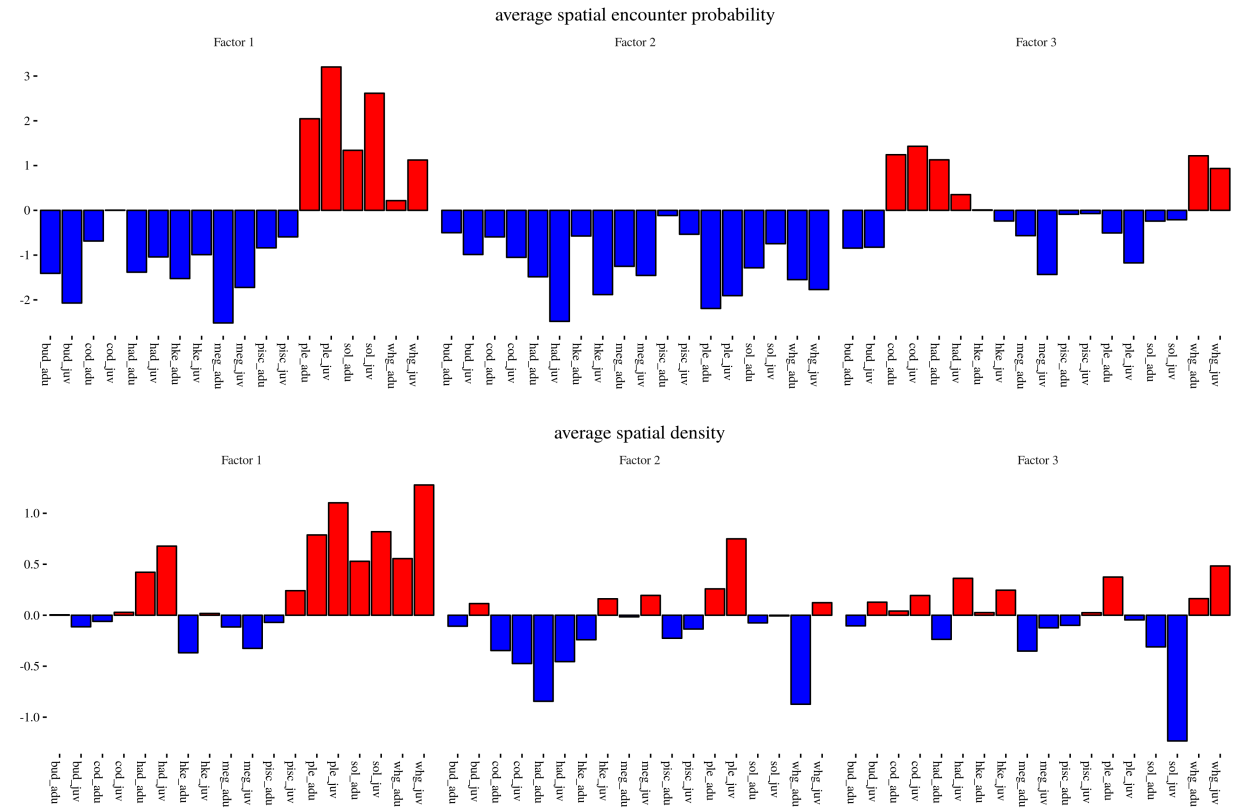

Figure S1: Top: First three species factor loadings for average spatial encounter probability, bottom: First three species factor loadings for average spatial density

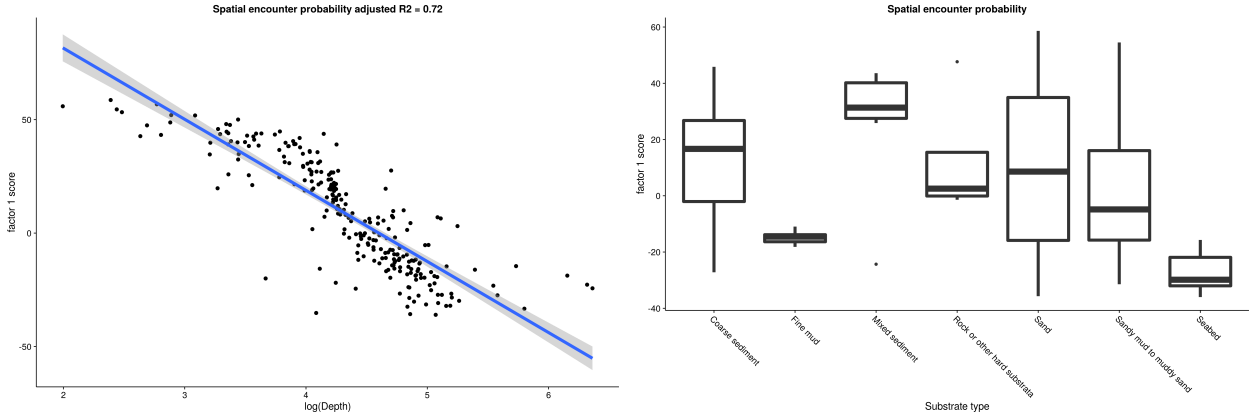

Figure S2: Left: Spatial Omega 1 correlated against Depth, Right: Omega 1 correlated against substrate type

