
Sociality:

The Behaviour of Group-Living Animals

Ashley Ward • Mike Webster

Sociality: The Behaviour of Group-Living Animals

 Springer

Ashley Ward
School of Life and
Environmental Sciences
The University of Sydney
Sydney
New South Wales
Australia

Mike Webster
School of Biology
University of St Andrews
St Andrews
Fife
UK

ISBN 978-3-319-28583-2 ISBN 978-3-319-28585-6 (eBook)
DOI 10.1007/978-3-319-28585-6

Library of Congress Control Number: 2016936371

© Springer International Publishing Switzerland 2016

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG Switzerland

'For Alison, Sammy and Freddy' (AJWW)

'To my parents and Kirsty Owen' (MMW)

Acknowledgements

A number of people have aided us in the production of this book. First of all, we would like to thank Claus-Dieter Bachem and Claudia Panuschka, our editors at Springer, for their patience and guidance. We thank our fellow researchers, Christos Ioannou, Jill Matteo, Chris Reid, Bill Romey, Tim Schaerf, Cedric Seuer, David Sumpter, Elizabeth Tibbetts and Dominic Wright, who read chapter drafts and provided invaluable criticism, comments and feedback. Stacey Lee-Jenkins and Amanda Ridley provided helpful information for the section on adoption and kidnapping behaviour for the ‘Group Size’ chapter. Jens Krause and James Herbert-Read read the entire manuscript, and we are especially grateful to them for their comments. More generally, we are thankful to all of our colleagues in the fields of animal behaviour, ecology and evolution for their inspiring and exciting research, which spurred us to take on the task of writing this book in the first place and enthused us enough to see it through to completion.

Contents

1	Sociality	1
1.1	Animal Aggregations	1
1.2	Different Types of Social Group	2
1.3	Social Group Characteristics I: Social Tendency.	3
1.4	Social Group Characteristics II: Social Structures and Organisation	5
1.4.1	The Dynamics of Social Organisation in Animal Populations	6
1.4.2	Multilevel Societies	7
1.5	The Scope of This Book.	8
2	Mechanisms: Social Recognition and Social Organisation	9
2.1	Introduction	9
2.2	What Is Social Recognition?	10
2.3	Different Levels of Specificity of Social Recognition	10
2.3.1	Basic Recognition	12
2.3.2	Recognition of Kin and Familiars	13
2.3.3	Individual Recognition.	16
2.4	Cues and Templates Used in Social Recognition.	17
2.5	The Sensory Bases of Sociality	20
2.6	Recognition Beyond Identification	24
2.7	Summary	26
3	Attraction, Alignment and Repulsion: How Groups Form and How They Function	29
3.1	Introduction	29
3.2	Finding Conspecifics and Forming Groups	30
3.3	Collective Behaviour	32
3.3.1	Interactions in the Group and Social Forces	33
3.4	Self-Organisation and Emergence	40
3.4.1	Examples of Self-Organisation	43
3.4.2	Insect Foraging Trails	43
3.4.3	Lane Formation in Ants	44
3.4.4	Group Morphology	46

3.5	Organisation and Structure of Animal Groups	48
3.5.1	Polarisation	49
3.5.2	Density	49
3.5.3	Bearing Angle	50
3.5.4	Transitions and Multistability	51
3.5.5	Synchronisation	52
3.6	Summary	53
4	Social Foraging and Predator-Prey Interactions	55
4.1	Introduction	55
4.2	From the Perspective of the Forager	56
4.2.1	Access to Information	56
4.2.2	Competition for Resources	64
4.3	From the Perspective of the Prey	71
4.3.1	Encounter Dilution, Attack Dilution and Attack Abatement	71
4.3.2	Predator Swamping	74
4.3.3	Detecting Predators: The Many-Eyes Effect	75
4.3.4	The Confusion Effect and the Oddity Effect	79
4.3.5	Group Defence Against Predators	80
4.3.6	Socially Facilitated Learning About Predators	82
4.3.7	Predator Learning of Prey Unpalatability	82
4.3.8	A Cost to Prey from Grouping: Area-Restricted Search Tactics by Predators	84
4.4	Mixed-Species Groups	84
4.5	Summary	87
5	Other Benefits and Costs of Grouping	89
5.1	Introduction	89
5.2	Cooperative Interactions	90
5.2.1	Kin Selection	90
5.2.2	Reciprocation	91
5.3	Courtship and Breeding	94
5.3.1	Access, Choice and Mating with Many Partners	94
5.3.2	Leks	96
5.3.3	Extra-pair Breeding	98
5.3.4	Harassment	99
5.4	Rearing Young	100
5.4.1	Communal Defence	100
5.4.2	Misdirected Parental Care	100
5.4.3	Other Costs: Stealing of Young, Cannibalism and Infanticide	101
5.5	Developmental Costs of Group Living	102
5.6	Homeostatic and Physiological Factors	103
5.6.1	Minimising Heat Loss	103
5.6.2	Minimising Water Loss	103
5.6.3	Oxygen Depletion	104

