Ecography

E5090
Sandvik, H. and Erikstad, K. 2008. Seabird life histories and climatic fluctuations: a phylogenetic-comparative time analysis of North Atlantic seabirds. – Ecography 31: 73–83.

Table S1. Species studied in the interspecific analyses. Scientific species names follow Schreiber and Burger (2002), vernacular names Gill and Wright (2006). Parameters are chicks fledged ("cf") and adult survival ("as"). Length of time series is given in years. "Original" indicates whether data were given in the original study (X) or whether they were read from figures (blank).

Scientific species name	Vernacular species name	Colony	Parameter	Length	Original	References
Procellariidae						
Calonectris diomedea	Cory's shearwater	Selvagem Grande	cf	14		Mougin et al. 2000
Calonectris diomedea	Cory's shearwater	Selvagem Grande	as	10	X	Mougin et al. 1990
Fulmarus glacialis	northern fulmar	Eynhallow	cf	21		Ollason and Dunnet 1980
Fulmarus glacialis	northern fulmar	Eynhallow	as	17	X	Dunnet and Ollason 1978
Pterodroma madeira	Zino's petrel	Madeira	cf	15	X	Zino et al. 2001
Puffinus puffinus	Manx shearwater	Canna	cf	22	X	Swann 1995, Swann 2000
Puffinus puffinus	Manx shearwater	Skokholm	cf	4	X	Brooke 1978
Puffinus puffinus	Manx shearwater	Skokholm	cf	4	X	Brooke 1978
Puffinus puffinus	Manx shearwater	Skokholm	as	4	X	Brooke 1990
Sulidae						
Morus bassanus	northern gannet	Troup Head	cf	8	X	Wanless et al. 1996a
Morus bassanus	northern gannet	Bass Rock	as	16	X	Nelson 1978
Phalacrocoracidae						
Phalacrocorax carbo	great cormorant	Ceann Leathad	cf	6	X	Budworth et al. 2000
Phalacrocorax carbo	great cormorant	Vorsø	as	19		Frederiksen and Bregnballe 2000
Stictocarbo aristotelis	European shag	Canna	cf	24		Swann 2000
Stictocarbo aristotelis	European shag	Farne I	cf	5	X	Potts et al. 1980
Stictocarbo aristotelis	European shag	May	cf	22	X	Aebischer 1986, Aebischer and Wanless 1992
Stictocarbo aristotelis	European shag	May	cf	13		Rindorf et al. 2000
Stictocarbo aristotelis	European shag	Runde	cf	4	X	Røv 1990
Stictocarbo aristotelis	European shag	Farne I	as	9	X	Potts et al. 1980
Stictocarbo aristotelis	European shag	May	as	11	X	Harris et al. 2000a
Stercorariidae						
Catharacta skua	great skua	Foula	cf	5	X	Catry et al. 1998
Catharacta skua	great skua	Foula	as	8	X	Catry et al. 1998
Catharacta skua	great skua	Foula	cf	5	X	Catry et al. 1998
Catharacta skua	great skua	Foula	as	8	X	Catry et al. 1998
Stercorarius parasiticus	parasitic jaeger	Foula	cf	9	X	Phillips et al. 1996
Stercorarius parasiticus	parasitic jaeger	Fair Isle	as	6	X	O'Donald 1983
Laridae						
Larus argentatus	herring gull	May	cf	6	X	Wanless et al. 1996b
Larus argentatus	herring gull	Sligneach Mor	cf	4	X	Craik and Campbell 2000
Larus argentatus	herring gull	Trébéron	cf	7	X	Pons and Migot 1995
Larus argentatus	herring gull	Tryskärsgrund	cf	6	X	Kilpi 1989
Larus argentatus	herring gull	May	as	4	X	Wanless et al. 1996b
Larus argentatus	herring gull	Skomer	as	19		Perrins and Smith 2000
Larus argentatus	herring gull	Trébéron	as	6	X	Pons and Migot 1995
Larus canus	mew gull	Hanko	cf	8	X	Kilpi 1995
Larus fuscus	lesser black-backed gull	May	cf	6	X	Wanless et al. 1996b
Larus fuscus	lesser black-backed gull	Skomer	cf	10		Perrins and Smith 2000