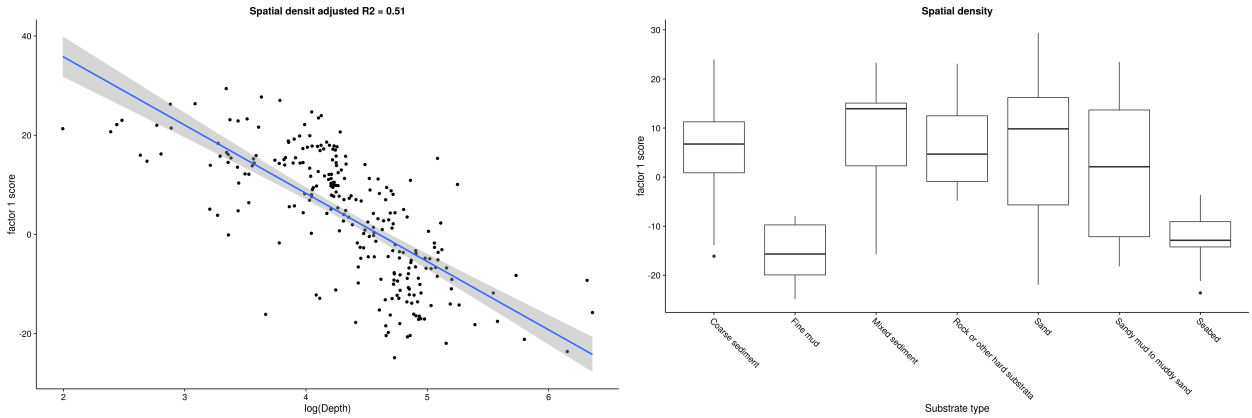

Figure S3: Left: Spatial Omega 2 correlated against Depth, Right: Omega 2 correlated against substrate type

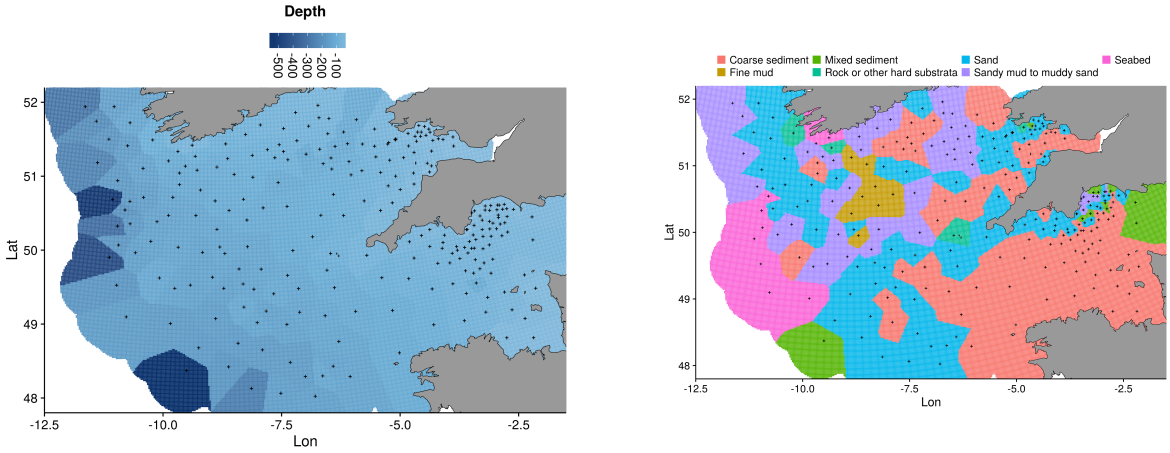

Figure S4: Left: Depth, Right: Substrate assigned to each spatial knot

Table S1: List of survey codes, names and brief description

Survey code	Name	Gear	Temporal extent
CEXP	Celtic Explorer (IE)	Otter trawl	2003 - 2015
CARLHELMAR	Carlhelmar (UK)	Commercial beam trawl	1989 - 2013
NWGFS	North West groundfish survey (UK)	Beam trawl	1988 - 2015
Q1SWBEAM	Quarter 1 south-west beam trawl survey (UK)	beam trawl	2006 - 2015
Q4SWIBTS	Quarter 4 south-west international bottom trawl survey (UK)	Otter trawl	2003 - 2010
THA2	EVHOE survey on Thalasa (FR)	Otter trawl	1997 - 2015
WCGFS	Western channel groundfish survey (UK)	Otter trawl (Portugese high headline)	1982 - 2004

