise, that can help stave off infections from the animals’ frequent tussling – as





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well as from castration.

Throughout the autumn of 2023, the Cornare team refined the procedure to as close to a science as possible. Then, in December, Mira and his colleagues faced a male hippo weighing almost 700kg, among the largest they had encountered. Tying ropes around the feet to pull the animal on to a sheet wouldn't work with an animal of this size. Instead, Mira and his six colleagues stationed themselves around the hippo's hind legs, forelegs, backside and head. After a count of "uno, dos, tres", they pushed, tugged, yanked, dragged and inched the sleeping behemoth a few yards towards the makeshift operating theatre. With a final heave, they raised the animal just enough to slide the canvas sheet beneath his bulk. (Two of the animals they operated on in 2023 were female, a fact that became known only after the hippos' sedation. "It's 200% more complicated with females," Mira told me. "You have to access the ovaries through the flanks, cutting through thicker skin and several layers of muscle. You have to go much deeper and really use your hands.")

The operation on the big hippo was a success. But, at the end of 2023, Cornare's contract with the government expired, and there was some question about when the programme would continue. By April, however, the veterinary team was back in the field, and had castrated three more hippos. Meanwhile, Colombia's ministry of the environment has apparently decided that the catch-and-castrate programme isn't sufficient to handle the hippo problem. Susana Muhamad, the minister of the environment, says that of 169 hippos so far confirmed to be roaming the Colombian countryside, "some" will have to be euthanised, although she also said that both castrations and attempts to move the beasts to overseas zoos will continue.

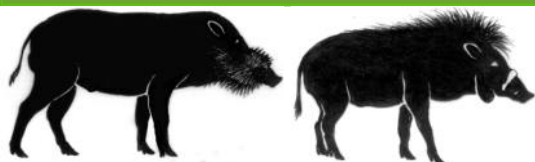
But the sentiment for a hardline solution is growing. After years of searching for a viable alternative, Echeverri López acknowledged to me that a cull will probably have to happen. Indeed, many hippo experts around the world agree. "Castration can slow population growth down a bit, but it's not a solution," Jan Pluháček, a Czech biologist and hippo specialist, told me. Culling, he said, is "the only thing that makes sense".

In one of my last days in rural Colombia, I drove with Mira to a guest house called Villa Sara, a couple of miles from Hacienda Nápoles. The caretaker had notified Cornare that a hippo had moved into a pond behind the property, and Mira had been called to assess the situation. Reports like these have become more common in the last couple of years, Mira told me.

We drove up the long driveway to a Spanish colonial-style villa where Escobar is reported to have lived in the 70s while hunting for a ranch. The caretaker, a young woman named Flor Daza, led us to the back garden. "There he is," she exclaimed, pointing to a pair of eyes and a snout protruding beyond the shoreline. Mira said the animal was probably a young male who had been cast out of a herd by the dominant male and forced to live on his own. "When he first looked at me in the eye, I was terrified," Daza said. But, she went on, "We see him every day, and we are no longer afraid of him." The owners of the villa, however, who live in Bogotá, remained concerned, and Daza could not rule out the possibility of violent run-ins between the hippo and unwitting guests.

Daza's ambivalence about the hippo reflected the perspective of many people I encountered in Colombia, who couldn't help but feel a mixture of affection and even protectiveness, along with a twinge of fear. In this beleaguered part of the country, which has suffered decades of violence, turmoil and civil war, many people see the hippos as a potential economic lifeline. At a grocery store just outside Escobar's former hacienda, the owner has turned the top floor of his establishment into a "tourist hotel", and he posts videos to social media showing groups of four or





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Hippos at Hacienda Nápoles, now a zoo and safari park, in 2021.

Photograph: Fernando Vergara/AP

lord's restored villa is now a memorial museum to his victims, just down a path from the pond where his original hippos once resided. (Today, the pond is home to a female hippo named Vanessa, the park's mascot.) A high arch stands at the entrance, topped by a replica of the single-engine Piper Super Cub plane that Escobar first used to fly cocaine to landing strips in the US. Colombian tourists moved somberly through galleries displaying portraits of politicians, policemen and ordinary citizens killed in car bombings and crossfire, and yellowing newspaper clippings and magazine covers documenting Escobar's atrocities. Billboards near the museum saluted the "triumph of the state" against "the worst criminal in our history".

On Doradal's main drag a mile away, however, I encountered a different kind of commemoration. At Pablo's Shop, which opened on the former site of one of his favourite cafes, some of those same tourists were posing for photographs alongside a lifesize Escobar mannequin and browsing for coffee mugs, T-shirts and refrigerator magnets emblazoned with his portrait. Those looking for more menacing mementoes could take their pick from display cases filled with replica pistols and AK-47s. The owner conceded that he had been nervous about opening the boutique – friends had warned him that he might face a backlash – but he'd had no trouble at all. In fact, business was booming. Escobar's charisma, his extraordinary wealth and his flamboyant notoriety had conferred on him the status of permanent celebrity.

Despite a recognition among Colombian officials that the hippos will have to be managed, whether by a culling programme, wide-scale sterilisation, targeted translocation or some combination, even in the best of circumstances Colombians are likely to have to live with a vestigial hippo population. Of 3,500 invasive animal species introduced by humans into new, unsuitable biomes around the world, few have been eradicated. Whether the intruders are Burmese pythons imported by exotic pet collectors and abandoned in the Florida Everglades, or lionfish from the Indo-Pacific eating up crustaceans, snappers, groupers and other aquatic animals along the East Coast and Gulf of Mexico, or giant African land snails devouring native plants across Asia and Latin America, there is no realistic way to turn back the clock. Colombians may have no choice but to make their peace with this reality.

At dusk, as we watched the hippo behind Villa Sara leave the lake and begin a search for food in the adjacent woods, Daza said: "I've accepted him, and I've come to view having him here as a privilege."

This article was first published in the Smithsonian Magazine

five hippos – "our pets", he calls them – wandering past the shop to graze in the bush at night. Isabel Romero, who runs a nonprofit that breeds endangered river tortoises on the Claro Cocorná Sur River, recently opened a hippo-viewing concession, offering lunch and a boat ride to the Magdalena for about \$100. It's doing a brisk business among both Colombian and foreign tourists.

This pragmatic embrace of Escobar's hippos was not so unlike the response to his legacy itself, as I realised when I visited his hacienda. The drug





Hippos might fly: UK research discovers animal can get airborne

Ian Sample, 3 Jul 2024

<https://www.theguardian.com/world/article/2024/jul/03/hippos-might-fly-uk-research-discovers-animal-can-get-airborne>

Analysis shows hippos get all four feet off the ground at once up to 15% of the time when at full pelt.

It takes a scientific mind to see the grunting hulk of a hippopotamus and wonder whether, given sufficient motivation, such an improbable beast might ever become airborne.

And so to researchers at the Royal Veterinary College in North Mymms, Hertfordshire, whose painstaking examination of footage of the creatures revealed that when the hefty herbivores reach top speed they do indeed take off.

Video showed hippos got all four feet off the ground at once up to 15% of the time when thundering along at full pelt, often to chase off hippo rivals.

The finding plugs a gap in scientific knowledge and places hippos somewhere between elephants and rhinos in terms of the athletic prowess displayed by some of the heaviest land animals when they need to get a move on. "I've struggled to get any work done on hippos before because they're so hard to access," said John Hutchinson, a professor of evolutionary biomechanics who led the research. "They're incredibly dangerous, they tend to be most active at night, and they spend a lot of their time in the water."

After finding no satisfying answer to the question in the scientific literature, Hutchinson dispatched a student, Emily Pringle, to Flamingo Land resort in North Yorkshire, where resident hippos have room to run. She videoed the animals as they moved between their stable and watering hole and brought back the footage for analysis.

The researchers went through it, and more gathered from YouTube, frame by frame to see whether hippos ever managed to get all four feet off the ground at once. Writing in PeerJ, they conclude that, unlike other large mammals, hippos typically stick to a trotting movement whatever speed they are moving at, but can become airborne in a rush.

Other large land animals move differently. Elephants have a standard walking gait even at high speed and never fully leave the ground. Rhinos, meanwhile, can walk, trot and even break into a gallop. The hippo footage showed the animals, which can reach more than 2,000kg, typically trot, a movement that involves diagonally opposite legs moving in synchrony.

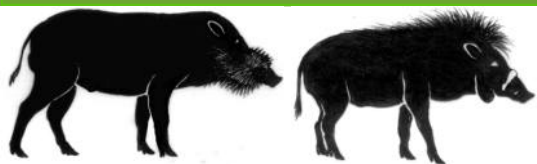
"It's important for our understanding of what it means to be a big animal and move on land," said Hutchinson. The work also helps researchers piece together the evolution of locomotion in large land animals, all the way back to the giant dinosaurs.

Hutchinson said the study was "as simple as biomechanics research can get", but had its challenges: clicking through stacks of videos frame-by-frame was not for everyone. "It's mind-numbing," he said. "It's one of the things in my work that I hate the most. It's really boring. Agonising."

And yet, further research beckons. Word has reached Hutchinson that pygmy hippos, a different species to the animals he studied, can gallop. It raises the question of whether baby hippos can do the same, suggesting a return trip to Flamingo Land may be in order.

"I'm wondering if baby hippos can do something that adult hippos can't," he said. "That would be pretty neat."

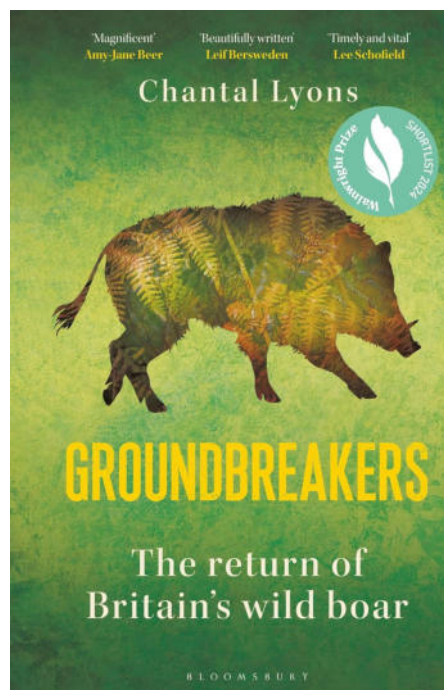




New books



Groundbreakers – The return of Britain's wild boar-haters



Nature writing has become a popular section of books about nature and wildlife, but there are very few books that deal with wild boar. Chantal Lyons has written a book about the return of Britain's wild boar. Therefore, it closes a gap.

Wild boars were hunted to extinction in Britain about 700 years ago and were reintroduced to England, Wales and Scotland at the end of the last century.

The book is separated in two parts: The larger first part deals with the past and the present of British wild boar, while the second part is about the future of British wild boars.

Chantal Lyons tells about her own experiences in the Forest of Dean in Gloucestershire, her travels to Scotland, to France and Spain. She asks people about their attitudes towards wild boar, talks with “boar-haters” and “boar-lovers”.

The role of wild boars in their ecosystems and the consequences of reintroducing wild boars in highly modified British landscapes are presented in an entertaining and charming writing style. The reader begins to think about the

wildlife around people, our role in nature and how much nature and wildlife Western European people can or want to accept around them. The wild boar with its intelligence and adaptability is shown as magnificent creature. This book is a wonderful tribute to the wild boar!

Reviewed by Thiemo Braasch

Groundbreakers – The return of Britain's wild boar-haters

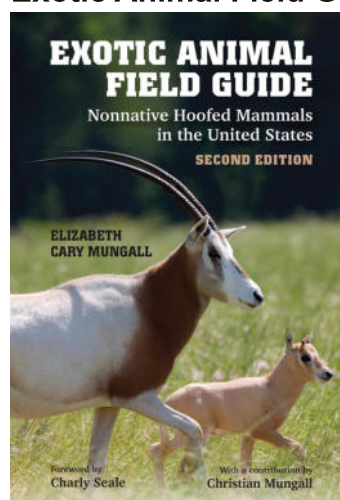
by Chantal Lyons

288 pages, Bloomsbury Wildlife, 2024

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Exotic Animal Field Guide – Nonnative Hoofed Mammals of the United States



The United States of America have a long history of introducing exotic nonnative hoofed mammals going back to late 1890s. This book deals with 91 exotic hoofed mammals (including a few hybrids) that are kept on private land and in public reserves all around the United States.

After a short introduction the author offers a brief history of introducing hoofed mammals to the United States. The purposes of these introductions (hunting, conservation breeding, etc.) are also discussed. A larger chapter deals with the places where you can see these exotic hoofed mammals in the United States. Further chapters deal with photography basics for exotics and owning exotics. If you are not familiar with wildlife photography and keeping wildlife, these





New books



chapters are very helpful for beginners. The main part of the book deals with the species accounts of exotic hoofed mammals including deer, antelopes, sheep and goats, cattle and other mammals including African rhinos and wild boar.

Each species account covers the name, the origin and species status regarding conservation, a description, food habits, habitat, water and climate conditions of the species, temperament and compatibility with other species, special considerations regarding keeping the species, breeding season, gestation and young per birth, sexual maturity as well as fencing and a map of its native distribution.

The species record of the wild boar is a nice overview. If you are not familiar with keeping wild boar you will get some interesting insights and considerations on how to keep wild boars.

Generally, this book offers many different facts about all the exotic hoofed mammals kept in the United States. The book helps to identify all the exotic hoofed mammal species kept in the United States. The author rounds off the book with a list of exotics-related organizations, a glossary and a list of references.

Reviewed by Thiemo Braasch

Exotic Animal Field Guide – Nonnative Hoofed Mammals of the United States

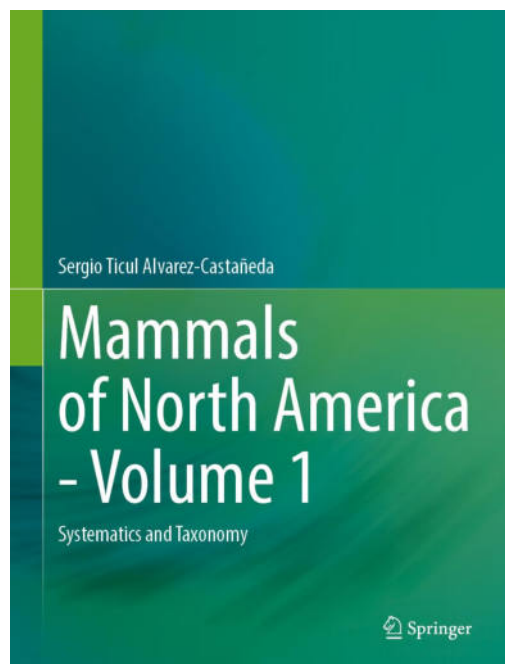
by Elizabeth Cary Mungall

368 pages, Second Edition, Texas A & M University Press, 2024

ISBN-10†: †1648432069

ISBN-13†: †978-1648432064

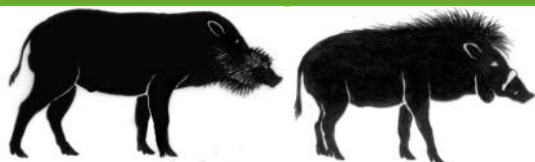
Mammals of North America – Volume 1, Systematics and Taxonomy



This is the first volume of a series of two books covering the systematics and taxonomy of all the mammals of North America including Mexico, Belize and Guatemala. While the second volume is about rodents the first volume comprises all the other mammal species including carnivores, ungulates, monkeys and bats, etc. For each taxonomic group this book offers an identification key. All species are presented with a list of their subspecies (if recognized) and a very helpful distribution map of the species and subspecies. The conservation status of each species is mentioned, its characteristics and its systematics are briefly discussed. Finally, additional literature to each species account is given. Regarding wild pigs, the Eurasian wild boar is mentioned as an invasive species. For collared peccaries seven subspecies are mentioned in North America and for the White-lipped peccary the only subspecies living in North America

(*Tayassu pecari ringens*). This book therefore offers a nice overview on peccaries living in North America.





