IUCN SSC Species Survival Commission

IUCN/SSC Small Carnivore Specialist Group

Conservation Planning Specialist Group — Changing the Future for Wildlife

Save Vietnam's Wildlife

CONSERVATION STRATEGY *FOR*

OWSTON'S CIVET

CHROTOGALE OWSTONI

2019 - 2029

FUNDED BY:

Wild Planet Trust

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This document summarises discussions and recommendations from the Save Owston's Civet Workshop, held in Hanoi, Vietnam, over 1 – 4 April 2019.

For further information about this action plan and its implementation, please contact the Owston's Civet Working Group of the IUCN SSC Small Carnivore Specialist Group: ***willcox.daniel@gmail.com***

COVER PHOTO:
Owston's Civet, photographed in captivity in Vietnam. ©SVW - Le Van Dung

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A collaboration between **Save Vietnam's Wildlife (SVW), the IUCN Species Survival Commission (SSC) Small Carnivore Specialist Group and the IUCN SSC Conservation Planning Specialist Group.**

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ACRONYMS AND ABBREVIATIONS

ATBC	Association for Tropical Biology and Conservation
AZA	[American] Association of Zoos and Aquariums
CBD	Convention on Biological Diversity
CPSG	Conservation Planning Specialist Group (of the IUCN SSC)
CITES COP	Convention on International Trade in Endangered Species (CITES) Conference of the Parties
EAZA	European Association of Zoos and Aquaria
IUCN	International Union for Conservation of Nature
IWT	illegal wildlife trade
MARD	Ministry of Agriculture and Rural Development (Vietnam)
MOH	Ministry of Health (Vietnam)
MONRE	Ministry of Natural Resources and Environment (Vietnam)
MPS	Ministry of Public Security
NTFP	non-timber forest product
PA	protected area
SCB	Society for Conservation Biology
SEAZA	South-east Asian Zoos and Aquariums Association
SSC	Species Survival Commission (of the IUCN)
SVW	Save Vietnam's Wildlife
WPT	Wild Planet Trust (formerly Whitley Wildlife Conservation Trust)
WSN	Wildlife Support Network (Vietnam)

EXECUTIVE SUMMARY

VISION

By 2050, the distinctive, beautiful Owston's Civet thrives as secured viable wild populations across its natural range. Valued by people locally and globally, it is protected effectively by the governments of Vietnam, Lao PDR and China. Owston's Civet's recovery is emblematic of the return of South-east Asia's forests to health by sustainable threat removal, and of small carnivore conservation.

IMMEDIATE PRIORITIES (1 – 2 YEARS)

Establish a framework for action

- Establish an Owston's Civet Working Group within the IUCN SSC Small Carnivore SG to coordinate ex-situ and in situ conservation efforts.
- Coordinate with efforts on other species/species groups that face similar threats e.g. Saola, Large-antlered Muntjac, Edwards's Pheasant, Annamite Striped Rabbit
- Secure funding for a Vietnamese programme officer to coordinate efforts.
- Build a tool for prioritising wild sites for conservation action including for release and founder collection.

Take a fresh approach to illegal hunting and the snaring crisis

- Review past attempts to reduce snaring pressures in range states and publish results
- By experimental study, determine the intensity of on-ground law enforcement required for effective snare reduction
- Engage central governments in range states to increase penalties and their application, particularly with regard to possession of snaring material
- Continue and where possible intensify, the existing level of law enforcement in range countries

Communicate the impacts of the wild meat trade

- Compile evidence in a briefing paper demonstrating: 1) the connection between snaring and wild meat consumption; 2) the scale and dynamics of the wild meat market and 3) the associated public health risks.
- Build support and raise profile for the issue in appropriate fora (e.g. CITES COP, CBD, IWT, SCB, and ATBC) and host meetings within NGO fora e.g., WSN (Vietnam), WG 15.7 (Laos) and national governments.

Build a conservation breeding program to prevent extinction and accelerate recovery

- Research the requirements for a successful ex-situ program.
- Establish facilities for a dedicated conservation breeding program.
- Secure a suitable founder population.

Owston's Civet Chrotogale owstoni was categorised as Endangered on the IUCN Red List of Threatened Species in 2016. This civet has one of the smallest distributions of any carnivore species in Asia; it is only found in Vietnam, Lao PDR and a small part of southern China.

Vietnam forms the largest part of Owston's Civet range and is one of the main demand countries in the illegal wildlife trade; it is in Vietnam where the greatest conservation impacts for this species can be made. Over 1–4 April 2019, a workshop was held in Hanoi, at which Vietnamese and international organisations, government partners, researchers and conservationists with a strong stake in Owston's Civet conservation gathered, to plan for its conservation and recovery.

Although the consumption of wild meat as a luxury in urban areas was identified as a main driver for the hunting crisis in Indochina's forests, it was recognised that this falls outside the work being done on the illegal wildlife trade, which mainly focuses on pangolin, elephant ivory and rhino horn trafficking. This gap needs urgently to be addressed if the region's endemic wildlife species such as Owston's Civet, Large-antlered Muntjac and Annamite Striped Rabbit are to be conserved. All of these species are threatened by indiscriminate snaring to meet the demand for luxury wild meat.

An ex-situ programme for the species has been in place since the late 1990s, in Cuc Phuong National Park, Vietnam, with partner zoos in Europe. However, this population is too small to be viable in the long-term and is vulnerable to infectious disease such as avian influenza. The workshop participants agreed that a reinvigorated conservation breeding programme is needed to prevent the extinction of Owston's Civet.

Despite these challenges there is potential to generate local and international support for conserving this species; the species is already part of an established conservation breeding programme, there are already local civil society organisations invested in its conservation, and there are protected areas where the species can be recorded.

The time to act is now, while the chance of success is still high.

Captive Owston's Civet at SVW's centre
© SVW - Le Van Dung

Captive Owston's Civet at SVW's centre
© SVW - Le Van Dung

THREATS

Demand from large and lucrative Asian markets for wild meat, for traditional medicine and for the ornamental and pet trades, drives large-scale, indiscriminate hunting of wildlife, outside and inside protected areas. Although not a specific target for any of these markets, Owston's Civets are a casualty of indiscriminate hunting methods, particularly snares.

Other civet species are farmed legally in Vietnam to supply meat to restaurants, but poor regulation of this industry provides cover for continued and unsustainable wild harvesting of all civet species, including Owston's Civet.

Workshop participants agreed that although there are some areas in this species's range not yet under pressure from large-scale and indiscriminate hunting, it is only a matter of time before this threat is present range-wide.

A snared Owston's Civet in Laos.

© The Biodiversity Offset Management Committee of Bolikhamxay Province, Lao PDR, Nam Chouane-Nam Xang Biodiversity Offset Site, 2018.

RECOMMENDED ACTIONS

It was agreed that securing the future of Owston's Civet in the wild requires better protection from hunting. Current resources for this are insufficient for the size of the task, and there are no known areas in which snaring is controlled to a level that will enable the recovery of hunting-sensitive species such as Owston's Civet. A better understanding of why past efforts have failed, and of the relationship between on-the-ground enforcement effort and snaring or hunting intensity were considered key to developing more successful approaches. Given the scarcity of resources, it will not be possible to take action everywhere that Owston's Civet occurs or could occur. To maximise conservation outcomes, site prioritisation should consider the potential conservation gains to be made at a site, as well as the likelihood of achieving them, given the characteristics and challenges present.

A reduction in the overall demand for wild meat would reduce hunting pressures. Reducing demand in this case is particularly challenging because Owston's Civet is not thought to be targeted by any particular consumer group. Although there is some historical evidence of trade in Owston's Civet pelts, and some recent cases of live animals in the pet trade, the dominant threat is believed confidently to be the commercial wild meat trade. Reducing this demand will be an enormous task, requiring concerted efforts by the wider conservation community. Participants focused their discussion on reducing demand for wild-caught and farmed civet meat, as this is considered to be the main driver of snaring. In turn, snaring is the form of hunting most damaging to Owston's Civet, within the species's range.

Participants agreed that although both these streams of action are extremely important, they are far from guaranteed to deliver results quickly enough to avert extinction. Therefore, it was also agreed that a viable ex-situ conservation breeding programme needs to be established as a matter of urgency, to ensure prevention of the species's extinction, and provide a resource to support its future recovery in the wild.

IMPLEMENTATION

Conservation programmes for threatened species are often inefficient because of poor communication between partners and parallel but uncoordinated strands of work. Saving Owston's Civet will require the support and collaboration of a diverse group of organisations. Ongoing communication and agreement on priority goals and activities will be critical to the success of this strategy.

An Owston's Civet Working Group will be established within the IUCN SSC Small Carnivore Specialist Group, with a dedicated programme officer based in Vietnam, to drive and support the implementation of this action plan and to ensure that its in-situ and ex-situ efforts are integrated. The priorities and actions described in this document will be reviewed and reported on quarterly. A more substantial revision will be carried out after three years, or before if needed.

Captive Owston's Civet at SVW's centre
© SVW - Matt Maran

INTRODUCTION

Over 1–4 April 2019, a multi-stakeholder group of 57 participants, including representatives of Vietnamese organisations, government partners, researchers and conservationists with a strong stake in Owston's Civet conservation, met for a four-day conservation planning workshop in Hanoi, Vietnam, to develop a conservation strategy for Owston's Civet.

Conservation Planning Workshop for Owston's Civet in Hanoi, April 2019
© SVW - Tran Phuong Mai

This document results from the workshop. It is intended for use by:

- workshop participants, as a record of the actions, initiatives and collaborations discussed;
- range- and consumer-country government agencies, to help guide and inform the development of national action plans and initiatives;
- non-governmental conservation organisations and community groups, to guide and inform their priorities and work plans;
- the Owston's Civet Working Group, to help in tracking and supporting progress; and
- donors and other partners, to help guide where best to support the programme.

In summary, the 2019–2029 Conservation Strategy and Action Plan for Owston's Civet includes:

- A long-term **VISION** for the future of Owston's Civet;
- A summary of current **CHALLENGES** to achieving the Vision;
- 10-year **GOALS** that represent achievable progress towards the vision;
- **OBJECTIVES** for achieving the goals, and rationales for these;
- **ACTIONS** for achieving the objectives, including recommendations on where and how

The content of the vision was agreed by all workshop participants. The strategy and actions were developed by three themed working groups: 1) site-based protection and management; 2) wildlife trade; and 3) ex-situ management, and the document is structured to reflect these broad areas of work. A further working group was convened to begin development of a framework for use in prioritising localities for Owston's Civet conservation action. A draft description of this work is captured in Appendix I.

An Owston's Civet Working Group, operating within the IUCN SSC Small Carnivore Specialist Group, will drive and coordinate implementation, particularly Goal 4 which comprises the ex-situ components. The Working Group will review and report on progress quarterly, and a three-year review of progress will be undertaken in 2022.

VISION

By 2050, the distinctive, beautiful Owston's Civet thrives as secured viable wild populations across its natural range. Valued by people locally and globally, it is protected effectively by the governments of Vietnam, Lao PDR and China. Owston's Civet's recovery is emblematic of the return of South-east Asia's forests to health by sustainable threat removal, and of small carnivore conservation.

The Strategy's vision will have been realised when:

1 Effective protection has been achieved in the wild for Owston's Civet and all co-occurring hunting-sensitive species, and Owston's Civet conservation has provided high conservation benefit for biodiversity conservation. This would be indicated by the presence of at least three sites where the species is effectively conserved which cover, between them:

- the species's full geographical range, and
- the species's full ecological range.

2 The demand for civet meat no longer threatens Owston's Civet populations at these three localities. This would be indicated by the closure of civet meat farms in Vietnam.

3 A healthy, sustainable ex-situ population functions as a tool for species recovery through reintroductions/supplementation.

Two captive Owston's Civets at SVW's centre
© SVW - Chien C. Lee

TEN-YEAR GOALS

1 **To implement effective protection of Owston's Civet and all co-occurring, hunting-sensitive species at a minimum of three priority sites.**

2 **To reduce the consumption of wild meat in restaurants in urban areas within Owston's Civet range states, by:**

- elevating the issue of reducing wild meat consumption as a priority for the conservation and government sectors.
- developing and implementing a strategy of behaviour change, targeted at wild meat consumption; the strategy will include policy and law enforcement.

3 **To reduce the impacts of poorly regulated captive facilities (private and government zoos, civet coffee farms, and civet meat farms) on Owston's Civet populations.**

4 **To establish a healthy, genetically diverse ex-situ population which:**

- provides insurance against extinction.
- is able to provide suitable animals for release to support the recovery of wild populations.

RECOMMENDED OBJECTIVES & ACTIONS

There are a number of blanks in the following tables, particularly in the indicators and years columns. Progress against these objectives and actions will be assessed by a working group on a regular basis, and the table will be updated where necessary.

GOAL 1

TO IMPLEMENT EFFECTIVE PROTECTION OF OWSTON'S CIVET AND ALL CO-OCCURRING, HUNTING-SENSITIVE SPECIES AT A MINIMUM OF THREE PRIORITY SITES.

Immediate priorities (i.e. for years 1-2) are highlighted in

OBJECTIVE 1.1

PRIORITISE SITES FOR OWSTON'S CIVET CONSERVATION ACTION.

Resources are scarce and priorities will need to be set that guide where to act. To improve overall success, prioritisation should account both for potential conservation gains and for the likelihood of achieving them given the specific on-ground characteristics and constraints. The dynamic nature of conservation means that these priority sites will need to be reviewed regularly. In addition to identifying priority sites/areas for targeted protection, priority sites/populations must be identified for extraction of founders for the ex-situ programme. A tool for identifying and agreeing these priorities, developed collaboratively and informed by expert knowledge, is expected to help concentrate available efforts and improve overall conservation outcomes. Historically, Owston's Civet forest habitat extended from sea level to over 2800 m a.s.l. As lowland forest has been lost the species's distribution has contracted to remaining forest areas, mostly at higher elevations. In considering the long-term future of the species, consideration should be given not just to where the species is now, but to where – on the basis of remaining habitat – it could be, such as the lowlands.

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2024	>Y5 >2024	LEADS (COLLABORATORS)
1.1.1	Develop and test a tool for prioritising localities for conservation action, based on collaboratively agreed criteria.	Tool is developed and circulated to stakeholders.	X	X					Rob Timmins, Oliver Wearn, workshop participants
1.1.2	Evaluate Owston's Civet sites and recommend priorities for long-term conservation of Owston's Civet, and for immediate founder acquisition.	List of priority sites with justification.	X	X					Rob Timmins, Oliver Wearn, workshop participants
1.1.3	Periodically refine recommended priorities with the input of stakeholders, coordinated through the Owston's Civet WG.	All stakeholders are aware of recommended priority sites for		X	X	X	X	X	Daniel Willcox, Rob Timmins, Oliver Wearn

OBJECTIVE 1.2

INCREASE PENALTIES FOR ALL HUNTING, ESPECIALLY SNARING.

Reducing hunting will require a combination of incentives and deterrents. Industrial-scale snaring, which was agreed to be the primary threat to Owston's Civet as well as to many other species, presents a particularly difficult challenge because it is not currently a high profile threat and because snares can be made easily from materials such as bicycle cable, possession of which is not readily challenged by law enforcers.