Larus fuscus	lesser black-backed gull	Söderskär	cf	10	X	Hario 1990
Larus fuscus	lesser black-backed gull	May	as	4	X	Wanless et al. 1996b
Larus fuscus	lesser black-backed gull	Skomer	as	20		Perrins and Smith 2000
Larus marinus	great black-backed gull	Skomer	cf	4		Perrins and Smith 2000
Larus marinus	great black-backed gull	Sligneach Mor	cf	5	X	Craik and Campbell 2000
Rissa tridactyla	black-legged kittiwake	Canna	cf	14	X	Swann 2000
Rissa tridactyla	black-legged kittiwake	Dunmore Black Knob	cf	5	X	Walsh and McGrath 1989
Rissa tridactyla	black-legged kittiwake	Dunmore Inner Harbour	cf	6	X	Walsh and McGrath 1989
Rissa tridactyla	black-legged kittiwake	Dunmore Outer Harbour	cf	5	X	Walsh and McGrath 1989
Rissa tridactyla	black-legged kittiwake	Fair Isle	cf	14		Rothery et al. 2002
Rissa tridactyla	black-legged kittiwake	Hornøya	cf	5	X	Erikstad et al. 1995
Rissa tridactyla	black-legged kittiwake	May	cf	13	X	Harris and Wanless 1997, Rindorf et al. 2000
Rissa tridactyla	black-legged kittiwake	S Shields	cf	30		Coulson and Thomas 1985
Rissa tridactyla	black-legged kittiwake	Wales	cf	16		Mavor et al. 2002
Rissa tridactyla	black-legged kittiwake	Breizh	as	14	X	Cam et al. 1998
Rissa tridactyla	black-legged kittiwake	Fair Isle	as	11	X	Rothery et al. 2002
Rissa tridactyla	black-legged kittiwake	Foula	as	11		Oro and Furness 2002
Rissa tridactyla	black-legged kittiwake	Hornøya	as	12	X	Sandvik et al. 2005
Rissa tridactyla	black-legged kittiwake	Lizard Point	as	6	X	Coulson and Butterfield 1986
Rissa tridactyla	black-legged kittiwake	May	as	11	X	Harris et al. 2000a
Rissa tridactyla	black-legged kittiwake	S Shields	as	44		Coulson and Strowger 1999
Sterna antillarum	least tern	New Jersey	cf	10		Burger 1989
Sterna dougallii	roseate tern	Bird Island	cf	4		Burger et al. 1996
Sterna dougallii	roseate tern	Cedar Beach	cf	4		Burger et al. 1996
Sterna dougallii	roseate tern	Falkner Island	as	8	X	Spendelow and Nichols 1989
Sterna hirundo	common tern	Augustgroden	cf	16	X	Becker 1998
Sterna hirundo	common tern	Banter See	cf	16	X	Becker 1998
Sterna hirundo	common tern	Buster	cf	5	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	Cedar Creek	cf	13	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	E Carvel	cf	13	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	E Ham	cf	9	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	E Vol	cf	12	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	Flat Creek	cf	5	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	Gulf Point	cf	4	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	Hester Sedge	cf	10	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	High Bar	cf	12	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	Little	cf	10	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	Log Creek	cf	11	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	Minsener Oldeoog	cf	17		Becker 1998, Thyen et al. 2000
Sterna hirundo	common tern	Mordecai	cf	11	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	N Lavallette	cf	13	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	NW Lavallette	cf	13	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	Pettit	cf	13	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	S Lavallette	cf	13	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	SW Cedar Bonnet	cf	8	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	SW Lavallette	cf	13	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	Thorofare	cf	7	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	W Carvel	cf	7	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	W Ham	cf	13	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	W Long Point	cf	5	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	W Vol	cf	13	X	Burger and Gochfeld 1991
Sterna hirundo	common tern	Banter See	as	7	X	Becker et al. 2001
Sterna maxima	royal tern	Bird Bank	cf	4	X	Blus et al. 1979
Sterna paradisaea	Arctic tern	Foula	cf	11	X	Furness 1983
Sterna paradisaea	Arctic tern	Machias Seal Island	cf	4	X	Newell 1985
Alcidae						
Alca torda	razorbill	May	cf	6	X	Harris and Wanless 1989
Alca torda	razorbill	Hornøya	as	8	X	Sandvik et al. 2005
Alca torda	razorbill	May	as	11	X	Harris et al. 2000a