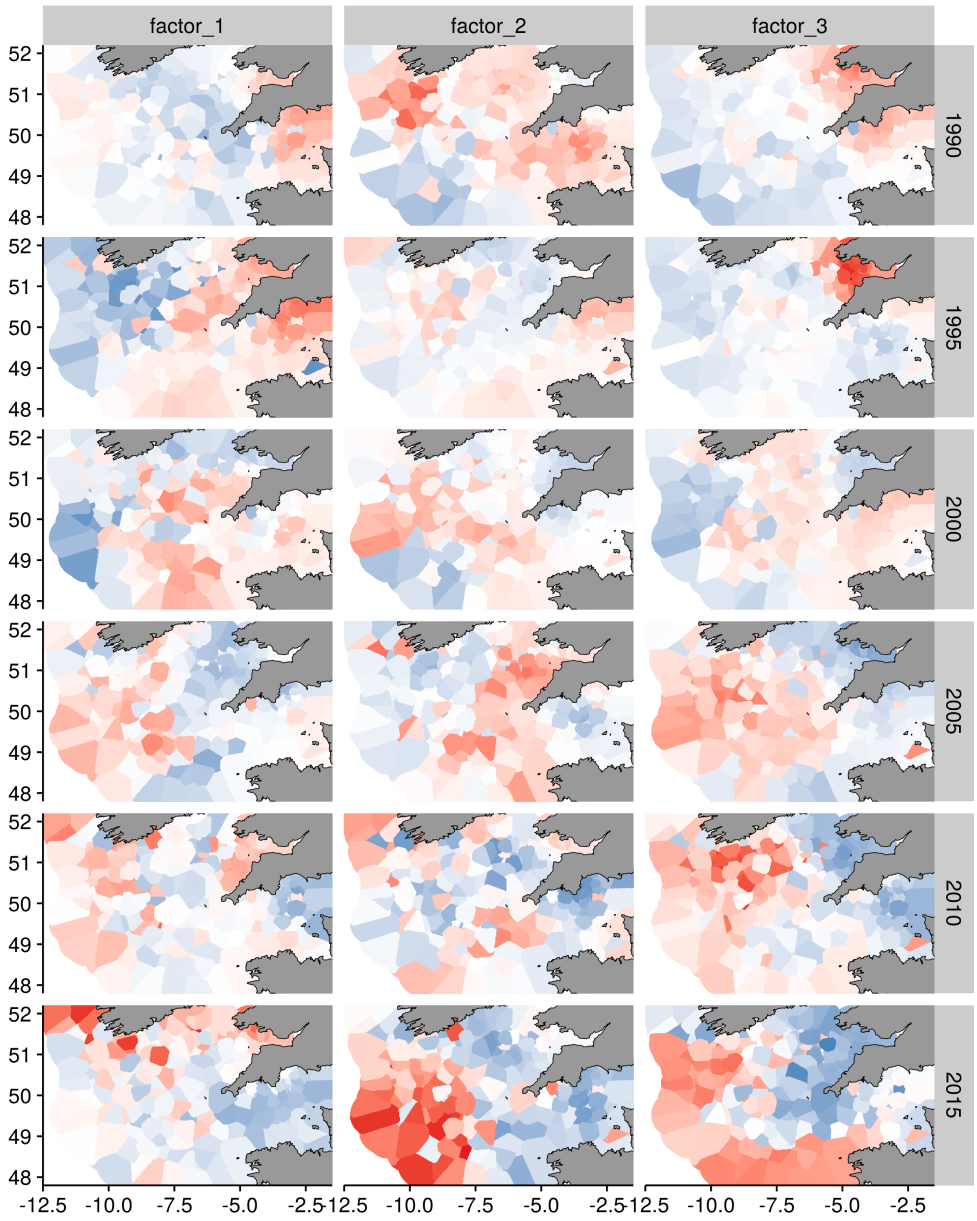

Figure S5: Spatial Loadings for first three factors every five years for spatio-temporal encounter probability

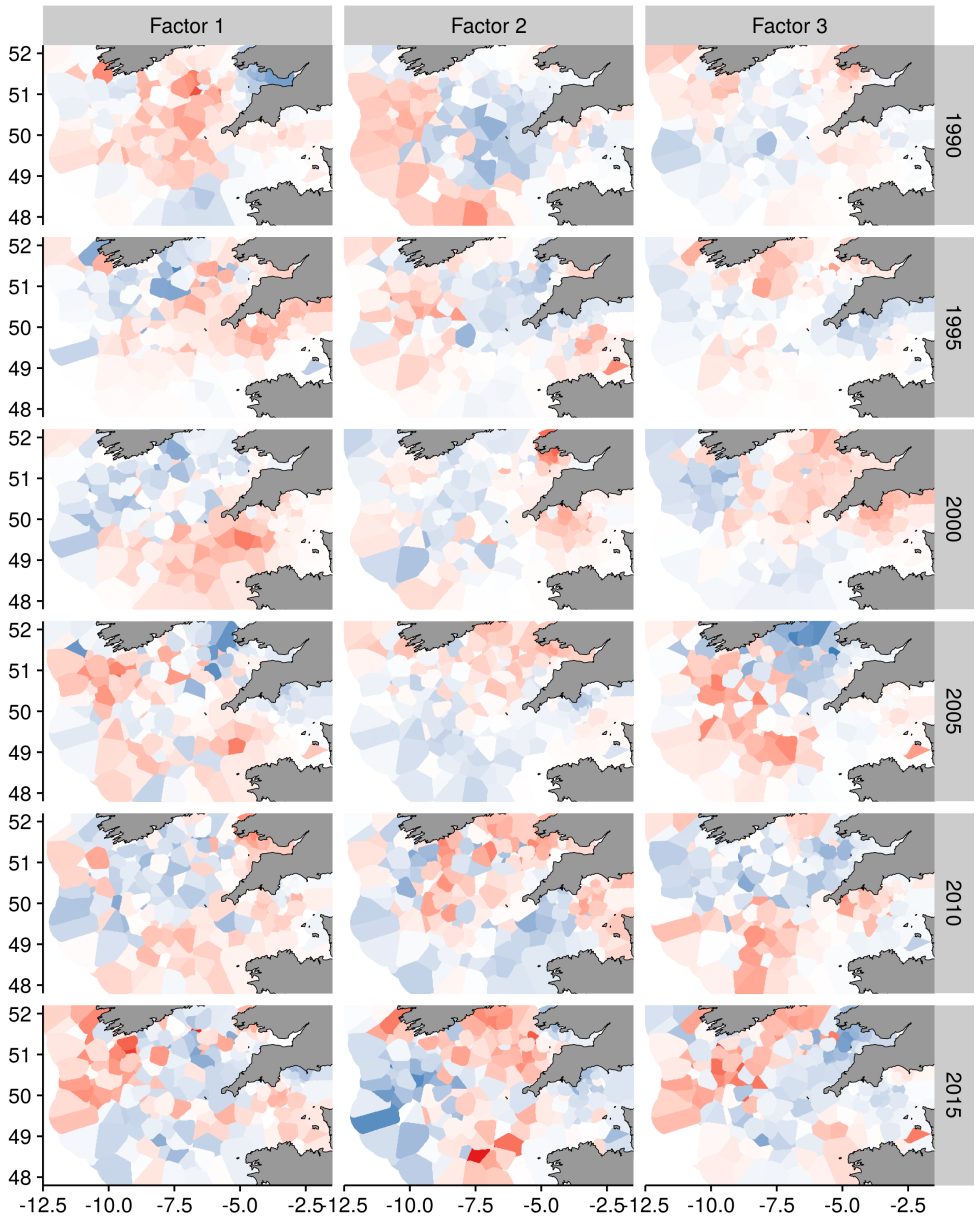

Figure S6: Spatial Loadings for first three factors every five years for spatio-temporal density

