Suiform Soundings

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PSG and HSG
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Suiform Soundings
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Editorial: A new beginning….

I thought for a long time about what to write in this editorial, as this latest issue of the newsletter comes at a rather momentous time in the history of the, now former, PPHSG. Having only joined this group fairly recently as editor of the newsletter, I was wondering how on earth I was going to do justice to the 29 year-old PPHSG in announcing it’s recent dissolution into three new SSC specialist groups – the Wild Pigs Specialist Group, the Peccaries Specialist Group and the Hippos Specialist Group. Thankfully I was saved from this daunting task by three far more capable and articulate contributors. Simon Stuart, William Oliver and Andrew Taber shed some light in the newsletter on why the decision was made to divide into these three new groups, and outline their hopes for the futures of the individual groups. I do, however, share their wish that the previous members of the PPHSG continue to communicate their research and discoveries with each other, and I hope that Suiform Soundings can continue to be the vehicle for this exchange. I am going to need some help with this though, so I ask the members of the various groups to please let me know how they see the newsletter evolving in light of these new circumstances, and whether we need to make any changes to our format.

As usual, this newsletter contains articles pertinent to all three of our new specialist groups: Rebecca Lewison reports on a recent pygmy hippo meeting, we have an update on the latest pygmy hog releases in India, an article on ageing feral pigs through tooth eruption and wear, and an interesting report on white-lipped peccaries raiding croplands under protection of armed guards!

Thank you to all who contributed to this issue of the newsletter, and I look forward to many more submissions. Enjoy reading this latest edition of Suiform Soundings, the newsletter of the Wild Pigs, Peccaries and Hippos Specialist Groups.

Anne-Marie Stewart, Addis Ababa, Ethiopia

WEBSITE MANAGER

We are also looking for a new webmaster to replace Susanne Loweth, who has been running the PPHSG website since its inception and has recently stepped down from the position. In Susanne’s own words, the job is relatively straightforward. It involves uploading the bi-annual newsletters to the IUCN server, occasionally updating the information on where to see wild pigs and peccaries in captivity, and selecting interesting news from the newsletters and various emails to showcase on the home page. Some experience in web design would be an advantage. Should you be interested, please contact William Oliver wlroliver@gmail.com
A Message from Simon Stuart, Chair, IUCN Species Survival Commission

This issue of Suiform Soundings comes at a major juncture in the history of the conservation of wild pigs, peccaries and hippos. The Pigs and Peccaries Specialist Group (PPSG) was founded in 1980, and merged with the Hippo Specialist Group in 1997 to become the Pigs, Peccaries and Hippos Specialist Group (PPHSG). Now, 12 years on, the decision has been divide the PPSG into its logical components: the Wild Pig SG chaired by William Oliver; the Peccary SG chaired by Andrew Taber; and the Hippo SG chaired by Rebecca Lewison. "Those who ignore history", said George Santayana, "are doomed to repeat it." As conservationists I often feel that we pay insufficient attention to our history, and in particular to those leaders of our movement who have got us to where we are today. For this reason, I strongly encourage all readers of Suiform Soundings not to be put off by the length of William Oliver's article: "The Pigs, Peccaries and Hippos Specialist Group (1980-2009): a personal retrospective and some thoughts on the ties that bind us.” Please read it! I think that it is incredibly important that William has recorded this history for us. It gives us hope that individuals working in the context of an IUCN/SSC Specialist Group really can make a difference.

On behalf of all of us, I would like to thank William for his 29 years of devoted service and leadership in chairing the PPSG and later the PPHSG. Without you, William, these species would never have been put on the conservation map. In particular, you kept the faith with the Pygmy Hog when most of us would have been tempted to give up, and your dedication to this species, and the threatened pigs of the Philippines is an example to us all. I am delighted that you have agreed to continue as chair of the new Wild Pig SG. I would also like to thank Andrew Taber and Rebecca Lewison for their long-term leadership within the PPHSG, and for agreeing to serve as chairs of the new Peccary and Hippo SGs respectively.

William makes many important points in his article, and I would like to single out two of them. First he emphasises the importance of collaboration between SSC SGs that are working on taxa with similar conservation needs in the same location. As the SGs become increasingly involved in promoting on-the-ground conservation action, the need inter-SG collaboration will grow. Second, William appeals for the ties between the three suiform SGs to be maintained, and I strongly agree. This will be achieved partly by Suiform Soundings acting as the combined journal of all three SGs, and I thank Anne-Marie Stewart for her willingness to continue editing it. We also hope to have one website to link all three SGs, and we are looking for a willing volunteer to run the new website!

I would like to close by thanking all members of the Wild Pig, Peccary and Hippo SGs for your work on behalf of these important, and in many cases increasingly threatened, species.

Simon N. Stuart

William L. R. Oliver, Chair, IUCN /SSC Wild Pig Specialist Group

The PPHSG is no more. After twenty-nine years of continual operations I am sure that those few stalwarts still amongst us that have shared the ride from the outset will have some mixed feelings, though the determining factors were almost all positive. In any event, the PPHSG has been duly dismantled and dismembered to produce three new SGs, namely: the Hippos S.G., the Peccaries S.G. and the Wild Pigs S.G. I understand that everyone most involved in these decisions believe this to be in the best interests of our respective mandates and modus operandi; though I regret this was not done as democratically as it might and should have been. On the contrary, I fear it was decided more-or-less on the spur of the moment during a long(ish) and late(ish) telephone conversation with the new SSC Chair, Simon Stuart, who I likewise hope and believe may carry the whole SSC SG network to many other positive and refreshing directions during the new quadrennium. So why and what happened?

The original ‘Pigs and Peccaries Specialist Group’ was established in 1980 at the invitation of (the late) Sir Peter Scott, then Chair of the SSC. It held its inaugural meeting in New Delhi in 1981 to coincide with a SSC Meeting, prior to an annual CITES Conference. This meeting was a modest, but seminal affair attended by most of the PPSG founder members and noted authorities on salient species, viz: Jean-Pierre d’Huart (forest hogs), David Cumming (warthogs), (the late) Ralph Wetzel (Chacoan peccary), (the late) Lyle Sowls (Tayassu peccaries), John MacKinnon (S.E. Asian suids), and (the late) Victoria Selmeir (babirusas). We each presented summaries of the conservation status and concerns of the species we were most familiar with (in my case, pygmy hogs), though John MacKinnon went one stage further by also preparing a short, but riveting report on the bewildering diversity of Indonesian suids still recognised at that time. In doing so he also introduced us to a similarly diverse array of ‘pigcultures’ and rounded it off with a short-list of likely research and conservation management priority concerns; the latter including the alarming news of the recent ‘disappearance’ of the (then) only known surviving population of Javan warty pigs (Sus v. verrucosus) from Udjong Kulon National Park in west Java (MacKinnon, 1981).

These and other jointly agreed recommendations constituted our first (if still perceptual) ‘action plan’, with everyone concurring that Javan warties, pygmy hogs and Chacoan peccaries merited the most pressing attention. It was depressingly followed by a return visit to Assam which confirmed all worst fears, namely the predicted extirpation of most of the last few remaining reserve forest populations of pygmy hogs, first described only four years earlier, via continued encroachments, profligate levels of dry season burning and other commercial forestry operations (Oliver, 1978, 1980, 1981, 1989).

These events also coincided with the publication of two classic reviews of the taxonomy of the suids by Colin Groves, who took on the task of unraveling the inordinate number of S.E. Asian wild pigs described mostly by late Victorian taxonomists. Colin’s reviews of Babyrousa (1980) and, especially, Sus (1981) provided the essential bases for our understanding of the diversity and regional genetic variation in these genera. In clarifying the affinities and distribution of innumerable naturalised populations, many of which had been erroneously recognised as valid taxa, Colin also provided a contextual framework for the interpretation and weighting of other, conservation-related data – viz: the basic ‘ammunition’ upon which we have all based our understandings and rationalised our priorities in conjunction with other data sets pertaining to known or likely threats to the continuing survival of these
In 1982, Mayer and Brandt published a major review of the distribution and status of the three peccary species, and funding support was secured to conduct a wide-ranging field status survey of the Javan warty pig. The latter project was conducted by Raleigh Blouch, who confirmed the continuing survival of these animals in several other locations on Java, but stressed the need for increased conservation activity in many of these areas where they were effectively unprotected and/or persecuted (Blouch et al., 1983).

In 1983, Colin and (the late) Peter Grubb, published a review of the taxonomy of Philippine deer (Grubb & Groves, 1983), which not only drew attention to the highly distinct (if hitherto essentially overlooked) Philippine or Prince Alfred’s spotted deer (*Cervus* - now *Rusa* - *alfredii*), but precipitated a series of events resulting in a number of expeditions to the central Philippines by Roger Cox between 1985 and 1990 and, hence, growing concerns re. the conservation status of both the spotted deer and a (similarly overlooked, but also highly distinct) warty pig (*S. barbatus cebifrons*, now *S. cebifrons*), which shared the same range of distribution (Cox, 1985, 1987; Oliver, 1993a,b).

A second PPSG meeting was convened amongst members attending the 2<sup>nd</sup> International Wild Boar Symposium in Toulouse (France) in 1984. In the same year, a wide-ranging survey of surviving grasslands in N. W. India and southern Nepal, confirmed the much wider than expected occurrence of Hisspid hares (*Caprolagus hispidus*), but failed to find any evidence of the possible survival of pygmy hogs (*Sus salvanius*, now *Porcula salvania*), which were known or presumed to have occurred throughout this region; thereby underlining the critical importance of the last few (and fast diminishing) recently known populations of these animals in N. W. Assam (Oliver, 1984).

In 1985, following PPSG representation, the Chacoan peccary (*Catagonus wagneri*) was adopted for a Species Survival Plan (SSP) under the aegis of the Conservation Management Committee of the American Association of Zoological Parks and Aquariums (AAZPA) (now the American Zoo and Aquarium Association (AZA)) and a captive breeding station was established the following year at Estancia Toledo, in the central Paraguayan Chaco (Byrd et al. 1988). In 1987, and again following PPSG representation, the first major field study of this species was initiated by Andrew Taber with funding support from the Wildlife Conservation Society. This study also resulted in the first comprehensive conservation plans for this species (Taber, 1990, 1991, 1993).

In the interim, the PPSG initiated diverse other activities, including preparation of a formally requested 'Conservation Action Plan for the Pigmy Hog', which was submitted to the relevant authorities of the Indian Central and Assam State Governments in December 1987. This Plan was agreed in full by all concerned parties, though no action was actually taken owing to high levels of civil unrest in N.W. Assam and other factors. The plan was therefore amended and re-submitted in 1990, when funding was approved by the Union Ministry of Environment & Forests, though subsequent implementation efforts by the Assam Forest Department produced mixed results and all salient activities were curtailed following continued insurgency problems and the promotional transfers of key officials (Oliver & Deb Roy, 1993).

In 1988, Peter Grubb started work on a major review of the taxonomy of the African suids; a challenge he generously accepted upon the urging of the PPSG. This study ultimately resulted in the formal rec-
ognition of 5 (rather than 3) living species, and at least 12 subspecies, of endemic African suids. These therefore included the formal ‘re-separation’ of the Red river hog and Bush pig as two full (and allopatrically distributed) species, i.e. *Potamachéros porcus* and *P. larvatus*, respectively; the latter with five distinct (if nonetheless ‘provisionally recognised’) subspecies (i.e. three on the African mainland and two more on Madagascar); and the similar recognition of two species of warthogs; i.e.: the Common warthog (*Phacochoérus africanus*), with at least 4 subspecies, and the Desert warthog (*P. aethiopicus*), with two subspecies. The latter therefore also included the astonishing ‘rediscovery’ of a surviving population of this species (*P. a. delameri*) in Somali and Kenya; which species had been formerly known only from a widely separated (but extinct) population from the Southern Cape, i.e. *P. a. aethiopicus* (Grubb, 1993) - the first known extinction of any wild suid taxon *via* anthropogenic means. Peter’s review also included recognition of 3 distinct subspecies of Forest hogs (*Hylochoérus meinertzhageni*), and helped draw attention to two (still undescribed) populations on these animals, viz: a ‘gap-filling’ form from Nigeria, presumably intermediate between the smallest, westernmost race (*H. m. ivoriensis*) and the central African (*H. m. rimator*), and an isolated population in south-central Ethiopia. 

Needless to say, all this likewise provided an indispensable rationale for weighting future research and conservation priorities amongst these animals, a process led by Jean-Pierre d’Huart (d’Huart & Oliver, 1993). In this particular instance, however, the prioritisation process was also greatly facilitated by the simultaneous collection of questionnaire data on the distribution and conservation status of all (sub-Saharan) suiformes from most African countries. Thus, in 1988/89, following a format similar to that devised by the Antelope Specialist Group (East, 1988), approximately 600 questionnaires (one questionnaire for each species of wild pig and hippo known or believed likely to occur in each country) were sent to a total of 115 wildlife officials and biologists in 42 countries. A total of 236 (39%) completed questionnaires and/or copies of relevant reports, reprints and maps, were returned by 93 (81%) correspondents, with information from 34 (81%) countries. Analyses of these data, together with information gleaned from a variety of other sources, including Peter Grubb’s review, provided the basis for the ‘action plan’ chapters for each species/genus in the PPSG and HSG Action Plan for these animals, which was completed in 1992 and published by the SSC in 1993 (Oliver, 1993c). Unfortunately, however, similar questionnaire surveys initiated in collaboration with the Deer Specialist Group in 1988/9 for all peccaries/deer in Central and South American countries and wild pigs/deer in South and Southeast Asian suids fizzled out owing to remarkably fewer responses being received; though the few data obtained by these means were also incorporated in relevant Action Plan chapters.

The questionnaire survey and production of the Action Plan therefore also marked the beginning of a long-standing (and hopefully long continuing - see below), collaboration with the Hippo S.G., duly spurred by the SSC as a means of enabling the publication of the HSG’s Action Plan (Eltringham, 1993) as part of a wider overview of the conservation status and future research and management priorities for all suiformes. This in turn, and again at the SSC’s request, led to the later merger of the PPSG and HSG following the retirement of the former HSG Chair, (the late) Keith Eltringham, and emergence of the PPHSG.

Many other things were done in the early to mid-1990s, including the convening of third and fourth meetings of the PPSG in 1990 and 1993 during the course of two international meetings on these animals, likewise facilitated by the PPSG. Of these, the former was held during a ‘Pigs and Peccaries Workshop’ at the Zoologischer Garten Berlin (West Berlin, Germany), kindly organised by long-standing group member, (the late) Hans Fraedrich (1991); whilst the latter was held in December 1993
during the course of the ‘2nd International Symposium on Wild Boar and Sub-order Suiformes’, in Bologna, Italy; an occasion which also marked the formal launching of the PPHSG Action Plan.

Earlier in the same year, the ‘Visayan Warty Pig (Sus cebifrons) Conservation Programme’, was formalised under the auspices of new Memorandum of Agreement (MOA) between the Department of Environment & Natural Resources (DENR, Government of the Philippines) and the Zoological Society of San Diego (ZSSD, USA) signed in June 1993 (Oliver, 1993b,c). Funding support kindly supplied by the ZSSD for this purpose enabled the development of a range of related in-situ and ex-situ activities, including diverse and wide-ranging field status and ethnobiological surveys, site-based biodiversity surveys and conservation management plans, education/awareness campaigns, and the establishment of the first properly structured conservation breeding programme for this species; the latter via three local threatened species rescue and breeding centres, and therefore also including founder breeding populations of animals from two separate islands - Negros and Panay.

The simultaneous collection of trophies (skulls and mandibles) kept by local hunters on various islands and subsequently deposited in the Natural History Museum, London, the Field Museum, Chicago and most recently, the Rabor Museum of Natural History, Los Banos, Philippines, also enabled both Colin Groves and Peter Grubb to determine that the Philippine suids were far more distinct and diverse than previously supposed. Consequentially, both the Visayan warty pig (S. cebifrons; IUCN ‘Critically Endangered) and Philippine warty pig (S. philippensis – IUCN ‘Vulnerable’) were upgraded as full species, each with two or more subspecies (Groves, 1991, 1997; Groves & Grubb, 1993), and the subsequent recognition of at least 3 more Philippine endemic suid species; viz: the Mindoro warty pig (S. oliveri – IUCN ‘Endangered; Groves 1997, 2001; Grubb, 2005), a new species of warty pig from the Sulu Islands (Rose & Grubb, unpublished; which should almost certainly be IUCN – ‘Endangered’), and the elevation of the Palawan bearded pig from a highly distinct subspecies to a full species (i.e. S. ahoenobarbus – IUCN ‘Vulnerable’ Groves, 2001; Lucchini et al., 2005). Indeed, the dramatic upheaval in our understanding of the diversity of the Philippine suids is especially remarkable given that only two endemic subspecies of two non-endemic species were recognised by Sanborn (1952), yet we now know of the occurrence of at least six species (of which five are endemic) and four subspecies (all endemic), with yet more taxa likely to be recognised in the wake of recent MitDNA studies by Tomono Ozawa (pers. comm. and in prep). As a consequence, however, the Philippines is not only now known to support more currently recognised endemic suid taxa than any other country, but to support far more threatened suids than any other country. Indeed all Philippine endemic suids are now threatened to varying degrees – several critically so – and the second known recent suid extinction, namely the Cebu warty pig (S. c. cebifrons), which was last recorded in the early 1960’s (Oliver, 1995, 1998; Oliver et al., 1993).

In 1995, 18 years after the formal submission and approval of the first ‘pygmy hog action plan’, a new ‘International Conservation Management and Research Agreement (ICRMA)’ was finally agreed and signed between the Union Ministry of Environment & Forests (Government of India, the Assam Forest Department (Assam State Government), the PPHSG and the Jersey Wildlife Preservation Trust (now Durrell Wildlife Conservation Trust); the latter having most kindly, and patiently, supported most field research, local advocacy and other salient activities since its original involvement in events following the ‘reappearance’ of this species in N.W. Assam in 1971. The ICMRA, the first such agreement of its kind in India, formalised recognition of the ‘Pygmy Hog Conservation Programme’ and ratified a duly updated ‘action plan’ focused on: a range of highest priority field research and conservation management interventions in Manas National Park (easily the single most important area for biodiversity con-
servation in N.E. India and by then supporting the only known surviving population of these animals; whilst also including surveys of the few surviving tall grasslands in neighbouring range states (regrettably unsuccessful in locating any other remnant populations of this species); and development of a properly structured conservation breeding programme. The latter activity was initiated in early 1996 following construction of a new ‘Pygmy Hog Research and Breeding Centre’, located on the outskirts of the Assam State capital, Guwahati, and accession of 6 (2♂♂4♀♀) wild-caught ‘founders’ in Manas. This capture was timed to coincide with the seasonal breeding cycles of these animals, specifically mid-term pregnancies, thereby resulting in the first captive-born litters from all (3) wild-caught adult sows, the addition of an unknown number of wild boar genes to the founder stock, and the tripling of the captive population a few weeks later (Narayan & Deka, 2002; Narayan et al. 1999; Oliver et al., 1997). In these respects at least, the PHCP realised many of its originally expected potentials, though there is no doubt that much more could have been achieved given more timely action by the salient governmental authorities, just as there is also no doubt that these potentials are again being tested via the first reintroductions of captive-bred hogs in Sonai Rupai Wildlife Sanctuary in 2008 (Narayan, 2006; Narayan et al., 2008) and 2009 (see separate article in this issue) and similar releases in other areas now in the planning stages.

After many seemingly interminable disappointments trying to get a newsletter started, the first edition of ‘Asia Wild Pig News’ was produced in early 2001 by Erik Meijaard (2001), doyen of the (then) ‘Asian Wild Pig Research and Conservation Group’, with funding support from the Centre for International Forestry Research (CIFOR). It was a splendid first issue, though each subsequent edition seemed to get better. The publication of the sixth edition (i.e. Vol. 3, No.2) in November 2003 also marked its expansion to include suiformes as the first official PPHSG Newsletter (Meijaard, 2003), and subsequent rechristening as ‘Suiform Soundings’ (Vol. 4, No.2; Meijaard, 2004). For all of this, we naturally owe a huge debt of gratitude to Erik; just as we do to Anne-Marie Stewart, who assumed the responsibility of compiling and editing this newsletter in 2007; just as we also do to Susanne Loweth for her equally important efforts in single-handedly establishing and managing the PPHSG website from its inception until the end of the last quadrennium.