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2024	>Y5 >2024	LEADS (COLLABORATORS)
1.2.1	Liaise with government authorities to revise regulations relating to all methods of hunting.	Recommendations and comments integrated in regulations, decrees, etc. at all levels of government (local, provincial, central).							- OCWG (coordinator) - Government of Vietnam; SVW to lead with engagement. [need to assign leads to engage with governments of China and Lao PDR]
1.2.2	Clarify decisions made on hunting regulations at all levels of government (local, provincial, central).	Recommendations and comments integrated in regulations, decrees, etc. at all levels.							Government of Vietnam; SVW to lead with engagement. [need to assign leads to engage with governments of China and Lao PDR]
1.2.3	Organise workshops to discuss snares; involve central governments.	Workshops held with central governments (x2/country).							[?]
1.2.4	Liaise with enforcement authorities to increase the application of penalties.	- % suspects punished. - severity of punishment.							Government of Vietnam; SVW to lead with engagement. [Need to collaborate with other actors engaged in site-based protection in Vietnam – FFI, WWF, VietNature] [need to assign leads to engage with governments of China and Lao PDR]
1.2.5	Advocate for banning the possession of snares within protected areas.	Recommendations and comments integrated in regulations, decrees, etc. at all levels.							Government of Vietnam; SVW to lead with engagement. [need to assign leads to engage with governments of China and Lao PDR]

OBJECTIVE 1.3

INCREASE COLLABORATION WITH HUMAN COMMUNITIES THAT ARE NOT PRACTISING INDUSTRIAL SNARING TO UNDERSTAND WHY AND HOW TRADITIONAL HUNTING TECHNIQUES ARE MAINTAINED.

Some local communities do not practise intensive snaring but have maintained their traditional hunting techniques with, for example, guns and dogs. Understanding why and how such systems are maintained may be of value in designing conservation action. Social science based research.

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2024	>Y5 >2024	LEADS (COLLABORATORS)
1.3.1	Study the past and current situation in areas where industrial hunting has not been carried out.	Report completed		X					Bill Robichaud's contacts [FFI – Hoang Lien Son/Van Ban?]
1.3.2	Follow up and act on the results of the study based on results.	As appropriate							TBC

OBJECTIVE 1.4

WORK WITH THE ORGANISATIONS INVOLVED TO EVALUATE AND LEARN FROM PAST APPROACHES TO ADDRESSING THE SNARING ISSUE.

There are currently no known examples, in the region, of areas in which snaring and other forms of indiscriminate hunting have been controlled to levels that allow healthy populations of snaring-sensitive wildlife to persist. This is an obstacle to designing effective conservation for Owston's Civet. Working with other organisations to learn from past projects is important in designing new approaches for testing

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2024	>Y5 >2024	LEADS (COLLABORATORS)
1.4.1	Study the past and current situation.								
1.4.2	Follow up and act on the results of the study based on results.								

OBJECTIVE 1.5

CONDUCT FIELD RESEARCH TO DETERMINE THE INTENSITY OF PATROLLING AND ENFORCEMENT REQUIRED PER UNIT OF AREA, TO ELIMINATE SNARING.

Important gaps in understanding how to mitigate the threat of snaring were summarised as follows:

- What is the threshold level of snaring below which Owston's Civet can survive?
- Is it financially realistic to stop snaring from occurring in any one area big enough to secure a population of Owston's Civets?

An experimental approach to answering these questions will help in designing conservation efforts.

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2024	>Y5 >2024	LEADS (COLLABORATORS)
1.5.1	Conduct a study on poacher behaviour and the intensity of patrolling and enforcement needed to exclude snaring. NB – poaching behaviour likely to be very site-specific; all NGOs with site programmes and engaged in snare removal should research this issue.								All NGOs engaged in site-based protection in Vietnam and Lao PDR, working in priority sites for Owston's Civet
1.5.2	Follow up and act on the results of the study.								

OBJECTIVE 1.6

MAINTAIN AND WHERE POSSIBLE IMPROVE CURRENT LAW ENFORCEMENT OPERATIONS.

Increasing law enforcement capacity and improving its effectiveness will be essential to conservation efforts for Owston's Civet and would bring benefits to many other species. Several strategies are targeted: i.e. new and better tools, stabilising resources, training, and incentives.

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2023	>Y5 >2024	LEADS (COLLABORATORS)
1.6.1	Review all systems of incentives (e.g. in Pu Mat National Park) and punishments.								
1.6.2	Follow up as appropriate, based on lessons learned.								
1.6.3	Sustain and rapidly improve current level of law enforcement operations.								Government of Vietnam (SVW and other NGOs in Vietnam – TBD). [need to assign leads to engage with governments of China and Lao PDR]
1.6.4	Promote adaptive management with the use of Spatial Monitoring And Reporting Tool (SMART) programme.								Government of Vietnam (SVW and other NGOs in Vietnam – TBD). [need to assign leads to engage with governments of China and Lao PDR]
1.6.5	Provide training to rangers and managers.								Government of Vietnam (SVW and other NGOs in Vietnam – TBD). [need to assign leads to engage with governments of China and Lao PDR]

OBJECTIVE 1.7

ENSURE BETTER SPATIALLY TARGETED PATROLLING TO MAXIMISE PROTECTION OF OWSTON'S CIVET.

Lack of resources for patrolling often results in available efforts being spread thinly. This can result in poor results across the entire area. Applying the same effort over smaller, key areas should improve overall results for wildlife and for Owston's Civet, if its key habitat is included in the areas prioritised. Results from Objective 1.6 should help support a transition to this approach in Owston's Civet areas.

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2023	>Y5 >2024	LEADS (COLLABORATORS)
1.7.1	Ensure priority patrol areas incorporate known habitat where Owston's Civet occurs.								
1.7.2	Monitor the population's presence and status.								
1.7.3	Maintain resources to sustain patrolling activities in target areas.								

OBJECTIVE 1.8

EINTERNATIONAL GOVERNMENT ENGAGEMENT TO HIGHLIGHT SNARING CRISIS.

Large-scale, indiscriminate snaring is a relatively low-profile threat and does not receive the international attention and accompanying resources allocated to other threats of similar magnitude. Guns, for example, have public security implications, which are more likely to produce government action. Elevating global awareness of the magnitude and scale of the the threat of snaring to wildlife would benefit mitigation efforts.

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2023	>Y5 >2024	LEADS (COLLABORATORS)
1.8.1	Organise a workshop/campaign to raise awareness/concern on the severity of snaring.								
1.8.2	Bring together NGOs, Governments and other stakeholders.								

OBJECTIVE 1.9

ENGAGE WITH LOCAL AUTHORITIES IN SELECTED OWSTON'S CIVET AREAS TO INCREASE GUN CONTROL.

Lack of resources for patrolling often results in available efforts being spread thinly. This can result in poor results across the entire area. Applying the same effort over smaller, key areas should improve overall results for wildlife and for Owston's Civet, if its key habitat is included in the areas prioritised. Results from Objective 1.6 should help support a transition to this approach in Owston's Civet areas.

*****THE IMPLEMENTATION OF THESE ACTIONS IS CONTINGENT UPON SATISFACTORY RESULTS UNDER OBJECTIVE 1.3*****

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2024	>Y5 >2024	LEADS (COLLABORATORS)
1.9.1	Organise workshops with, and official visits to, local authorities to raise awareness on the severity of gun hunting issues								
1.9.2	Support forest management teams to sign an agreement on banning gun use and other hunting techniques (most crucially, snares) inside protected areas								
1.9.3	Use the media to highlight the use of guns as a conservation issue								


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GOAL 2

TO REDUCE THE CONSUMPTION OF WILD MEAT IN RESTAURANTS IN URBAN AREAS WITHIN OWSTON'S CIVET RANGE STATES, BY:

- **PRIORITISING THE ISSUE OF WILD MEAT CONSUMPTION FOR THE CONSERVATION AND GOVERNMENT SECTORS.**
- **DEVELOPING AND IMPLEMENTING A BEHAVIOUR CHANGE STRATEGY TARGETED AT WILD MEAT CONSUMPTION THAT INCLUDES POLICY AND LAW ENFORCEMENT.**

Immediate priorities (i.e. for years 1-2) are highlighted in

OBJECTIVE 2.1

TO REDUCE CONSUMPTION OF WILD MEAT IN URBAN AREAS WITHIN OWSTON'S CIVET RANGE COUNTRIES.

'Urban areas' include district towns (e.g. major towns beside protected areas). Historically most NGO and research efforts have focused on consumer behaviour and prevalence of wild meat trade in major cities in Vietnam (Hanoi, Ho Chi Minh City, Da Nang and Hue), although a significant portion of wild meat consumption probably occurs outside these areas, particularly for lower-profile mammal groups, such as civets. The connexions between the snaring crisis in Indochina's protected areas and the wild meat trade are poorly recognised amongst all stakeholders; the majority of activities focused on the illegal wildlife trade are on the international trafficking of pangolins, elephant ivory, rhino horn, and big cats. Behavioural change campaigns will require local application if targeting consumers at a site (e.g. district towns that border protected areas); local context must be taken into account during design stage.

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2024	>Y5 >2024	LEADS (COLLABORATORS)
2.1.1	Prioritise the issue of wild meat consumption for the conservation community (local, national, international, civil society, donors, and relevant govt. agencies) (through meetings and 1:1 contact/s). Where: VN, Lao PDR, China	Multi-NGO agreement on shared goals. Joint policy briefings (including in local languages), targeted funding calls from donors, national and international press coverage.	X	X					**When:** within two years **Who:** IUCN, SSC, SCSG **Country/site specific:** **Vietnam**: MARD (including CITES) MONRE, MPS, MOH, National Assembly; ENV, WCS, TRAFFIC, SVW, WWF, IUCN Vietnam, Da Nang – GreenViet **China**: [?], **Lao PDR**: [?]
2.1.2	Develop a behaviour change strategy targeted at wild meat consumption, which includes policy and law enforcement Where: Vietnam, Lao PDR, China NB – must use behavioural change experts in design stage and learn from the multiple previous, failed (and mislabelled) behaviour change campaigns in the region. NB - success will depend on coordinating and collaborating with other species groups which are affected by the same threat process, e.g. ungulates	# of behavioural change campaigns designed that take into consideration local (i.e. site) and national-level variation in consumer behaviour; # of policies and guidance documents that explicitly include enforcement activities focused on the wild meat trade.	X	X	X				Government of Vietnam (SVW, WCS and other NGOs TBD). [need to assign leads to engage with governments of China and Lao PDR]
2.1.3	Implement behaviour change strategy. Where: National – Vietnam, China, Lao PDR [Vietnamese and Chinese diasporas in Lao PDR?] Site-level, Vietnam – Pu Mat NP, Bi Doup NP [TBC]	% reduction in wild meat consumption; % increase in enforcement activities and prosecutions on wild meat restaurant owners; # of policy briefings that are transmuted into national laws/regulations.	X	X	X	X	X	X	Vietnam: Government of Vietnam, SVW China: [?] Lao PDR: [?]

GOAL 3

TO REDUCE THE IMPACTS OF POORLY REGULATED CAPTIVE FACILITIES (PRIVATE AND GOVERNMENT ZOOS, CIVET COFFEE FARMS, AND CIVET MEAT FARMS) ON OWSTON'S CIVET POPULATIONS.

Immediate priorities (i.e. for years 1-2) are highlighted in

OBJECTIVE 3.1

ELIMINATE THE THREAT OF CIVET FARMING TO WILD OWSTON'S CIVET POPULATIONS.

Civet farming is a threat to all wild civet populations in Vietnam and to human health. Captive conditions are poor (often too poor to facilitate any breeding) and turnover of animals likely to be very high. As with civet coffee trade, requests from facilities for more civets, to restock farms, will increase hunting inside protected areas, as these are probably the only places in Vietnam where relatively healthy civet populations exist. As the most common hunting method for mammals is indiscriminate snaring, this will impact Owston's Civet populations. Civet farms also pose significant threats to human health and if in close proximity to protected areas, wildlife health; civets are known reservoirs or hosts for zoonoses such as SARS and H5N1.

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2024	>Y5 >2024	LEADS (COLLABORATORS)
3.1.1	Communicate public health risk of civet farming.	Policy briefings and other awareness materials in English and Vietnamese.	X	X	X				**When:** ?2024 **Who:** Multi-agency WCS Vietnam (wildlife health)
3.1.2	Support government proposals to have Owston's Civet listed on the highest species protection category which would prevent wildlife farms from owning or breeding this species.	Species granted full legal protection in Vietnam.	X	X					Government of Vietnam (SVW, WCS Vietnam, ENV)

OBJECTIVE 3.2

UNDERSTAND THE DYNAMICS OF CIVET COFFEE FARMING IN VIETNAM.

Owston's Civets (three individuals, Da Lat, 2018) have been recorded in civet coffee farms in Vietnam. The civet coffee industry relies mainly on Common Palm Civets but the turnover of animals in industrial civet coffee farms is likely to be high; demand for more live 'civets' may sometimes result in Owston's Civet being accidently hunted by indiscriminate snaring to restock civet coffee farms. It is unknown how significant a threat civet coffee is, but given the proximity of Vietnam's coffee growing region to some priority sites for Owston's Civet (e.g. Ngoc Linh), it might be a significant but localised threat.

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	>Y5 >2024	LEADS (COLLABORATORS)
3.2.1	Site visits & interviews, collation of data with MARD, corroborating existing data/trade-body ground-truthing. Where: coffee growing areas in Vietnam, Lao PDR	Threat assessment.	X					When: Immediately Vietnam: SVW Lao PDR: [?]

OBJECTIVE 3.3

ASSESS THE ONGOING LEVEL OF THREAT OF THE ZOO AND PET TRADE TO OWSTON'S CIVETS AND FACILITATE TRANSFER OR INCLUSION OF INDIVIDUALS INTO THE CONSERVATION BREEDING PROGRAMME.

This is assumed to be a low-level threat but one that will need monitoring to assess any changes in its impacts to Owston's Civet populations. It represents an opportunity to secure new founders for the conservation breeding programme, although a limited one given the numbers involved and the inherent difficulties in enforcement against the online pet trade and animal transfers between private zoos. It is assumed to be a low-level threat because the numbers of known Owston's Civet in the trade in the last 10 years are low (fewer than 10 individuals). Although there have been some recent cases, it is assumed that because most populations are in isolated higher-altitude forests, from where extracting live animals is challenging, that most hunted Owston's Civets will be for the wild meat trade.