New books



Overall this book is the most updated book about the taxonomy of mammals in North America. It will become the main source for taxonomy and systematics of North American mammals and their subspecies for the next years!

Reviewed by Thiemo Braasch

Mammals of North America – Volume 1, Systematics and Taxonomy

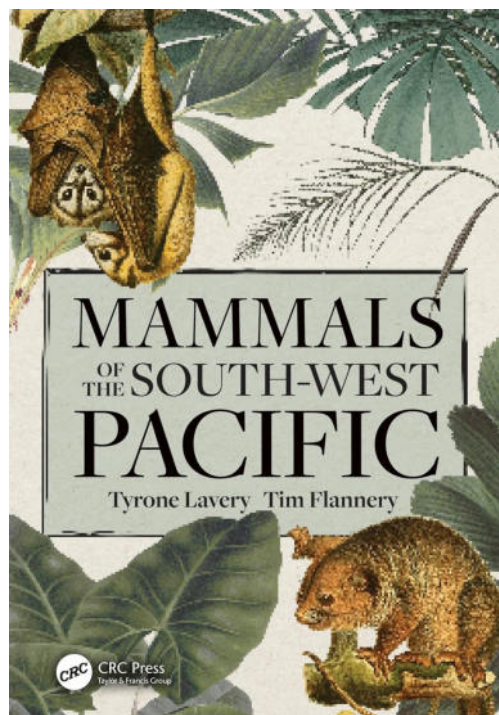
by Sergio Álvarez-Castañeda

708 pages, First Edition, Springer, 2024

ISBN-10†: †3031416600

ISBN-13†: †978-3031416606

Mammals of the South-west Pacific



This book covers a broad area ranging from western New Guinea in the west to eastern Polynesia in the east and from northern Micronesia to New Zealand in the south. Therefore, Micronesia, Melanesia and Polynesia (except Hawaii) are comprised by the book, a region that includes 184 indigenous species, 95 of them endemic to the area. At the end of the book 43 introduced species are also presented.

After a short introduction and a preamble to species accounts the authors (several experts on mammals of this region) write about the geology, flora and vegetation, human presence, translocation and extinction, paleontology of all the islands), zoogeography and conservation of South-west Pacific mammals. 63 of the 184 indigenous species are classified as extinct or threatened (vulnerable, endangered or critically endangered) according to the IUCN Red List. The authors discuss the threats to the species like forest disturbance

and deforestation, hunting, introduced species and climate change.

The pig is one of the species that was widely introduced to the South-west Pacific prehistorically. They can alter habitats (e.g. via digging) and therefore pose threats to endemic species. Its species account presented in this book delves deep into the origin of the pigs introduced to this vast area and the history of its introduction. The authors also write about the cultural significance of pigs there, pig behaviour and damage to vegetation.

Every introduced species' account comprise of a small box with the scientific name, the native range, the introduced range, the characteristics for identification and the conservation status on the IUCN Red List. Furthermore, a photo is presented of each of these species.

The largest part of the book contains the species accounts of the 184 indigenous species of the South-west Pacific. After the descriptions of the taxonomic family, the species accounts offer short descriptions of the species (including its ecology and behaviour), a distribution map, photos or drawings of the species (if available), a box with its scientific name, body measurements,





New books



characteristics for identification, synonyms, subspecies (if available), a description of its distribution, its conservation status and the etymology of its scientific name. A very detailed list of references makes it easy to go even deeper into the existing knowledge of the species. A well written glossary and an annotated faunal list for the nations and territories of the region (including introduced and marine mammal species) complete this marvelous book.

Overall, its overwhelming to scroll through the species accounts and to read about many, mostly unknown species. This book is and will remain the main source for mammals information of the South-west Pacific for the next years! It will hopefully help to raise interests in the threatened species living there and the threats they are facing!

Reviewed by Thiemo Braasch

Mammals of the South-west Pacific
by Tyrone Lavery and Tim Flannery
345 pages, First Edition CRC Press, 2023
ISBN-10↑: ↑1032254408
ISBN-13↑: ↑978-1032254401

Mammals of Oklahoma



This is the second edition of the book. The second volume updates the first volume published in 1989. The book reviewed here encompasses 117 species (including extinct and introduced species). After a short introduction and well written chapters about the history of mammalogy in Oklahoma, ecoregions of Oklahoma, a glossary and general notes about identification keys each mammalian family is presented with an identification key and profiles of the species belonging to this family.

Each species account comprises notes about the etymology of the species name, a detailed species description, a description of the measurements and dental formula, distribution including a detailed map of Oklahoma showing the borders of all counties and ecoregions of this USA's state, detailed information about ecology, taxonomy including subspecies and comments. All species accounts present at least one photo of the species. The large references list at the end of the book is a proof for the authors' hard work

collection all the information.

The feral pig has been introduced to many states of the USA including Oklahoma. There it is found throughout most of the state. The highest densities can be found in southern Oklahoma. Most of the wild individuals originated from domesticated hogs. The text about the pig's ecology comprises also many details. Additional information about systematics and comments about pig





New books



control complete this species account. Similarly, the account about the Collared peccary is an in-depth description of it. It is rare in Oklahoma and found in the southwestern part of this state. The peccaries found there are mostly transitory, while some may have been imported from Texas. Oklahoma is at the northern limit of the Collared peccary's distribution range.

Overall, this book is a great source for studying the biology and ecology of mammals in Oklahoma and the southwestern United States. It presents a cornucopia of information. Everyone interested in North American mammals will enjoy reading this book! People interested in pigs and peccaries get a comprehensive collection of information about Collared peccaries and feral pigs living in North America!

Reviewed by Thiemo Braasch

Mammals of Oklahoma

by William Caire, Lynda Samanie Loucks and Michelle L. Hayne

672 pages, Second Edition, University of Oklahoma Press, 2024

ISBN-10†: †0806193697

ISBN-13†: †978-0806193694





General articles about Suiformes

Experience shapes wild boar spatial response to drive hunts

Olejarz, A., Augustsson, E., Kjellander, P., Ježek, M. & T. Podgórski (2024).

Scientific Reports 14:19930

Human-induced disturbances of the environment are rapid and often unpredictable in space and time, exposing wildlife to strong selection pressure favouring plasticity in specific traits. Measuring wildlife behavioural plasticity in response to human-induced disturbances such as hunting pressures is crucial in understanding population expansion in the highly plastic wild boar species. We collected GPS-based movement data from 55 wild boars during drive hunts over three hunting seasons (2019–2022) in the Czech Republic and Sweden to identify behavioural plasticity in space use and movement strategies over a range of experienced hunting disturbances. Daily distance, daily range, and daily range overlap with hunting area were not affected by hunting intensity but were clearly related to wild boar hunting experience. On average, the post-hunt flight distance was 1.80 km, and the flight duration lasted 25.8 h until they returned to their previous ranging area. We detected no relationship in flight behaviour to hunting intensity or wild boar experience. Wild boar monitored in our study showed two behavioural responses to drive hunts, “remain” or “leave”. Wild boars tended to “leave” more often with increasing hunting experience. Overall, this study highlights the behavioural plasticity of wild boar in response to drive hunts.

What drives wild boar density and population growth in Mediterranean environments?

Colomer J, Massei G, Roos D, Rosell C, Rodríguez-Teijeiro JD (2024).

Science of The Total Environment 931

Accurate prediction of fluctuations of wildlife local number of individuals is crucial for effective population management to minimise human-wildlife conflicts. Climate, habitat, food availability, and density dependence are among the main factors influencing mammalian population dynamics. In southern Europe, precipitation and temperature, particularly during summer have been suggested as key factors affecting wild boar (*Sus scrofa* L.). However, there is uncertainty regarding the role of these factors and the mechanisms driving population fluctuations. This study utilized long-term data of wild boar populations from 14 study sites collected for 23 years in Catalonia, Spain, to analyse the factors that drive population density and growth rate. Generalized Additive Mixed Models (GAMM) explained respectively, 94 % and 65 % of the density and growth rate variability. Spring precipitation in both current and previous year, female weight, and forest cover (particularly above 60 %) were directly associated with higher wild boar densities and population growth rates. The interaction between crop cover and total annual precipitation also played a significant role in determining population density. Higher densities were linked to lower population growth in the following year, likely due to a density-dependent process. These results suggest that the expected decrease in rainfall linked with global warming may limit the availability of natural resources and potentially slow wild boar population growth. Nevertheless, wild boar can exploit alternative anthropogenic food sources, potentially leading to an increase of human-wildlife conflicts. Therefore, incorporating management policies aimed at restricting wild boar access to human food sources is key for controlling their reproductive output. Additionally, landscape management strategies targeted at diminishing refuge and resource availability in regions experiencing high wild boar impact are essential for contributing to sustainable coexistence between wild boars and human populations.





Modelling wild boar abundance at high resolution

ENETWILD-consortium, Croft S, Blanco-Aguilar JA, Acevedo P, Illanas S, Vicente J, Warren DA, Smith GC (2024).

EFSA Supporting Publications 21(7)

By using the latest available data, we provide estimates of wild boar (*Sus scrofa*) distribution and abundance pre-African Swine Fever (ASF) based on occurrence data in Europe. Secondly, as a basis for the calibration model output into densities, we used the predictions of relative abundance, and hunting yield-based model (hunted individuals per km²), at 2x2 km for wild boar (by ENETWILD Consortium) and local wild boar densities (individuals per km²) considered reliable and obtained in the framework of the European Observatory of Wildlife (EOW), as well as some from recent literature (2015 onwards). Hunting yield predictions were considered at different spatial scales namely 5, 10 and 15 km radii buffer around localities with density estimations. The calibration of hunting yield-based model into densities are a better fit for 15 km radius buffer and a significant relationship between model predictions of hunting yield and reliable density values at European level. This calibration of wild boar hunting yield-based model into densities will offer the possibility to predict density values of wild boar. This will be useful to incorporate into risk factor analyses for African Swine Fever at the selected spatial range. This is the first time that absolute density estimates have been made using these two approaches for Europe, which demonstrates the added value of the observatory approach (a number of study areas where reliable density values are obtained, such as from the EOW) to generate novel information of high value for epidemiological assessment. During an ASF outbreak hunting effort will change dramatically and will take a few years to return to similar pre-ASF levels, so post-ASF estimates of density would be limited to areas where ASF has been present for a while. However, there will be relatively limited effect on sighting data as these rely on a number of different actors, many of whom may be expected to return to normal activities relatively soon after ASF arrives. Thus, relative post-ASF wild boar density may be more reliable in the short term. These relative post-ASF densities were calculated but with the limited sighting data available at the chosen locations the uncertainty was high. We advocate for the developing this network of wildlife monitoring across Europe, and in general, harmonized wildlife monitoring programs, ensuring standardisation and consistency in the data generated and collected, which is essential for assessing management and risks related not only to ASF but other wildlife diseases.

Evaluating hunting and capture methods for urban wild boar population management

Escobar-González M, López-Martín JM, Mentaberre G, Valdeperes M, Estruch J, Tampach S, Castillo-Contreras R, Conejero C, Roldán J, Lavín S, Serrano E, López-Olvera JR (2024).

Science of The Total Environment Volume 940

Wild ungulates are expanding in range and number worldwide leading to an urgent need to manage their populations to minimize conflicts and promote coexistence with humans. In the metropolitan area of Barcelona (MAB), wild boar is the main wildlife species causing a nuisance, from traffic accidents to health risks. Selective harvesting of specific sex and age classes and reducing anthropogenic food resources would be the most efficient approach to dealing with overpopulation. Nonetheless, there is a gap in knowledge regarding the age and sex selectivity of the capture methods currently applied in the MAB for wild boar population control.

Thus, this study aimed to evaluate the performance and age and sex bias of different hunting and





capture methods and the seasonal patterns in their performance (number of captured individuals per event). From February 2014 to August 2022, 1454 wild boars were captured in the MAB using drop net, teleanaesthesia, cage traps, night stalks, and drive hunting. We applied generalized linear models (GLM) to compare the performance of these methods for the total number of wild boars, the wild boars belonging to each age category (i.e., adult, yearling, and juvenile), and for each season.

The studied capture methods showed age-class bias and sex bias in adults (>2 years). Drive hunting and drop net removed mainly adult females and yearlings (1–2 years), with drive hunting having the highest performance for adult males. Instead, cage traps and drop net were the best methods to capture juveniles (<1 year). Overall, global performance was higher in summer, decreasingly followed by autumn and spring, winter being the worst performing season. Wildlife managers and researchers should consider the different performance and sex and age bias of each hunting and capture method, as well as the associated public cost, to improve efficiency and achieve the best results in wild boar population management.

Identifying wild boar (*Sus scrofa*) crop damage hotspots to mitigate human-wild boar conflicts in northern Iran

Eshtiaghi A, Naderi S, Mohammadi A, Wan HY (2024).

Global Ecology and Conservation Volume 54

Conflict between wild boars and humans, and the ensuing economic losses has been a global challenge for government authorities and conservation biologists for over a decade. Understanding the interplay of ecological and anthropogenic factors driving human–wild boar conflicts is paramount for formulating effective strategies to address this challenge. This study employed species distribution modeling (SDM) to predict the extent and distribution of wild boar damage risk in Taleghan, Iran, where crop cultivation and livestock rearing represent the primary livelihood activities for the local communities. Our analyses revealed that 7.7 % of the overall study area is at high risk of wild boar crop damage. The area of high risk is proportionally smaller in the no-hunting zone (1.6 %) compared to the non-protected zone (14.8 %). Also, the areas at high risk were significantly lower within the no-hunting (1200 ha) area than in non-protected area (9500 ha). The most important determinants of the occurrence of high wild boar damage are presence of orchards (30.7 %), rangeland density (24.4 %), distance to human settlements (19.4 %), and slope (10.7 %). This study successfully mapped wild boar damage risk in northern Iran. The results suggest that areas with gentle slopes, heterogeneous landscapes featuring dense vegetation (i.e., orchards and rangelands) and human settlements with sparse road networks are at the highest risk of wild boar damage. The resulting map of conflict hotspots offers a concise visualization of conflict patterns across the landscape, facilitating prioritization and development of conflict mitigation measures for areas that require immediate attention.

