Research priorities for the small carnivores of Colombia

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Abstract

Small carnivores, families Mustelidae, Procyonidae and Mephitidae, are some of the lesser known species in Colombia; however, they represent an important component of Colombian mammal fauna. Thus, it is necessary to assess their basic natural history, distribution, and conservation status in the country. During 2010, the First Symposium on Small Carnivores of Colombia was held at the III Colombian Zoology Congress with the participation of numerous researchers and institutions from the country. After a series of presentations describing current knowledge and critical issues of small carnivores, an exercise defining research priorities was conducted with participants to establish a framework for small carnivore studies in Colombia. These priorities were categorised in three rank levels of importance by species and topical area. High priorities for species research included assessing the distribution and status of the Colombian Weasel *Mustela felipei* and olingos *Bassaricyon* spp. For topical areas, country-level assessments for all small carnivores, characterisation of types and magnitudes of threats to small carnivores and clarification of species taxonomy (including olingos, raccoons, and mountain coatis), especially of museum specimens, were considered highest priority. This priority-setting exercise provides a framework for small carnivore investigations in Colombia with an ultimate goal of aiding their conservation.

Keywords: conservation, distribution, ecology, Mephitidae, Mustelidae, Procyonidae

Prioridades de investigación para los pequeños carnívoros de Colombia

Resumen

Las especies de pequeños carnívoros, familias Mustelidae, Procyonidae y Mephitidae, son uno de los grupos menos conocidos en Colombia, sin embargo, representan un componente importante de la fauna de mamíferos del país. Por tal razón, es necesario evaluar aspectos básicos de su historia natural, distribución y estado de conservación a nivel nacional. Durante el 2010 se realizó el Primer Simposio de Pequeños Carnívoros de Colombia como parte del III Congreso Colombiano de Zoología con la participación de numerosos investigadores e instituciones del país. Luego de una serie de presentaciones describiendo el conocimiento actual y algunos otros temas críticos sobre pequeños carnívoros, se desarrolló un ejercicio de definición de prioridades de investigación con los participantes, con el fin de establecer un marco para el estudio de estas especies en Colombia. Estas prioridades fueron categorizadas en tres niveles de importancia según especies y tema. Las principales prioridades de investigación incluyeron la caracterización de la distribución y estado de conservación de la Comadreja Colombiana *Mustela felipei* y los olingos *Bassaricyon* spp. En cuanto a temas, evaluaciones a nivel nacional para todos los pequeños carnívoros, caracterización de las amenazas sobre los pequeños carnívoros y clarificación de la taxonomía (incluyendo olingos, mapaches y coatis de montaña), en especial especímenes de museo, fueron consideradas las prioridades más altas. Este ejercicio de definición de prioridades provee de un marco para la investigación sobre pequeños carnívoros en Colombia, con el fin último de aportar a su conservación.

Palabras clave: conservación, distribución, ecología, Mephitidae, Mustelidae, Procyonidae

Introduction

Small carnivores, as defined by the International Union for Conservation of Nature (IUCN), include nine families worldwide. Despite their diversity and global distribution, many small carnivores have received limited scientific attention; consequently there is often little information on their distribution, ecological roles, and conservation status. Colombia possesses three families of small carnivores: Mephitidae, Procyonidae, and Mustelidae, containing 14 species generally accepted to occur in the country and four species potentially present but unconfirmed (IUCN 2010, and one mountain coati as discussed here; Fig. 1; Table 1). For one of these species its purported occurrence requires reassessment (Northern Raccoon *Procyon lotor*; Alberico *et al*. 2000).

Available information on small carnivores in Colombia is not only scarce but in some cases neither verifiable nor reliable. In addition, some taxonomic and identification issues concerning potentially sympatric congeners (e.g. *Procyon* spp. and *Mustela* spp.) remain unclear, as does the basic ecology, biology and conservation status of all small carnivores. Some recent research has emphasised small carnivores in Colombia, including their ecological importance and role in ecological processes (Castaño-Uribe *et al.* 2010, Zárrate-Charry *et al.* 2010). In some cases, small carnivore distributions and regional conservation status have been used as conservation targets and surrogates for decision-making, particularly related to their demonstrated function, role, and influence on ecosystem processes (Castaño-Uribe *et al.* 2010, Zárrate-Charry *et al.* 2010).