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2024	>Y5 >2024	LEADS (COLLABORATORS)
3.3.1	Raise awareness of Owston's Civet within trade-monitoring NGOs so there is a clear line of reporting to SVW. NB – small carnivore identification is challenging, and even relatively longstanding NGO personnel can confuse, e.g., Spotted Linsang with Owston's Civet. Reporting should focus on civet trade in general.	Regular reporting to SVW of any civet trade cases or animals seen in zoos (whether private or government).	X	X	X	X	X	X	**When:** ongoing **Vietnam:** SVW [TRAFFIC, ENV, WCS, Free the Bears?] **China:** [WCS, Kadoorie?] Lao PDR: [Free the Bears, LCWT, WCS?] **Regional:** [SEAZA?], WRS
3.3.2	Establish relationships to maximise acquisition of founder animals from the illegal wildlife trade and from captive facilities that are not part of the conservation breeding programme (e.g. private zoos in Vietnam)	# number of founder animals secured (target of 30).	X	X	X	X	X	X	Vietnam: SVW (with support from ENV, WCS), Vietnamese government. OCWG – for institutes covered by EAZA, AZA or SEAZA


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GOAL 4

TO ESTABLISH A HEALTHY, GENETICALLY DIVERSE EX-SITU POPULATION WHICH:

- **PROVIDES INSURANCE AGAINST EXTINCTION;**
- **IS ABLE TO PROVIDE SUITABLE ANIMALS FOR RELEASE TO SUPPORT THE RECOVERY OF WILD POPULATIONS.**

Immediate priorities (i.e. for years 1-2) are highlighted in

OBJECTIVE 4.1

ESTABLISH A SUITABLE FOUNDER POPULATION FOR CONSERVATION BREEDING.

The ex-situ population is small (fewer than 20 animals) and ageing, and there are insufficient founder animals. This is due largely to inadequate legislation and in some areas lack of government support to obtain wild and confiscated individuals for the conservation breeding programme. Even if legislation and government awareness can be improved, this is unlikely to produce the number of founder animals required for a functioning conservation breeding programme; the species is rare within most protected areas in Vietnam, and rarely seen in the trade (fewer than 10 animals observed in the trade in the last 10 years). Acquisition of trade-confiscated Owston's Civets is covered in goal 3, Objective 3.3; the breeding programme's success will most likely depend on capturing wild founders. The taxonomy of the species is poorly understood, and previous attempts at resolving it have been based on a single mitochondrial gene, from animals of either unknown/northern provenance. Based on the taxonomic status of other mammal species in the south of Vietnam (see Annex 4), it is probable that the southern populations of Owston's Civet could be a different conservation unit, perhaps even to species level. Any animals that are suspected/known to have come from southern populations should be managed as a separate unit in the conservation breeding programme.

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2024	>Y5 >2024	LEADS (COLLABORATORS)
4.1.1	Obtain permissions to acquire wild founders.	Sufficient founders (30) are acquired		X	X	X	X	OG	Government of Vietnam, SVW

OBJECTIVE 4.2

ESTABLISH DEDICATED CONSERVATION BREEDING FACILITIES.

There is a lack of dedicated conservation breeding facilities, of veterinary facilities and of funding, which is impacting on animal care and captive population functionality.

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2024	>Y5 >2024	LEADS (COLLABORATORS)
4.2.1	Ex-situ needs assessment to cover locations, design, governance and resourcing for a breeding programme that would include 100+ Owston's Civets, including sites outside Vietnam.	Ex-situ needs assessment produced.	X						SVW (WPT, WRS) External consultants specialising in breeding programmes for species recovery [Black-footed Ferret programme? Zoos Victoria?]
4.2.2	Improve diagnostic capacity for wildlife health in Vietnam.	Options for wildlife health investigation are available in Vietnam.	X	X	X	X	X	OG	SVW, WCS (WRS)
4.2.3	Raise funding for facilities with capacity for 2 x 50 civets.	Sufficient funding has been obtained	X	X	X	X	X		SVW (Ex-situ partners)
4.2.4	Construct the first dedicated breeding facility in Vietnam.	Construction is completed		X	X				SVW
4.2.5	Construct the second dedicated breeding facility in Vietnam.	Construction is completed					X	X	SVW
4.2.6	Adapt breeding facility design to suit locations chosen outside Vietnam and construct a facility.	Design finalised (2022), construction completed (2023)				X	X		OCWG of the IUCN SCSG

OBJECTIVE 4.3

FILL INFORMATION GAPS RELEVANT TO IMPROVING OWSTON'S CIVET CARE AND REPRODUCTIVE SUCCESS.

Paucity of knowledge of ecology, behaviour, physiology, disease and life history limits the success of the conservation breeding programme. Current mortality rates are too high; high levels of infant mortality have been recorded, and the species is vulnerable to wildlife diseases, including some zoonoses. The taxonomy of the species is poorly understood, and previous attempts at resolving it have been based on a single mitochondrial gene, from animals of either unknown/northern provenance. Based on the taxonomic status of other mammal species in the south of Vietnam (see Annex 4), it is probable that the southern populations of Owston's Civet could be a different conservation unit, perhaps even to species level.

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2024	>Y5 >2024	LEADS (COLLABORATORS)
4.3.1	Information on morbidity and mortality in the captive breeding population is circulated annually.	Information on morbidity and mortality in the captive breeding population is circulated annually.	X	X	X	X	X	OG	SVW/Wild Planet Trust, EAZA Small Carnivore TAG, future holders
4.3.2	Conduct research of genetics of wild individuals to understand variability and taxonomic differences, if any. Particular focus should be on southern populations in Vietnam, not covered in Veron et al. 2004.	Reliable information on genetic and taxonomic diversity of wild individuals is obtained.		X	X	X	X		SVW (IEBR, FFI, IZW, WRS)
4.3.3	Obtain information on species's ecology including wild nutrition, breeding, spatial ecology, and on any environmental parameters that may influence captive morbidity and mortality.	Reliable data are obtained from completed research projects from across the range of Owston's Civet; basic ecology, including wild diets, are better understood		X	X	X			SVW (Vinh University, WRS, IZW, Taronga Conservation Society). Technical advice from Wild Planet Trust.
4.3.4	The conservation breeding programme adopts a suitable welfare audit, and this is conducted annually.	International animal welfare standards met.	X	X	X	X	X	OG	SVW/Wild Planet Trust, EAZA Small Carnivore TAG, future holders
4.3.5	Research to understand normal physiological values in captivity has been conducted.	Normal physiological values in captivity are understood.	X	X	X				Wild Planet Trust (SVW, and future holders)
4.3.6	Research on reproductive biology on captive Owston's Civets.	Information on reproductive biology is available to guide improvements in reproduction.	X	X	X	X	X	OG	SVW/Wild Planet Trust, EAZA Small Carnivore TAG, future holders
4.3.7	Research on reproductive endocrinology of other captive civet species.	Method established on other civet species that can be used for Owston's Civet.	X	X					Wildlife Reserves Singapore
4.3.8	Analyse genetics of captive individuals to establish inter-relationships.	Reliable information on relationships is being used to inform breeding management.		X	X				SVW, Wild Planet Trust, KFBG (WCS, CRES)

OBJECTIVE 4.4

TO ESTABLISH BEST PRACTICE MANAGEMENT PROTOCOLS FOR OWSTON'S CIVET.

Gaps in knowledge have resulted in sub-optimal management practices for Owston's Civet, impacting animal care and captive population functionality.

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2024	>Y5 >2024	LEADS (COLLABORATORS)
4.4.1	Carry out retrospective research on husbandry practices which have led to optimal reproductive success.	Research completed and has informed best practice management protocols.	X	X					Wild Planet Trust /SVW
4.4.2	Compile all available evidence to produce best practice management protocols, which are regularly evaluated.	Management protocols are created and peer-reviewed, and are evaluated/updated regularly.		X	X (v1)				Wild Planet Trust/OCWG of the IUCN SCSG

OBJECTIVE 4.5

ESTABLISH HUMAN RESOURCE CAPACITY TO DELIVER SUCCESSFUL CONSERVATION BREEDING FOR OWSTON'S CIVET.

Lack of dedicated, qualified human resources for conservation breeding of Owston's Civet affects animal care.

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2024	>Y5 >2024	LEADS (COLLABORATORS)
4.5.1	Implement on-site and off-site training for staff to fulfil the requirements of the management protocols	100% of staff are trained by the time the first facility is opened in Vietnam.	X	X	X				OCWG/SVW. Wild planet Trust – keeper exchanges.
4.5.2	Establish competence-based annual appraisals for staff employed in conservation breeding facilities	Competence-based appraisal system is established and there is an annual record of staff competency.	X	X	X	X	X	X OG	OCWG/SVW
4.5.3	Implement ongoing professional development for management, husbandry, and veterinary staff	Professional development is implemented.	X	X	X	X	X	X OG	OCWG/SVW

OBJECTIVE 4.6

REDEFINE NATIONAL AND INTERNATIONAL COOPERATION TO CREATE A SUCCESSFUL CONSERVATION BREEDING PROGRAMME.

International cooperation within the conservation breeding programme is functioning poorly as communication is poor. New cooperative opportunities have not been explored to their full potential towards a successful conservation breeding programme.

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2024	>Y5 >2024	LEADS (COLLABORATORS)
4.6.1	Establish a coordination mechanism that will facilitate fundraising, capacity and support for the founder, growth and maintenance phase of the conservation breeding programme.	Quarterly meetings and updates on progress towards Goal 4.	X	X	X	X	X	X	OCWG (All ex-situ/conservation breeding partners)

OBJECTIVE 4.7

DEVELOP SPECIES-SPECIFIC GUIDELINES FOR RELEASE OF OWSTON'S CIVET.

Lack of species-specific guidelines for the release of Owston's Civets could impact negatively on the success of reintroduction or restocking programmes.

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2024	>Y5 >2024	LEADS (COLLABORATORS)
4.7.1	Review previous release protocols and produce species-specific guidelines for release of Owston's Civets; monitor and test appropriateness of guidelines.	Release protocols for Owston's Civets designed; implementation critically reviewed.	X	X	X	X	X	OG	IUCN SCSG (Vinh University, IEBR, IZW, IUCN experts)

OBJECTIVE 4.8

ESTABLISH SUITABLE FACILITIES TO SUPPORT RELEASE

Lack of dedicated facilities to support release of Owston's Civet will hamper success.

	ACTION	INDICATOR of ACHIEVEMENT	Y1 2020	Y2 2021	Y3 2022	Y4 2023	Y5 2024	>Y5 >2024	LEADS (COLLABORATORS)
4.8.1	Undertake a disease risk analysis to inform design and management of facilities for the release of Owston's Civets.						X	OG	SVW (IUCN CPSG)
4.8.2	Construct release facilities at suitable locations, guided by in-situ knowledge.							X OG	SVW / OCWG

ANNEX 1
CHALLENGES TO SUCCESS

ANNEX 2
WORKING GROUP REPORTS

WORKING GROUP 1	SITE-BASED PROTECTION AND MANAGEMENT

CONTRIBUTORS

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RECORDER

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SCOPE

from among a wide range of potential threats, discussions of site-based protection and management considered the following challenges as pertinent to the species's conservation: indiscriminate hunting; habitat loss, degradation and fragmentation; susceptibility to disease outbreak; small population issues; and lack of information on species distribution.

INDISCRIMINATE HUNTING

Indiscriminate hunting of wildlife, particularly large-scale commercial snaring but also using other methods such as guns, dogs and traps, leads to the capture or killing of Owston's Civets, among many other species. Hunting occurs across the species's range, and although its intensity is lower in some areas, the intensity in these is expected to increase in the near future, assuming demand for wild meat stays the same or increases.

Owston's Civets may be used for meat, for their pelts or for traditional medicine, though they are not a specific target for any of these. Live-caught Owston's Civets may be traded as pets or sold to civet farms for meat or coffee production, though they are unsuited to the latter as they are not primarily fruit-eaters.

In the last 20 years there has been a trend away from bamboo and other traditional plant-based traps, to commercial cable snares. These snares are set in many hundreds per square kilometer. This has had a devastating and indiscriminate impact on mammal species.

There are very few quantified data on relative snaring intensities. However, at a coarse scale, the past and current locations of snaring are known and there is a clear trend towards ongoing expansion of industrial-scale snaring (Gray et al. 2017). This is based on expert opinion and the documented declines of several species that are known to be vulnerable to snaring (Harrison et al. 2016).

It is sensible to assume that sites not currently affected by snaring may be affected in future. In areas where intensive snaring has occurred, Owston's Civet populations have been extinguished or reduced to almost zero. While snares are considered the biggest threat, their incidence is not uniformly distributed and they are mainly in use in the central regions of Lao PDR and Vietnam with fewer in the northern regions, where guns are used more. In both Lao PDR and Vietnam there are areas that have been hunted with guns for decades in which Owston's Civet still occurs at densities readily detectable by ordinary camera-trapping. Such a status has not been found in any area that is industrially snared. This indicates that gun hunting as typically undertaken in these areas has less impact on Owston's Civet populations than does intensive snaring. There are known differences between communities, to some extent based along ethnic lines, in attitudes or uptake of industrial snaring in both Lao PDR and Vietnam. For example, some Hmong communities generally do not practise intensive snaring but have maintained their traditional hunting techniques with guns and dogs. Understanding why and how this system has been maintained may be of value in designing conservation action.

In the absence of effective government controls, gun ownership and use are increasing in some areas of Vietnam so gun use needs to be considered a risk to wild Owston's Civet populations. However, in some areas of China and Lao PDR, government gun control has led to an increase in the use of snares, and therefore may have had a net negative effect on local Owston's Civet conservation status. These may be difficult issues to balance.

A snared Owston's Civet in Van Ban, Vietnam
© Barney Long-FFI Vietnam programme

Consumer demand for wildlife and increased access to remote areas were considered the two most influential drivers of the current intensity and scale of indiscriminate hunting. Consumer demand comes from several sectors, of which wildlife trade was considered to be the largest. However, other types of demand may be important in particular areas or during particular periods of time. Hunting for subsistence is commonly practised among those carrying out other activities in the forest, such as legal or illegal non-timber forest products (NTFP) collection, logging, cardamom cultivation or illegal agar-wood collection. Some ethnic groups have been hunting traditionally for generations and periodic increases in hunting may occur around specific festivals such as the Lunar New Year. Recreational hunting is popular among some wealthy or influential people. In some areas, loss of the larger species from the forests has increased hunting pressure on smaller ones, including civets.

Although it is clear that many forms of indiscriminate hunting exist, industrial-scale snaring was prioritised by the group as by far the largest threat to Owston's Civet, as well as to many other ground-dwelling mammal and bird species in these countries.

Excluding all hunting from all areas retaining Owston's Civet is not considered feasible. However, it is likely that healthy wildlife populations, including of Owston's Civet, can tolerate some level of hunting intensity, although thresholds are likely to vary between species and these thresholds are currently unknown. Further, there are currently no known examples in the region of areas in which snaring and other forms of indiscriminate hunting have been successfully controlled, to levels that allow healthy populations of species such as Owston's Civet to persist. Important gaps in knowledge were summarised as follows:

- What is the threshold level of snaring below which Owston's Civet can survive?
- Is it feasible that law enforcement could achieve this threshold over a large enough area for a population of Owston's Civet to persist?
- If not, over what size area would it be possible to establish 'snare exclusion zones', i.e. areas where snaring has been reduced to sufficiently low levels?
- How effective is patrolling/enforcement? What would it take to get snares taken as seriously by authorities as typically guns are taken at present?

HABITAT LOSS, DEGRADATION AND FRAGMENTATION

For the purposes of discussion:

a) habitat loss was defined as a reduction in the amount of area suitable for Owston's Civet in the absence of offtake;

b) habitat degradation was defined as a reduction in the quality, for Owston's Civet, of the original habitat, leading to a reduction in Owston's Civet population density; and

c) habitat fragmentation was defined as the isolation of areas of habitat to an extent expected to reduce population sizes and increase risk of losses from small population effects (genetic and demographic).