Sleep in the wild: the importance of individual effects and environmental conditions on sleep behaviour in wild boar

Mortlock E, Silovský V, Güldenpfennig J, Faltusová M, Olejarz A, Börger L, Ježek M, Jennings DJ, Capellini, I (2024).

Proc R. Nat. B. 291(2023)

Sleep serves vital physiological functions, yet how sleep in wild animals is influenced by environmental conditions is poorly understood. Here we use high-resolution biologgers to





investigate sleep in wild animals over ecologically relevant time scales and quantify variability between individuals under changing conditions. We developed a robust classification for accelerometer data and measured multiple dimensions of sleep in the wild boar (*Sus scrofa*) over an annual cycle. In support of the hypothesis that environmental conditions determine thermoregulatory challenges, which regulate sleep, we show that sleep quantity, efficiency and quality are reduced on warmer days, sleep is less fragmented in longer and more humid days, while greater snow cover and rainfall promote sleep quality. Importantly, this longest and most detailed analysis of sleep in wild animals to date reveals large inter- and intra-individual variation. Specifically, short-sleepers sleep up to 46% less than long-sleepers but do not compensate for their short sleep through greater plasticity or quality, suggesting they may pay higher costs of sleep deprivation. Given the major role of sleep in health, our results suggest that global warming and the associated increase in extreme climatic events are likely to negatively impact sleep, and consequently health, in wildlife, particularly in nocturnal animals.

Density-dependent dinner: Wild boar overuse agricultural land at high densities

Augustsson E, Kim H, Andrén H, Graf L, Kjellander P, Widgren S, Månsson J, Malmsten J, Thurfjell, H. (2024).

European Journal of Wildlife Research 70:15

The Swedish wild boar (*Sus scrofa*) population has increased rapidly over the last decades, resulting in conflicts with human activities. Particularly, the increase has been challenging for agriculture as wild boar cause damage on crops and grasslands. To predict under what conditions to expect damage and where to prioritize management actions, basic knowledge about wild boar habitat and space use is needed. In this study, we used data from 99 wild boar equipped with GPS-collars, collected over a large temporal scale and throughout their distributional range in southern Sweden. We investigated wild boar home range size and habitat use across gradients of habitat availability and population density. Functional response in habitat use was assessed by estimating the use and availability of agricultural land on individual level and then, on population-level evaluating how use changed with changing availability. Finally, a potential response in habitat use was evaluated in relation to population density, i.e., the interaction between availability and population density. Home range size was negatively related to population density for both male and female wild boar. Wild boar used agricultural land more intensively with increasing population density and when other habitat types were less available. Our findings show that wild boar spatial behavior is highly context dependent and may vary considerably due to landscape characteristics and local conditions. Wild boars tend to overuse agricultural land at high densities which has strong implications for wildlife management. It is therefore important to consider local conditions when predicting space and habitat use by wild boar. Overall, this study provided a better understanding of the drivers of wild boar distribution and space use in agro-forested mosaic landscapes and how this knowledge can improve management practices.

Navigating discreetly: Spatial ecology of urban wild boar in Bordeaux City's landscape of fear, France

Marin C, Werno J, Le Campion G, Couderchet L (2024).

Science of The Total Environment 954

An exemplary urban adapter, the wild boar (*Sus scrofa*) has successfully colonized urban ecological niches worldwide. Improvement of strategies for optimal management of urban wild





boar need to gather more empirical evidence of their spatial ecology. This study is based on GPS tracking and capture-mark-recapture (CMR) of 10 and 59 wild boar, respectively, captured in Bordeaux Metropolis (France). It shows that wild boar have become urban dwellers, with intra-urban home ranges varying from 1.3 to 64.6 km² (MCP 100 %) and from 0.5 to 9.6 km² (KDE 95 %), depending on urban conditions. CMR results confirm the low propensity to move away from urban areas (with a mean distance of 2 km between capture and recapture sites), despite a relatively low one-year survival rate since capture (47.5 %), primarily attributable to removal efforts. Wild boar strongly depended on urban woods, mostly during daytime resting, and highly frequented urban meadows during night foraging. Their use of urban agricultural areas was minimal, but they were mostly monitored following corn and grape harvests. Wild boar mitigated the risk associated with close proximity to humans by: a nocturnal activity (72.2 % of active locations registered from sunset to sunrise), which could also be partially attributed to their sensitivity to heat; a strong use of covered habitats, especially during daytime resting and when close to buildings and roads; and a low mobility during night-time foraging (1974 m average daily distance travelled). Moreover, we demonstrate high inter- and intra-individual variability in the spatio-temporal behaviour of urban wild boar. Finally, we discuss the gap between these results and the narratives surrounding the spatial ecology of urban wild boar. Our results not only confirm the species' ability to adapt to urban environments, but also highlight their behavioural flexibility, underscoring the relevance of significant changes in representations and management activities to mitigate human-urban wild boar conflicts.

Sex-specific seasonal variations of wild boar distance traveled and home range size

Cavazza S, Brogi R, Apollonio M (2024).

Current Zoology, 70, 284–290

Distance traveled and home range size describe how animals move in space. The seasonal variations of these parameters are important to comprehensively understand animal ecology and its connection with reproductive behavior and energy costs. Researchers usually estimate the distance traveled as the sum of the straight-line displacements between sampled positions, but this approach is sensitive to the sampling frequency and does not account for the tortuosity of the animal's movements. By means of the continuous-time movement modeling which takes into account autocorrelation and tortuosity of movement data, we estimated the distance traveled and monthly home range size of 28 wild boar *Sus scrofa* and modeled their inter-sexual seasonal variability. Males traveled longer distances and used larger home ranges than females, particularly during the rut in autumn-winter, consistently with the different biological cycles of males and females. Males enlarged their home ranges during the rut but traveled constant average distances along the year, whereas females traveled shorter distances in correspondence with the peak of food resources and birth periods but exhibited constant home range size across seasons. The differences between the seasonal variation patterns of distance traveled and home range size, observed in both sexes, revealed the complex relationship between these two aspects of spatial behavior and the great opportunity of including both distance traveled and home range size in behavioral ecology investigations. We provided a detailed analysis of wild boar spatial behavior and its relationships with the reproductive cycles of males and females, promoting a deeper comprehension of their behavioral ecology.





The many boar identities: understanding difference and change in the geographies of European wild boar management

von Essena, E, O'Mahony K, Szczygielska M, Gieserb T, Vate V, Arregui A, Broz L(2025).

Journal of Environmental Planning and Management, 68(3): 728–750

Wildlife management across Europe is increasingly characterised by a 'war on wild boar'. In response to epidemiological and economic threats to pig production and agriculture, state agencies, policymakers and hunting organizations have altered their management as they attempt to contain wild boar. Through a cross-section overview of eight European countries with differentiated strategies – the Czech Republic, France, Germany, Great Britain, Norway, Poland, Spain, and Sweden – we analyze five critical components of contemporary wild boar management: categorizing, responsabilizing, calculating, controlling, and sanitizing. We consider three critical triggers that change how wild boar and, by extension, a range of other 'wild' species are managed in relation to the aforementioned categories: (over)abundance and population growth, biosecurity crises, and technological innovation. While these triggers, on one hand, might streamline transborder management policies, we show how wild boar also uproot longstanding wildlife management cultures by transforming hunting traditions, landowner-hunter relations and meat handling practices.

Frequent flight responses, but low escape distance of wild boar to nonlethal human disturbance

Wielgus E, Henrich M, Fiderer C. Töws A, Michel J-N, Kronthaler F, Heurich M (2024).

Ecological Solutions and Evidence 5(2)

1. Human activities can affect the behaviour and fitness of wildlife. However, the response of animals to nonlethal human activities has not been well-studied in wild boar, *Sus scrofa*, even though it is a widespread species in Europe and has become of increasing concern because of crop damages and its vector capacity for diseases.
2. We study the behavioural responses of GPS-collared wild boar to nonlethal experimental human approaches in the Bohemian Forest Ecosystem along the border between Germany and the Czech Republic. We describe and quantify the flight responses of the animals and assess whether they vary with the distance to recreational paths and the occurrence of hunting in the area.
3. We show that wild boar were disturbed and displaced by human approaches on foot in 69% of the trials, but the average flight initiation and escape distances were relatively small (93 and 256 m, respectively). The probability of a flight response decreased with distance from the paths and increased with the ruggedness of the terrain. In the non-hunting zone, the flight initiation distances and flight durations were shorter than in the hunting zone.
4. Our results suggest a weak effect of nonlethal human disturbances on the movement of wild boar, although the animals were sensitive to the perceived risk in relation to recreation infrastructure and hunting.
5. For the management of diseases such as African swine fever, it can be concluded that nonlethal disturbances are unlikely to accelerate the spread of the disease due to far-distance movements. Guidelines for restrictions in case of an outbreak might be adjusted accordingly.





Plasticity in activity patterns of ungulates under the influence of shade coffee agricultural intensification in Ethiopia

Etana, B., Fashing, P., Atickem, A., Bekele, A., & Stenseth, N. C. (2024).

Available at SSRN: <https://ssrn.com/abstract=4897507> or <http://dx.doi.org/10.2139/ssrn.4897507>.

A better understanding of mammalian activity patterns is essential for assessing responses to anthropogenic disturbances. A number of ungulates play a crucial role in maintaining forest functions and are vulnerable to human disturbances. Understanding how this functional group responds to coffee forest intensification is crucial. We investigated diel activity patterns and behavioral responses of ungulates in relation to coffee forest management systems (semi-forests, semi-plantations, and plantations) and nearby natural forests in the Belete-Gera National Forest Priority Area, southwest Ethiopia. We surveyed mammals using motion-detecting camera traps at 90 stations for a total of 4142 cumulative camera days. We fitted kernel density functions of activity times for six species of ungulates individually in coffee natural forests in order to develop activity overlap plots. Additionally, we compared behavioral responses using NMDS. Our findings showed that with increasing intensity of coffee forest management, ungulate diel activity patterns shift primarily to crepuscular and nocturnal for bushbucks, giant forest hogs, and bushpigs, but not for bush duiker, warthog and buffalo. It is possible that this adaptation is a result of forced inactivity during daylight hours that occurs in intensified coffee habitats. In addition, there was a distinct clustering of feeding, resting, and moving behavior patterns in the plantation coffee. The habitat quality for some ungulates decreases with increasing management intensity of shade coffee. Species-specific requirements should be developed in conservation measures. Humans should also limit their movements in coffee forest habitats at night, early in the morning, and late in the afternoon to ensure coexistence.

Intra-tooth stable isotope analysis reveals seasonal dietary variability and niche partitioning among bushpigs/red river hogs and warthogs

Yang, D., Uno, K. T., Cerling, T. E., Mwebi, O., Leakey, L. N., Grine, F. E., & Souron, A. (2024).

Current Zoology, 70(6), 739-751. <https://doi.org/10.1093/cz/zoae007>.

How animals respond to seasonal resource availability has profound implications for their dietary flexibility and realized ecological niches. We sought to understand seasonal dietary niche partitioning in extant African suids using intra-tooth stable isotope analysis of enamel. We collected enamel samples from canines of red river hogs/bushpigs (*Potamochoerus* spp.) and third molars of warthogs (*Phacochoerus* spp.) in 3 different regions of central and eastern Africa. We analyzed multiple samples from each tooth and used variations in stable carbon and oxygen isotope ratios ($\delta^{13}\text{C}$ and $\delta^{18}\text{O}$) and covariances between them to infer seasonal dietary changes. We found that most *Phacochoerus* display C₄-dominated diets, while most *Potamochoerus* display C₃-dominated diets. *Phacochoerus* and *Potamochoerus* that co-occur in the same region display no overlap in intra-tooth $\delta^{13}\text{C}$, which suggests dietary niche partitioning. They also show diverging $\delta^{13}\text{C}$ values as the dry seasons progress and converging $\delta^{13}\text{C}$ values during the peak of the rainy seasons, which suggests a greater dietary niche separation during the dry seasons when resources are scarce than during the rainy season. We found statistically significant cross-correlations between intra-tooth $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ in most specimens. We also observed a temporal lag between $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ in some specimens. This study demonstrates that intra-tooth stable isotope analysis is a promising approach to investigate seasonal dietary niche variation. However, large inter-individual variations in $\delta^{18}\text{O}$ at certain localities can be





challenging to interpret. Future studies that expand the intra-tooth stable isotope surveys or include controlled feeding experiments will improve its application in ecological studies.

Understanding resource use of an invasive species: Diet of the common warthog in Eastern Cape succulent thicket

Mgqatsa, N., Jama, K., Landman, M., & Kerley, G. I. (2024).

Journal of Arid Environments, 222, 105155. <https://doi.org/10.1016/j.jaridenv.2024.105155>.

Understanding resource use of invasive species provides insights for predicting and mitigating their impacts on biodiversity. We explored the predictability of diet of the invasive common warthog by describing and comparing the diet of warthog populations from two semi-arid, invaded sites, Addo Elephant National Park (AMC), and Great Fish River Nature Reserve (GFRNR), Eastern Cape, South Africa. These sites are both dominated by the Subtropical Thicket biome, but differ in vegetation type. We used forage availability to estimate diet preferences at AMC. We predicted that warthog would consume grass in invaded landscapes. Additionally, we predicted that the diet at one invaded site would predict this at another invaded site. As predicted, warthog mainly consumed grass at both sites (AMC – 87.4%, GFRNR – 88.5%), eating few woody plants, succulents, and forbs. *Cynodon dactylon* was the most consumed species in AMC, in GFRNR this was *Eragrostis curvula* and *Cymbopogon pospichilii*. Our ability to predict the diet between sites was constrained by variation in the plant species consumed. We found strong relationships between the consumption of preferred plant species at AMC and their consumption at GFRNR. We show that warthogs are specialised grazers outside their native range and thus can be expected to impact grass communities in invaded areas, especially preferred grass species. Thus, conservation managers need to monitor grasses in areas invaded by warthog to better detect and manage their impacts.

Assessment of domestic pig–bushpig (*Potamochoerus larvatus*) interactions through local knowledge in rural areas of Madagascar

Rakotoarivony, R., Kassie, D., Andriamahefa, A., Andria-Mananjara, D., Rakotoarinoro, M., Ramaroson, H. S., Raliniaina, M., Rasamoelina, M., Gomez-Vazquez, J. P. & Jori, F. (2024).

Scientific Reports, 14(1), 16310. <https://doi.org/10.1038/s41598-024-67208-1>.