To focus future efforts on these species, the First Symposium on Small Carnivores of Colombia was held as part of the III Colombian Zoology Congress in November 2010. The primary goal of this symposium, which comprised over 10 presentations and more than 30 participants, was to identify and prioritise information gaps for small carnivores, providing a framework to guide future research. An additional goal was to attract scientists and

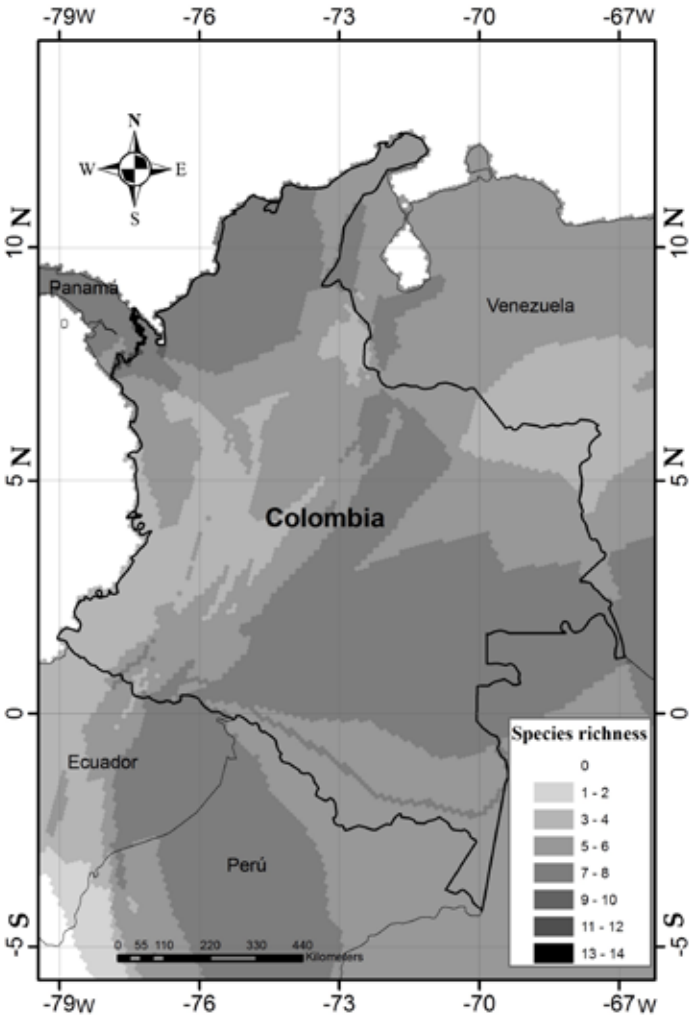

Fig. 1. Distribution of small carnivore species in Colombia (from IUCN 2010).

conservationists throughout Colombia to enhance communication and collaboration to advance our knowledge of small carnivores nationally. The congress proceedings, including summaries of all presentations at this symposium, were included in Asociación Colombiana de Zoología (2010). Herein, we summarise those presentations of greatest relevance to establishing small carnivore research priorities.

Methods

Defining priorities

As a multi-disciplinary and inter-institutional effort, we outlined information needs for small carnivores and developed priorities using the following guidelines: 1) describing the current state of knowledge of each species, 2) characterising specific questions and information needs for species, and 3) defining and ranking research priorities (Schipper *et al.* in ACZ 2010). The development of the process followed this order and began with oral presentations from researchers about most of the families and species and our current state of knowledge. This was followed by additional oral presentations on specific topics of small carnivores such as evidence for mesocarnivore ecological release after loss of top predators, conservation status in specific regions of the country, taxonomic issues and potential solutions, and finished with examples of small carnivore conservation priorities and status throughout the Western Hemisphere. Immediately following these presentations, a survey sought all symposium participants' opinions on small carnivore information and research needs. Following this, a final discussion session was held to define conservation and research priorities for Colombia based on the symposium presentations and results of the informal survey. This represents the first detailed reference for small carnivore information needs in the country. Information from surveys and presentations was synthesised defining priorities by species and research topic.