Historically, Owston's Civet forest habitat extended from sea level to at least 2800 m above sea level. As lowland forest has been lost, the species's distribution has contracted to remaining forest areas, usually at higher elevations. It has been found in various kinds of forest but it is not known how much of this indicates ecological preference and how much is the result of recent habitat- and hunting-induced changes in occurrence. It is assumed that the species can tolerate some level of anthropogenic change in forest structure because it is recorded in some such forests. Changes in forest condition that lead to drying would be expected to reduce suitability for Owston's Civet because the species is not known from dry habitats.

The causes of habitat loss, degradation and fragmentation include: **agricultural expansion** (monoculture plantations such as rubber, rice and cassava and, to a lesser extent, subsistence agriculture); **road improvements and new roads**; **hydropower dams; mining; logging for timber; livestock grazing; understory crops** (e.g. cardamom, which can clear large areas where market value is high); **tourism developments and their associated infrastructure** (e.g. big corporations carry out land clearance for future tourism development, though not currently in or near Owston's Civet habitats); **poor land-use planning** and, potentially, climate change.

It was emphasised that the main problem caused nowadays to Owston's Civet by all of these activities, is the increased access that they provide to remaining habitat, which facilitates hunting. In the past, huge areas of Owston's Civet habitat have been lost, meaning that the maximum wild global population now if – hypothetically – offtake threats were removed is much lower than it would have been even a century ago. However, this loss is not on its own sufficient to put the species at risk of extinction: ample habitat remains that if the offtake issue can be dealt with, the species would legitimately be categorised as Least Concern on the IUCN Red List of Threatened Species.

Key knowledge gaps about this issue were considered to include:

- What is the current Owston's Civet distribution?
- What are the key ecological features of prime Owston's Civet habitat?
- What are the impacts of the various forms of anthropogenic change in habitat structure on Owston's Civet? (i.e., which of them degrade the habitat value specifically for this species?)
- How suitable for Owston's Civet are various habitat types?
- In particular, of habitats used, which ones allow high breeding output and which if any, are occupied without allowing meaningful breeding output?
- What are the trends in the migration of people?
- How will climate change affect wild populations of Owston's Civet?

However, it was agreed that these gaps do not need to be filled before effective action can be taken.

The paucity of resources available for conservation in general, and for Owston's Civet specifically, requires prioritisation of effort. It will be important to agree which area, or combination of areas, would make the most contribution to the overall vision for Owston's Civet, taking into account both the intrinsic conservation value of areas and the likelihood of achieving successful conservation outcomes there. It was agreed that a tool for transparent prioritisation of areas for Owston's Civet conservation action would be valuable. It is vital to consider not just where the species is now but where it could be. Three categories of "Current or Potential Owston's Civet Habitat" were considered:

1) Occupied habitat: sites where Owston's Civet currently occurs (in Vietnam, most are formal 'Protected Areas'). It was agreed that 'currently occurs' should encompass both healthy, viable populations and non-viable, small populations.

2) Non-occupied habitat: sites where Owston's Civet has already been lost through offtake, but the habitat remains intrinsically suitable for it. These areas may be important to achieving the overall vision; not all such sites need to be protected, but the vision for the future might include some of them. For example, to ensure that Owston's Civet remains represented in all of its traditional ecological settings, re-stocking some lowland sites may be important. Although reintroductions will not happen immediately, it should be emphasised that conservation actions for sites in these groups should be started immediately, otherwise they may be lost forever from the future portfolio of reintroduction sites.

3) Non-occupied former habitat: sites that are degraded or deforested, where Owston's Civet used to occur before this loss. It is possible that these areas may be important to achieving the overall vision. However, this is unlikely given the resources required to do this, and the high human population densities that live within some of these localities. The priorities are occupied habitat and non-occupied habitat.

SMALL POPULATION ISSUES

Some populations are small and isolated, although the extent of this is not known. Small, isolated populations are at greater risk of chance genetic and demographic effects. Depending on population size and situation, these effects can be summarised as follows (see Shaffer 1987, Frankham et al. 2017):

- demographic stochasticity, i.e. chance-driven fluctuations in birth and death rate and in sex-ratio, which can de-stabilise populations and drive decline, when numbers are small;
- year-to-year environmental fluctuations (within the normal range of 'good' and 'bad' years for the species) cause corresponding fluctuations in birth and death rates which, though easily buffered by large populations, can de-stabilise and cause declines in small ones;
- catastrophes, i.e. rare, unexpected, extreme mortality or reproductive events, resulting from natural disaster or disease, pose a greater risk to smaller populations with limited distributions;
- genetic stochasticity can drive a depression in population fitness (lowering birth rates and raising death rates) through mechanisms such as inbreeding and chance-driven loss of gene diversity (drift).

These issues may be affecting Owston's Civet at some locations. It was agreed that this should be dealt with at the site or area level, once priority sites/areas have been identified. Monitoring the response of small populations to protection against hunting will help to clarify population viability thresholds, and determine in which cases, if any, population supplementation or reinforcement is likely to be required. Unlike some of its syntopic fellow Indochinese endemics (e.g. Saola), the wild numbers of Owston's Civet remain sufficiently large that there is no a priori need to conserve any of the small populations, although such might be justifiable on a case-by-case basis.

DISEASE OUTBREAK

Disease outbreak can pose an extinction risk to small, isolated wild populations. There are known diseases that pose a health risk to civets that are present in other wildlife species (e.g. avian influenza: Clark, 2012) and in domestic animals such as dogs, and which may be present in Owston's Civet habitats. It is not known how much risk to wild Owston's Civet populations is posed by disease agents but it is assumed to be far lower than that posed by hunting. Further, it is assumed that the fragmentation and isolation of Owston's Civet populations will serve to contain disease risks to some extent, preventing their spread species-wide.

Translocation of wild civets from one area to another, or reinforcement from captivity, is another potential route for introduction of disease pathogens into a wild population. Any conservation-directed movements should be guided by a disease risk analysis, and preceded by the mitigating actions recommended through that process. This is dealt with in the ex-situ management section.

PAUCITY OF INFORMATION ON SPECIES DISTRIBUTION, STATUS AND BASIC ECOLOGY

It was agreed that although there are gaps in knowledge with respect to the species's distribution, status, and ecology, enough is known to build a ten-year plan of action for mitigation of threats at prioritised sites. Survey work will also be required to determine good source populations and good release sites.

The ex-situ group identified that attempts at good husbandry in the conservation breeding programme are handicapped by poor knowledge of the basic ecology of Owston's Civet in the wild. The specific ecological information needed for ex-situ management were not pursued by this group but are dealt with in the ex-situ management section.

WORKING GROUP 2	ILLEGAL WILDLIFE TRADE: CIVET TRADE AND DEMAND REDUCTION

CONTRIBUTORS

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SCOPE

discussions focused on five key areas:

- The impact of urban consumption of wild meat on wild populations;
- The way in which unregulated civet farming enables hunting of wild civets;
- The increase in unregulated civet coffee production due to expanding demand;
- The capture of civets for unregulated zoos (government and private); and
- The rising demand for exotic wild animals as pets.

IMPACT OF URBAN CONSUMPTION OF WILD MEAT ON OWSTON'S CIVET POPULATIONS

The high demand for wild meat in urban areas is a recognised major threat to South-east Asia's mammals. Urban demand for luxury wild meat is assumed to be escalating. This is thought to be linked to a growing urban population in South-east Asia, as well as rising urban prosperity. The majority of the wild animal species harvested in Vietnam are feeding commercial trade networks and it is these that serve the demand of the urban middle class, typically in restaurant settings in provincial towns and cities (Drury 2011).

Findings by Shairp et al. (2016) indicated that demand for wild meat in Vietnam is both heterogeneous and highly context specific. At the higher end of societal hierarchy, wild-sourced, rare and expensive wild meat-types are eaten to convey wealth and status; whereas cheaper, legal and farmed substitutes for wild-sourced meats are also consumed, but typically in more casual or social environments. While the rarity of wild meat strengthens its desirability and value, the perception of its being healthier to consume than is farmed meat may also increase its demand.

This demand for wild meat is met by widespread poaching. Illegal hunters in Lao PDR, Vietnam and parts of Cambodia frequently use snares, which by their indiscriminate nature and sheer number have a severe impact on most ground-dwelling vertebrate species, including Owston's Civet. Data have shown civets (including Owston's Civet) to be a major part of the wild meat trade (Bell et al. 2004, Drury 2011, Thanh et al. 2011). It therefore stands to reason that as the prevalence of civets in the wild meat trade increases (as the trend for consumption of wild meat continues to rise), snaring will continue to be a significant threat to Owston's Civet populations.

It was recognised that there are some significant knowledge gaps which need to be filled in order to target a reduction in luxury (i.e. non-subsistence) wild meat consumption. This includes a focus on, for example, locations and availability, numbers of animals and consumer characteristics such as the demand, social status and frequency of wild meat consumption.

The other threats to Owston's Civet discussed under the wider umbrella of 'illegal wildlife trade' were, in general, difficult to quantify in terms of their impact, reflecting the insufficient knowledge and existing information about them.

IMPACT OF UNREGULATED CIVET FARMS ON HUNTING OF WILD CIVETS

Farming of the Common Palm Civet Paradoxurus hermaphroditus (which is legal) has the potential to affect Owston's Civet because of the limited interest in distinguishing between civet species as farms are re-stocked, and because the main hunting method, snaring, is indiscriminate. The opportunity to launder wild-caught civets into unregulated civet farms has been confirmed in surveys reported by ENV in 2014 and 2015, and WCS in 2008. Wildlife farms are unregulated and violations have been recorded, associated with the easy purchase of licences and poor governance.

Insufficient knowledge of the scale and numbers of civet farms and, in particular the extent to which wild civets are captured to supplement farm stocks, makes it challenging to assess the true impact of this threat on wild civet populations. Zoonotic infections are a recognised risk from mixed-species farms with negligible biosecurity in Vietnam *(Carrique-Mas & Bryant 2013)*. Because these farms themselves indirectly threaten Owston's Civet, pursuing their closure should be considered beneficial, and arguably essential, from both a public health and a biodiversity conservation perspective.

IMPACT OF INCREASED DEMAND FOR CIVET COFFEE

The expanding demand for civet coffee, which is being met by the increasing intensification of civet farming, may also pose a threat to Owston's Civet; at least three individuals are known to have gone through civet coffee facilities in Da Lat in 2018. As with other issues relating to illegal wildlife trade, Owston's Civets are indiscriminately captured with Common Palm Civets and Masked Palm Civets Paguma larvata, which are needed to sustain the farming industry. If this threat is considered to be substantial enough to require action, the dynamics of the civet coffee industry need to be understood: for example, who is driving demand, and is there evidence that it has increased or is increasing? What are the scale and trends of civet coffee farms? An investigation into the location of civet coffee farms, specifically to identify their proximity to known Owston's Civet sites, may also provide valuable insights into whether their operation is causing a decline in local Owston's Civet populations.

IMPACT OF POORLY REGULATED ZOOS

The growing trend for zoos in Vietnam was also mooted as a threat to Owston's Civet. Several zoos and commercial farms in Vietnam are known to be involved in buying, selling, and laundering wildlife *(Brunner 2012)*, facilitated by lack of regulation and enforcement. Many zoos are also funded by (or under the ownership of) wealthy and influential companies, which creates challenges for their regulation. Civets, including Owston's Civet, have been found in Saigon Zoo, Hanoi Zoo and Phu Quoc Safari. It is not clear if the species is specifically targeted for their collections or will be specifically targeted in future, as new zoos are created. More data are required to gain a clearer understanding of the scale of this issue. There may also be opportunities to engage with the private zoo community to ensure that any Owston's Civets in captivity are part of the conservation breeding programme and contributing more broadly to species conservation in Vietnam.

IMPACT OF THE EXOTIC PET TRADE

The potential impact of the exotic pet trade on Owston's Civet is unclear. It is generally thought that there is probably only a low specific demand for this species, because the capture of live animals is likely often to be opportunistic and to happen as part of a general demand for 'civets' or even 'wildlife' to supply the exotic pet market. However, because there has been a rise in the number of small carnivores in the pet trade, robust, systematic, long-term monitoring of the exotic pet trade could be extremely valuable in assessing the level of threat posed to Owston's Civet, as well as clarifying the status of this demand and its impacts on wildlife in general.

WORKING GROUP 3 — EX-SITU CONSERVATION

CONTRIBUTORS

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SCOPE

This group worked through a series of steps: to establish the need for, and potential role(s) of, an ex-situ conservation programme for Owston's Civet; to identify the challenges to delivering each of the roles identified; and to recommend the actions required to overcome these challenges and ensure a healthy ex-situ Owston's Civet population.

CURRENT STATUS OF THE EX-SITU POPULATION

Current records show that 18 individuals - 11 males and 7 females - form the known ex-situ population. The holding institutions comprise: Carnivore and Pangolin Conservation Program (CPCP) – Cuc Phuong National Park, Vietnam; Newquay Zoo, UK; Port Lympne, UK; Shaldon Wildlife Trust, UK; Thrigby Hall Wildlife Gardens, UK; Zoo de Lyon, France; and Vinpearl Safari, Phu Quoc (Phu Quoc Safari), Vietnam. Other centres, such as a wildlife centre in Zanhuayen, Chengdu, Sichuan Province of China, may potentially have Owston's Civet in their collections.

THE ROLE OF EX-SITU MANAGEMENT IN OWSTON'S CIVET CONSERVATION

EX-SITU VISION

In the next 10 years, a thriving insurance population will be established. This will provide suitable animals for reintroduction which support recovery of wild populations in the future. This insurance population will be self-sustaining, genetically diverse, healthy, and demonstrating species-appropriate behaviour.

The existing ex-situ population for the Owston's Civet was started by accident, from a handful of rescued animals given to a researcher studying the species in Vietnam. Enclosures were designed to house the animals, and after more were received from the illegal wildlife trade, a decision was made to start a breeding programme. However, this population aside, a consideration whether a conservation breeding programme for Owston's Civet is required answers a definite 'yes'. The reasoning for this follows:

- There are no areas within the species's range which are effectively protected across a large enough part of them to allow a stable wild population of Owston's Civet;
- The primary threat to Owston's Civet is snaring, but currently this threat has not yet been sufficiently addressed;

• The future of this species is dependent on mechanisms which are sophisticated enough to remove snares in an efficient way; current snare removal programmes are very resource intensive, and there is no evidence, yet, that these are at a level that will support species recovery in these sites;
• Ex-situ conservation and taking animals into captivity should not be a last-minute resort;
• Historically there have been numerous examples where ex-situ conservation efforts were initiated too late for a species. For Owston's Civet, it is NOT too late if actions start NOW;
• There are areas from where the founders for an ex-situ conservation programme can be obtained from the wild with relative ease and without prejudicing the survival prospects for the species in the wild.

This working group started discussions by defining the role of ex-situ conservation management of Owston's Civet population. It clearly defined that all discussions and recommendations should not be misinterpreted or used for the purpose of commercial farming of civets. The working group is not in support of commercial farming of civets.