In many parts of the world, domestic and wild animal populations interact at the interface between natural and agricultural ecosystems. Introduced with the first inhabitants arriving from eastern Africa, the bushpig (*Potamochoerus larvatus*) is the largest living terrestrial mammal in Madagascar. Bushpigs are regularly reported close to human settlements where they damage crops and gardens. As domestic pigs are often raised in free-ranging conditions around the villages, bushpigs and domestic pigs can interact leading to the transmission and circulation of shared swine pathogens that impact both animal and human health. In this study, we characterized the socio-ecological context of bushpig–domestic pig interactions in two different regions of western Madagascar. We conducted participatory mapping sessions and focus group interviews with 65 hunters, 80 pig farmers and 96 crop farmers in 20 fokontany, the smallest administrative unit in Madagascar. After discussing with participants, we gathered information about the spatialization of interactions and their potential geographical drivers. We explored data by performing multiple correspondence analysis and hierarchical clustering on principal components. Based on the reported occurrence or absence of bushpig-domestic pig interactions we were able to classify areas with high or intermediate levels of interactions or no interactions at





all. Interactions between the two pig species were reported in only 25% of the fokontany assessed. Even though both suid species were attracted to fruit trees, crops, and water sources, only indirect interactions in those spots were reported. Direct interactions were reported in 10% of cases and referred to interspecific sexual and/or agonistic behavior. The participatory methods used to acquire local knowledge about natural events were confirmed as valuable, low-cost exploratory methods to characterize areas with wild-domestic animal interactions. The results of this study will help plan future studies to characterize the interface between the two species from an ecological or epidemiological perspective using more sensitive and sophisticated ecological approaches.

Connecting Habitats: Modeling Landscape Connectivity for Large Mammals in Omo-Shasha-Oluwa Forest Reserves, South-West Nigeria

Fasona, M. I., Okimiji, P. O., Soneye, A. S., Gregory, A. J., & Egonmwan, R. I. (2024).

Journal of Landscape Ecology, 17, 35-46. <https://doi.org/10.2478/jlecol-2024-0003>.

Preserving landscape connectivity in the Omo-Shasha-Oluwa Forest Reserves is crucial due to human-induced fragmentation, shrinking habitats, and disrupted migration routes for wildlife. From 2014 to 2016, we conducted surveys to gather large mammal presence data, mapping their distribution using the MaxEnt algorithm. Employing Circuitscape software and circuit theory concepts, we predicted connectivity patterns for six large mammal species. Our results consistently showed robust predictive performance, with Area Under the Curve (AUC) values exceeding 0.75 for species distribution models. Notably, we identified suitable habitat patches for seven key species, spanning 1760 km² for *C. civetta*, 1515 km² for *T. scriptus*, 729 km² for *L. cyclotis*, 1693 km² for *P. porcus*, 1350 km² for *C. mona*, 1406 km² for *P. maxwellii*, and 1379 km² for *C. torquatus*. Our analysis highlighted distance to human settlements as the most significant predictor for habitat models concerning *T. scriptus*, *C. civetta*, *P. maxwellii*, *C. torquatus*, *P. porcus*, and *C. mona*, whereas land use type emerged as a critical factor for *L. cyclotis*. Furthermore, examination of maximum current flow patterns revealed varying degrees of connectivity among habitat patches, indicating potential bottlenecks to species movement, particularly across major rivers and in areas affected by human activities. These findings offer crucial insights for conservation efforts, guiding strategies to preserve wildlife metapopulation dynamics in the Omo-Shasha-Oluwa Forest Reserves landscape.

A Multi Species occupancy modelling approach to access the impacts of ecological covariates on terrestrial vertebrates in a tropical hotspot in central, Cameroon

Fotsing, E. D., & Kamkeng, M. M. (2025).

African Journal of Ecology, 63(3), e70048. <https://doi.org/10.1111/aje.70048>.

Mammalian communities living in tropical forests, particularly those in ecological transition zones, are under constant threat from human activities. In many regions, baseline data on mammal richness, occupancy, detection probability and the environmental factors that influence these metrics are lacking. As a key metric for guiding conservation decisions, species richness can be underestimated due to varying detection probabilities, leading to species being overlooked. Advances in technology and methodology have revolutionised wildlife monitoring, fostering the increase of multi-species occupancy models (MSOMs) for efficient studies of community, shifting focus from single species to entire communities. MSOMs, hierarchical models that share information across species via random effects, address imperfect detection to provide accurate





and unbiased species richness estimates. To fill this information gap, we used camera trap data from Mpem and Djim National Park, Central Cameroun. We used generalised linear models and a model selection approach to evaluate factors affecting species detection events. Similarly, we used MSOMs within a Bayesian hierarchical framework to evaluate our initial species richness estimate at each camera trap location and to understand the influence of environmental covariates on the occupancy and detection probability of 19 vertebrates recorded in the area to inform management decisions for these species. From 915 independent photographic events obtained over 1700 days of capture, the study results highlight the importance of habitat, distance to river, normalised difference vegetation index and topographic position index (TPI) in explaining patterns of detection events. We found that forest (GLM: B 0.31, IRR 1.36, CI 0.14–0.48, $p < 0.001$), NDVI (GLM: B 0.31, IRR 1.36, CI 0.21–0.41, $p < 0.001$) and TPI (GLM: B 0.17, IRR 1.19, CI 0.08–0.26, $p < 0.001$) were positively associated with species detection events, whereas distance to river (GLM: B -0.19 , IRR 0.83, CI 0.027 to (-0.11) , $p < 0.001$) was negatively associated with species detection events. However, the mean probability of community occupancy was 0.33 ± 0.10 [2.5%–97.5% CI: 0.17, 0.54], while the mean probability of community detection was 0.07 ± 0.02 [2.5%–95% CI: 0.04, 0.12], indicating that, on average, approximately 33% of the sites are likely to be occupied by the community of interest, with a 7% probability of detection at occupied sites. After accounting for imperfect detection, the maximum occupancy and detection probability estimated from the MSOMs were 0.88 ± 0.07 (2.5%–97.5% CI: 0.71–0.98) and 0.22 ± 0.2 (2.5%–97.5% CI: 0.18–0.27) for *Philantomba monticola*, respectively. Globally, the community responses were close to zero and relatively weak, probably due to mixed responses at the species level. Despite their weak effect, distance to road (β : -1.53 ± 1.97 [2.5%–97.5% CI: -1.72 – 5.62]) and NDVI (β : -0.09 ± 0.22 [2.5%–97.5% CI: -0.50 – 0.38]) had a negative significant effect on occupancy. However, there were significant responses at the species level with *Cephalophus nigrifrons*, for example, exhibiting a strong response to NDVI. This study contributes to baseline information on the ecology of mammal communities in Central Cameroon and supports the need for future multi-season surveys to understand the influence of temporal factors on community occupancy and richness in the area.

Uso de cuerpos de agua por parte del pecarí de collar *Pecari tajacu* (Artiodactyla: Tayassuidae) en la Selva Maya, México

Romo, JLC, Sánchez-Pinzón, K., Contreras-Moreno, FM, Jesús-Espinosa, D., & Méndez-Tun, J. (2024).

ACTA ZOOLOGICA MEXICANA (NS), 1-13. DOI: <https://doi.org/10.21829/azm.2024.4012681>.

La disponibilidad de agua es un factor crítico que influye en la abundancia y distribución de las especies, especialmente en entornos donde es escasa. Este estudio tuvo como objetivo evaluar el índice de frecuencia de visitas (IVF, un indicador de abundancia) y los patrones de actividad del pecarí de collar (*Pecari tajacu*) en diversas fuentes de agua naturales y artificiales en la Reserva de la Biosfera de Calakmul, Campeche, México. Empleamos trampas cámara desde enero hasta diciembre de 2020, monitoreando 30 cuerpos de agua: 10 bebederos artificiales, 10 aguadas naturales (depresiones donde se acumula el agua de lluvia) y 10 sartenejas (cavidades formadas por erosión en suelos rocosos que recogen agua de lluvia). Nuestros resultados indican que *P. tajacu* utilizó con mayor frecuencia sartenejas (IVF = 29.92 registros/día-trampa) y bebederos (IVF = 22.08 registros/día-trampa) en comparación con las aguadas (IVF = 6.54 registros/día-trampa). Los patrones de actividad diaria de *P. tajacu* fueron predominantemente





diurnos en bebederos y aguadas, mientras que en sartenejas la actividad fue catemeral. A pesar de ser una especie conocida por su dependencia de las fuentes de agua, el IVF registrado en este estudio fue inferior al de estudios previos. Esta disminución probablemente esté relacionada con un aumento en la disponibilidad de agua en la región durante el período de estudio, lo que pudo haber llevado a un comportamiento de evitación por parte de *P. tajacu* debido a la presencia de pecaríes de labios blancos (*Tayassu pecari*) y depredadores como jaguares (*Panthera onca*) y pumas (*Puma concolor*), que fueron más abundantes en las aguadas. Considerando el rápido avance del cambio climático y el aumento de eventos extremos de sequía y lluvias en la región, es crucial profundizar en la comprensión de las relaciones entre la disponibilidad de agua y la dinámica poblacional de las especies de vida silvestre. Este conocimiento será esencial para desarrollar estrategias que mitiguen los efectos adversos del cambio climático sobre la biodiversidad.

Impact of collared peccaries *Dicotyles tajacu* (Artiodactyla: Tayassuidae) on understory vegetation in the tropical rainforest of the Nogal-La selva biological corridor, Costa Rica

Osorio-Núñez, M. H., Alfaro-Alvarado, L. D., Chinchilla-Romero, F. A., & Guimarães-Rodrigues, F. H. (2024).

Revista de Biología Tropical, 72(1). <http://dx.doi.org/10.15517/rev.biol.trop.v72i1.53238>

Introduction: Evidence suggests that herbivores, such as peccaries, shape vegetation structure and diversity through predation, trampling, dispersal, and rooting behavior. Objective: To evaluate the impact of peccaries (*Dicotyles tajacu*) on the understory vegetation of the tropical rainforest in the Nogal-La Selva Local Biological Corridor, Costa Rica, comparing a site with the absence of peccaries to another with the presence of these animals. Methodology: From June to November 2021, 20 experimental exclusions and 20 free access plots, each measuring 2 m² were used to quantify herbivory, the number of leaf blades, damaged leaves, healthy leaves, sapling height, and fallen biomass at both sites. Results: A higher sapling density was found in the Nogal Reserve, but a lower sapling diversity, while in La Selva there was a higher sapling diversity, but a lower density of seedlings. Herbivory and sapling height in La Selva exceeded those in Nogal. The exclusion of peccaries reduced seedling damage but did not affect the dynamics of fallen biomass. Conclusion: For the design, implementation, and evaluation of the effectiveness of biological corridors, it is crucial to consider plant-animal interactions to enhance the flow of ecological processes through functional and structural connectivity, analyzed from interactions such as those presented in this paper.

Primer registro del pecarí de cuello blanco (*Dicotyles tajacu*) con piebaldismo a lo largo de toda su distribución

Leão-Vulcão, O., Gurjão-Pinheiro do Val, H., Ramos Brasil, G., Brito-Pezzuti, J. C. y Ribeiro-Carvalho Jr, E. A. 2024.

Mammalogy Notes 10 (2), 450. <https://doi.org/10.47603/mano.v10n2.450>.

La coloración es crucial para la adaptación de los mamíferos, influenciando aspectos como la defensa contra depredadores y el comportamiento social. En las últimas décadas, se han documentado anomalías cromáticas en mamíferos neotropicales, como el albinismo, el leucismo y el piebaldismo, que afectan a diversas especies. El piebaldismo es una rara condición autosómica que se caracteriza por marcas despigmentadas asimétricas en el cuerpo. Este estudio presenta el primer registro de piebaldismo en el pecarí de collar (*Dicotyles tajacu*





Linnaeus, 1758) en toda la región neotropical. El registro se realizó con cámaras trampa en la Estação Ecológica (ESEC) da Terra do Meio en 2023. Durante las observaciones, se notó que el pecarí afectado convivía normalmente con otros pecaríes, realizando comportamientos típicos de alimentación y socialización, sugiriendo que el piebaldismo no altera la sociabilidad entre los individuos. Esta observación es consistente con la literatura que indica que las señales químicas son más importantes que las visuales en la sociabilidad de los *Tayassu*ideos. Este hallazgo resalta la necesidad de estudiar la frecuencia y distribución de anomalías cromáticas para evaluar sus implicaciones en la conservación.

Collared peccary wallows are hubs of animal activity and diversity in a central american wet forest

Eckhoff, A., Medina Charriez, A., Zerger, M., Romero, A., Hackney, D., Aide, T. M., & Reider, K. (2025).

Ecology and Evolution, 15(2), e70713. <https://doi.org/10.1002/ece3.70713>.

Despite research linking peccary wallows to increased amphibian biodiversity in wet tropical forests in Amazonia, wallow use by the broader vertebrate community has been overlooked. We investigated collared peccary (*Pecari (Dicotyles) tajacu*) activity patterns at wallows and used multiple detection methods to assess wallow use by the vertebrate community in a Central American lowland wet forest in northeastern Costa Rica. We found significantly higher vertebrate activity and diversity at wallows compared to the nearby surrounding understory forest. We documented 13 amphibian, 2 reptile, 11 bird, and 16 nonvolant mammal species, and behaviors including reproduction, drinking, and bathing at wallows. Our observations suggest that wallows can sometimes persist for at least 6 years and are consistently used over that time period by peccaries and breeding amphibians. Our study improves understanding of the ecological importance of collared peccary wallows in the region amid recent changes to Central American peccary populations and ongoing land use and climate shifts.

Native peccaries activity patterns and temporal overlap with wild boar in the southern Brazilian Atlantic Forest

Pereira, A. D., Juraszek, A., de Souza, C., Golec, C., Golec, F., Costa, L., Borille, M. E., Bazilio, S. (2024).

Studies on Neotropical Fauna and Environment, 59(3), 1044–1053. <https://doi.org/10.1080/01650521.2024.2322308>

We analyzed long-term camera-trap data from Protected Areas in the Brazilian Atlantic Forest to study activity patterns of coexisting peccary species (*Tayassu pecari* and *Dicotyles tajacu*) and the exotic wild boar (*Sus scrofa*). The highest pattern overlap was between *D. tajacu* and *S. scrofa* ($\Delta 1 = 0.78$), followed by *T. pecari* and *S. scrofa* ($\Delta 1 = 0.64$), and the lowest between *D. tajacu* and *T. pecari* ($\Delta 1 = 0.61$). In the presence of feral pigs, collared peccary activity exhibited two distinct peaks, occurring in the late evening and early morning. When coexisting with white-lipped peccaries, their activity peaks early in the evening and again in the mid-morning, potentially enabling them to avoid overlapping with the activity peaks of white-lipped peccaries, which are distributed throughout the day. Our findings suggest a potential interference of wild boars in the temporal niche dynamics of native peccaries across various areas within the Brazilian Atlantic Forest biome. Nonetheless, we emphasize the imperative for more focused investigations at both regional micro and macro scales throughout the Atlantic Forest, specifically





delving into other dimensions of the niche, such as food and habitat utilization among the three species.

Javelina (*Dicotyles tajacu*) range extension indicated by new sightings in Petrified Forest National Park

Schneider, D. (2024).

Lithodendron Vol. 1: 139–144, Spring. <https://doi.org/10.69575/QIUD4036>.