Table 1. Small carnivores recorded in Colombia (after Alberico et al. *2000, IUCN 2010).*

Family	Sub-family	Genus	Species	Author	Common name	IUCN category
Mustelidae	Mustelinae	*Eira*	*barbara*	Linnaeus, 1758	Tayra	LC
Mustelidae	Mustelinae	*Galictis*	*vittata*	Schreber, 1776	Greater Grison	LC
Mustelidae	Mustelinae	*Mustela*	*felipei*	Izor and de la Torre, 1978	Colombian Weasel	VU
Mustelidae	Mustelinae	*Mustela*	*frenata*	Lichtenstein, 1831	Long-tailed Weasel	LC
Mustelidae*	Mustelinae	*Mustela*	*africana*	Desmarest, 1818	Amazon Weasel	LC
Mephitidae		*Conepatus*	*semistriatus*	Boddaert, 1785	Striped Hog-nosed Skunk	LC
Mustelidae	Lutrinae	*Lontra*	*longicaudis*	Olfers, 1818	Neotropical Otter	DD
Mustelidae	Lutrinae	*Pteronura*	*brasiliensis*	Gmelin, 1788	Giant Otter	EN
Procyonidae		*Bassaricyon*	*gabbii*	J. A. Allen, 1876	Bushy-tailed Olingo	LC
Procyonidae		*Nasua*	*narica*	Linnaeus, 1766	White-nosed Coati	LC
Procyonidae		*Nasua*	*nasua*	Linnaeus, 1766	South American Coati	LC
Procyonidae		*Nasuella*	*olivacea*	Gray, 1865	Western Mountain Coati	DD
Procyonidae		*Potos*	*flavus*	Schreber, 1774	Kinkajou	LC
Procyonidae		*Procyon*	*cancrivorus*	G. [Baron] Cuvier, 1798	Crab-eating Raccoon	LC
Procyonidae		*Procyon*	*lotor*	Linnaeus, 1758	Northern Raccoon	LC
Procyonidae*		*Bassaricyon*	*alleni*	Thomas, 1880	Allen's Olingo	LC
Procyonidae*		*Bassaricyon*	*beddardi*	Pocock, 1921	Beddard's Olingo	LC

* Species not yet confirmed but inferred or suspected based on IUCN (2010) or other sources detailed in the text. In addition, the potential occurrence of Eastern Mountain Coati *Nasuella meridensis* is discussed in the text.

Table 2. Species research priorities for small carnivore in Colombia, by level of priority.

Family	Species	Priority	Topics
Mustelidae	*Mustela felipei*	I	Distribution, ecology, natural history, threats and current conservation status, and check of collection specimens presently identified as *M. frenata*
Procyonidae	*Bassaricyon* spp.	I	Verification of specimens in collections and field surveys for confirmation of species presence. Definition of species distributions within multi-country biogeographical units.
Procyonidae	*Nasuella olivacea*	II	Reassessment of threat category and presence investigation of *N. meridensis* in the country.
Mustelidae	*Eira barbara* and *Galictis vittata*	II	Biology, ecology and distribution; new threats and mesocarnivore release processes
Mustelidae	*Lontra longicaudis* and *Pteronura brasiliensis*	II	Conservation status, extent of occurrence, threats
Mephitidae	*Conepatus semistriatus*	II	Occurrence and biogeography
Procyonidae	*Procyon* spp.	III	Taxonomy, phylogeography and distribution, and ecology in areas of sympatry within the genus
Mustelidae	*Mustela* spp.		
Procyonidae	*Nasua* spp.	III	Distribution and ecology in areas of sympatry within the genus

The research priorities developed emphasised the lack of information on species and recommended research based on previous studies of small carnivores in Colombia (Guzmán-Lenis 2004, Balaguera-Reina *et al.* 2009, Burneo *et al.* 2009, Helgen *et al.* 2009, Tirira & González-Maya 2009, Rodríguez-Bolaños *et al.* in ACZ 2010, among others) and more recent studies presented at the symposium. There was no geographical prioritisation, reflecting limited information on the distribution and biogeography of most species at the country level, although some projects are addressing this topic based on available information (e.g., Torres-Palacios *et al.* 2010). Finally, information gaps were categorised into three levels of priority: I = high, II = medium and III = low, using the following information: 1) current understanding of each species's status and threats; 2) extent of knowledge of species' ecology, biology and taxonomy; and 3) relative awareness of species and their roles in ecosystems, conservation planning, and country-level biodiversity information.

