Co	nter	Camera irap conceptual contract that nearnammi Ste			
	incer				
Abo	ut the	editors			ix
		contributors			x
	eword				xii
Pref	ace				xiv
Ack	nowled	dgements			xvi
Onli	ine res	ources			xvii
	7.4	Case study: the Eurasian Ivex			103
1.	Intr	oduction			1
	Fran	cesco Rovero and Fridolin Zimmermann			
	1.1	A brief history of camera trapping	.1.11.4		1
	1.2	Efficiency of camera trapping and advantages over othe	r wildlife		2
		detection methods			3
2.	Cam	nera features related to specific ecological app	lication		8
2.		ing completeness	incation.	N.R	0
	Fran	cesco Rovero and Fridolin Zimmermann			
	2.1	Introduction			8
	2.2	Camera trap systems			8
	2.3	Camera features to consider when choosing models			10
	2.4	Camera performance in relation to study designs			14
		2.4.1 Faunal inventories			14
		2.4.2 Occupancy studies (species and community-lev	vel)		15
		2.4.3 Capture–recapture			15
		2.4.4 Behavioural studies			16
	2.5	Review of currently available camera trap models and co	omparativ	re	
		performance tests			16
	2.6	Limitations and future developments of camera technologies	ogy		18
3.	Fiel	d doployment of comore trans			22
5.	Fiel	d deployment of camera traps			22
	Fride	olin Zimmermann and Francesco Rovero			
	3.1	Pre-field planning			22
	3.2	Sotting comero trans in the field			25
	0.2	201 Charlesting and all second			25
		3.2.1 Site selection and placement 3.2.2 Trail settings			25
		3.2.3 Checklist of actions to activate the camera trap			30
		3.2.4 Checking and retrieving camera traps			30
		3.2.5 Checklist of actions when checking and removi	ng the		
		camera trap	Autor		31

31

camera trap After the fieldwork

3.3

4.	Can	nera tra	p data management and interoperability	33
	Eric Fegraus and James MacCarthy			
	4.1	Introdu	action	33
	4.2	Camer	a trap data	34
		4.2.1	Camera trap conceptual components	34
	4.3	Manag	ing camera trap data: Wild.ID	35
		4.3.1	Setting up a camera trap project	35
		4.3.2	Processing camera trap data	37
		4.3.3	Retrofitting legacy camera trap data	40
		4.3.4	Additional camera trap data management tools	40
	4.4	Camer	a trap data interoperability	41
	4.5	Wildlif	e Insights – the camera trap data network	41
	4.6	The fut service	ture: more repositories, better data management and analytical s	42
-	Dre		Introduction	43
5.	Presence/absence and species inventory			43
			vero and Daniel Spitale	
	5.1	Introdu		43
	5.2		escriptors: naïve occupancy and detection rate as a relative	
	STL L BA		ance index	44
	5.3	÷	ng design	
	5.4	-	ng completeness	48
	5.5	Case st		49
		5.5.1	Raw data format (.CSV file)	49
		5.5.2	Importing data in R	50
		5.5.3	Deriving sampling effort, events and species' list	55
		5.5.4	Naïve occupancy	58
		5.5.5	Species accumulation	59
		5.5.6	Activity pattern	60
		5.5.7	Presentation and interpretation of results	61
	5.6	Conclu	ISIONS	65
6.	Spe	cies-lev	el occupancy analysis	68
	Fran	cesco Roy	vero and Daniel Spitale	
	6.1	Introdu	action	68
	6.2	Theore	tical framework and modelling approach	69
		6.2.1	Basic single-season model	69
		6.2.2	Covariate modeling and assessing model fit	72
		6.2.3	Multi-season occupancy models	74
	6.3	Sampli	ng design	74
	6.4	Survey	effort and sampling completeness	76
		6.4.1	Deciding the best number of sites and sampling duration	76
		6.4.2	Post-hoc discretisation of sampling duration in sampling	
			occasions	78
	6.5	Case st	tudy	79