Javelina sightings in Petrified Forest National Park (PEFO) are increasing after the first recorded observation in 2018. The current seven recorded sightings detailed in this report are just the latest observations in an apparent northward expansion of this species. While not surprising due to unrecorded sightings from Arizona Game and Fish Department (AZGFD) and increased surveillance, javelina have not been officially documented in this region before. Habitat change due to overgrazing and drought as well as warmer temperatures may play a factor in this expansion.

Seasonal changes in occupancy and activity patterns in native Collared Peccary and non-native wild pig and Common Warthog in southern Texas, the United States

Kupferman, C. A., Snow, N. P., VerCauteren, K. C., Melton, M. H., Gann, W. J., & Beasley, J. C. (2025).

Journal of Mammalogy, gyaf002. <https://doi.org/10.1093/jmammal/gyaf002>.

Southern Texas, USA, is home to native collared peccaries (*Dicotyles tajacu*) and introduced populations of invasive wild pigs (generally *Sus scrofa* × *domesticus* hybrids) and non-native African warthogs (*Phacochoerus africanus*). Although these ecologically similar mammals co-occur in this region, the potential impacts of invasive suids on collared peccaries are poorly understood. We examined co-occupancy and activity pattern overlap of collared peccaries, wild pigs, and warthogs across 3 seasons (fall, winter, and spring) using remote camera data collected from Chaparral Wildlife Management Area, Cotulla, Texas (November 2020 to June 2021). Using activity pattern analyses and single and 2-species occupancy models incorporating habitat and climate characteristics, we found evidence of extensive spatial overlap between all species pairs and varying degrees of temporal overlap depending on species pairs and season. Collared peccaries and wild pigs displayed moderate temporal overlap across all seasons. Collared peccaries appeared to alter fall activity in the presence of wild pigs to be active earlier in the morning and less active during the day. Collared peccaries and warthogs had low-to-moderate temporal overlap (low in fall, winter; moderate in spring). Wild pigs and warthogs had low temporal overlap (fall, spring) and wild pigs appeared to alter activity in the presence of warthogs (fall), becoming less active during the day during peak warthog activity. Overall, our results suggest that peccary, wild pig, and warthog interactions and activity are dynamic and vary seasonally according to the ecology and preferred environmental conditions of each species. Given the potential for interspecific competition and disease transmission with Collared Peccary and other native wildlife, resource partitioning between wild pigs and warthogs needs to be further examined to aid in effective management strategies.

Impact of behavioral differences on white-lipped peccary reintroduction success in the Atlantic forest

Neto, C. J. C., Nogueira-Filho, S. L., Nogueira, A. L., Ilg, L., & Nogueira, S. S. (2025).





Scientific Reports, 15(1), 7705. <https://doi.org/10.1038/s41598-025-90853-z>.

Some studies suggest that behavioral variation among animals destined for reintroduction programs could influence their post-release survival and overall reintroduction success. Therefore, we aimed to test whether individual behavioral differences in white-lipped peccaries (*Tayassu pecari* - WLPs) influence their exploratory and dispersal behavior after reintroduction. Using a standard ethological approach, we described the behavioral traits of 17 captive WLPs along three dimensions: aggressiveness, exploration, and sociability. Then, using spatial and temporal unpredictability of food supply, we subjected the animals to 90 days of pre-release training. Following this, we moved the WLPs to a pre-release enclosure at the release site in a remnant area of the Brazilian Atlantic Forest. In this enclosure, we maintained spatial and temporal unpredictability to provide locally available fruits and roots using the soft release technique. After 32 days, we released the WLPs and tracked their movements for the next 12 months. As expected, WLPs displayed individual behavioral variation across the three dimensions analyzed. While sex and age did not affect their behavioral trait scores, an increase in body weight was associated with heightened aggressiveness. The least sociable WLPs were the first ones to explore and disperse in the release site. Our results showed that the individual behavioral variation indeed influences the exploration and dispersal of reintroduced WLPs. Therefore, to increase the chances of successful reintroduction, it is necessary to develop pre-release training strategies that are tailored to the behavioral traits of the individuals.

Estimation population size peccaries (*Tayassu pecari*), in the “Rio Negro” farm-Brazilian Pantanal, during 2003-2004, by means capture and recapture multiple method

Salvador, M. L., dos Santos Moreira, V., Hirai, W. Y., Keuroghlian, A., & de Lara, I. A. R. (2024). BRAZILIAN JOURNAL OF AGRICULTURE-Revista de Agricultura, 99(1), 52-60. <https://doi.org/10.37856/bja.v99i1.4351>.

The *Tayassu pecari* are predominantly distributed in conserved biomes and the maintenance of the species is very susceptible to human activity. In this context, it is important the search for methods of population estimation as well as apply robust methods that allow more accurate estimative. Therefore, this work aims to estimate the population of peccaries, on the Rio Negro farm (Aquidauana-MS) through the multiple captures and recapture method during the years 2003 and 2004, considering the assumption that the population is closed. The estimate of the population size was obtained by the computational resampling and three procedures are compared. It was verified the marked difference between males and females for both years. The population size it was estimated in 134 and 192, however, by means the bootstrap method, a notable change in the distribution pattern of estimates was verified, being positively asymmetric and symmetric, for 2003 and 2004 respectively.

Urgent prioritization of conservation sites for the Jagüilla (*Tayassu pecari*) in the Honduran Moskitia region

Portillo-Reyes, H. O., & Martínez, M. (2024). Therya, 15(1), 71-75. <https://doi.org/10.12933/therya-24-5879>.

Tayassu pecari (known in Honduras as jagüilla and Wari in Miskito), is one of two types of wild pigs (chanchos de monte) found in Honduras (Marineros and Martinez 1998). Currently, its conservation status on the IUCN red list is vulnerable (VU) and critically endangered (CR) for Honduras (WCS 2021). According to Portillo and Elvir (2016), the potential area for jagüilla





distribution is 6,126 km² corresponding to 5.5 % of the country territory. The potential area for this species is in three sites, mainly protected area of the Reserva del Hombre and the Biósfera del Río Plátano (RHBRP), with approximately 70 % of the predicted potential distribution (4,288 km²), 20 % (1,225 km²) in the indigenous territories of Rus Rus, Mocerón and Warunta, and 10 % (613 km²) in the Tawahka Asagni Biosphere Reserve. The aim of this note is to contribute to the prioritization of four sites where evidence of small groups of jagüillas have been found: 1) Sierra de Agalta National Park. 2) the core zone of the RHBRP. 3) the cultural zone of the RHBRP. 4) the Warunta Mountains. Records of jagüilla were obtained from diverse sources (Table 1), mainly from biological monitoring implemented in various locations of the Río Plátano Biosphere (buffer zone, cultural zone, and core zone), Warunta Mountains, riparian forest in Rus Rus River, as well as the Tawahka Biosphere Reserve through the use of camera traps which were carried out between 2016 and 2022. In the RHBRP jagüilla were registered in two of the three zones these being the core zone and the cultural zone; no records of the species were obtained in the buffer zone. In these localities, groups of 2 to 45 individuals were documented. For the Warunta region in the Indigenous Federation of Mocerón and Segovia Zone (FINZMOS territory), tracks, and photographic evidence of a large group of 50 to 100 individuals were registered moving in this territory covered mainly by primary broadleaf forest. Hunting by invasive settlers and habitat loss due to deforestation in protected areas, has had an impact on jagüilla populations, reducing this species in the Honduran Moskitia region as mentioned by Portillo and Elvir (2016). One of the important aspects of this work is to highlight the findings in NP Sierra de Agalta as a potential site for future research and biological monitoring efforts for the development of conservation processes for the jagüilla as a park conservation target (Figure 2) since the last records of this species were documented at La Quebrada del Sol, NP Sierra de Agalta, in 1994 (Marineros and Martínez 1998). It is of utmost importance to establish monitoring and participatory conservation processes with the local communities (Larsen 2019; Martínez et al. 2022).

Connectivity at risk: a critical scenario for the endangered Baird's tapir and the vulnerable white-lipped peccary in the Maya Forest

Falconi-Briones, F. A., Bolom-Huet, R., Naranjo, E. J., Reyna-Hurtado, R., Enríquez-Rocha, P. L., Moreira-Ramírez, J. F., García, M. J. & Medellín, R. A. (2025).

Biodiversity and Conservation, 34(1), 235-254. <https://doi.org/10.1007/s10531-024-02968-w>.

Populations of the threatened Baird's tapir (*Tapirus bairdii*) and the white-lipped peccary (*Tayassu pecari*) face increasing isolation due to rampant deforestation and forest fragmentation across the Greater Maya Forest shared by southeastern Mexico, northern Guatemala, and Belize. We identified (1) the critical areas to ensure the persistence of Baird's tapir and the white-lipped peccary in the Maya Forest; (2) the corridors and sites with the best conditions to maintain connectivity among core habitats, and (3) the nodes with higher risk of habitat loss compromising landscape connectivity. We used a methodological framework combining circuit theory and species distribution modeling to estimate landscape resistance, land use, and the effect of roads and trails on the current distribution of the two focal species in the Maya Forest. We detected that major roads associated with agricultural landscapes are the primary barriers to the movements of tapirs and white-lipped peccaries in the study area. Conserving corridors that link the forests of the Lacandon and the Calakmul regions, along with the protected area network of northern Belize and establishing nodes between remaining forest fragments, are critical measures to mitigate the





impact of habitat fragmentation and loss for both species. The critical constriction areas (pinch points) and the corridors identified in this study support our prediction of the least-cost paths. Our assessment of threats to landscape connectivity provides useful information to inform effective decision-making for conserving Baird's tapir and white-lipped peccary populations in the Greater Maya Forest.

New records of White-lipped Peccaries in altered landscapes of the Brazilian Midwest

Freitas-Oliveira, R., Guimarães-Silva, M. A., Andreani, T. L., Hannibal, W., Bastos, R. P., Moreira, J. C., & Morais, A. R. (2024).

Mammal Research, 69(1), 177-182. <https://doi.org/10.1007/s13364-023-00729-8>.

The White-lipped Peccary (WLP) is a large-sized mammal that lives in groups and needs large, preserved areas to survive. Over the last decades, the distribution area of the WLP has been reduced, being absent from areas where its occurrence is expected, such as the central region of southwestern Goiás, Brazilian Midwest. Therefore, here we presented eight new records of WLP in southwestern of Goiás state, with information on group size and landscape context. WLPs were recorded by camera trap, and we extracted the percentage of native cover (NC%), mean of Euclidean nearest-neighbor distance (MENND), and largest native patch area (LP (hectares)) in the landscape occupied by them. The WLP group size ranged from 1 to 52 individuals in anthropized landscapes (4.6 to 30.7 of NC%), with a MENND range of 89.4 to 165 m and LP ranged from 48.8 to 297.9. These findings could be an indication that the species is returning to use the region. However, we stress that this area may not support viable WLP populations in the long-term due to the level of anthropization of the studied landscape.

Agroindustrial landscapes and white-lipped peccary habitat use in the Cerrado of Brazil

Neto, E. P., Barquero, G., Cullen Jr, L., & Fragoso, J. M. V. (2024).

Journal for Nature Conservation, 77, 126540. <https://doi.org/10.1016/j.jnc.2023.126540>.

The conversion of natural areas into agricultural land has increased human-wildlife interactions, often resulting in crop damage. This study focuses on the white-lipped peccary (*Tayassu pecari*), which thrives in landscapes where well-preserved, naturally-vegetated public and private lands are juxtaposed with agricultural fields. We investigated the habitat use and selection of four herds of white-lipped peccaries in a landscape mosaic along the southern border of Emas National Park in the Cerrado biome of Brazil. Our findings reveal that white-lipped peccaries prefer both corn plantations and gallery forests as habitats. Through high-frequency GPS telemetry, we observed a strong tendency to turn when herds were in agricultural areas and gallery forests, indicating feeding behavior. On the other hand, they typically move in straight lines for long distances when traversing bare soil fields and native Cerrado vegetation, suggesting they are merely passing through these habitats. The extensive feeding on corn crops in agricultural fields has resulted in significant financial losses for producers, leading to a conflict between white-lipped peccaries and landowners. Understanding the movement dynamics of the species and their intensive use of both private and public lands can aid in the development of management strategies that minimize or eliminate crop losses while ensuring the survival of this vulnerable species in landscapes comprising agricultural fields and native habitats.





A predominantly diurnal tropical mammal increases nocturnality in response to high temperatures

Peterson, M. C., Jorge, M. L. S., & Keuroghlian, A. (2024).

Biotropica, 56(1), 18-27. <https://doi.org/10.1111/btp.13271>.

The extent to which animals may compensate for rising temperatures through behavioral thermoregulation is an important unknown in predicting responses to climate change. Flexibility in temporal activity in particular may be an important factor in determining species' vulnerability. In this study, we examine whether the white-lipped peccary, a predominantly diurnal Neotropical mammal, shifts its temporal activity and microclimate selection in response to daily temperature variation in the Pantanal biome of Brazil. From November 2021 to October 2022, we deployed camera traps and microclimate data loggers to record white-lipped peccary activity and air temperature on a fine spatiotemporal scale. We found that the percentage of peccary activity that is nocturnal increased with maximum daily temperature at a rate of 3.7% per 1°C past a threshold of 31.2°C, and increased with maximum daily wet-bulb temperature at a rate of 4.7% per-1°C past a threshold of 24.9°C. The afternoon period (i.e., solar noon to sunset) went from having the highest frequency of peccary activity at the lower end of our observed temperature range to having the lowest frequency of activity at the higher end. We did not find evidence of microclimate selection. Our findings indicate that white-lipped peccaries in the Pantanal demonstrate substantial behavioral flexibility in their response to high temperatures, which may help to buffer them against the impact of rising temperatures caused by climate change.

Habitat connectivity of threatened ungulate species in a native savanna landscape of northern South America

Mosquera-Guerra, F., Barreto, S., Moreno-Niño, N., González-Delgado, T. M., & Armenteras-Pascual, D. (2024).

Mammalian Biology, 104(3), 259-275. <https://doi.org/10.1007/s42991-024-00404-8>.

The native savanna ecosystem of the Orinoquia region is the habitat of 50% of the wild ungulate species reported for Colombia. Over the last 20 years, this high species diversity has been strongly threatened by the human transformation of the natural land cover causing connectivity loss of the habitats. The Orinoquia region lacks a biological connectivity analysis with a multi-species approach involving species groups that are representative of the savanna ecosystem such as the ungulates. Understanding the spatial distributions of suitable areas and the main habitats that act as primary habitats for ungulate species in these landscapes is fundamental for the design of conservation strategies. We use an occurrence dataset for lowland tapir (*Tapirus terrestris*), white-tailed deer (*Odocoileus virginianus*), and white-lipped peccary (*Tayassu pecari*) in the development of species' potential distribution models, binarization process, and morphological spatial pattern analysis. This information was used for the modeling of dispersal corridors connecting the core habitats of the ungulate focal species using the randomized shortest path algorithm and quantifying the weighted global connectivity metrics. Our results suggest an integral corridor with potential least-cost dispersal routes between the native savanna landscape on the middle basins of the savanna rivers and the Meta River. These areas associated with the fluvial dendritic systems are connected, while the core habitats in the eastern part of the savanna landscape are disconnected. We discuss how the application of such knowledge on the spatial ecology of ungulate focal species might improve the management of the metapopulations in the Orinoquia region.





