



UvA-DARE (Digital Academic Repository)

Outflying climate change

Optimal timing of migratory geese breeding in a warming Arctic

Lameris, T.K.

[Link to publication](#)

Creative Commons License (see <https://creativecommons.org/use-remix/cc-licenses/>):

Other

Citation for published version (APA):

Lameris, T. K. (2018). *Outflying climate change: Optimal timing of migratory geese breeding in a warming Arctic*.

General rights

It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations

If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: <https://uba.uva.nl/en/contact>, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.

Outflying climate change

Optimal timing of migratory geese
breeding in a warming Arctic

Thomas Koert Lameris



Outflying climate change:

Optimal timing of migratory geese
breeding in a warming Arctic



NETHERLANDS INSTITUTE OF ECOLOGY (NIOO-KNAW)
NETHERLANDS INSTITUTE OF ECOLOGY (NIOO-KNAW)



UNIVERSITEIT VAN AMSTERDAM

The research presented in this thesis was carried out in the Department of Animal Ecology of the Netherlands Institute of Ecology (NIOO-KNAW) and in the Computational and Theoretical Ecology group of the Institute for Biodiversity and Ecosystem Dynamics (IBED) at the University of Amsterdam.

This research was funded by the Netherlands Organisation for Scientific Research in an NWO-NPP grant awarded to Bart A. Nolet (866.13.010). GPS-trackers and other equipment were co-funded by the strategic fund of the Netherlands Institute of Ecology. Additional fieldwork on the Westplaat Buitengronden was funded by Van der Hucht De Beukelaar stichting.

This thesis should be cited as:

Lameris, T.K. (2018) Outflying climate change: Optimal timing of migratory geese breeding in a warming Arctic. PhD Thesis, University of Amsterdam, Amsterdam, The Netherlands.

Printing: Ridderprint BV - www.ridderprint.nl

Lay-out: Nikki Vermeulen - Ridderprint BV

Cover design: Nikolai Fomin

Photographs & artwork: Alena Lemazina (pp. 6), Olga Pokrovskaya (pp. 76), Erik Kleyheeg (pp. 90), Ilse Scholten (pp. 23, 67, 125), Jasper Koster (pp. 6, 7, 116, 166, 214, 240, 276), Kees Schreven (pp. 7), Margje de Jong (pp. 188), Stefan Sand (pp. 7).

ISBN: 978-94-91407-60-4

© 2018, Thomas Koert Lameris, the Netherlands

All rights reserved. No part of this thesis may be reproduced or transmitted in any form or print, photoprint, microfilm or other means, by any reason, without prior written permission of the author.

Outflying climate change:

Optimal timing of migratory geese
breeding in a warming Arctic

ACADEMISCH PROEFSCHRIFT

ter verkrijging van de graad van doctor

aan de Universiteit van Amsterdam

op gezag van de Rector Magnificus

prof. dr. ir. K.I.J. Maex

ten overstaan van een door het College voor Promoties ingestelde commissie,

in het openbaar te verdedigen in de Agnietenkapel

op vrijdag 18 mei 2018, te 14.00 uur

door

Thomas Koert Lameris

geboren te Groningen

Promotiecommissie

Promotores:	prof. dr. B.A. Nolet	Universiteit van Amsterdam
	prof. dr. ir. W. Bouten	Universiteit van Amsterdam
Copromotor:	dr. H.P. van der Jeugd	NIOO-KNAW
Overige leden:	prof. dr. J. Bêty	Université du Québec à Rimouski
	prof. dr. T. Piersma	Rijksuniversiteit Groningen
	prof. dr. A.M. de Roos	Universiteit van Amsterdam
	dr. J.Z. Shamoun-Baranes	Universiteit van Amsterdam
	dr. I.Y.M. Tulp	Wageningen Marine Research
	prof. dr. S.A. Wich	Universiteit van Amsterdam
Faculteit:	Faculteit der Natuurwetenschappen, Wiskunde en Informatica	

Contents

Chapter 1	General introduction	9
Part I: Predictions on climate warming effects		
Chapter 2	Forage plants of an Arctic-nesting herbivore show larger warming response in breeding than wintering grounds, potentially disrupting migration phenology	25
Chapter 3	Potential for an Arctic-breeding migratory bird to adjust spring migration phenology to Arctic amplification	45
Part II: Tracking migratory geese		
Box A	A novel harness for attaching tracking devices to migratory geese	69
Chapter 4	Implications of a modified harness for tracking device attachment on survival, migration and reproduction of migratory waterfowl	77
Chapter 5	Reduction in adverse effects of tracking devices on waterfowl requires better measuring and reporting	91
Box B	Detailed spring migration tracks of barnacle geese	117
Part III: Limitations in adjustment to climate warming		
Chapter 6	Keeping up with early springs: can avian herbivores advance fuelling for reproduction and migration?	127
Box C	Habitat switch in a migrating herbivore: individual variation in switching behaviour of pre-migratory Barnacle Geese	153
Chapter 7	Arctic geese tune migration to a warming climate but still suffer from a phenological mismatch	167
Chapter 8	Reproductive benefits of a warming climate differ between barnacle geese breeding in the low and high Arctic	189
Chapter 9	Synthesis: Optimal timing of migratory geese breeding in a warming Arctic.	215
	References	242
	Author contributions	273
	Affiliations of co-authors	274
	Summary / Samenvatting / Резюме	277
	Acknowledgements	292