

Acknowledgements

This book balances the best available science with compelling firsthand narrative. Much of the information has been consolidated or disseminated for the first time and I am immensely grateful to be able to include it. Over the last three years, my contributors have endured innumerable questions and diligently gathered obscure bits of information in the midst of their infernally busy schedules. I commend them for the dedication which they show in their work and for their ability to address the issue of wildlife poisoning both objectively and passionately.

The support of the Analytical Chemistry Trust Fund of the Royal Society of Chemistry and the John Ray Trust enabled me to travel to Kenya in early 2010 to experience for myself some of the logistical constraints both in the field and laboratory, to gain a better grasp of the issues unfolding there and to speak at length with stakeholders. My editorial task was lightened considerably by the solid work of my contributors, many also serving as reviewers, and by those who commented on various chapters and sections, especially: Darcy Ogada, Alana Balogh, Stephen Donovan, Caroline Kennedy, Carol Meteyer, Michael Fry and a number of individuals who wished to remain anonymous. Mark Taggart went above and beyond the call of duty as a reviewer, and his feedback was indispensable. Special thanks are extended to my editor Fiona Woods for her guidance and patience, and for allowing all the 'eleventh hour' additions in order to provide an up-to-the-minute account of critical events as they unfolded in Kenya and the United States. Sara Barnes, copyeditor extraordinaire, also showed monumental patience and flexibility as we neared the home stretch. Shanmuga Priya and the Macmillan Publishing Solutions team were extremely accommodating as well. I am particularly grateful to my parents, Gary and Christina Richards, who made it possible for me to focus almost entirely on this book over the last year of its creation. My mother (Christina Davidson Richards) also did an outstanding job indexing the book. My colleagues at Working Dogs for Conservation were very understanding, allowing me to finalise the book while juggling new work responsibilities. I would also like to express appreciation to my mentor and colleague Pierre Mineau for his contributions and for giving me the rigorous training and support that such a large undertaking both requires and merits. And, finally, thanks to Iñigo Fajardo, who has helped deepen my understanding of wildlife forensics and confirmed what an effective tool it is in the right hands.

This book is dedicated to all those who are confronting wildlife poisoning, erosion of biodiversity and infringement upon the integrity of our ecosystems, who have acquired indelible knowledge and experiences in the process, and placed themselves and their careers in harm's way by speaking out. I also make a special dedication to griffon vulture C15, whose story is told in Chapter 5, and who epitomises each of the individuals that have succumbed to poisoning. Let the reader assimilate all of their stories, and may their loss not have been in vain.



Contributor Biographies

Ngaio L. Richards

Ngaio Richards is a forensic ecologist and conservationist. Her multidisciplinary background includes a BSc (Hons) in Environmental Science from Acadia University (Nova Scotia, Canada) and an MSc in Natural Resource Sciences with emphasis on applied wildlife biology and ecotoxicology from McGill University (Québec, Canada). Her MSc research, conducted under the direction of Pierre Mineau and David Bird, examined the relative risks posed by habitat loss and pesticide exposure to eastern screech-owls in apple orchards of southern Québec. In autumn 2010, she obtained a PhD in Forensic Science from Anglia Ruskin University (UK) for a study titled: *Detection of nonsteroidal anti-inflammatory drugs in hair, nails and feathers using GC-MS, with emphasis on diclofenac, a forensic tool for wildlife conservation*. Her interests lie in small-scale community-based conservation initiatives and facilitating the development of collaborative environmental monitoring networks. She also has a great fondness for vultures, owls, bears, hyenas and wolves, and is a champion for uncharismatic wildlife. Ngaio is the Canine Field Specialist for Working Dogs for Conservation, a non-profit organisation based in Montana (USA).

CHAPTER 1

Stephen Donovan

Stephen Donovan has been a principal research chemist in the Agrichemical Industry for over 25 years, working for American Cyanamid, BASF and FMC. He obtained a PhD in Organic Chemistry from the University of California and conducted his post-doctoral research at Cornell University. Dr Donovan is the author of numerous publications and patents relating to pesticides. He is proficient with a variety of modern analytical tools such as: LC/MS, LC/MS/MS, GC/MS, ICP/MS and LC/ICP/MS. He also has expertise in organic synthesis, compound purification, compound identification, physical property measurements, quantitative structure activity relationships (QSAR), pharmacokinetics and ADMET (absorption, distribution, metabolism, excretion, and toxicity). He is currently serving as an analytical chemist at the Pennsylvania Department of Health in the Chemical Terrorism Preparedness Section (affiliated with the Centre for Disease Control (CDC)), where he measures toxins in human fluids via LC-MS/MS and LC-ICP/MS.

