Supplementary material

Deriving the map of sandeel habitats (S1)

From the data collected (Figure S1), the final map of the sandeel fishing grounds was produced using the five-step procedure below.

(i) A point shapefile with the data was created from a textfile using ArcMap (ESRI ArcGIS);
(ii) A kernel density analysis (Silverman, 1986) was applied to the shapefile using a quadratic kernel function to fit a smoothly tapered surface to each point (search radius, 0.015 decimal degrees; output cell size, 0.006 decimal degrees), to produce a grid using the Spatial Analyst extension with ArcGIS;
(iii) From this grid, a new grid including only cells with a density of points >50 000 was produced, subbsequently converted to a shapefile so that each fishing ground is defined as a polygon;
(iv) The polygons were adjusted manually considering raw data along with information on individual grounds, location of fishing tracks, and topography, the greatest weight being given to the information in the raw data;
(v) Fishers from different ports evaluated the map of fishing grounds, after which it was modified according to their guidelines, resulting in the inclusion of additional grounds (from additional navigation data) and deletion of non-sandeel grounds. The map was subjected to several such evaluations before the final map was produced (Figure S2).

Table S1 presents the results of the comparison of length distributions between fishing grounds.

References

Silverman, B. W. 1986. Density Estimation for Statistics and Data Analysis. Chapman and Hall, New York. 175 pp.