Alca torda	razorbill	Shiant Islands	as	6	X	Steventon 1979
Fratercula arctica	Atlantic puffin	Dùn	cf	17	X	Harris et al. 1998
Fratercula arctica	Atlantic puffin	May	cf	14	X	Harris and Bailey 1992
Fratercula arctica	Atlantic puffin	Hornøya	as	12	X	Sandvik et al. 2005
Fratercula arctica	Atlantic puffin	May	as	20	X	Harris et al. 1997
Fratercula arctica	Atlantic puffin	Skomer	as	4	X	Ashcroft 1979
Uria aalge	common murre	May	cf	10	X	Harris and Bailey 1992
Uria aalge	common murre	May	cf	13		Rindorf et al. 2000
Uria aalge	common murre	Stora Karlsö	cf	4	X	Hedgren 1980
Uria aalge	common murre	Canna	as	12	X	Harris et al. 2000b
Uria aalge	common murre	Colonsay	as	5	X	Harris et al. 2000b
Uria aalge	common murre	Hornøya	as	14	X	Sandvik et al. 2005
Uria aalge	common murre	May	as	13	X	Harris et al. 2000b
Uria lomvia	thick-billed murre	Hornøya	as	13	X	Sandvik et al. 2005

References

Aebischer, N. J. 1986. Retrospective investigation of an ecological disaster in the shag, *Phalacrocorax aristotelis*: a general method based on long-term marking. – J. Anim. Ecol. 55: 613–629.

Aebischer, N. J. and Wanless, S. 1992. Relationships between colony size, adult non-breeding and environmental conditions for shags *Phalacrocorax aristotelis* on the Isle of May, Scotland. – Bird Study 39: 43–52.

Ashcroft, R. E. 1979. Survival rates and breeding biology of puffins on Skomer Island, Wales. – Ornis Scand. 10: 100–110.

Becker, P. H. 1998. Langzeittrends des Bruterfolges der Flußseeschwalbe *Sterna hirundo* und seiner Einflußgrößen im Wattenmeer. – Vogelwelt 119: 223–234.

Becker, P. H. et al. 2001. Population dynamics, recruitment, individual quality and reproductive strategies in common terns *Sterna hirundo* marked with transponders. – Ardea 89: 241–252.

Blus, L. J. et al. 1979. Relation of environmental factors to breeding status of royal and sandwich terns in South Carolina, USA. – Biol. Conserv. 16: 301–320.

Brooke, M. de L. 1978. Some factors affecting the laying date, incubation and breeding success of the manx shearwater, *Puffinus puffinus*. – J. Anim. Ecol. 47: 477–495.

Brooke, M. de L. 1990. The Manx shearwater. – Poyser.

Budworth, D. et al. 2000. Status, productivity, movements and mortality of great cormorants *Phalacrocorax carbo* breeding in Caithness, Scotland: a study of a declining population. – Atl. Seabirds 2: 165–180.

Burger, J. 1989. Least tern populations in coastal New Jersey: monitoring and management of a regionally-endangered species. – J. Coast. Res. 5: 801–811.

Burger, J. and Gochfeld, M. 1991. The common tern: its breeding biology and social behavior. – Columbia Univ. Press.

Burger, J. et al. 1996. Temporal patterns in reproductive success in the endangered roseate tern (*Sterna dougallii*) nesting on Long Island, New York, and Bird Island, Massachusetts. – Auk 113: 131–142.

Cam, E. et al. 1998. Are adult nonbreeders prudent parents? The Kittiwake model. – Ecology 79: 2917–2930.

Catry, P. et al. 1998. The incidence of nonbreeding by adult great skuas and parasitic jaegers from Foula, Shetland. – Condor 100: 448–455.

Coulson, J. C. and Thomas, C. 1985. Differences in the breeding performance of individual kittiwake gulls, *Rissa tridactyla* (L.). – In: Sibly, R. M. and Smith, R. H. (eds), Behavioural ecology: ecological consequences of adaptive behaviour. Blackwell, pp. 489–503.

Coulson, J. C. and Butterfield, J. 1986. Studies on a colony of colour-ringed herring gulls *Larus argentatus*: I. Adult survival rates. – Bird Study 33: 51–54.

Coulson, J. C. and Strowger, J. 1999. The annual mortality rate of black-legged kittiwakes in NE England from 1954 to 1998 and a recent exceptionally high mortality. – Waterbirds 22: 3–13.