Results and Discussion

Species research priorities (Table 2)

Priority I

Colombian Weasel *Mustela felipei* — The Colombian Weasel is the least-understood small carnivore in Colombia, known only from six confirmed localities in Colombia and Ecuador, and with very little information on its biology and ecology (Tirira & González-Maya 2009). Although considered Vulnerable by the IUCN Red List (Emmons & Helgen 2008), with such limited information a re-evaluation is warranted: it is possible this species may be under greater threat or perhaps it may be simply overlooked. A recent review of several collections noted low representation of this species, still considering only six specimens confirmed (Ramírez-Chávez & Mantilla-Meluk 2009). Information regarding its distribution, ecology, natural history, threats, and current population status is urgently needed to understand its conservation status. We recommend a thorough review of available museum specimens and surveys within its estimated geographic range, to document this species's distribution and status.

Olingos *Bassaricyon* spp. — The genus is poorly known in Colombia and there is discussion about whether Allen's Olingo *B. alleni* and Beddard's Olingo *B. beddardi* occur in the country. Also, the genus's taxonomy and distribution, and each species's range, are poorly known, which is undoubtedly why some mapped distribution limits occur at political borders (e.g. *B. alleni*; Reid & Helgen 2008a). In Colombia the only confirmed species is Bushy-tailed Olingo *B. gabbi*, with few specimens in museums (Alberico *et al.* 2000), and limited information about its distribution and ecology (Alberico *et al.* 2000, Mejia Correa 2009). It is necessary to review specimens present in collections for confirmation of these species. Field surveys would help clarify taxonomic problems, providing specimens and genetic material (Allen's Olingo is only known from the type collection) to allow locality records based on firm species identifications. There is considerable need for biologists to collaborate at the regional or multi-national level to define species distributions within shared biogeographical units.

Priority II

Mountain coatis *Nasuella* spp. — The current Red List assessment of mountain coati, which treats all taxa as conspecific, is Data Deficient (DD; Reid & Helgen 2008b), but recent information suggests it could be Near Threatened (NT; Balaguera-Reina *et al.* 2009). More research is required to increase our understanding of this species in the Andean region of Colombia and Ecuador and to reassess the threat category currently assigned. There are serious threats to the species due to the close relationship with local communities in terms of use, conflicts, and knowledge. Further, the former single species of mountain coati was recently separated into two, Western Mountain Coati *N. olivacea* across the Andes mountains of Colombia and Ecuador, and Eastern Mountain Coati *N. meridensis* restricted to a disjunct portion of the Andes in Venezuela (Helgen *et al.* 2009). The known distribution of Eastern Mountain Coati is adjacent to Colombia, suggesting it may inhabit the country; it is also possible the two species are sympatric. Additional understanding of ecological and biological differences between *Nasuella* species is also warranted.

Tayra *Eira barbara* and Greater Grison *Galictis vittata* — Although available published literature and museum specimens suggest these species are common in Colombia with wide distributions, there is almost no information on their biology or ecology (Torres-Palacios *et al.* 2010). Recent data suggest increased potential threat of hunting from recent establishment of farms and

pastures for livestock grazing within these species' geographic distributions, and the general view by local human communities of these species as pests (González-Maya *et al.* 2010). Where large carnivores have been eliminated, Tayra abundance appears to have increased, suggesting mesocarnivore ecological release as demographical exploitation (Castaño-Uribe *et al.* 2010, González-Maya *et al.* 2010). We recommend that Tayra undergo a taxonomic review: its distribution across several ecoregions suggests potential intra-specific variation, and the possibility of as-yet unknown conservation needs and priorities.