Mark Taggart

Mark Taggart is an experienced environmental chemist and ecotoxicologist currently working as a research fellow at the Environmental Research Institute in the Highlands of Scotland. He studied as an undergraduate in Liverpool, undertaking a BSc in Earth Science and Countryside Management, and then turned more toward chemistry, carrying out an MSc in Geochemistry at Leeds. He then worked in industry, in flue gas desulphurisation in the two largest coal-fired power stations in the UK, before spending four years with the Environment Agency in London as a Monitoring and Investigations Officer. In 2000, he returned to academia to undertake a PhD in arsenic biogeochemistry at Aberdeen

in Scotland, studying the effects of one of Europe's largest ever acid mine spills at Aznalcóllar in Spain. Since this point, he has undertaken a very wide range of research related to the fate, behaviour and toxicology of organic/inorganic pollutants in the environment in the UK, Spain and India. He has published well over 40-peer reviewed articles and book chapters in this field, many of which are related to the ecotoxicology of heavy metals and metalloids, and the impact of diclofenac (a non-steroidal anti-inflammatory drug) on vultures in India. He has worked extensively within the field of avian ecotoxicology in particular.

CHAPTER 2

Pierre Mineau

Pierre Mineau is a Senior Research Scientist in the Science and Technology Branch of Environment Canada. He is also an Adjunct Professor in the Department of Biology at Carleton University and in the Department of Veterinary Biomedical Sciences at the University of Saskatchewan. He obtained his BSc from McGill University (Québec, Canada) and his MSc and PhD from Queens University (Ontario, Canada). His doctoral research focused on the effects of forestry insecticides on food-caching memory in birds.

For a 15-year period, Dr Mineau was responsible for the wildlife risk assessment of pesticides for the Canadian regulatory system. As part of these responsibilities, he led the scientific review of carbofuran which culminated in the removal of most of its uses from Canada. He received formal commendation for this work. Following a restructuring of this system, he turned to full-time research. With the help of many collaborators, he spans various scales of biological organisation—from the use of sub-cellular biomarkers of pesticide exposure, to analyses of bird population trends in response to pesticide use patterns. By extension, he also studies risk assessment methodology, how agricultural practices affect wildlife and the environment more generally, how to objectively measure and communicate the 'environmental footprint' of pest control practices, as well as the ecological 'value' of birds in cropland. Dr Mineau has authored over 100 peer-reviewed publications and given over 200 presentations. He has served as a consultant in the area of pesticide impacts to several international agencies as well as governmental and non-governmental organisations in Canada and abroad.

Carol Uphoff Meteyer

Carol Meteyer has been a wildlife pathologist at the USGS National Wildlife Health Center (NWHC) in Madison, Wisconsin (USA) since 1992. She received a BSc in Biology and Chemistry at the University of Iowa and worked as a research assistant in Costa Rica on a study of the ecology and feeding habits of *Atta cephalotes* (leaf-cutter ant) in Guanacaste National Forest. She completed a Doctorate in Veterinary Medicine at Iowa State University in 1983. Starting in 1984, Carol conducted a three-year residency in comparative pathology in association with the University of Southern California and the Los Angeles County Medical and Veterinary Service. From 1987 to 1991, she was on the faculty of the UC Davis College of Veterinary Medicine as a diagnostic pathologist with the California Veterinary Diagnostic Laboratory System. She received board certification by the American College of Veterinary Pathologists in 1988.

Carol's duties at the NWHC have both a forensic and diagnostic component. In her capacity as a forensic pathologist, she provides pathology support for legal cases within the US Fish and Wildlife Service Division of Law Enforcement. She has also investigated numerous incidences

of animal poisoning, including carbamate and organophosphate poisoning cases. As a diagnostic pathologist, she is involved in determining the cause of morbidity and mortality in wildlife. Carol has participated in special investigations on migratory birds, endangered species and species of concern, including assessing causes of: southern sea otter (*Enhydra lutris nereis*) population declines, amphibian malformations, vulture (*Gyps* sp.) population declines in Pakistan due to secondary poisoning with the nonsteroidal anti-inflammatory drug diclofenac, the pathology of monkey pox in rodents, pathogenesis of plague in prairie dogs, and the highly pathogenic avian influenza H5N1 in kestrels and shorebirds. Carol has also been part of a team to define pathologic changes associated with diseases in coral and she has served as the lead pathologist at the NWHC investigating white-nose syndrome in bats.