The various roles identified for the conservation ex-situ programme for the Owston's Civet include:

1. Insurance population

i. Serves as a safety population to avoid extinction while preserving genetic diversity
ii. Model of excellence for long term ex-situ population, which can also serve as an example for other Vietnamese species/other species in the range
iii. Conservation breeding to restore wild populations
iv. Intervene in required locations with demographic manipulation
v. Source for ecological replacement
vi. Source for assisted colonisation
vii. Play the role of a bio bank – access to reproductive tissues for assisted reproduction if required in the future

2. Education/awareness

i. Raising the profile as well as increasing empathy for appreciation of the species
ii. Lobbying government, targeting decision-makers to support other sectors of the overall conservation programme
iii. Motivation - where this works, this can provide motivation to government rangers to continue and expand their vital work
iv. General public awareness/education

3. Research

i. Reproductive biology/management
ii. Veterinary – understanding normal physiology, disease risks, etc.
iii. Ecology
iv. Genetic diversity

4. Rescue/Rehabilitation/Release

i. Development of protocols to address the threat of disease
ii. Preventing random release of civets to the wild by the presence of the ex-situ programme
iii. Development of protocols for reintroduction techniques

5. Help raise funding for the conservation priorities for the species – can be a vehicle for attracting funders

Three captive Owston's Civets in SVW's centre, 2014
© SVW - Nguyen Van Thai

CHALLENGES TO ESTABLISHING A HIGH-PERFORMING EX-SITU PROGRAMME

HIGH EARLY MORTALITY

High infant and juvenile mortality rates, including cases of infanticide, have been recorded. Pre-reproductive mortality in this species also can be high, reaching more than 20% (Maran 2011). Later mortality does not appear to be a problem. The oldest known animal was approximately 16 years (recorded from Cuc Phuong, Vietnam). Mortality rates have been observed to increase after 10 years of age.

DIET

Poor captive diet is another challenge affecting the ex-situ population with dental disease one of the most frequently reported clinical signs (Clark 2012). Nutritionists have recommended reducing fruit content and increasing whole prey components of the diet (invertebrates and vertebrates).

REPRODUCTION IN CAPTIVITY

The ideal breeding age for female Owston's Civets is thought to be between four and ten years of age. Gestation is estimated at 75–90 days. Typically, a female gives birth to one or two young and most births occur between April and July. There has been only one successful birth since 2014; a single animal was born in Newquay Zoo, UK in 2019. There were four births in 2017 in Cuc Phuong, all stillborn. The current population is ageing with a skewed sex ratio (only seven males and no females exist at the centre in Cuc Phuong).

DISEASE RISK IN CAPTIVITY

Several wildlife disease incidents have significantly impacted the captive population of Owston's Civet in Cuc Phuong. Some of the documented and identified disease incidents are:

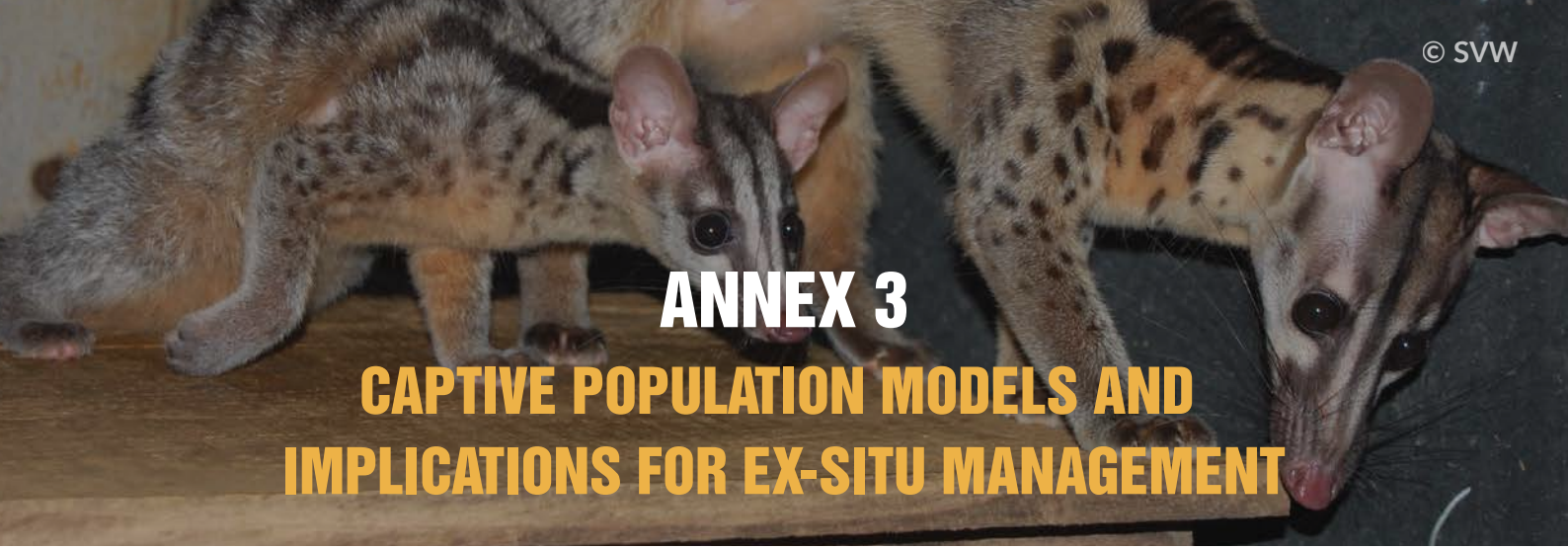
- death of three animals in 2005 due to a H5N1 (avian flu) outbreak (Roberton et al. 2006);
- death of four animals in 2006 after displaying neurological and respiratory symptoms for 24 hours. All were found negative for H5N1 (Clark 2012);
- death of one male in 2007 in Vietnam from severe periodontal disease (Clark 2012);
- death of four animals in 2008 due to a H5N1 outbreak (Clark 2012);
- death of one animal in 2009 after displaying neurological and respiratory symptoms for 24 hours. All were found negative for H5N1 (Clark 2012); and
- death of six individuals in Cuc Phuong National Park from an unknown pathogen between April and June 2018. All were negative for H5N1 and canine distemper.

Owston's Civet displaying facial neurological signs (outbreak of H5N1 in CPCP in February, 2018)

© Leanne Wicker.

DEMOGRAPHIC AND GENETIC HEALTH

Captive populations are vulnerable to the same chance-driven demographic and genetic effects as small, isolated wild populations. In addition, over generations, their genetic composition may change in response to the ex-situ environment, making them less representative of wild populations and, as a result, less suited to conditions in the wild. These risks are understood by conservation breeding practitioners and can be mitigated with careful management. Population simulation models were used during the workshop to support discussions and recommendations about aspects of programme design that influence these risks: including the number of founders, population growth rate, facility capacity and programme length that should be targeted, to achieve the stated aims of the proposed conservation breeding programme. Details of these models and the conclusions drawn from them are provided in the following section.



ANNEX 3
CAPTIVE POPULATION MODELS AND IMPLICATIONS FOR EX-SITU MANAGEMENT

INTRODUCTION

In advance of the workshop, population viability analysis models were built using the programme VORTEX (Lacy & Pollack 2017). VORTEX models were used to explore the scale and characteristics of a captive population able to deliver the stated aims of the proposed conservation breeding programme,

To establish a healthy, genetically diverse ex-situ population which:

- **provides insurance against extinction;**
- **is able to provide suitable animals for release to support the recovery of wild populations.**

In this analysis, 'insurance against extinction' is considered to be provided where the modelled population shows zero likelihood of extinction over the time period considered (the default used here 100 years but others are considered). 'Able to provide suitable animals for release' is considered to be satisfied where the modelled population can be shown to sustain a regular harvest of more than two animals per year, to retain at least 90% gene diversity and to maintain mean inbreeding at less than F=0.125, for the period of the programme. In practice, the definition of 'suitable' would be expected to encompass additional characteristics, but these are not the subject of these analyses and can be dealt with at a later stage.

SUMMARY OF MODEL OUTPUTS

Avoiding stochastic extinctions: models indicate that facilities with carrying capacities of at least 50 individuals, and husbandry practices able to deliver at least 12% annual growth as and when needed, should be resistant to extinction over a 100-year time-frame. While a closed population of 50 individuals would not satisfy the genetic requirements of the programme, it provides a guide to a sensible minimum carrying capacity for a single facility or for a national sub-population within the wider programme.

Maintaining population-wide genetic health: larger initial founder numbers trap more gene diversity and allow potentially deleterious thresholds of gene diversity loss and inbreeding accumulation to be avoided for longer. For a short-term programme (25 years), 20 founders may be sufficient, provided they can grow to a population size of at least 100 animals. For 50- or 100-year programmes, larger carrying capacities or more founders would be needed. For example, with 50 founders both genetic targets can be met for 50 years at K=100, and for 100 years at K=250 (K = carrying capacity). Note that for genetic purposes, a 'population' can be spread across several sites as long as there is regular gene-flow between them to ensure that they function as a single entity of the required size.

The role of supplementation: not all 'founders' need to be present at the start of the programme. Gene diversity can be renewed and inbreeding mitigated by periodic addition of unrelated animals. For a population founded with 20 individuals and with carrying capacity limited to K=100 individuals, meeting both inbreeding and gene diversity retention targets for 25 years requires no supplementation. However, meeting both targets for 50 or 100 years can be achieved through the addition of 2 individuals every 2 years. Increasing the available carrying capacity would allow targets to be met at lower rates of supplementation.

Capacity to generate civets for release: for the values modelled (a population starting at 20 and constrained by carrying capacities of K=25, 50, 75 and 100 and by annual growth rates of 7%, 12% and 17%), the number of Owston's Civets that a conservation breeding programme could release varied from zero (for any scenario with a growth rate of 7%) to 16 animals per year (for K=100 and annual growth of 17%). Growth rates of 12% and 17% allowed populations to reach a capacity of K=100 in 15 and 25 years respectively, after which releases would be possible. At the lower breeding rate (7%), carrying capacities of >50 are not achievable within a 25-year window and populations remain vulnerable to extinction throughout. **Consistently good husbandry will be critical to achieving the growth rates required for a successful programme.**

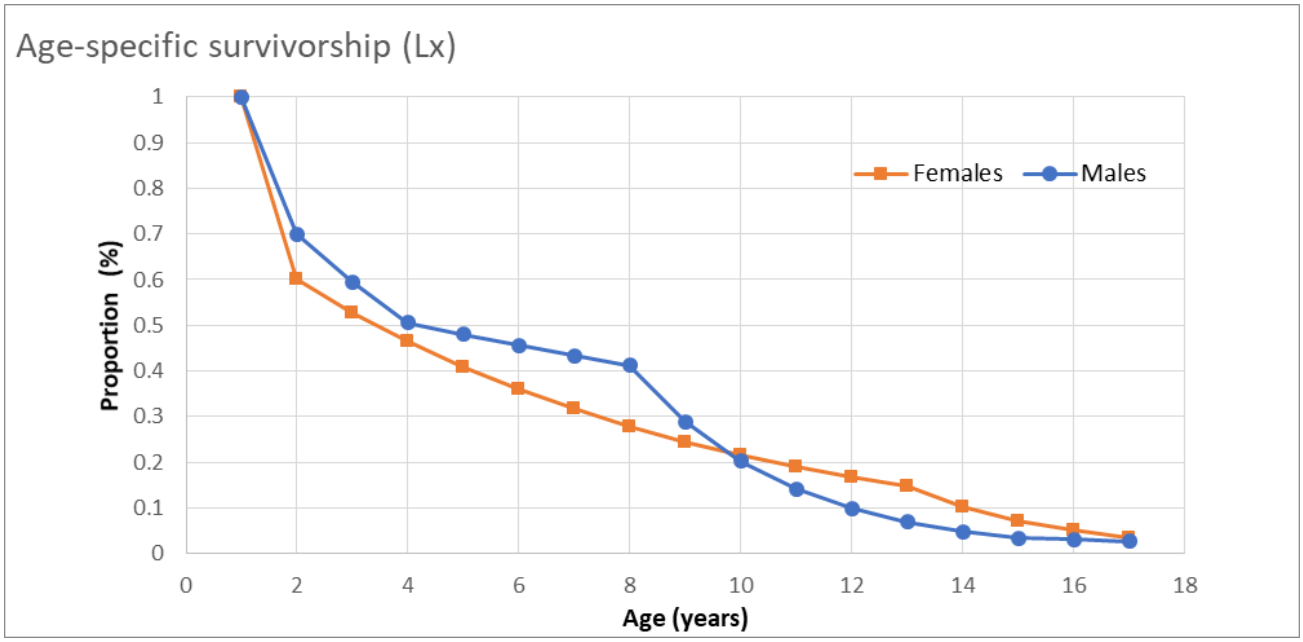
CAPTIVE MODEL PARAMETERS

Input values for the baseline model were drawn from the European Studbook for Owston's Civet (Taylor, 2019). Values were reviewed, modified and confirmed by the working group. Values are listed in Table 1 below. The age-specific mortality parameters used in the models are illustrated in Figure 2 and closely mirror those observed to date in captivity.

Table 1. Demographic parameters for Owston's Civet

Demographic parameters	Parameter value
Age at first reproduction (female)	2
Age at First Reproduction (male)	2
Max. lifespan	16
Max. number of litters per year	1
Max. number of progeny per litter	2
Sex ratio	50%
Max. age of female reproduction	13
Max. age of male reproduction	15
Females breeding (%)	65%
Females with 1 offspring	20%
Females with 2 offspring	80%

Figure 1. Modelled age-specific survivorship for Owston's Civet



INSURANCE AGAINST EXTINCTION

The captive population will provide adequate insurance against extinction only if its own risk of extinction is sufficiently low; P(Ex)=0.00 is the threshold selected for these analyses. As a general rule, larger populations will be less at risk but several other factors feed into this, including: the length of the programme (bigger populations are needed for longer time periods); the population's ability to grow (and therefore its ability to bounce back from losses); and susceptibility to inbreeding depression (and the expected impact of this on breeding and mortality rates over time). The influence of these factors is explored here, to help set thresholds for minimum captive population size.

