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Supporting Information for

The effect of climate change on offspring production in 201 avian populations: a global meta-analysis

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Supporting Text S1. Details about the criteria to classify the species as single- or multi-brooded.

Because we were unable to find precise definitions of single- and multi-brooded species or populations (Svensson 1995, Anim. Behav. 49: 1569-1575; Dhondt 2010, J. Ornithol. 151: 955-957), we generated our own definition based on the frequency of second broods. A large fraction of species in our data set did not produce second broods, and populations of such species were classified as single-brooded (n = 155). Among the remaining species, there was large variation in the mean proportion of pairs raising second broods in a year (0.06 – 83.6%), the maximum proportion of pairs raising second broods in any one year (1.2 – 96%), and the proportion of study years during which second broods were observed (3 – 100%). These three variables correlated significantly with one another, especially the first and second (r_S = 0.92, p = 0.001), indicating that populations with few second broods also had relatively low maximum proportion of females with second broods recorded in any one year. Consequently, we used the two first criteria to classify a population as single- or multi-brooded. A population was classified as single brooded if the mean annual proportion of females with second broods was < 5% and the proportion of second broods never exceeded 30%. Following this definition, 29 populations were classified as multi-brooded while the remaining 172 were considered single-brooded (Table S1).

Supporting Text S2. Sources of literature data included in the meta-analysis.

Dragoo, D. E., G. Thomson, & M. D. Romano. 2017. Biological monitoring at Cape Lisburne, Alaska in 2017. U. S. Fish and Wildl. Serv. Report AMNWR 2017/15. Homer, Alaska.

Drummond, B. A. & J. C. Williams. 2015. Biological monitoring in the central Aleutian Islands, Alaska in 2009-2015. U.S. Fish and Wildl. Serv. Rep., AMNWR 2015/16. Homer, Alaska

Evans, S. A., D. J. Schultz, & N. A. Rojek. 2017. Biological monitoring at Chowiet Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2017/18. Homer, Alaska.

Evans, S. A., D. J. Schultz, & B. A. Drummond. 2018. Biological monitoring at Saint Lazaria Island, Alaska in 2018. U.S. Fish and Wildl. Serv. Rep., AMNWR 2018/19. Homer, Alaska.

Hatch, S. 2017. Middleton Island Seabird Research and Monitoring. 2017. Field Report. Institute for Seabird Research and Conservation.

Kettle, A.B. 2017. Biological monitoring at East Amatuli Island, Alaska in 2016. U.S. Fish and Wildlife Service Report, AMNWR 2017/08. Homer, Alaska

Mong, R. N. & M. D. Romano. 2017. Biological monitoring at St. Paul Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2017/16. Homer, Alaska.

Morgan, D., Barth, M. & Kinloch, M. 2015. The South Australian subspecies of the glossy black-cockatoo (*Calyptorhynchus lathami halmaturinus*) Strategic Plan 2015–2020. A report by Natural Resources Kangaroo Island for the Kangaroo Island Natural Resources Management Board. Australian Government.

Moss, R., Oswald, J. & Baines, D. 2001. Climate Change and Breeding Success: Decline of the Capercaillie in Scotland. *Journal of Animal Ecology* 70: 47–61.

Murphy, E.C., Roseneau, D.G., Springer, A.M. & Byrd, G.V. 2016. Breeding chronology and productivity of Black-legged Kittiwakes *Rissa tridacytla* at Bluff, Alaska, 1975–2008: Associations with regional environmental indices and distant colonies. *Marine Ornithology* 44: 183–201.

Osa, Y, Watanuki, Y. 2002. Status of Seabirds Breeding in Hokkaido. *Journal of the Yamashina Institute for Ornithology* 33: 107–141.

Pietrzak, K. W., M. L. Mudge, S. L. Walden, & N. A. Rojek. 2017. Biological monitoring at Buldir Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2017/17 Homer, Alaska.

Phillips, H.J. 1985. The breeding biology of White-tailed Tropicbirds *Phaethon lepturus* at Cousin Island, Seychelles. Ibis 129: 10–24.

Pollom, E. L., J. P. Gorey & M. D. Romano. 2018. Biological monitoring at St. George Island, Alaska in 2017. U.S. Fish and Wildlife Service. Rep., AMNWR 2018/01. Homer, Alaska.

Ramos, J., Bowler, J., Betts, M., Pacheco, C., Agombar, J., Bullock, I., & Monticelli, D. 2005. Productivity of White-Tailed Tropicbird on Aride Island, Seychelles. *Waterbirds: The International Journal of Waterbird Biology 28:* 405–410.

Ramos, J.A. & Monticelli, D. 2007. Long-term studies on productivity of Roseate Terns and Lesser Noddies on Aride Island, Seychelles. *Ostrich* 78: 443 – 447.

Seward, A., Ratcliffe, N., Newton, S., et al. 2019. Metapopulation dynamics of roseate terns: Sources, sinks and implications for conservation management decisions. *J. Anim. Ecol*. 88: 138–153.

Turner, D.M. 2010. Counts and breeding success of Black-legged Kittiwakes *Rissa tridactyla* nesting on man-made structures along the River Tyne, northeast England, 1994–2009. *Seabird* 23: 11–126.

Turner, D.M. 2014. Summary of kittiwake breeding data on the River Tyne, northeast England, 2010–2013. *Birds in Northumbria 2013:* 206–208, Northumberland and Tyneside Bird Club.

Turner, D.M. 2015. Summary of Black-legged Kittiwake *Rissa tridactyla* breeding data recorded on the River Tyne, northeast England, during 2010–2015. Natural History Society of Northumbria website (www.nhsn.ncl.ac.uk).

Turner, D.M. 2016. Summary of Black-legged Kittiwake *Rissa tridactyla* breeding data recorded on the River Tyne, northeast England, during 2016. Natural History Society of Northumbria website (www.nhsn.ncl.ac.uk).

Turner, D.M. 2017. Summary of Black-legged Kittiwake *Rissa tridactyla* breeding data recorded on the River Tyne, northeast England, during 2017. Natural History Society of Northumbria website (www.nhsn.ncl.ac.uk).

Watanuki, Y. & Ito, M. 2012. Climatic effects on breeding seabirds of the northern Japan Sea. *Marine Ecology Progress Series* 454: 183–196.

Wegge, P. & Rolstad, J. 2017. Climate change and bird reproduction: warmer springs benefit breeding success in boreal forest grouse. *Proc. R. Soc. B* 284 (1866): 20171528.

Surmacki, A., Stępniewski, J. 2007. Do weather conditions affect the dynamics of bearded tit *Panurus biarmicus* populations throughout the year? A case study from western Poland. *Ann. Zool. Fennici* 44: 35–42.

Youngren, S. M., D. C. Rapp, and N. A. Rojek. 2018. Biological monitoring at Aiktak Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2018/03. Homer, Alaska

Zbyryt, A., Kapowicz, E., Kapowicz, R., Zub, K. 2016. Numbers, density and breeding success of the Lesser Spotted Eagle Clanga pomarina in the Knyszyn Forest (NE Poland) in 1999 – 2015. *Ornis Polonica* 57: 237–247.

Supporting Text S3. Details about the process of searching for breeding data from the authors of long-term studies: numbers of negative replies or unsuitable data sets.

Between October 2018 and April 2019, we contacted 313 authors of long-term studies asking them whether their data met our criteria, and whether they would like to collaborate in the meta-analysis project. When the authors replied positively, but failed to provide their data within two months, we sent them a reminder. If they responded to the reminder, but did not send the data, we sent them another reminder, and if they still failed to provide any data we did not follow up. In total: 101 authors shared their data; 37 replied positively, but did not provide data; 43 responded positively, but their data did not meet our criteria for inclusion; 106 did not reply to our contacts; 10 replied that they were not in charge of the data; and 16 would not share their data. As some authors provided data on several species, we obtained data on 87 species and 129 populations.

Supporting Text S4. Problems with species number analyzed in this study.

In Supporting Tables there are names of 105 species, whose data were used in this study. However, two of them: Cory's shearwater (*Calonectris borealis*) and Scopoli's shearwater (*Calonectris diomedea*) were officially separated about 10 years ago, while species lists used for constructions of phylogenetic trees are rarely updated. Because *Calonectris borealis* is not present on these lists, and all our analyses include phylogenetical corrections, they are based on 104 species.

Table S1. Population identities (id pop); species names; data sources (the name of the main author of dataset or citation of publication from which data were extracted; year of publication in brackets); total number of study years; first and last year of the study; number of analyzed females and clutches; number of broods (refers to classification of a population as single-brooded (1) or multi-brooded (2)); information about the status of the study area (protected – 1, non-protected – 0); the presence of protection of nests against predators (yes – 1, no – 0); nest-box study (yes – 1, no – 0); effect sizes and their standard errors (see Methods).

id pop	Species	source	n study years	first study year	last study year	n clutches	n broods	protected area	protected nests	nest-boxes	slope	slope SE
1	Accipiter cooperi	Robert N. Rosenfield	39	1980	2018	669	1	0	0	0	0.025	0.014
2	Accipiter gentilis	Jan Tøttrup Nielsen	41	1977	2017	2006	1	0	0	0	-0.007	0.014
3	Accipiter gentilis	Jere Tolvanen	29	1990	2018	413	1	0	0	0	-0.019	0.023
4	Accipiter nisus	Jan Tøttrup Nielsen	19	1978	1997	649	1	0	0	0	0.080	0.036
5	Acrocephalus scirpaceus	Lucyna Halupka	14	1980	2012	816	2	1	0	0	0.053	0.018
6	Aegolius funereus	Markéta Zárybnická	19	2000	2018	323	1	0	0	1	-0.018	0.044
7	Aegolius funereus	Pierre-Alain Ravussin	32	1987	2018	614	1	0	1	1	-0.003	0.020
8	Aegolius funereus	Erkki Korpimäki	21	1977	1997	921	1	0	0	1	-0.062	0.035
9	Aethia cristatella	Pietrzak et al. (2017)	29	1988	2017	1608	1	1	0	0	0.008	0.022
10	Aethia cristatella	Elena Yu. Golubova	28	1987	2018	1576	1	1	0	0	-0.038	0.019
11	Aethia psittacula	Pietrzak et al. (2017)	26	1991	2017	1223	1	1	0	0	-0.012	0.026
12	Aethia psittacula	Evans et al (2017)	15	1976	2017	523	1	1	0	0	0.023	0.028
13	Aethia psittacula	Elena Yu. Golubova	28	1987	2018	1265	1	1	0	0	-0.018	0.020
14	Aethia pusilla	Pietrzak et al. (2017)	29	1988	2017	1366	1	1	0	0	0.046	0.020
15	Aethia pygmaea	Pietrzak et al. (2017)	26	1991	2017	1599	1	1	0	0	0.036	0.025
16	Alca torda	Robert T. Barrett	21	1981	2013	1117	1	1	0	0	-0.043	0.022
17	Alectrurus risora	Adrián S. Di Giacomo	15	2004	2018	332	2	1	0	0	-0.057	0.062
18	Anous tenuirostris	Ramos & Monticelli (2007)	15	1987	2002	1717	1	1	0	0	-0.081	0.054
19	Apus apus	Heikki Kolunen	39	1979	2017	1092	1	0	0	1	0.015	0.014
20	Branta leucopsis	Jouke Prop	14	1978	2018	2291	1	1	0	0	-0.047	0.013
21	Bucephala clangula	Hannu Pöysä	23	1995	2017	643	1	0	0	1	-0.015	0.033
22	Bucorvus cafer	Kate F. Carstens	15	2001	2015	158	1	1	0	1	-0.010	0.058
23	Bulweria bulwerii	Verónica C. Neves	12	2002	2017	522	1	1	0	0	0.196	0.046
24	Calonectris borealis	Joël Bried	12	1994	2012	851	1	1	0	0	-0.014	0.067
25	Calonectris diomedea	Daniel Oro	18	2001	2018	2888	1	1	0	0	0.039	0.047
26	Calyptorhynchus lathami	Morgan et al. (2015)	20	1995	2014	1125	1	1	0	0	0.017	0.041