Similar debts of gratitude are surely and equally owing to: Colin Groves and Peter Grubb for their enormous and invaluable contributions to our current understandings of the diversity of these animals; Jean-Pierre d’Huart, for his long-standing and central role in coordinating and championing the best research and conservation interests of the Afro-tropical suids from the very beginnings of the PPSG/PPHSG; to Kristin Leus for deftly managing the role of PPHSG ‘Red List Authority’; Alastair Macdonald for his long-term advocacy and championship of mainland Sulawesi babirusa (Babyrousa celebensis) and for putting and keeping the EAZA WPP&H TAG on the map; a role similarly employed and made meaningful in their turns by Carmi Penny, Curby Simmerson, Jeff Holland and Bob Barnes apropos the AZA WPP&H AG, and their further contributions in enabling implementation of highest conservation priority recommendations per critically threatened suids in the Philippines, Indonesia and elsewhere.

In all of these regards, I would also like to pay due tribute to the equally extraordinary contributions of (the late) Gerald Durrell and many others of the Durrell Wildlife Conservation Trust, both in terms of their unstinting support of the PPSG during its formative years but, and for more importantly, their crucial and tireless support of the Pygmy Hog Conservation Programme, now extending back over more than three decades. In much the same veins, the PPHSG also owes debts of gratitude to: Roland Wirth, founder President of the ‘Zoological Society for the Conservation of Species & Populations’ (ZGAP,
Germany), for somehow (and often uncannily) being well ahead of everyone else in identifying and assisting emerging species’ conservation issues; Paul Vercammen, Ettore Randi, Tomono Ozawa and others for pioneering and/or synthesizing important and original research findings that have, and may hopefully long continue to enable the PPHSG (in whatever forms) to stay on course in promoting salient conservation interventions; and, most especially, to both Rebecca Lewison, Chair of the ‘Hippo Subgroup’, and her HSG team colleagues, and to Andrew Taber, long-serving Vice Chair of the PPHSG and Chair of the Peccary Sub-Group, who together with Richard Bodmer, Mariana Altrichter and all of their PSG colleagues, for brilliantly espousing, organising and advancing the conservation interests of the Neotropic peccaries.

But therein lies both the ‘rub’ and the ‘essence’ of the aforementioned late night telephone deliberations with Simon Stuart. In short (if also to paraphrase), it was agreed that the ties that bound the PPHSG were essentially based on the early phylogenies of the three extant suiform ‘Families’, and thus also essentially ‘abstract’ in the context of our respective objectives in enabling conservation outcomes amongst a highly disjunct and unevenly represented series of species groups, most of which were (literally and metaphorically) continents apart. Realistically speaking, all this was also true even in the context of any closer biogeographic associations, such as the African suids and hippos, whose respective research and conservation priorities seldom overlap and wherein the vast majority of the PPHSG’s wider collective interests, activities and experience were otherwise engaged on matters far removed from the practical realities and needs of the last two surviving hippo species. As such, the inherent weaknesses of the systematic approach – at least at higher taxonomic (e.g. Family) levels – were not only exposed but long manifested in the fact that both the ‘Hippo SG’ and ‘Peccary SG’ have inevitably operated increasingly independently of the rest of the PPHSG since its restructuring in the wake of the PPSG and HSG merger.

True, hippos are spectacularly more specialised than the pigs or the peccaries, which have rather more in common adaptively and, therefore, ecologically and behaviourally, speaking. Both groups also obviously suffer from many of the same kinds of threats, though rather few of these threats are in any way unique to these groups of animals, but are instead shared many other larger mammals. More to the point, the practical realities of delivering conservation are most often regionally focused and site-based; meaning that the best conservation interests of these species are more likely to be advanced via alliances between regionally-based groups, than between taxonomically based groups. Which is exactly why the PSG has forged collaborative alliances with both the Tapir S.G. and the Neo-tropical section of the Deer S.G. in areas of mutual interest to these groups; just as the Afro-tropical and Asian suid sections of the (former) PPHSG (now WPSG) has in past joined forces with the Equid S.G., Antelope S.G., Deer S.G., Cat S.G. and (most recently) the Wild Cattle S.G. (see separate article/announcement elsewhere in this issue); all of which collaborations have naturally all focused on particular regional or site-base conservation issues of topical concern to each party.

The point here is that Peccary Group, like the Hippo Group, has not only operated more-or-less independently of the rest of the PPHSG, but also organised itself into an active and cohesive and (to judge from the number of recent reports published in recent issues of *Suiform Soundings*) a highly productive force, now at the forefront of peccary research and conservation management in several Latin American countries. It is my hope and belief that this process was advantaged by the PPHSG as a whole, but it is also undoubtedly the case that the Peccary S.G. has made close, practical and doubtless more useful alliances with other relevant SGs operating in the same areas than it did with any other sectors of the PPHSG. This is surely exactly as it should be given that there are many more clear and obvious
convergences of practical interests between salient large mammal SGs working in Latin America than there are between like-minded colleagues working to conserve threatened suids in sub-Saharan Africa, South and South-East Asia. The underlining notion in dismembering the PPHSG was therefore to assist this process by further empowering these groups as independent entities, to develop in their own ways according to their own needs, whilst also (it has to be said) unburdening them of the somehow demeaning “sub-group” epithet.

This is surely a much better arrangement and one that was arguably long overdue. However, though there is an obvious potential downside which I very much hope we may avoid, namely untying the ties that bound us together in the first place. Taxonomy may be an inexact science, but its crucial and fundamental importance in shaping our understanding of our respective priorities is self-evident and cannot be overstated. We may therefore continue to work on different groups of species in different areas, but we will surely continue to share the same general interests, even passions, and we can and must surely continue to exchange ideas and experiences to the benefit of all concerned. The lessons learned in developing and delivering conservation interventions in one country or region are often equally applicable elsewhere, even if necessarily adjusted to meet differing local requirements.

All of that apart, I feel sure I am also not alone in being just as entranced by news of the doings of the peccary and hippo specialists as I am by those working on African suids or suids elsewhere in Asia. We may all need to forge new alliances with other salient interest groups to better pursue local conservation priorities, but I would urge that we do not do this at the expense of any existing alliances which have served us well. In particular, I would therefore hope that we may all agree (at the very least) to continue to report our respective findings and progress in the existing and shared forums of the (excellent) Suiform Soundings as the official newsletter for all three Groups, and to retain (or rather re-build and develop) the (former) PPHSG website as the key (if not only) website for all three groups. By all the same tokens, I would also urge that we continue to pursue any and all opportunities that may arise to rejoin forces via joint research projects/publications, workshops and symposia, and continue to alert each other to salient funding opportunities, research findings, etc. Of these, the latter items are surely nothing we should not, or would not, do as a matter of course in collaboration with any other parties with whom we have common interests; but the newsletter and website are surely crucial to any notion of sustaining the ideas that brought us into being, that have served us well thus far, which have produced many extraordinarily undertakings and revelations, and which lie at the heart of all SSC operations via its (equally extraordinary and unsurpassed) network of voluntary expertise.

As such, I would also respectfully suggest that there is an opportunity here for the (former) ‘PPHSG’ network to re-join forces on an ad hoc basis to lead the field in setting important new precedents re. the forging of active and coherent (if needs be ‘formal’) alliances between both ‘taxonomic’ and ‘regional’ interest groups. As I understand matters at present, none of us ‘have got it quite right’ in terms of realising our practical conservation potentials versus our salient institutional interests. For sure, the SSC focus on taxonomic subsets is as basic as it is sometimes realistacally impractical, even potentially inappropriate, in conservation terms. Either way, and rightly or wrongly, effective conservation outcomes are almost always delivered by key individuals supported by salient organisations, rather than by those same organisations; meaning that the SSC’s most effective means of delivering conservation is by empowering such individuals with the requisite institutional authority and credibility per local governmental and/or local or international donor agency requirements. This it does much better and far more extensively than any other agency and it is hoped and expected that this process may be advanced by the division (but hopefully not the dissolution) of the PPHSG and the opportunities this presents for the
advancement of the three new groups. At least that was the idea and we can only hope it finds favour with all concerned.

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Launch of the Peccary Specialist Group

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The decision of the Species Survival Commission of the International Union for the Conservation of Nature to create an independent Peccary Specialist Group, from within the Pigs, Peccaries and Hippos SG, is a wonderful step forward for the conservation of these keystone Western Hemisphere mammals.

The formation of this new group underlines the recognition by the international conservation science community of the ecological and economic importance of the Tayassuidae family. Even more, it reflects the emergence of a numerous and vibrant community of peccary biologists and conservationists across the range states. At this time of transition it is valuable to recognize past actions of the PPHSG to support peccary research and conservation, as well as to consider some of the key challenges for the future.

In particular, I would like to acknowledge the staunch leadership of the long-time chair of the PPHSG, William Oliver, in getting peccaries on to the international conservation agenda. While his major personal contributions to science and conservation have been in Asia, William inspired the first full generation of Neotropical tayassuid biologists. He encouraged and supported some of the first research and status surveys for Chacoan peccary (*Catagonus wagneri*) in the 1980’s by Lyle Sowls, John J. Mayer, and Philip N. Brandt. Subsequently, he convinced the New York Zoological Society (now the Wildlife Conservation Society) to support an in-depth field project on this species.

He recruited me to lead this effort, fresh out of graduate school, starting me off on my professional conservation career - for which I owe him my gratitude. Amongst many other contributions to peccary conservation, William was involved in the Royal Geographical Society expedition to Maraca Island in isolated Roraima in the Brazilian Amazon, where later José Fragoso undertook his pioneering ecological study on rain forest peccaries. He further encouraged Richard Bodmer’s long-term work on peccary ecology and management in Amazonian Peru, as well as Ignacio March’s research on white-lipped peccaries in the early 1990s. William also organized and/or participated in a number of meetings, symposiums and workshops in which peccaries featured. Significantly, he led the production of the Pigs, Peccary...
ries and Hippos Action Plan, published in 1993, which represented the first full compilation of the status and conservation needs for these species. Without his support and encouragement the state of knowledge on peccary ecology and conservation would clearly not be where it is today. As the new chair of the Peccary Specialist Group, I look forward to keeping him on as an emeritus member to help guide and contribute to the new group’s work going forward.

During the 1990’s, and through the current decade, the community of peccary specialists has grow continually; and has produced a large body of knowledge and experience on the biology, ecology, conservation and management of these species. The series of Amazonian wildlife management congresses held at varying intervals since 1991, long championed by Richard Bodmer, have provided a particularly important venue for bringing together scientists and wildlife managers focused on peccaries. The number of talks and posters presented on peccary-related topics at these meetings has been remarkable.

Today, in large part as a result of these efforts, a critical mass of peccary biologists now exists across the family’s range. The best evidence of this is that the initial membership of the new peccary specialist group includes some forty individuals from at least 15 countries. One remarkable aspect of this growth is the large number of Latin American’s, including many women, working on these species today in the field.

Looking forward, there are many challenges for conserving and managing these important architects of tropical and subtropical habitats across the Americas. Unsustainable hunting and habitat destruction remain ever-present challenges to peccaries, worsened by looming threats from global climate change. The lack of knowledge on many aspects of peccary biology remains problematic as best evidenced by the fact that scientists are not yet certain how many species are extant today in the wild. On the other hand, the excellent models for sustainable use of the Tayassuids developed in Peru provide a strong baseline for other countries in the range states to adapt to local conditions. The production of an updated Action Plan for the peccaries is clearly an important next step. The process of producing this plan will provide an opportunity to draw together experience from across the family’s range to capture the state of knowledge, and identify and act on priorities. A preliminary meeting of the PSG will be held amongst those members attending the forthcoming International Mammal Congress in Mendoza, Argentina this August to start developing the action plan, and identify next steps for the group. In short, these are exciting times for peccaries and those people who are dedicated to their study, conservation and sustainable management.
Pygmy hippo researchers meet to discuss conservation strategies and regional coordination

Dr. Rebecca Lewison, Chair, IUCN Hippo Specialist Group

Pygmy hippos were upgraded to Endangered on the IUCN Red List in 2004. Extant populations of pygmy hippos are found only in four West African countries (Guinea, Sierra Leone, Liberia, Côte d'Ivoire) and are believed to number in the range of 3,000-6,000 individuals, although there has been no confirmation of that estimate. This past April, scientists representing research teams from all four countries gathered in London to discuss the state of pygmy hippo populations, research and conservation efforts. Hosted by the Zoological Society of London, the one day meeting described ongoing efforts in Gola Forest Reserve, Sierre Leone, Sapo National Park, Liberia, Taï National Park, Côte d'Ivoire and N' Zérékoré Forestry Center, Guinea. The meeting also involved key representatives from captive facilities and organizations, including the coordinator for the European Association of Zoos and Aquariums and the Institute for Breeding Rare and Endangered African Mammals.

The meeting represented an important turning point for pygmy hippos as this was the first time scientists and conservationists involved in pygmy hippo work have met to discuss opportunities and goals for collaboration. Exploring innovative approaches to surveys (e.g. utilizing remotely-sensed information, camera traps), standardization of field methods, genetic research, and telemetry were all identified as important avenues for continued efforts. The group plans to continue to work together to catalyze regional approaches to pygmy hippo research and conservation.

Indonesian national conservation planning workshops for Anoas, Babirusa and Banteng provide hope for threatened species.

James Burton, Chair, IUCN/SSC Asian Wild Cattle Specialist Group

(IUCN Species website)
http://www.iucn.org/about/work/programmes/species/?3274/Asian-wild-cattle-and-buffalos-threatened-with-extinction

(Asian Wild Cattle Specialist Group Website)
http://www.asianwildcattle.org/workshop1.shtml

Jakarta, May 18th - Over 110 Indonesian stakeholders met to agree on 10 year National Conservation Plans for four of Indonesia’s most threatened species. These species are the Anoas, two species of dwarf buffalo; the Babirusa, a wild pig; and the Banteng, a wild cattle species.

All four species are threatened with extinction according to the IUCN Red List of Threatened Species™, 2008. Poaching and habitat destruction and degradation are amongst the major threats facing these species. Also The Directorate General of Forest Protection and Nature Conservation, Indonesia, has identified these species as high priorities for species conservation, due to their threatened status.

Two workshops were successfully held. For the Anoas and Babirusa, endemic to Sulawesi Island in eastern Indonesia, the workshop was held in the Island’s northern city of Manado on the 5-6th May. The Banteng workshop was held on the 11-12th May in Bogor, Java, as this species is found in isolated populations on Java and Kalimantan. These national workshops are a continuation of the Regional Strategic Planning for wild cattle and buffaloes of South-east Asia, begun at a workshop in June 2008.

These species act as important flagships for their respective islands. Additionally, they play a vital role in their natural environment by helping to maintain habitat diversity through grazing. They also represent a major reservoir of genetic material that could help scientists safeguard and improve domestic cattle breeds throughout the world. This is best represented by the Banteng, which has a domesticated form – the Bali cattle - that is now widely used for meat and milk production across Indonesia and other south-east Asian countries.

Representatives at the workshops comprised government officials from provincial and national forestry departments, local and international NGO staff, Indonesian zoo staff, and academics. The workshops were hosted by the Indonesian Ministry of Forestry and the IUCN/SSC Asian Wild Cattle Specialist Group. The two workshops were sponsored by Leipzig Zoo, Chester Zoo, Centre for Conservation of Tropical Ungulates, Los Angeles City Zoo, Opel Zoo, Stuttgart Zoo, Houston Zoo, Audubon Zoo, the University of Edinburgh, Wildlife Conservation Society, and Earthwatch Institute.

Amongst the outcomes from the meeting are a set of priority actions that will be published as National Action Plans in 2010. Much needed information on distribution of these species was provided by attendees and will be collated onto maps as part of the Action Plans. The priority actions identified during the workshop include the urgent need for surveys to assess distribution and abundance of these species, and following from this the need to protect the priority populations through engagement and education with local communities and empowering protection agencies. The launch and implementation of these Action Plans will begin in 2010 facilitated by The Directorate General of Forest Protection and Nature
Conservation, in collaboration with the Asian Wild Cattle Specialist Group, NGOs and zoos. AWCSG and the Wild Pig Specialist Group will assist in future by developing partnerships to provide expertise and funding to priority projects.

Attendees at the Anoa and Babirusa workshop in Manado, Sulawesi.

Los chanchos de monte *Tayassu pecari* tienen guardas personales en la Península de Osa, Costa Rica

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In May 2008, the white-lipped peccaries that inhabit the Corcovado National Park went on their normal migratory movement through the Osa Peninsula, following seasonal and spatial patterns of fruiting. But this time it was different; they were escorted by a group of armed park rangers. The peccaries arrived at a local town, Rancho Quemado, and found that there was plenty of easy to gather food on people’s farms. Since they were not attacked by the local people as usual, they felt at home and remained in the town for almost 8 months, consuming a large part of people’s crops. Peccaries were seen in the streets, the farms, even inside houses. Several females gave birth and 24 piglets were born. Park rangers followed the peccaries 24 hours a day. Locals were not allowed to shoot the animals, and their attempts to chase them away from the crops with noise, dogs and stones were unsuccessful. Locals watched incredulously as their subsistence crops were destroyed by herds of peccaries, while the government wasn’t proposing any viable solution. This exacerbated the conflicts that have existed for a long time between locals and the National Park, increasing resentment towards the park and their conservation efforts.

At the end of the visit, only 5 peccaries were killed by the locals, in contrast with the past when up to 80% of the herds were killed when passing through the town. Is this a conservation triumph for this
peccary population? Doubtful. The Osa Conservation Area received funds from the Moore Foundation and the Nature Conservancy to hire personnel in order to increase, among other functions, control and patrolling. However, if conservation efforts are not integrative and participatory, taking into account the local peoples’ needs, it is not difficult to imagine what will happen once those funds are used up.

Hasta hace unos pocos años, la rápida disminución de chanchos de monte (*Tayassu pecari*) en el Parque Nacional Corcovado (Península de Osa, Suroeste de Costa Rica) era alarmante. Cacería dentro y fuera del parque, sumada a la deforestación en los perímetros del parque, estaban poniendo esta población en peligro. Uno o dos guardaparques en cada estación del parque no daban abasto con sus funciones y no podían hacer un control efectivo de la cacería.

Históricamente, los chanchos se desplazaban por la península de Osa, probablemente en busca de alimento apropiado. La disponibilidad de frutos varía espacialmente y a lo largo del año, por lo que el mosaico de tipos de bosque presente en la península proporcionaba a los chanchos un hábitat ideal para suplir sus necesidades de alimento todo el año. Estos desplazamientos continuaron aún cuando gran parte de la península se deforestó y pobló. Por lo tanto, los chanchos salían del parque en sus recorridos habituales pero se encontraban con pobladores quienes aprovechaban la situación para proveerse de abundante carne. La situación se tornó aún más difícil para los chanchos cuando sumado a la cacería de subsistencia, cazadores deportivos ilegales, usando armas modernas, encontraron en la Península de Osa un sitio para practicar su puntería. Varios estudios, artículos científicos y notas en la prensa alertaron sobre la situación preocupante de la desaparición de los chanchos.

En Marzo del 2005, entre el Proyecto Fundación Moore y The Nature Conservancy, se obtuvieron fondos suficientes para la contratación de 67 empleados para ACOSA (Área de Conservación Osa). Esto aumentó el número de guardaparques en Corcovado a 53. Un grupo grande de estos guardaparques fue destinado a patrullar el parque y en consecuencia la cacería disminuyó de manera evidente, según dicen los mismos guardaparques (Aún no hay estudios que comprueben esta observación).