Craik, J. C. A. and Campbell, B. 2000. Bruce Campbell's Islands revisited: changes in seabirds of Loch Sunart after half a century. – Atl. Seabirds 2: 181–194.

Dunnet, G. M. and Ollason, J. C. 1978. The estimation of survival rate in the fulmar, *Fulmarus glacialis*. – J. Anim. Ecol. 47: 507–520.

Erikstad, K. E. et al. 1995. Adult survival and chick production in long-lived seabirds: a 5-year study of the kittiwake *Rissa tridactyla*. – In: Skjoldal, H. R. et al. (eds), Ecology of fjords and coastal waters. Proceedings of the Mare Nor Symposium on the Ecology of Fjords and Coastal Waters, Tromsø, Norway, 5–9 December, 1994. Elsevier, pp. 471–477.

Frederiksen, M. and Bregnballe, T. 2000. Evidence for density-dependent survival in adult cormorants from a combined analysis of recoveries and resightings. – J. Anim. Ecol. 69: 737–752.

Furness, R. W. 1983. The birds of Foula. – Brathay Hall Trust.

Gill, F. and Wright, M. (eds) 2006. Birds of the world: recommended English names. – Helm.

Hario, M. 1990. Breeding failure and feeding conditions of lesser black-backed gulls *Larus f. fuscus* in the Gulf of Finland. – Ornis Fenn. 67: 113–129.

Harris, M. P. and Wanless, S. 1989. The breeding biology of razorbills *Alca torda* on the Isle of May. – Bird Study 36: 105–114.

Harris, M. P. and Bailey, R. S. 1992. Mortality rates of puffin *Fratercula arctica* and guillemot *Uria aalge* and fish abundance in the North Sea. – Biol. Conserv. 60: 39–46.

Harris, M. P. and Wanless, S. 1997. Breeding success, diet, and brood neglect in the kittiwake (*Rissa tridactyla*) over an 11-year period. – Int. Counc. Explor. Sea J. Mar. Sci. 54: 615–623.

Harris, M. P. et al. 1997. Factors influencing the survival of puffins *Fratercula arctica* at a North Sea colony over a 20-year period. – J. Avian Biol. 28: 287–295.

Harris, M. P. et al. 1998. Long-term changes in breeding performance of puffins *Fratercula arctica* on St Kilda. – Bird Study 45: 371–374.

Harris, M. P. et al. 2000a. Adult survival rates of shag *Phalacrocorax aristotelis*, common guillemot *Uria aalge*, razorbill *Alca torda*, puffin *Fratercula arctica* and kittwake *Rissa tridactyla* on the Isle of May 1986–96. – Atl. Seabirds 2: 133–150.

Harris, M. P. et al. 2000b. Survival of adult common guillemots *Uria aalge* at three Scottish colonies. – Bird Study 47: 1–7.

Hedgren, S. 1980. Reproductive success of guillemots *Uria aalge* on the island of Stora Karlsö. – Ornis Fenn. 57: 49–57.

Kilpi, M. 1989. The effect of varying pair numbers on reproduction and use of space in a small herring gull *Larus argentatus* colony. – Ornis Scand. 20: 204–210.

Kilpi, M. 1995. Breeding success, predation and local dynamics of colonial common gulls *Larus canus*. – Ann. Zool. Fenn. 32: 175–182.

Mavor, R. A. et al. 2002. Seabird numbers and breeding success in Britain and Ireland, 2001. – Joint Nature Conservation Committee.

Mougin, J.-L. et al. 1990. L'évolution des effectifs de la population reproductrice de puffins cendrés *Calonectris diomedea borealis* de l'île Selvagem Grande (30°09′N, 15°52′W) de 1986 à 1989. – Bol. Mus. Munic. Funchal 42: 39–50.

Mougin, J.-L. et al. 2000. Mate fidelity in Cory's shearwater *Calonectris diomedea* on Selvagem Grande. – Ibis 142: 421–427.