Stuart Porter

Stuart Porter is a Professor of Veterinary Technology at Blue Ridge Community College in Weyers Cave, Virginia (USA). His background includes a BSc in Biology from Washington and Lee University (Virginia) and a VMD from the University of Pennsylvania (Philadelphia). He has worked as a resident veterinarian at the Memphis, Tennessee and Gladys Porter Zoos. In 1982, he co-founded the Wildlife Centre of Virginia (WCV), where he went on to serve as the Director of Veterinary Services for 12 years. It was at the WCV that he documented intoxication in a number of wild birds from carbamates (including carbofuran) and organophosphates, lead and chlorinated hydrocarbons. As a result, he initiated the measurement of cholinesterase levels in various raptors to determine in-house reference ranges. In the process, he discovered that many hawks and eagles admitted as 'car strikes' also tested positive for poisoning. He was able to confirm his findings and gather more data by networking with other wildlife professionals across the country. Dr Porter has served on the board of directors of the National Wildlife Rehabilitators Association, the Rachel Carson Council, and the Virginia Veterinary Medical Association. He has given presentations to veterinary students, veterinarians, wildlife rehabilitators and wildlife biologists throughout the US and as far away as Australia to increase awareness of the many man-made toxins and how they affect native wildlife. He has also contributed many articles and book chapters centring on various wildlife-related issues.

CHAPTER 3: KENYA

Joseph O. Lalah

Professor Joseph Lalah has a BSc (Hons) in Chemistry and Biochemistry from the University of Nairobi, an MSc in Energy from the University of Leeds and a PhD in Chemistry from the University of Nairobi. He has worked in various sectors, including government, industry and university. He was a senior lecturer in the Department of Chemistry, Maseno University, before joining the Kenya Polytechnic University College as an Associate Professor in March 2010. Professor Lalah lectures in analytical, inorganic and environmental chemistry. His research area is environmental chemistry and ecotoxicology and he has published several papers in internationally recognised journals. His current research interest is in contaminant residue distribution, fate and impact on the environment and wildlife. He is an alumnus of the British Council Award, the German Academic Exchange Programme (DAAD), the International Atomic Energy Agency and the Alexander von Humboldt Foundation and an affiliate member of IUPAC (Crop Protection Chemistry).

Peter Otieno

Peter Otieno is an environmental research scientist who is keen to study the distribution, fate and contamination of pesticides residues in the environment. He grew up in a village on the shores of Lake Victoria in Kenya, studied at Usenge Primary School and Usenge High School before joining Egerton University in 1992 for a Bachelor of Education, with a major in chemistry. Upon completion, Peter taught chemistry in various secondary schools during which he rose through the ranks to become a Principal. In 2009, he received an MSc in Environmental Chemistry from Maseno University. Mentored by Professor Joseph Lalah, his thesis was titled: *Monitoring carbofuran residues in Laikipia and Isiolo districts for ecological risk assessment*.

The data Peter collected has contributed significantly to the deeper understanding of the potential risks posed by carbofuran residues in the Kenyan environment. Two publications in peer reviewed journals, one using innovative forensic analyses, is a testimony of this contribution. He is currently working on a PhD assessing the influence of climate change on the distribution and contamination of selected carbamates and organophosphate pesticides residues in Lake Naivasha and its biodiversity. This work is partly supported by an International Climate Protection and Resource Conservation Research Fellowship at the Institute of Ecological Chemistry in Munich, Germany.

Martin Odino

Martin Odino is an ecologist with a specialisation in ornithology and a passion for preserving biodiversity. He received a BSc in Zoology from Moi University in 2005 and was affiliated as an intern at the Ornithology Section of the National Museums of Kenya from 2006 to 2007. Through a closely associated committee, the Bird Committee of Nature Kenya, he was assigned to conduct a minor, random survey on the availability, use and regulation of Furadan in Kenya from the end of 2007 into 2008. Based on his findings, he then executed a follow-up study titled: *A selective survey on pastoralist and plantation farming sites for Furadan availability and use as a poison* (2008). Between 2007 and 2008, Martin served as a Species Programme and Advocacy intern with BirdLife African Partnership Secretariat (Kenya) and was involved in another 'mini-survey' which was also conducted jointly with Nature Kenya on: *Availability, use and conservation implication of diclofenac to vultures in Kenya* diclofenac is the veterinary drug responsible for the catastrophic decline of *Gyps* vultures in India).

Periodically, between 2008 to the present, Martin has been affiliated with the Nairobi-based charitable group WildlifeDirect as a consultant in the Campaign to End Wildlife Poisoning. He has also been involved in various projects, both individual and collaborative, mostly ornithological but always relevant to wildlife poisoning: 1) *Measuring the conservation threat to birds in Kenya from pesticide poisoning: a case study of Bunyala Rice Irrigation Scheme* (Funded by Rufford Small Grants (RSG) and detailed in Chapter 3); 2) *Avifaunal and threat status survey in Northern Yala Swamp, Kenya* (Funded by African Bird Club (ABC)); 3) *Assessing the impact of pesticide poisoning on Kenya's big cats and possible alleviation of the situation* (Funded by the National Geographic Society).