Striped Hog-nosed Skunk *Conepatus semistriatus* — Based on the latest conservation assessment (Cuarón *et al.* 2008), this species has a disjunct distribution in Colombia with reports from the Pacific, Caribbean, and Orinoco regions. It seems likely to be found in the Andean and Amazon regions as well, because it has been reported in adjacent regions in Brazil (Cuarón *et al.* 2008). It is also important to assess the phylogeography of the species due to its disjunct distribution (Nowak 2005).

Otters *Lontra longicaudis* and *Pteronura brasiliensis* — Despite their widespread distribution in the country, these two species still lack some basic information. *P. brasiliensis* is well studied in the Amazon and Orinoco rivers (Alvarez-León 2009), however, its abundance and extent of occurrence in the rest of the country outside these two rivers is poorly known, as are the main threats to the species in the country (Donadio 1978, Gómez & Jorgenson 1999, Alvarez-León 2009). On the other hand, *L. longicaudis* is of special interest for research and conservation assessment due to the high pressure it suffered during the 1950s–1970s, involving local extinction of several populations (Donadio 1978). Currently, there is no information regarding its ecology and biology, or even its populations, distribution, and threats in the country, all of great importance for its conservation in Colombia. Both species have wide distributions in South America, so their global survival is not tied to any one country; but information regarding within-country status is needed to prevent national- and population-level extinctions.

Priority III

Raccoons *Procyon* spp. and weasels *Mustela* spp. — The current inability to differentiate species confidently within each genus in field conditions is a considerable barrier for biological and ecological investigations (Marín *et al*. 2010). It may be possible to develop identification criteria for these species in the field, and genetic tools may help differentiate species records, especially for *Mustela*. This is particularly important to describe these species' distributions accurately in Colombia and assess their status better for potential use in conservation planning. Clarification of species in each genus that inhabit Colombia, and each one's distribution, would help understand national small carnivore species richness and distribution. Surveys for Northern Raccoon in northwestern Colombia (adjacent to Panamá), and for Amazon Weasel *M. africana* in south and southeastern portions of the country, should be conducted to investigate the possibility of their presence in the country. If congeners were ultimately found to be sympatric, studies focusing on resource portioning or possible hybridisation would be warranted.

Coatis *Nasua* spp. — Current knowledge of distribution of *Nasua* species is poor across the country, particularly for *N. narica*. The few records regarding this species in areas where both this and *Nasua nasua* are potentially present are not reliable, with the only accurate and confirmed records for the country being from the Chocó area near the Panamá border (including a recent sighting by authors); the only two specimens in national museums available are from this area (Alberico *et al.* 2000). Overall, few certainly accurate records exist for both species; some others are inferred for some areas, but no evidence is presented (i.e. Sucre department, Caribbean; Galván-Guevara *et al.* 2009). Only extensive surveys for *N. narica* could define its distribution within the country and indeed its current presence in Colombia. If current hypotheses about distribution are supported, the ecology in sympatry of these two species is important to understand because it would be the only part of America where both species co-occur.

Topical research priorities (Table 3)

Priority I

Assessment of species — It is necessary to assess all species at the country level to understand their conservation status. This will require development of tools to identify some species, such as raccoons, weasels, olingos, and mountain coatis, based on common methods employed in the country such as camera-traps and track surveys. However, it is quite possible that track surveys cannot be used or developed as a reliable method for some of these genera. The extent of ecosystem or habitat degradation as well as the threat of expanding land uses, such as the development of oil palm plantations, should also be considered in future species conservation assessments (Cepeda *et al.* in ACZ 2010).

Table 3. Topical research priorities for small carnivore of Colombia, by level of priority.

Topic	Priority	Focal areas
Conservation reassessment	I	National assessment of all species, data for global assessments, and reliable identification methods
Threats	I	Threats and inclusion in management plans
Taxonomy and collections validation	I	Occurrence in Colombia and validity and error corrections of specimen identity
Small carnivore population expansion following major reduction in large-carnivore populations	II	Extent and magnitude of the phenomenon
Education	II	Community outreach and awareness in academic and rural realms.
Distribution	II	Occurrence at ecoregional scale, patterns and biogeographical analyses.
Areas of conservation importance	II	Identification of important areas for small carnivores.
General ecology	III	Habitat use, population size or density, changes in populations over time (i.e. monitoring), diet, among others

Threats to small carnivores — It is necessary to assess the potential threats to long-term persistence in Colombia thoroughly for each species. Based on the results of these assessments, the relative importance of integrating small carnivores into management plans, conservation strategies, and monitoring should be considered and these should result in improvement of existing use of these species as conservation targets in the country.