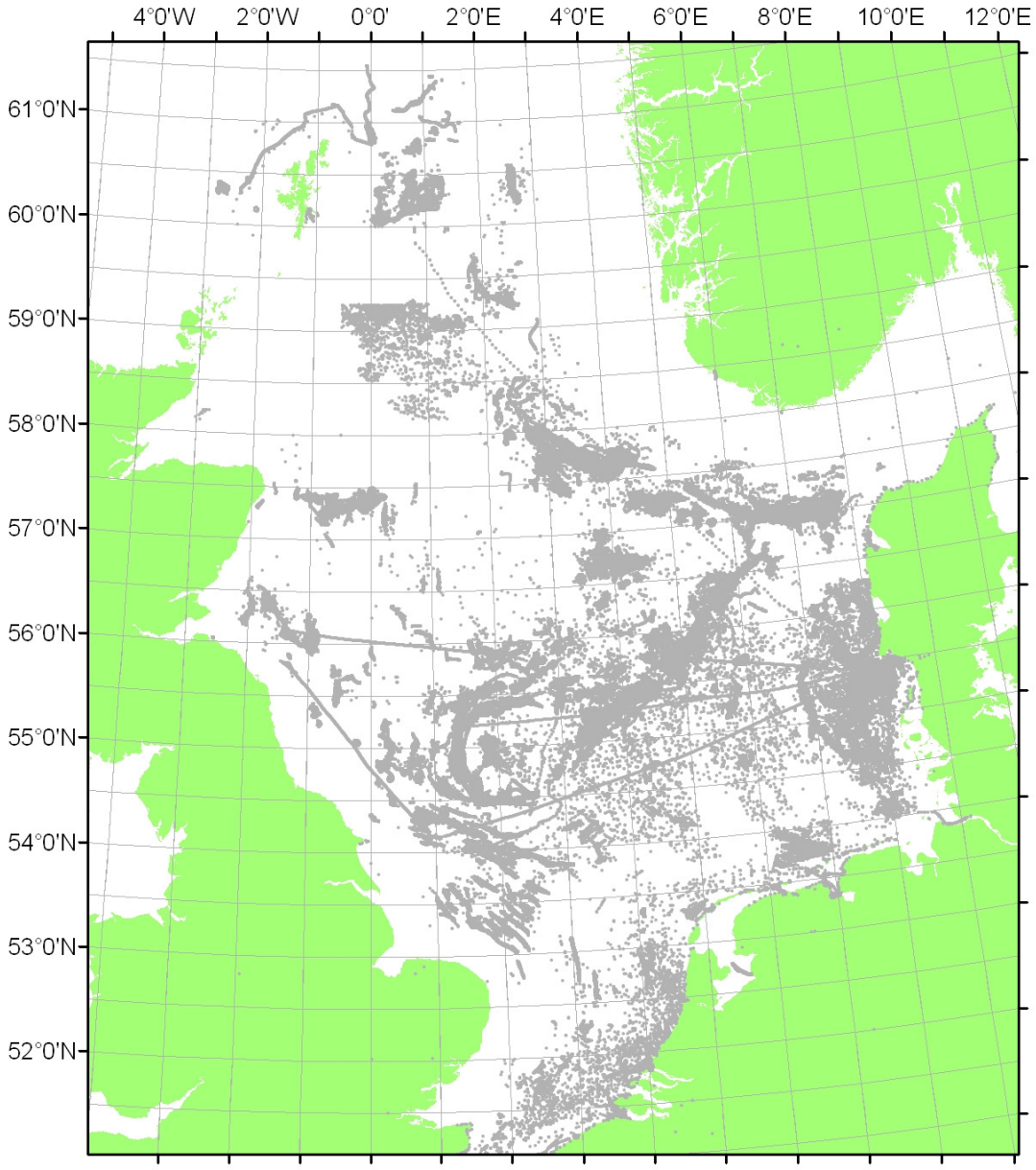

Figure S1. Map of raw data from various GPS-based navigation systems.