Agriculturally developed areas reduce genetic connectivity for a keystone neotropical ungulate

Baptista, M. S. P., Keuroghlian, A., Tambosi, L. R., Côrtes, M. C., de Góes Maciel, F., Cirino, D. W., Schmaedecke, G. & Biondo, C. (2025).

Biotropica, 57(1), e13418. <https://doi.org/10.1111/btp.13418>.

Modified landscapes can restrict the movement of organisms, leading to isolation and reduced population viability, particularly for species with extensive home ranges and long-distance travel, such as white-lipped peccaries (WLPs, *Tayassu pecari*). Previous studies have indicated that forested areas favor WLP herd movements, but the impact of the non-forested areas on their genetic connectivity is unknown. In this study, we used land use and land cover maps and population genetic data to investigate the impact of non-forested matrices on WLP's genetic connectivity in the Pantanal floodplain and surrounding Cerrado plateau of central-west Brazil. We compared isolation-by-distance (IBD), isolation-by-barrier, and isolation-by-resistance models and tested 39 hypotheses within a modeling framework. Finally, we identified the optimal areas for ecological corridors based on the most effective landscape model. Barrier and landscape resistance were more strongly correlated with genetic relatedness than the IBD model. The model that received the most robust support considered only forest as habitat. All other classes formed a matrix that impeded gene flow, including agriculture, grassland, savannah, and paved and unpaved roads. WLP herds living in landscapes with reduced forest cover are more vulnerable to the effects of genetic isolation. To maintain gene flow, conservation programs should prioritize strategies that strengthen connections between habitats, including facilitating wildlife road-crossing structures and creating/restoring ecological corridors to link isolated habitat fragments.

Loss of genetic diversity and isolation by distance and by environment in populations of a keystone ungulate species

de Góes Maciel, F., O'Rourke, S., Jones, M., Hemstrom, W., Miller, M. R., Schmaedecke, G., Tambosi, L. R., Pires-Baptista, M. S., Keuroghlian, A., Dales-Nava, A. F., Schiavo-Nardi, M., Almeida-Jácomo, A. T., Silveira, L., Malzoni-Furtado, M., Mundim-Tôrres, N. & Biondo, C. (2024). Conservation Genetics, 25(4), 939-953. <https://doi.org/10.1007/s10592-024-01614-w>.

Adaptive genetic and neutral variations are essential for maintaining population viability in changing environmental conditions. Habitat loss and fragmentation can be reflected in the patterns of genetic variation in the populations. White-lipped peccaries (WLPs, *Tayassu pecari*) are wide-ranging Neotropical ungulates with important ecological roles in the ecosystem suffering local extinctions worldwide. Here, we used a RAD-seq protocol to genotype 192 individuals. After filtering, we identified sets of SNP markers (ranging from 147 to 151,792 SNPs) to assess the genetic diversity and population structure of WLPs from Pantanal, Cerrado, and Atlantic Forest in Brazil. We found signals of loss ($\theta_w < \theta_\pi$) and lower genetic diversity (allelic richness, nucleotide diversity, and observed and expected heterozygosities) in the Central Cerrado and Atlantic Forest populations. Principal Component Analysis (PCA) and admixture analyses (NGSAdmix) using genome-wide and neutral SNP data sets showed three major genetic clusters according to the biomes. Multiple matrix regression with randomization (MMRR) analysis found an isolation-by-distance pattern explaining the neutral genetic differentiation. We used Latent Factor Mixed Models (LFMM) and Redundancy Analysis (RDA) to identify candidate SNPs involved in different biological processes, such as metabolism and immune and neuronal responses, mainly





associated with temperature and precipitation variables. We found an adaptive population genetic structure, suggesting three adaptive units with significant patterns of isolation-by-distance and isolation-by-environment. Our results highlighted the importance of conservation strategies for maintaining the genetic diversity of WLP populations. Furthermore, conservation plans and translocation programs should preserve and consider the adaptive variation.

Filling gaps in the southern range of the Endangered Chacoan Peccary, *Parachoerus wagneri* (Rusconi, 1930) (Artiodactyla, Tayassuidae), in Argentina

Wajner, M., Merlo, F., Argibay, D., & Zamudio, F. (2025).

Check List, 21(1), 184-190. <https://doi.org/10.15560/21.1.184>.

New records of the Endangered *Parachoerus wagneri* (Rusconi, 1930) are reported in northwestern Córdoba and south Santiago del Estero, Argentina. These records were obtained through interviews, confirmed with photographic evidence provided by the interviewees, and trail camera surveys. These findings confirm the presence of this species in strategic areas of its distribution and provide evidence of potential connection between northern and southern populations in Argentina. Participatory sampling is proving to be an essential tool for gathering high quality information in these areas, thus has become crucial in obtaining records and clarifying the distribution of *P. wagneri*.

Footfall patterns and stride parameters of Common hippopotamus (*Hippopotamus amphibius*) on land

Hutchinson JR, Pringle EV. (2024).

PeerJ 12: e17675 <https://doi.org/10.7717/peerj.17675>.

Common hippopotamuses (hippos) are among the largest extant land mammals. They thus offer potential further insight into how giant body size on land influences locomotor patterns and abilities. Furthermore, as they have semi-aquatic habits and unusual morphology, they prompt important questions about how locomotion evolved in Hippopotamidae. However, basic information about how hippos move is limited and sometimes contradictory. We aimed to test if hippos trot at all speeds and if they ever use an aerial (suspended) phase, and to quantify how their locomotor patterns (footfalls and stride parameters) change with approximate speed. We surveyed videos available online and collected new video data from two zoo hippos in order to calculate the data needed to achieve our aims; gathering a sample of 169 strides from 32 hippos. No hippos studied used other than trotting (or near-trotting) footfall patterns, but at the fastest relative speeds hippos used brief aerial phases, apparently a new discovery. Hippos exhibit relatively greater athletic capacity than elephants in several ways, but perhaps not greater than rhinoceroses. Our data help form a baseline for assessing if other hippos use normal locomotion; relevant to clinical veterinary assessments of lameness; and for reconstructing the evolutionary biomechanics of hippo lineages.

Human-common hippo (*Hippopotamus amphibius*)-conflict in the Dhidhessa Wildlife Sanctuary and its surrounding, Southwestern Ethiopia

Tefera, G. G., Tessema, T. H., Bekere, T. A., & Gutema, T. M. (2024).

Plos one, 19(5), e0303647. <https://doi.org/10.1371/journal.pone.0303647>.

The common hippopotamus (*Hippopotamus amphibius*) is one of the most endangered mega herbivore in Africa. Although the human-hippo conflict (HHC) is currently escalating due to habitat





loss, little is known about the scope of the conflict and potential mitigation measures. From 2021 to 2022, the extent of HHC, the perception of local inhabitants towards the animal, and its impacts on the conservation of the hippo were assessed within and in the surrounding areas of Dhidhessa Wildlife Sanctuary, southwestern Ethiopia. A total of 227 households were used as a data sources, participating in the questionnaire survey, focus group discussion and key informant interviews. Direct field observations were also used as key data source. Crop raiding and damage (63%, $n = 143$), was the most severely reported source of conflict, followed by direct human attack (22.9%, $n = 52$). Livestock predation and increased hippo mortality were also common types of HHC in the area. According to the study, the majority of respondents (74.4%, $n = 169$) agreed that the trend of conflict was increasing, while 16.7% ($n = 38$) argued that there was no change. Food scarcities in the buffer zone, as well as agricultural expansion in the area, have been identified as major drivers of HHC. The majority of respondents had a negative attitude toward hippo conservation; however, there were differences based on gender, age, and educational level. The major traditional hippo conflict mitigation strategies in the area include guarding, fencing, and trenching. Field observation revealed that a large extent of the former grazing and ranging areas of hippo in the area are heavily encroached and taken over by large private and public agricultural investments. Vacating and recovering at least the former buffer areas dedicated to the wildlife in the area and modern, non-lethal mitigation strategies are recommended for better conservation and safeguarding of the currently good-sized hippo population of the sanctuary.

Zambia–Zimbabwe 2022 hippopotamus (*Hippopotamus amphibius*) and other species population distribution along Zambezi River

Chakuya, J., Mulenga, P., Ndebele, M., Maimbo, H., Malunga, A., & Kilundo, A. (2024).

International Journal of Environmental Studies, 81(2), 865-880.
<https://doi.org/10.1080/00207233.2024.2330276>.

A hippopotamus and other wildlife species survey were conducted in the Zambezi River between Kariba dam wall and Luangwa River confluence. The main objective of the survey was to establish hippopotamus and other wildlife species population distribution and densities along the Zambezi River. The boat survey method was used on both sides of the river in October 2022 for 262 km. Individual hippopotamus counted were 1769 on the Zambian side and 1424 on the Zimbabwean side. The Zimbabwean side recorded higher hippopotamus pods (138) than the Zambian side (123). Individual hippopotamus density was 26.60/km with a pod density of 0.45/km. There was a significant difference in hippo population between the five Zambezi River sections on the Zambian side ($\chi^2 = 2345$, $df = 4$, $p = 0.01$) and Zimbabwean side ($\chi^2 = 538$, $df = 4$, $p = 0.01$). The study established areas with high hippo and other wildlife species population distribution and densities, and the study helps to inform management of protected areas' carrying capacities and management of Human Wildlife Conflicts. The study recommends more studies on hippopotamus migration, population demography, variation in home ranges and regular population surveys in both rivers and inland waterholes.

Population status and habitat suitability of the vulnerable common hippopotamus (*Hippopotamus amphibius*) in the Dhidhessa Wildlife Sanctuary, Southwestern Ethiopia

Tefera, G. G., Tessema, T. H., Bekere, T. A., & Gutema, T. M. (2024).

Heliyon, 10(22). <https://doi.org/10.1016/j.heliyon.2024.e40186>.





Common hippopotamuses (*Hippopotamus amphibious*) are among the top five herbivorous animals in Africa. Despite being listed as a vulnerable species by the International Union for Conservation of Nature, they are a common mammal in Ethiopia's protected areas, lakes, rivers, and marshes. However, there is insufficient data to evaluate status of the population and habitat compatibility across the most of the country. The aim of this research was to ascertain the population size of hippos and the suitability of its habitat in the Dhidhessa Wildlife Sanctuary (DWS) in southwest Ethiopia. The study was conducted between 2021 and 2022. To estimate the population size, the total count procedures were employed. The adaptability of each habitat for hippos was determined using the multi-ring buffer analysis in Arc GIS 10.2. A total of 231 and 133 hippos were observed during both the dry and wet seasons, respectively. Of the surveyed individuals, 62.08 % were adults, 20.88 % were under-adults, and 17 % were young. More hippos (45.1 %) were observed in the savanna grassland during the rainy season. Subsequently, the hippos (50.6 %) relocated to the riverine forest in the dry season. Thus, the habitats in DWS and their environs were determined to range from most suitable to unsuitable for hippos. The results showed that 58.31 % of the regions were unsuitable, 18.49 % were moderately suitable, and 23.18 % were highly suitable for hippos grazing. 7.95 % of the research area slope was suitable, 26.32 % moderate and 65.72 % not suitable and 19.8 % was considered most suitable for human interference, 46.3 % was severely disturbed, and 33.9 % was moderately affected. Based on the current investigation, it has been determined that human interference in hippos' habitats is significant. In order to protect the hippos' habitats from excessive human activities and their impacts, a buffer should be created around the DWS area.

Knowledge and Perceptions of Local People Towards the Hippopotamus, *Hippopotamus amphibious* and its Conservation: Insights from Ghana

Lawer EA & Ishaq M. (2024).

Tropical Conservation Science.17. doi:10.1177/19400829241265649.

Background and Aim: The native range of the African hippo has contracted significantly due to various anthropogenic threats such as poaching and habitat destruction, thus making the species highly prone to extinction. Protected areas can safeguard hippo populations through legal restrictions and other effective strategies. However, knowledge, perceived threats, and benefits of the species can influence local people's attitudes towards their conservation. Yet, gaps in our understanding of what people know about hippos and their conservation persist, especially in Ghana, where their population is vulnerable, thus requiring urgent research. **Methods:** To improve this knowledge deficit, we employed a mixed-methods research approach to collect data from household heads in five communities in the Bui National Park (BNP) landscape for descriptive and regression-based statistical analyses. **Results:** Our findings revealed that respondent's knowledge of hippos was significantly influenced by education and exposure to the species. Several respondents reported relatively stable or declining population patterns for hippos and attributed the causes to poaching and the construction of the hydropower dam in the BNP. Most respondents wanted hippo populations to increase in the future due to the potential benefits they could derive through tourism while the remaining respondents wanted their numbers to decline due to perceived conflict situations such as boat capsizing and crop damage. **Conclusion:** Local people's knowledge of the hippo and its conservation is influenced by education and exposure to the species, and its population is perceived to be declining due to human activities. **Implications for Conservation:** Authentic and meaningful engagements among diverse stakeholders (e.g.,





farmers, fishermen, and park authorities) in the BNP landscape are critical to ensuring hippo conservation based on our findings. In particular, community-wide education to enhance hippo literacy, avoidance of farming along riverbank habitats, and adoption of sustainable livelihood approaches may benefit the aquatic environment, hippos, and local people.

Population Size, Sex-Ratio and Age Structure of *Hippopotamus amphibius* in Nimule National Park, South Sudan

Demaya, G. S., Morjan, M. D., Lado, T. F., Gordon, S. A., Di Vittorio, M., Dendi, D., Fa, J. E. & Luiselli, L. (2024).

Journal of East African Natural History, 113(6), 50-58. <https://doi.org/10.2982/028.113.0601>.

Hippopotamus is widely declining in several African countries, whereas its status and population size are still unknown in other countries, including South Sudan. We provide insights into population estimates, sex ratios, and age structures of the hippopotamus within Nimule National Park, South Sudan. Ground surveys and indirect counts were carried out for six days in 2020. Two line transects were walked, each of four km in length, using binoculars to identify their sex and age. We applied the Out-Bound Approach method to estimate the hippopotamus population size. A total of 190 individuals were estimated, but the confidence interval (Standard Error) of this estimate was too high to make this value satisfactorily accurate. An average population density of 0.463 individuals/km² was estimated. Notably, the adult sex ratio was significantly skewed towards females (1:1.5), calves comprised about 23% of the total number (n = 510). Four earlier unpublished studies (1983-2014) were compared with the data from this study. The results of this comparison showed a moderate increase in the hippopotamus population over the past 37 years, although with considerable fluctuations from survey to survey. Overall, Nimule National Park seems to house a stable hippopotamus population, that can be important for the conservation management planning for this species along the White Nile River course.

Common Hippopotamus, *Hippopotamus amphibius* (Linnaeus, 1758) in the Kouoptamo Subdivision-Cameroon

Olivier, M. F., & Jamyl, N. M. (2024).