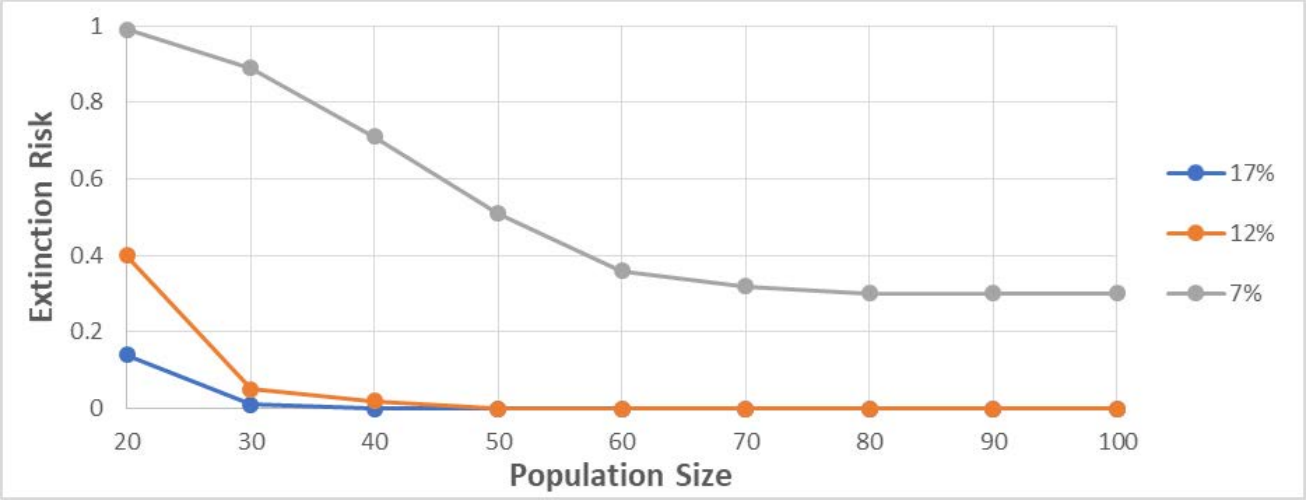
REQUIREMENTS FOR ZERO EXTINCTION RISK OVER 100 YEARS

These models focused on the 100-year extinction risks associated with three different rates of annual growth: Optimistic = 17%, Best Guess = 12%, Pessimistic = 7%. Models deviate from the baseline model described above in the proportion of breeding females (set at 50%, 65%, and 80%), and in inbreeding severity (Lethal Equivalents set at 6.29, 3.14, and 3.14). The extinction risks for carrying capacities (K) of between K=20 and K=100 were estimated. All modelled populations began with 20 unrelated individuals.

Table 2. Extinction risks for various combinations of carrying capacity and population annual growth rate. *Pink shading indicates unsuccessful scenarios (i.e. P(Ex) > 0.00)*

Carrying Capacity (K)	Growth Rate 17%	12%	7%
20	0.14	0.40	0.99
30	0.01	0.05	0.89
40	0.00	0.02	0.71
50	0.00	0.00	0.51
60	0.00	0.00	0.36
70	0.00	0.00	0.32
80	0.00	0.00	0.30
90	0.00	0.00	0.30
100	0.00	0.00	0.30

Figure 2. Graph showing the changes in 100-year extinction risk, for populations allowed to grow to different carrying capacities, at three different rates of growth (17%, 12% and 7%).



CONCLUSION

Modelled populations with carrying capacities of 30 or fewer individuals always show a greater than zero risk of extinction over the 100-year time-frame, regardless of their capacity to grow. All modelled populations with growth rates of 7% show greater than zero risks of extinction, regardless of available carrying capacity. Populations where K=40 show zero extinction risk at 17% annual growth but not at 12% and populations where K=50 individuals and above show zero extinction risk at 12% and 17% annual rates of growth.

Models indicate that facilities with carrying capacities of at least 50 individuals, and husbandry practices able to deliver at least 12% annual growth as and when needed, should be resistant to extinction over a 100-year time-frame. Note that closed populations of 50 individuals would not be expected to satisfy the genetic requirements of the programme (see below).

MAINTAINING GENETIC HEALTH

Chance loss of gene diversity (drift) and inbreeding can reduce fitness in populations, making them more prone to decline and reducing their value as sources for reinforcement or reintroduction. These problems increase as populations become smaller. Based on international conventions, thresholds for success here are set at retention of 90% of wild source gene diversity and at maintaining mean population inbreeding levels below F=0.125 (that which would result from a pairing of half-siblings).

The analyses in this section explore changes in these genetic coefficients over 25, 50 and 100 years.

Factors affecting gene diversity retention and accumulation of inbreeding include: the number of initial founders (i.e. the amount of wild source gene diversity captured); how quickly and equally those founders reproduce to fill the available capacity; how large the population can grow; the extent to which pairings can be genetically optimised; and the frequency and number of additional founders added to the population over time. The following analyses explore the thresholds for success in this area.

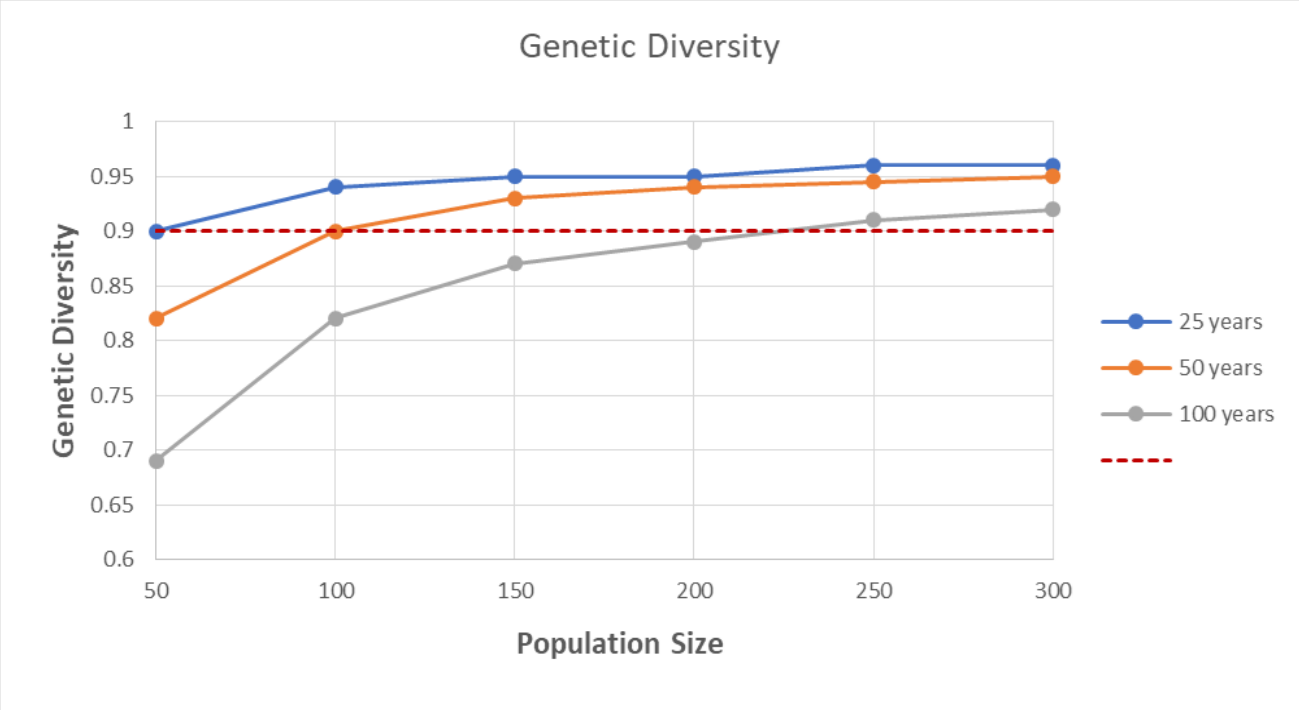
PERFORMANCE OF POPULATIONS INITIATED WITH 50 INDIVIDUALS

In these models, we track gene diversity retention and population mean inbreeding coefficients, in populations that begin with 50 unrelated individuals (founders), and are able to grow to sizes of between 50 and 300. Population performance is tracked for 25, 50 and 100 years.

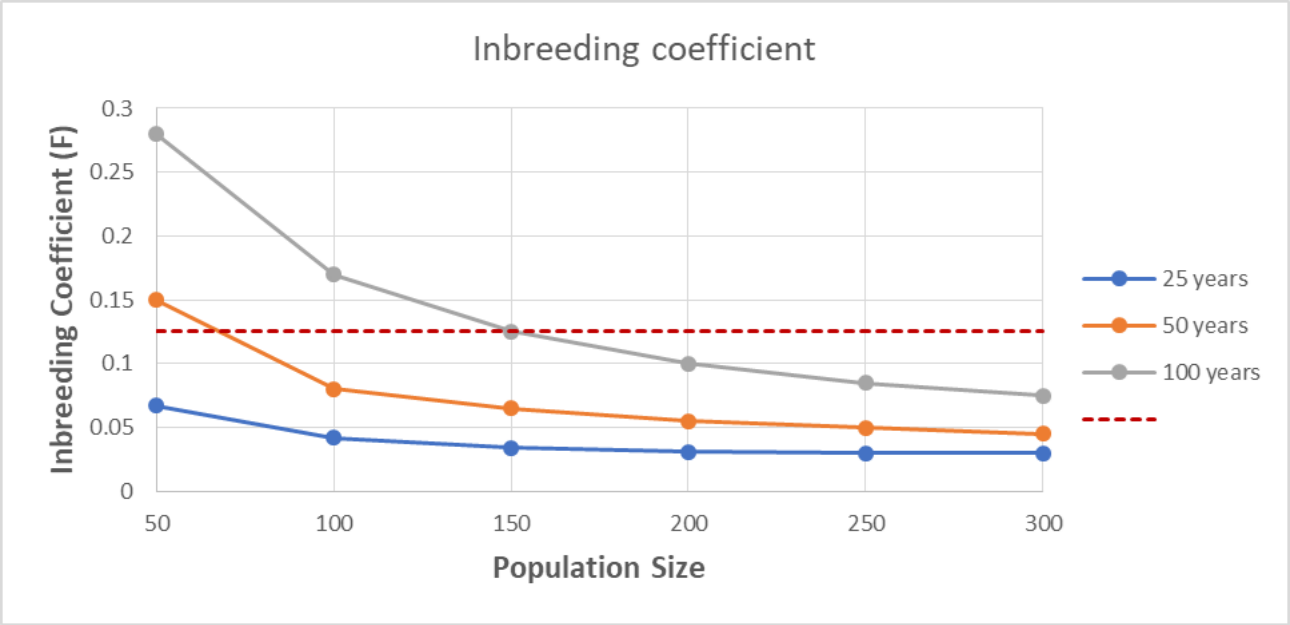
Table 3. Gene diversity retention and population mean inbreeding coefficient at 25, 50 and 100 years, for population founded with 50 individuals and constrained by carrying capacities ranging from 50-300. *Pink shading indicates scenarios that do not meet the definition of a genetically healthy population*

		Genetic Diversity			Inbreeding Coefficient		
		25 yrs	50 yrs	100 yrs	25 yrs	50 yrs	100 yrs
Carrying Capacity	50	0.90	0.82	0.69	0.067	0.150	0.280
	100	0.94	0.90	0.82	0.042	0.080	0.170
	150	0.95	0.93	0.87	0.034	0.065	0.125
	200	0.95	0.94	0.89	0.031	0.055	0.100
	250	0.96	0.95	0.91	0.030	0.050	0.085
	300	0.96	0.95	0.92	0.030	0.045	0.075

Graph 4. Gene diversity retention at 25, 50 and 100 years, for populations founded with 50 individuals and constrained by carrying capacities ranging from 50 to 300. Gene diversity ≥ 0.9 is considered a successful result (i.e. at least 90% of wild source gene diversity is retained).



Graph 5. Population mean inbreeding coefficient at 25, 50 and 100 years, for populations founded with 50 individuals and constrained by carrying capacities ranging from 50-300. F≤0.125 is considered a successful result.



CONCLUSION

Populations initiated with 50 individuals meet both gene diversity retention and inbreeding avoidance requirements over a 25-year period, at all carrying capacities considered. Over 50 years both requirements are met at carrying capacities of 100 or more. To meet both requirements for 100 years requires a carrying capacity of 250 or more. Note that a population can be spread across several sites as long as there is regular gene-flow between them to ensure that they function as a single entity of the required size.

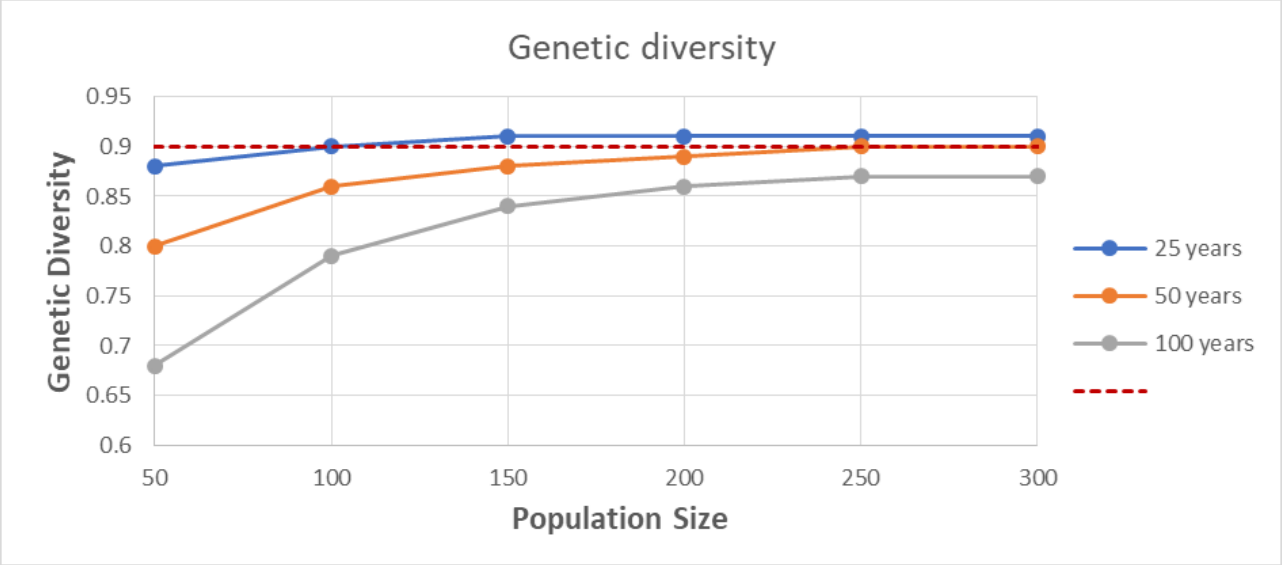
PERFORMANCE OF POPULATIONS INITIATED WITH 20 INDIVIDUALS

The models in this section differ from the previous ones in beginning with a population of 20 unrelated founders instead of 50. Coefficients are reported after 25, 50 or 100 years for varying carrying capacities.