Lo interesante es que se llegó a una situación en la que los pobladores locales pasaron a ser las víctimas de los chanchos:

En Mayo del 2008 los chanchos de monte llegaron al pueblo Rancho Quemado, ubicado al norte del parque, y se instalaron a pasar unos meses dándose festines con los cultivos de la gente. Uno de nosotros, pasando tiempo en la comunidad, identificó tres mandas en el mismo día en diferentes sitios, cada una de de 40 a 50 animales. Es decir que al menos había 120 animales en el pueblo y alrededores. Los chanchos estuvieron en el pueblo y los alrededores hasta Diciembre. Los chanchos, seguidos y protegidos de cerca por una patrulla de guardaparques armados, perdieron rápidamente el miedo a los humanos y se instalaron en el pueblo, donde encontraron refugio y sobre todo, abundante comida en los cultivos. Los chanchos andaban en las calles del pueblo, en los jardines, en las huertas. Algunos chanchos incluso entraron en las casas. La gente tenía miedo y los niños no fueron a la escuela por varios días. Tan a gusto se sentían los chanchos que varias hembras parieron en el pueblo y nacieron 24 chanchitos. Además de dar cuenta de las huertas familiares, los chanchos también mataron algunas gallinas y perros que se atrevieron a atacarlos.

Con la ayuda de voluntarios y funcionarios extras destinados únicamente a cuidar los chanchos, el cuerpo de guardas mantuvo vigilancia constante durante todo el tiempo. Los pobladores no podían usar armas para ahuyentar los animales, y sus intentos con piedras y ruido fracasaron mientras observaban con incredulidad como los chanchos consumían gran parte de sus cultivos. Esto creó muchos conflictos...
entre la gente y MINAET (Ministerio de Ambiente, energía y tecnología), ya que los pobladores dependen de sus cultivos para consumo propio y mínimas ventas, y sin embargo, el gobierno no presentó una solución viable al problema (más detalle de los daños y conflictos causados se puede ver en este mismo número; Almeida et al. 2009).

El comportamiento de desplazamiento de los chanchos no es nuevo. Lo que es nuevo es que al no encontrarse con las armas de los pobladores, lo animales se instalaron en el pueblo y alrededores donde encontraron comida. Antes, los chanchos bajaban desde las filas pero la gente los espantaba y mataba con carabinas hasta que las manadas se desviaban y seguían otra dirección. Otro cambio que ocurrió es el abandono de unas 50 ha de fincas dentro y alrededor del pueblo. Estas fincas tienen árboles frutales y palma africana, lo cual provee abundante comida para la fauna, y están cubiertas de tacotal, proveyendo refugio. Por otro lado, según los mismos pobladores y algunos estudios aún no publicados, se cree que la producción de frutos naturales está cambiando. Durante el 2008, muchos árboles silvestres y domésticos no fructificaron. Esto puede haber motivado a los chanchos a salir del parque en Mayo y permanecer por tanto tiempo en la zona de cultivos, cuando antes hacían sus largos desplazamientos en algún momento entre Octubre y Enero, y generalmente por no más de dos meses. Los pobladores creen que los chanchos van a regresar. Ellos dicen que el bosque ha cambiado y que los animales no tienen suficiente comida. El problema es que los pobladores tampoco van a tener suficiente comida si sus cultivos son destruidos por los chanchos. Esta situación requiere de una solución creativa y participativa, integrando la gente, el gobierno, y los científicos que pueden tratar de explicar el fenómeno realizando más estudios de fenología en la zona.

Se puede pensar que el cuidado constante por parte de los guardaparques es un triunfo para la conservación de esta población de chanchos de monte. Durante los casi ocho meses que los chanchos estuvieron en el pueblo, la gente mató 5 animales. Dos fueron decomisados, y los otros tres fueron consumidos. Esto es sorprendente, comparado con situaciones similares unos pocos años atrás donde entre el 50% y 80% de los miembros de las manadas eran cazados por los pobladores. Sin embargo, si no se encuentra una solución para los pobladores, su resentimiento hacia el parque y la fauna solo va a aumentar. Que pasara entonces cuando se terminen los fondos que soportan tanta cantidad de funcionarios, y los chanchos pierdan sus guardas personales?
Emerging infectious diseases: swine flu

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The world is experiencing a period of unprecedented infectious disease emergence. Nearly half of all human infectious diseases known today can be classified as emerging. These are diseases that 1) have been newly discovered; 2) have recently increased in incidence or prevalence; 3) have recently expanded in geographic or climatologic range; or 4) have jumped from animal populations into humans. This differs somewhat from reemerging infectious diseases, which are diseases that have been discovered previously in a species and are often at enzootic levels in that species but, for some reason, have significantly increased in incidence in specific geographic region (Newman et. al, 2005).

In March 2009, an outbreak of influenza in North America was found to be caused by a new strain of influenza virus, designated Influenza H1N1 2009, which is a reassortant of swine, avian and human influenza viruses (Gallaher, 2009). This virus is spreading from person-to-person, probably in much the same way that regular seasonal influenza viruses spread (Center for Disease Control, 2009). H1N1 was originally referred to as “swine flu” because laboratory testing showed that many of the genes in this new virus were very similar to influenza viruses that normally occur in pigs in North America. But further study has shown that this new virus is very different from what normally circulates in North American pigs. It has two genes from flu viruses that normally circulate in pigs in Europe and Asia as well as avian genes and human genes. Scientists call this a “quadruple reassortant” virus (Hoffmann et al, 2000).

Our international air travel has made it possible for this strain to circle the globe in 2 weeks, whereas previous influenza pandemics took much much longer. There were just some pigs (10-40%) that tested positive for H5N1 in Indonesia. So the 1918 flu was much like this H1N1 in its first year, and then probably got into a mixing vessel, recombined with a very virulent bird flu strain. We've seen human to pig transmission of H1N1 and we know pigs in southeast Asia have H5N1, so once these strains "meet up" we are "rolling the dice" as to what strains might arise after recombination.

A main culprit for emerging infectious diseases (EIDs) is human intrusion into and destruction of previously pristine habitats. This problem is amplified and propagated by the mobility of modern society and the globalization of cultures and commerce. Although most EIDs have existed for at least as long as their natural hosts, recent disturbances to their equilibrium, which has been attained during substantial evolutionary time, have led to sudden and often catastrophic consequences, especially when dis-
eases are introduced into naïve ecosystems (Schloegel et al., 2005). In Africa, there is a growing problem with zoonotic pathogens going the other way. That is, from humans to animals. Many people have depressed immune systems due to HIV and so some pathogens that had faded out of importance are now becoming problems again. One specific problem involves tuberculosis going from humans to mongooses and the mongoose populations are in trouble. There is already one case of humans passing infection onto their herd pigs. So, is swine flu a threat for peccaries? Can the contact between swine and peccaries lead the swine flu virus to cross over the species barrier again?

For swine flu, the virus is in a specific stage where it’s adapted for human to human transmission. The wild animal’s involvement in swine flu is still very distant, because the viral mutation probably occurred in pigs raised for slaughter in a commercial environment. The principal carriers of the virus now are humans but there is no certainty that the pathogen will stay with this host species in the future.

The virus transmission for wildlife is not reported yet. Influenza A viruses consist of eight segments of single stranded RNA and each strand contains at least one gene. The hemagglutinin (HA) gene codes viral for antigens that are particularly important in virus entry into host cells and they are also what the immune system recognizes. Although the flu is considered to have a broad host range, the virus is really only efficient in one species and spillover events can occur. What keeps the flu relatively in check is that there simply are not many species that are susceptible to it - with humans, pigs and certain kinds of birds leading the list. However, these viruses are constantly mutating and in the case of co-infections they can recombine with each other and spawn new viruses.

As the global panic subsides, scientists will focus on figuring out how to ward off the next emerging disease before it lands on our doorstep. One way to start would be to trace how, and where the H1N1 virus emerged from pigs into people. The H1N1 virus contains human, avian and swine flu genes, and genetic analysis indicates that it reassorted years ago, meaning it could have been in pig populations for some time before the virus gained the ability to transmit easily from person to person. Another lesson learned is that we need to survey our agricultural animals. If we had an extensive surveillance program, we would have known this virus was present and may have had more information about H1N1. This could have aided in curtailing the initial spread of the virus (Times, 2009). It will also be important in the future to catalog pathogens found in wild animals. This may be especially true with today’s ever expanding society that is bringing people into more and different types of contact with wild animals as we encroach further into their domains. By researching the links between wildlife, livestock and humans, scientists can better identify the movement of many new disease-causing agents before they move to people. In case we had any doubts, the rapid spread of the H1N1 virus should convince us that biologically, we live in one world, sharing microbes between species and across borders. When it comes to crafting a global early-warning system equal to the challenges posed by new pathogens, we're only as strong as our weakest link. It's one world, one health.

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Reintroduced pygmy hogs (*Porcula salvania*) thrive a year after release – more hogs released in Sonai Rupai Wildlife Sanctuary, Assam, India

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Summary

In May 2008, sixteen captive bred pygmy hogs (*Porcula salvania*) were reintroduced in Sonai Rupai Wildlife Sanctuary of Assam by the Pygmy Hog Conservation Programme (Narayan *et al.*, 2008). The released hogs were monitored in the wild *via* a borrowed camera trap and location of ‘field sign’, following serious problems experienced with radio-tracking ‘harnesses’ attached to trial animals prior to their releases. From data obtained by these means it appears that up to two-thirds of the released hogs were surviving a year after their release. In May 2009, two more groups totaling nine (four male and five female) hogs were released in Sonai Rupai. Another group of three (1♂2♀) hogs were also scheduled for release, but owing to unexpected delays in the release schedule one of the sows farrowed in the pre-release enclosure before the group was transported to the release site. The second sow is also believed to be pregnant. This group will now be released in October or November 2009 when the rainy season ends.

The pygmy hog conservation breeding and reintroduction project was started in 1996 with six (2♂4♀) wild hogs captured under permit in Manas National Park, and the later addition of 1♂ rescued from the Manas River in October 2002. The current captive breeding stock of 50 to 60 is maintained in the main Pygmy Hog Conservation Breeding and Research Centre in Basistha (located on the outskirts of the Assam State capital, Guwahati) at the pre-release facility at Potasali (close to Nameri National Park on the Assam State border with Bhutan). The programme has already released 25 hogs into the wild, which amounts to about four times the number of founders captured, and it plans to release up to 20 animals every year.
Monitoring of released hogs in Sonai Rupai

As mentioned in the last report (Narayan et al., 2008), at least three released hogs died within a month of release and a male hog did not join any other group after his female group mate died, but instead lived alone in the vicinity of the Gelgeli Protection and Monitoring camp (1.3 km from the release site). This animal lost its rear right foot in December 2008, presumably after being attacked by larger animal (possibly a wild pig, *Sus scrofa*) or after its escape from a poacher’s noose. Despite its disability it survived for a further five months with the help of regular supplementary feeds given by forest guards stationed at Gelgeli. However, it was found dead of unknown causes in May 2009.

The group compositions of the remaining 12 (5♂♂7♀♀) released hogs could not be accurately determined in the absence of any direct sightings, but it became clear from evidence of recent signs (i.e. nests, forage marks, footprints, and droppings) that at least three groups had established themselves in separate locations within a kilometer of the release site. At least one of the females that farrowed after the 2008 release separated from her group to raise her young. By mid-July, all the hogs had stopped visiting the ‘bait’ station, so supplementary feeding was discontinued at the end of July 2008. Ground surveys were continued in the area in order to monitor the hogs, but after mid-July it became increasingly difficult to enter the grass due to heavy rains, very poor visibility due to the height and density of grass, and above all, the serious threat from herds of wild elephants. The Kalamati-Gelgeli road does not remain traversable by vehicle in the rainy season between July and October, meaning that PHCP monitoring and caretaking personnel had to walk and wade for 12 km with armed guards to reach Gelgeli Camp. Unfortunately, the presence of a rogue bull elephant in the area constituted a serious risk as it was prone to attack without any apparent provocation, and two forest department workers eventually lost their lives in separate incidents. Another serious problem in Sonai Rupai area was the drug-resistant strains of malaria (both *Plasmodium vivax* and *P. falciparum*) that afflicted several inhabitants of Gelgeli Camp, including two PHCP staff who had to be evacuated to hospital.

**Ground Surveys**

In July 2008, six active nests, four freshly abandoned nests and three degraded pygmy hog nest were found in four different locations. In August, monitoring surveys were limited but four active nests, a freshly abandoned nest and eight degraded nests were found in three different locations. Four of the eight degraded nests found in August were active in July. Evidence of hog activity was recorded from eight separate locations, two of which showed only rooting/oranging marks, though these are characteristic for the species.

The hogs regularly moved their area main activity areas, presumably selecting new foraging and nest making sites while avoiding areas with intensive wild elephant activity. In August two of the groups had move 50-100 m southward while in September their area of activity shifted to a new location 100-200 m north/north-east of an area where two active nest and five older nests were found. While searching for the hogs in September, five more old nests, not recorded in July or August, were located. Signs of pygmy hog activity were seen at seven different locations over the next two months. While one of the groups moved to a grass sward closer to some waterholes, another group shifted to an area 200 m south-west of the release site. In the drier months of January and February the hogs evidently selected areas with some moisture in the soil where foraging/rooting was easier.

After some extensive areas of the grassland were accidentally burnt in December, four burnt (probably old) nests were found in the area. A couple of new nests were also found at the edge of the burnt area,
but it could not be ascertained if these were abandoned prior to or during the burning. In addition, six intact pygmy hog nests and four degraded nests were found in the vicinity. Although some foraging signs were noted close to the edge of the burnt area, there were significantly fewer signs of pygmy hog activity in the burnt area.

Besides the footprints and foraging signs, hog activity was also indicated by presence of latrines, usually found along hog tracks that tunnel through thick undergrowth. Hog latrines comprised accumulated droppings of varying freshness spread over a 1-2 meter area.

![Lone boar at Gelgeli Camp a year after release — note the amputated hind foot.](image1)

![Pygmy hog droppings on a track made by the hogs.](image2)

**Camera trap**

A video camera trap (handy-cam with DV tapes, housed in a weather-proof casing, triggered by a motion sensor. Developed at the Centre for Electronic Design and Technology, Indian Institute of Science, Bangalore) was borrowed from the Nature Conservation Foundation for monitoring the released hogs in the months of November and February. It was carefully deployed near active nests, causing least possible disturbance to the surroundings to avoid attracting predators. Due to dense growth of grass around the nests it was difficult to place the camera at a reasonable distance for wider coverage. It was placed barely 1.5 - 2 m from the nest at a height of about 25 cm. A few processed soybean chunks were used as bait (as these do not smell or decompose quickly) for the camera trap.

In November 2008, hogs were videographed near two different nests. Using identification marks (body hair-clipping) it was possible to identify one of the individuals near the second nest as a female that was last seen at the end of May 2008, a couple of weeks after the release. In February, two other females were videographed near a nest in another area. The hogs caught by the camera appeared healthy and had shiny coats, unlike the somewhat emaciated hogs captured from the wild in Manas in 1996. The fact that the released hogs appeared to be in good health despite harsh weather and sometimes difficult foraging conditions, up to nine months after their release, was most encouraging in that it not only confirmed their survival, but suggested their successful adaptation to the wild after at least one or
(in most cases) two generations of captive management.

**Sightings**
Direct sighting of released hogs were predictably very rare after the animals stopped visiting the ‘bait’ station for supplementary food, though it was not anticipated that this would happen as soon as it did. In fact, with the exception of the lone Gelgeli boar, project staff sighted released hogs on only two occasions; a pair were seen crossing a path close to the release site in November 2008, and a another male was sighted in a wooded area almost 3 km south-east of the release site in May 2009, presumably while moving from one grassland to another. This is the farthest a pygmy hog has been recorded in Sonai Rupai after their release. The forest protection staff also reported hog sightings on 2 or 3 occasions after their release.

**Observations on habitat and foraging preferences**
The hogs generally avoided flooded or very boggy areas, or areas with intensive wild elephant or wild pig activity. The available data suggest they also rarely venture into surrounding woodlands as no sign has been found in these areas; all such field sign instead being found in and around open and dense grasslands radiating away from the release site. All the nests were found in relatively dense vegetation. Aerial distance between the nests ranged from 90 m to 275 m. The distances of the closest and farthest nests from the release site were 75 m and 620 m, indicating limited dispersal of the hogs.

**Foraging**
Besides rooting around grass and other plants, hogs regularly raid ant and termite nests. During one month’s ground surveys, for example, pygmy hog forage marks and tracks were recorded at six ant nests in five different locations and four termite nests in four locations. The hogs foraged within an average radius of about 37 m from their respective nest sites and foraging areas of two groups did not overlap. Fresh foraging marks and tracks of baby and adult pygmy hogs were also found near a suspected farrowing nest in June 2008, as shown by tracks of a sow with one or more young piglets close to the nest site.

With the advent of the dry season in December, remains of chewed grass shoots started appearing in areas of hog activity. It is assumed that the hogs fulfilled their need for water by chewing succulent grass shoots. The waterholes and pools in the wooded area around the release grasslands did not have any evidence of pygmy hog activity even in the driest months (December to March). Sporadic foraging signs of S. scrofa were noticed in the woodlands and in the fringe of the grasslands. The foraging areas of released pygmy hogs and wild pigs did not overlap.

Relatively fresh stool samples were collected from four locations and were examined under a microscope. No parasitic ova or other abnormalities were detected. The droppings contained remnants of insects, pollen and vegetative parts.

**Release of more pygmy hogs in 2009**
To augment the reintroduced population in Sonai Rupai, a second release of three social groups of captive bred hogs was planned. Surveys were carried out in the sanctuary from September to November to locate and assess new grassland areas for the second release. A large area, about a kilometer south-east of the first release site was selected for this purpose as being sufficiently close to the first release to fa-
ciliate both routine monitoring exercises and likely future contacts between the first and second released animals (i.e. supplementing the existing population, rather than establishing a second ‘sub-population’ in a different area, which will be done at a later date). Ground surveys failed to yield any indications of pygmy hog activity in this area, suggesting that the first released hogs had not (yet?) ventured here. Unfortunately, however, this was also one of the areas accidentally burnt in December-January, necessitating the temporary postponement of the second releases (originally planned for early to mid-April) pending re-growth of vegetation following early rains in the first half of May 2009.

In December 2008, 12 (5♂7♀♀) first and second generation captive-bred hogs from three existing social groups were transferred from the main breeding centre at Basistha to the pre-release facility at Potasali. At Potasali, the hogs were released in their social groups into three large (c. 2,000-3,000m$^2$) enclosures heavily planted with various grasses originally collected in Manas and Sonai-Rupai to simulate their natural habitat. Thereafter, the hogs were maintained under minimum management intervention or other human contact, and encouraged to forage for themselves by providing well-balanced diets, comprising least preferred foodstuffs. These were offered in small corrals where the animals could be easily contained and recaptured for transfer to Sonai-Rupai. However, the unexpected burning of the grassland at the intended release site and consequent postponement of these releases also resulted in one of the sows in the trio (1♂2♀♀) group farrowing before this group could be transferred (it was intended that the adult sows selected for release were mated in order to farrow and rear their litters some weeks after their release). This caused a further postponement to the release of this group until the piglets were closer to weaning age (i.e. well-grown and thus more likely to survive in the wild). Thus, only 9 (4♂5♀♀) hogs were finally transferred to Sonai-Rupai in mid-May in two consecutive groups.

![Yearling hogs in feeding corral at Potosali](image1.jpg) ![Hogs in feeding corral, leading from pre-release enclosure, Potosali](image2.jpg)

**Soft-releases.**

During the reintroduction of 2008, the four groups intended for release were transferred to a single ‘pre-release’ enclosure divided into four smaller compartments, with the intention of releasing these groups after a 10-14 days initial local habituation period. This was timed to coincide with, or be a little in advance of, the expected rapid re-growth of vegetation following early rains in late April/early May.
This is also the main birth season of the pygmy hogs. Apart from the timing aspect, the most important factor taken into account was that of available manpower and other resources, which allowed only one such area to be reasonably guarded against wild elephant incursions. However, this also resulted in all four groups being temporarily remixed prior to and following their releases, which resulted in inevitable aggression and the loss of one individual killed by a particularly aggressive boar.

In learning from these problems and the behaviour of these animals after their release, it was instead decided to instead release 2009 groups consecutively in slightly different areas, about 300 m apart. After transfer from Potasali to Sonai Rupai, each group was kept in separate soft-release enclosures for 3 days before being released to the wild. These release enclosures were protected from elephant damage using temporary solar power fences. A 24 hour vigil was kept for three days from a sheltered ‘machan’ (watch tower) built in a tree near the soft-release enclosure. After releasing the hogs, the release site was used as baiting station and a watch was kept during daytime hours to observe any hog returning to the site.