	halmaturinus											
27	Calyptorhynchus latirostris	Denis A. Saunders	29	1970	2018	1843	1	0	0	0	0.002	0.012
28	Cerorhinca monocerata	Watanuki & Ito (2012)	21	1992	2009	798	1	1	0	0	-0.091	0.042
29	Cerorhinca monocerata	Evans et al (2018)	24	1994	2018	4180	1	1	0	0	0.114	0.018
30	Chroicocephalus ridibundus	Dariusz Bukaciński	21	1985	2018	5145	1	0	0	0	-0.008	0.021
31	Ciconia ciconia	Andrzej Wuczyński	29	1989	2017	625	1	0	0	0	-0.011	0.023
32	Ciconia ciconia	Beata Orłowska	19	1991	2014	1645	1	1	0	0	-0.007	0.037
33	Ciconia ciconia	Marcin Tobolka	31	1974	2017	8690	1	0	0	0	0.012	0.013
34	Ciconia ciconia	Anna Chernomorets	14	2004	2018	288	1	0	0	0	-0.140	0.050
35	Ciconia ciconia	Irina E. Samusenko	13	2004	2018	2386	1	0	0	0	-0.171	0.054
36	Circus cyaneus	Alexandre Millon	21	1993	2017	1572	1	0	1	0	-0.026	0.029
37	Circus pygargus	Pascal Albert	25	1993	2017	2673	1	0	1	0	-0.003	0.029
38	Circus pygargus	Thierry Printemps	19	2000	2018	817	1	0	1	0	-0.040	0.043
39	Circus pygargus	Jarosław Wiącek	16	1990	2012	125	1	1	0	0	-0.124	0.015
40	Clanga clanga	Valery C. Dombrovski	12	2001	2017	386	1	1	0	0	-0.052	0.072
41	Clanga pomarina	Zbyryt et al (2015)	17	1999	2015	360	1	1	0	0	-0.054	0.051
42	Colaptes auratus	Karen L. Wiebe	16	1998	2013	2063	1	0	0	0	-0.066	0.055
43	Corvus corone	Vittorio Baglione	16	1995	2018	1786	1	0	0	0	-0.016	0.031
44	Cyanistes caeruleus	Jaime Potti	30	1984	2017	659	1	1	0	1	0.003	0.019
45	Cyanistes caeruleus	János Török	11	1982	2014	789	1	0	0	1	0.017	0.019
46	Cyanistes caeruleus	Jerzy Bańbura	11	2003	2018	372	1	0	0	1	0.064	0.065
47	Cyanistes caeruleus	Marcel E. Visser	49	1970	2018	2575	1	1	0	1	-0.014	0.010
48	Cyanistes caeruleus	Marcel E. Visser	49	1970	2018	1144	1	1	0	1	0.024	0.010
49	Cyanistes caeruleus	Marcel E. Visser	48	1970	2018	1014	1	1	0	1	0.009	0.010
50	Cyanistes caeruleus	Marcel E. Visser	49	1970	2018	2401	2	1	0	1	-0.008	0.010
51	Cygnus bewickii	Diana V. Solovyeva	11	2004	2018	256	1	0	0	0	-0.049	0.089
52	Delichon urbicum	Alfonso Marzal	15	1985	2011	2004	2	0	0	0	-0.092	0.026
53	Diomedea exulans	Richard A. Phillips	38	1979	2016	42403	1	0	0	0	0.030	0.015
54	Falco naumanni	Inês Catry	16	2003	2018	5499	1	1	0	0	0.101	0.058
55	Falco tinnunculus	Juan Antonio Fargallo	23	1994	2017	678	1	1	0	1	-0.048	0.030
56	Ficedula albicollis	Milos Krist	17	1998	2017	1292	1	0	1	1	0.026	0.040
57	Ficedula albicollis	Peter Adamík	18	2000	2017	1379	1	0	1	1	0.028	0.048
58	Ficedula albicollis	János Török	34	1982	2015	7686	1	0	0	1	0.063	0.014
59	Ficedula hypoleuca	Jaime Potti	33	1984	2017	3818	1	1	0	1	0.029	0.017
60	Ficedula hypoleuca	Tapio Eeva	27	1991	2017	3124	1	0	1	1	0.003	0.026
61	Ficedula hypoleuca	Alexander V. Artemyev	38	1980	2017	3795	1	1	0	1	-0.015	0.015

62	Ficedula hypoleuca	Marcel E. Visser	49	1970	2018	4238	1	1	0	1	0.015	0.010
63	Ficedula hypoleuca	E. Belskii. A. Lyakhov	28	1989	2017	1617	1	0	0	1	-0.002	0.024
64	Ficedula hypoleuca	Boris D. Kuranov	28	1987	2018	1843	1	0	0	1	0.038	0.020
65	Ficedula hypoleuca	Mirosława Bańbura	11	2002	2018	254	1	0	0	1	0.049	0.074
66	Ficedula hypoleuca	Indrikis Krams	30	1989	2018	1978	1	0	0	1	-0.035	0.021
67	Fratercula arctica	Robert T. Barrett	29	1980	2013	1144	1	1	0	0	-0.059	0.017
68	Fratercula cirrhata	Youngren et al. (2018)	22	1995	2017	1398	1	1	0	0	0.032	0.032
69	Fratercula cirrhata	Pietrzak et al. (2017)	30	1988	2017	707	1	1	0	0	-0.008	0.022
70	Fratercula cirrhata	Evans et al (2017)	13	1976	2017	582	1	1	0	0	0.011	0.030
71	Fratercula cirrhata	Elena Yu. Golubova	28	1987	2018	1510	1	1	0	0	-0.019	0.020
72	Fratercula corniculata	Youngren et al. (2018)	16	1998	2017	179	1	1	0	0	0.043	0.046
73	Fratercula corniculata	Pietrzak et al. (2017)	30	1988	2017	1019	1	1	0	0	0.019	0.022
74	Fratercula corniculata	Evans et al (2017)	15	1976	2017	778	1	1	0	0	-0.013	0.029
75	Fratercula corniculata	Elena Yu. Golubova	28	1987	2018	2536	1	1	0	0	-0.004	0.020
76	Fulmarus glacialis	Paul M. Thompson	48	1970	2018	5946	1	0	0	0	-0.015	0.010
77	Gypaetus barbatus	Antoni Margalida	25	1992	2016	640	1	1	0	0	-0.084	0.023
78	Gypaetus barbatus	Sonja Krüger	17	2002	2018	228	1	0	0	0	-0.009	0.053
79	Haematopus bachmani	Youngren et al. (2018)	21	1997	2017	251	1	1	0	0	0.076	0.033
80	Haematopus ostralegus	Martijn van de Pol	30	1984	2013	4101	1	1	0	0	-0.058	0.019
81	Hirundo rustica	Anders P. Møller	35	1984	2018	4884	2	0	0	0	-0.047	0.015
82	Hirundo rustica	Florentino de Lope	10	1990	2006	779	2	0	0	0	0.111	0.056
83	Jynx torquilla	Michael Schaub	17	2002	2018	588	2	0	0	1	0.119	0.043
84	Lamprotornis superbus	Dustin R. Rubenstein	17	2002	2018	1135	2	0	0	0	-0.081	0.048
85	Larus canus	Monika Bukacińska	23	1983	2018	5666	1	0	0	0	-0.052	0.015
86	Larus crassirostris	Watanuki & Ito (2012)	21	1992	2009	1407	1	1	0	0	0.070	0.051
87	Larus glaucescens	Youngren et al. (2018)	23	1995	2017	2579	1	1	0	0	-0.075	0.029
88	Larus glaucescens	Pietrzak et al. (2017)	20	1997	2017	754	1	1	0	0	0.029	0.039
89	Larus glaucescens	Evans et al (2017)	15	1998	2017	2397	1	1	0	0	0.100	0.044
90	Larus glaucescens	Evans et al (2018)	24	1994	2018	2162	1	1	0	0	-0.027	0.030
91	Macronectes giganteus	Andrew G. Wood	17	1978	2017	3918	1	0	0	0	-0.050	0.014
92	Macronectes halli	Andrew G. Wood	17	1978	2017	7353	1	0	0	0	-0.045	0.015
93	Malurus elegans	Lyanne Brouwer	18	1980	2018	1226	2	1	0	0	-0.060	0.008
94	Margarops fuscatus	Wayne J. Arendt	19	1979	2000	998	2	1	0	1	-0.08	0.03
95	Melanerpes formicivorus	Walter D. Koenig	39	1980	2017	1133	2	1	0	0	0.027	0.015
96	Mergus squamatus	Diana V. Solovyeva	15	2004	2018	194	1	0	0	1	-0.026	0.064
97	Milvus migrans	Fabrizio Sergio	16	1989	2013	650	1	1	0	0	-0.003	0.034

98	Oceanodroma furcata	Youngren et al. (2018)	18	1995	2017	795	1	1	0	0	-0.044	0.039
99	Oceanodroma furcata	Pietrzak et al. (2017)	32	1974	2017	1790	1	1	0	0	0.011	0.016
100	Oceanodroma furcata	Kettle (2017)	17	1998	2016	1519	1	1	0	0	0.125	0.037
101	Oceanodroma furcata	Evans et al (2018)	23	1995	2018	2809	1	1	0	0	0.027	0.032
102	Oceanodroma furcata	Drummond & Williams (2015)	15	1996	2015	594	1	1	0	0	0.010	0.053
103	Oceanodroma leucorhoa	Youngren et al. (2018)	18	1995	2017	1332	1	1	0	0	0.019	0.041
104	Oceanodroma leucorhoa	Pietrzak et al. (2017)	32	1974	2017	1859	1	1	0	0	0.057	0.012
105	Oceanodroma leucorhoa	Evans et al (2018)	23	1995	2018	2141	1	1	0	0	-0.001	0.032
106	Oceanodroma monteiroi	Mark Bolton	19	2000	2018	985	1	1	0	1	-0.065	0.041
107	Oenanthe oenanthe	Debora Arlt	26	1993	2018	1390	1	0	0	0	-0.015	0.027
108	Pachyptila belcheri	Petra Quillfeldt	10	2002	2018	748	1	1	0	0	-0.042	0.064
109	Panurus biarmicus	Janusz Stępniewski	10	1988	2018	242	2	0	0	0	0.027	0.028
110	Parus major	Marcel E. Visser	49	1970	2018	7749	2	1	0	1	-0.026	0.010
111	Parus major	Marcel E. Visser	49	1970	2018	2419	2	1	0	1	-0.011	0.010
112	Parus major	Marcel E. Visser	49	1970	2018	2538	2	1	0	1	-0.030	0.009
113	Parus major	Marcel E. Visser	49	1970	2018	9344	2	1	0	1	-0.032	0.009
114	Parus major	Juan C. Senar	21	1998	2018	928	2	1	1	1	0.062	0.035
115	Parus major	Emilio Barba	23	1993	2015	2677	2	0	0	1	0.076	0.028
116	Parus major	János Török	33	1982	2014	1509	1	0	0	1	0.043	0.017
117	Parus major	Indrikis Krams	30	1989	2018	2426	2	0	0	1	0.012	0.022
118	Passer domesticus	David F. Westneat	26	1993	2018	4674	2	0	1	1	-0.042	0.026
119	Passerculus sandwichensis	Nathaniel T. Wheelwright	19	1987	2005	1678	2	1	0	0	-0.017	0.048
120	Perisoreus infaustus	Michael Griesser	18	1990	2013	503	1	0	0	0	0.045	0.037
121	Phaethon lepturus	Ramos et al. (2005)	10	1989	2002	661	1	1	0	0	0.027	0.078
122	Phalacrocorax auritus	Youngren et al. (2018)	12	2000	2017	206	1	1	0	0	-0.040	0.064
123	Phalacrocorax capillatus	Watanuki & Ito (2012)	21	1992	2009	924	1	1	0	0	-0.059	0.046
124	Phalacrocorax pelagicus	Youngren et al. (2018)	16	1995	2017	400	1	1	0	0	-0.051	0.038
125	Phalacrocorax pelagicus	Pietrzak et al. (2017)	26	1974	2017	1227	1	1	0	0	0.019	0.023
126	Phalacrocorax pelagicus	Evans et al (2018)	22	1995	2016	2610	1	1	0	0	-0.066	0.032
127	Phalacrocorax pelagicus	Hatch (2017)	16	2002	2017	1440	1	1	0	0	-0.044	0.057
128	Phalacrocorax urile	Youngren et al. (2018)	13	1997	2017	828	1	1	0	0	-0.024	0.052
129	Phalacrocorax urile	Pollom et al. (2018)	18	2000	2017	903	1	1	0	0	-0.066	0.045
130	Phalacrocorax urile	Mong et al. (2017)	33	1975	2017	2071	1	1	0	0	0.017	0.014
131	Phalacrocorax urile	Drummond & Williams (2015)	12	1997	2015	482	1	1	0	0	-0.017	0.063
132	Philetairus socius	Rita Covas	10	1999	2017	4683	2	1	0	0	0.020	0.059
133	Phoebastria immutabilis	Donald C. Dearborn	19	1980	1998	22871	1	1	0	0	0.019	0.044