		6.5.1	Single-season occupancy analysis	79
		6.5.2	Multi-season occupancy analysis	87
	6.6	Conclu	ISIONS	92
7.	Сар	ture-re	ecapture methods for density estimation	95
Ab	Frido	lin Zimn	nermann and Danilo Foresti	
	7.1	Introd	uction	95
	7.2	Equip	ment and field practices	97
		7.2.1	Camera traps	97
		7.2.2	Focal species and other members of its guild	97
		7.2.3	Camera trap sites and camera trap placement	97
	7.3	Survey	v design	100
		7.3.1	Season, survey duration and demographic closure	100
		7.3.2	Spatial sampling and geographic closure	101
	7.4	Case s	tudy: the Eurasian lynx	107
		7.4.1	Analytical steps during field work	108
		7.4.2	Dates and times in R	113
		7.4.3	Analysis with secr	116
		7.4.4	Abundance and density estimation in conventional	
			(i.e. non-spatial) capture-recapture models	132
	7.5	Conclu	asions	133
8.	Behavioural studies			
	Frido	olin Zimn	nermann, Danilo Foresti and Francesco Rovero	
	8.1	Introd		142
	8.2		stages and disadvantages of camera trapping compared to	wiss.
			echnologies used to study animal behaviour	142
	8.3		cation of camera trapping in behavioural studies	145
	8.4		portance of choosing the site in relation to a variety of	
	//	study	1 0 1	145
	8.5	-	ctivity pattern and activity pattern overlap between species	146
	0.0	8.5.1	Definition and assumptions of the activity level measured by	
		ololi	means of camera traps	147
		8.5.2	Overlap between pairs of activity patterns	148
	8.6	Case s		149
	0.0	8.6.1	Marking behaviour studies in Eurasian lynx and brown bear	149
			Comparison of activity patterns	153
	8.7	Conclu		162
200	-	Bui	11.5.5 Technology and e-innovations in camera trapp	100
9.			y-level occupancy analysis	168
	Simo	one Tena	n	
	9.1	Introd	uction	168
	9.2	Measu	ring biodiversity while accounting for imperfect detection	169
	9.3	Static	(or single-season) multi-species occupancy models	170
		9.3.1	Case study	173
	9.4	Dynar	nic (or multi-season) multi-species occupancy models	178

	9.5	9.4.1Case study18Conclusions19			
10.	Cam	era trapping as a monitoring tool at national and global			
20.	levels 196				
	-	A. Ahumada, Timothy G. O'Brien, Badru Mugerwa and			
	Johan	na Hurtado			
	10.1	Introduction 19	96		
	10.2 A national monitoring system for wildlife: from idea to a functioning				
		system 19	99		
		10.2.1 A global model for national monitoring: The TEAM			
		Camera Trap Network 20	)0		
		10.2.2 Goals and targets of a national monitoring system for wildlife 20			
		10.2.3Design of a national monitoring system20			
		10.2.4 Implementation 20	)5		
		10.2.5 Cost components 21	.0		
	10.3	How a wildlife monitoring system can improve protected area			
		effectiveness: examples from the TEAM Network 21			
		10.3.1 African golden cats in Bwindi Impenetrable Forest, Uganda 21	4		
		10.3.2 Effects of hunting at the Volcán Barva transect, Costa Rica 21	.5		
	10.4	Conclusions 21	.6		
11.	Cam	era traps and public engagement 21	9		
		Aeek and Fridolin Zimmermann			
	11.1		0		
	11.1	Introduction 21			
	11.2				
		11.2.1     Categories of public participation in scientific research     22       11.2.2     Canaral annual processing and annual processing of the second procesecond processing of the second processing o			
	11.2	11.2.2     General approaches to programme development     22       Citizen acien as reasonable processory with a special former or several former or severa former or several former or several former o	.0		
	11.3	Citizen science research process with a special focus on camera	11		
		trapping studies 22			
		11.3.1 Data collection and identification 22   11.2.2 Data means and and and an infraction 22			
	70 ber	0			
	11.4	Examples of camera trap citizen science projects 22			
	11.5	What is the future of citizen science camera trapping?2211.5.1Training			
		11.5.1 Training 22			
		11.5.2 Data integrity 22			
		11.5.3 Motivation, engagement and retention in citizen science 22			
		11.5.4 Cultural sensitivity and privacy 22   11.5.5 Taska algorithms in summing the sensitivity of the sensitity of the sensitivity of the sensitivity of			
	11 (	11.5.5Technology and e-innovations in camera trapping23Conclusions23			
	11.6	Conclusions 23	)1		
App	endices		37		
	sary	Survey effort and sampling completeness notbubortini 1.9 27			
Inde	-	22 9.2 noiMassuring biodiversity while accounting for impedent detection			