Taxonomy and collections validation — A thorough review of museum specimens throughout Colombia is needed to clarify taxonomic status for many species. Taxonomically, clarification of occurrence of some species, including those in the genera *Bassaricyon* (for which there is debate about the validity of these species; K. M. Helgen verbally 2009) and *Nasuella* is needed to complete the list of small carnivores of Colombia. Colombian Weasel is perhaps more widely represented in collections than currently recognised, due to misidentification as the similar-looking Long-tailed Weasel *M. frenata.* The genus *Procyon* is poorly represented in national and international collections, and warrants review in all the country's collections (Marín *et al.* 2010).

Priority II

Small carnivore ecological release — This process, understood as an ecological response of mesocarnivore populations' exponential growth after top-predator depletion, is potentially frequent in several tropical ecosystems (Terborgh *et al*. 2001). In Colombia it appears to be a widespread process (Castaño-Uribe *et al.* 2010, González-Maya *et al.* 2010). The loss of large predators like the Jaguar *Panthera onca* and Puma *Puma concolor*, species that may perform roles of population regulation in species assemblages, may be causing this process in several regions of the country (Castaño-Uribe *et al.* 2010, González-Maya *et al.* 2010). Preliminary studies in the Colombian Caribbean since 2008 suggest higher abundance of small and medium-sized carnivores where large predators are extirpated or are rare (Castaño-Uribe *et al.* 2010, González-Maya *et al.* 2010, Zárrate-Charry *et al.* 2010). Loss of apex predators represents an important change in mammal assemblages and it is important to assess these effects on ecosystem function, as well as the direct effects of increased abundance of several small carnivore species (e.g. Tayra, raccoons).

Education — Interest in the biology, ecology, and conservation of Mephitidae, Procyonidae and Mustelidae is limited among researchers and academia, and the rural people who coexist with these species. Education plans and projects for the public, particularly children, should be developed and implemented to raise awareness about the relevance of small carnivores. Also, cultural awareness, importance, and symbolism should be explored for small carnivores in general since this topic, often ignored and poorly studied, could be a great aid for understanding threats and as a conservation tool. It would also be advantageous to develop a network of communication and support among researchers regarding existing and future projects on small carnivores. To achieve this end, a macro-project called Small Carnivores of Colombia is being developed with the participation of several organisations and researchers.

Distribution — Distribution ranges are poorly known for all species. Projects regarding their current and potential distributions should be undertaken to better understand their conservation status. As mentioned before, there is probable misidentification of small carnivores in several museum collections, especially weasels, coatis, raccoons and olingos. A thorough review of specimens and localities should be undertaken to clarify occurrence, distribution, and museum holdings in the country.

Many global species distributions reflect suppositions of contributors from a range of countries and do not include verified data from each country itself. Therefore, a workshop with researchers familiar with small carnivores from field investigations and museum collections from throughout Colombia and adjacent countries, is the most efficient way to compile and use existing information to validate the presence of some species and refine understanding of distributions of all small carnivores in Colombia. Biogeography, especially of small carnivores, is poorly understood in the country: therefore, new research topics and interest could be raised to understand patterns of distribution at country and continental scale.

Areas of conservation importance — The presence of most small carnivores in many areas of high biodiversity priority in Colombia is currently unknown, hindering possible conservation measures. Clarifying the distribution patterns of all species relative to habitat attributes, threats, abundance, and existing protected areas would allow modelling (e.g., maximum entropy) and other approaches to estimate extent of occurrence and potential distribution for each species and overlaid in a geographic information system. From this, critical areas for small carnivore conservation could be proposed and delineated for Colombia, including probable presence in national and regional protected areas systems, for which conservation plans and management actions could be developed with caution. These types of analyses, especially those with a high degree of confidence, should be strongly linked to decision-making with information made available as outreach material to general public.