The two groups of 4 (2♂♂2♀♀) and 5 (2♂♂3♀♀) hogs were released on 14th and 19th May in this manner. Initially, most of them returned regularly to the baiting station, but their visits became less frequent over ensuing days and ceased altogether by the second week of June. Two females in these groups were pregnant and are presumed to have farrowed in the wild. Ground surveys to track the released hogs are being continued. It is also proposed to test transmitter/battery implants in selected individuals to improve monitoring activities in future releases.

The hogs being transported to the soft-release enclosures.  
Pygmy hogs soon after release into the Sonai Rupai Wildlife Sanctuary.

References

Enfermidades de Ocorrência no Porco Monteiro (*Sus scrofa*) no Pantanal Sul-Mato-Grossense, Brasil

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A brucelose, leptospirose e doença de Aujeszky vêm sendo estudadas em porco silvestre no pantanal sul-mato-grossense. No período de 2002 a 2007, foram capturados 193 animais sendo 62 na sub-região de Nhecolândia e 131 na sub-região de Rio Negro. Deste total, 162 amostras foram examinadas para diagnóstico de brucelose sendo que oito apresentaram reação positiva ao teste com antígeno acidificado tamponado (TAA). No entanto, somente duas foram confirmadas pelo exame de soroaglutinação lenta com 2-mercaptopetanol (2-ME). Para diagnóstico de leptospirose foram examinados 75 soros, sete dos quais foram reagentes para a doença (9,3%). Os sorovares encontrados foram copenhageni, icterohaemorrhagiae, shermani e patoc. Bovinos, suínos domésticos e cães da região da Nhecolândia também foram testados para a doença. Os resultados apresentaram reação em 11/35 bovinos e 6/25 cães. Nenhum dos nove porcos domésticos amostrados foi reagente. Dentre as 165 amostras submetidas ao teste de ELISA para exame da doença de Aujeszky, 34 (36,5%) foram soropositivas sendo 70,6% provenientes de fêmeas. O exame *pos-mortem* em 32 animais necropsiados não demonstrou lesões compatíveis com as doenças em estudo e sim, correlacionadas com parasitoses. Em vários animais foram encontrados adultos de *Macracanthorhynchus hirudinaceus*, *Stephanurus dentatus* e *Metastrongylus*.

Brucelosis, leptospirosis, and Aujeszky's disease in feral pigs has been studied in the Pantanal of Mato Grosso do Sul, Brasil from 2002 to 2007. During this period, a total of 193 animals were captured: 62 from Nhecolandia, and 131 from the Rio Negro region. For the evaluation of antibodies against brucellosis, 8 out of 162 tested samples showed a positive response using the tamponated acidified antigen test (TAA). However, only 2 were confirmed using the slow agglutination test with 2-Mercaptoethanol (2-ME). Diagnosis of leptospirosis was accomplished by testing 75 serum samples, and 7 (9,3%) were tested positive. The serovars found were: copenhageni, icterohaemorrhagiae, shermani and patoc. Cattle and domestic pigs and dogs from the Nhecolandia region were also tested for leptospirosis. None of the pigs tested positive, but 11/35 cows and 6/25 dogs were tested positive. Out of the 165 samples tested for Aujeszky disease, using the ELISA test, 34 (36,5%) were seropositive, and 70,6% that were positive were females. A necropsy (post-mortem exam) was conducted on 32 animals, and there were no indications of lesions compatible to the Aujeszky disease. Instead, parasitosis was evident, with...
adult *Macracanthorhynchus hirudinaceus*, *Stephanurus dentatus* and *Metastrongylus* identified.

1. Introdução

O porco doméstico (Figura 1) foi introduzido no pantanal pelos primeiros colonizadores, ainda no século XVI. Altamente prolífera, a espécie adaptou-se à região e tornou-se feral em decorrência do abandono de suas criações, por ocasião da guerra do Paraguai. As condições do meio selecionaram adaptações fisiológicas e comportamentais que influenciaram sua morfologia atual, a ponto de aproximá-lo de seus ancestrais selvagens e diferenciá-lo, cada vez mais, do porco doméstico, apesar de pertencerem à mesma espécie. É caçado pelos moradores locais para obtenção de carne e banha.

Em 2002, o Laboratório de Diagnóstico de Doenças de Animais e Microbiologia de Alimentos (Laddan/ lagro/ MS) e a Universidade para o Desenvolvimento do Estado e da Região do Pantanal (Uniderp/ Anhanguera) iniciaram estudos sobre a ocorrência de brucelose, leptospirose e doença de Aujesky em porco monteiro nas sub-regiões do Rio Negro e da Nhecolândia, no pantanal sul-mato-grossense. Em complementação, foram realizados estudos anatomopatológicos para eventual detecção de lesões que pudessem estar relacionadas a alguma das doenças pesquisadas ou à presença de parasitos.

2. Métodos: Doenças Investigadas

2.1. Brucelose - O agente etiológico da brucelose suína é a *Brucella suis*, causadora de graves transtornos reprodutivos, como abortos e endometrites nas porcas (Sobestiansky et al., 2001), e orquite uni ou bilateral, epididimite e inflamações articulares, com perturbações locomotoras, nos varrões (Beer, 1999). O aborto ocorre mais comumente do primeiro ao terceiro mês de gestação. O nascimento de leitões fracos, mal formados ou natimortos também pode ser observado. As principais fontes de infecção são a água, os alimentos, fômites contaminados por aborto, placenta, secundínas e lóquios, mas, na espécie suína, a transmissão é, comumente, venérea. Os exames laboratoriais utilizados para diagnóstico da doença foram a soroaglutinação rápida, com antígeno acidificado tamponado (AAT), e soroaglutinação lenta, em paralelo com o 2-mercaptoetanol (2-ME), em que a *Brucella abortus* é usada como antígeno. Para interpretação dos resultados utilizou-se a tabela para animais não vacinados da Instrução Normativa nº 2, de 10/01/2001, a qual regulamenta o Programa Nacional de Controle e Erradicação da Brucelose e Tuberculose – PNCEBT (Ministério da Agricultura, Pecuária e Abastecimento, 2001).

2.2. Leptospirose - A leptospirose é uma zoonose caracterizada por transtornos reprodutivos, tais como abortos, natimortos, fetos mumificados e nascimento de leitões fracos, que não sobrevivem...

No presente trabalho, o teste diagnóstico utilizado foi o da soroaglutinação microscópica (SAM). As amostras reagentes foram, posteriormente, tituladas.

2.3. Doença de Aujeszky – Causada por um herpesvírus, a DA afeta animais domésticos e silvestres, mas nunca foi diagnosticada no homem (Wooten, 1998; Thawley et al., 1988). Hospedeiros naturais, os porcos domésticos e silvestres podem tornar-se portadores sadios. Uma vez infectados, eles permanecem portadores por toda a vida e podem infectar outros animais com os quais tiverem contato. Após a infecção natural, as porcas adquirem imunidade que é transferida para os leitões, através do colostru, nos quais persiste por até quatro semanas de idade (Radostits et al., 2000).

A via de infecção mais comum é a nasal. Após a infecção o vírus atinge o sistema nervoso central e permanece em estado de latência nos gânglios trigeminais, a partir de onde pode recrudescer quando ativado por algum fator de estresse. A infecção pode ocorrer por contato direto, indireto (Wooten, 1998; Thawley et al., 1988), ou por aerosóis. Nas populações silvestres, a via de transmissão mais frequente é a venérea (Romero, 2001). Os sintomas estão relacionados ao sistema nervoso, respiratório e reprodutivo (reabsoção fetal, retorno ao cio, abortos, natimortos, malformações, nascimento de leitões fracos e infertilidade). Como prova sorológica foi utilizado o ensaio de imunoadsorção enzimática (ELISA) e o teste de soronueralização (World Organization for Animal Health, 2000).

3. Resultados e discussão

Os dados do presente trabalho foram levantados a partir de uma amostragem constituída de 193 animais capturados no Pantanal de Mato Grosso do Sul, sendo 62 da região de Nhecolândia e 131 da região de Rio Negro, no período de 2002 a 2007 (Tabelas 1).

Quadro 1. Epécimes de porco monteiro capturados nas regiões de Nhecolândia e Rio Negro, no período de 2002 a 2007, por sexo e grupos etários.

<table>
<thead>
<tr>
<th>Especificação</th>
<th>Nhecolândia</th>
<th>Rio Negro</th>
<th>Soma</th>
</tr>
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<tbody>
<tr>
<td>Quantidade de animais capturados</td>
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<td>131</td>
<td>193</td>
</tr>
<tr>
<td>Fêmeas</td>
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<td>63</td>
<td>107</td>
</tr>
<tr>
<td>Machos</td>
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<td>86</td>
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<td>131</td>
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<td>20</td>
</tr>
<tr>
<td>Recaptura</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

* Dentre os 193 animais, alguns não puderam ser categorizados quanto à idade.
3.1. Brucelose
Processadas 162 amostras de soro, oito apresentaram reação positiva ao teste AAT. Ainda assim, frente ao teste confirmatório de 2-ME, apenas duas, que eram provenientes de machos adultos, mostraram-se reagentes.

Gresham et al. (2002), pesquisaram 227 porcos ferais adultos na Carolina do Sul, USA, e encontraram 44% de animais soropositivos para *B. suis*. Estudos anteriores (1976 e 1992), realizados na mesma região e usando a mesma metodologia, indicaram uma prevalência de 28% e 18%, respectivamente, para o mesmo agente.

3.2. Leptospirose

Mason et al. (1998) examinaram anticorpos contra leptospiras em 195 soros de porcos selvagens abatidos em temporada de caça na Austrália. Eles utilizaram 14 sorovares previamente isolados de suínos domésticos e selvagens na região. Os resultados demonstraram aglutininas em 20% dos soros testados sendo que o sorovar pomona foi mais frequentemente detectado. Não houve diferença entre sexos e entre as regiões estudadas (de baixa e alta pluviosidade).

Girio et al. (2004) examinaram 39 amostras de soros de porco monteiro provenientes da Região de Nhecolândia utilizando a prova de SAM contra 24 sorovares. Sete soros foram reagentes (17,9%), sendo *icterohaemorrhagiae e copenhageni* os sorovares observados com maior freqüência.

3.3. Doença de Aujeszky
Dentre as amostras colhidas, 165 foram submetidas ao teste de ELISA (triagem ou monoclonal) para a DA. Os soros reagentes foram processados pelo exame de soroneutralização, resultando em 34 amostras soropositivas (36,5%). Deste grupo, dez eram provenientes de machos (29,4%) e 24 de fêmeas (70,6%). Quanto à faixa etária, 28 das amostras correspondiam a indivíduos adultos (82,4%) e seis a sub-adultos (17,6%). Em relação à região de procedência, 24 eram da região de Rio Negro e dez da região de Nhecolândia.

Freitas et al. (2004) analisaram 63 queixadas, 7 catetos e 17 porcos na sub-região do Rio Negro, Pantanal sul-mato-grossense, e encontraram 70% de porco monteiro soropositivo para DA enquanto nos queixadas e catetos todas as amostras foram negativas.

Cunha et al. (2006) testaram 358 soros de jauléis em sete fazendas, no estado de São Paulo, através de ensaio imunoenzimático (ELISA) e soroneutralização para detecção de anticorpos contra o VDA, entre o período de 1998 e 2001. Animais soropositivos foram encontrados em três das sete fazendas pesquisadas, variando a positividade entre 25,2% e 100%.

Na Espanha, Gortazar et al. (2002) descreveram um surto de DA em porco feral com mortalidade
estimada em 14% de jovens e 7,5% de adultos. A maioria dos animais afetados tinha entre quatro e oito meses de idade. As lesões consistiam, principalmente, de aumento de volume e congestão das tonsilas e linfonodos, petequias no intestino delgado e ingurgitamento dos vasos sanguíneos cerebrais e meninges. Lesões histológicas possibilitaram a observação de uma meningoencefalite não supurativa. Anticorpos fluorescentes foram demonstrados nos tecidos dos animais afetados e a sorologia permitiu a identificação de 56% de amostras positivas.

3.4. Exame Post-mortem
Necropsiados 32 animais, os órgãos foram avaliados quanto ao tamanho, coloração, formato, consistência, conteúdos, além de aspecto da superfície serosa. Fragmentos de vísceras aparentemente normais, ou que representassem áreas de alterações visíveis macroscopicamente foram recolhidos em frascos contendo fixador universal (formol a 10%), para processamento histológico. Após a fixação, os fragmentos foram clivados, desidratados, diafanizados e incluídos em parafina. Cortes do material incluído em parafina, com 5µm de espessura, foram corados pela técnica de hematoxilina e eosina (H&E) e examinadas ao microscópio óptico.

As parasitoses com a clássica monotonía de seus quadros anatomopatológicos foram os achados mais significativos. Em associação com a infestação por *Macracanthorhynchus hirudinaceus* (Figura 2), na totalidade dos animais, as alterações intestinais puderam ser resumidas como sendo uma entérica granulomatosa crônica multifocal, onde a reação tecidual foi caracterizada por um infiltrado inflamatório de linfócitos, plasmócitos e eosinófilos, além de discreta proliferação conjuntiva.

![Figura 2: Espécime de Macracanthorhynchus hirudinaceus encontrado em porco monteiro no pantanal sul-mato-grossense.](image-url)

Em vários animais, lesões granulomatosas dos tecidos adiposos e conjuntivo perirrenal foram atribuídas à infestação pelo parasita *Stephanurus dentatus*. À migração larvária desse mesmo parasita atribuiu-se a hepatite granulomatosa crônica multifocal e a perivascular granulomatosa crônica que envolvia vasos sanguíneos do mesentério e do tecido conjuntivo pericapsular de órgãos abdominais como a adrenal e linfonodos mesentéricos. Mantida a monotonía caracterizada por linfócitos, plasmócitos e eosinófilos, a particularidade registrada em todo esse cenário foi a abundância de células epitelióides e eventuais células gigantes, especialmente nos bordos dos tratos necróticos das lesões perirrenais e hepáticas, além do esforço de encapsulamento dessas lesões por tecido conjuntivo, em alguns dos casos.

De escassa distribuição e extensão foram as lesões pulmonares relacionadas com a presença do *Metastrongylus* sp, em alguns animais. De fato, pequeno era o número de brônquios e bronquiolos contendo seções do parasita e reduzida era a quantidade de exemplares contida em cada um deles. A reação pulmonar encontrada limitava-se a uma hiperplasia do tecido linfóide associada aos brônquios e bronquiolos e à hiperplasia das células caliciformes produtoras de muco, o que caracterizava uma discreta broncopneumonia catarral crônica.
Tal conjunto de alterações compõe um quadro de monotonia usualmente observado nas doenças parasitárias, como didaticamente apresentado nas clássicas obras de patologia veterinária, dentre elas a de McGavin et al. (2001).

Em um animal, no gânglio trigemin, foram observados dois minúsculos agregados de células inflamatórias mononucleares em meio aos quais havia alguns eosínófilos. Neurônios, em razoável número, tinham o citoplasma acidófilo, homogêneo e núcleos picnóticos sugestivos de alterações causadas pelo Vírus da DA.

No entanto, este animal trata-se de uma fêmea, adulta, cujo resultado sorológico (ELISA com anticorpo monoclonal), foi negativo.

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Predation of young palms (*Atalea phalerata*) by feral pigs in the Brazilian Pantanal

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Introduction

Feral pigs (*Sus scrofa*) are one of the most successful invasive mammalian species in the world (Lowe *et al*. 2000). Many studies document the negative ecological and socio-economic consequences of feral pig invasions (Wolf and Conover 2003) and for this reason, most of the literature on feral pigs discusses methods of control and eradication (Choquenot *et al*. 1996, Cruz *et al*. 2005). Feral pigs were introduced to the Pantanal more than 200 years ago and can now be found throughout the floodplain (Mourão *et al*. 2002). The ecological impact of this species in the Pantanal is still not well understood. It has been shown that they may act as reservoirs for disease (Freitas *et al*. 2004; Herrera *et al*. 2005; Paes *et al*. 2008) predate eggs of ground nesting birds (Desbiez *et al*. 2009) and reptiles (Campos 1993) and disturb large areas of pasture (Desbiez 2007). Feral pigs are also the main hunting target of local people in the Pantanal thereby diluting the hunting pressure on native species (Desbiez 2007). Feral pigs may also act as potential seed dispersers (Desbiez 2007, Donatti *et al*. 2007) Along with tapirs (*Tapirus terrestris*), cows (*Bos taurus*), and rheas (*Rhea americana*) feral pigs are one the few species capable of ingesting whole seeds of the *Atalea phalerata* palm and dispersing them far away from the parent tree (Desbiez *et al*. 2009). Furthermore, they are the second main consumers of this fruit (Desbiez 2007). *A. phalerata* seeds were encountered in 56% of 94 fecal samples of feral pigs collected during a study on feral pigs diet (Desbiez *et al*. 2009). We have also observed that feral pigs predate young *A. phalerata* palms during the dry season.

*A. phalerata* palms occur in high density aggregations scattered around the landscape and are locally referred to as “acurizal”. These aggregations have been considered as one of the most prominent structural components of the Pantanal ecosystem (Prance and Schaller 1982, Pott and Pott 1994). *A. phalerata* palms may be considered as a key resource as they provide abundant fruit during a time of the year when fruit production is at it’s lowest and is consumed by a wide range of species (Desbiez 2007). Furthermore this palm is an important source of browse and shelter to both fauna and livestock (Santos *et al*. 2002). The aim of this study was to describe and evaluate the importance of feral pig predation and consumption of young *A. phalerata*, and speculate on the impact of *A. phalerata* recruitment.
Methods

Research took place on traditionally managed ranches in the central region of the Brazilian Pantanal at the Embrapa Pantanal Nhumirim ranch and 6 neighboring ranches covering an area of >200 km² (18º 59’ South; 56º 39’ West). Traditionally managed ranches are mostly comprised of native vegetation, cattle range freely within large grazing areas, and human densities and impact are very low.

Fecal samples of feral pigs were collected opportunistically at any time in the field between August 2002 and September 2003. Following fresh trails or groups of animals, fecal samples were collected soon after they had been deposited and before they were scattered by dung beetles. Fecal samples that were not associated with recognizable tracks or direct animal observations were excluded from the analyses. A total of 94 fecal samples were collected; 64 during the dry season (April –September) and 30 during the wet season (October- March). Micro-histological analysis was then used to identify the roots and stems from *Attalea phalerata* in the fecal samples following methods developed by Sparks and Malecheck (1968) including modifications from Scott and Dahl (1980).

During the dry season in August 2003, the number of *A. phalerata* plants dug up by feral pigs and the structure of the acurizal were evaluated while walking transects through two acurizals. One acurizal where predation (based on number of holes dug by feral pigs to uproot the plants) was high and another where predation was mild, were evaluated. The growth stage of *A. phalerata* plants was divided into the following growth stage categories:

- Category 1: germinating plants with one or two leaves that are closed
- Category 2: more than two leaves but they are still closed
- Category 3: 3 to 4 leaves that are open and waist high
- Category 4: open leaves above the waist up to the shoulder
- Category 5: more than 4 open leaves higher than shoulder
- Category 6: between class 5 and mature *Attalea phalerata* tree.
- Category 7: mature tree that gives fruits

Results

Fibers from the roots and stems of the *A. phalerata* were encountered in 40.6% (N=26) of the fecal samples collected during the dry season and in 10% (N=3) of the fecal samples collected during the wet season.

In the acurizal with mild predation by feral pigs, 420 m² were surveyed and 26 holes made by feral pigs to uproot *A. phalerata* were found. In the acurizal with high predation by feral pigs, 490m² were surveyed and 63 holes were found. Plant categories 4 to 7, belonging to the more mature stages, appeared in similar numbers between the two areas while the other categories corresponding to initial growth stages (1-4) were lower in the areas highly predated by feral pigs (Figure 1). Observations showed that feral pigs could dig up an *A. phalerata* palm within minutes and holes could be up to 50cm deep (Figure 2).