Global Journal of Zoology, 9(1), 005-009. <https://dx.doi.org/10.17352/gjz.000030>.

The Kouoptamo subdivision is one of the localities of the Noun Division that adjoins the Noun River. It served as a study area because of the presence of hippopotamus. This study carried out from January to July 2017, aimed to contribute to the sustainable management of wildlife by improving the observation of hippopotamuses (*Hippopotamus amphibius*) along the Noun River in the Kouoptamo subdivision. The data were obtained by administering a semi-structured survey form to fishermen, farmers, and local authorities. The results show that the average number of hippopotamuses observed along the River Noun in Kouoptamo is 10. On average, Mefuh records a very abundant potential with 13 individuals. This is followed by Buea and Mangouhnoun (7), Upstream of the dam (5), Makoumahou (4), and Downstream of the dam (3). According to habitat types, megaherbivores are highest in herbaceous savannah (6), followed by forest gallery (5), and finally shrub savannah (3). The months of observation are January and April with the greatest potential (20) and (15), followed by February and June (9) respectively, then March, May, and July (7) respectively. These pachyderms are most frequently observed in the afternoon between 2 p.m. and 6 p.m. (7), followed by the morning between 5 a.m. and 10 a.m. (6), then at midday between 11 a.m. and 1 p.m. (5) and finally at night between 7 p.m. and 4 a.m. (4). Very few





studies have been carried out on hippopotamuses in Cameroon, so aspects of their biology and ecology remain unknown; precise estimates of population size and evolutionary trends are still incomplete. However, according to the CBD, knowledge of these resources is essential for better management.

Common hippopotamus research in Ndumo Game Reserve: a reflection on an iconic flagship species

Fritsch, C. J. (2025).

African Journal of Wildlife Research, 55(sp1). <https://doi.org/10.3957/056.055.0159>.

This reflection chronicles a lineage of impactful research on the common hippopotamus (*Hippopotamus amphibius*) in Ndumo Game Reserve, South Africa, as conducted by Scotcher, Hancock, and Fritsch. Scotcher's foundational work established a nuanced understanding of hippo dietary patterns and their interaction with seasonal plant communities. Hancock built upon this by examining hippo grazing ecology and population dynamics, providing critical insights into their ecological impact. Recently, Fritsch has extended this legacy using UAVs for comprehensive population monitoring, revealing significant spatiotemporal distribution patterns and pod structures in response to environmental flows and drought conditions. Collectively, their studies have underscored the hippo's status as a keystone species and ecosystem engineer within Ndumo Game Reserve's biodiverse seasonal floodplain system. The sequential research reflects an evolving methodology and a deepening comprehension of the hippo's ecological role, emphasizing the necessity for integrated conservation strategies that consider both biological and socio-economic factors. It is hoped that this body of work illuminates the complexities of contemporary hippo conservation and research and contributes to the broader narrative of conservation and management Ndumo Game Reserve, an area of both national and international ecological significance.

Un megaherbívoro invasor al descubierto: ecología de la población de hipopótamos (*Hippopotamus amphibius*) en Colombia

Moreno-Arias, R., Nova-León, L. J., García-Loaiza, L. M., Baptiste-Espinosa, M. P., Montenegro-Díaz, O. L., López-Arévalo, H. F., Loaiza, C., Santamaría-Castiblanco, David. & Díaz-Rodríguez, G. (2024).

Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales, 48(188), 564-581. <https://doi.org/10.18257/issn.0370-3908>.

Debido a las condiciones climáticas y ecológicas favorables de los ecosistemas colombianos, la población de hipopótamos introducida en los años 80 en el país se ha incrementado y ahora se distribuye desde el valle medio del río Magdalena en Antioquia hasta la depresión momposina en Bolívar. Recientemente, el gobierno nacional declaró al hipopótamo como una especie invasora por los efectos negativos que causa su presencia en los ecosistemas, los medios de subsistencia y la vida de las personas. Se hizo un extenso estudio demográfico para determinar el tamaño y la estructura de la población de hipopótamos, describir su distribución espacial y proyectar su dinámica poblacional futura. Usando múltiples técnicas, se obtuvieron registros directos e indirectos que permitieron estimar una población de al menos 181 hipopótamos distribuidos en siete grupos, de los cuales cinco se encuentran en etapas avanzadas de invasión biológica. Dada la estructura y el tamaño poblacional estimados, se espera que la población llegue a mil individuos alrededor del 2040 si no se implementan medidas urgentes para su erradicación.





Present distribution of common hippopotamus populations in southern Africa, and the need for a centralised database

Lacy, H., Beger, M., & Traill, L. W. (2025).

Biological Conservation, 301, 110878. <https://doi.org/10.1016/j.biocon.2024.110878>.

The geographical range of common hippopotamus' (*Hippopotamus amphibius*) has retracted over the last century as a result of anthropogenic pressures. At present, extant common hippopotamus (hereafter, hippo) populations are fragmented and largely constrained to Protected Areas. There is an urgent need for conservation management, but data and information on the spatial ecology of hippos to base conservation strategies on are lacking. Without a centralised and collaborative database that documents their distribution and abundance, comprehensive population assessments remain a challenge. This study establishes a detailed spatial database of hippo population estimates and distribution across southern Africa, by collating recent survey data from a range of sources, facilitating population monitoring and informed conservation decision making. Drawing from a review of the primary literature, grey literature, aerial surveys, websites, and expert input, we provide a comprehensive geographic range map for hippos and evaluate hippo distribution within Protected Areas. Our review reveals several discrepancies between our data and previous hippo distribution and abundance estimates. We also highlight inconsistent methods used to survey hippo populations across southern Africa. By identifying twelve regions with large populations of hippos (>1000 individuals), our findings underscore the importance of extensive and well-connected Transfrontier Conservation Areas to support large, dense hippo populations. We encourage the IUCN SSC Hippo Specialist Group to promote standardised and coordinated surveys and progress a spatial database of hippo distribution and abundance across the rest of Africa.

Human-common hippopotamus (*Hippopotamus amphibius* Linné, 1758) conflicts in the Bettié and Toumodi Departments of Côte d'Ivoire

Brou, P. M., Ouattara, K., Vale, P. D., Monket, A. E. H., & Houa, N. A. (2024).

Afrique SCIENCE, 25(6), 13-22.

Anthropogenic activities in the vicinity of wildlife, particularly hippopotamuses, are leading to an increase in human-hippopotamus conflicts in rural areas. In order to contribute to the prevention and management of these conflicts, this study was initiated with the objective of characterizing human-hippopotamus conflicts along and on the Comoé and Bandama rivers. Thus, from November 2022 to December 2023, surveys using the RECCE and Attwell methods made it possible to make observations on the activities of hippopotamuses and human populations both on the banks and on the rivers. Then, community surveys were conducted to assess human-hippo interactions. The results indicate simultaneous activities between hippopotamuses and the human population living along these rivers both on the river and on land. This therefore involves a risk of direct conflicts through physical and indirect interactions between humans and hippopotamuses. The surveys conducted on 196 people in the two Departments have highlighted several types of activities and damage caused by hippopotamuses. Crop destruction was more observed in rice fields (25%) and fishing nets (41 %) in Toumodi and cocoa fields (13 %) and fishing nets (31 %) in Bettié. During the investigations, both injuries (29 %) were mentioned in Bettié and Toumodi (6 %) but only loss of life (8 %) in Bettié. The majority of those questioned had no means of fighting hippopotamuses in Bettié (71 %) and Toumodi (82%). However, the





minority of respondents used traditional methods that were not very effective in reducing or even stopping the damage. Zoning on the banks and raising awareness of the risk areas of the Comoé and Bandama rivers are recommended to significantly reduce the risk of human-hippopotamus conflicts.

Negative Human-Wildlife Interactions at Lake Kariba: Emphasis on Crocodile and Hippo Attacks on People

Matanzima, J. (2024).

The Materiality of Lake Kariba. Palgrave Macmillan, Singapore. https://doi.org/10.1007/978-981-99-9573-8_5.

This chapter considers the prevalence of negative human-animal relations in communities surrounding Lake Kariba. People in different communities (i.e., Kariba town, fishing camps/villages and rural areas) are impacted in different ways by attacks from wild animals. As a result of human-wildlife conflict (HWC), people incur minor and serious injuries, death, loss of property and disruption of livelihoods. While the chapter generally refers to all animals (terrestrial and aquatic), detailed data of conflicts induced by crocodiles and hippos are given largely because the book is about the Lake. The HWC incidents and impacts are unevenly distributed across different social groups in the region. Among the fishing communities, for example, the most impacted are men because they engage in riskier activities and spend longer periods in the Lake compared to women and children. Overall, little is being done in terms of mitigating human-wildlife conflict at Lake Kariba and the chapter provides reasons for this. Consequently, humans continue to develop negative attitudes towards animals and, in retaliation for attacks, they resort to lethal means of dealing with the problem animals. Retaliation is a major threat to conservation at Lake Kariba, I argue.

Forest loss during 2000–2019 in pygmy hippopotamus (*Choeropsis liberiensis*) habitats was driven by shifting agriculture

Erazo-Mera, E., Younes, N., Horwood, P. F., Paris, D., Paris, M., & Murray, N. (2024).

Environmental Conservation, 51(1), 55-63. <https://doi.org/10.1017/S0376892923000310>.

Abstrac. The Upper Guinea Forest (UGF; West Africa), a global biodiversity hotspot, has lost more than 90% of its original area since 1900, threatening endemic species such as the endangered pygmy hippopotamus (*Choeropsis liberiensis*). However, little is known about the proximate causes of this deforestation. We classified Sentinel-2 data using the random forest algorithm to differentiate between three main human processes (shifting agriculture, intensive agriculture or urban expansion) driving deforestation between 2000 and 2019 across the pygmy hippopotamus distribution area. Out of c. 89 600 km² in the year 2000, 15 900 km² (17%) of forest were lost, primarily to shifting agriculture (14 900 km²). Côte d'Ivoire and Liberia accounted for 14 900 km² (94%) of the net area of forest lost, c. 15 times greater than deforestation in Sierra Leone and Guinea combined (953 km²). Forest loss inside protected areas is pervasive, and it is essential to prioritize conservation efforts in areas where deforestation is still low (e.g., Taï, Sapo and Gola Rainforest national parks). We suggest that the preservation of the UGF will face challenges associated with people's demand for food and income. Continued landscape-scale planning and action to reduce deforestation are urgently needed to limit the impact of shifting agriculture on pygmy hippopotamus habitat.





Diseases

Mapping Multiple Wild Pig Species' Population Dynamics in Southeast Asia During the African Swine Fever Outbreak (2018–2024)

Lieb Z., Meijaard E, Brodie JF et al. (2025).

Conservation Letters 18:e13105

The 2018 arrival of African swine fever (ASF) in China was followed by reports of wild pig deaths across most countries in Southeast Asia. However, the magnitude and duration of population-level impacts of ASF on wild pig species remain unclear. To elucidate the spatiotemporal spread of ASF in the region for native pig species, we gathered qualitative information on wild pig population dynamics in Southeast Asia between 2018 and 2024 from 88 expert elicitation questionnaires representing sites in 11 countries. Peak reported population declines occurred in 2021 and 2022, with more than half of respondents reporting declining wild pig populations, far higher than in earlier years. The reported declines waned to 44.23% in 2024, whereas simultaneously, the number of populations reported to be “increasing” increased from 11.3% – 13.2% in 2019–2022 to 28.9% in 2024. These reports suggest that the ASF outbreak may have peaked for wild boars and bearded pigs in mainland Southeast Asia, Borneo, and Sumatra, with some subsequent recovery. However, the disease is still expanding into the ranges of island endemic species, such as new reports for the Sulawesi warty pig (*Sus celebensis*) in September of 2024. Island endemics remain particularly vulnerable to extinction from ASF and require urgent monitoring and conservation action

Landscape connectivity for predicting the spread of ASF in the European wild boar population

Goicolea T, Cisneros-Araújo P, Aguilar Vega C, Sánchez-Vizcaíno JM, Mateo-Sánchez MC & Bosch J (2024).

Scientific Reports 14:3414

African swine fever (ASF) is an infectious and highly fatal disease affecting wild and domestic swine, which is unstoppably spreading worldwide. In Europe, wild boars are one of the main drivers of spread, transmission, and maintenance of the disease. Landscape connectivity studies are the main discipline to analyze wild-species dispersal networks, and it can be an essential tool to predict dispersal-wild

boar movement routes and probabilities and therefore the associated potential ASF spread through the suitable habitat. We aimed to integrate wild boar habitat connectivity predictions with their occurrence, population abundance, and ASF notifications to calculate the impact (i.e., the capacity of a landscape feature to favor ASF spread) and the risk (i.e., the likelihood of a habitat patch becoming infected) of wild boar infection across Europe. Furthermore, we tested the accuracy of the risk of infection by comparing the results with the temporal distribution of ASF cases. Our findings identified the areas with the highest impact and risk factors within Europe's central and Eastern regions where ASF is currently distributed. Additionally, the impact factor was 31 times higher on habitat patches that were infected vs non-infected, proving the utility of the proposed approach and the key role of wild boar movements in ASF-spread. All data and resulting maps are openly accessible and usable.





An insight into brucellosis in wild boar and domestic pigs in Europe: A systematic review

Martins Ruano Z, Mateus TL, Vieira-Pinto M (2025).

Journal of Infection and Public Health 18, 4

In some European countries, animal brucellosis is a concern that requires a comprehensive understanding of its distribution, hosts and transmission routes, particularly involving wild species, in which the disease is still neglected. This systematic review was designed to summarize the current knowledge on the epidemiology of brucellosis in wild boar and domestic pigs in Europe. A systematic search was conducted in four databases to identify relevant original research articles. Thirty-six articles were included. Brucellosis has been identified in 17 European countries and the most reported circulating *Brucella* species and biovar was *Brucella suis* biovar 2. *Brucella suis* biovar 1, *Brucella suis* biovar 3, *Brucella melitensis* biovar 3 and *Brucella microti* were also identified from molecular investigations. We highlight the diversity in the occurrence of this infection, with the presence of *Brucella* species with zoonotic potential, and emphasize the need for surveillance.

Wild boar carcasses in the center of boar activity: crucial risks of ASF transmission

Cukor J, Faltusová M, Vacek Z, Linda R, Skoták V, Václavek P, Ježek M, Šálek M, Havránek F (2024).

Front. Vet. Sci. 11

African swine fever (ASF) is a highly virulent disease rapidly spreading through Europe with fatal consequences for wild boar and domestic pigs. Understanding pathogen transmission among individuals and populations is crucial for disease control. However, the carcass attractiveness for boars was surprisingly almost unstudied. Here, we evaluated if the wild boar carcasses are perceived as an attractant compared to the control sites throughout the year. For this purpose, 28 wild boar carcasses were placed in seven forest stands and continuously monitored in 2019–2020 by camera traps combined with control locations situated at least 200 m away in comparable habitats. Overall, we have recorded 3,602 wild boar visits, from which 3,017 (83.8%) were recorded in locations with placed carcasses and 585 (16.2%) in control locations. Most visits were recorded after sunset and before sunrise, corresponding to common peaks of wild boar activity. On average, the first visits were detected 4.7 days after carcass placement. Contrarily, it was 61.5 days for the control site. In conclusion, we have proven an enormous wild boar carcass attractiveness for boars, which exhibits an entirely new aspect of wild boar behavior. Therefore, the carcass removal is a crucial measure for controlling the spread of ASF.