134	Phoebastria nigripes	Donald C. Dearborn	18	1981	1998	11464	1	1	0	0	0.103	0.041
135	Phoenicurus phoenicurus	Jiří Porkert	15	1994	2014	267	2	0	0	1	-0.018	0.044
136	Phoenicurus phoenicurus	Sergey I. Gashkov	24	1995	2018	383	1	0	0	1	0.032	0.030
137	Plectrophenax nivalis	Yngve Espmark	16	1998	2013	1273	1	0	0	0	0.058	0.056
138	Podiceps grisegena	Janusz Kloskowski	19	1996	2014	435	1	0	0	0	0.075	0.040
139	Protonotaria citrea	Jeffrey P. Hoover	19	1994	2012	6969	2	1	0	1	0.056	0.042
140	Protonotaria citrea	Lesley Bulluck	23	1995	2017	3286	2	0	0	1	0.064	0.030
141	Pygoscelis adeliae	Louise M. Emmerson	19	1990	2008	37093	1	1	0	0	-0.073	0.041
142	Pygoscelis adeliae	Michael J. Dunn	22	1996	2018	35489	1	1	0	0	0.033	0.034
143	Pygoscelis antarcticus	Małgorzata Korczak-Abshire	17	1977	2017	7634	1	1	0	0	-0.003	0.021
144	Rissa brevirostris	Pietrzak et al. (2017)	30	1988	2017	3197	1	1	0	0	0.015	0.022
145	Rissa brevirostris	Pollom et al. (2018)	35	1981	2017	18534	1	1	0	0	-0.004	0.017
146	Rissa brevirostris	Mong et al. (2017)	35	1975	2017	1385	1	1	0	0	0.023	0.020
147	Rissa tridactyla	Turner (2010, 2016, 2017)	17	2000	2017	15408	1	0	0	0	0.010	0.048
148	Rissa tridactyla	Robert T. Barrett	30	1980	2013	42202	1	1	0	0	-0.058	0.017
149	Rissa tridactyla	Mong et al. (2017)	35	1975	2017	11528	1	1	0	0	-0.021	0.013
150	Rissa tridactyla	Murphy et al. (2016)	31	1975	2008	5065	1	1	0	0	-0.008	0.018
151	Rissa tridactyla	Pietrzak et al. (2017)	30	1988	2017	9894	1	1	0	0	0.006	0.022
152	Rissa tridactyla	Dragoo et al. (2017)	23	1983	2017	3811	1	1	0	0	-0.032	0.025
153	Rissa tridactyla	Evans et al (2017)	22	1979	2017	5015	1	1	0	0	-0.016	0.018
154	Rissa tridactyla	Kettle (2017)	22	1993	2016	7382	1	1	0	0	-0.066	0.032
155	Rissa tridactyla	Pollom et al. (2018)	35	1981	2017	8654	1	1	0	0	0.005	0.017
156	Rissa tridactyla	Hatch (2017)	22	1996	2017	2958	1	1	0	0	-0.027	0.035
157	Rissa tridactyla	Elena Yu. Golubova	28	1988	2018	3085	1	1	0	0	-0.055	0.019
158	Rissa tridactyla	Drummond & Williams (2015)	12	1996	2010	4359	1	1	0	0	0.042	0.076
159	Somateria fischeri	Diana V. Solovyeva	16	2002	2018	1088	1	0	0	0	-0.090	0.048
160	Somateria mollissima	Markus Öst	15	2002	2018	3367	1	1	0	0	-0.113	0.054
161	Sterna dougallii	Seward et al (2018)	25	1992	2016	1552	1	1	0	0	-0.017	0.029
162	Sterna dougallii	Seward et al (2018)	25	1992	2016	5672	1	1	0	0	-0.079	0.024
163	Sterna dougallii	Seward et al (2018)	20	1992	2016	1876	1	1	0	0	0.007	0.033
164	Sterna dougallii	Jaime A. Ramos	21	1987	2010	8144	1	1	0	0	0.006	0.035
165	Sterna hirundo	Peter H. Becker	26	1992	2017	4077	1	1	1	0	-0.051	0.025
166	Strix aluco	Tapio Solonen	25	1988	2017	605	1	0	0	1	0.024	0.024
167	Strix aluco	Patrik Karell	40	1979	2018	1025	1	0	0	1	-0.022	0.014
168	Strix aluco	Xavier Lambin	31	1980	2010	1106	1	0	0	1	-0.008	0.021
169	Strix uralensis	Hannu Pietiäinen	41	1977	2017	1798	1	0	0	1	0.009	0.013

170	Sturnus unicolor	Vicente Polo	17	2001	2017	1216	2	1	0	1	0.021	0.052
171	Sturnus vulgaris	Alexander Numerov	20	1990	2017	337	1	0	0	1	0.017	0.030
172	Sula nebouxii	Hugh Drummond	26	1993	2018	22221	1	1	0	0	-0.052	0.025
173	Synthliboramphus antiquus	Youngren et al. (2018)	27	1997	2017	1201	1	1	0	0	0.079	0.033
174	Synthliboramphus antiquus	Elena Yu. Golubova	27	1988	2018	1932	1	1	0	0	0.044	0.022
175	Tachycineta bicolor	Michael P. Lombardo	27	1992	2018	1689	1	0	1	1	0.003	0.026
176	Tachycineta bicolor	Nathaniel T. Wheelwright	20	1987	2006	885	1	1	0	1	0.005	0.041
177	Tachymarptis melba	Pierre Bize	20	1999	2018	948	1	0	1	0	0.016	0.041
178	Tachymarptis melba	Pierre Bize	19	2000	2018	1445	1	0	1	0	-0.027	0.044
179	Tetrao tetrix	Wegge & Rolstad (2017)	38	1979	2016	842	1	0	0	0	0.032	0.014
180	Tetrao urogallus	Wegge & Rolstad (2017)	38	1979	2016	1018	1	0	0	0	0.034	0.014
181	Tetrao urogallus	Moss et al. (2001)	24	1975	1998	320	1	0	0	0	-0.095	0.023
182	Thalassarche chrysostoma	Richard A. Phillips	28	1989	2016	4954	1	0	0	0	-0.028	0.024
183	Thalassarche melanophris	Richard A. Philiips	35	1983	2017	11941	1	0	0	0	0.005	0.018
184	Troglodytes aedon	E. Keith Bowers	39	1980	2018	13418	2	1	1	1	0.014	0.014
185	Turdus merula	Dariusz Wysocki	21	1997	2017	2320	2	0	0	0	-0.031	0.037
186	Tyto alba	Alexandre Roulin	28	1990	2017	1564	2	0	0	1	0.033	0.023
187	Tyto alba	Motti Charter	15	2002	2016	1878	1	0	0	1	-0.072	0.061
188	Uria aalge	Mike P. Harris	36	1982	2017	28649	1	1	0	0	-0.035	0.015
189	Uria aalge	Mong et al. (2017)	31	1976	2017	3765	1	1	0	0	-0.039	0.015
190	Uria aalge	Youngren et al. (2018)	22	1995	2017	805	1	1	0	0	-0.028	0.033
191	Uria aalge	Evans et al (2017)	22	1979	2017	4765	1	1	0	0	-0.024	0.018
192	Uria aalge	Evans et al (2018)	24	1994	2018	1650	1	1	0	0	-0.018	0.030
193	Uria aalge	Pollom et al. (2018)	34	1978	2017	3366	1	1	0	0	-0.033	0.016
194	Uria aalge	Elena Yu. Golubova	21	1987	2018	4411	1	1	0	0	-0.029	0.027
195	Uria lomvia	Pollom et al. (2018)	35	1981	2017	21764	1	1	0	0	-0.049	0.015
196	Uria lomvia	Mong et al. (2017)	33	1976	2017	11065	1	1	0	0	-0.025	0.014
197	Uria lomvia	Youngren et al. (2018)	22	1995	2017	500	1	1	0	0	-0.053	0.031
198	Uria lomvia	Pietrzak et al. (2017)	30	1988	2017	7625	1	1	0	0	-0.070	0.017
199	Uria lomvia	Evans et al (2017)	22	1979	2017	2699	1	1	0	0	-0.031	0.017
200	Uria lomvia	Evans et al (2018)	24	1994	2018	949	1	1	0	0	0.005	0.030
201	Uria lomvia	Elena Yu. Golubova	21	1987	2018	1436	1	1	0	0	-0.012	0.027

Table S2. Akaike information criterion values for meta-regression models explaining heterogeneity in annual changes in three fitness-related traits. In all models, phylogenetic correlations between species and population and species identifiers were included as random factors. Each model includes the same set of fixed predictor variables: *ln* body mass, number of broods, migratory habits, and the change in local temperature. Additionally, models included all possible interactions between predictor variables (up to four-way) or two-way interactions with the change in local temperature over five periods of the breeding season. The best model for each examined trait is shown in bold; we arbitrarily selected the model of changes in clutch size with temperatures in egg-laying period as the best.

Model	Pre-laying	Egg laying	Egg laying & incubation	Nestling	Whole season
Changes in productivity					
All possible interactions	-573	-576	-580	-590	-585
All two-way interactions with temp.	-618	-615	-617	**-622**	-619
Changes in clutch size					
All possible interactions	-267	-270	-265	-285	-269
All two-way interactions with temp.	-312	**-315**	-310	-315	-311
Changes in nest success					
All possible interactions	370	371	376	369	369
All two-way interactions with temp.	**360**	374	373	369	370

Table S3. Meta-regression model of annual changes in offspring production. This model is similar to the model listed in the left section of Table 2, and the only change is the addition of a new fixed predictor: nest boxes (binary: 0 = birds used natural nest sites, 1 = birds nested in nest-boxes). Beta coefficients whose 95% confidence limits (c.l.) do not include zero are shown in bold.

Term	Beta coefficients and their confidence intervals		
Intercept	0.005	-0.044	0.053
Log(body mass)	-0.004	-0.010	0.003
Migratory habits (sedentary vs migratory)	0.011	-0.011	0.033
Number of broods (single- vs multi-brooded)	-0.021	-0.056	0.014
Nest boxes (yes = 1)	-0.003	-0.022	0.016
Change in temperature	**1.276**	**0.263**	**2.289**
Log (body mass) x change in temperature	**-0.141**	**-0.274**	**-0.008**
Migratory habits x change in temperature	**-0.624**	**-1.180**	**-0.068**
Number of broods x change in temperature	0.003	-0.732	0.737

Table S4. Population identities (id pop), species names, data sources (the name of the main author of dataset or citation of publication from which data were extracted, year of publication in brackets), and references describing field methods used in studies of the focal populations (or text, if references in English are not available).

id pop	Species	source	references
1	Accipiter cooperi	Robert N. Rosenfield	Rosenfield, R.N., W.E. Stout, M.D. Giovanni, N.H. Levine, J.A. Cava, M.G. Hardin & T.G. Haynes, T.G. 2015. Does breeding population trajectory and age of nesting females influence disparate nestling sex ratios in two populations of Cooper's Hawks. Ecology and Evolution 5: 4037–4048. Rosenfield, R.N., J. Bielefeldt, T.L. Booms, J.A. Cava, and M.A. Bozek. 2013. Life-history trade-offs of breeding in one-year-old male Cooper's Hawks. Condor 115: 306–315.
2	Accipiter gentilis	Jan Tøttrup Nielsen	Herfindal, I., van de Pol, M., Nielsen, J. T., Sæther, B.-E. & Møller, A. P. 2015: Climatic conditions cause complex patterns of covariation between demographic traits in a long-lived raptor. J. Anim. Ecol. 84:702-711. Nielsen, J.T. & J. Drachmann 1999: Development and productivity in a Danish Goshawk *Accipiter gentilis* population. Dansk Orn. Foren. Tidsskr. 93: 153–161.
3	Accipiter gentilis	Jere Tolvanen	Tolvanen et al. 2017 Apparent survival, territory turnover and site fidelity rates in Northern Goshawk *Accipiter gentilis* populations close to the northern range limit. Bird Study 64:168–177. Steenhof & Newton 2007 Assessing nesting success and productivity. In: Bird, D.M. & Bildstein, K.L. (eds) Raptor Research and Management Techniques, 181–192. Raptor Research Foundation, Hancock House Publishers, Blaine.; https://raptorresearchfoundation.org/wp-content/uploads/2021/11/Chapter-11.pdf). Fledgling numbers were based on the number of ringed chicks (ringing age usually 20-34 days old, after which losses are very rare). Nest climbs/checks are not possible at later stage of the nestling period to avoid premature fledging of the young.
4	Accipiter nisus	Jan Tøttrup Nielsen	Herfindal, I., van de Pol, M., Nielsen, J. T., Sæther, B.-E. & Møller, A. P. 2015: Climatic conditions cause complex patterns of covariation between demographic traits in a long-lived raptor. J. Anim. Ecol. 84:702-711. Nielsen, J.T. & J. Drachmann 1999: Development and productivity in a Danish Goshawk *Accipiter gentilis* population. Dansk Orn. Foren. Tidsskr. 93: 153–161.
5	Acrocephalus scirpaceus	Lucyna Halupka	Halupka, L., Borowiec, M., Neubauer, G., & Halupka, K. 2021. Fitness consequences of longer breeding seasons of a migratory passerine under changing climatic conditions. Journal of Animal Ecology 90: 1655–1665. Hałupka L., Dyrcz A., Borowiec M. 2008. Climate change affects breeding of reed warblers *Acrocephalus scirpaceus*. Journal of Avian Biology 39: 95–100.
6	Aegolius funereus	Markéta Zárybnická	Zárybnická M., Sedláček O., Salo P., Šťastný K., Korpimäki E. 2015. Reproductive responses of temperate and boreal Tengmalm's Owl *Aegolius funereus* populations to spatial and temporal variation in prey availability. Ibis 157: 369–383.