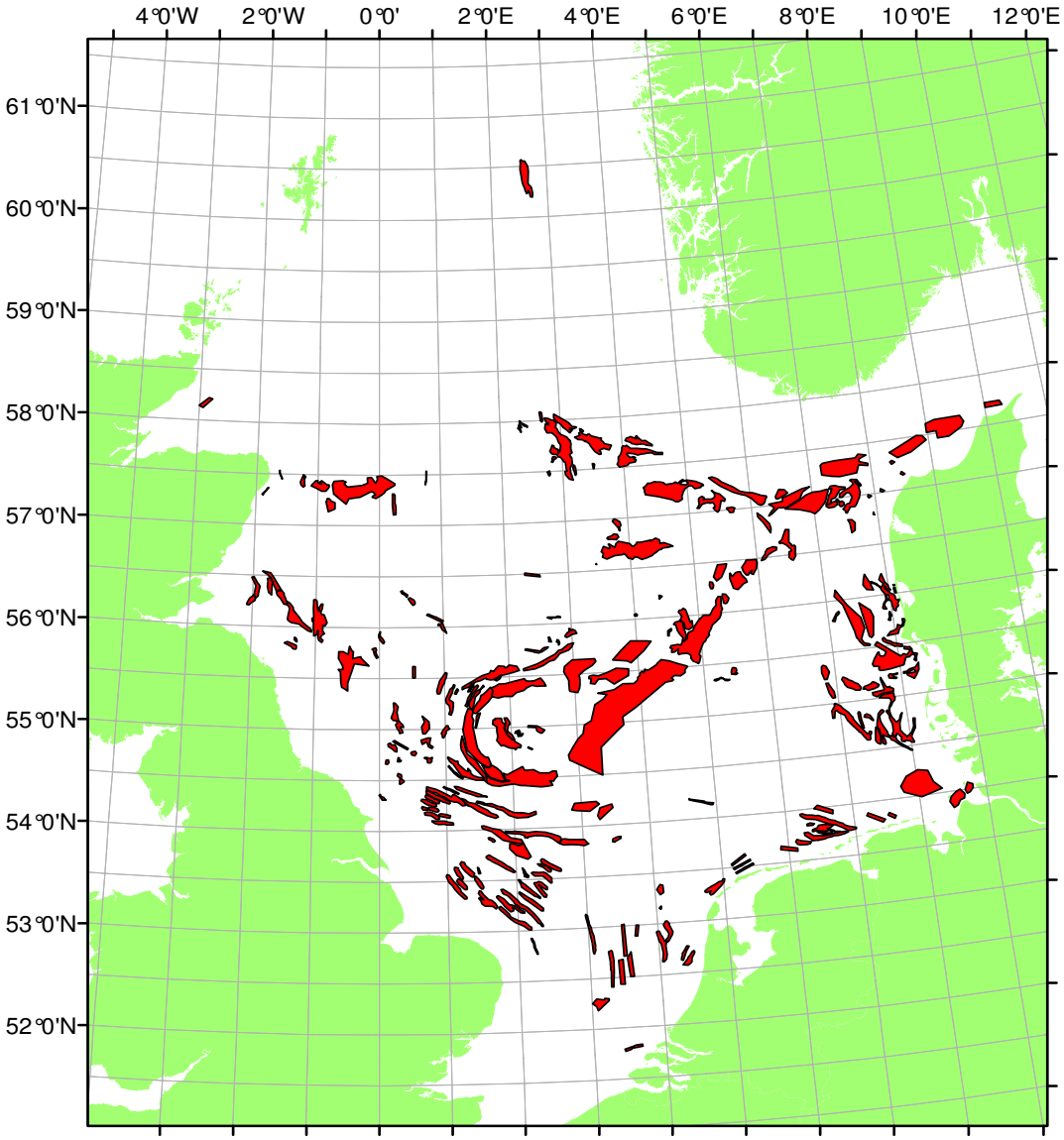

Figure S2. Sandeel habitat areas.

Table S1. Results of the comparison of length distributions between fishing grounds.

Ground 1	Ground 2	Distance-group	Total area		Ground-specific		*F*	*p*(*F*)
			Deviance	d.f.	Deviance	d.f.		
N.W. Rough	Stendysse/Lissis Revle	0	416	159	52	5	4.11	0.0012
N.W. Rough	Stendysse/Lissis Revle	10	433	174	53	5	4.35	0.0007
N.W. Rough	Stendysse/Lissis Revle	10	1 150	179	249	6	6.67	<0.0001
N.W. Rough	Southernmost Rough	20	430	153	43	6	2.64	0.0159
N.W. Rough	Southernmost Rough	20	995	239	84	6	3.45	0.0022
N.W. Rough	Southernmost Rough	20	1 112	196	81	6	2.45	0.0234
N.W. Rough	Stendysse/Lissis Revle	20	474	160	120	5	8.39	<0.0001
N.W. Rough	Stendysse/Lissis Revle	20	892	228	36	6	1.57	0.1524
Rute 18	N.W. Rough	20	278	129	42	5	4.08	0.0014
Scooter Plads	Wee Bankie - S.W.	20	1 243	382	284	6	14.79	<0.0001
N.W. Rough	Southernmost Rough	30	482	168	56	6	3.36	0.0030
N.W. Rough	Southernmost Rough	30	1 291	259	63	6	2.15	0.0455
N.W. Rough	Southernmost Rough	30	640	186	36	7	1.56	0.1430
N.W. Rough	Stendysse/Lissis Revle	30	736	178	48	6	2.01	0.0614
Rute 18	N.W. Rough	30	522	179	74	5	5.25	0.0001
Sorel	N.W. Rough	30	1 723	255	1 141	6	28.81	<0.0001
Sorel	N.W. Rough	30	791	164	30	5	1.29	0.2664
Sorel	Stenkanten vs. Sorel	30	513	204	118	6	8.06	<0.0001
Middle Rough	Sorel	40	679	177	101	5	5.40	0.0001
N.W. Rough	Southernmost Rough	40	557	157	148	6	7.20	<0.0001
N.W. Rough	Southernmost Rough	40	425	153	47	6	2.91	0.0086
N.W. Rough	Southernmost Rough	40	1 447	270	534	6	16.96	<0.0001
N.W. Rough	Southernmost Rough	40	1 937	388	64	6	2.17	0.0432
N.W. Rough	Southernmost Rough	40	1 313	324	272	7	9.81	<0.0001
Rute 18	Stendysse/Lissis Revle	40	617	159	157	5	8.36	<0.0001
Sorel	Lisborgs Revle	40	663	209	185	6	9.99	<0.0001
Sorel	N.W. Rough	40	2 098	313	1 344	6	34.07	<0.0001
Sorel	N.W. Rough	40	849	197	191	6	7.62	<0.0001
Sorel	N.W. Rough	40	985	248	47	5	2.40	0.0356
Sorel	Stenkanten vs. Sorel	40	554	218	135	6	9.08	<0.0001
Middle Rough	Sorel	50	1 148	300	234	5	12.42	<0.0001
N.W. Rough	S.W. Spit	50	434	140	63	6	3.56	0.0019
N.W. Rough	Southernmost Rough	50	580	158	143	6	6.74	<0.0001
N.W. Rough	Southernmost Rough	50	425	138	34	6	1.94	0.0736
N.W. Rough	Southernmost Rough	50	1 591	285	424	6	12.93	<0.0001
N.W. Rough	Southernmost Rough	50	1 762	341	72	6	2.36	0.0284
N.W. Rough	Southernmost Rough	50	2 090	394	575	6	18.35	<0.0001
N.W. Rough	Southernmost Rough	50	1 374	236	280	6	8.21	<0.0001
Rute 18	Southernmost Rough	50	618	168	97	5	5.45	0.0001
Sorel	Lisborgs Revle	50	663	209	185	6	9.99	<0.0001

