

Seabird–fish interactions: the fall and rise of a common guillemot *Uria aalge* population

Kjell Einar Erikstad^{1,*}, Tone Kristin Reiertsen², Robert T. Barrett²,
Frode Vikebø³, Hanno Sandvik⁴

¹Norwegian Institute for Nature Research, FRAM – High North Research Centre for Climate and the Environment, 9296 Tromsø, Norway

²Dept. of Natural Sciences, Tromsø University Museum, 9037 Tromsø, Norway

³Institute of Marine Research, Box 1870, Nordnes, 5817 Bergen, Norway

⁴Centre for Conservation Biology, Dept of Biology, Norwegian University of Science and Technology (NTNU), 7049 Trondheim, Norway

*Email: kjell.e.erikstad@nina.no

Marine Ecology Progress Series: 475: 267–276 (2013)

Supplement 1. Correlation between explanatory variables

Explanatory variables used in modelling common guillemot population dynamics were log-transformed stock sizes of cod (0-group only), capelin (all age groups summed) and herring (0-group only). Each covariate was tested both unlagged and lagged by 4, 5 and 6 yr. Collinearity between the explanatory variables was investigated using a correlation matrix (Table S1).

Table S1. *Gadus morhua*, *Mallotus villosus*, and *Clupea harengus*. Correlation matrix of covariates used. Significance levels are indicated using asterisks, ***p < 0.001, **p < 0.01, *p < 0.05, +p < 0.1. **Boldface** indicates the correlation between the variables of the top-ranked model (cf. Table 1 in the main text)

Species/ time lag (yr)	Cod			Capelin				Herring			
	lag 4	lag 5	lag 6	lag 0	lag 4	lag 5	lag 6	lag 0	lag 4	lag 5	lag 6
Cod/0	−0.14	−0.09	−0.07	−0.08	+0.23	−0.01	−0.18	+0.06	+0.16	+0.25	+0.35 ⁺
Cod/4		+0.51**	+0.36 ⁺	−0.04	+0.07	+0.20	+0.16	−0.40 ⁺	+0.36 ⁺	+0.43*	+0.27
Cod/5			+0.53**	+0.25	−0.24	−0.01	+0.15	−0.28	+0.27	+0.40*	+0.42*
Cod/6				+0.51*	−0.37⁺	−0.31	−0.09	−0.11	−0.04	+0.38 ⁺	+0.48*
Capelin/0					−0.82***	−0.73***	−0.28	+0.01	−0.39 ⁺	+0.03	+0.30
Capelin/4						+0.64***	+0.05	−0.09	+0.25	−0.08	−0.40*
Capelin/5							+0.66***	−0.35 ⁺	+0.56**	+0.12	−0.21
Capelin/6								−0.46*	+0.48*	+0.35 ⁺	−0.05
Herring/0									−0.36 ⁺	−0.18	+0.11
Herring/4										+0.19	+0.16
Herring/5											+0.40 ⁺

Supplement 2. Complete set of models tested

The complete set of population models tested is shown in Table S2. The models displayed in Table 1 of the main text are a subset of Table S2, viz. only the models that have a lower AIC_C than the respective neighbouring models with fewer parameters.

Table S2. *Uria aalge*. Comparison of all population models tested of common guillemot on Hornøya with fish stocks at different time lags as covariates. Models are sorted by ascending ΔAIC_C (change in Akaike's Information Criterion corrected for small sample sizes). Models with a negative slope were disregarded when calculating model likelihoods. Number of parameters is designated as k , variance explained as r^2

Model: fish (lag in yr)	k	AIC	ΔAIC_C	Model likelihood	r^2
Cod (0) + cod (6) + capelin (4)	6	-70.76	0.00	1.000	0.559
Cod (0) + cod (6)	5	-69.23	0.22	0.895	0.489
Cod (0) + cod (4)	5	-69.10	0.35	0.839	0.487
Cod (0) + cod (6) + capelin (5)	6	-70.28	0.48	0.787	0.551
Cod (0) + cod (4) + herring (4) ^a	6	-70.27	0.49		
Cod (0) + cod (4) + capelin (6) ^a	6	-69.79	0.97		
Cod (0) + cod (4) + herring (6)	6	-69.78	1.00	0.606	0.542
Cod (0) + cod (4) + capelin (4)	6	-69.46	1.30	0.521	0.535
Cod (0)	4	-67.19	1.31	0.520	0.396
Cod (0) + cod (4) + capelin (5)	6	-69.16	1.60	0.449	0.530
Cod (0) + cod (4) + herring (0) ^a	6	-69.05	1.71		
Cod (0) + cod (4) + herring (5)	6	-69.01	1.75	0.418	0.527
Cod (0) + cod (5)	5	-67.65	1.80	0.406	0.455
Cod (0) + herring (6)	5	-66.95	2.50	0.287	0.439
Cod (0) + cod (6) + cod (5)	6	-67.92	2.84	0.241	0.504
Cod (0) + cod (6) + cod (4)	6	-67.80	2.96	0.227	0.502
Cod (0) + herring (5)	5	-66.44	3.00	0.222	0.427
Cod (0) + herring (0) ^a	5	-66.29	3.16		
Cod (0) + cod (6) + herring (6)	6	-67.59	3.17	0.205	0.497
Cod (0) + cod (6) + herring (4)	6	-67.36	3.40	0.183	0.492
Cod (0) + cod (6) + capelin (6) ^a	6	-67.27	3.49		
Cod (0) + capelin (5)	5	-65.93	3.52	0.172	0.415

Model: fish (lag in yr)	k	AIC	ΔAIC_c	Model likelihood	r^2
Cod (0) + cod (4) + cod (5)	6	-67.07	3.69	0.158	0.487
Cod (0) + capelin (4)	5	-65.50	3.95	0.139	0.404
Cod (0) + capelin (6) ^a	5	-65.32	4.13		
Cod (0) + cod (6) + capelin (0) ^a	6	-66.54	4.22		
Cod (0) + herring (4) ^a	5	-65.19	4.26		
Cod (0) + cod (4) + capelin (0) ^a	6	-66.05	4.71		
Cod (0) + cod (6) + herring (0) ^a	6	-65.70	5.06		
Cod (0) + cod (6) + herring (5)	6	-65.14	5.62	0.060	0.443
Cod (0) + capelin (0) ^a	5	-61.27	8.18		
Herring (6)	4	-58.38	10.11	0.006	0.128
[Null model]	3	-57.13	10.70	0.005	0.048
Herring (5)	4	-57.14	11.35	0.003	0.080
Capelin (4)	4	-56.92	11.57	0.003	0.072
Cod (4)	4	-56.38	12.11	0.002	0.051
Cod (6)	4	-55.99	12.51	0.002	0.035
Capelin (6) ^a	4	-55.81	12.68		
Cod (5)	4	-55.63	12.86	0.002	0.021
Capelin (5)	4	-55.57	12.92	0.002	0.018
Herring (0) ^a	4	-55.40	13.09		
Herring (4)	4	-55.25	13.24	0.001	0.005
Capelin (0) ^a	4	-53.62	14.87		

^aThe estimate was negative, and the model was disregarded