			Zárybnická M., Korpimäki E., Griesser M. 2012. Dark or Short Nights: Differential Latitudinal Constraints in Nestling Provisioning Patterns of a Nocturnally Hunting Bird Species. PLoS ONE 7(5): e36932.
7	Aegolius funereus	Pierre-Alain Ravussin	Ravussin, P.-A., D. Trolliet, L. Willenegger & D. Béguin (1993) Observations sur les fluctuations d'une population de Chouettes de Tengmalm (*Aegolius funereus*) dans le Jura vaudois (Suisse). Nos Oiseaux 42: 127-142. Nests in natural cavities were found after nocturnal listening every year during the period of over 40 years. Furthermore, nesting boxes were installed by us in the most suitable environments. Occupied nests are visited between 3 and 5 times, in order to determine the date of laying, clutch size, number of eggs hatched and number of young fledged. Females and young, and sometimes males, are ringed. The young from natural cavities are ringed when they are about 25 days old, i.e. about 7-10 days before fledging, and there is no subsequent monitoring. Cases of possible predation between banding and fledging are not known. In the case of nest boxes, observation and sampling of the nest remnants after the young have fledged makes it possible to determine breeding success and the exact number of young fledged.
8	Aegolius funereus	Erkki Korpimäki	Korpimäki, E. & Hakkarainen, H. 1991. Fluctuating food supply affects the clutch size of Tengmalm's Owl independent of laying date. Oecologia 85: 543–552. Hakkarainen, H., Mykrä, S., Kurki, S., Korpimäki, E., Nikula, A. & Koivunen, V. 2003. Habitat composition as a determinant of reproductive success of Tengmalm's owls under fluctuating food conditions. Oikos 100:162–171.
9	Aethia cristatella	Pietrzak et al. (2017)	Pietrzak, K. W., M. L. Mudge, S. L. Walden, & N. A. Rojek. 2017. Biological monitoring at Buldir Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2017/17 Homer, Alaska.
10	Aethia cristatella	Elena Yu. Golubova	Golubova E. Yu. 2021. Breeding Biology of the Crested Auklet (Aethia cristatella, Alcidae, Charadriiformes) in the Northern Part of the Sea of Okhotsk. Biology Bulletin 48: 1541–1562.
11	Aethia psittacula	Pietrzak et al. (2017)	Pietrzak, K. W., M. L. Mudge, S. L. Walden, & N. A. Rojek. 2017. Biological monitoring at Buldir Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2017/17 Homer, Alaska.
12	Aethia psittacula	Evans et al (2017)	Evans, S. A., D. J. Schultz, & N. A. Rojek. 2017. Biological monitoring at Chowiet Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2017/18. Homer, Alaska.
13	Aethia psittacula	Elena Yu. Golubova	Golubova E.Yu. 2017. Breeding Biology of the Parakeet Auklet (Cyclorrhynchus psittacula) on Talan Island (Northern Sea of Okhotsk). Biology Bulletin 44, No. 7. Pp. 735–750.
14	Aethia pusilla	Pietrzak et al. (2017)	Pietrzak, K. W., M. L. Mudge, S. L. Walden, & N. A. Rojek. 2017. Biological monitoring at Buldir Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2017/17 Homer, Alaska.
15	Aethia pygmaea	Pietrzak et al. (2017)	Pietrzak, K. W., M. L. Mudge, S. L. Walden, & N. A. Rojek. 2017. Biological monitoring at Buldir Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2017/17 Homer, Alaska.
16	Alca torda	Robert T. Barrett	Barrett, R.T. 2001. The breeding demography and egg size of North Norwegian Atlantic Puffins *Fratercula arctica* and Razorbills *Alca torda* during 20 years of climatic variability. Atlantic Seabirds 3: 97–112. Each year 40-50 marked nests were inspected once during the incubation period and 2-4 times during the chick-

			rearing period at a c. 5-20 day intervals. Breeding success was estimated as the proportion of half-fully grown chicks found in burrows/no. burrows with egg.
17	Alectrurus risora	Adrián S. Di Giacomo	Di Giacomo, A.S., A. G. Di Giacomo & J. C. Reboreda. 2011. Male and female reproductive success in a threatened polygynous species: the Strange-Tailed Tyrant (*Alectrurus risora*). The Condor 103: 619–628. Di Giacomo, A.G., A. S. Di Giacomo, y J. C. Reboreda. 2011. Effects of grassland burning on reproductive success of globally threatened Strange-tailed Tyrants Alectrurus risora. Bird Conservation International 21: 411–422.
18	Anous tenuirostris	Ramos & Monticelli (2007)	Ramos J.A. & David Monticelli. 2007. Long-term studies on productivity of Roseate Terns and Lesser Noddies on Aride Island, Seychelles. Ostrich 78: 443–447. Ramos, J. A., A. M. Maul, J. Bowler, D. Monticelli e C. Pacheco. 2004. Laying date, chick provisioning, and breeding success of Lesser Noddies on Aride Island, Seychelles. Condor 106: 888–896.
19	Apus apus	Heikki Kolunen	Kolunen H. 1986. Tervapääskyn (*Apus apus*) pesyekoon määräytyminen. Msc Thesis, University of Helsinki. The colony of common swifts nests on a house which was built in the early 1900s, and since then boxes have been occupied. Since 1979 adults and young have been ringed by Heikki Kolunen. Nests were visited 2-4 times during each breeding season (breeding is highly synchronised). The number of eggs and nestlings was confirmed for each nestbox. If offspring disappeared before the expected fledging time, the nests was classified as failed. If the young were present before, and during last visit (after the expected fledging time) the young disappeared without traces of predation, the nest was classified as successful.
20	Branta leucopsis	Jouke Prop	Prop, J., & De Vries, J. 1993. Impact of snow and food conditions on the reproductive performance of barnacle geese *Branta leucopsis*. Ornis Scandinavica 24: 110–121. Lameris, T. K., de Jong, M. E., Boom, M. P., van der Jeugd, H. P., Litvin, K. E., Loonen, M. J. J. E., Nolet, B. A., & Prop, J. (2019). Climate warming may affect the optimal timing of reproduction for migratory geese differently in the low and high Arctic. Oecologia 191: 1003–1014.
21	Bucephala clangula	Hannu Pöysä	Pöysä, H. 1999. Conspecific nest parasitism is associated with inequality in nest predation risk in the common goldeneye (*Bucephala clangula*). Behavioral Ecology 10: 533–540. Pöysä, H. 2006. Public information and conspecific nest parasitism in goldeneyes: targeting safe nests by parasites. Behavioral Ecology 17: 459–465.
22	Bucorvus cafer	Kate F. Carstens	Carstens et al. 2019. Breeding success and population growth of Southern Ground Hornbills *Bucorvus leadbeateri* in an area supplemented with nest boxes. Bird Conservation International 29(4): 627 – 643.
23	Bulweria bulwerii	Verónica C. Neves	Bried, J., Andris, M., Dubois, M.-P. & Jarne, P. 2021. Decreased selectivity during mate choice in a small-sized population of a long-lived seabird. Journal of Avian Biology 52(12): e02837. doi: 10.1111/jav.02837 Cruz-Flores, M., Pradel, R., Bried, J., Militão, T., Neves, V.C., González-Solís, J. & Ramos, R. 2022. Will climate change affect the survival of tropical and subtropical species? Predictions based on Bulwer's petrel populations in the NE Atlantic Ocean. Science of the Total Environment 847: 157352. DOI:10.1016/j.scitotenv.2022.157352.

24	Calonectris borealis	Joël Bried	Fontaine, R., Gimenez, O. & Bried, J. 2011. The impact of introduced predators, light-induced mortality of fledglings and poaching on the dynamics of the Cory's Shearwater (*Calonectris diomedea*) population from the Azores, northeastern subtropical Atlantic. Biological Conservation 144: 1998–2011.
25	Calonectris diomedea	Daniel Oro	Genovart, M., Sanz-Aguilar, A., Fernández-Chacón, A., Igual, J.M.; Pradel, R., Forero, M.G. & Oro, D. 2013. Contrasting effects of climatic variability on the demography of a trans-equatorial migratory seabird. Journal of Animal Ecology 82: 121–130. Sanz-Aguilar, A., Igual, J.M., Oro, D., Genovart, M. & Tavecchia, G. 2016. Estimating recruitment and survival in partially-monitored populations. Journal of Applied Ecology 53: 73–82
26	Calyptorhynchus lathami halmaturinus	Morgan et al. (2015)	Morgan, D., Barth, M. & Kinloch, M. 2015. The South Australian subspecies of the glossy black-cockatoo (*Calyptorhynchus lathami halmaturinus*) Strategic Plan 2015–2020. A report by Natural Resources Kangaroo Island for the Kangaroo Island Natural Resources Management Board. Australian Government.
27	Calyptorhynchus latirostris	Denis A. Saunders	Saunders, D. A. & Dawson, R. 2018. Cumulative learnings and conservation implications of a long-term study of the endangered Carnaby's Cockatoo *Calyptorhynchus latirostris.*Australian Zoologist 39: 591–609.
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99	Oceanodroma furcata	Pietrzak et al. (2017)	Pietrzak, K. W., M. L. Mudge, S. L. Walden, & N. A. Rojek. 2017. Biological monitoring at Buldir Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2017/17 Homer, Alaska.
100	Oceanodroma furcata	Kettle (2017)	Kettle, A.B. 2017. Biological monitoring at East Amatuli Island, Alaska in 2016. U.S. Fish and Wildlife Service Report, AMNWR 2017/08. Homer, Alaska
101	Oceanodroma furcata	Evans et al (2018)	Evans, S. A., D. J. Schultz, & B. A. Drummond. 2018. Biological monitoring at Saint Lazaria Island, Alaska in 2018. U.S. Fish and Wildl. Serv. Rep., AMNWR 2018/19. Homer, Alaska.
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103	Oceanodroma leucorhoa	Youngren et al. (2018)	Youngren, S. M., D. C. Rapp, & N. A. Rojek. 2018. Biological monitoring at Aiktak Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2018/03. Homer, Alaska
104	Oceanodroma leucorhoa	Pietrzak et al. (2017)	Pietrzak, K. W., M. L. Mudge, S. L. Walden, & N. A. Rojek. 2017. Biological monitoring at Buldir Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2017/17 Homer, Alaska.