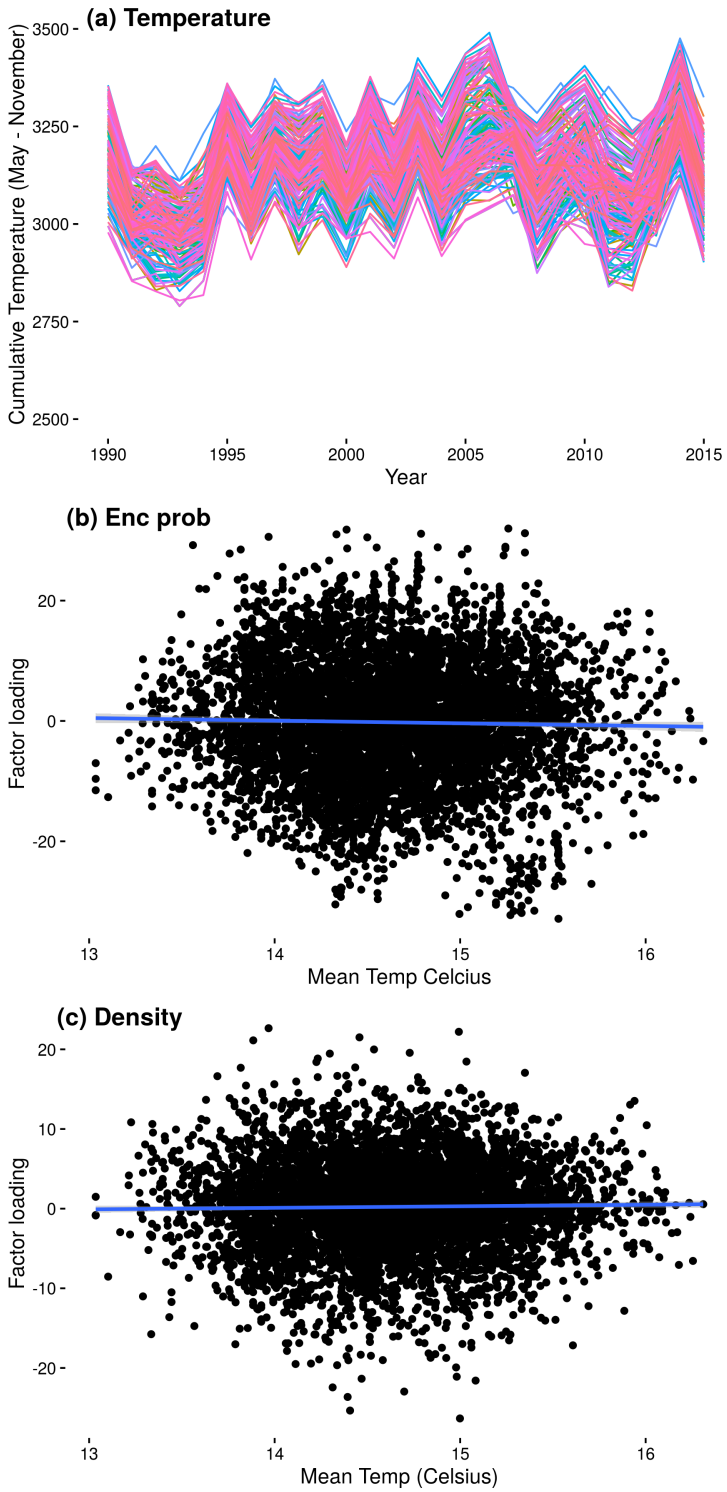

Figure S7: Association of temperature and knots (individual lines; top) with Spatio-temporal factor loadings for encounter probability (middle) and density (bottom)

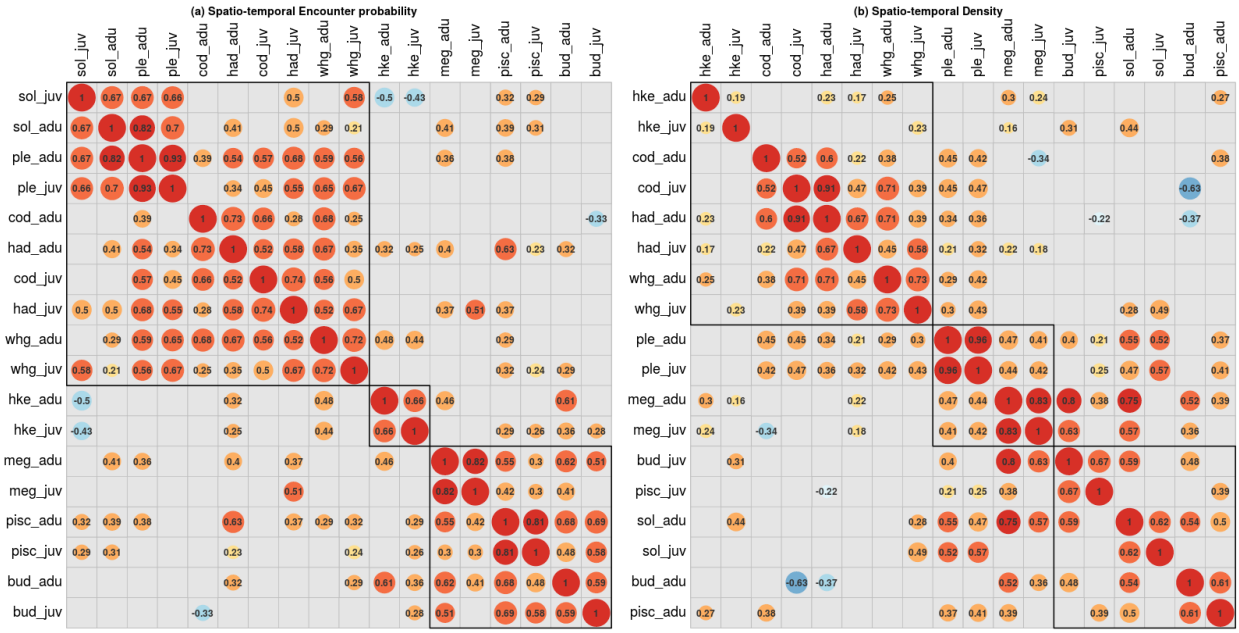

Figure S8: Inter-species correlations for (a) spatio-temporal encounter probability and b) spatio-temporal density. Species-groups are clustered into three groups based on a hierarchical clustering method with non-significant correlations (those where the Confidence Interval spanned zero) left blank