Munir Z. Virani

Munir Z. Virani was born and raised in Nairobi, Kenya. He has been associated with The Peregrine Fund (TPF) since 1992, when he was selected to train as a raptor biologist under Simon Thomsett. Munir obtained a PhD in Biological Sciences and Medicine from the University of Leicester (UK) in 2000 and was awarded the Aga Khan Foundation award for excellence in the Field of Science and Technology in 2002. Munir has published over 100 scientific and popular articles including a paper in the esteemed journal *Nature*. In 2007, he was awarded a prize for the Wildlife Photographer of the

Year in a competition organised by *Twende Travel Magazine*. He currently heads TPF's Africa and South Asian Raptor Conservation Programs. His research has focused on Augur buzzards, African fish eagles, Sokoke scops owls, and, more recently, on *Gyps* vultures (investigating the catastrophic population decline in the species that was triggered by the use of the nonsteroidal anti-inflammatory drug diclofenac to treat livestock on the Asian subcontinent).

Darcy Ogada

Darcy Ogada is a wildlife conservationist who specialises in the ecology and conservation of African raptors. In 2008, she was awarded a PhD in Zoology from Rhodes University (South Africa) for a study titled: *The ecology and conservation of Mackinder's eagle owls (Bubo capensis mackinderi) in central Kenya in relation to agricultural land-use and cultural attitudes*. She received an MSc in Biology from the State University of New York at Albany (USA) in 2002 for research that examined the impacts of large ungulates on bird populations in an East African savannah. Dr Ogada currently works as Assistant Director of Africa Programs for The Peregrine Fund and is based in Kenya. She also chairs the Raptor Working Group of Nature Kenya. Actively involved in the campaign to stop wildlife poisoning in Kenya since 2007, Darcy has authored a number of reports and papers which are referenced in Chapter 3, one of which, on the issue of Furadan use to poison wildlife species, catalysed stakeholders into action again.

Laurence Frank

Laurence G. Frank has a BA from Reed College (Oregon, US), an MSc from the University of Aberdeen (UK), and a PhD from the University of California at Berkeley (US). He has been a research scientist at Berkeley since 1984, first as part of the Berkeley Hyena Project and currently in the Museum of Vertebrate Zoology. After spending 20 years studying the behavioural ecology and endocrinology of the spotted hyena (*Crocuta crocuta*), he turned to conservation research and is now affiliated with Panthera. Laurence directs the *Living with Lions* programme in Kenya, which uses a multidisciplinary approach to the conservation and management of lions and other large African predators outside protected areas.

Alayne H. Cotterill

Alayne Cotterill has worked with large carnivores in Africa since 1993, when she carried out the first cost-benefit analysis for including lions in the growing private wildlife reserves in southern Africa as part of her MSc. Over the last 18 years, she has developed extensive experience on the issue of large carnivore/human conflict in southern and eastern Africa, and has spent the last seven years as a biologist with the *Living with Lions* programme in Kenya. Alayne is also the recipient of two Panthera Kaplan Graduate Awards. She is currently carrying out a DPhil with Oxford University's Wildlife Conservation Research Unit, investigating how conflict with humans affects lion behavioural ecology and demography.

Stephanie Dolrenry

Stephanie Dolrenry is a field biologist who has spent the past 15 years in a variety of biomes, across the US, the Bahamas, Hawaii and, for the past six years, Kenyan Maasailand. Her research in Kenya

focuses on the behavioural ecology of large carnivores, namely lions and spotted hyenas, living in human and livestock-dominated areas. She is interested in the development and implementation of non-invasive and local knowledge-based monitoring techniques to study behaviours and mitigate conflicts of elusive and persecuted carnivore populations. Stephanie is the Director of Carnivore Biology for the Lion Guardians programme. She has a Wildlife Conservation and Management degree from Missouri State University and is currently completing her PhD at the University of Wisconsin-Madison as part of the Carnivore Coexistence Lab. Stephanie's research is funded through a National Science Foundation Graduate Fellowship and she has twice been a recipient of a Panthera Kaplan Graduate Award.

Leela Hazzah

Leela Hazzah has a BSc in Biology from Denison University and an MSc from the University of Wisconsin-Madison, where she is also completing her PhD. She has worked on conservation issues in East Africa for 12 years, spending half of this time working with *Living with Lions*. Leela's research interest is in designing co-management frameworks, specifically using cultural and traditional values to initiate conservation programmes and mitigate livestock-carnivore conflict. Leela currently directs the Lion Guardians programme, a community conservation initiative which provides a platform for Maasai warriors to engage with and participate in lion conservation. Leela has been awarded a Fulbright Hays Doctoral Fellowship, four Panthera Kaplan Graduate Awards, a Fellowship from Wings WorldQuest, and a Jordan Prize for African Studies.