Discussion

The negative impact of feral pigs on plant recruitment has been reported in several studies throughout their distribution (Wolf and Conover 2003). Feral pigs alter plant communities through their rooting.
activities (Aplet et al. 1991, Finlayson et al. 1997, Mayer et al. 2000, Drake 2001, Cushman et al. 2004) or even more directly by predating on seedling and young plants (de Nevers and Goatcher 1990, Mayer et al. 2000, Drake 2001). Even their nest constructing behavior has been shown to cause substantial local damage to shrubs and saplings (Ickes et al. 2005). Feral pigs uproot young plants and chew at the base of the stem and roots. The excavation and uprooting of young *Attalea phalerata* palms is spectacular and a herd of feral pigs can rapidly dig up large areas and destroy many plants.

![Figure 1](image.png)

**Figure 1.** Number of *Attalea phalerata* plants at different growth stage in areas under high and mild feral pig predation in August 2003 (dry season) in the Embrapa Pantanal Nhumirim ranch (Category 1: germinating plants with one or two leaves that are closed; Category 2: more than two leaves but they are still closed; Category 3: 3 to 4 leaves that are open and waist high; Category 4: Open leaves above the waist up to the shoulder; Category 5: More than 4 open leaves higher than shoulder; Category 6: Between class 5 and mature *A. phalerata* tree; Category 7: Mature tree that gives fruits)

Palms of *A. phalerata* at initial growth phases are an important resource for feral pigs during the dry season. In another study, Desbiez et al. (2009) analyzed the frequency of items encountered in fecal samples of feral pigs. Percentages of leaves, fibers and invertebrates were similar between both seasons. However there was a marked difference in the percentage of fruits and roots found in the samples. During the wet season over 55% of the diet were fruits, while fruits made up only 13% of their diet during the dry season. Roots made up only 5% of the diet during the wet season and over 40% in the dry season. Roots are an important resource for feral pigs during periods of low fruit availability (dry season) and a high percentage of the roots ingested were young *A. phalerata* palms.
Some studies suggest a positive effect of feral pig rooting. Lacki and Lancia (1986) examined the effect of rooting on tree growth. They found that beech responded to feral pig rooting with increased height growth, which they speculate resulted from enhanced nutrient mobilization in soils disturbed by pigs. Other studies find no impact. A study by Groot Bruinderink and Hazebroek (1996) in the Netherlands examined the effects of rooting by wild boar on soil chemistry and forest regeneration in various habitats. They did not find a significant impact from wild boars. However, in the acurizals the rooting behavior is not random and is directly linked to predation of young palms. The overall effect is loss of young plants.

Other factors may be affecting *A. phalerata* recruitment in acurizals. In the Pantanal, cattle trampling was found to affect the recruitment of young manduvi (*Sterculia apetala*) (Johnson *et al.* 1997) and in a similar way most certainly impact *A. phalerata* recruitment in acurizals. When it is windy or colder, cattle sleep in acurizals and trample young plants. Traditionally, pasture in the Pantanal is frequently burned (Rodrigues *et al.* 2002). These fires may propagate themselves in forested areas. Although older *A. phalerata* trees are resistant to fire (Pott and Pott 1994) young plants might be killed.

**Figure 2.** Predated category 3 *Attalea phalerata* palm, August 2003 (dry season).
The preliminary data presented here does not enable us to measure the long lasting impact of young *A. phalerata* palm predation by feral pigs. Number of mature trees was similar between highly predated and mildly predated areas. In another study (Keuroghlián & Eaton, in press), predation of *A. phalerata* seedlings was found to promote the maintenance of acurizais by reducing competition between the young plants. This study needs to be repeated in several areas and feral pig predation of plants needs to be monitored. The use of exclosure plots could be used to evaluate the impact of cattle trampling and feral pig rooting in acurizais. This study shows that young *A. phalerata* plams roots and stems are an important part of feral pig diet particularly during the dry season when fruit availability is low. It predicts that predation may have a long lasting impact on *A. phalerata* recruitment.

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El chancho de monte (Tayassu pecari) se alimenta de los cultivos de las comunidades adyacentes al Parque Nacional Corcovado, Península de Osa, Costa Rica.

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Introducción

Las características biogeográficas de la Península de Osa la posicionan como uno de los sitios megadiversos del planeta. El parque Nacional Corcovado protege 47,757 hectáreas de bosque tropical lluvioso, bioma remanente en la región del Pacífico Centroamericano. La alteración del hábitat y la cacería han afectado varias especies como el jaguar (Panthera onca), la danta (Tapirus bairdii), el chancho de monte (Tayassu pecari), el oso caballo (Myrmecophaga tridactyla), el águila arpía (Harpia harpyja) y la lapa roja (Ara macao), disminuyendo sus poblaciones a niveles preocupantes. Dichas especies carecen de estudios y monitoreos a largo plazo para diagnosticar su estado de conservación.

El chancho de monte es una especie muy móvil, considerada por algunos autores como nómade o migratoria. El chancho de monte es principalmente frugívoro, pero también se alimenta de raíces, tallos, hojas, lombrices y otros invertebrados (Altrichter et al., 2000), y vive en grandes manadas por lo que necesita grandes extensiones para encontrar suficiente alimento. El chancho de monte es una especie clave debido a que depreda gran cantidad de semillas y dispersa otras, alterando la estructura y composición del hábitat. En costa Rica esta especie ha desaparecido en gran parte de su distribución original, pero poblaciones importantes subsisten en el Parque Nacional Corcovado. La cacería fuera del parque y en los bordes del mismo ha afectado a las poblaciones (Altrichter & Almeida 2002), sin embargo, no se conoce actualmente cual es la situación de conservación de la especie en la región.

El parque nacional Corcovado está rodeado por una reserva indígena Guaymi y aproximadamente 20 pueblos pequeños. La gente local consume varias especies silvestres. La mayoría de los habitantes practican agricultura de subsistencia y ganadería. El chancho de monte ha sido una de las presas favoritas de la gente local. Históricamente se conoce que los chanchos hacen largos desplazamientos por la península, generalmente hacia el final de la época húmeda entre octubre y diciembre. Un estudio realizado en 1997 encontró que la disponibilidad de frutos dentro del parque disminuyó drásticamente durante esta época, y consecuentemente, la cantidad de frutos y semillas consumida por los chanchos también disminuyó. Los chanchos se observaron en estado de estrés durante esos meses, consumiendo casi únicamente tallos y hojas y desplazándose largas distancias diarias (Altrichter, 1997; Altrichter et al., 2001).

Actualmente, un nuevo fenómeno está ocurriendo en la península que llama la atención; Los chanchos de monte están saliendo del parque nacional Corcovado durante varios meses al año y permanecen en los alrededores de las comunidades adyacentes, alimentándose de los cultivos. Debido a la estricta protección y la presencia constante de guardaparques, los habitantes no pueden usar armas para ahuyentarlos. Esta permanencia larga de los chanchos en las áreas de cultivos puede responder a un
aumento de las poblaciones de la especie, o a cambios ecológicos que afecten la disponibilidad de alimento natural.
La relación vida silvestre y asentamientos humanos en la Península de Osa fueron estudiadas por Almeida (2000,2003), Altrichter et al (1999) y Altrichter y Almeida (2002). Los autores describen a la expansión de las actividades agropecuarias como uno de los factores que conllevan a la disminución y extinción de poblaciones de fauna. La expansión agropecuaria está ligada a la cacería como fuente de sustento de los campesinos y también como forma de controlar el daño producido por la fauna a los cultivos. La problemática del efecto de la fauna a la producción agropecuaria es un tema controversial. A pesar de la existencia de legislación pertinentes, no ha habido respuesta por parte de administradores de los recursos naturales del país en términos de monitoreo y búsqueda de soluciones para las pérdidas en la productividad local y la conservación de la fauna afectada. Este estudio se enfocó en identificar las especies que están alimentándose de los cultivos y el tipo de daño producido en la comunidad de Rancho Quemado.

**Problemática de la presencia de chancho de monte en la comunidad de Rancho Quemado**

- El movimiento de los grupos de chanchos de monte desde la bajura del Parque Nacional Corcovado hacia las partes altas de la Península de Osa es un comportamiento natural de esta especie e históricamente conocido por los habitantes de la zona.
- Rancho Quemado, entre muchos otros sitios de la Península de Osa, es uno de los hábitats que los grupos de chanchos prefieren por sus condiciones ambientales (comida y refugio).
- La cacería de esta especie fue históricamente realizada por los habitantes de los bosques de la Península de Osa principalmente cuando los grupos de fauna realizaban sus movimientos migratorios.
- La creación y aplicación de la Ley de Conservación de la Vida Silvestre No. 7317, a partir del año de 1992 y la veda total de la cacería en el Área de Conservación Osa (ACOSA), prohíbe la explotación de fauna silvestre para consumo.
- Los cambios climáticos a nivel mundial pueden estar afectando los ciclos productivos de la flora de los bosques de la Península de Osa, conduciendo a la disminución de frutos y otros recursos vegetales consumidos por la fauna local.
- La escasez de frutos y otros recursos florísticos (hojas, tallos, flores y semillas), además de afectar a las poblaciones animales que los consumen, estaría también afectando toda la dinámica ecosistémica de la montaña.
- La protección de la fauna es preocupante porque las áreas protegidas son muy pequeñas como para mantener poblaciones viables de grandes mamíferos.
- Las poblaciones de fauna silvestre pueden crecer de tal manera dentro de las áreas protegidas que exceden la capacidad de carga de las mismas y consecuentemente llegan a sobreexplotar los recursos disponibles o a desplazarse fuera de las mismas.
- En estos casos es seguro que dichas poblaciones buscan suplir sus necesidades alimentarias con las producciones agropecuarias de las zonas vecinas a sus hábitats.

**Área de estudio**

El estudio fue realizado en la Reserva Forestal Golfo Dulce, en la comunidad de Rancho Quemado (N08°41’15”, W083°34’15”) en la península de Osa (Fig. 1). La comunidad está ubicada en un valle a 200 m.s.n.m., rodeada por un relieve montañoso con bastante cobertura boscosa, representada por bosque tropical denso siempreverde latifoliado basal bien drenado y bosque tropical denso
siempreverde latifoliado pre montano bien drenado (Kappelle et al., 2002). En el valle se ubica la Laguna Chocuaco, humedal de gran importancia ecológica, donde nace el Río Riyito.

Las propiedades dentro de la comunidad (lotes, parcelas y fincas) tienen un tamaño entre 0.02 y 300 has. La actividad agropecuaria está representada por cultivos estacionales, en su gran mayoría frutales y plantaciones de melina y palma africana. La carga ganadera es de aproximadamente 500 cabezas de ganado. También se da la crianza de cerdos y aves domésticas. La población de Rancho Quemado está compuesta por aproximadamente 150 habitantes.

**Figura 1.** Ubicación de Rancho Quemado y el Parque Nacional Corcovado en la Península de Osa, Costa Rica.

**Métodos**

Al iniciar el estudio se realizaron entrevistas con informantes clave locales, seleccionados dentro de la Asociación de desarrollo Integral, MINAET y Consejo Local Peninsular, además de miembros de la comunidad.

Se uso una encuesta semiestructurada con los propietarios afectados por daños producidos por fauna silvestre en la producción agropecuaria. Todos los entrevistados tuvieron más de 20 años de vivir en la zona. Sus familias suman 66 personas consideradas en este estudio como afectadas directamente por los daños ocasionados por la fauna silvestre. Todos los entrevistados son agricultores de profesión y las entradas económicas de la familia dependen de la producción.

Para el análisis de los daños ocasionados por fauna silvestre se consideraron casos ocurridos entre noviembre de 2007 y octubre de 2008. Parte de esta información estuvo relacionada con daños ocasionados por chanchos de monte entre mayo y agosto de 2008.

Para cada actividad agropecuaria afectada se calculó la perdida de la producción, estimando los valores de tres procesos de la producción:

1. Mano de obra
2. Insumos
3. Producto

Para calcular los valores de los tres procesos antedichos, se tuvo en cuenta la estimación realizada por el damnificado, el promedio local y los valores nacionales (Consejo Nacional de Producción, 20–26 de Octubre de 2008).

**Resultados**

La información colectada a través de las entrevistas a informante claves indicó que la problemática de la destrucción de cultivos por chanchos de monte en las comunidades estuvo relacionada con lo siguiente:
1. Manejo inadecuado de la fauna silvestre por los gestores gubernamentales (ACOSA-MINAET).
2. Falta de capacidades técnicas y legales para el manejo del conflicto por parte de ACOSA-MINAET.
3. Diferencias de intereses y posiciones de los miembros de la comunidad con relación a la presencia de los chanchos.
4. Pérdidas socioeconómicas que afectan la calidad de vida.
5. Falta de información ecológica confiable que explique el problema.

Los entrevistados indicaron que la danta ocasiona la mayoría de los daños en cultivos (79%), seguida del pizote (64%) y chanco de monte (57%) (Fig. 2).

![Fig. 2 Frecuencia de fauna silvestre mencionada como dañina para la producción agropecuaria](image)

La producción agropecuaria más afectada por los chanchos de monte fueron tubérculos (Cuadro 1).
Cuadro 1. Producción agropecuaria afectada por fauna silvestre en la comunidad de Rancho Quemado

<table>
<thead>
<tr>
<th>Cultivo</th>
<th>% de agricultores que reportaron daño</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yuca</td>
<td>37</td>
</tr>
<tr>
<td>Chamol</td>
<td>32</td>
</tr>
<tr>
<td>Maiz</td>
<td>14</td>
</tr>
<tr>
<td>Tiquisque</td>
<td>9</td>
</tr>
<tr>
<td>Caña de azúcar</td>
<td>4</td>
</tr>
</tbody>
</table>

Básicamente los entrevistados utilizaron tres medidas para mitigar los daños ocasionados por fauna silvestre: ahuyentar los animales con piedras o palos (20%), ahuyentar animales con perros (13%) o haciendo ruido (13%). La mayoría (54%) no hizo nada. Estos agricultores mencionaron que la distancia entre sus casas y los cultivos dificultó la vigilancia de los mismos. Sin embargo el mayor impedimento para ahuyentar animales tales como los chanchos de monte fue la presencia continua de personal del Ministerio de Ambiente, Energía y Tecnología (MINAET) que impidieron el uso de armas. Para las especies de hábitos nocturnos como la danta, las posibilidades de intervenir durante su daño son muy remotas, y mencionadas como peligrosas por los entrevistados.

Según los entrevistados la presencia de los chanchos de monte dentro de la comunidad estaría relacionado con factores ambientales del bosque, la protección y vigilancia de los guarda parques y la disponibilidad de alimento provista por los cultivos (Cuadro 2).

Cuadro 2. Causas de la presencia de los chanchos de monte en la comunidad mencionadas por los pobladores.

<table>
<thead>
<tr>
<th>Causa</th>
<th>Porcentaje de las respuestas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escasez de alimentos en los bosques</td>
<td>41</td>
</tr>
<tr>
<td>Disponibilidad de alimentos (cultivos) en la comunidad</td>
<td>29</td>
</tr>
<tr>
<td>Protección contra depredadores</td>
<td>12</td>
</tr>
<tr>
<td>No sabe</td>
<td>12</td>
</tr>
<tr>
<td>Aumento de la población de chanchos</td>
<td>6</td>
</tr>
</tbody>
</table>

Valoración de los daños ocasionados por fauna silvestre en los cultivos de Rancho Quemado

Diez especies de fauna silvestre estuvieron involucradas en los daños provocados a las actividades agropecuarias en la comunidad de Rancho Quemado. La danta y chanco de monte fueron las especies más involucradas con el 71% y 57% respectivamente.

La mayoría de los daños ocasionados por la danta fueron en cultivos de frijol junto con otras dos especies (pajilla y babosa) totalizando aproximadamente 3.220kg de pérdidas, con un valor atribuido de
2.833.000 colones (5060 dólares).

Los chanchos de monte afectaron más a los cultivos de tubérculos (Cuadro 1) con un total de 31.927 kg, valorados en 30.144.000 colones (53800 dólares).

**Discusión**

ACOSA-MINAET asume como misión institucional el promover la protección y la conservación de los recursos naturales del país. Los gestores de MINAET de la Reserva Forestal Golfo Dulce crearon operativos garantizando la protección de los chanchos de monte en la comunidad, impidiendo cualquier intento de alteración del comportamiento de la fauna por parte de los pobladores locales. Esto favorece la protección de la especie pero no presenta alternativas que ayuden a los agricultores locales a solventar sus pérdidas. A esto se suman antecedentes conflictivos durante la creación de la Reserva Forestal Golfo Dulce y Parque Nacional Corcovado que contribuyeron a que más de la mitad de los entrevistados indicara una regular/mala administración por parte de ACOSA-MINAET y una mala relación entre la institución y las comunidades.

Las pérdidas de cultivos representan una gran pérdida económica y de sustento para los pobladores locales. Esta valoración económica de los daños se basa en un análisis social y ambiental del caso presentado en la comunidad de Rancho Quemado. A pesar de la existencia de legislación que permite la asistencia del gobierno a este tipo de casos, los procedimientos técnicos y legales para esta asistencia carecen aún de modelos y protocolos que orienten la ejecución de la ley. Es indispensable encontrar formas de mitigar o impedir la destrucción de los cultivos. Además de las actividades agropecuarias hay interés por parte de algunos propietarios en desarrollar actividades agroecoturísticas. Durante los últimos diez años se han promovido pequeños proyectos turísticos en la península de Osa, en especial en las comunidades de la zona de amortiguamiento del Parque Nacional Corcovado. En Rancho Quemado cinco proyectos turísticos familiares fueron creados fundamentados en los atractivos ecológicos y paisajísticos de la zona. Durante este estudio algunos entrevistados mencionaron que la presencia de los chanchos de monte en la comunidad podría ser canalizada hacia la promoción ecoturística y por lo tanto aumentar las entradas económicas de la comunidad.

Es interesante observar que hace 10 años las especies más dañinas para los cultivos locales en esta comunidad eran el pizote (*Nasua narica*), la taltuza (*Dasyprocta punctata*) y el mono cariblanco (*Cebus capucinus*) (Altrichter *et al.*, 1999). La danta y chanco de monte no fueron citados en la lista de fauna dañina en esa época. La inclusión de la danta y chanco de monte en la actual lista de fauna dañina podría estar relacionada con el cambio de comportamiento de estas especies, debido a factores ambientales y socioculturales de la comunidad.

Un estudio previo (Altrichter, 1997; Altrichter *et al.*, 2001) encontró que la disponibilidad de frutos dentro del parque nacional Corcovado fue baja al final de la época lluviosa, entre octubre y diciembre. La gente mencionó que antes los chanchos se desplazaban por la península durante esos meses, pero que en los últimos años esto ha cambiado. Es necesario realizar nuevos estudios que hagan un detallado monitoreo fenológico de las especies que forman parte de la dieta de los chanchos de monte para entender mejor la relación entre disponibilidad de frutos dentro del parque y los desplazamientos migratorios de los chanchos. Algunos de entrevistados mencionaron el fenómeno de la mortalidad y hambruna de algunos animales en la época lluviosa del año 2005. Para ellos este fenómeno estaría relacionado con la escasez de frutos en los bosques, hecho que todavía estaría ocurriendo en la
actualidad. Las secuelas locales del cambio climático podrían estar afectando la fenología de los bosques de la zona. Esta hipótesis necesita de mayores estudios a largo plazo.

**Literatura citada**


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Ageing feral pigs (*Sus scrofa*) through tooth eruption and wear

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Introduction

Feral pigs (*Sus scrofa*) were introduced to the Pantanal more than 200 years ago. It is thought that domestic pigs became feral during the Paraguay War (1865–1870), when ranches in the Pantanal were devastated and abandoned. Today, social groups of feral pigs can be found throughout the floodplain (Mourão *et al.*, 2002). The ecological impact of feral pigs in the Pantanal is still not well understood. Through their rooting activities, feral pigs can disturb large areas (Hone, 1988). In the Pantanal, when present at high densities, herds of feral pigs are reported by local people to cause extensive damage to pasture. In forested areas feral pigs uproot saplings and seedlings and may affect the recruitment of certain species (Desbiez *et al.*, 2009). Feral pigs predate eggs of ground nesting birds (Desbiez *et al.*, 2009), and some reptiles such as the *Caiman yacare* (Campos, 1993). Most importantly, feral pigs are potential reservoirs of diseases (Doran & Laffan, 2005; Herrera *et al.*, 2005; Corner, 2006; Ruiz-Fons *et al.*, 2007). Understanding the population ecology of this introduced species is important for both conservation and economic reasons. Data on mortality rates of adult feral pigs is one of the demographic parameters necessary for this purpose. The objective of this study was to obtain quantitative data on adult feral pig mortality rates through the analysis of tooth emergence and tooth wear from skulls collected within the central region of the Pantanal.