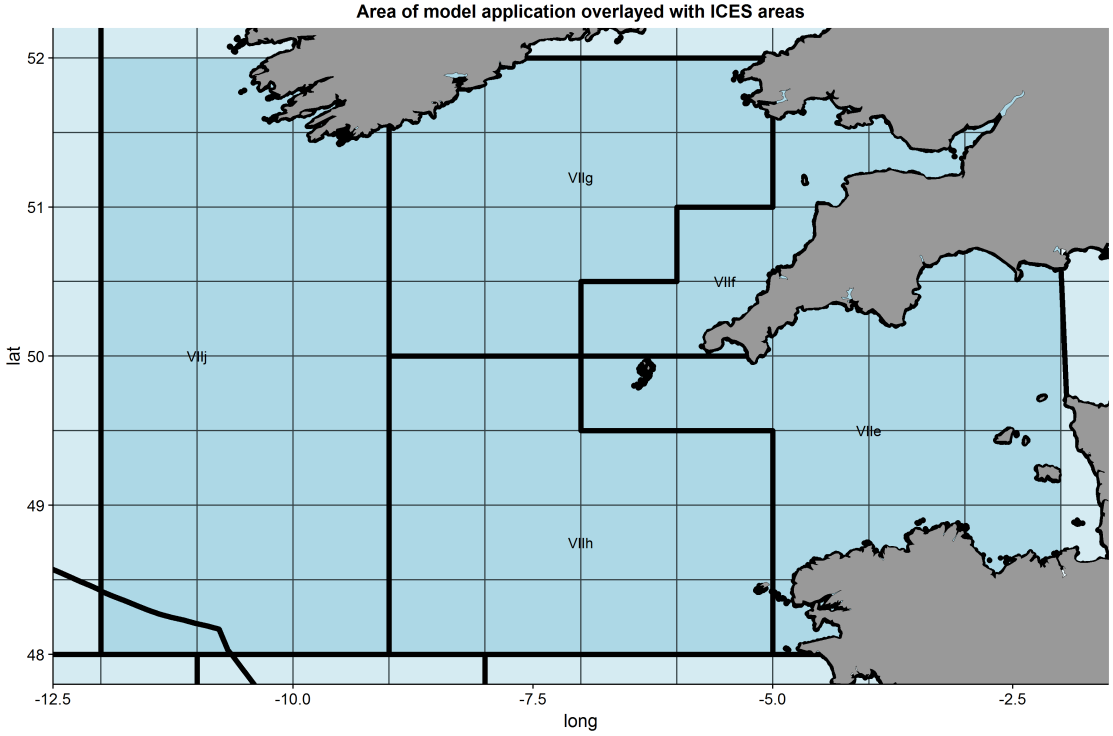

Figure S9: Spatial bounds of case study area

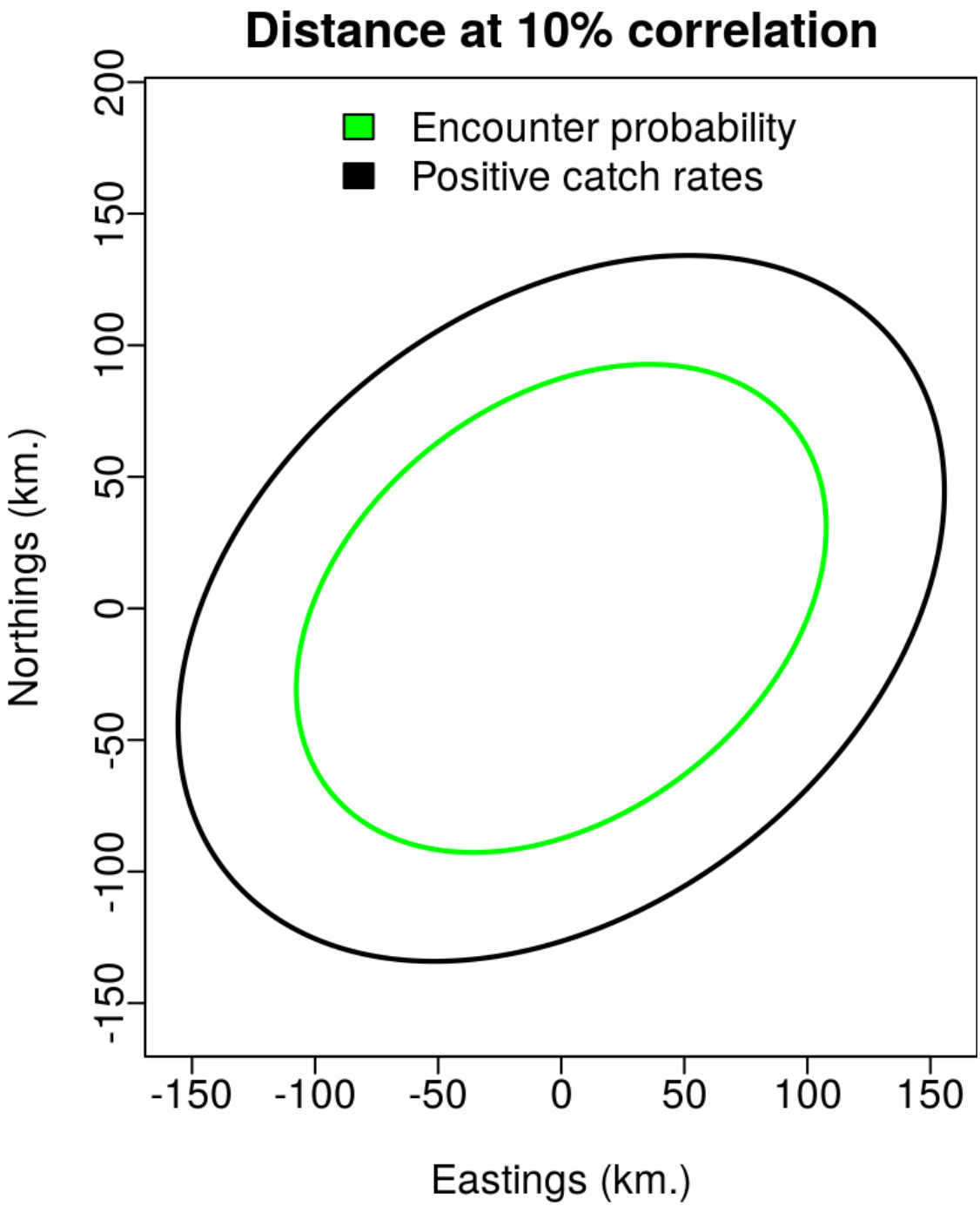

Figure S10: Estimates of distances at 10 % correlation from the Matérn covariance function for encounter probability and positive catch rates