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125	Phalacrocorax pelagicus	Pietrzak et al. (2017)	Pietrzak, K. W., M. L. Mudge, S. L. Walden, & N. A. Rojek. 2017. Biological monitoring at Buldir Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2017/17 Homer, Alaska.
126	Phalacrocorax pelagicus	Evans et al (2018)	Evans, S. A., D. J. Schultz, & B. A. Drummond. 2018. Biological monitoring at Saint Lazaria Island, Alaska in 2018. U.S. Fish and Wildl. Serv. Rep., AMNWR 2018/19. Homer, Alaska.
127	Phalacrocorax pelagicus	Hatch (2017)	Hatch, S. 2017. Middleton Island Seabird Research and Monitoring. 2017 Field Report. Institute for Seabird Research and Conservation.
128	Phalacrocorax urile	Youngren et al. (2018)	Youngren, S. M., D. C. Rapp, & N. A. Rojek. 2018. Biological monitoring at Aiktak Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2018/03. Homer, Alaska
129	Phalacrocorax urile	Pollom et al. (2018)	Pollom, E. L., J. P. Gorey, & M. D. Romano. 2018. Biological monitoring at St. George Island, Alaska in 2017. U.S. Fish and Wildlife Service. Rep., AMNWR 2018/01. Homer, Alaska.
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145	Rissa brevirostris	Pollom et al. (2018)	Pollom, E. L., J. P. Gorey, & M. D. Romano. 2018. Biological monitoring at St. George Island, Alaska in 2017. U.S. Fish and Wildlife Service. Rep., AMNWR 2018/01. Homer, Alaska.
146	Rissa brevirostris	Mong et al. (2017)	Mong, R. N. a& M. D. Romano. 2017. Biological monitoring at St. Paul Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2017/16. Homer, Alaska
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150	Rissa tridactyla	Murphy et al. (2016)	Murphy E.C., Roseneau D.G., Springer A.M. & Byrd G.V. 2016. Breeding chronology and productivity of Black-legged Kittiwakes *Rissa tridacytla* at Bluff, Alaska, 1975–2008: Associations with regional environmental indices and distant colonies. *Marine Ornithology* 44: 183–201.
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152	Rissa tridactyla	Dragoo et al. (2017)	Dragoo, D. E., G. Thomson, & M. D. Romano. 2017. Biological monitoring at Cape Lisburne, Alaska in 2017. U. S. Fish and Wildl. Serv. Report AMNWR 2017/15. Homer, Alaska.
153	Rissa tridactyla	Evans et al (2017)	Evans, S. A., D. J. Schultz, & B. A. Drummond. 2018. Biological monitoring at Saint Lazaria Island, Alaska in 2018. U.S. Fish and Wildl. Serv. Rep., AMNWR 2018/19. Homer, Alaska.
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155	Rissa tridactyla	Pollom et al. (2018)	Pollom, E. L., J. P. Gorey, & M. D. Romano. 2018. Biological monitoring at St. George Island, Alaska in 2017. U.S. Fish and Wildlife Service. Rep., AMNWR 2018/01. Homer, Alaska.
156	Rissa tridactyla	Hatch (2017)	Hatch, S. 2017. Middleton Island Seabird Research and Monitoring. 2017 Field Report. Institute for Seabird Research and Conservation.
157	Rissa tridactyla	Elena Yu. Golubova	Golubova E.Yu. 2018. Population numbers, phenology and productivity of the Black-legged kittiwake (Rissa tridactyla, CHARADRIIFORMES, LARIDAE) from Tauiskaya bay, sea of Okhotsk // Zoologicheskiy zhurnal 97: 32–55. During the nest visit the researcher was on the opposite slope (at a distance of 10-30 m) and examines a colony in the "top-down" direction with binoculars. For each site of the colony photographs were taken in advance where all known nests of kittiwakes are subsequently noted. Sites were visited every 3 days if possible. We recorded the presence of adult birds, the presence of clutch or chicks. We noted the number of eggs laid, hatched and fledglings in each nest. Average clutch size was determined by the ratio of the total number of eggs laid to the number of nests with clutches. The ratio of the number of fledglings to the number of pairs with clutches was used as a parameter of breeding success. The productivity of the kittiwake was assessed by the ratio of the number of fledglings to the total number of pairs with nests, including pairs that did not start laying eggs.
158	Rissa tridactyla	Drummond & Williams (2015)	Drummond, B. A. & J. C. Williams. 2015. Biological monitoring in the central Aleutian Islands, Alaska in 2009-2015. U.S. Fish and Wildl. Serv. Rep., AMNWR 2015/16. Homer, Alaska
159	Somateria fischeri	Diana V. Solovyeva	Solovyeva D.V., Vartanyan S.L., Frederiksen M., Fox A.D. 2018. Changes in nesting success and breeding abundance of Spectacled eiders Somateria fischeri in the Chaun delta, Chukotka, Russia, 2003–2016. Polar Biology 41: 743–751.
160	Somateria mollissima	Markus Öst	Mohring, B., Angelier, F., Jaatinen, K., Steele, B., Lönnberg, E. & Öst, M. 2022: Drivers of within- and among-individual variation in risk-taking behaviour during reproduction in a long-lived bird. Proceedings of the Royal Society B: Biological Sciences 289: 20221338. Öst, M., Lindén, A., Karell, P. Ramula, S. & Kilpi, M. 2018: To breed or not to breed: drivers of intermittent breeding in a seabird under increasing predation risk and male bias. Oecologia 188:129–138.
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163	Sterna dougallii	Seward et al. (2018)	Seward, A., Ratcliffe, N., Newton, S. et al. 2019. Metapopulation dynamics of roseate terns: Sources, sinks and implications for conservation management decisions. J. Anim. Ecol. 88: 138–153.
164	Sterna dougallii	Jaime A. Ramos	Ramos, J.A. & Monticelli, D. 2007. Long-term studies on productivity of Roseate Terns and Lesser Noddies on Aride Island, Seychelles. Ostrich 78: 443–447. Ramos, J. A., A. M. Maul, V. Ayrton, I. Bullock, J. Hunter, J. Bowler, G. Castle, R. Mileto & C. Pacheco. 2002. The

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165	Sterna hirundo	Peter H. Becker	Becker P.H., Wendeln H., González-Solís J. 2001. Population dynamics, recruitment, individual quality and reproductive strategies in Common Terns marked with transponders. Ardea 89: 239–250. Becker P.H. 2010. Populationsökologie der Flussseeschwalbe: Das Individuum im Blickpunkt. In Bairlein F, Becker PH (eds) 100 Jahre Institut für Vogelforschung „Vogelwarte Helgoland“. Aula, Wiebelsheim, p 137–155. The walls surrounding the islands make it easy to specify hatching and fledging success and the fate of older chicks. There is almost no predation on old chicks. If during a check marked chicks are no longer found present on the breeding islands (alive or dead) and if they also are not found dead later in the surroundings of the colony they are recorded as fledged (min fledging age is 18 d, mean 27 d).
166	Strix aluco	Tapio Solonen	Solonen, T. & Ursin, K. 2008: Breeding of Tawny Owls Strix aluco in rural and urban habitats in southern Finland. Bird Study 55: 216–221.
167	Strix aluco	Patrik Karell	Morosinotto, C., Ahola, K., Karstinen, T., Aaltonen, E., Brommer, J.E., Lindqvist, A. & Karell, P. 2020. Fledging mass is color morph specific and affects local recruitment in a wild bird. American Naturalist, 196: 609–619. Karell, P., Ahola, K., Karstinen, T., Zolei, A. & Brommer, J.E. 2009. Population dynamics in a cyclic environment: Consequences of cyclic food abundance on tawny owl reproduction and survival. Journal of Animal Ecology 78: 150–162.
168	Strix aluco	Xavier Lambin	Millon, A., Petty, S. J. & Lambin, X. 2010. Pulsed resources affect the timing of first breeding and lifetime reproductive success of tawny owls. Journal of Animal Ecology 79: 426–435. Millon A, SJ. Petty, B Little & X Lambin. 2011. Natal conditions alter age-specific reproduction but not survival or senescence in a long-lived bird of prey. Journal of Animal Ecology 80: 968–75.
169	Strix uralensis	Hannu Pietiäinen	Pietiäinen, H. 1989: Seasonal and individual variation in the production of offspring in the Ural Owl Strix uralensis. J. Anim. Ecol. 58: 905–920. Brommer, J., Pietiäinen, H. & Kolunen, H. 1998. The effect of age at first breeding on Ural Owl lifetime reproductive success and fitness under cyclic food conditions. J. Anim. Ecol. 67: 359–369.
170	Sturnus unicolor	Vicente Polo	J.P. Veiga, V. Polo, A. Salvador & M.B. Morales. 2002. El estornino negro-Sturnus unicolor. In: Enciclopedia Virtual de los vertebrados españoles (L.M. Carrascal & A. Salvador). Madrid. Museo Nacional de Ciencias Naturales see http://www.vertebradosibericos.org/aves/habitat/stuuniha.html. V. Polo, J.P. Veiga, P.J. Cordero, J. Vińuela, P. Monaghan. 2004. Female starlings adjust primary sex ratio in reponse to aromatic plants in the nest. Proc. R. Soc. Lond. B. 271: 1929–1933.
171	Sturnus vulgaris	Alexander Numerov	Numerov, A.D. 2007. Species composition and population dynamics of nest boxes birds in Usmansky Bor. Proceedings of the Voronezh State Reserve 25: 193–205.
172	Sula nebouxii	Hugh Drummond	Drummond, H., R. Torres & V.V. Krishnan. 2003. Buffered development: resilience after aggressive subordination in infancy. American Naturalist 161: 794–807.

173	Synthliboramphus antiquus	Youngren et al. (2018)	Youngren, S. M., D. C. Rapp, & N. A. Rojek. 2018. Biological monitoring at Aiktak Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2018/03. Homer, Alaska.
174	Synthliboramphus antiquus	Elena Yu. Golubova	Golubova E.Yu. 2017. Breeding Biology of the Parakeet Auklet (Cyclorrhynchus psittacula) on Talan Island (Northern Sea of Okhotsk). Biology Bulletin 44: 735–750. Golubova E.Yu. 2011. Monitoring of the Ancient murrelet (*Synthliboramphus antiquus*) population in the northern sea of Okhotsk. Zoologicheskiy zhurnal 90: 1216–1229.
175	Tachycineta bicolor	Michael P. Lombardo	Lombardo, M. P., P. A. Thorpe, Sango Otieno, Alyssa Hawker, Dan Welgarz, Danielle Andrews & A. Black. 2020. Yearly variation in factors associated with local recruitment of Tree Swallows. Journal of Field Ornithology 91: 199–213. Lombardo, M. P., P. A. Thorpe, S. Otieno, D. Welgarz, & A. Hawker. 2021. Factors associated with egg mass in Tree Swallows (Tachycineta bicolor) varied yearly from 2008-2016 in Michigan. Journal of Avian Biology 52: https://doi.org/10.1111/jav.02460
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177	Tachymarptis melba	Pierre Bize	Bize, P., Devevey, G., Monaghan, P., Doligez, B., & Christe, P. 2008. Fecundity and survival in relation to resistance to oxidative stress in a free living bird. Ecology 89: 2584–2593.
178	Tachymarptis melba	Pierre Bize	Bize, P., Devevey, G., Monaghan, P., Doligez, B., & Christe, P. 2008. Fecundity and survival in relation to resistance to oxidative stress in a free living bird. Ecology 89, 2584–2593.
179	Tetrao tetrix	Wegge & Rolstad (2017)	Wegge P. & Rolstad J. 2017. Climate change and bird reproduction: warmer springs benefit breeding success in boreal forest grouse. Proc. R. Soc. B 284: 20171528.
180	Tetrao urogallus	Wegge & Rolstad (2017)	Wegge P. & Rolstad J. 2017. Climate change and bird reproduction: warmer springs benefit breeding success in boreal forest grouse. Proc. R. Soc. B 284: 20171528.
181	Tetrao urogallus	Moss et al. (2001)	Moss, R., Oswald, J., & Baines, D. 2001. Climate Change and Breeding Success: Decline of the Capercaillie in Scotland. Journal of Animal Ecology 70: 47–61.
182	Thalassarche chrysostoma	Richard A. Phillips	Pardo, D., Forcada, J., Wood, A.G., Tuck, G.N., Ireland, L., Pradel, R., J.P. Croxall & Phillips, R.A. 2017. Additive effects of climate and fisheries drive catastrophic declines in multiple albatross species. Proceedings of the National Academy of Science of the Unites States of America 114, E10829-E10837.
183	Thalassarche melanophris	Richard A. Phillips	Pardo, D., Forcada, J., Wood, A.G., Tuck, G.N., Ireland, L., Pradel, R., J.P. Croxall & Phillips, R.A. 2017. Additive effects of climate and fisheries drive catastrophic declines in multiple albatross species. Proceedings of the National Academy of Science of the Unites States of America 114, E10829-E10837.
184	Troglodytes aedon	E. Keith Bowers	Bowers et al. 2016. Spring temperatures influence selection on breeding date and the potential for phenological