Premises and assumptions

Analysis of the sequence of tooth emergence and tooth wear was used to estimate mortality rates of adult feral pigs. The main assumption of this method is that age distribution is stable (Caughley, 1966, 1977). Further assumptions include that (1) pig teeth form and erupt in a regular sequence at predictable intervals, (2) tooth emergence and sequence for feral pigs in the Pantanal is similar to those of the European wild boar (*Sus scrofa*), (3) tooth wear occurs progressively throughout an animal’s life and can therefore be categorized to reflect an animal’s age, (4) the attrition rate of pig teeth is similar amongst individuals of the study area.

The first assumption is validated by several documented tooth emergence sequences for both wild and domestic suids using samples of animals of known age (Matschke, 1967; Choquenot & Saunders, 1993). The second assumption is justified by the relatively late timing of tooth emergence of the European wild boar in comparison to modern domestic pigs, particularly in the case of the second and third molar. Tooth emergence of the European wild boar is comparable to wild and late maturing domestic pigs (Bull & Payne, 1982). The feral pig in the Pantanal is a domestic pig turned feral and for which ancestral characteristics of pigs are present. Therefore, it is most likely that the teeth of feral pigs from
the Pantanal form and erupt in a sequence similar to that of the European wild boar and late-maturing domestic breeds. In addition, we have found that the first premolar is present in populations of feral pigs in the Pantanal. This tooth, which only appears as a permanent tooth, is present in European wild boar while it is often absent in modern domestic breeds of pigs. The third assumption, that tooth wear increases with the age of an individual, is a characteristic used by archaeologists, anthropologists, palaeontologists and of course biologists (Grant, 1982; Klein & Cruz-Uribe, 1983; Anderson & Stone, 1993; Rolett & Min-yung, 1994; Ashby & Santiapillai, 1998; Tuen et al., 1999; Mysterud et al., 2001; Fernandez-Llario & Mateos-Quesada, 2003; Maffei, 2003). Finally, the last assumption is reasonable since similar resources and feeding areas are available to the whole population from the study area.

Methods

Feral pig skulls were collected from the Embrapa Pantanal Nhumirim Farm (UTM 21 K 0538193 7901838) and five surrounding ranches in the centre of the Pantanal for over two years between July 2002 and December 2004. It is thought that almost all of the skulls from animals that died during this period were collected. After killing a feral pig, hunters typically cut off the animals head and feet to facilitate carrying the carcass back to the ranch on horseback. Skulls collected in the field therefore included animals that died as a result of hunting as well as natural causes. Male and female feral pig skulls can be easily distinguished. One of the most striking characteristics is the size, shape and angle of the incisors, as well as the bone structure from which they protrude (Figure 1a & b). A total of 222 feral pig skulls or parts of skulls were collected representing 126 males and 96 females of different ages.

Both the maxilla and mandible of each skull were analysed. Tooth eruption stage was noted. The eruption stage of the third molar was carefully described: third molar not visible, first cusp erupting, second cusp erupting, and third cusp erupting. Tooth wear stages were assigned using a classification adapted from Rolett and Chiu (1994) and Grant (1982) (Table 1; Figure 2). Classification categorised the shapes of the darker dentine that is revealed as the enamel of the biting surface is gradually worn away. Categories ranged from: $a$ to $l$ for the third molar, and from $a$ to $p$ for the second and third molars. Signs of tooth wear increased between categories $a$ to $p$. All skulls were analysed by the same observer and a random sample of skulls was reanalysed to ensure uniformity of the results.

Figure 1 (a). Male feral pig skull (left) and female feral pig (right)
Figure 1 (b). Male feral pig skull (left) and female feral pig (right)

Figure 2. Analysis of tooth wear from an adult male feral pig maxillae and mandible

Ideally a calibration curve of measurements from wild feral pigs of known age that have fed in natural conditions and therefore been subjected to similar abrasiveness of soils and hard foods would be necessary. In the absence of this information, we used comparisons between tooth wear from different eruption sequences to create a classification for tooth wear into age categories for the study site. The first and second molar erupt 24 and 16 months respectively prior to the eruption of the third molar for the maxilla teeth and 20 and 11 months prior to the third molar for the mandible. We also used comparisons of tooth wear between the third molar of the maxilla and mandible that erupt within approximately five months of each other. Using these comparisons as well as the literature (Matschke, 1967; Choque-not & Saunders, 1993; Rolett & Min-yung, 1994), age categories for maxilla and mandible were established in months (Table 2).
Table 1. Classification categories of the shapes of the darker dentine. Signs of tooth wear increased from categories \(a\) to \(p\). The classification is adapted from Rolett and Chiu (1994) and Grant (1982).

![Classification categories of the shapes of the darker dentine.](image)

Table 2. Age estimates in months according to tooth eruption and levels of tooth wear.

<table>
<thead>
<tr>
<th>Second molar</th>
<th>Third molar</th>
<th>Mandible</th>
<th>Maxilla</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>less than 22</td>
<td>less than 26</td>
<td></td>
</tr>
<tr>
<td>c,d,e</td>
<td>1-2 cusps</td>
<td>21 to 30</td>
<td>26 to 36</td>
</tr>
<tr>
<td>d,e,f</td>
<td>3 cusps to a</td>
<td>30 to 42</td>
<td>36 to 48</td>
</tr>
<tr>
<td>e,f,g,h</td>
<td>b to c</td>
<td>42 to 54</td>
<td>48 to 60</td>
</tr>
<tr>
<td>g,h,j,k,l</td>
<td>d to e</td>
<td>54 to 66</td>
<td>60 to 72</td>
</tr>
<tr>
<td>k,l,m,n,x</td>
<td>f to g</td>
<td>66 to 78</td>
<td>72 to 84</td>
</tr>
</tbody>
</table>

Due to slight differences in tooth wear between the right and left maxilla or mandible, the right maxilla was selected for analysis in this study. Using the classification estimates, age of death for male (\(N=114\)) and female (\(N=81\)) feral pigs was obtained. A life table was built and survival and mortality rates for male and female feral pigs based on the right maxilla were calculated. Using a linear regression, average mortality rates for adults were estimated.

**Results and Discussion**

Most of the skulls collected from both males and female feral pigs belonged to younger age classes, defined as four years or less (Tables 3 & 4). Both males and females appear to have higher mortality rate during their fourth year. Results suggest that when male feral pigs are less than three years of age
their mortality rates are lower than females, after that age male mortality rates increase (Figure 3). Female feral pig mortality rates appear to be more constant than males. This may be explained by the traditional hunting practices in the region.

Table 3. Estimates of survival and mortality rates of male feral pigs from maxilla. (N=114)

<table>
<thead>
<tr>
<th>Tooth wear category</th>
<th>Age estimates</th>
<th>Number of maxilla</th>
<th>Total left</th>
<th>% of animals left</th>
<th>Survival rate</th>
<th>Mortality rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>&lt;2</td>
<td>5</td>
<td>114</td>
<td>1.00</td>
<td>0.96</td>
<td>0.04</td>
</tr>
<tr>
<td>1-2 cusps</td>
<td>2nd year</td>
<td>16</td>
<td>109</td>
<td>0.96</td>
<td>0.85</td>
<td>0.15</td>
</tr>
<tr>
<td>3 cusps to a</td>
<td>3rd year</td>
<td>20</td>
<td>93</td>
<td>0.82</td>
<td>0.78</td>
<td>0.22</td>
</tr>
<tr>
<td>b to c</td>
<td>4th year</td>
<td>44</td>
<td>73</td>
<td>0.64</td>
<td>0.40</td>
<td>0.60</td>
</tr>
<tr>
<td>d to e</td>
<td>5th year</td>
<td>20</td>
<td>29</td>
<td>0.25</td>
<td>0.31</td>
<td>0.69</td>
</tr>
<tr>
<td>f to g</td>
<td>6th year</td>
<td>5</td>
<td>9</td>
<td>0.08</td>
<td>0.44</td>
<td>0.56</td>
</tr>
<tr>
<td>beyond</td>
<td>&gt;6</td>
<td>4</td>
<td>4</td>
<td>0.04</td>
<td>0.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Table 4. Estimates of survival and mortality rates of female feral pigs from maxilla. (N=81)

<table>
<thead>
<tr>
<th>Tooth wear category</th>
<th>Age estimates</th>
<th>Number of maxilla</th>
<th>Total left</th>
<th>% of animals left</th>
<th>Survival rate</th>
<th>Mortality rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>&lt;2</td>
<td>12</td>
<td>81</td>
<td>1.00</td>
<td>0.85</td>
<td>0.15</td>
</tr>
<tr>
<td>1-2 cusps</td>
<td>2nd year</td>
<td>9</td>
<td>69</td>
<td>0.85</td>
<td>0.87</td>
<td>0.13</td>
</tr>
<tr>
<td>3 cusps to a</td>
<td>3rd year</td>
<td>13</td>
<td>60</td>
<td>0.74</td>
<td>0.78</td>
<td>0.22</td>
</tr>
<tr>
<td>b to c</td>
<td>4th year</td>
<td>24</td>
<td>47</td>
<td>0.58</td>
<td>0.49</td>
<td>0.51</td>
</tr>
<tr>
<td>d to e</td>
<td>5th year</td>
<td>11</td>
<td>23</td>
<td>0.28</td>
<td>0.52</td>
<td>0.48</td>
</tr>
<tr>
<td>f to g</td>
<td>6th year</td>
<td>7</td>
<td>12</td>
<td>0.15</td>
<td>0.42</td>
<td>0.58</td>
</tr>
<tr>
<td>beyond</td>
<td>&gt;6</td>
<td>5</td>
<td>5</td>
<td>0.06</td>
<td>0.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Feral pigs are the main hunting target of the people living in the area. One of the most striking aspects of feral pig hunting is the harvest of previously castrated fat male feral pigs. Indeed, young male feral pigs are caught, castrated, and then released (Desbiez, 2007). Castrated males then heal, gain weight and are killed several months later. A fat castrated male, is the main target of all hunting expeditions, if it is not found then a female will be killed (Desbiez, 2007). This practice may explain why male mortality is higher after three years old, when castrated males would be killed. Animals at four years of age are in their prime condition which may explain the higher mortality rate for this age class. Average adult mortality rates are 15% per year for males (R^2=0.877; y=-0.130 + 0.149x) and 13% for females.
(R^2=0.866; y=-0.093 + 0.133x) (Figures 4 & 5). Since these mortality rates include hunting, they represent average mortality rates of feral pigs under traditional hunting pressure.

**Figure 3.** Proportion of male and female feral pigs per age group based on estimates from right maxilla (N=114 for males; N= 81 for females).

**Figure 4.** Female feral pig mortality rates estimated from skulls.
Figure 5. Male feral pig mortality rates estimated from skulls.

Results from this study can be used to model population dynamics of feral pigs from the region. Mortality rates for specific age groups have been used in a Vortex model built for feral pigs from the study area (Desbiez, 2007), and can be used in other types of population dynamic models. The method described in this paper can be used on any feral pig population, but will probably require adjustments. Rate of tooth wear will vary due to diet and environmental conditions. This is particularly true in the Pantanal where the abrasiveness of soils in the feeding areas of feral pigs is extremely high due to its sandy nature (Soriano et al., 1997). For this reason, we recommend that comparisons between tooth wear from different eruption sequences be adapted to create a classification for tooth wear into age categories specific to geographic locations.

Acknowledgements

Funding for this study was provided by the European Union INCO PECARI project and the Royal Zoological Society of Scotland (RZSS). We are very grateful to the owners of Porto Alegre, Dom Valdir, Campo Dora, Ipanema, and Alegria for allowing research on their properties and the people living on the Embrapa Pantanal Nhumbirim ranch for their dedication, help, and support.

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Rare pygmy hogs head for the wild

Subir Bhaumik, BBC news, Calcutta

(BBC Wildlife website 19 May 2009)

The world’s smallest and rarest species of wild pig was once believed to be extinct - but it may now be saved thanks to conservation efforts.

The pygmy hog (Porcula salvania) stands barely 25-30 cm (10-12 inches) high and weighs up to 9kg (20lb). Just a few hundred at most are thought to remain, all of them in India's north-eastern state of Assam. Over the past decade the pigs have been bred in captivity and the process of releasing them into the wild has begun.

'Soft release'

After 12 years of patient conservation effort, which began with six wild pygmy hogs, Assam Forest officials and experts from the Pygmy Hog Conservation Programme (PHCP) have now released 16 hogs into the Sonai Rupai wildlife sanctuary, about 175km (110 miles) north of the state capital, Guwahati.

"This is a great day in the history of animal conservation throughout the world and we are proud of the achievement," Assam's chief wildlife warden MC Malakar said.

Dr Goutam Narayan of Durrell Wildlife and EcoSystems-India is the man credited with the success of the programme.
"The hogs are going through a soft release process. We have kept them in an enclosure in the Sonai Rupai grasslands," he told the BBC.
"After a while, we will open the gates of the enclosures and let them out in the wilds, but will closely monitor them."

Dr Narayan and his team of wildlife experts have achieved their success with support from the Durrell Wildlife Conservation Trust (DWCT), a Jersey-based conservation organisation started by naturalist Gerald Durrell.
"By 1964, the pygmy hog was thought to be extinct with no sightings reported for several years. Then in 1971, four pygmy hogs were recovered from a market in Paneri in north Assam and that gave everyone cause for hope," Dr Narayan said.

He said there could be fewer than 400 pygmy hogs in the world and all of them are in Assam's Manas national park in the foothills of Bhutan.

**Habitat threatened**

It was at Manas that six pygmy hogs were captured in 1996 and the conservation programme was started.
"The present 16 animals are the result of the only captive population of the species in the world," Dr Narayan said.

Once out in the wilds, the pygmy hogs will be threatened by pythons and tigers - but their biggest threat is the destruction of their grassland habitats by man. Experts say the pygmy hogs’ preferred grassland habitat across the southern foothills of the Himalayas has been largely gobbled up by human encroachment.

"It's a great loss of habitat," said William Oliver, chairman of the Pigs, Peccaries and Hippos Specialist Group of the International Union for Conservation of Nature.
"Ceaseless population expansion have diminished those habitats to a few isolated fragments and those isolated fragments are susceptible to other forms of disturbance like annual dry season burning and livestock grazing."

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**Abstracts of new papers from our regular contributors**

Wildlife habitat selection and sustainable resources management in a Neotropical wetland.


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The identification of key habitat types for wildlife is an essential step to plan and promote sustainable...
land management strategies. Private cattle ranches occupy most of the Brazilian Pantanal and the recent intensification in land use practices is thought to threaten wildlife. Using encounter rates from transects, landscape use and habitat selection of the community of medium to large-sized mammals was examined to identify key wildlife habitats. Overall landscapes that had a higher proportion of forested habitats were the most used by wildlife. Within the different landscapes, forested environments can be considered key habitats for most of the native mammals considered in this study. Unfortunately, these are also the habitats most at risk by the recent changes in land use practices. Results from this study predict that current intensifications of ranching practices will be detrimental to wildlife. In addition to deforestation, other threats such as land degradation, fire, landscape alterations such as fencing and artificial water holes may also impact landscape and habitat quality. The key to conserving biodiversity in the Pantanal is preserving the natural habitat matrix that sustains the diversity of landscapes and to continue integrating cattle ranching into the natural processes that sustain a functioning ecosystem.

Key words: Deforestation, floodplain, habitat selection, Neotropical mammals, Brazilian Pantanal

Oil industry, wild meat trade and roads: indirect effects of oil extraction activities in a protected area in north-eastern Ecuador


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Starting in 1994, a wholesale wild meat market developed in north-eastern Ecuador, involving Waorani and Kichwa people in the area of influence of a road built to facilitate oil extraction within Yasuní National Park. Between 2005 and 2007, we recorded the trade of 11 717 kg of wild meat in this market, with pacas Cuniculus paca, white-lipped peccaries Tayassu pecari, collared peccaries Pecari tajacu and woolly monkeys Lagothrix poeppiggi accounting for 80% of the total biomass. Almost half of the wild meat brought to the market was transported by dealers for resale at restaurants in Tena, a medium-sized town 234 km west of the market. Prices of wild meat were 1.3–2 times higher than the price of meat of domestic animals, suggesting that it is a different commodity and not a supplementary protein source in the urban areas where it is consumed. The actual price of transportation between the local communities and the market was a significant predictor of the amount of meat sold in Pompeya. Based on this relationship the Waorani hunters sold exceptionally larger amounts of wild meat than would be expected if they would not have the transportation subsidies provided by the oil companies. Although the scale of this wild meat wholesale market is still relatively small, its dynamic reflects the complex interactions that emerge as the overriding influence of oil companies or other private industries modify the culture and subsistence patterns of marginalized indigenous groups, increasing their potential impacts on wildlife and natural ecosystems.

Keywords: Ecuador; wild meat market; oil industry; roads; Yasuní National Park; indigenous people; wildlife trade.
Niche partitioning among white-lipped peccaries (*Tayassu pecari*), collared peccaries (*Pecari tajacu*), and feral pigs (*Sus scrofa*).


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The introduction of a species into an ecosystem with species already occupying a similar trophic level is predicted to lead to a high degree of niche overlap. The feral pig (*Sus scrofa*), one of the world’s worst invasive species, was introduced to the Pantanal about 200 years ago and is thought to compete with the native white lipped peccary (*Tayassu pecari*) and collared peccary (*Pecari tajacu*). Resource partitioning between the 3 species was examined, including analysis of fruit items and plants in fecal samples as well as encounter rates in different habitats, to help generate hypotheses about competitive interactions among the species. Overlaps in food resources and habitat use between feral pigs and peccaries were found to be lower than expected. In fact, niche overlap was highest between the native species. Results indicate that currently, feral pigs are not a direct threat to the native peccaries in the study area. Differences in morphology and behavior indicate possible mechanisms of niche partitioning between the species. Feral pigs may, nevertheless, impact the wildlife community in other ways as predators of eggs, by destruction of vegetation through rooting, or by functioning as disease reservoirs.

Cattle-ranching activities may favor feral pigs and the current anthropogenic changes in the landscape could lead to changes in competitive dynamics between feral pigs and native species.

Key words: competition, frugivore, introduced species, niche overlap, Pantanal, *Pecari tajacu*, peccary, resource partitioning, *Sus scrofa*, *Tayassu pecari*

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Conservation status of the white-lipped peccary (*Tayassu pecari*) outside the Calakmul Biosphere Reserve in Campeche, Mexico: a synthesis

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The white-lipped peccary is a social ungulate that forms the largest groups documented for any other ungulate species living in tropical forests. White-lipped peccaries have become increasingly rare in Mexico and Central America in the last 50 years. Here I suggest some management actions for conservation of this endangered species in the Calakmul region based on a synthesis of ecological and social data coming mainly from a two year field study conducted in the Calakmul Biosphere Reserve (CBR) and three human communities (*ejidos*) that surround it in Southeastern Mexico. Group size and breeding season were recorded in the CBR and in four adjacent hunted sites. Home range, habitat use, and population density were estimated only for the CBR, and hunting patterns were recorded for the three adjacent villages. Home range was among the largest reported anywhere for this species. White-lipped peccary groups were larger in the CBR than in the hunted areas, but groups were generally smaller than those reported in other forests. These smaller group sizes signal a conservation concern for this species in the Calakmul region. Hunting occurs mainly in the dry season when the breeding season is at the peak and peccary groups are visiting water bodies where they are more easily hunted. To conserve the white-lipped peccary in the Calakmul region we need to reduce hunting pressure and preserve large forested areas outside the CBR.