Nelson, J. B. 1978. The Sulidae: gannets and boobies. – Oxford Univ. Press.
Newell, R. B. 1985. Nesting ecology of Arctic terns *Sterna paradisaea* Pontoppidan in relation to habitat on Machias Seal Island. – M.Sc. thesis, Acadia Univ.
O'Donald, P. 1983. The Arctic skua: a study of the ecology and evolution of a seabird. – Cambridge Univ. Press.
Ollason, J. C. and Dunnet, G. M. 1980. Nest failures in the fulmar: the effect of observers. – J. Field Ornithol. 51: 39–54.
Oro, D. and Furness, R. W. 2002. Influences of food availability and predation on survival of kittiwakes. – Ecology 83: 2516–2528.
Perrins, C. M. and Smith, S. B. 2000. The breeding *Larus* gulls on Skomer Island National Nature Reserve, Pembrokeshire. – Atl. Seabirds 2: 195–210.
Phillips, R. A. et al. 1996. The influence of food availability on the breeding effort and reproductive success of Arctic skuas *Stercorarius parasiticus*. – Ibis 138: 410–419.
Pons, J.-M. and Migot, P. 1995. Life-history strategy of the herring gull: changes in survival and fecundity in a population subjected to various feeding conditions. – J. Anim. Ecol. 64: 592–599.
Potts, G. R. et al. 1980. Population dynamics and breeding success of the shag, *Phalacrocorax aristotelis*, on the Farne Islands, Northumberland. – J. Anim. Ecol. 49: 465–484.
Rindorf, A. et al. 2000. Effects of changes in sandeel availability on the reproductive output of seabirds. – Mar. Ecol. Prog. Ser. 202: 241–252.
Rothery, P. et al. 2002. Colony size, adult survival rates, productivity and population projections of black-legged kittiwakes *Rissa tridactyla* on Fair Isle. – Atl. Seabirds 4: 17–28.
Røv, N. 1990. Bestandsforhold hos toppskarv i Norge. – Nor. Inst. Naturforsk. Forsk.-rapp. 7: 1–28.
Sandvik, H. et al. 2005. The effect of climate on adult survival in five species of North Atlantic seabirds. – J. Anim. Ecol. 74: 817–831.
Schreiber, E. A. and Burger, J. (eds) 2002. Biology of marine birds. – CRC.
Spendelow, J. A. and Nichols, J. D. 1989. Annual survival rates of breeding adult roseate terns. – Auk 106: 367–374.
Steventon, D. J. 1979. Razorbill survival and population estimates. – Ringing Migr. 2: 105–112.
Swann, B. 2000. Integrated seabird monitoring studies on the Isle of Canna, Scotland 1969–99. – Atl. Seabirds 2: 151–164.
Swann, R. L. 1995. Numbers and breeding success of Manx shearwaters on the Isle of Canna, 1973–94. – Scott. Birds 18: 56–57.
Thyen, S. et al. 2000. Bruterfolgsmonitoring bei Küstenvögeln im Wattenmeer 1996 und 1997. – Vogelwelt 121: 269–280.
Walsh, P. M. and McGrath, D. 1989. Breeding productivity of kittiwakes *Rissa tridactyla* in southeast Ireland, 1983–88. – Seabird 12: 54–63.
Wanless, S. et al. 1996a. The Troup Head gannetry. – Scott. Birds 18: 214–221.
Wanless, S. et al. 1996b. Modelling responses of herring gull and lesser black-backed gull populations to reduction of reproductive output: implications for control measures. – J. Appl. Ecol. 33: 1420–1432.
Zino, F. et al. 2001. Conservation of Zino's petrel *Pterodroma madeira* in the archipelago of Madeira. – Oryx 35: 128–136.

Table S2. Responsiveness to climatic variation in chick production of 22 species of North Atlantic seabirds. Responsiveness to climate – estimated for time lags between zero and six years – was defined as the coefficient of determination derived from Pearson's correlation (see Material and Methods). Superscripts in brackets indicate the number of colonies that exhibited significant correlations at the 5% level. The columns "n_S" and "n_Y" provide sample sizes in terms of colonies and colony-years, respectively. Bold numbers give summary statistics: the column "0–3" indicates the mean responsiveness across these time lags. Significance levels in this column ($0.05 > p^* \geq 0.01 > p^{**} \geq 0.001$) and the final row are derived from a bootstrapping procedure (see Material and Methods). The cells at the intersection between the "0–3" column and the "Mean" and "p" rows provide overall test results for time lags 0–3 across all species.