			mismatch in a migratory bird. Ecology 97: 2880–2891. Bowers et al. 2019. Condition-dependent begging elicits increased parental investment in a wild bird population. Am Nat. 193: 725–737.
185	Turdus merula	Dariusz Wysocki	Wysocki, D., Cholewa, M. & Jankowiak, Ł. 2017. Fledgling adoption in European Blackbirds: an unrecognized phenomenon in a well-known species. Behav. Ecol. 29, 230–235. Jankowiak, Ł., Zyskowski, D. & Wysocki, D. 2017. Age-specific reproduction and disposable soma in an urban population of common blackbirds Turdus merula. Ibis160: 130–144.
186	Tyto alba	Alexandre Roulin	Frey, C., Sonnay C., Dreiss, A.N., Roulin, A. 2011. Habitat, breeding performance, diet and individual age in Swiss barn owls (Tyto alba). J. Ornithol. 152: 279–290.
187	Tyto alba	Motti Charter	Charter M., Izhaki I., Leshem, Y., Meyrom K., and A Roulin 2017. The relationship between weather and reproduction of the barn owl Tyto alba in a semi-arid agricultural landscape in Israel. Avian Biology Research 10: 253-258. Charter M. and G. Rozman. 2022. The importance of nest box placement for Barn Owls (Tyto alba) nesting in Israel. Animals 12(20), p.2815.
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189	Uria aalge	Mong et al. (2017)	Mong, R. N. & M. D. Romano. 2017. Biological monitoring at St. Paul Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2017/16. Homer, Alaska
190	Uria aalge	Youngren et al. (2018)	Youngren, S. M., D. C. Rapp, & N. A. Rojek. 2018. Biological monitoring at Aiktak Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2018/03. Homer, Alaska
191	Uria aalge	Evans et al (2017)	Evans, S. A., D. J. Schultz, & N. A. Rojek. 2017. Biological monitoring at Chowiet Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2017/18. Homer, Alaska.
192	Uria aalge	Evans et al (2018)	Evans, S. A., D. J. Schultz, & B. A. Drummond. 2018. Biological monitoring at Saint Lazaria Island, Alaska in 2018. U.S. Fish and Wildl. Serv. Rep., AMNWR 2018/19. Homer, Alaska.
193	Uria aalge	Pollom et al. (2018)	Pollom, E. L., J. P. Gorey, and M. D. Romano. 2018. Biological monitoring at St. George Island, Alaska in 2017. U.S. Fish and Wildlife Service. Rep., AMNWR 2018/01. Homer, Alaska.
194	Uria aalge	Elena Yu. Golubova	Golubova E. Yu. 2014. Monitoring of the Common murre (Uria aalge) and Thick-billed murre (Uria lomvia) populations from Tauiskaya bay, the sea of Okhotsk. Zoologicheskiy zhurnal 93: 1086–1105. Birkhead T.R., Nettleship D.N., 1980. Census method for murres, Uria species: a unified approach. Canadian Wildlife Service: Occasional Paper 43: 4–22.). For each site of the colony photographs were taken in advance where all known nests of guillemots were subsequently noted. To examine the nest content a researcher visited the opposite slope (at a distance of 10-30 m) and examined a colony in the "top-down" direction with binoculars. Sites were visited every 3 days if possible. We recorded the presence of adult birds, the presence of clutch or chicks. The success of breeding was the ratio of the number of chicks

			leaving to the sea to the total number of nests with eggs. The productivity of guillemots was estimated by the ratio of the number of chicks leaving to the sea to the total number of pairs with nests including those that did not lay eggs.
195	Uria lomvia	Pollom et al. (2018)	Pollom, E. L., J. P. Gorey, and M. D. Romano. 2018. Biological monitoring at St. George Island, Alaska in 2017. U.S. Fish and Wildlife Service. Rep., AMNWR 2018/01. Homer, Alaska.
196	Uria lomvia	Mong et al. (2017)	Mong, R. N. and M. D. Romano. 2017. Biological monitoring at St. Paul Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2017/16. Homer, Alaska.
197	Uria lomvia	Youngren et al. (2018)	Youngren, S. M., D. C. Rapp, and N. A. Rojek. 2018. Biological monitoring at Aiktak Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2018/03. Homer, Alaska.
198	Uria lomvia	Pietrzak et al. (2017)	Pietrzak, K. W., M. L. Mudge, S. L. Walden, and N. A. Rojek. 2017. Biological monitoring at Buldir Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2017/17 Homer, Alaska.
199	Uria lomvia	Evans et al. (2017)	Evans, S. A., D. J. Schultz, and N. A. Rojek. 2017. Biological monitoring at Chowiet Island, Alaska in 2017. U.S. Fish and Wildl. Serv. Rep., AMNWR 2017/18. Homer, Alaska.
200	Uria lomvia	Evans et al. (2018)	Evans, S. A., D. J. Schultz, & B. A. Drummond. 2018. Biological monitoring at Saint Lazaria Island, Alaska in 2018. U.S. Fish and Wildl. Serv. Rep., AMNWR 2018/19. Homer, Alaska.
201	Uria lomvia	Elena Yu. Golubova	Golubova E. Yu. 2014. Monitoring of the Common murre (Uria aalge) and Thick-billed murre (Uria lomvia) populations from Tauiskaya bay, the sea of Okhotsk. Zoologicheskiy zhurnal 93: 1086–1105. Birkhead T.R., Nettleship D.N., 1980. Census method for murres, Uria species: a unified approach. Canadian Wildlife Service: Occasional Paper 43: 4–22. For each site of the colony photographs were taken in advance where all known nests of guillemots were subsequently noted. To examine the nest content a researcher visited the opposite slope (at a distance of 10-30 m) and examined a colony in the "top-down" direction with binoculars. Sites were visited every 3 days if possible. We recorded the presence of adult birds, the presence of clutch or chicks. The success of breeding was the ratio of the number of chicks leaving to the sea to the total number of nests with eggs. The productivity of guillemots was estimated by the ratio of the number of chicks leaving to the sea to the total number of pairs with nests including those that did not lay eggs.

Table S5. List of variables used in the statistical analyses.

Variable	Role	Description
Changes in productivity	response	Change in mean number of offspring per female, measured in SDs per year
Changes in clutch size	response	Change in mean clutch size, measured in SDs per year
Changes in nest success	response	Change in proportion of successful nesting attempts, measured in percentage points per year
Changes in date of first egg	response	Change in mean date of the season start, measured in days per year
Changes in duration of laying period	response	Change in duration of laying period, measured in days per year
Changes in population density	predictor	Change in number of breeding pairs
ln(body mass)	predictor	Natural logarithm of female body mass
Number of broods	predictor	Discrete: single- or multi-brooded species
Migratory habits	predictor	Discrete: sedentary or migratory species
Absolute latitude	predictor	Distance from the equator measured in latitude degrees, rounded to whole numbers
Type of environment	predictor	Discrete, depending on foraging habitat: sea, freshwater and land species
Human Footprint Index	predictor	Degree of anthropogenic pressure on habitat, measured in arbitrary units (interval scale)
Changes in local temperatures	predictor	Change in mean temperature, measured in °C per year
Changes in local precipitation	predictor	Change in mean precipitation, measured in mm per year

Table S6. Acknowledgments.

We are grateful to our most important collaborators who helped us to collect the data on the study species, as well as funding institutions, other institutions we collaborated with, and some meteorological stations that allowed us to use their data. Population IDs correspond with numbers provided elsewhere in the manuscript. In the third column the author responsible for the data set is mentioned or the reference to the literature data (in red).

Pop. ID	Species	Author/ Literature data	Main collaborators	Funding Institutions (grant numbers), other institutions & meteorological stations
1	*Accipiter cooperi*	Robert N. ROSENFIELD	John BIELEFELDT (Deceased)	
2	*Accipiter gentilis*	Jan T. NIELSEN		
3	*Accipiter gentilis*	Jere TOLVANEN	Risto TORNBERG	
4	*Accipiter nisus*	Jan T. NIELSEN		
5	*Acrocephalus scirpaceus*	Lucyna HALUPKA	Marta BOROWIEC, Ewelina KLIMCZUK, Hanna SZTWIERTNIA	Polish National Science Centre (2017/27/B/NZ8/00465); Polish Ministry of Education and Science (2 P04F 053 30)
6	*Aegolius funereus*	Markéta ZÁRYBNICKÁ	Karel ŠŤASTNÝ, Jan ZÁRYBNICKÝ, Jiří ŠINDELÁŘ, Richard ŠEVČÍK, Alena HÝLOVÁ, Marek KOUBA, Václav TOMÁŠEK, Jan HANEL, Petra SLÁMOVÁ, Petr HOLÝ	The Faculty of Environmental Sciences CULS Prague; The Czech University of Life Sciences Prague; The Forests of the Czech Republic; EEA – Iceland, Liechtenstein, and Norway grants; The Ministry of the Environment of the Czech Republic; The Ministry of Education, Youth and Sports of the Czech Republic
7	*Aegolius funereus*	Pierre-Alain RAVUSSIN		
8	*Aegolius funereus*	Erkki KORPIMÄKI	Mikko HAST, Kari HONGISTO, Timo HYRSKY, Vesa KOIVUNE, Marek KOUBA, Jorma NURMI, Reijo	

			PASSINEN, Rauno VARJONEN, late Harri HAKKARAINEN, Toni LAAKSONEN	
9	*Aethia cristatella*	Pietrzak et al. (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
10	*Aethia cristatella*	Elena Yu. GOLUBOVA		
11	*Aethia psittacula*	Pietrzak et al. (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
12	*Aethia psittacula*	Evans et al (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
13	*Aethia psittacula*	Elena Yu. GOLUBOVA	the staff of Alaska Maritime National Wildlife Refuge	
14	*Aethia pusilla*	Pietrzak et al. (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
15	*Aethia pygmaea*	Pietrzak et al. (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
16	*Alca torda*	Robert T. BARRETT		
17	*Alectrurus risora*	Adrián S. DI GIACOMO	Alejandro G. DI GIACOMO	Agencia Nacional de Promoción Científica y Tecnológica (PICT 2018–3407) Alejandro Di Giacomo y ALPARAMIS S.A. for its support to work in Reserva El Bagual, Formosa
18	*Anous tenuirostris*	Ramos & Monticelli (2007)		
19	*Apus apus*	Heikki KOLUNEN		
20	*Branta leucopsis*	Jouke PROP		
21	*Bucephala clangula*	Hannu PÖYSÄ		
22	*Bucorvus leadbeateri*	Kate F. CARSTENS		
23	*Bulweria bulwerii*	Verónica C. NEVES	Joël BRIED, Miriam CUESTA, Wiebke SCHAEFER, Miguel	(1) Operational Program AZORES 2020, through the Fund 01-0145-FEDER-000140 "MarAZ Researchers: Consolidate a body of researchers

			TARITA, Pedro RAPOSO, Luís AGUIAR, Maria C. MAGALHĂES, Rémi FONTAINE, Malvina ANDRIS	in Marine Sciences in the Azores" of the European Union and the Azorean Science &Technology Fund (FRCT) through individual contracts M3.1.a/F/006/2016/008, (2) the project PTDC/BIABDE/67286/2006 funded by FCT and by FEDER through the Programme COMPETE (Ref: FCOMP-01-0124-FEDER-007061), and coordinated by JB, and (3) the Programmes 'MARE' (Integrated Management of Coastal and Marine Sites of the Azores, Life contract B4-3200/98-509), 'OGAMP' (Planning and Management of Marine Protected Areas, Interreg IIIB-MAC/4.2/A2), 'MARMAC' (Knowledge, Promotion and Valorization for a Sustainable Utilization of Marine Protected Areas in Macaronesia, Interreg IIIB/FEDER/MARMAC/003-4/2005-6 and Interreg IIIB-05/MAC/4.2/A4), and MoniAves, all coordinated by R. S. Santos. IMAR-DOP/UAç is funded by FCT and DRCT-Azores as Research Unit 531 and Associate Laboratory 9 (ISR-Lisbon)
24	*Calonectris borealis*	Joël BRIED	Maria C. MAGALHĂES, Rémi FONTAINE, Malvina ANDRIS	The data provided by Mark Bolton, Joël Bried and Verónica C. Neves were collected in the frame of (1) the projects PRAXIS/C/BIA/13194/98 andPOCTI-BIA-13194/98 funded by FCT and coordinated by MB, (2) the project PTDC/BIABDE/67286/2006 funded by FCT and by FEDER through the Programme COMPETE (Ref: FCOMP-01-0124-FEDER-007061), and coordinated by JB, and (3) the Programmes 'MARE' (Integrated Management of Coastal and Marine Sites of the Azores, Life contract B4-3200/98-509), 'OGAMP' (Planning and Management of Marine Protected Areas, Interreg IIIB-MAC/4.2/A2), 'MARMAC' (Knowledge, Promotion and Valorization for a Sustainable Utilization of Marine Protected Areas in Macaronesia, Interreg IIIB/FEDER/MARMAC/003-4/2005-6 and Interreg IIIB-05/MAC/4.2/A4), and MoniAves, all coordinated by R. S. Santos. IMAR-DOP/UAç is funded by FCT and DRCT-Azores as Research Unit 531 and Associate Laboratory 9 (ISR-Lisbon).
25	*Calonectris diomedea*	Daniel ORO	Meritxell GENOVART, José Manuel IGUAL, Giacomo TAVECCHIA, Ana SANZ	Spanish Ministry of Science, AEI and FEDER funds (Grant ref. CGL2017-85210-P) Ebro Delta N.P. and IMEDEA (CSIC-UIB)
26	*Calyptorhynchus lathami*	Morgan et al. (2015)		
27	*Calyptorhynchus latirostris*	Denis A. SAUNDERS		