Dino Martins

Dino J. Martins, a conservationist and biologist, completed a PhD at Harvard University in 2011 that focused on the interactions of insects and plants, specifically those between ants and acacias in relation to external species and how they influence/exploit mutualisms. Dino also holds an MSc in Botany from the University of Kwa Zulu Natal, South Africa, and a BA in Anthropology (with distinction) from Indiana University (USA). Dino has published numerous articles in scientific, natural history, and environmental magazines. He is currently the Chair of the Insect Committee for Nature Kenya and The East Africa Natural History Society.

Dino has taught courses and led expeditions in Africa for the Kenya Museum Society, Princeton University, Georgetown University and Stony Brook University. A recipient of the Derek Bok Teaching Award and the Ashford Fellowship in the Natural Sciences from Harvard University, he also held the Smithsonian Institution Fellowship in 2004, and was awarded the 2002 and 2003 Peter Jenkins Award for Excellence in African Environmental Journalism. In 2009, he won the Whitley Award for Conservation – one of the most prestigious global conservation prizes – called the 'Green Oscar'. This was for his work on pollinator conservation in Kenya, which is detailed in Chapter 3. In May 2011 Dino was named an Emerging Explorer by National Geographic.

CHAPTER 4: INDIA

Venkataramanan Ragothaman and Sreekumar Chirukandoth

Dr V. Ragothaman (MVSc) an animal geneticist, is presently working as Assistant Professor at the Sheep Breeding Research Station (SBRS), Tamil Nadu Veterinary and Animal Sciences University

(TANUVAS), Sandynallah, The Nilgiris. He had earlier served in Nilgiris as a Veterinary Assistant Surgeon for six years in the Animal Husbandry Department of Tamil Nadu, and has extensive working knowledge of the area. He is also a wildlife enthusiast and actively participates in wildlife-related endeavours. Dr S. Chirukandoth has a doctorate in Veterinary Parasitology and, after a brief stint with the State Animal Husbandry Department as a Veterinary Assistant Surgeon, joined TANUVAS in 1994. He is currently working as an Associate Professor in the SBRS. He is a self-taught herpetologist and is actively involved in the conservation of venomous snakes.

The Nilgiris Biosphere Reserve was the first Biosphere Reserve established in India and includes several national parks, tiger reserves and wildlife sanctuaries. Both Drs Ragothaman and Chirukandoth have been involved in wildlife rescues and have performed necropsies on a variety of wildlife species, including those intentionally poisoned with a number of compounds. As practicing veterinarians, they have treated several cases of poisoning in domestic cattle using pesticides, including carbofuran, within the region. They have also documented several incidences of carbofuran poisonings in peer-reviewed journals (referenced in Chapter 4).

CHAPTER 5: THE EUROPEAN UNION AND OTHER PARTS OF EUROPE

Jitka Větrovcová

Jitka Větrovcová is a biologist and conservationist currently at the Agency for Nature Conservation and Landscape Protection of the Czech Republic, where she coordinates the implementation and preparation of country-wide Action Plans and Management Plans for endangered animal species. She obtained a BSc in Environmental Biology and an MSc in General Biology from the University of Texas at Arlington. Her thesis focused on monitoring methods for Eurasian otters (*Lutra lutra*).

Kateřina Poledníková

Kateřina Poledníková obtained an MSc in Systematic Biology and Ecology from the Palacky University in Olomouc. Her thesis focused on the pied flycatcher (*Ficedula hypoleuca*). Since then, she has worked on various research projects focusing on Eurasian otter as well as American and European mink (*Mustelidae*), both in the Czech Republic and abroad. In 2007, she established the NGO ALKA Wildlife and is currently involved as a director and scientific researcher there.

Lukáš Poledník

Lukáš Poledník obtained an MSc in Systematic Biology and Ecology from Palacky University in Olomouc. His thesis focused on the marking behaviour of the Eurasian otter. In 2005, he completed a PhD at the same university. He has led/participated in various scientific projects on otters, American and European mink and recently joined the NGO ALKA Wildlife. Dr Poledník coordinates otter monitoring efforts within the Czech Republic and is a member of the IUCN Otter Specialist Group.

Hugh Jansman

Hugh Jansman is an animal ecologist. From 1992 to 1998, he studied Biomedical Science within the Medical Department of Leiden University (Netherlands). During the final stage of his studies he

focused on wildlife health, specialising in necropsies and the effects of toxic substances on animal populations. Since then, he has worked for Alterra, a research institute affiliated with Wageningen University, which is involved in the conservation (and sometimes re-introduction) of species such as otter, black grouse, wild boar, red deer, meadow birds, geese, birds of prey, predators, reptiles and amphibians. Dr Jansman uses molecular tools to carry out both non-invasive and more conventional forms of monitoring. He also conducts necropsies and is involved in telemetry work. He is often consulted by law enforcement groups on matters related to species determination and the use of conservation genetics (e.g., kinship determination). Dr Jansman is the chairman of the Dutch working group on pine martens (www.werkgroepboommarter.nl) and a board member of the Dutch Mammal Society (www.zoogdiervereniging.nl).