Species	n_S	n_Y	Time lags 0	1	2	3	**0–3**	4	5	6
Procellariidae										
Calonectris diomedea	1	14	0.001	0.044	0.014	0.017	**0.019**	0.020	0.328 (1)	0.109
Fulmarus glacialis	1	21	0.310 (1)	0.003	0.006	0.006	**0.081**	0.133	0.220 (1)	0.008
Pterodroma madeira	1	15	0.218	0.567 (1)	0.129	0.010	**0.231** **	0.013	0.013	0.007
Puffinus puffinus	3	30	0.100	0.022	0.134 (1)	0.130	**0.096**	0.134	0.045	0.390 (1)
Sulidae										
Morus bassanus	1	8	0.556 (1)	0.169	0.004	0.084	**0.203**	0.080	0.105	0.338
Phalacrocoracidae										
Phalacrocorax carbo	1	6	0.005	0.158	0.358	0.333	**0.214**	0.199	0.785 (1)	0.073
Stictocarbo aristotelis	5	68	0.086	0.123	0.072	0.073	**0.089**	0.051	0.080	0.123 (1)
Stercorariidae										
Catharacta skua	1	5	0.147	0.057	0.019	0.067	**0.073**	0.116	0.516	0.338
Stercorarius parasiticus	1	9	0.009	0.141	0.706 (1)	0.502 (1)	**0.339** *	0.114	0.011	0.502 (1)
Laridae										
Larus argentatus	4	23	0.261 (1)	0.246 (1)	0.103	0.188	**0.234**	0.188	0.195 (1)	0.326 (1)
Larus canus	1	8	0.005	0.296	0.223	0.000	**0.131**	0.191	0.578 (1)	0.034
Larus fuscus	3	26	0.070	0.226	0.106	0.071	**0.118**	0.091	0.071	0.123
Larus marinus	2	9	0.052	0.324	0.134	0.504	**0.254**	0.113	0.091	0.174
Rissa tridactyla	9	108	0.074	0.231 (4)	0.149 (1)	0.052	**0.126**	0.120	0.068	0.137 (3)
Sterna antillarum	1	10	0.001	0.051	0.200	0.427 (1)	**0.170**	0.091	0.019	0.145
Sterna dougallii	2	8	0.334	0.766	0.224	0.257	**0.395**	0.157	0.544 (1)	0.042
Sterna hirundo	26	282	0.110 (1)	0.087 (1)	0.038	0.073 (1)	**0.077**	0.265 (8)	0.060 (1)	0.100 (1)
Sterna maxima	1	4	0.825	0.175	0.357	0.623	**0.495**	0.479	0.088	0.037
Sterna paradisaea	2	15	0.282	0.197	0.109	0.142	**0.182**	0.163	0.517 (1)	0.231
Alcidae										
Alca torda	1	6	0.054	0.005	0.690 (1)	0.284	**0.258**	0.022	0.279	0.589
Fratercula arctica	2	31	0.071	0.088	0.076	0.021	**0.064**	0.015	0.007	0.083
Uria aalge	3	27	0.023	0.142	0.072	0.126	**0.091**	0.260 (1)	0.362 (2)	0.051
Sum	**72**	**733**	**(4)**	**(6)**	**(4)**	**(3)**		**(9)**	**(10)**	**(8)**
Mean	**3**	**33**	**0.163**	**0.187**	**0.188**	**0.177**	0.179	**0.137**	**0.226**	**0.180**
p			**0.40**	**0.18**	**0.18**	**0.26**	**0.095**	**0.71**	**0.029**	**0.024**

Table S3. Responsiveness to climatic variation in adult survival of 17 species of North Atlantic seabirds. Asterisks indicate significance levels ($0.1 > p^{+} \geq 0.05 > p^{*} \geq 0.01 > p^{**} \geq 0.001$). See Table S2 for further explanations.

