Ecography

E5901

Edrén, S. M. C., Wisz, M. S., Teilmann, J., Dietz, R. and Söderkvist, J. 2010. Modelling spatial patterns in harbour porpoise satellite telemetry data using maximum entropy. – Ecography 33: 698-708.

Supplementary materials

Appendix 1. Settings for the SAS Argos-Filter v7.03

Parameters	Setting
Minoffh	0.0001
Maxredun	5
Minrate	10
Ratecoef	10
R_only	1
R_or_a	0
Keep_lc	3
keeplast	0
pickday	0
Testp_0a	2
Testp_bz	2

Appendix 2. Explanation of the modelling of hydrodynamic variables

The hydrodynamic variables were modelled for this study and are based on the primitive equation ocean circulation model COHERENS (Luyten et al. 1999). The present mode set up uses spherical coordinates on a 2′ × 2′ minute horizontal grid and 30 vertical sigma layers. Temperature and salinity at the open boundaries were determined from station 1004 (58.9°N, 11.3°E) in the northern Kattegat, located just north of the model domain, and data from a station in Hanöbukten (55.62°N, 14.87°E) at the eastern boundary. The water level at the open boundaries was similarly determined from a water level station at Skagen (57.72°N, 10.62°E), which is located at the western side of the entrance from Skagerrak, and the water level station from Rønne (55.10°N, 14.68°E) at the island Bornholm, which is located approximately in the middle of the eastern boundary. The model was forced with hourly meteorological fields of 2 m air temperature, wind speed, wind stress vector, cloud cover and relative humidity. The meteorological forcing was obtained from an operational atmospheric model (Brandt et al. 2001). The initial fields for temperature and salinity were determined from observed values in February, which was distributed to the nearest model grid points, and the currents were set to zero. From forcing and initial fields the model computed the evolution for several parameters, such as salinity, temperature, and currents. The model was run for the years 2001 to 2003, starting 1st of January each year. Since the model results for January were dominated by the initial field, only results from February to December were analyzed. A detailed presentation of the model set up and model validation are presented in Bendtsen et al. (unpubl.). Here we analyze statistical values computed from the model results. From hourly values of salinity, temperature, and currents during the tree years of integration, we computed seasonal mean values and the standard deviation.

References

Brandt, J. et al. 2001. Operational air pollution forecasts from European to local scale. – Atmos. Environ. Suppl. 35: S91–S98.

Luyten, P. J. et al. 1999. COHERENS – a coupled hydrodynamical–ecological model for regional and shelf seas: user documentation. – MUMM Report, Management Unit of Mathematical Models of the North Sea.

Appendix 3. Correlation of environmental variables

Spearman rank correlation coefficient (r) of the environmental variables within four seasons are presented in the following four tables. Correlation is based on 10 000 randomly picked cells.

Table S1. Winter season (Dec.–Feb.).

	Var. in bottom salinity	Bottom N–S current	Var. in bottom N–S current	Var. in bottom E–W current	Bottom E–W current	Distance to coast	Bathymetry	Sediment
Bottom salinity	–0.55	–0.24	0.08	0.29	–0.08	0.34	0.40	0.28
Variation in bottom salinity		0.20	–0.05	–0.16	0.15	–0.40	–0.32	–0.15
Bottom N–S current			–0.34	–0.09	0	–0.18	–0.39	–0.17
Var. in bottom N–S current				0.32	–0.10	0.15	0.23	0.01
Var. in bottom E–W current					0.01	0.24	0.25	0.07
Bottom E–W current						–0.10	0.12	0.10
Distance to coast							0.63	0.24
Bathymetry								0.50

Table S2. Spring season (Mar.–May).

	Var. in bottom salinity	Bottom N–S current	Var. in bottom N–S current	Var. in bottom E–W current	Bottom E–W current	Distance to coast	Bathymetry	Sediment
Bottom salinity	–0.09	–0.26	0	0.17	0.09	0.34	0.41	0.28
Variation in bottom salinity		0.30	0.12	0.03	–0.04	–0.39	–0.35	–0.12
Bottom N–S current			–0.17	–0.03	0	–0.22	–0.40	–0.20
Var. in bottom N–S current				0.31	–0.21	0.15	0.08	–0.07
Var. in bottom E–W current					–0.26	0.39	0.12	–0.05
Bottom E–W current						–0.17	0.07	0.12
Distance to coast							0.63	0.24
Bathymetry								0.50

Table S3. Summer season (Jun.–Aug.).

	Var. in bottom salinity	Bottom N–S current	Var. in bottom N–S current	Var. in bottom E–W current	Bottom E–W current	Distance to coast	Bathymetry	Sediment
Bottom salinity	–0.60	–0.11	0.12	0.07	0.05	0.32	0.40	0.27
Variation in bottom salinity		0.15	–0.16	–0.03	–0.04	–0.23	–0.27	–0.11
Bottom N–S current			0.15	0.05	–0.04	–0.14	–0.28	–0.13
Var. in bottom N–S current				0.25	0.15	0.15	0.17	0
Var. in bottom E–W current					–0.20	0.30	0.14	–0.04
Bottom E–W current						–0.17	0.08	0.07
Distance to coast							0.63	0.24
Bathymetry								0.50

Table S4. Autumn season (Sep.–Nov.).

	Var. in bottom salinity	Bottom N–S current	Var. in bottom N–S current	Var. in bottom E–W current	Bottom E–W current	Distance to coast	Bathymetry	Sediment
Bottom salinity	–0.37	–0.22	0.20	0.07	–0.13	0.34	0.41	0.27
Variation in bottom salinity		0.17	–0.08	–0.05	0	–0.32	–0.34	–0.08
Bottom N–S current			0	–0.16	–0.05	–0.19	–0.37	–0.17
Var. in bottom N–S current				0.13	–0.05	0.23	0.05	–0.04
Var. in bottom E–W current					–0.14	0.17	0.17	–0.04
Bottom E–W current						–0.13	0.07	0.03
Distance to coast							0.63	0.24
Bathymetry								0.50

Appendix 4. Moran's I estimates for each environmental variable

Spatial autocorrelation using Moran's I for each variable within each season calculated from 1000 randomly picked pixels within the study site. The p-value for each calculation is below 0.001 indicating autocorrelation within variables.

Variables	Winter	Spring	Summer	Autumn
Bathymetry	0.624	0.708	0.659	0.669
Salinity	0.863	0.896	0.861	0.843
Variation in salinity	0.613	0.731	0.590	0.546
Current E–W	0.569	0.672	0.621	0.694
Current N–S	0.576	0.662	0.630	0.651
Variation in E–W	0.293	0.245	0.205	0.187
Variation in N–S	0.277	0.230	0.145	0.172
Distance to coast	0.795	0.788	0.798	0.802
Sediment	0.301	0.298	0.282	0.261

Appendix 5. Cross seasonal evaluation of models

Models were trained for each season and projected to other seasons and evaluated with independent porpoise telemetry data from the projected seasons. Mean AUC[1] values ± 1 standard error are presented for 100 bootstrapped models within each test season.

		Test data			
		Winter	Spring	Summer	Autumn
Training data	Winter	–	0.607 (0.001)	0.631 (0.001)	0.692 (0.001)
	Spring	0.657 (0.002)	–	0.717 (0.001)	0.639 (0.001)
	Summer	0.698 (0.002)	0.715 (0.001)	–	0.658 (0.001)
	Autumn	0.773 (0.001)	0.667 (0.001)	0.686 (0.001)	–

[1]AUC = Area under the receiver operating characteristic (ROC) curve.