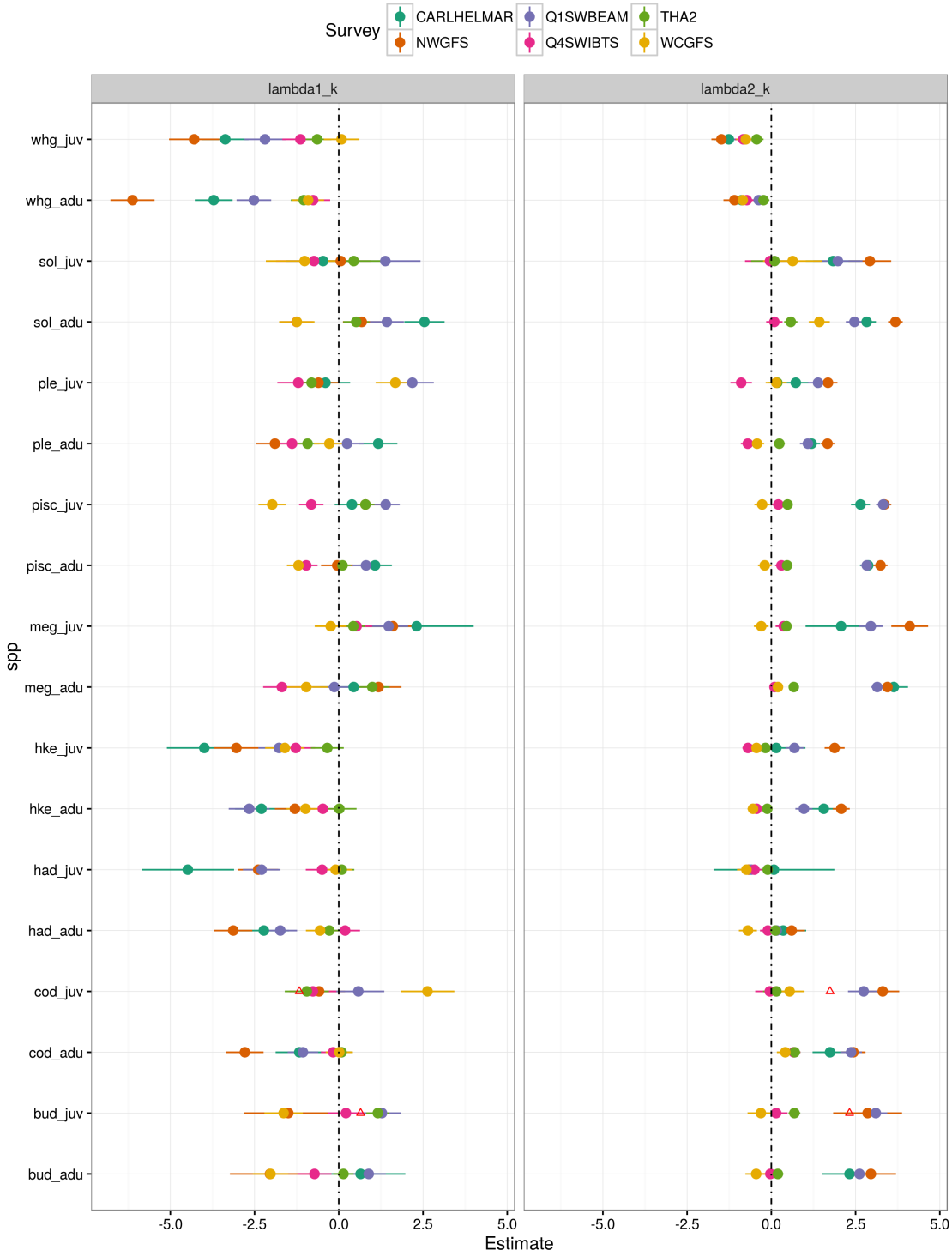

Figure S11: Fixed effect estimates for surveys for each species-group. Note all values within a species-group are relative to the CEXP survey