Detection of selected pathogens in reproductive tissues of wild boars in the Campania region, southern Italy

Ferrara G, Piscopo N, Pagnini U, Esposito L, Montagnaro S. (2024).

Acta Veterinaria Scandinavica 66:9

Monitoring disease among wildlife is critical to preserving health in both domestic animals and wildlife, and it becomes much more critical when the diseases cause significant economic damage to the livestock industry or threaten public health. Given the continuous increase in populations and its role as a reservoir for several infections, wild boar (*Sus scrofa*) requires special attention regarding disease surveillance and monitoring. In this study, we investigated the molecular prevalence of selected pathogens in the wild boar population of Campania, southern Italy. The prevalence of pathogens causing reproductive problems in pigs (*Sus domesticus*),





including porcine parvovirus (PPV), porcine circovirus types 2 and 3 (PCV-2 and PCV-3), pseudorabies virus (PRV), *Coxiella burnetii*, and *Brucella suis*, was evaluated by testing the reproductive organs collected from 63 wild boars with polymerase chain reaction. The most common pathogens were PPV (44.4%) and two porcine circoviruses (14.3%). PRV and *C. burnetii*, on the other hand, showed a significantly lower prevalence (1.6%). No reproductive organs tested were positive for *B. suis*. Risk factor analysis revealed a correlation between age and PCV-2 positivity, with animals less than 12 months old having significantly higher prevalence rates. Our findings suggest that wild boars hunted in the Campania region harbour several infections potentially transmissible to other mammals' reproductive tracts. Furthermore, our results emphasized the importance of strict adherence to biosecurity protocols on domestic swine farms, especially on free-range farms, to avoid interactions between domestic and wild animals.

Genetic differentiation of wild boar populations in a region affected by African swine fever

Simon U, Gerhards K, Becker S, Willems H, Friedrichs V, Forth JH, Calvelage S, Blome S, Reiner G (2024).

European Journal of Wildlife Research (2024) 70:54

In the European Union, African swine fever (ASF) affects wild boar (*Sus scrofa*) populations in several Member States. Knowledge of population connectivity is important for the implementation of control measures, in particular the establishment of effective barriers. Population genetic comparisons of neighbouring populations can be very helpful in this respect. The present study investigated the genetic differentiation of wild boar in eastern Germany. This region has been affected by ASF since September 2020. A total of 1,262 wild boars from 31 hunting grounds (populations) in ASF-affected and ASF-free districts were sampled over a total area of almost 100,000 km². The study area encompassed a network of geographical factors that promote (roads, rivers, cities) or inhibit (natural areas, habitat corridors) genetic differentiation between wild boar populations. The genetic differentiation of the areas was based on 12 microsatellite markers. Three different Bayesian algorithms were used to analyse the data. The results were combined into a common approach with 9 clusters. Based on the cluster distribution in each population, the connectivity between the areas was quantified. The strongest differentiation was found along an imaginary line along the lower Elbe valley through Berlin and the A11 freeway to the Szczecin Lagoon. In contrast, the Mecklenburg Lake District and the south-east of the study area showed strong connectivity between areas. The special features of the landscapes along the lower Elbe valley, which was assessed as highly connective, and the high barrier effect of the A11 freeway in contrast to the other freeways in the study area show that barrier effects cannot be generalised in principle, but are actually determined by the circumstances of individual structures. The results of the connectivity analysis were compared with the distribution of viral lineages and variants. The genotypes of the wild boar populations and the ASFV lineages and variants showed a good explanatory approach for the observed disease dynamics in the study area. The newly gained knowledge on barriers and regionally different connectivity between wild boar populations can support considerations and measures for the containment of ASF in the affected areas by improving the understanding of wild boar dispersal dynamics.





Spatial prediction of wild boar distribution in Thailand applications for African swine fever prevention and control

Thanapongtharm W, Wiratsudakul A, Gilbert M, Chamsai T, Pabutta C, Wiriyarat W, Oh Y, Jayme S, Songsaeng N, Maneekan K, Yano T, Suwanpakdee S. (2025).

Scientific Reports 15:9987

African swine fever (ASF) has spread to many Southeast Asian countries, affecting domestic pig farms and wild boars. This is especially prevalent in areas where human settlements, domestic animals, and wildlife intersect. Our study suggests using the Random Forest (RF) technique to predict the presence or absence of wild boars and estimate their population density in a specified area. We suggest using data from the Spatial Monitoring and Reporting Tool (SMART) to estimate the wild boar population in Southeast Asian countries, particularly in mainland Southeast Asia. Our findings indicate a relatively high abundance of free-ranging wild boars in protected areas of northwest Thailand, where there is a significant interface between domestic pig farms and wild boars bordering Myanmar. Wild boars were also observed in the northern region, bordering Lao PDR, and in the central and southern regions of Thailand. These findings highlight the need for ASF surveillance in border areas. The study also found that the presence of wild boars is linked to deep forest cover, elevation, and distance to water bodies, in contrast, a high density of human population, rainfed cropland, and irrigated cropland were negatively associated. These results are valuable for planning risk mitigation strategies against ASF infection in wild boars and domestic pigs in Thailand and Southeast Asia for transboundary disease surveillance.

Preparing collared peccary (*Pecari tajacu* Linnaeus, 1758) for reintroduction into the wild: A screening for parasites and hemopathogens of a captive population

Silveira, J. A. G. D., Moreira, S. M., Nascimento, A. F. D., Oliveira, M. M. D., Santos, H. A. D., Estevam, L. G. T. D. M., Rodrigues, P. C., Guimarães, O. A. G., Lauria, D. M., Carvalho, A. A., & Silva, J. M. M. (2024).

Pathogens, 13(1), 47. <https://doi.org/10.3390/pathogens13010047>.

The reintroduction of captive animals to the wild helps restore endangered species, but it risks pathogen transmission, harming wild populations. Such transmission can impact the genetic diversity and long-term viability of these populations. This study assessed parasite diversity and load in captive *Pecari tajacu*, a species native to the Americas and culturally significant to Brazilian indigenous culture, prior to reintroduction. Samples from 24 peccaries were analyzed for ectoparasites, hemopathogens, and stool parasites with direct and molecular analysis. Findings showed that various parasites were present. Two peccaries (8.3%) were infested by the adult tick *Amblyomma sculptum*. Six (25.0%) tested positive for *Trypanosoma evansi*, four (16.7%) for hemobacteria of the family Anaplasmataceae, twelve (50.0%) for hemotropic Mycoplasma, and seven (29.2%) for *Leishmania braziliensis*. Stool samples indicated multiple parasites, with sixteen (66.7%) peccaries infected by Strongylida order parasites, Spiruridae in three (12.5%), and *Ascaris suum* in one (4.2%) animal. Cysts of *Balantidium* sp. were found in twenty (83.3%), *Entamoeba polecki* in five (20.8%), and *Iodamoeba bütschlii* in two (8.3%) peccaries. To our current knowledge, this is the first global report of *Leishmania braziliensis*, *Iodamoeba bütschlii*, and *Entamoeba polecki* in *P. tajacu*, irrespective of the environment, including both captivity and wild conditions. Some of these parasites are common in domestic animals, and others are zoonotic, indicating potential interspecies pathogen transmission.





Presence of gastrointestinal parasites in *Dicotyles tajacu* in conservation areas and backyards of Campeche and Yucatán, México

Flota-Bañuelos, C., Santos-Alcocer, F. E., Quej-Chi, V. H., Tun-Kuyoc, J. M., Soberanis-Soberanis, R. del A., & Canul-Solís, J. R. (2024).

Therya Notes, 5(3), 255-260. https://doi.org/10.12933/therya_notes-24-182.

Dicotyles tajacu se enfrenta a la destrucción de su hábitat, cacería furtiva en vida libre y al parasitismo en cautiverio, que provoca diarreas, pérdida de peso y la muerte. El objetivo fue determinar la presencia de nemátodos y protozoos en individuos en cautiverio en Campeche y Yucatán, México. El estudio se realizó en 2 Unidades de Manejo para la Conservación de la Vida Silvestre (UMAS) y 1 traspatio ubicados en Campeche y 1 Predio e Instalación que Maneja Vida Silvestre (PIMVS) en Yucatán, donde se obtuvieron muestras de heces de 47 individuos, que se colocaron en bolsas de polietileno rotuladas. Las heces fueron procesadas mediante sedimentación y flotación, y para la identificación de parásitos gastrointestinales se usaron los caracteres morfométricos. Los datos obtenidos se analizaron mediante la prueba de χ^2 ($P \leq 0.05$) en el software Statistica v. 9.1. Los pecaríes del PIMVS presentaron mayor prevalencia con 53.3 % individuos positivos y la carga parasitaria más elevada ($P \leq 0.05$) debido a la presencia de huevos del helminto *Strongylida* sp. y ooquistes del coccidio *Eimeria* sp. La prevalencia registrada y los parásitos de los géneros *Strongylida* sp. y *Eimeria* encontradas en el PIMVS, fue similar a zoológicos de otros países, lo que implica que estos animales en espacios cerrados son más vulnerables al endoparasitismo. La determinación de endoparásitos en *D. tajacu* es relevante para el manejo zoonosario en PIMVS, UMAS y traspatios, para evitar zoonosis, sobre todo antes de fusionar espacios comunes para el manejo de 2 o más especies.

Investigating African swine fever virus susceptibility across seven genera of pigs and peccaries using peripheral blood mononuclear cells

Friedrichs, V., Deutschmann, P., Carrau, T., Hambrecht, S., Hantschmann, A., Husemann, F., Jebam, J., Kern, C., Marcodes, S., Pauly, A., Rode-White, J., Siebert, M., Weber, H., Westerhüs, U., Blome, S. & Beckmann, J. (2025).

Journal of Zoo and Aquarium Research, 13(1), 45-51. <https://doi.org/10.19227/jzar.v13i1.850>.

African swine fever (ASF), a viral haemorrhagic fever of suids, has recently transformed from an exotic disease to a panzootic threat to domestic and wild suids worldwide. By 2023, ASF had reached large parts of Europe and Asia, parts of the Americas, and with the Democratic Republic of Timor-Leste the doorstep of Australia. The disease is caused by a large and very complex DNA virus of the genus *Asfivirus* in the family *Asfarviridae* that replicates primarily in monocytes and macrophages. So far, susceptibility to ASF virus (ASFV) has only been shown for members of the *Suidae* family. With regard to members of the *Tayassuidae* family, only collared peccaries *Dicotyles tajacu* have been investigated and showed no obvious susceptibility. In the present study, the susceptibility of peccaries was further investigated using blood-derived monocytic cells from a collared peccary, a Chacoan peccary *Catagonus wagneri* and a white-lipped peccary *Tayassu pecari* from European zoos. Viral replication was monitored using indirect immunofluorescence staining and hemadsorption tests. Unlike cells from *Suidae* including domestic pigs *Sus scrofa domesticus*, wild boar *S. scrofa*, bearded pig *S. barbatus*, Visayan warty pig *S. cebifrons*, Sulawesi babirusa *Babirusa celebensis*, red river hog *Potamochoerus porcus* and warthog *Phacochoerus africanus*, *Tayassuidae* macrophages did not support ASFV replication and thus susceptibility is highly unlikely. There is no evidence that peccaries could play any role in ASF epidemiology.





Monitoring of Selected Swine Viral Diseases in Peruvian Amazon Peccaries

Menajovsky, M. F., Mayor, P., Bodmer, R., Pérez-Peña, P., Ulloa, G. M., Greenwood, A. D., Montero, S., Lescano, A. G., Santolalla, M. L., Segalés, J., Sibila, M., Cabezón, O. & Espunyes, J. (2025).

EcoHealth 22, 69–78 (2025). <https://doi.org/10.1007/s10393-024-01692-9>.

Peccaries (collared peccary—CP—and white-lipped peccary—WLP) are an essential source of protein and income for rural communities in the Amazon region. Since 1980s, researchers in the Amazon have reported recurrent local disappearances of WLP populations. Although such disappearances impact the species conservation and the food security of rural societies, no studies have drawn consistent conclusions about the causes of these population collapses. However, it has recently been proposed that the overabundance of this species before its decline would be related to infectious disease outbreaks. In the current study, we aimed to determine the circulation (occurrence and exposure) of viruses relevant to swine health in CP and WLP populations, namely classical swine fever virus (CSFV), Aujeszky's disease virus (ADV), swine vesicular disease virus (SVDV), and porcine circoviruses (PCV). The study was conducted in two areas of the northeastern Peruvian Amazon: the Yavarí-Mirín River basin (2008 -2020), where WLPs experienced extreme population fluctuations, and the Pucacuro National Reserve (2012–2014), where no WLP disappearances have been reported. Since WLP is not easily found during population declines, we also sampled CP as an indicator of virus circulation in the area as they are likely to be susceptible to the same pathogens. CSFV and ADV antibodies were detected in both peccary species and both areas. Diseases caused by CSFV and ADV have the potential to act as ultimate causes of population collapse, especially in large WLP populations where overabundance could increase the rate of pathogen transmission. Our results were inconclusive in establishing whether or not these viruses drove the WLP population to collapse, but their potential role warrants deeper investigation, expanding the geographical coverage of studies on infectious diseases in peccaries.

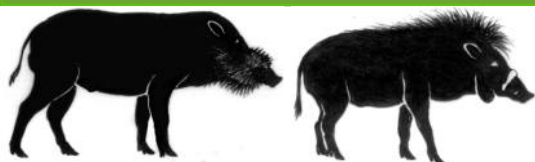
Hippopotamidae

Miller, M. A., Cooper, D. V., & Buss, P. E. (2025).

Zoo Animal and Wildlife Immobilization and Anesthesia, 1043-1054.
<https://doi.org/10.1002/9781119539278.ch49>.

There are two existing species of hippopotamus, the Nile or common hippopotamus and the pygmy hippopotamus. One of the obstacles to hippopotamus immobilization is the severe, often fatal, respiratory depression associated with potent opioid administration. Drug administration to hippopotamuses is generally performed using darts, although options for confined hippopotamuses can include pole-syringe, hand-injection, or oral administration. Historically, immobilizations of common hippopotamuses employed potent narcotics (etorphine) with or without xylazine or acepromazine. The use of potent opioids requires close monitoring for adverse signs and prompt reversal if complications occur. Depending on the initial drug dose and combination, a hippopotamus will remain immobilized for 45-60 minutes. If required, ketamine can be used to deepen the level of immobilization. There have been a few anesthetic events using narcotics in pygmy hippopotamuses combining etorphine or carfentanil with xylazine, or etorphine and acepromazine.





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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.