28	*Cerorhinca monocerata*	Watanuki & Ito (2012)		
29	*Cerorhinca monocerata*	Evans et al. (2018)	Alaska Maritime National Wildlife Refuge	
30	*Chroicocephalus ridibundus*	Dariusz BUKACIŃSKI	Monika BUKACIŃSKA, Arkadiusz BUCZYŃSKI	
31	*Ciconia ciconia*	Andrzej Wuczyński		Institute of Nature Conservation, Polish Academy of Sciences (statutory activity)
32	*Ciconia ciconia*	Beata ORŁOWSKA	Józef WITKOWSKI	
33	*Ciconia ciconia*	Marcin TOBOLKA	Joanna T. BIAŁAS, Katarzyna M. ŻOŁNIEROWICZ, Stanisław KUŹNIAK	National Science Centre (Poland): Sonata 2016/23/D/NZ8/01902, Preludium 2012/05/N/NZ8/01186
34	*Ciconia ciconia*	Anna V. CHERNOMORETS	Irina E. SAMUSENKO, Aleksandr V. BALASH, Vasilij V. GRITSHIK	Faculty of Biology, Belarusian State University Scientific and Practical Center National Academy of Sciences of Belarus on bioresources
35	*Ciconia ciconia*	Irina E. SAMUSENKO	Anna V. CHERNOMORETS	
36	*Circus cyaneus*	Alexandre MILLON	Pascal ALBERT, Serge PARIS, Francis TALOT, Claude FREULET, Jean-Luc BOURRIOUX, Laurent COCQUYT, Bernard VACHERET, ROland FAYNOT, Vincent TERNOIS, Gérard CROUZIER	
37	*Circus pygargus*	Pascal ALBERT		
38	*Circus pygargus*	Thierry PRINTEMPS		
39	*Circus pygargus*	Jarosław WIĄCEK		
40	*Clanga clanga*	Valery C. DOMBROVSKI	Denis KITEL, Dzmitry ZHURAULIOU, Oleg OSTROVSKY	
41	*Clanga pomarina*	Zbyryt et al (2015)		

42	*Colaptes auratus*	Karen L. WIEBE		NSERC Discovery Grant 203177
43	*Corvus corone*	Vittorio BAGLIONE	Daniela CANESTRARI	Ministerio Espańol de Economía y Competitividad (project CGL 2016-77636-P to VB) Agencia Estatal de Meteorología (AEMET)
44	*Cyanistes caeruleus*	Jaime POTTI	Carlos CAMACHO, David CANAL	
45	*Cyanistes caeruleus*	János TÖRÖK	Gergely HEGYI, Balázs ROSIVALL, László Zsolt GARAMSZEGI, Gergely NAGY, Miklós LACZI	
46	*Cyanistes caeruleus*	Jerzy BAŃBURA	Piotr ZIELIŃSKI, Adam KALIŃSKI, Jarosław WAWRZYNIAK, Joanna SKWARSKA, Michał GLĄDALSKI, Marcin MARKOWSKI, Iwona DEMESKO	University of Lodz
47	*Cyanistes caeruleus*	Marcel E. VISSER	Louis VERNOOIJ	
48	*Cyanistes caeruleus*	Marcel E. VISSER	Louis VERNOOIJ	
49	*Cyanistes caeruleus*	Marcel E. VISSER	Louis VERNOOIJ	
50	*Cyanistes caeruleus*	Marcel E. VISSER	Louis VERNOOIJ	
51	*Cygnus bewickii*	Diana V. SOLOVYEVA		Chukotka Gold Mine Co, a subsidiary of Kinross Gold; US Fish and Wildlife Service; The Wildfowl and Wetlands Trust
52	*Delichon urbicum*	Alfonso MARZAL		Junta de Extremadura (IB20089)
53	*Diomedea exulans*	Richard A. PHILLIPS	Andrew G. WOOD Bird Island field assistants, John CROXALL	Ecosystems component of the British Antarctic Survey Polar Science for Planet Earth Programme, funded by The Natural Environment Research Council
54	*Falco naumanni*	Inęs CATRY	Teresa CATRY, João GAMEIRO, Rita ALCAZAR, Aldina FRANCO	Fundação para a Cięncia e a Tecnologia (FCT) through contracts (DL57/2016/CP1440/CT0023) grant to InBIO (UID/BIA/50027/2013)

55	*Falco tinnunculus*	Juan Antonio FARGALLO		Ministerio de Ciencia e Innovación. Grant numbers: CGL2007–61395, CGL2010–15726, CGL2013–42451-P; Estación Biológica El Ventorrillo
56	*Ficedula albicollis*	Miloš KRIST		
57	*Ficedula albicollis*	Peter ADAMÍK	Miroslav KRÁL	Czech Science Fundation grant no. 20-00648S
58	*Ficedula albicollis*	János TÖRÖK	Gergely HEGYI, Balázs ROSIVALL, László Zsolt GARAMSZEGI, Gergely NAGY, Miklós LACZI	
59	*Ficedula hypoleuca*	Jaime POTTI	Carlos CAMACHO, David CANAL	
60	*Ficedula hypoleuca*	Tapio Eeva	Jorma NURMI	Academy of Finland (338180)
61	*Ficedula hypoleuca*	Alexander V. ARTEMYEV		state orders IB KarRC RAS No. FMEN-2022-0003
62	*Ficedula hypoleuca*	Marcel E. VISSER	Louis VERNOOIJ	
63	*Ficedula hypoleuca*	E. BELSKII & A. LYAKHOV		Ministry of Science and Higher Education of the Russian Federation (State Contract with the Institute of Plant and Animal Ecology, Ural Branch, Russian Academy of Sciences, AAAA-A19-119031890088-4). Data on temperatures at the weather station in Revda were provided by the Ural Department of Hydrometeorology and Environmental Monitoring (Yekaterinburg)
64	*Ficedula hypoleuca*	Boris D. KURANOV		Ministry of Science and Higher Education of the Russian Federation (project No. FSWM-2020-0019)
65	*Ficedula hypoleuca*	Mirosława BAŃBURA	Piotr ZIELIŃSKI, Adam KALIŃSKI, Jarosław WAWRZYNIAK, Joanna SKWARSKA, Michał GLĄDALSKI, Marcin MARKOWSKI, Iwona DEMESKO	University of Lodz
66	*Ficedula hypoleuca*	Indrikis KRAMS	Tatjana KRAMA	
67	*Fratercula arctica*	Robert T. BARRETT		

68	*Fratercula cirrhata*	Youngren et al. (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
69	*Fratercula cirrhata*	Pietrzak et al. (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
70	*Fratercula cirrhata*	Evans et al (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
71	*Fratercula cirrhata*	Elena Yu. GOLUBOVA		
72	*Fratercula corniculata*	Youngren et al. (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
73	*Fratercula corniculata*	Pietrzak et al. (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
74	*Fratercula corniculata*	Evans et al (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
75	*Fratercula corniculata*	Elena Yu. GOLUBOVA		
76	*Fulmarus glacialis*	Paul M. THOMPSON	George M. DUNNET (Deceased)	
77	*Gypaetus barbatus*	Antoni MARGALIDA	Joan BERTRAN, Diego GARCÍA, Rafael PELAYO, Pedro PELAYO, Jordi CANUT, Elena VEGA, Juanjo GARCÍA, Jose BOLADO	
78	*Gypaetus barbatus*	Sonja C. KRÜGER	Arjun AMAR	
79	*Haematopus bachmani*	Youngren et al. (2018)		
80	*Haematopus ostralegus*	Martijn VAN DE POL	Kees OOSTERBEEK, Christiaan BOTH	
81	*Hirundo rustica*	Anders P. MØLLER		
82	*Hirundo rustica*	Florentino DE LOPE		
83	*Jynx torquilla*	Michael SCHAUB		
84	*Lamprotornis*	Dustin R.	Wilson NDERITU	U.S. National Science Foundation grants IOS-1257530 and IOS-1656098

	superbus	RUBENSTEIN		to D.R.R K. K. Caylor, J. Gitonga, D. J. Martins, Mpala Research Centre Meteorological and Hydrological Dataset [Datafile] (Mpala Research Centre, Laikipia, Kenya, 2017); accessible through https://mpala.org/data/weather-and-climate/
85	*Larus canus*	Monika BUKACIŃSKA	Dariusz BUKACIŃSKI, Arkadiusz BUCZYŃSKI	
86	*Larus crassirostris*	Watanuki & Ito (2012)		
87	*Larus glaucescens*	Youngren et al. (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
88	*Larus glaucescens*	Pietrzak et al. (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
89	*Larus glaucescens*	Evans et al (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
90	*Larus glaucescens*	Evans et al (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
91	*Macronectes giganteus*	Andrew G. WOOD	Richard A. PHILLIPS Bird Island field assistants	Ecosystems component of the British Antarctic Survey Polar Science for Planet Earth Programme, funded by The Natural Environment Research Council
92	*Macronectes halli*	Andrew G. WOOD	Richard A. PHILLIPS Bird Island field assistants	Ecosystems component of the British Antarctic Survey Polar Science for Planet Earth Programme, funded by The Natural Environment Research Council
93	*Malurus elegans*	Lyanne BROUWER	Marina LOUTER	Australian Research Council (DE130100174)
94	*Margarops fuscatus*	Wayne J. ARENDT	Jerry BAUER, Marvin A. TÓRREZ, Susannah B. LERMAN, David I. KING	USDA Forest Service, International Institute of Tropical Forestry
95	*Melanerpes formicivorus*	Walter D. KOENIG	Eric L. WALTERS	
96	*Mergus squamatus*	Diana V. SOLOVYEVA		Chukotka Gold Mine Co, a subsidiary of Kinross Gold; US Fish and Wildlife Service; The Wildfowl and Wetlands Trust
97	*Milvus migrans*	Fabrizio SERGIO	Julio BLAS, Fernando HIRALDO, Alessandro	Spanish Ministry of Science, Innovation and Universities with Feder Funds (project PGC2018-095860-B-I00)

			TANFERNA	Junta de Andalucía, Consejería de Conocimiento, Investigación y Universidad (Spain) (P18-FR-4239)
98	*Oceanodroma furcata*	Youngren et al. (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
99	*Oceanodroma furcata*	Pietrzak et al. (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
100	*Oceanodroma furcata*	Kettle (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
101	*Oceanodroma furcata*	Evans et al (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
102	*Oceanodroma furcata*	Drummond & Williams (2015)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
103	*Oceanodroma leucorhoa*	Youngren et al. (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
104	*Oceanodroma leucorhoa*	Pietrzak et al. (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
105	*Oceanodroma leucorhoa*	Evans et al (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
106	*Oceanodroma monteiroi*	Mark BOLTON	Joël BRIED	The data provided by Mark Bolton, Joël Bried and Verónica C. Neves were collected in the frame of (1) the projects PRAXIS/C/BIA/13194/98 andPOCTI-BIA-13194/98 funded by FCT and coordinated by MB, (2) the project PTDC/BIABDE/67286/2006 funded by FCT and by FEDER through the Programme COMPETE (Ref: FCOMP-01-0124-FEDER-007061), and coordinated by JB, and (3) the Programmes 'MARE' (Integrated Management of Coastal and Marine Sites of the Azores, Life contract B4-3200/98-509), 'OGAMP' (Planning and Management of Marine Protected Areas, Interreg IIIB-MAC/4.2/A2), 'MARMAC' (Knowledge, Promotion and Valorization for a Sustainable Utilization of Marine Protected Areas in Macaronesia, Interreg IIIB/FEDER/MARMAC/003-4/2005-6 and Interreg IIIB-05/MAC/4.2/A4), and MoniAves, all coordinated by R. S. Santos. IMAR-DOP/UAç is funded by FCT and DRCT-Azores as Research Unit 531 and Associate Laboratory 9 (ISR-Lisbon). Meteorological data were provided by the 'Delegação Regional dos Açores do Instituto Portuguęs do Mar e da Atmosfera' (Portuguese Institute for