Peter van Tulden

Peter van Tulden has worked in the field of wildlife forensics since October 2009. His multidisciplinary background is based on a study of medical biology at the Higher Laboratory School (in Delft, Holland). After finishing his schooling, he initiated work on isotype-specific ELISAs for bovine herpes virus (Type 1) antibodies in Lelystad, Holland. He was an analyst at the National Fish Disease Laboratory (also in Lelystad) for three years. From 2002 until 2009, he served as the Head of the Dispatching Service Unit of the Central Veterinary Institute (Lelystad), where he is currently acting as the Wildlife Research Coordinator. His interests lie in birds, especially birds of prey.

Hermann Ammer

Hermann Ammer is a veterinarian who graduated from the University of Munich (Germany) in 1986. After working in a mixed large and companion animal practice, he moved back to the university in 1990 to carry out a PhD in Pharmacology and Toxicology. He has been a Professor of Clinical Pharmacology in the Department of Veterinary Sciences at the University of Munich since 2002. He is especially interested in the cellular and molecular mechanisms of adverse drug reactions and is currently establishing a pharmacovigilance centre for the southern region of Germany. He runs an analytical laboratory unit for drug monitoring and the detection of common animal poisonings, offering this service to veterinary surgeons in southern Germany, Austria and Switzerland to help them with diagnosis and therapy of intoxications.

Christian Pichler

Christian Pichler is an ecologist and conservationist. He studied Biology at the University of Vienna (with emphasis on ecology and specialisation in limnology). His MSc research, conducted at the same university, under the direction of Friedrich Schiemer, examined the ecology of the fishes of Quebrada Negra, a first order neotropical lowland stream in Costa Rica. Christian began working for WWF Austria in 2006, immediately after completing his studies. Since then, he has been part of the National Programme, within the Department of Natural Conservation. At present, he is mainly responsible for the conservation of large carnivores in Austria (especially white-tailed eagle, brown bear, Eurasian lynx and grey wolf). The ultimate goal is to have viable bear, lynx, wolf and white-tailed eagle populations in Austria, in the sense of their having a favourable conservation status and being connected with other populations, while ensuring an administrative framework and adequate legislation to proactively manage conflicts with human interests.

Iñigo Fajardo

Iñigo Fajardo has a PhD in Biology and an MSc in Environmental Management. He has devoted much of his time to the management and conservation of highly threatened Iberian species, and has been involved in similar endeavours in other countries including Argentina, Perú, South Africa, Zimbabwe, Uganda, the United Kingdom, Norway and Malaysia. He trained as a marine mammal medic (British Diver's Marine Life Rescue) and lectures on a number of topics including wildlife management and forensic techniques. Since 2000, he has served as an advisor on wildlife matters for the Government of Andalucía. His areas of specialisation are applied forensics and prosecution of crimes against wildlife.

Irene Zorrilla

Irene Zorrilla has a PhD in Biological Sciences from the University of Málaga (Spain) and has written a second doctoral thesis in veterinary medicine (University of Murcia). For 11 years, she was involved in research and teaching in the departments of Microbiology of the Faculty of Sciences of the University of Málaga, the University of Santiago de Compostela and the University of Valencia (UV, Spain). She has also served as the Technical Director of the Andalusian Institute of Pathology and Microbiology of Málaga (IAMA). Irene is currently Head of Laboratory at the Centro de Análisis y Diagnóstico de la Fauna Silvestre (Centre for Analysis and Diagnosis of Wildlife) for the Ministry of Environment of Andalucía.

Antonio Ruiz

Antonio Ruiz has a BSc in Biological Sciences. He is part of the antipoisoning project: Estrategia de Control de Venenos y otras Amenazas para la Fauna Catalogada for the Consejería de Medio Ambiente. Antonio has coordinated field assistants on the ground for the control of poisoning in Andalucía since 2004. He specialises in the investigation of poisoning, the coordination of police forces and the execution/implementation of antipoisoning measures. Antonio currently designs and manages the strategic use of canine units for the region and oversees the database of poisoning incidents managed by the government.

Isabel Fernández

Isabel Fernández is a veterinarian who graduated from the Complutense University of Madrid (Spain) in 2004. She then completed a series of internships to broaden her knowledge in equine medicine and reproduction, and to widen her experience in exotic/wild animal medicine and management (e.g., Aznalcóllar Equine Hospital (Seville), Zoo-Aquarium (Madrid), Foundation for the Preservation and Recovery of Marine Animals (Barcelona). Isabel is currently head of the veterinary branch of the Centro de Análisis y Diagnóstico de la Fauna Silvestre for the Ministry of Environment of Andalucía.