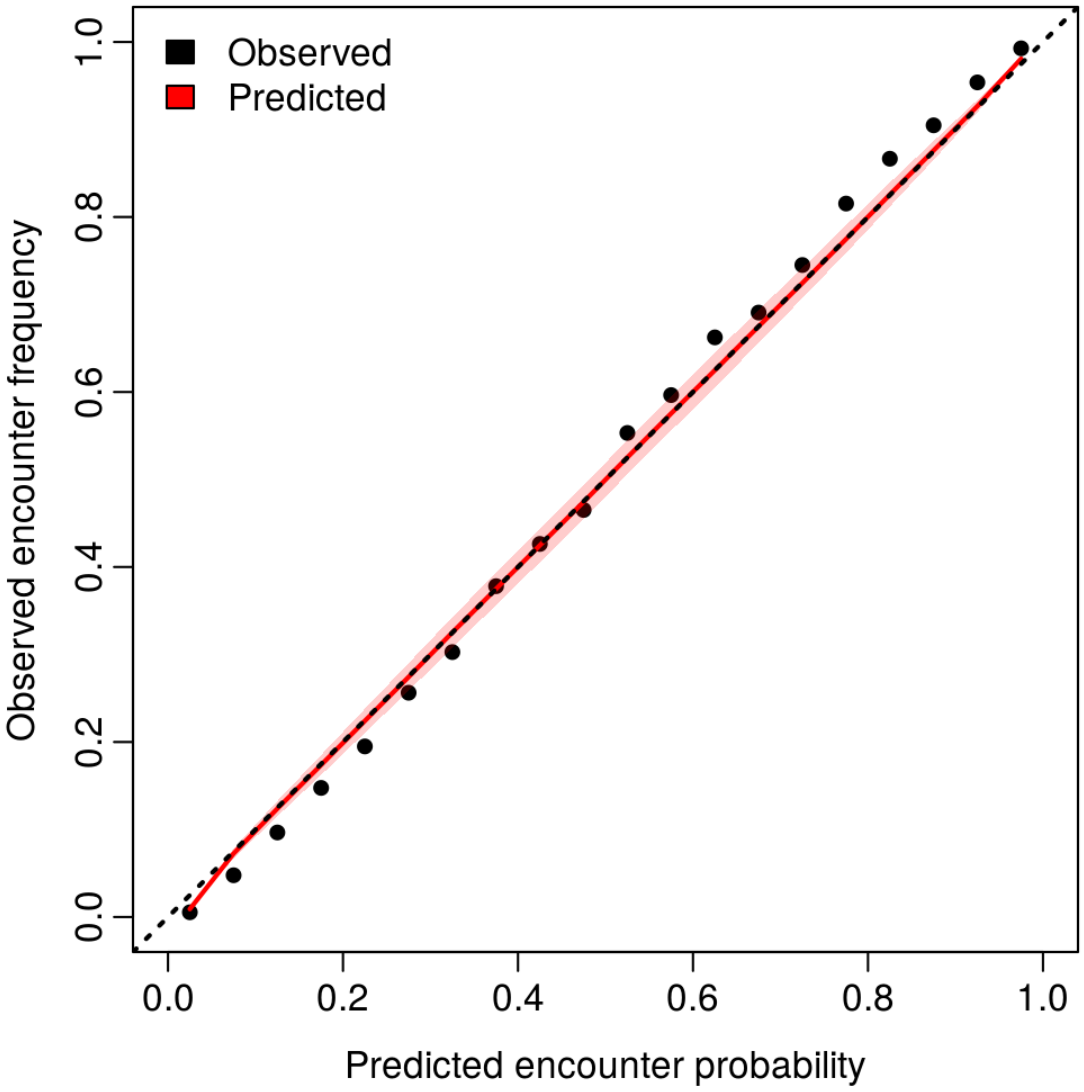

Figure S12: Model diagnostics output showing correlation between the predicted encounter probability and the data

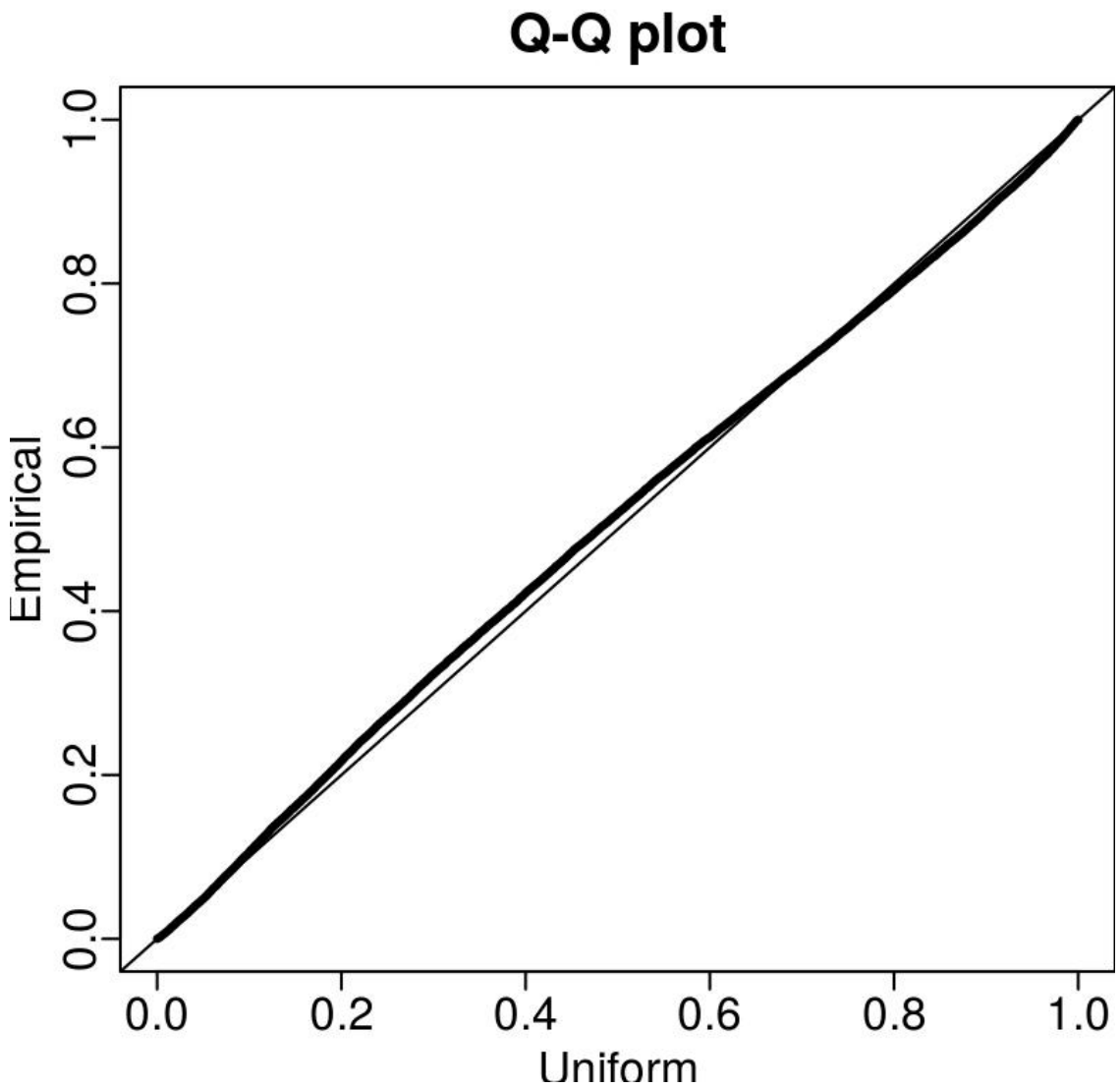

Figure S13: Model diagnostics output showing the Q-Q plot for the positive catch rates