Priority III

Ecology and biology — A general paucity of information on the ecology and basic natural history of small carnivores in Colombia has few exceptions (see Balaguera-Reina *et al.* 2009); therefore, basic biological and ecological research on all species, such as habitat use, population size or density, changes in populations over time (i.e. monitoring), diet, general life traits, among others, should be developed in several areas of the country, including each of the biogeographic regions (i.e. Amazon, Andes, Caribbean, Orinoquía and Chocó), because differences between regions are potentially of importance to real comprehension of the species at country level.

Conclusions

In general, small carnivores are poorly known in Colombia, so initiatives to clarify these species' importance and conservation status are recommended. The presence of at least 14 species (as well as four more of potential occurrence), of which two are categorised as globally threatened (Endangered and Vulnerable), and a further two as globally Data Deficient on *The IUCN Red List of Threatened Species*, makes Colombia an important country for small carnivores emphasising the importance to evaluate and define actions for their conservation.

We have summarised the first national approach to define priorities for small carnivores in Colombia, based on the experiences and opinions of multiple investigators from several institutions. This is a considerable advance in our overall understanding of research needs to ensure their long-term conservation. This process

will require periodic reassessments to describe which actions have been completed and their outcomes, and assess whether other priorities remain valid, and if new priorities have emerged. Defining information gaps and prioritising research needs for small carnivores was a major step toward developing a better understanding of these species in Colombia, ultimately to enhance their conservation.

Acknowledgements

We thank all participants of the First Symposium on Small Carnivores of Colombia for their valuable input and participation. Thanks to Catalina Torres for her participation in organising the symposium and their continued interest in small carnivores. Sarah Wyatt and Jan Schipper were key participants and supported the entire process including the improvement of the manuscript. Also, we thank the organisers of the III Colombian Zoology Congress, especially Maria Isabel Moreno and José Vicente Rodríguez-M, for coordinating such an important event, and allowing the development of this symposium.

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Obituary: Dorothea AUGUST

Conservationists are deeply saddened by the sudden passing away of Dorothea August on 11 January 2011. Her tragic and unexpected death at the age of 35 following complications after a viral infection is a big shock for everyone who knew her and who had the joy to collaborate with her.

In 2004 Dorothea graduated as an engineer in land-use planning, landscape conservation, nature protection and environmental development from Universität Hannover, Germany, focusing on the conservation status of the European Mink *Mustela lutreola* in her dissertation. Already before her studies and still afterwards she was a keen supporter of European Mink and Eurasian Otter *Lutra lutra* conservation, with an emphasis on wetlands in the Danube Delta and also elsewhere in Eastern and South-eastern Europe.

As of early 2005 Dorothea worked for the Ramsar Secretariat to provide assistance and advice to countries in Europe. Participants at Ramsar Conference of the Parties (CoP) 9 in Uganda may remember her as a particularly helpful soul at the CoP. In 2006, she organised the successful planning meeting for the Carpathian Wetland Initiative for Ramsar. In 2007 Dorothea started to work for WWF Germany's Freshwater Department as River Basin and Water Resources Management Officer. There she worked on a number of innovative projects across Europe, focussing on sustainable wetland and resources management, water stress mitigation and spatial planning, always keeping an eye on threat mitigation and supporting habitat needs for European Mink and Eurasian Otter. From her office in Frankfurt she managed a regional conservation project portfolio overseeing WWF Germany's investment in Madagascar and in the Mara river basin in East Africa. Dorothea always conducted her work in a very professional and holistic way, involving state actors as well as the local communities, the non-government sector and the scientific community. We will always remember Dorothea as a very dedicated, friendly, generous and enthusiastic person. Besides her work as a conservationist, she was committed to many other projects, including the provision of key support as founding member and liaison person to France for the '*Youth for Dora*' association within the memorial foundation for the survivors of a Second World War concentration camp close to her home town, and her family's horticulture business.

Dorothea will be sorely missed by her family, friends, colleagues and all those who knew her.

Roland MELISCH, TRAFFIC International and WWF Germany
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Dorothea August during a recent work visit to Kenya (Photograph © WWF)