This README file is a slightly modified version of Appendix 4 that accompanies the paper.

Appendix 4: R code and data for space-time occurrence models

The folder 'Space-time models.zip' contains R code and data to run all models described in the paper. Due to confidentially issues, the 'herring_data.csv' dataset is a modified version of that used in the paper, so results of the analyses will differ. However, to encourage further exploration of our specific results, we include the 'quadres2_sLap.Rdata', a list containing model output that allows readers to reproduce the figures and tables presented in the manuscript.

Key components of the R code stored in this folder include:-

(1) Preparing the data for modelling using the SPDE approach, allowing for different degrees of linearity and non-stationarity in the covariates and different specifications of the spatiotemporal random effects.

(2) Creating a triangulated mesh upon which the GMRFs can be calculated.

(3) Fitting the models, assessing model fit and predictive performance.

(4) Extracting results from the posterior distribution and plotting summaries.

(5) Making spatial predictions to an area of interest within the time series.

(6) Assessing predictive performance to years outside the time series.

Folder name: 'Space-time models.zip'

Relevant files/subfolders: i) 'Herring models_23yrs.R' (R code and functions for

                                        SPDE models).

ii) 'mesh creation.R' (R code for different mesh resolutions).

iii) 'herring_data.csv' (.csv data file containing point-referenced occurrence/absence records and covariates).

iv) 'bisland.csv' (.csv data file with coordinates of the Icelandic coast).

v) 'Adult-recruit ratios_SSB_numbers.csv' (.csv data file including time series of demographic parameters for Icelandic summer spawning herring – see main text of the paper for parameter codes).

vi) 'space_grid.csv' (.csv data file with coordinates for spatial prediction grid).

vii) 'quadres2_sLap.Rdata' (a four-element list containing model output for plotting Figs. 3-5, A7, reproducing Tables 2, 3, A1-A3, and summarizing key results). This list is accessed directly through the 'Herring models_23yrs.R' R script.

viii) 'Final prediction rasters' (folder containing covariate layers for making spatial predictions for a subset of seasons).