Sorel	N.W. Rough	50	2 873	441	1 652	6	42.85	<0.0001
Sorel	N.W. Rough	50	813	197	138	6	5.73	<0.0001
Sorel	N.W. Rough	50	820	192	32	5	1.53	0.1788
Sorel	Stenkanten vs. Sorel	50	382	154	71	6	4.94	0.0001
Middle Rough	Sorel	60	1 110	299	231	5	12.64	<0.0001
N.W. Rough	Southernmost Rough	60	468	130	118	6	5.71	<0.0001
N.W. Rough	Southernmost Rough	60	1 447	270	534	6	16.96	<0.0001
N.W. Rough	Southernmost Rough	60	1 584	291	110	6	3.44	0.0022
N.W. Rough	Southernmost Rough	60	1 996	380	664	6	21.39	<0.0001
N.W. Rough	Southernmost Rough	60	1 374	236	280	6	8.21	<0.0001
Rute 18	Southernmost Rough	60	618	168	97	5	5.45	0.0001
Sorel	Lisborgs Revle	60	527	153	131	5	7.85	<0.0001
Sorel	N.W. Rough	60	2 819	441	1 619	6	42.78	<0.0001
Sorel	N.W. Rough	60	948	232	222	6	9.29	<0.0001
Sorel	N.W. Rough	60	1 181	293	91	5	4.61	0.0004
Middle Rough	Sorel	70	872	230	273	5	14.71	<0.0001
N.W. Rough	Southernmost Rough	70	943	139	493	5	15.05	<0.0001
N.W. Rough	Southernmost Rough	70	986	188	157	6	5.15	<0.0001
Sorel	N.W. Rough	70	2 975	469	1 720	6	45.76	<0.0001
Sorel	N.W. Rough	70	990	244	252	6	10.60	<0.0001
Sorel	N.W. Rough	70	1 181	293	91	5	4.61	0.0004

Total area deviance and d.f. indicate the deviance from a common length distribution and the degrees of freedom of this common length distribution. Ground-specific deviance and d.f. indicate the reduction in deviance obtained by modelling the length distribution in each area separately, and the associated loss of degrees of freedom. Distance-groups are 10-km groups denoted by the least distance in the group (e.g. 0 equals the group 0–10 km).