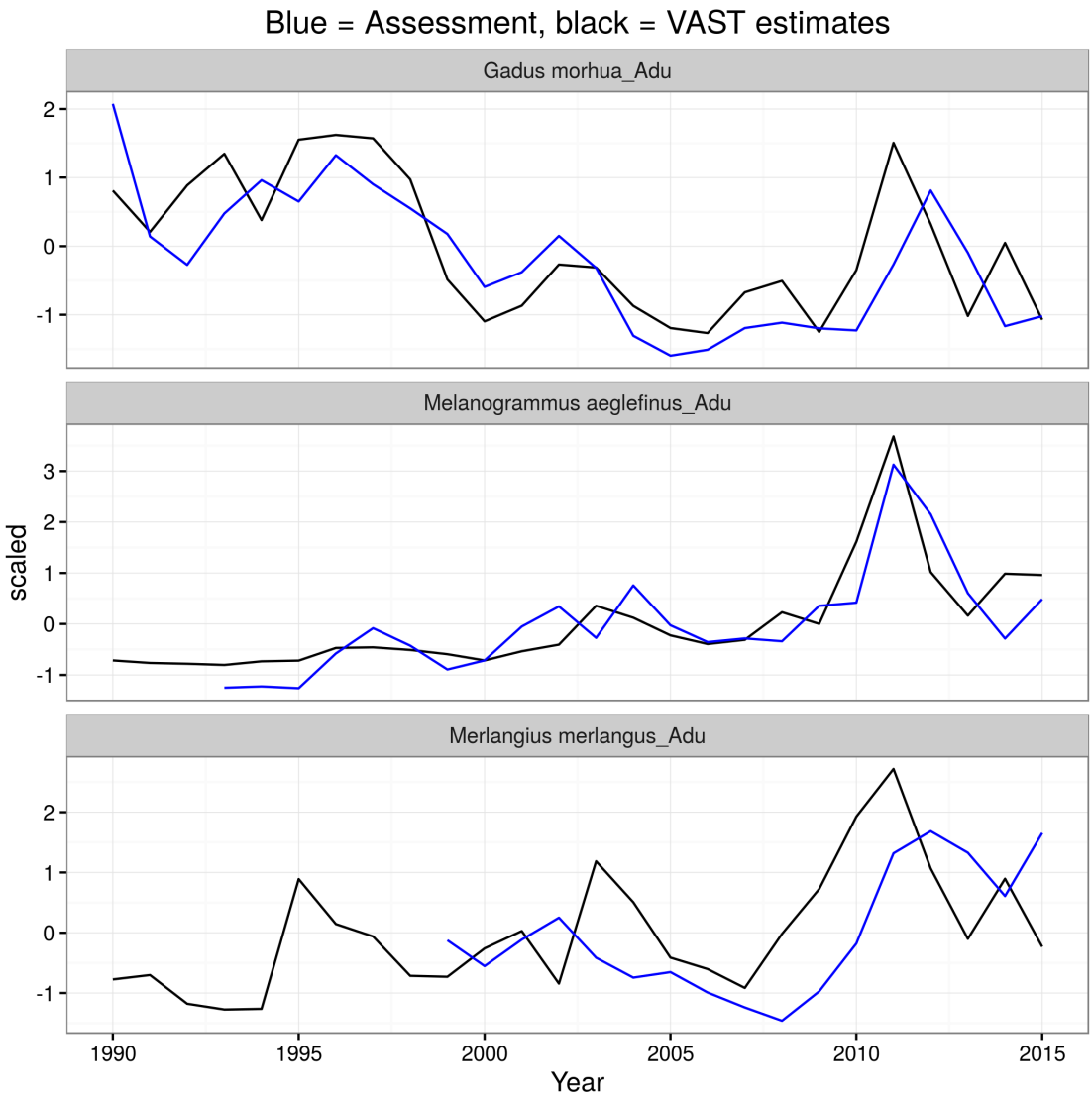

Figure S14: Comparison between the standardised index from the VAST output and the standardised spawning stock biomass (SSB) from the assessments for cod, haddock and whiting

Table S2: List of species codes, names and minimum conservation reference size used to separate juvenile and adult fish

Species code	Common name	Species	MCRS (cm)
juv	Juvenile		
adu	Adult		
bud	Black bellied anglerfish	*Lophius budgessa*	32*
cod	Atlantic cod	*Gadus morhua*	35
had	Atlatic haddock	*Melanogrammus aeglefinus*	30
hke	Atlantic hake	*Merluccius merluccius*	27
meg	Megrim	*Lepidorhombus whiffiagonis*	20
pisc	White bellied anglerfish	*Lophius piscatorius*	32*
ple	European Plaice	*Pleuronectes platessa*	27
sol	Common sole	*Solea solea*	24
whg	Atlantic whiting	*Merlangius merlangus*	27

*Anglerfish species estimated based on a 500g minimum marketing weight

Table S3: Description of model variants and AIC / BIC

Model	Description	No fixed parameters	No random parameters	AIC	BIC
H0	Vessel random effects, no covariates	1462	129276	125954	140187
H1	With fixed gear effect, no density covariates	1674	129276	116012	132309
H2	With fixed gear effect, substrate and depth density covariates	1688	129276	116013	132446