				Sea and Atmosphere - Azores Regional Delegation).
107	*Oenanthe oenanthe*	Debora ARLT	Tomas PÄRT	Swedish Research Council VR; Swedish Research Council Formas; Ultuna Climate Station
108	*Pachyptila belcheri*	Petra QUILLFELDT		
109	*Panurus biarmicus*	Janusz Stępniewski		
110	*Parus major*	Marcel E. VISSER	Louis VERNOOIJ	
111	*Parus major*	Marcel E. VISSER	Louis VERNOOIJ	
112	*Parus major*	Marcel E. VISSER	Louis VERNOOIJ	
113	*Parus major*	Marcel E. VISSER	Louis VERNOOIJ	
114	*Parus major*	Juan C. Senar	J. QUESADA, F. MATEOS, E. PAGANI, H. NAVALPOTRO, L. ARROYO, D. MAZZONI	Ministry of Science and Innovation (CGL-2020 PID2020-114907GB-C21)
115	*Parus major*	Emilio BARBA	Elena ÁLVAREZ	
116	*Parus major*	János TÖRÖK	Gergely HEGYI, Balázs ROSIVALL, László Zsolt GARAMSZEGI, Gergely NAGY, Miklós LACZI	
117	*Parus major*	Indrikis KRAMS	Tatjana KRAMA	
118	*Passer domesticus*	David F. WESTNEAT	I.R.K. STEWART, M.I. HATCH, D.P. WETZEL, A. MUTZEL, R. FOX	U.S. National Science Foundation (IBN-9816989, IBN-0542097 and IOS1257718)
119	*Passerculus sandwichensis*	Nathaniel T. WHEELWRIGHT		
120	*Perisoreus infaustus*	Michael GRIESSER		Swiss National Science Foundation (PPOOP3_123520, PP00P3_150752, ERANet BiodivERsA (31BD30_172465d), Swedish Research Council (also to Jan Ekman), FORMAS (to Jan Ekman), University of Zurich, Deutsche Forschungsgemeinschaft (GR 4650/3-1, GR 4650/2-1).
121	*Phaethon lepturus*	Ramos et al. (2005)		

122	*Phalacrocorax auritus*	Youngren et al. (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
123	*Phalacrocorax capillatus*	Watanuki & Ito (2012)		
124	*Phalacrocorax pelagicus*	Youngren et al. (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
125	*Phalacrocorax pelagicus*	Pietrzak et al. (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
126	*Phalacrocorax pelagicus*	Evans et al (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
127	*Phalacrocorax pelagicus*	Hatch (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
128	*Phalacrocorax urile*	Youngren et al. (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
129	*Phalacrocorax urile*	Pollom et al. (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
130	*Phalacrocorax urile*	Mong et al. (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
131	*Phalacrocorax urile*	Drummond & Williams (2015)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
132	*Philetairus socius*	Rita COVAS	Claire DOUTRELANT	DST-NRF Centre of Excellence at the FitzPatrick Institute of African Ornithology (South Africa), FCT (Portugal; grants IF/01411/2014/CP1256/ CT0007 and PTDC/BIA-EVF/5249/2014 to RC) and ANR (France; grants ANR- 15-CE32-0012-02 and ANR 19-CE02-0014-02 to CD). De Beers Mining Corporation provided access to Benfontein Nature Reserve.
133	*Phoebastria immutabilis*	Donald C. DEARBORN	Elizabeth N. FLINT	
134	*Phoebastria nigripes*	Donald C. DEARBORN	Elizabeth N. FLINT	
135	*Phoenicurus phoenicurus*	Jiří PORKERT		

136	*Phoenicurus phoenicurus*	Sergey I. GASHKOV		Grant RSF 22-24-00468
137	*Plectrophenax nivalis*	Yngve ESPMARK	Arne MOKSNES	
138	*Podiceps grisegena*	Janusz KLOSKOWSKI		
139	*Protonotaria citrea*	Jeffrey P. HOOVER	Wendy M. SCHELSKY, Scott K. ROBINSON	United States Fish and Wildlife Service (INT 1448-0003-95-1007 and Neotropical Migratory Bird Conservation Act funds), the Illinois Department of Natural Resources (Conservation 2000 Grant and State Wildlife Grant), The Nature Conservancy in Illinois, The National Fish and Wildlife Fund, The R.J. Kosie Fund, Wings Over the Americas, the University of Illinois , Champaign County and Decatur Audubon Societies, Illinois Ornithological Society, American Ornithologists' Union, Sigma Xi, North American Bluebird Society, and the American Museum of Natural History.
140	*Protonotaria citrea*	Lesley BULLUCK	Charles BLEM, Cathy VIVERETTE	
141	*Pygoscelis adeliae*	Louise M. EMMERSON	Colin SOUTHWELL, Knowles KERRY	Australian Antarctic Division provided funding and logistics through Australian Antarctic Science projects 2722, 2205, 4086, and 4518
142	*Pygoscelis adeliae*	Michael J. DUNN	Signy Island field assistants	Ecosystems component of the British Antarctic Survey Polar Science for Planet Earth Programme, funded by The Natural Environment Research Council
143	*Pygoscelis antarcticus*	Małgorzata KORCZAK-ABSHIRE	Boleslaw JABLONSKI, Kazimierz SIERAKOWSKI	Henryk Arctowski Polish Antarctic Station
144	*Rissa brevirostris*	Pietrzak et al. (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
145	*Rissa brevirostris*	Pollom et al. (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
146	*Rissa brevirostris*	Mong et al. (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
147	*Rissa tridactyla*	Turner (2010, 2015, 2016, 2017)		
148	*Rissa tridactyla*	Robert T. BARRETT		

149	*Rissa tridactyla*	Mong et al. (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
150	*Rissa tridactyla*	Murphy et al. (2016)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
151	*Rissa tridactyla*	Pietrzak et al. (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
152	*Rissa tridactyla*	Dragoo et al. (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
153	*Rissa tridactyla*	Evans et al (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
154	*Rissa tridactyla*	Kettle (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
155	*Rissa tridactyla*	Pollom et al. (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
156	*Rissa tridactyla*	Hatch (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
157	*Rissa tridactyla*	Elena Yu. GOLUBOVA		
158	*Rissa tridactyla*	Drummond & Williams (2015)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
159	*Somateria fischeri*	Diana V. SOLOVYEVA		Chukotka Gold Mine Co, a subsidiary of Kinross Gold; US Fish and Wildlife Service; The Wildfowl and Wetlands Trust
160	*Somateria mollissima*	Markus ÖST	Kim JAATINEN, Benjamin B. STEELE	Swedish Cultural Foundation in Finland [grant numbers 17/3317, 602 16/1476, 15/3296, 14/2657, 13/2654, 138139, 149014, 158026, 168333 and 177733 to M.Ö.]; Tvärminne Zoological Station, University of Helsinki, Hanko, Finland
161	*Sterna dougallii*	Seward et al (2018)		
162	*Sterna dougallii*	Seward et al (2018)		
163	*Sterna dougallii*	Seward et al (2018)		
164	*Sterna dougallii*	Jaime A. RAMOS	David MONTICELLI	strategic program of MARE, financed by FCT (UID/MAR/04292/ 2020), through national funds; James Cadbury of the Royal Society for Nature Conservation and Aride Island Nature Reserve

165	*Sterna hirundo*	Peter H. BECKER	Sandra BOUWHUIS, K. Lesley SZOSTEK	German Research Foundation (Be 916); Institute of Avian Research (together with Sandra Bouwhuis); Station Cuxhaven, Deutscher Wetterdienst www.dwd.de
166	*Strix aluco*	Tapio SOLONEN		
167	*Strix aluco*	Patrik KARELL	Kari AHOLA, Teuvo KARSTINEN, Esa AALTONEN	Academy of Finland (grant numbers 309992, 335335, and 314108)
168	*Strix aluco*	Xavier LAMBIN	Steve J PETTY, Martin DAVIDSON, Alexandre MILLON, Brian LITTLE (deceased) and local staff from FORESTRY ENGLAND	
169	*Strix uralensis*	Hannu PIETIÄINEN		
170	*Sturnus unicolor*	Vicente POLO		
171	*Sturnus vulgaris*	Alexander NUMEROV		
172	*Sula nebouxii*	Hugh DRUMMOND	Cristina RODRÍGUEZ JUAREZ	UNAM PAPIIT (grants IN211491, IN-200702-3, IN206610-3, IN205313 and IN205819); CONACYT (grants 81823, 47599, 34500-V, 4722-N9407 and 104313); National Geographic Society (grant 991416); Mexican Navy and the staff of the Parque Nacional Isla Isabel
173	*Synthliboramphus antiquus*	Youngren et al. (2018)	Alaska Maritime National Wildlife Refuge	
174	*Synthliboramphus antiquus*	Elena Yu. GOLUBOVA		
175	*Tachycineta bicolor*	Michael P. LOMBARDO	Patrick A. THORPE	
176	*Tachycineta bicolor*	Nathaniel T. WHEELWRIGHT		
177	*Tachymarptis melba*	Pierre Bize	Charlotte KARSEGARD	This work was funded over the years by grants from the Swiss National Science Foundation (PA00A-109009, 31003A_124988), Carnegie Trust (RIG007773) and University of Aberdeen Research Board to Pierre Bize
178	*Tachymarptis melba*	Pierre Bize	Charlotte KARSEGARD	This work was funded over the years by grants from the Swiss National

				Science Foundation (PA00A-109009, 31003A_124988), Carnegie Trust (RIG007773) and University of Aberdeen Research Board to Pierre Bize
179	*Tetrao (Lyrurus) tetrix*	Wegge & Rolstad (2017)		
180	*Tetrao urogallus*	Wegge & Rolstad (2017)		
181	*Tetrao urogallus*	Moss et al. (2001)		
182	*Thalassarche chrysostoma*	Richard A. PHILLIPS	Andrew G. WOOD Bird Island field assistants, John CROXALL	Ecosystems component of the British Antarctic Survey Polar Science for Planet Earth Programme, funded by The Natural Environment Research Council
183	*Thalassarche melanophris*	Richard A. PHILLIPS	Andrew G. WOOD Bird Island field assistants, John CROXALL	Ecosystems component of the British Antarctic Survey Polar Science for Planet Earth Programme, funded by The Natural Environment Research Council
184	*Troglodytes aedon*	E. Keith BOWERS	Charles F. THOMPSON, Scott K. SAKALUK	
185	*Turdus merula*	Dariusz WYSOCKI		
186	*Tyto alba*	Alexandre ROULIN		
187	*Tyto alba*	Motti CHARTER		
188	*Uria aalge*	Michael P. HARRIS	Sarah WANLESS, Francis DAUNT, Mark NEWELL	
189	*Uria aalge*	Mong et al. (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
190	*Uria aalge*	Youngren et al. (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
191	*Uria aalge*	Evans et al (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
192	*Uria aalge*	Evans et al (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
193	*Uria aalge*	Pollom et al. (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge

194	*Uria aalge*	Elena Yu. GOLUBOVA		
195	*Uria lomvia*	Pollom et al. (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
196	*Uria lomvia*	Mong et al. (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
197	*Uria lomvia*	Youngren et al. (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
198	*Uria lomvia*	Pietrzak et al. (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
199	*Uria lomvia*	Evans et al (2017)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
200	*Uria lomvia*	Evans et al (2018)	the staff of Alaska Maritime National Wildlife Refuge	Alaska Maritime National Wildlife Refuge
201	*Uria lomvia*	Elena Yu. GOLUBOVA		