Species	n_S	n_Y	Time lags: 0	1	2	3	0–3	4	5	6
Procellariidae										
Calonectris diomedea	1	10	0.153	0.118	0.132	0.082	**0.121**	0.237	0.002	0.213
Fulmarus glacialis	1	17	0.388 (1)	0.099	0.067	0.005	**0.140** +	0.091	0.005	0.026
Puffinus puffinus	1	4	0.476	0.003	0.355	0.099	**0.234**	0.007	0.230	0.241
Sulidae										
Morus bassanus	1	16	0.031	0.033	0.060	0.077	**0.050**	0.023	0.003	0.009
Phalacrocoracidae										
Phalacrocorax carbo	1	19	0.045	0.005	0.093	0.467 (1)	**0.153** *	0.003	0.064	0.020
Stictocarbo aristotelis	2	20	0.261	0.137	0.009	0.032	**0.109**	0.075	0.287	0.196
Stercorariidae										
Catharacta skua	1	8	0.305	0.138	0.000	0.011	**0.113**	0.260	0.226	0.317
Stercorarius parasiticus	1	6	0.282	0.261	0.202	0.414	**0.290**	0.436	0.874 (1)	0.014
Laridae										
Larus argentatus	3	29	0.027	0.235 (1)	0.089	0.252	**0.151**	0.141	0.034	0.085
Larus fuscus	2	24	0.057	0.000	0.022	0.067	**0.037**	0.136	0.238 (1)	0.223 (1)
Rissa tridactyla	7	109	0.061	0.109 (2)	0.057	0.041	**0.067**	0.084	0.063	0.066
Sterna dougallii	1	8	0.054	0.521 (1)	0.001	0.055	**0.158**	0.013	0.256	0.026
Sterna hirundo	1	7	0.736 (1)	0.003	0.001	0.007	**0.187**	0.040	0.138	0.109
Alcidae										
Alca torda	3	25	0.210	0.074	0.036	0.137	**0.115**	0.075	0.065	0.335 (1)
Fratercula arctica	3	36	0.237 (1)	0.086	0.226 (1)	0.132	**0.170** *	0.122	0.081	0.176 (1)
Uria lomvia	1	13	0.168	0.010	0.024	0.010	**0.053**	0.042	0.111	0.100
Uria aalge	4	44	0.124 (1)	0.046	0.109	0.100 (1)	**0.095**	0.048	0.197 (1)	0.036
Sum	**34**	**395**	(4)	(4)	(1)	(2)		(3)	(3)	(3)
Mean	**2**	**23**	**0.213** **	**0.110**	**0.087**	**0.117**	**0.132**	**0.108**	**0.169**	**0.129**
p			**0.0063**	**0.66**	**0.88**	**0.57**	**0.31**	**0.70**	**0.098**	**0.42**

Table S4. Correlations between the responsiveness to climatic variability in offspring production and adult survival, respectively, and six explanatory variables at different time lags (0–3 yr). Values provided are the correlation coefficients between the interspecific variation of the climatic responsiveness at the given time lag, and the explanatory variables. The sample size (n) is the number of phylogenetically independent contrasts. Asterisks indicate significance levels: $0.1 > p^{+} \geq 0.05 > p^{*} \geq 0.01 > p^{**} \geq 0.001$. Bold numbers give summary statistics across columns or rows: the column "0–3" and the row "overall probability" indicate probabilities derived from a bootstrapping procedure (see Material and Methods). The cells at the intersection between the "0–3" column and the "overall probability" rows provide overall test results for time lags 0–3 across all explanatory variables except the principal component, which is given in separate rows. Probabilities are given in italics to facilitate the discrimination from correlation coefficients.

				Time lag		
Explanatory variable	n	0	1	2	3	**0–3**
Climatic responsiveness in **offspring production**						
clutch size	14	–0.664**	–0.047	+0.140	+0.052	***0.15***
chick production	19	–0.268	+0.174	+0.105	+0.107	***0.82***
age at maturity	19	+0.411+	–0.214	–0.449*	–0.122	***0.076***
adult survival	19	–0.147	–0.148	–0.438*	–0.417*	***0.40***
foraging distance	19	+0.015	–0.181	–0.286	–0.467*	***0.18***
diving depth	19	+0.257	–0.022	+0.069	+0.300	***0.73***
overall probability		***0.081***	***0.90***	***0.35***	***0.34***	***0.30***
principal component	**19**	**–0.433***	**+0.204**	**+0.436***	**+0.300**	***0.031***
Climatic responsiveness in **adult survival**						
clutch size	9	+0.045	–0.118	–0.128	+0.474	***0.37***
chick production	13	–0.243	+0.184	+0.104	+0.551*	***0.054***
age at maturity	14	+0.033	–0.058	–0.164	–0.411+	***0.64***
adult survival	14	+0.045	–0.195	+0.166	–0.073	***0.87***
foraging distance	14	+0.227	–0.413+	–0.106	–0.349	***0.11***
diving depth	13	–0.231	–0.153	–0.004	+0.240	***0.46***
overall probability		***0.73***	***0.43***	***0.90***	***0.020***	***0.24***
principal component	**14**	**–0.096**	**+0.187**	**+0.056**	**+0.499***	***0.088***