Antonio Valero, Ernesto Sáez, F.M. Molino and Jesús Olivares

Antonio Valero (BSc in Biological Sciences), Ernesto Sáez, F.M. Molino and Jesús Olivares have served as field assistants in western and eastern Andalucía since 2004. They are all part of the antipoisoning project: Estrategia de Control de Venenos y otras Amenazas para la Fauna Catalogada. Together, they are the beating heart of the project, speaking directly to farmers, shepherds,

landowners and hunters, among others and disseminating valuable information to stakeholders. They also attend all dog inspections and assess the police in their investigative techniques and procedures.

Péter Bedö

Péter Bedö is a farming/agricultural trade journalist and part-time naturalist in Hungary. He has an MSc in Agricultural Sciences (with a specialisation in Wildlife Management) and his thesis focused on population changes in rook and crow populations in Hungary. He has participated in field-based conservation projects in Hungary since 2001, mostly monitoring raptors and studying large carnivores. In the autumn of 2004, Péter interned at Hawk Mountain Sanctuary (Pennsylvania, USA), where his tasks ranged from guiding visitors to mapping migratory patterns using GIS applications. Since 2005, he has worked as a writer for a trade magazine while focusing increasingly on large carnivore monitoring. Besides tracking lynx in the northern hills of Hungary, he has, since 2010, been working with an NGO based in Slovakia on a project that aims to increase the available data about large carnivores, primarily using volunteers to gather the information.

Gordana Pavokovic

Since childhood, Gordana Pavokovic has been interested in animals and their conservation. The war in Croatia prevented her from studying at the Veterinary University in Zagreb and she chose instead to study as a health inspector at the University of Rijeka in the Medical Faculty (1991–1995). But her love of nature directed her again towards studies in natural sciences and she went on to complete an MSc in Ecology at the University of Zagreb in the Faculty of Science in 1998. She wanted to work on a project that would help animals and became involved in the issue of illegal poisoning of Eurasian griffon vultures on the Kvarner Islands in the northern Adriatic. Her thesis was titled: *Population viability analysis of Eurasian griffon (Gyps fulvus) in Croatia*. Many griffons brought to the Vulture Recovery Centre on the Island of Cres, where she worked for a time, suffered from neurological symptoms, accompanied by vomiting and diarrhoea (all characteristic of exposure to organophosphorus and carbamate pesticides), which usually ended with the death of the bird. After seeing this so much firsthand, she decided to pursue the use of these compounds as poisoning agents. Due to her dedicated work with griffon vultures, she was elected vice president of the Eurasian Griffon Vulture Working Group in 2005. She is presently working as a teacher of biology.

CHAPTER 6: THE UNITED KINGDOM AND THE REPUBLIC OF IRELAND

Ruth Tingay

Ruth Tingay is a British-based ornithologist with field experience from North and Central America, Europe, Africa, the Middle East, Central Asia and South East Asia. She studied the critically endangered Madagascar fish eagle for an MSc (2000) and PhD (2005) with The Peregrine Fund at the University of Nottingham, UK. In addition to her studies in Madagascar, other research has included Mauritius kestrels and echo parakeets (Indian Ocean), raptor migration (USA, Israel and Mexico), American kestrels (USA), white-tailed sea eagles, golden eagles, goshawks, hen harriers, red kites, whooper swans and golden plover (Scotland), grey-headed fish eagles (Cambodia), and Pallas' fish eagles, white-naped cranes, whooper swans and bar-headed geese (Mongolia).

Ruth is a member of the Scottish Raptor Study Group, the Eagle Conservation Alliance, the Asian Raptor Research and Conservation Network and the African Raptor Network. She is a research associate at Hawk Mountain Sanctuary (USA) and the Percy Fitzpatrick Institute of African Ornithology (South Africa) and has worked as an associate with the Wildlife Conservation Society (Cambodia and Mongolia). Ruth serves on the Review Board of the European Science Foundation and served two terms as an International Director of the Raptor Research Foundation (2004–2008); she is currently serving as President (2009–2013). Her first book, *The Eagle Watchers: Observing and Conserving Raptors around the World* was published in 2010 by Cornell University Press.

Douglas McAdam

Douglas McAdam is the Chief Executive of the Scottish Rural Property and Business Association (SRPBA). The SRPBA represents the interests of land owners, estates, farmers and diversified rural land-based businesses across Scotland. Prior to joining the SRPBA as CEO in October 2006, Doug had an international career in the commercial sector in the Far East and Europe, working at senior and director level for companies including: The Swire Group, Cathay Pacific Airways Ltd, Kelvin International Services & Primary Management Ltd (a part of the Sodexo Group), and Thames Water. He received an MSc (Hons) in Geography from the University of St Andrews (Scotland). A resident of Highland Perthshire, his passions are deer stalking and management, fly fishing and field sports, classic Land Rovers and mountain biking.