**Key words:** White-lipped peccary, Calakmul Biosphere Reserve, conservation, population density

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El pecari labios blancos o senso es un ungulado social que forma los grupos más grandes de todos los ungulados que viven en bosques tropicales densos. Esta especie ha desaparecido de grandes áreas de Centroamérica y México debido a la cacería y desaparición del hábitat en los últimos 50 años. Aquí presento sugerencias de manejo para la conservación de este ungulado tropical en peligro de extinguición en la región de Calakmul en base a una síntesis de información ecológica y de comunidades humanas obtenidas principalmente en la Reserva de la Biosfera de Calakmul y en tres ejidos aledaños. Anteriormente en 2005 y 2006, estudié patrones de movimientos, ámbito-hogareño, tamaños de grupo, densidad y temporadas de reproducción y cacería de esta especie en la Reserva de la Biosfera de Calakmul, un bosque tropical semi-seco del sur de México. Capturamos y seguimos individuos de cuatro grupos de pecaríes por diversos periodos durante 2005 y 2006. Los ámbitos hogareños fueron de los más grandes reportados en la literatura y los tamaños de grupo de los más pequeños. Los grupos fueron más grandes en la zona protegida que en las zonas con cacería. La cacería legal y de subsistencia de esta especie se realiza en la época de secas que coincide también con la época de reproducción cuando esta especie visita los cuerpos de agua regularmente y es altamente vulnerable. La conservación del pecari labios blancos requiere la preservación de grandes extensiones de bosque tanto en el área protegida como en los ejidos y la reducción y control de la cacería de subsistencia y deportiva.

**Palabras clave:** Pecari labios blancos, Reserva de la Biosfera de Calakmul, conservación, densidad de población.

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**Veterinary, Genetic and Physiological Studies**


The Eurasian wild boar (*Sus scrofa*) is a reservoir for pathogens that affect both humans and domestic animals. The control of these diseases requires the development of strategies such as oral vaccination of the reservoir species. The aim of the present study was to determine the species-specific visitation
and removal rates of cereal-based baits under field conditions in an overabundant wild boar population. Two different field trials were conducted at a hunting estate. In one trial, baits were placed at track stations set up either randomly in the undeveloped portions of the estate or close to permanent wild boar feeding places. In the second trial, baits were placed in feeders that were selective for use by wild boar piglets. Both trials were conducted in summer 2007 and repeated in spring 2008. No evidence of attractant effect by the bait was found when comparing baited against control stations. A close proximity to the feeders was associated with an increased probability of being visited by wild boar, and piglet feeders were shown to be highly selective for young wild boar. Baits disappeared faster in summer than in spring (i.e. similar to 70% consumption after the first day in selective feeders in summer, and 40% in spring). Therefore, a combination of a summer season and selective feeders was found to be a potentially reliable bait-deployment strategy for wild boar juveniles under Mediterranean conditions. These results support the use of selective feeders for oral delivery of baits to 2-4-month-old wild boar piglets, which is the preferred age for vaccination. Our delivery technique based on selective piglet feeders also has potential for other uses in the Eurasian wild boar and wild pigs under different management conditions.


The objective of this study was to develop and evaluate new baits for the oral delivery of vaccine preparations to 2-4 month-old wild boar piglets. Baits were prepared using a matrix composed of wild boar feed, wheat flour, paraffin, sacarose and cinnamon-truffle powder attractant with polyethylene capsules dipped into the matrix to introduce vaccine formulation. Physical stability studies demonstrated that baits were stable for at least three days at temperatures as high as 42 degrees C. Recombinant *Escherichia coli* expressing the membrane-displayed BM95-MSP1a fusion protein were used to test bacterial viability in the baits and the antibody response in orally immunized wild boar. The *E. coli* viability was not significantly affected after bait incubation at 25 and 37 degrees C for 96 h. Bait acceptance studies using artificial feeders in the field showed that baits were accepted by 2-3 month-old animals. the preferred age for vaccination. Orally immunized wild boar piglets excreted recombinant *E. coli* in the feces and developed antibody titers to recombinant BM95-MSP1a protein, thus confirming that vaccine composition was released and reached the wild boar gastrointestinal track. The results of these experiments support the use of these baits for oral delivery of vaccine formulations to 2-4 month-old wild boar piglets.


More effective methods to control feral swine (*Sus scrofa*) damage are needed. We evaluated 8 oral delivery systems designed to deliver pharmaceuticals to feral swine on 2 properties in southern Texas, USA. We used modified PIGOUT(R) feral pig bait (Animal Control Technologies Australia P/L, Somerton, Victoria, Australia) throughout our trials to compare species-specific visitation and removal rates. Given our consistent finding of high nontarget removal of baits intended for feral swine, we question whether a swine-specific oral delivery system exists for this region.

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


Complete sequencing of p54-gene from 67 European, American, and West and East African Swine Fever virus (ASFV) isolates revealed that West African and European ASFV isolates classified within the predominant Genotype I according to partial sequencing of p72 were discriminated into four major sub-types on the basis of their p54 sequences. This highlighted the value of p54 gene sequencing as an additional, intermediate-resolution, molecular epidemiological tool for typing of ASFV viruses. We further evaluated p54-based genotyping, in combination with partial sequences of two other genes, for determining the genetic relationships and origin of viruses responsible for disease outbreaks in Kenya. Animals from Western and central Kenya were confirmed as being infected with ASFV using a p72 gene-based PCR assay, following outbreaks of severe hemorrhagic disease in domestic pigs in 2006 and 2007. Eleven hemadsorbing viruses were isolated in macrophage culture and genotyped using a combination of full-length p54-gene sequencing, partial p72-gene sequencing, and analysis of tetrameric amino acid repeat regions within the variable region of the B602L gene (CVR). The data revealed that these isolates were identical in their p72 and p54 sequence to viruses responsible for ASF outbreaks in Uganda in 2003. There was a minor difference in the number of tetrameric repeats within the B602L sequence of the Kenyan isolates that caused the second Kenyan outbreak in 2007. A practical implication of the genetic similarity of the Kenyan and Ugandan viral isolates is that ASF control requires a regional approach.


Leptospirosis, an endemic zoonoses, is maintained in the environment by several wildlife species in the Peruvian Amazon. In order to evaluate the possible role of collared peccaries (CP) in the maintenance of this disease, two serological surveys of leptospirosis were performed and zootechnical parameters were monitored in a captive CP colony in an interval of 27 months. Total seroprevalence changed from 100% (n = 27) to 86.4% (n = 22), with reactions to a diversity of serogroups of zoonotic importance. Serological reactions to Leptospira liceriasiae serogroup Iquitos, a new species recently identified locally and Leptospira interrogans serogroup Icterohaemorrhagiae were highly prevalent. The observa-
tion of leptospiral antibodies in both surveys, changes on serological reactions to different serogroups in large part of the herd and poor reproductive performances, provided an indication of the role of CP farms as a favourable environment for maintaining leptospirosis. Further research regarding the role of CP in the epidemiology of leptospirosis in the Peruvian Amazon is encouraged.


Viral disease persistence in species without a reservoir host is of importance for public health and disease management. But how can disease persistence be explained? We developed a spatially-explicit individual-based model that takes into account both ecological and viral traits as well as variable space to test disease persistence hypotheses under debate. We introduce a novel concept of modeling alternative disease courses at the individual level, causing transient infections or killing infected animals, with the lethally infected having a variable life-expectancy. We systematically distinguish between disease invasion and persistence. We use classical swine fever (CSF), an economically very important livestock disease in a social host, the wild boar, as a reference system to test and rank the persistence hypotheses under debate. Parameter values for host population demographics and CSF epidemiology reflect current knowledge. Sensitivity analysis of the model parameters revealed that the most important factor for disease persistence is a disease profile with mostly transient, i.e. surviving individuals requiring immunity, and some chronically, long-term infected animals. Immune individuals can constantly produce susceptible offspring, while some chronically infected individuals act as 'super spreaders' in time. Thus, variations in the course of the disease at the individual level are important factors determining persistence, which is usually not taken into account in the prominent measure of epidemiology, i.e. the basic reproductive number R-0, which reflects the 'reproductive potential' of the infected subpopulation. We discuss our results with regard to the general issues of modeling epidemics and disease management issues.


The eutrophic process potentially caused by a high urine and faecal load resulting from an unusually high hippopotamus (*Hippopotamus amphibious*) density in the Nhlangazwane Dam, Kruger National Park, South Africa, triggered a chain of events characterised by an increase in the growth of primary producers (*Microcystis aeruginosa*). This increase in *M. aeruginosa* biomass was followed by bio-intoxication incidents in wild animals. In this study, we determine if a *M. aeruginosa* bloom with a total microcystin level of 23,718 μg l(-1) have been responsible for mortalities of megaherbivores in the Nhlangazwane Dam. We further use microcystin molecular markers derived from the mcy gene cluster to identify potentially toxigenic environmental *Microcystis* strains in the dam during the occurrence of animal intoxications. The estimated total microcystin-LR daily intake by an adult mate white rhinoceros (*Ceratotherium simum*) from cyanobacterial-contaminated water of the dam during the toxic event was an order of magnitude higher (754.29 μg kg(-1) bw) in comparison with the lowest observed adverse effecting level (LOAEL) value measured for pigs in a previous study by other authors. In this study the presence of toxic cyanobacterial strains was confirmed with the use of molecular markers that detected the presence of the mcy gene cluster responsible for the production of toxin by *M. aeruginosa*. 
Wild boars *Sus scrofa* have a social organization based on female groups that can include several generations of adults and offspring, and are thus likely matrilineal. However, little is known about the degree of relatedness between animals living in such groups or occupying the same core area of spatial activity. Also, polygynous male mating combined with matrilineal female groups can have strong influences on the genetic structure of populations. We used microsatellite genotyping combined with behavioral data to investigate the fine-scale population genetic structure and the mating system of wild boars in a multi-year study at Chateauvillain-Arc-en-Barrois (France). According to spatial genetic autocorrelation, females in spatial proximity were significantly inter-related. However, we found that numerous males contributed to the next generation, even within the same social group. Based on our genetic data and behavioral observations, wild boars in this population appear to have a low level of polygyny associated with matrilineal female groups, and infrequent multiple paternity. Mortality due to hunting may facilitate the breakup of what historically has been a more predominantly polygynous mating system, and likely accelerates the turnover of adults within the matrilineal groups.


The Porcine Reproductive and Respiratory Syndrome (PRRS) is one of the economically most important swine diseases worldwide. The virus can be spread by viraemic and persistent infected pigs. Spread and infection are advanced in areas with high herd and population densities. As wild boars have been found seropositive for PRRSV in Germany, France, and the USA, exchange between wild and domestic pig populations may exist. However, comprehensive information on PRRSV infection in wild boars is presently not available. The aim of the current study was thus, to systematically study PRRSV infection in wild boars to provide information on spatiotemporal, host and viral effects. The study was based on 531 wild boars from 52 hunts in Germany (2004-2007). PRRSV infection was determined and strains (US/EU) were classified by PCR. A total of 15.9% of the wild boars were PRRSV-positive (US: 14.2%; EU: 6.2%), with remarkable effects of state (US: 5.1-46.2%; EU: 0-17.6%), season (0-36.5%) and tissue (lungs: 89%; tonsils: 11%). Prevalences did neither correlate with age or weight, nor with density of production units, domestic pigs or wild boars. Open reading frame (ORF) 1-sequences within EU- and US-strains didnot differ among wild boar samples. Homologies between EU-samples/Lelystad-virus and US-samples/PRRSV-MLV virus were 99.3 and 97%, respectively. This is the first comprehensive evidence of PRRSV infection in wild boars. We conclude that there is only a weak relation between wild boar and domestic PRRSV infection.


The digestion of plant material in mammalian herbivores basically depends on the chemical and structural composition of the diet, the mean particle size to which the forage is processed, and the ingesta retention time. These different factors can be influenced by the animal, and they can presumably compensate for each other. The pygmy hippopotamus, a non-ruminating foregut fermenter, has longer mean retention times than ruminants; however hippos do not achieve higher (fibre) digestibilities on
comparable diets, which could be due to ineffective mastication. We performed feeding trials with six pygmy hippos (*Hexaprotodon liberiensis*) and six banteng cattle (*Bos javanicus*) on a grass diet. As predicted, both species achieved similar dry matter, organic matter, crude protein and gross energy digestibilities. However, neutral and acid detergent fibre digestibility was lower in pygmy hippos. Apparently, in these species, fibre digestibility was more influenced by particle size, which was larger in pygmy hippos compared to banteng, than by retention time. In spite of their higher relative food intake, the banteng in this study did not have greater relative gut fills than the hippos. Ruminants traditionally appear intake-limited when compared to equids, because feed particles above a certain size cannot leave the rumen. But when compared to nonruminating foregut fermenters, rumination seems to free foregut fermenters from an intrinsic food intake limitation. The higher energy intakes and metabolic rates in wild cattle compared to hippos could have life-history consequences, such as a higher relative reproductive rate.


Feral swine (*Sus scrofa*) are present in 38 of the 50 United States, and their populations continue to expand. Domestic swine are, widely regarded as vulnerable to diseases harbored by feral swine. Our objectives were to determine antibody prevalence for selected pathogens in Texas feral swine populations and identify contact events between feral and domestic swine. Overall prevalence of antibodies against brucellosis and pseudorabies virus was 11% and 30%, respectively. Antibodies to porcine reproductive and respiratory disease virus were detected in 3% of feral swine front southern Texas. All samples tested negative for antibodies to classical swine fever virus. To determine the frequency of contact events between feral swine and domestic swine in neighboring Facilities, we analyzed movement data from 37 adult feral swine that were trapped <= 10 km from domestic swine facilities and equipped with geographic positioning system collars. Seven of the 37 feral swine had contact (relocated within 100 m) with domestic swine. We found that contact between feral swine and domestic swine occurred predominantly at night. Additionally, we analyzed 60 consecutive days of experimental track plots around pens that contained domestic swine and empty control pens, and found greater visitation by feral swine to the domestic swine pens. Our data demonstrate that Feral swine have direct contact with domestic swine, which presents opportunity for disease transmission.

**Taxonomic, Morphological, Biogeographic and Evolutionary Studies**


Use of the aquatic environment by hippopotami (*Hippopotamus amphibius*) allows locomotive styles impossible to achieve on land by such heavy animals. Videos of the underwater locomotion of 2 hippopotami were analyzed frame by frame. Average horizontal velocity underwater was 0.47 m/s. Hippopotami used a gait underwater that was similar to a gallop with extended unsupported intervals. Ground contact time decreased with increasing horizontal velocity, vertical displacement during the unsupported intervals increased with an increase in ground contact time, and time between consecutive footfalls decreased with an increase in horizontal velocity. Hippopotami use an unstable gait underwater, which is facilitated by the increased buoyancy of water. Despite restrictions to movement on land due to its massive weight, locomotion of the hippopotamus underwater is analogous to movement in a mi-
crogravity environment.

Despite having only begun similar to 10,000 years ago, the process of domestication has resulted in a degree of phenotypic variation within individual species normally associated with much deeper evolutionary time scales. Though many variable traits found in domestic animals are the result of relatively recent human-mediated selection, uncertainty remains as to whether the modern ubiquity of long-standing variable traits such as coat color results from selection or drift, and whether the underlying alleles were present in the wild ancestor or appeared after domestication began. Here, through an investigation of sequence diversity at the porcine melanocortin receptor 1 (MC1R) locus, we provide evidence that wild and domestic pig (Sus scrofa) haplotypes from China and Europe are the result of strikingly different selection pressures, and that coat color variation is the result of intentional selection for alleles that appeared after the advent of domestication. Asian and European wild boar (evolutionarily distinct subspecies) differed only by synonymous substitutions, demonstrating that camouflage coat color is maintained by purifying selection. In domestic pigs, however, each of nine unique mutations altered the amino acid sequence thus generating coat color diversity. Most domestic MC1R alleles differed by more than one mutation from the wild-type, implying a long history of strong positive selection for coat color variants, during which time humans have cherry-picked rare mutations that would be quickly eliminated in wild contexts. This pattern demonstrates that coat color phenotypes result from direct human selection and not via a simple relaxation of natural selective pressures.


The study investigated developmental defects of the dental hard tissues and postmortem changes in archaeological pig molars from Fais Island, Micronesia. The developmental defects of enamel were indicative of a disturbance of the secretory stage (accentuation of the incremental pattern, occurrence of Wilson bands and of hypoplastic defects) and the maturation stage of amelogenesis (hypomineralisation). Presence of coronal cementum in an M-3 indicated a partial premature breakdown of the reduced enamel epithelium or a partial demise of the enamel organ earlier during tooth development. Developmental defects of dentine presented as accentuated Andresen lines and areas of interglobular dentine. The pattern of developmental defects in the studied molars and the fact that deciduous premolars of the pigs from Fais did not exhibit developmental defects on macroscopic inspection are consistent with the hypothesis that the tooth defects were caused by periods of severe nutritional Stress occurring after weaning. Postmortem changes caused by microbial infiltration were recorded in dentine and cementum. A presumed case Of Soft tissue preservation in the form of presence of odon-to-blast processes was observed in an M-1.


Body size reduction in mammals is usually associated with only moderate brain size reduction, because the brain and sensory organs complete their growth before the rest of the body during ontogeny. On this basis, 'phyletic dwarfs' are predicted to have a greater relative brain size than 'phyletic giants'. However, this trend has been questioned in the special case of dwarfism of mammals on islands. Here
we show that the endocranial capacities of extinct dwarf species of hippopotamus from Madagascar are up to 30% smaller than those of a mainland African ancestor scaled to equivalent body mass. These results show that brain size reduction is much greater than predicted from an intraspecific 'late ontogenetic' model of dwarfism in which brain size scales to body size with an exponent of 0.35. The nature of the proportional change or grade shift observed here indicates that selective pressures on brain size are potentially independent of those on body size. This study demonstrates empirically that it is mechanistically possible for dwarf mammals on islands to evolve significantly smaller brains than would be predicted from a model of dwarfing based on the intraspecific scaling of the mainland ancestor. Our findings challenge current understanding of brain-body allometric relationships in mammals and suggest that the process of dwarfism could in principle explain small brain size, a factor relevant to the interpretation of the small-brained hominin found on the Island of Flores, Indonesia.

**Ecology and Conservation Studies**


Invasive feral swine (*Sus scrofa*) cause deleterious impacts to ecosystem processes and functioning throughout their worldwide distribution, including forested ecosystems in the United States. Unfortunately, many feral swine damage management programs are conducted in a piecemeal fashion, are not adequately funded, and lack clearly stated or realistic objectives. This review paper identifies damage caused by feral swine to forest resources and presents techniques used to prevent and control feral swine damage. Concluding points related to planning a feral swine damage management program are: (1) the value of using a variety of techniques in an integrated fashion cannot be overstated; (2) there is value in using indices for both feral swine populations and their damage pre and post management activities; (3) innovative technologies will increasing be of value in the pursuit of feral swine damage reduction; and (4) though not appropriate in every situation, there is value in involving the public in feral swine damage management decisions and activities.


Feral pig populations are expanding in many regions of the world following historically recent introductions. Populations are controlled to reduce damage to agriculture and the environment, and are also a recreational hunting resource. Knowledge of the area over which feral pigs may expand in the future could be used regionally to assist biosecurity planning, control efforts and the protection of biodiversity assets. The present study sought to estimate the future distribution of a recently introduced, expanding feral pig population in the remote Kimberley region of north-western Australia. An existing survey of feral pig distributions was enhanced and remote-sensing and weather data, reflecting or correlated with factors that may affect feral pig distributions, were collated and analysed. Relationships between feral pig distributions and these data were identified by using a generalised additive modelling approach. By the use of the model, the distribution of favourable habitat was estimated across the study region (89 125 km²). The potential future distribution of feral pigs in the Kimberley was then estimated, assuming only natural dispersal of feral pigs from areas of known feral pig status (cf. hunter-assisted movements or escape of domestic pigs). The modelling suggests that feral pigs could expand their distribution by realistic natural dispersal in the future (to 61 950 km²). This expansion possibility contains several strategically important areas (such as sea ports and biologically significant wetlands). This approach has
the potential to improve biosecurity planning for the containment of the feral pig in the Kimberley and may have utility for other recently introduced invasive species in other regions. These results may also be used to improve pest-management programmes and contingency planning for exotic-disease incursions.