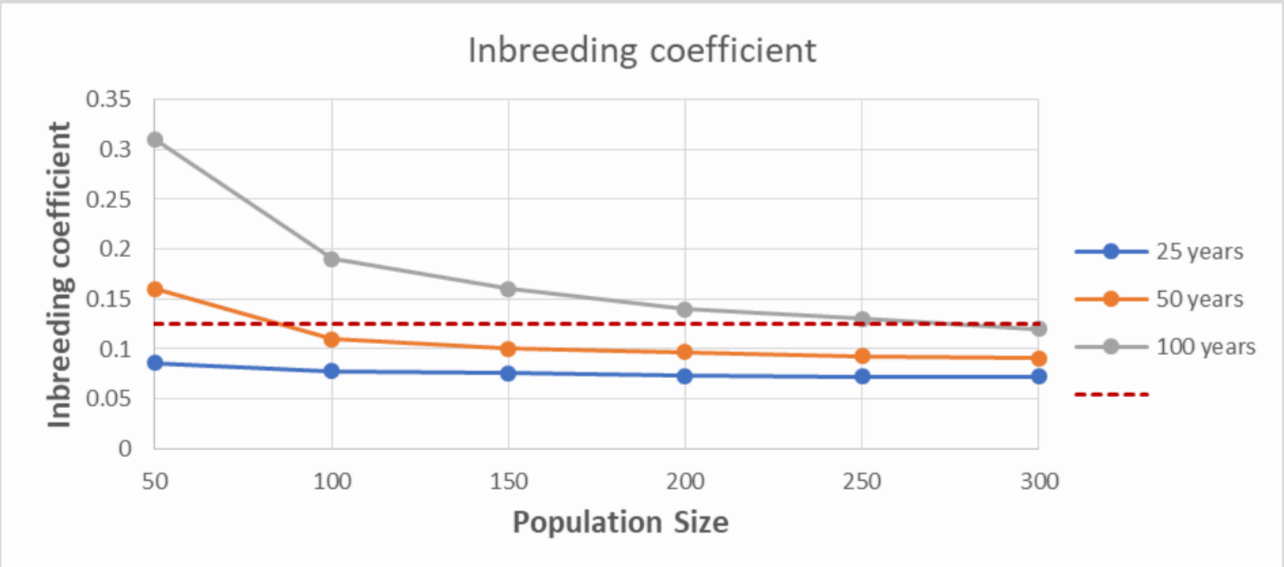
Table 4. Gene diversity retention and inbreeding accumulation over 25, 50 and 100 years, in populations founded with 20 unrelated individuals and constrained by carrying capacities varying from K=50-500. *Pink shading indicates unsuccessful outcomes.*

		Gene Diversity			Inbreeding Coefficient		
		25 yrs.	50 yrs.	100 yrs.	25 yrs.	50 yrs.	100 yrs.
Carrying Capacity	50	0.88	0.80	0.68	0.09	0.16	0.31
	100	0.90	0.86	0.79	0.08	0.11	0.19
	150	0.91	0.88	0.84	0.08	0.10	0.16
	200	0.91	0.89	0.86	0.07	0.10	0.14
	250	0.91	0.90	0.87	0.07	0.09	0.13
	300	0.91	0.90	0.87	0.07	0.09	0.12
	400	0.91	0.90	0.88	0.07	0.09	0.11
	500	0.92	0.90	0.89	0.07	0.09	0.11
	600	0.92	0.91	0.89	0.07	0.09	0.10

Graph 6. Gene diversity retention at 25, 50 and 100 years, for population founded with 20 individuals and constrained by carrying capacities ranging from 50-300.



Graph 7. Population mean inbreeding coefficient at 25, 50 and 100 years, for population founded with 20 individuals and constrained by carrying capacities ranging from 50-300.



CONCLUSION

Populations initiated with 20 individuals meet both gene diversity retention and inbreeding avoidance requirements over a 25-year period, at carrying capacities above 100. Over 50 years both requirements are met at carrying capacities of 250 or more. None of the modelled scenarios meet both requirements for 100 years, though carrying capacities of 300 or more come close. Note as before that a population can be spread across several sites as long as there is regular gene-flow between them to ensure that they function as a single entity.

Larger initial founder numbers trap more gene diversity and allow potentially deleterious thresholds of gene diversity loss and inbreeding accumulation to be avoided for longer. For a short-term programme (25 years), 20 founders may be sufficient, provided they can grow to a population size of at least 100. For 50- or 100-year programmes, larger carrying capacities or more founders will be needed.

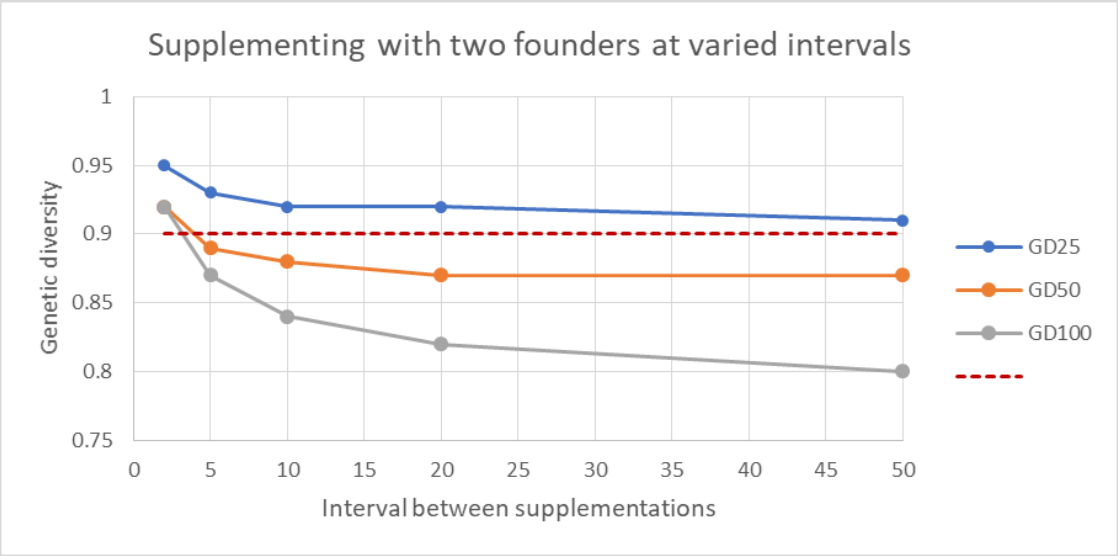
PERFORMANCE OF POPULATIONS UNDER ONGOING SUPPLEMENTATION

Periodic supplementation with unrelated individuals can help to buffer inbreeding depression and enhance genetic diversity. The following models add a pair of wild animals to the captive population every 2, 5, 10, 20 or 50 generations, for comparison. Populations are all initiated with 20 individuals and carrying capacity is limited to 100 individuals.

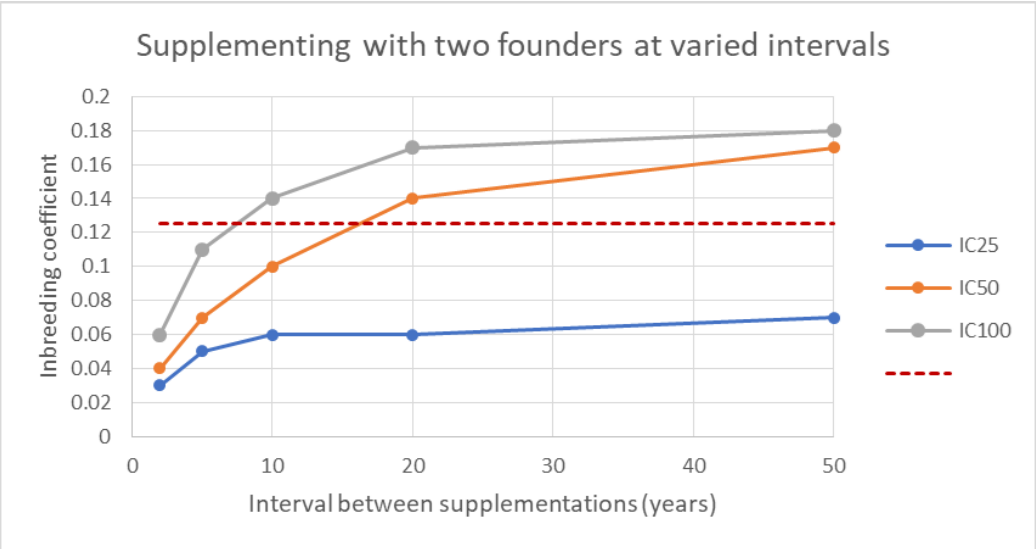
Table 5. Gene diversity retention and inbreeding accumulation over 25, 50 and 100 years, in populations founded with 20 animals, constrained to K=100, and supplemented with a pair of unrelated animals every 2, 5, 10, 20 and 50 years. Pink shading indicates unsuccessful outcomes.

	Intervals of supplementation (with 2 individuals)					
	2yrs	5yrs	10yrs	20yrs	50yrs	None
GD25	0.95	0.93	0.92	0.92	0.91	0.90
GD50	0.92	0.89	0.88	0.87	0.87	0.86
GD100	0.92	0.87	0.84	0.82	0.80	0.78
IC25	0.03	0.05	0.06	0.06	0.07	0.07
IC50	0.04	0.07	0.10	0.14	0.17	0.17
IC100	0.06	0.11	0.14	0.17	0.18	0.19

Graph 8. Population gene diversity at 25, 50 and 100 years, for populations founded with 20 individuals, constrained by a carrying capacity of 100, and supplemented with 2 new founders every 2 to 50 years.



Graph 9. Population mean inbreeding coefficient at 25, 50 and 100 years, for populations founded with 20 individuals, constrained by a carrying capacity of 100 individuals, and supplemented with two new founders every 2 - 50 years.

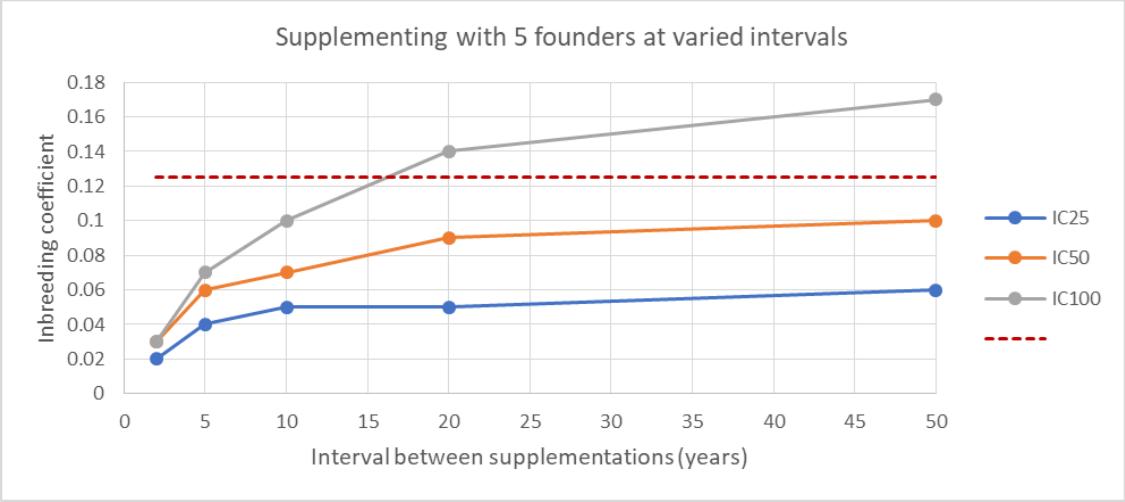


For comparison, the following models use the same basic parameters but populations are supplemented with 5 individuals every 2, 5, 10, 20 and 50 years.

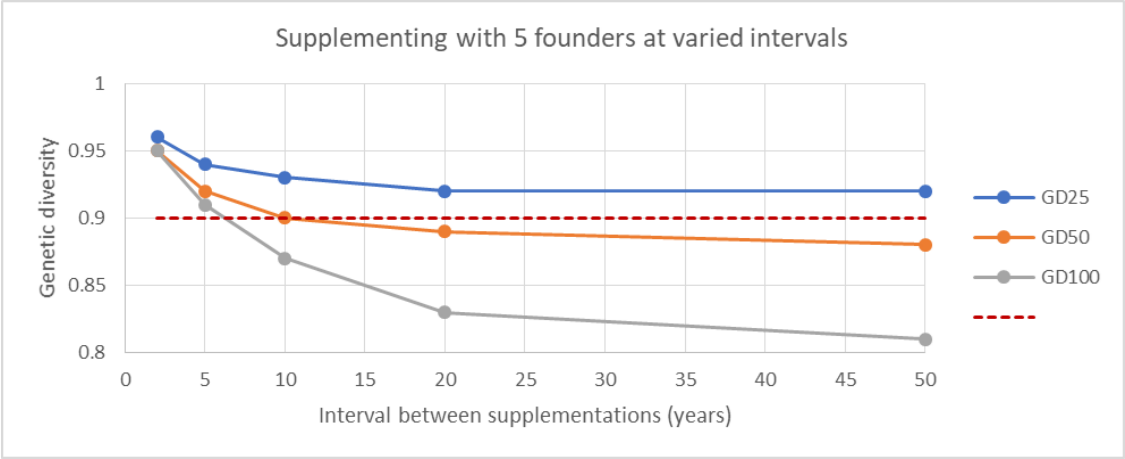
Table 6. Gene diversity retention and inbreeding accumulation over 25, 50 and 100 years, in populations founded with 20 animals, constrained to K=100, and supplemented with 5 unrelated animals every 2, 5, 10, 20 and 50 years. Pink shading indicates unsuccessful outcomes.

	Supplementing with 5 individuals at varied intervals					
	2	5	10	20	50	None
GD25	0.96	0.94	0.93	0.92	0.92	0.90
GD50	0.95	0.92	0.90	0.89	0.88	0.86
GD100	0.95	0.91	0.87	0.83	0.81	0.78
	0.9	0.9	0.9	0.9	0.9	0.9
IC25	0.02	0.04	0.05	0.05	0.06	0.07
IC50	0.03	0.06	0.07	0.09	0.10	0.11
IC100	0.03	0.07	0.10	0.14	0.17	0.19

Graph 10. Gene diversity retention at 25, 50 and 100 years, for populations founded with 20 individuals, constrained by a carrying capacity of 100, and supplemented with 5 new founders every 2–50 years.



Graph 11. Population mean Inbreeding coefficient at 25, 50 and 100 years, for populations founded with 20 individuals, constrained by a carrying capacity of 100 individuals, and supplemented with 5 new founders every 2–50 years.



CONCLUSION

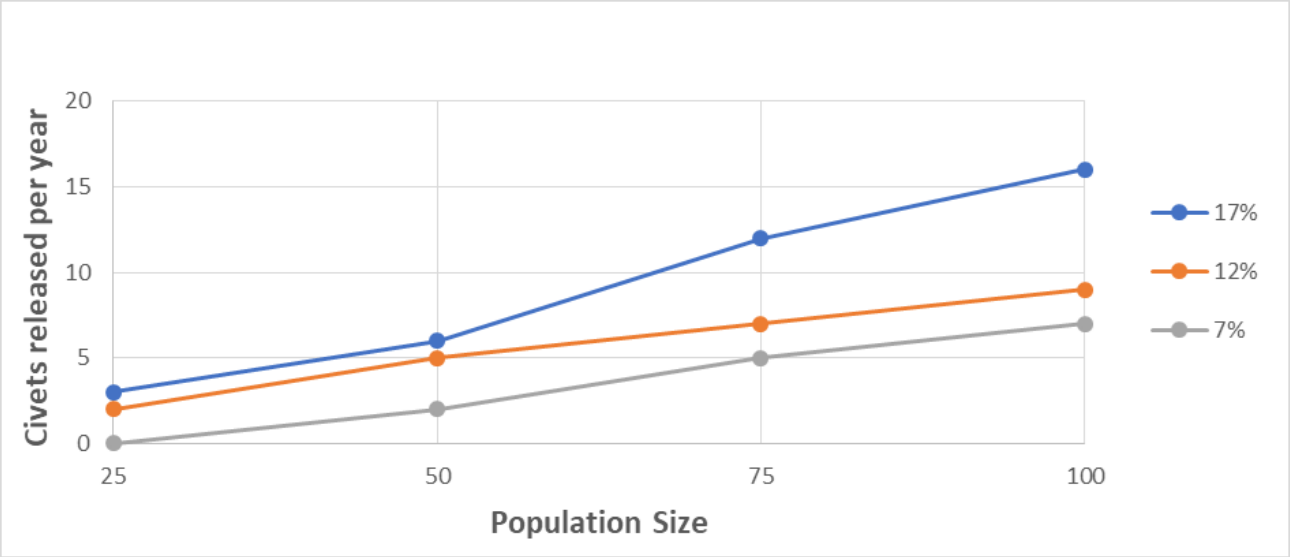
For a population founded with 20 individuals and with carrying capacity limited to K=100 individuals, meeting both inbreeding and gene diversity retention targets for 25 years requires no supplementation. However, meeting both targets for 50 years requires supplementation with 2 individuals every 2 years, or with 5 animals every 10 years. Meeting both targets over 100 requires approximately 1 animal per year (or 2 every 2 years, 5 every 5 years, etc.). Increasing the available carrying capacity would allow targets to be met at lower rates of supplementation.