Michael J Taylor

Mike Taylor (BSc, PhD, CChem.) is Head of Chemistry at Science and Advice for Scottish Agriculture (SASA), an Edinburgh-based scientific division of the Scottish Government. SASA Chemistry Branch provides a variety of analytical chemistry services and expert advice in support of the Scottish Government's participation in UK and EU annual surveillance programmes that monitor the impact of pesticide use on food and drink, animals and honeybees. The unit also provides essential support to law enforcement agencies and NGOs investigating suspected (illegal) animal poisoning activities. Mike's current appointment followed an extensive career in industry and the commercial sector where he used a wide range of mass spectrometric and chromatographic techniques in novel applications as a Senior Research Scientist (ICI Materials Science Group), Analytical Services Technical Manager (Enron Teesside Operations Ltd) and European Applications and Demonstration Laboratory Manager (Waters Corporation). Mike received his PhD from the University of Wales – Swansea in 1995 for research on '*Field Desorption Mass Spectrometry Applied to Polymers and Compounds Relevant to their Synthesis*'. This was achieved while working full time at ICI and under the academic supervision of Professor Dai Games. Mike has authored and co-authored several peer-reviewed papers and contributed to the scientific programme of numerous national and international scientific meetings throughout his career.

CHAPTER 7: LATIN AMERICA

Alexandre de Almeida

Alexandre de Almeida holds a degree in Biological Sciences from the Universidade Estadual Paulista 'Júlio de Mesquita Filho' (1997), an MSc in Forestry Resources (2001) and a PhD in Applied Ecology

(2006), both from the University of São Paulo. He also completed post-doctoral work in Zoology at the Federal University of Bahia (2010). Alexandre has worked in environmental consulting enterprises, forestry companies, federal government, nongovernmental organisations, research and teaching. His areas of interest include biological conservation, ecology (birds and mammals) and management of environmental impacts. He is currently a Professor in the Department of Environmental Resources of the National Service of Industry (SENAI-CETIND) in Lauro de Freitas, Bahia.

Álvaro Fernando de Almeida

Álvaro Fernando de Almeida received a degree in Biological Sciences from the University of Mogi das Cruzes (1972) and a PhD in Biological Sciences (Zoology) from the University of São Paulo (1982). He was a Professor in the Department of Forestry Science, University of São Paulo since 1979, acting in the Wildlife Management, Biological Conservation and Management of Environmental Impacts. Álvaro retired in 2003, but continued teaching until 2010. He is currently a consultant and a happy farmer.

CHAPTER 8: THE UNITED STATES AND CANADA

Linda Lyons

Linda Lyon received BA and MSc degrees from Rutgers College and Rutgers University, respectively (New Jersey, USA). She has worked for the United States Departments of Energy, Commerce, Agriculture, and Interior and the Environmental Protection Agency (EPA). While at EPA, Linda's assignments included principal ecologist for the Special Review of carbofuran. In 1991, she transferred to the Fish and Wildlife Service (FWS) where she served as the Coordinator for Integrated Pest Management. Responsibilities included oversight of FWS pesticide use; Endangered Species Act consultations for pesticides; legal investigations concerning wildlife die-offs caused by pesticides; and instructing on courses such as *Pesticide Effects to Fish and Wildlife Resources*, *Environmental Crimes Investigations*, and *Environmental Toxicology*. She has taught for the Federal Law Enforcement Training Centres at Marana (Arizona), and Glynco (Georgia); Environmental Protection Agency; National Park Service; Department of Defense; US Forest Service National Advanced Resource Technology Centre; and several state agencies. Since 1997, Linda has been the Environmental Contaminants Coordinator for the National Wildlife Refuge System. Duties involve issues such as oil spill response, contaminant cleanup, contaminant investigations, oil and gas production, and Superfund-related actions. Linda maintains credentials as a Certified Pesticide Applicator, Hazardous Materials Responder and Emergency Medical Technician.

Stella McMillin

Stella McMillin is an environmental scientist with the California Department of Fish and Game, where she investigates pesticide-related fish and wildlife losses in the State of California. Her current research includes monitoring anticoagulant rodenticides in non-target wildlife, mostly as a result of secondary exposure. One of her responsibilities is to review pesticide registration information for potential hazards to wildlife in the State. Ms McMillin is also involved in educating pesticide applicators about wildlife issues and participates in environmental education of elementary school students. She received a BSc and MSc in Biological Sciences from California State University in San Luis Obispo, California.