The aim of the study was to determine the apparent consumption of dry matter (DM), gross energy (GE), crude protein (CP) and amino acids (AA) from pasture by European wild boar in a pastoral system. Two pasture-types were used, one consisting predominantly of Lolium perenne and the other predominantly of Plantago lanceolata. The study was conducted in Spring and repeated in Summer. Twelve purebred European Wild Boar of 18.8 +/- 0.8 kg (mean +/- sem) with nose rings were randomly grouped into six pairs. Each day of the 19-day study, a pair of animals was placed into each of three areas of a pasture strip (1.4 x 6.3 m per area) from each pasture type from 8:30 h until 16:30 h, after which the animals entered a barn and had free access to a commercial diet for 45 min, with each pasture strip being grazed once. Pasture samples were taken on days 4 to 19 from each grazed area preand post-grazing and the DM content of these samples was used to calculate DM consumption of the animals. Additional pasture samples were collected and analysed for gross energy, crude protein and amino acids. The wild boar consumed (mean +/- SEM) 418 +/- 72.2 and 210 +/- 38.3 g of DM per day in the L. perenne paddock during Spring and Summer, respectively, and 550 +/- 85.9 and 226 +/- 44.8 g DM per day in the P. lanceolata paddock during Spring and Summer, respectively. The amount of DM, energy, crude protein and amino acids that the animals consumed varied markedly between days but did not significantly differ in amount between the L. perenne and P. lanceolata paddocks. However, the consumptions were significantly lower in Summer than in Spring. It is estimated that the wild boar would have satisfied somewhat less than 90 and 45% of their daily maintenance digestible energy requirements through consumption of pasture when grazing the L. perenne paddock in Spring and Summer, respectively.


Predictive population models designed to assist managers and policy makers require an explicit treatment of inherent uncertainty and variability. These are particular concerns when modelling non-native and reintroduced species, when data have been collected within one geographical or ecological context but predictions are required for another, or when extending models to predict the consequences of environmental change (e.g., climate or land-use). We present an aspatial, probabilistic framework of hierarchical process models for predicting population growth even when data are sparse or of poor quality. Insight into the factors affecting population dynamics in real landscapes can be provided and Kullback-Leibier distances are used to compare the relative output of models. This flexible yet robust framework gives easily interpretable results, allowing managers as well as modellers to invalidate anomalous models and apply others to real-life scenarios. We illustrate the framework’s power with a meta-analysis of European wild boar (Sus scrofa) data. We test hypotheses about the effect of geographic region, hunting and mast years on wild boar population growth, to build models of wild boar dynamics for the UK. The framework quantifies the importance of hunting pressure as a driver of population growth, and
confirms that reproductive success is greatly decreased in poor mast years, suggesting that the key to predicting wild boar dynamics is to ascertain local hunting pressure and to better understand changing food availability. Geography had no significant effect, indicating that it is not a good proxy for modelling the impact of change in climate or land-use on wild boar populations at the European scale. We use the framework to predict population abundance 9 years after an isolated population of wild boar established in the UK; in a comparison with the only field data and two independent modelling exercises, our framework provides the most robust and informative results.


We investigated the social organization of wild boars (Sus scrofa) using genetic and spatial data from a study population in Tuscany, Italy. In total, 120 wild boars of different sexes and age classes were captured and monitored from 2002 to 2006. All of them were genetically analyzed by using 10 polymorphic microsatellites (H-E = 0.693, k = 6.6) and a matrix of pairwise relatedness was calculated. In addition, a reference sample of fully related individuals was created by genotyping 11 adult females and their fetuses (n = 56). Spatial data were gathered for 65 animals that had been fitted with either radio-collars or ear transmitters. Sixteen social units were identified by capture data and confirmed by observations and telemetry. A correlation between interindividual spatial distance and relatedness was observed only in summer-early autumn and seemed to be associated to the presence of piglets. The prediction of matrilinearity in wild boar social units was not confirmed, because a low degree of relatedness among boars was observed within groups. Aggregations of unrelated adult females (with their litters) were detected in the study population. The high turnover in the population due to human-caused mortality seems to be the main factor responsible for this altered social structure. Accordingly, we suggest that the observed social organization would result from grouping of unrelated survivors.


In a radiotelemetry study in North-East Germany, we analysed spatial utilisation of 22 female wild boar (Sus scrofa) out of 21 wild boar groups during summer (2003-2006). We compared summer season home ranges (16 May-15 August) with "field home ranges", i.e. periods between first and last appearance within cereal fields. Wild boar appeared inside fields with beginning of grain and rapeseed flowering and vanished usually with harvest. Three types of spatial utilisation patterns were defined: "field sows", who shifted their home range entirely into fields; "commuters", who roamed between forest and fields; and "forest sows", who remained in the forest. Yearlings were predominantly commut- ers, whilst family groups did not roam but either shifted to fields or stayed in forest. Field sows had smaller mean field home ranges than total summer home ranges, whereas commuters and forest sows showed no differences. All three groups did not differ significantly in home range size measures but, however, showed different mean shifts from spring to summer home range. The home range sizes of sows of the different spatial patterns were similar, as all resources were permanently available all-over the study area. However, dislocations into outstanding profitable nutritional habitats (e.g. agricultural fields in summer) may enlarge annual home ranges of commuters and field sows.

Keuroghlian A and Eaton DP. 2009. Removal of palm fruits and ecosystem engineering in palm stands by white-lipped peccaries (Tayassu pecari) and other frugivores in an isolated Atlantic Forest frag-
Long-term studies in a 2,178 ha fragment of semideciduous Atlantic Forest demonstrated important interactions between white-lipped peccaries (*Tayassu pecari*) and the common palms, *Syagrus romanzoffiana* and *Euterpe edulis*. We conducted fruit removal and medium-to-large-sized mammalian exclusion experiments to: (1) quantify seasonal fruit consumption from high-density patches beneath parent trees by *T. pecari* and other consumers, and (2) measure impacts of *T. pecari* rooting and foraging activities on seedling dynamics in *E. edulis* stands. A diverse array of fauna consumed *S. romanzoffiana* fruits. During the dry season, when *S. romanzoffiana* palms provided 68% of fruit dry weight in the fragment, *T. pecari* consumed significantly greater amounts than other consumers, and along with *Pecari tajacu* and *Tapirus terrestris*, were potential seed dispersers. The rodents, *Sciurus ingrami* and *Agouti paca*, consumed most *S. romanzoffiana* fruits in the wet season, acting as both seed dispersers and predators. More than 95% of *E. edulis* fruit removal was due to seed predation by *T. pecari*. Intense removal during the dry season was closely linked with previously documented range shifts and habitat preferences by *T. pecari*. Exclusion plot experiments in *E. edulis* (palmito) stands showed that the number and proportion of nonpalmito (not *E. edulis*) seedlings increased dramatically in the absence of *T. pecari* rooting and foraging activities that disturbed soil and thinned seedlings. We discuss the importance of these ecosystem engineering activities and palm-peccary trophic interactions for long-term maintenance of *E. edulis* stands and *T. pecari* populations, as well as water balance, in the forest fragment.


The use of line transect methodology and portable thermal imaging for ground survey of wildlife should require a good knowledge of the behavioural response of the animals to the presence of an observer, in order to take into account the potential bias in density estimate caused by deviation from the assumption that distances are recorded at the initial position. We used ten fallow deer and eight wild boar fitted with radiocollars to investigate animals' response during simulated nocturnal line transect surveys, carried out in a Mediterranean plain forest. The experiment consisted in radiolocating a focal animal before and after an observer walked a transect nearby (< 100 m). Each transect line was followed using a Global Positioning System (GPS) navigator. We carried out a total of 64 trials on fallow deer and 57 on wild boar. Results showed that despite most of the animals moved significantly in response to the observer (mean +/- standard error, wild boar-95.3 +/- 10.0 m; fallow deer-149.6 +/- 14.2 m), the flying patterns were different in the two species: the reaction of fallow deer turned out to be more intense and directional with respect to that showed by wild boar. Although these results sound explorative, the experiment attempted here, for the first time, is relevant for an appropriate design of nocturnal distance-sampling surveys and gives information about potential bias arising from animal's behavioural response. We believe that these first results may foster more in-depth analyses which are now made possible with the adoption of GPS technology for animal location.


The Wet Tropics bioregion of north Queensland has been identified as an area of global significance. The world-heritage-listed rainforests have been invaded by feral pigs (*Sus scrofa*) that are perceived to
cause substantial environmental damage. A community perception exists of an annual altitudinal migra-
tion of the feral-pig population. The present study describes the movements of 29 feral pigs in relation

to altitudinal migration (highland, transitional and lowland areas). Feral pigs were sedentary and

stayed within their home range throughout a 4-year study period. No altitudinal migration was de-
tected; pigs moved no more than a mean distance of 1.0 km from the centre of their calculated home
ranges. There was no significant difference between the mean (+/- 95% confidence interval) aggregate
home ranges for males (8.7 +/- 4.3 km$^2$, n = 15) and females (7.2 +/- 1.8 km$^2$, n = 14). No difference in

home range was detected among the three altitudinal areas: 7.2 +/- 2.4 km$^2$ for highland, 6.2 +/- 3.9

km$^2$ for transitional and 9.9 +/- 5.3 km$^2$ for lowland areas. The aggregate mean home range for all pigs

in the present study was 8.0 +/- 2.4 km$^2$. The study also assessed the influence seasons had on the home

range of eight feral pigs on the rainforest boundary; home ranges did not significantly vary in size be-
tween the tropical wet and dry seasons, although the mean home range in the dry season (7.7 +/- 6.9

km$^2$) was more than twice the home range in the wet season (2.9 +/- 0.8 km$^2$). Heavier pigs tended to

have larger home ranges. The results of the present study suggest that feral pigs are sedentary through-
out the year so broad-scale control techniques need to be applied over sufficient areas to encompass

individual home ranges. Control strategies need a coordinated approach if a long-term reduction in the

pig population is to be achieved.


A major challenge facing pest-eradication efforts is determining when eradication has been achieved.

When the pest can no longer be detected, managers have to decide whether the pest has actually been

eliminated and hence to decide when to terminate the eradication program. For most eradication pro-

grams, this decision entails considerable risk and is the largest single issue facing managers of such

programs. We addressed this issue for an eradication program of feral pigs (Sus scrofa) from Santa

Cruz Island, California. Using a Bayesian approach, we estimated the degree of confidence in the suc-

cess of the eradication program at the point when monitoring failed to detect any more pigs. Catch-

effort modeling of the hunting effort required to dispatch pigs during the eradication program was used

to determine the relationship between detection probability and searching effort for different hunting

methods. We then used these relationships to estimate the amount of monitoring effort required to de-
clare eradication successful with criteria that either set a threshold for the probability that pigs re-

mained undetected (type I error) or minimized the net expected costs of the eradication program (cost

of type I and II errors). For aerial and ground-based monitoring techniques, the amount of search effort

required to declare eradication successful on the basis of either criterion was highly dependent on the

prior belief in the success of the program unless monitoring intensities exceeded 30 km of searching

effort per square kilometer of search area for aerial monitoring and, equivalently, 38 km for ground

monitoring. Calculation of these criteria to gauge the success of eradication should form an essential

component of any eradication program as it allows for a transparent assessment of the risks inherent in

the decision to terminate the program.

Sparklin BD, Mitchell MS, Hanson LB, Jolley DB and Ditchkoff SS. 2009. Territoriality of Feral Pigs


497-502.

We examined home range behavior of female feral pigs (Sus scrofa) in a heavily hunted population on

Fort Benning Military Reservation in west-central Georgia, USA. We used Global Positioning System
location data from 24 individuals representing 18 sounders (i.e., F social groups) combined with mark-recapture and camera-trap data to evaluate evidence of territorial behavior at the individual and sounder levels. Through a manipulative experiment, we examined evidence for an inverse relationship between population density and home range size that would be expected for territorial animals. Pigs from the same sounder had extensive home range overlap and did not have exclusive core areas. Sounders had nearly exclusive home ranges and had completely exclusive core areas, suggesting that female feral pigs on Fort Benning were territorial at the sounder level but not at the individual level. Lethal removal maintained stable densities of pigs in our treatment area, whereas density increased in our control area; territory size in the 2 areas was weakly and inversely related to density of pigs. Territorial behavior in feral pigs could influence population density by limiting access to reproductive space. Removal strategies that 1) match distribution of removal efforts to distribution of territories, 2) remove entire sounders instead of individuals, and 3) focus efforts where high-quality food resources strongly influence territorial behaviors may be best for long-term control of feral pigs.


We studied the habitat use, activity patterns and use of mineral licks by five species of Amazonian ungulate using data from four 60-d camera trap surveys at two different sites in the lowland rain forest of Madre de Dios, Peru. Camera traps were set out in two regular grids with 40 and 43 camera stations covering an area of 50 and 65 km², as well its at five mineral licks. Using occupancy, analysis we tested the hypothesis that species are spatially separated. The results showed that the grey brocket deer (Mazama gouazoubria) occurred almost exclusively in terra firme forests, and that the while-lipped peccary (Tayussu pecari) used floodplain forest more frequently during some surveys. All other species showed no habitat preference and we did not find any spatial avoidance of species. The white-lipped peccary, the Collared peccary (Pecari tajacu) as well its the grey brocket deer were strictly diurnal while the lowland tapir (Tapirus terrestris) was nocturnal. The red brocket deer (Mazama americana) was active day and night. The tapir was the species With the highest number of visits to mineral licks (average 52.8 visits per 100 d) followed by the white-lipped peccary (average 16.1 visits per 100 d) and the red brocket deer (average 17.1 visits per 100 d). The collared peccary was only recorded on three occasions and the grey brocket deer was never seen at a lick. Our results suggest that resource partitioning takes place mainly at the diet level and less at it spatial level: however. differences in small-scale habitat use are still possible.


In African savannahs, large trees improve grass quality, particularly in dry and nutrient poor areas. Enhanced below-canopy grass nutrients, such as nitrogen and phosphorus contents should therefore attract and benefit grazers. To predict whether ungulates really need these forage quality islands we focused oil four grazer species, i.e., zebra, buffalo, wildebeest, and warthog, differing in body size and digestive system. We confronted literature estimtions of their feeding requirements with forage availability and quality, observed in three South African savannah systems, through linear modelling. The model predicted the proportion of below-canopy grass that grazers should include in their diet to meet their nutritional requirements. During the wet season, the model predicted that all animals could satisfy their daily nutrient requirements when feeding on a combination of below- and outside-canopy grasses.
However, wildebeest, having relatively high nutrient demands, could meet their nutrient requirements only by feeding almost exclusively below canopies. During the dry season, all animals could gain almost twice as much digestible protein when feeding oil below compared to outside-canopy forage. Nonetheless, only warthogs could satisfy their nutrient requirements - when feeding almost exclusively oil below-canopy grasses. The other ungulate species could not meet their phosphorus demands by feeding at either site. Without exceeding their maximum fibre intake, indicating the unfavourable conditions during the dry season. We conclude that grazing ungulates, particularly warthog, zebra, and buffalo, actually depend on the available below-canopy grass resources. Our model therefore helps to quantify the importance of higher quality forage patches beneath savannah trees. The composition of grazer communities depending on below-canopy grasses can be anticipated if grazer food requirements and the abundance of large trees in savannahs are known. The model suggests that the conservation of large single-standing trees ill savannahs is crucial for maintenance of locally grazing herbivores.


We suggest an ethno-biological approach to analyze the cultural and social drivers of hunting activities and assess sustainability in villages near Makokou, northeast Gabon, based on interviews with hunters, participatory mapping of hunting territories, and daily records of offtakes for 1 yr. Hunting in villages of northeast Gabon is practiced for both local consumption and cash income to cover basic family expenses. There appears to be no clear tendency to abandon subsistence hunting for commercial hunting as in other regions of Africa. Cultural and socioeconomic factors explain the temporal and spatial variation in hunting activities. Hunting increases in the dry season during circumcision ceremonies, when it is practiced mainly at > 10 km from villages, and decreases during the rainy season because most hunters are occupied by other economic activities. Degraded forest such as secondary regrowth supplies 20% of the animals killed and the greatest diversity of species at short distances from villages. Mature forest supplies the species with the greatest commercial value, e.g., red river hog (*Potamochoerus porcus*), and is the preferred source of meat for traditional ceremonies. In the last 15 yr, hunting patterns have changed rapidly, mainly because of the spread of gun hunting, which had serious implications for the nature of offtakes. Our results suggest that there is potential to allow hunting for resistant species such as blue duiker (*Cephalophus monticola*) and African brush-tailed porcupine (*Atherurus africanus*). Other species such as red river hog and small diurnal monkeys require more attention. Specific management systems could be discussed in participatory hunting management plans to identify possible solutions.


Interactions among sympatric large predators and their prey and how they respond to conservation measures are poorly known. This study examines predictions concerning the effects of establishing a protected area in Nepal on tigers (*Panthera tigris*), leopards (*Panthera pardus*), and their ungulate prey. Within a part of the park, after 22 years the total density of wild ungulates had increased fourfold, to ca. 200 animals/km², almost exclusively due to a remarkable increase in chital deer (*Axis axis*). Tiger density also increased markedly to nearly 20 animals/100 km², whereas leopard density did not and was ca. 5 animals/ 100 km². The prediction that grazers should increase more than browsers was only partially supported. The prediction of positive density dependence in prey selection was not supported.
Instead, the most abundant species (chital and hog deer, *Axis porcinus*) were killed less frequently than expected, whereas the lower-density wild boar (*Sus scrofa*) was preferred. Predictions that (i) initially rare species suffer highest predation was partially supported, that (ii) predation is highest among the most abundant prey was not supported, and that (iii) predation is highest among the most preferred prey independently of their densities was supported. Clearly, the conservation efforts adopted in Bardia were successful, as both tigers and their natural prey base increased. However, the positive numerical response of tigers limited and depressed the abundance of some prey species. Thus, conservation activities aimed at restoring large predators are likely to change in the composition of the overall mammal community, potentially eliminating rare but preferred prey species.


Warthogs, *Phacochoerus africanus*, are an unusual ungulate. They are facultative cooperative breeders where females within the same population display both solitary and cooperative reproductive strategies. Warthogs require burrows for sleeping and rearing their young, yet they are unable to dig their own burrows and rely on aardvark excavations. Studies of warthogs have failed to show any reproductive benefits to females participating in communal care and suggest a reproductive cost to cooperation. The ecological constraints hypothesis proposes that environmental factors limit an individual's ability to successfully disperse and reproduce. In this study we investigated whether limitations in burrow sites can explain cooperative breeding in this species. We checked over 500 burrows for signs of use systematically for 1 year to determine whether burrows were a limiting resource and to investigate burrow use preferences. Our methodology allowed us to determine whether burrows were used by adults with young or by adults without young. We found that burrow availability did not appear to pose an ecological constraint on independent living, as the percentage of burrows used remained relatively low throughout the year. Additionally, the number of burrows in a warthog clan area did not influence the percentage of females breeding cooperatively. Predator avoidance appeared to be the main factor influencing individual burrow selection by warthogs and communal nesting may best be explained as a form of antipredator behaviour.


Wild pigs (*Sus scrofa*) are considered opportunistic omnivores that consume primarily plant matter; vertebrates are thought to constitute only a minor component of their diets, primarily as carrion, but active predation on vertebrates has been suspected. We examined the stomach contents of 104 wild pigs collected during a 7-year period in oak woodlands of the Diablo Range, California, and found that 40.4% contained vertebrate prey comprising 20 species, including 11 mammals, and totaling 167 individuals. Most stomachs with vertebrate prey included multiple individuals (<= 18) of >1 species (<= 6). Predation occurred in both male and female pigs and was most frequent during summer and fall, probably in response to protein deficiency in the diet. Wild pigs are a conservation concern because of their rooting behavior and consumption of mast; our results extend their potential impact to include predation on vertebrates, especially small mammals.
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The newsletter of the IUCN/SSC Wild Pigs, Peccaries and Hippos Specialist Groups (previously Asian Wild Pig News)

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

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

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

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

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

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