POTENTIAL FOR HARVEST

Models are used here to estimate how many animals would be releasable every year, from captive populations constrained by different carrying capacities (K=25, 50, 75 or 100) and growth rates (17%, 12% or 7%).

Table 7 *(right)* and **Figure 12** *(below)*. Sustainable annual harvests for release from captive populations constrained by different carrying capacities and growth rates.

		Growth Rate		
		17%	12%	7%
Carrying Capacity	25	3	2	0
	50	6	5	2
	75	12	7	5
	100	16	9	7



CONCLUSION

For the values modelled, the number of Owston's Civets that a conservation breeding programme could release varied from 0 to 16 animals per year depending on the carrying capacity of the programme and the annual growth rate. Releases have been modelled here as yearly events but larger cohorts could be harvested if the releases were less frequent. **Consistently good husbandry will be critical to achieving the growth rates required for a successful release programme.**

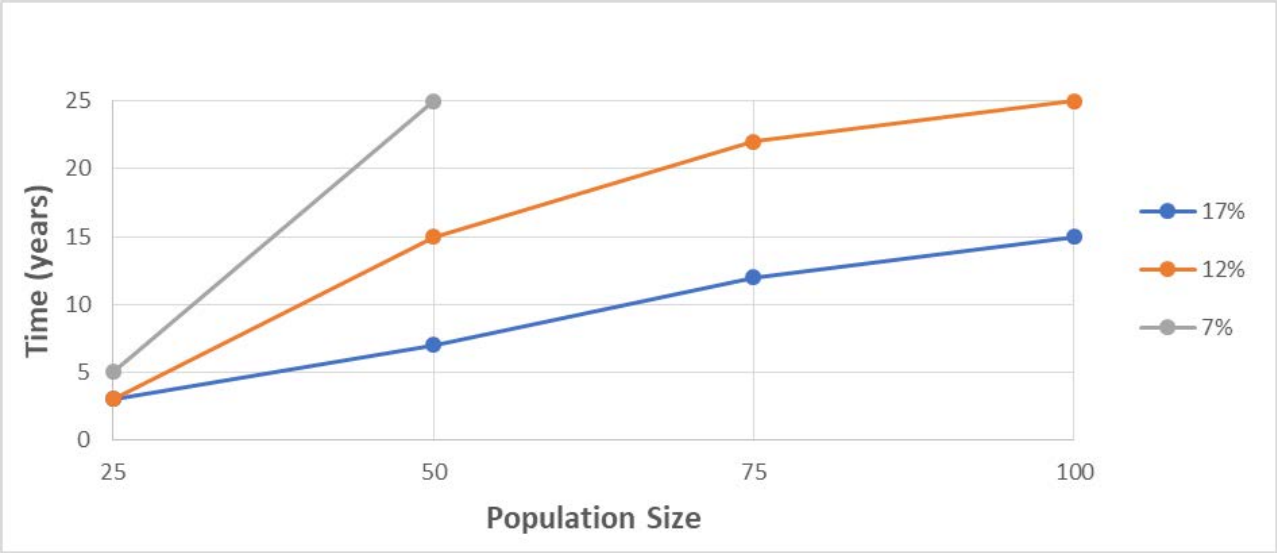
TIME TO FIRST RELEASE

It is assumed that the first releases will not occur until the conservation breeding programme has grown to full capacity. Understanding how long this could take is important in planning the preparation of wild sites. Starting from a population of 20 founder individuals, modelled populations were allowed to grow to carrying capacities of K=25, 50, 75 or 100. The number of years taken to reach carrying capacity are shown below, for annual growth rates of 7%, 12% and 17%.

		Growth Rate		
		17%	**12%**	**7%**
Carrying Capacity	25	3	3	5
	50	7	15	25
	75	12	22	100
	100	15	25	100

Table 8 (left). Number of years taken to reach carrying capacity for populations starting with 20 founders, given varied growth rates.

Figure 13 (below). Ability of a population of 20 individuals to grow to capacities of 25, 50, 75 and 100, over a 25-year period, given different rates of growth.



CONCLUSION

Time taken to reach the carrying capacity of a breeding centre will influence the time before managers can release Owston's Civets into the wild. At an annual breeding rate of 17%, the population can grow to a capacity of 100 in just 15 years, at the lower breeding rate (7%), carrying capacities of >50 are not achievable within a 25-year window and populations remains vulnerable to extinction throughout. Consistently good husbandry will be critical to achieving the growth rates required for a successful programme.

ANNEX 4

OWSTON'S CIVET *Chrotogale owstoni* TAXONOMY

R J. Timmins, September 2019

There has never been a comprehensive assessment of the intraspecific taxonomy of Owston's Civet. Veron et al. (2004) looked at a single mitochondrial gene, cytochrome b, from samples taken from 26 animals of presumed rather than proven provenance. Those samples were presumed all to have come from north (i.e. north of 13°50') of the lowland 'dry' forest corridor that stretches from the interior Cambodian deciduous forests to the south China Sea through the Vietnamese provinces of Gia Lai, Dak Lak and Phu Yen. This corridor separates the wet evergreen forests of the Southern Annamites from those of the Northern and Central Annamites. Not unexpectedly, given current understandings of the biogeography of Indochina, their results recovered two clearly differentiated clades (with eight unambiguous synapomorphies) and an average sequence divergence between the two clades of 1.24%, over the range of 0.8–2% (SD=0.22). These authors, based on S. Heard Rosenthal (in Veron et al. 2004), indicated also that there might also be pelage colour and pattern differences between animals in these two clades; there apparently has never been a thorough morphological analysis, because available specimens are few, and seemingly restricted to animals of postulated 'clade I'. If the presumed provenances of animals are correct, then the most plausible explanation for the distribution of the two clades would be that their 'clade I' encompassed animals from the Northern Annamites and Northern Highlands of Indochina, and that 'clade II' consisted of animals from the Central Annamites. Such a pattern of divergence is well documented in, amongst others, several birds, especially the laughingthrush genus *Garrulax* (s.l.), and the pheasant *Lophura edwardsii* and its congener *hatinhensis*. It is visible to an extent in two primate genera, doucs in the species *Pygathrix nemaeus* and *P. cinereus*, and gibbons in the species *Nomascus siki* and *N.annamensis*. It is noteworthy here that several such examples are of species-pairs rather than intraspecific pairs. As Veron et al. (2004) suggested a Pleistocene age for lineage divergence, climatic differences (cooler drier climates) during this epoch presumably isolated populations to the main montane regions, although during the Holocene, prior to the forest destruction of the later decades of the twentieth century, there is no evidence to suggest that Owston's Civet populations in the Central and Northern Annamites and Northern Highlands were not all contiguous with each other.

If this is the case, then the Southern Annamite population has not been sampled either morphologically or genetically. This could be potentially very significant for the taxonomic interpretation of *Chrotogale owstoni* s.l. Throughout the Holocene, the Southern Annamite population has probably been isolated, by and large, from the northern populations, by the above-mentioned lowland 'dry' forest corridor. Biogeographically the Southern Annamites are more distinct from the Central and Northern Annamites than are the latter two regions from each other. More lineage divergences in taxa between the Southern Annamites and the other areas are treated as species-level differences rather than merely subspecific differences. Current understanding of biogeographic patterns in a wide range of taxa suggests that the Southern Annamite population of Owston's Civet is very likely to be even more divergent from both Central and Northern Annamite populations than these are from each other. It is even conceivable, if the genus *Chrotogale* is in an evolutionary sense morphologically conservative, that the Southern Annamite population could be a distinct species.

The above uncertainty, and the particular possibility that the Southern Annamite population could be much more distinct than has been assumed to date, urges caution in captive breeding, at minimum sequencing all individuals and maintaining separate breeding populations based on clades I and II, and as soon as possible obtaining samples of known provenance from the Southern Annamites and carrying out more thorough genetic and morphological analyses. Determining the geographic distribution of clades I and II is also highly desirable.

REFERENCES

Brunner, J., 2012. Biodiversity conservation in Vietnam: A perfect storm. IUCN NBSAP workshop paper.

Clark, L. 2012. Disease issues associated with captive and trade-confiscated viverrids in northern Vietnam. Masters thesis, The University of Sydney, Australia.

Dury, R, 2011. Hungry for success: Urban consumer demand for wild animal products in Vietnam. Conservation and Society 9: 247–257.

Gray, T. N., Hughes, A. C., Laurance, W. F., Long, B., Lynam, A. J., O'Kelly, H., Ripple, W. J., Seng, T., Scotson, L. and Wilkinson, N. M. 2017. The wildlife snaring crisis: an insidious and pervasive threat to biodiversity in Southeast Asia. Biodiversity and Conservation 27: 1031–1037.

Harrison, R.D., Sreekar, R, Brodie, J.F., Brook, S., Luskin, M., O'Kelly, H., Rao, M., Scheffers, B. and Velho, N., 2016. Impacts of hunting on tropical forests in Southeast Asia. Conservation Biology, 30(5), pp.972-981.

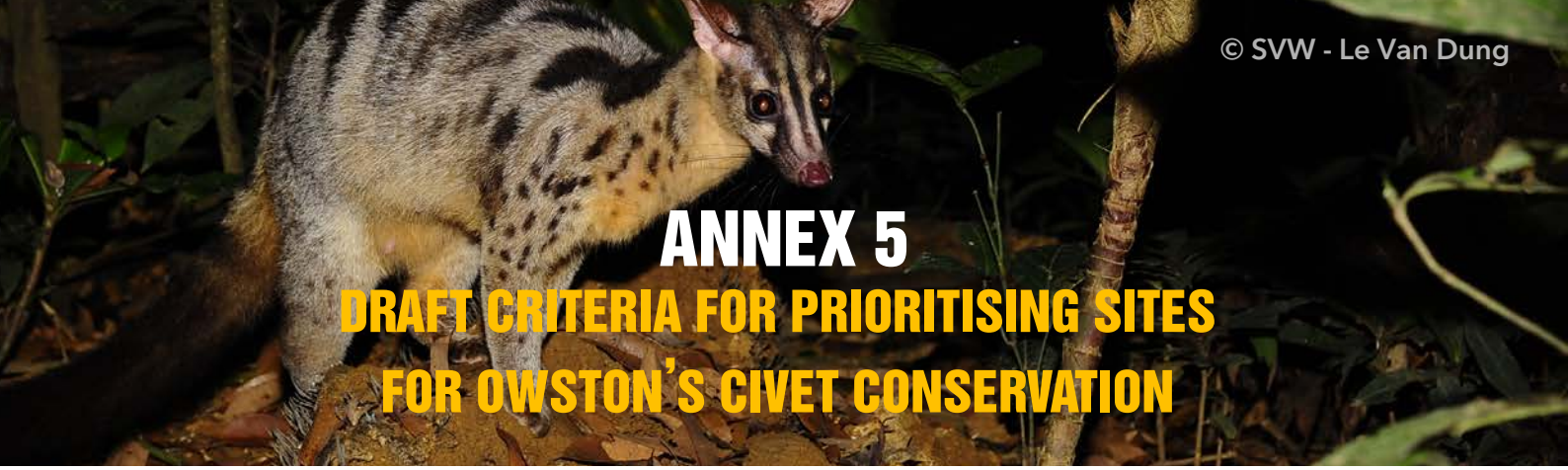
Lacy, R.C., & J.P. Pollack, 2017. VORTEX: A Stochastic Simulation of the Extinction Process. Version 10.2.6. Chicago Zoological Society, Brookfield Zoo, USA.

Ralls, K. Ballou, J.D., Dudash, M.R, Eldridge, M.D.B., Fenster, C.B., Lacy, R.C., Sunnucks, P., and R Frankham, 2018. Call for a Paradigm Shift in the Genetic Management of Fragmented Populations. Conservation Letters 11(2): 1–6

Shaffer, M., 1987. Minimum viable populations: coping with uncertainty. In: Viable populations for conservation. Soule, M. (Ed). Cambridge Univ. Press.

Shairp, R, Veríssimo, D., Fraser, I., Challender D., MacMillan, D., 2016. Understanding Urban Demand for Wild Meat in Vietnam: Implications for Conservation Actions. PLoS ONE 11(1): e0134787. doi:10.1371/journal.pone.0134787

Veron, G., Rosenthal, S.H., Long, B. and Roberton, S., 2004, January. The molecular systematics and conservation of an endangered carnivore, the Owston's palm civet *Chrotogale owstoni* (Thomas, 1912) (Carnivora, Viverridae, Hemigalinae). Animal Conservation forum (Vol. 7, No. 1, pp. 107-112).



ANNEX 5
DRAFT CRITERIA FOR PRIORITISING SITES FOR OWSTON'S CIVET CONSERVATION

CATEGORIES	SPECIFIC CRITERION
1. Owston's Civet population	Abundance/Distribution
	Trend
2. Habitat	Area
	Connectivity
	Ecological variation captured for Owston's civet (*niche capture*)
	Forest condition (degradation)
	Rates of loss/degradation (next 5 yrs)
	Villages/people in area
	Emerging threats at landscape scale (e.g. extractives/infrastructure/hydro)
3. Hunting (including snaring)	Current hunting
	Trend in hunting
4. Co-benefits & synergies	Endemism & biodiversity significance
	Defaunation & original species complement (including trees)
	Presence of flagships
	Ecosystem services
	Accessibility for decision-makers (education & awareness-raising opportunities)
	Other conservation projects in existence
5. Protected area effectiveness	Management/enforcement efficiency (encompasses financial/human/technical resources available & motivation)
	Management/enforcement sustainability (will management continue into the future?)
6. Government support	National government
	Local government
7. Communities	Awareness & support for conservation
	Options for livelihoods that do not impact on Owston's Civet
8. NGOs (and their donors)	Institutional commitment & funding
9. Accessibility/logistics	Travel time & access across area

These categories are not listed in order of priority, and plausibly will undergo considerable modification as the process road-tests them.

ANNEX 6
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