5.7	Parasites and Pathogens	105
5.7.1	Transmission of Pathogens and Parasites	105
5.7.2	Allogrooming.	105
5.7.3	Costs of Allogrooming.	106
5.8	Travelling Together	108
5.8.1	Energetic Benefits	108
5.8.2	Navigation	108
5.9	Summary	109
6	Distributions of Costs and Benefits Within Groups.	111
6.1	Introduction	111
6.2	Position-Related Differences in Costs and Benefits	111
6.2.1	Group Position and Predation Risk	112
6.2.2	Group Position and Foraging.	115
6.2.3	Travelling Efficiency in Moving Groups	116
6.2.4	Group Position and the Conservation of Resources.	118
6.3	Positional Preferences and the Trading-Off of Costs and Benefits	119
6.4	Dominance and the Costs and Benefits of Group Membership	121
6.4.1	Dominance and Positioning Behaviour in Groups	122
6.5	Summary	124
7	Group Size	125
7.1	Introduction	125
7.2	Group Size Distributions	126
7.2.1	Group Sizes in Open and Structured Environments: Ecological Versus Emergent Explanations.	127
7.2.2	Individual Behaviour and Fission-Fusion Models of Group Formation	127
7.3	Are Group Sizes Optimal?	128
7.3.1	Larger than Optimal Group Sizes: The Sibly Model	129
7.3.2	Accounting for Competitive Differences Between Individuals: Skew Theory	131
7.3.3	Accounting for Relatedness.	134
7.4	Proactive and Reactive Grouping Decisions: How Can Animals Modify Group Size?	135
7.4.1	Proactive Grouping Decisions	136
7.4.2	Reactive Grouping Decisions.	143
7.5	How Does Group Size Affect Behaviour?	146
7.6	Summary	148

8	Collective Decision-Making	149
8.1	Introduction	149
8.2	Information Acquisition and Information Transfer	150
8.3	Collective Decision-Making	154
8.3.1	Mechanisms for Consensus Decision-Making Based on Local Communication	156
8.3.2	Mechanisms for Consensus Decision-Making Based on Global Communication	159
8.3.3	Quorums and Consensus Decisions for Nest Sites in Social Insects.	160
8.4	Decision-Making and Leadership	162
8.4.1	Who Decides?	163
8.4.2	Leadership and Animal Personality	168
8.5	The Functional Benefits of Collective Decision-Making: How Good Are Collective Decisions?	169
8.6	Mechanisms Underlying Improvements in Decision-Making with Group Size	171
8.7	Summary	173
9	Development, Ontogeny and Parasite-Mediated Changes in Social Behaviour	175
9.1	Introduction	175
9.2	Ontogeny of Sociality	176
9.2.1	Animals that Aggregate Mainly in Early Life	176
9.2.2	Animals that Aggregate Mainly in Later Life	180
9.3	Effects of the Rearing Environment on the Development of Sociality	181
9.4	Ecological and Environmental Effects on the Expression of Social Behaviour	183
9.4.1	Induced Effects	183
9.4.2	Anthropogenic Impacts on Social Behaviour	184
9.4.3	The Effect of Parasites on the Expression of Social Behaviour	186
9.5	Summary	189
10	The Evolution of Group Living	191
10.1	Introduction	191
10.2	Variation and Heritability	193
10.2.1	Intrapopulation Variability in Sociability	193
10.2.2	Interpopulation Variation in Sociability	195
10.2.3	Shoaling in Fishes	196
10.2.4	Colonial Breeding in Birds	199
10.3	Phylogenetic Perspectives on the Evolution of Group Living	199
10.3.1	Eusocial Insects	200
10.3.2	Cooperative Breeding in Birds	201

10.3.3	Herd Sizes of African Antelopes	202
10.3.4	Primate Group Size and Structure	205
10.3.5	Flocking in Birds	208
10.4	Simulating the Evolution of Grouping and Coordinated Behaviour	208
10.5	Some Major Consequences Arising from the Transition to Sociality	211
10.5.1	Selection in Response to Disease and Parasite Exposure	211
10.5.2	Social Cognition	212
10.5.3	Culture	213
10.6	Summary	216
11	Conclusions	217
11.1	Mechanisms	217
11.1.1	Interaction Rules	217
11.1.2	Physiology	218
11.2	Functions	219
11.3	Development	221
11.4	Evolution	222
11.5	Last Word.	223
	Bibliography	225
	Index.	271