

Not to be cited without prior reference to the FRS Marine Laboratory, Aberdeen.

FRV *Alba na Mara*

Cruise 2022A

REPORT

6-22 December 2022

Personnel

T Regnier (SIC)
J Clarke (Sci)
J Hunter (ENG)

Objectives

1. To determine the abundance, length and age of sandeels in the sediment from regions east of the Firth of Forth and around Turbot Bank.
2. To collect and preserve samples of *A. marinus*, from the different stations for further analyses.
3. To determine the sex and maturity stage of all sandeels selected for ageing.
4. To determine the abundance, length and age of sandeels in the sediment from stations within the NnG and Seagreen offshore windfarms (OWF).

Out-turn days per project: 20732 - 16 days

Equipment

Sandeel dredge × 2 (modified 4' scallop dredge with 6" teeth and spare toothbars) with towing bar and camera attachment.

Day grab

Minilogger (or equivalent – i.e. DST).

Cruise Narrative

Scientists joined *Alba na mara*, berthed in Leith, on 5 December in the afternoon to prepare the laboratory and mount the armoured cable the same afternoon. *Alba na Mara* locked out of Leith on 6 December at 9.30 and made passage to the survey area and prospect anchor sites clear of creels in daylight. Multiple sites were prospected (Isle of May, Crail), however, the presence of creels forced *Alba* to anchor West at Largo Bay for the evening. After having cleared the necessary permits with NNG OWF developers, *Alba* made passage to the OWF on 7 December to sample a site within the OWF boundary, however, a buoy was anchored in the middle of the planned tows and the station had to

be abandoned. *Alba na Mara* went West to sample two stations on Wee Bankie. The weather degraded rapidly and *Alba* returned to Largo Bay to find shelter for the night. The poor weather conditions made work impossible the next day, however, an anchor site clear of creels was found in St Andrews Bay. On 9 December stations at Bell Rock, Marr Bank and Wee Bankie were sampled and *Alba* went back on anchor in St Andrews Bay to find shelter from the deteriorating weather conditions. On 10 December a water refill was needed and arrangements were made to refill in Montrose harbour. However, the very poor conditions made it impossible to enter the harbour and decision was made to go to Aberdeen harbour for a refill. Due to the very poor conditions, decision was made to stay the night in Aberdeen harbour. On 11 December, *Alba na Mara* left Aberdeen for the Seagreen OWF where two stations were sampled before reaching Marr Bank where an additional two stations were sampled. The improved weather conditions made it possible to stay out at night and be on Stendysen the following morning. On 12 December, two stations were sampled in Stendysen before making passage to Berwick Bank where sampling on another three stations was completed. The good conditions made it possible to make passage to Turbot Bank East through the night. On 13 December, stations on Turbot Bank East and Turbot Bank Central were sampled before making passage to Fraserburgh harbour to find shelter for the night. The poor weather conditions made work impossible on 14 December and *Alba na Mara* stayed in Fraserburgh harbour for the day. On 15 December, stations at Rattray head, Aeroplane Bank and Belgar head were sampled before returning to Fraserburgh harbour for the night. The next day (16 December) passage was made to Turbot Bank Central to finish the work there and complete sampling on Turbot Bank West. On 17 December the strong Southerly winds forced *Alba na Mara* to stay close inshore in the Moray Firth and stations near Buckie and on Aberdour Bay were sampled before returning to Fraserburgh for the night. On 18 December, a station off Fraserburgh was sampled in the morning before returning to harbour to find shelter from the adverse weather. On 19 December work resumed close to shore in the Moray Firth due to strong Southerly winds. Stations in Cullen and Lossiemouth were sampled before anchoring near Lossiemouth. On 20 December a station at Mithcowie Bank was sampled before returning to Fraserburgh harbour, the end of the afternoon and the next morning were used to catch-up with the otoliths reading. On 21 December, servicing of the equipment and laboratory took place as well as cleaning and packing for unloading the next day (22 December).

Results

NB: Numbers refer to cruise programme objectives.

1. Between 6 and 22 December 2022, a total of 101 dredge hauls - of which 101 were valid - were made on previously sampled stations at the Firth of Forth, Turbot Bank, Rattray Head and Moray Firth grounds as well as new stations in Stendysen and in the Moray Firth. As in previous years of the survey, stations were sampled with a modified scallop dredge equipped with a live camera.

Table 1 gives station number, dredge shoot and haul positions, and actual and raised (i.e. numbers multiplied by the tow duration as a proportion of one hour) sandeel quantities caught in all hauls.

Haul	Date	Depth	Station	Bank	Shoot Lat	Shoot Lon	Haul Lat	Haul Lon	Sandeel per hour
307	07/12/2022	47	4	Wee Bankie	56.2444	-2.0378	56.2376	-2.0375	2743
308	07/12/2022	48	4	Wee Bankie	56.2502	-2.0384	56.2429	-2.0393	1085
309	07/12/2022	48	4	Wee Bankie	56.2461	-2.0419	56.2393	-2.0419	1504
310	07/12/2022	51	12	Wee Bankie	56.2483	-1.9839	56.2411	-1.9829	104
311	07/12/2022	51	12	Wee Bankie	56.2487	-1.9813	56.2417	-1.9812	35
312	07/12/2022	52	12	Wee Bankie	56.2478	-1.9787	56.2413	-1.9780	23
313	09/12/2022	33	7	Bell Rock	56.4225	-2.4420	56.4230	-2.4322	2121
314	09/12/2022	33	7	Bell Rock	56.4240	-2.4325	56.4237	-2.4438	1140
315	09/12/2022	33	7	Bell Rock	56.4224	-2.4414	56.4222	-2.4308	1538
316	09/12/2022	49	8	Marr Bank	56.4188	-1.9794	56.4182	-1.9911	29
317	09/12/2022	50	8	Marr Bank	56.4177	-1.9845	56.4165	-1.9971	73
318	09/12/2022	54	8	Marr Bank	56.4155	-1.9925	56.4167	-1.9811	28
319	09/12/2022	43	3	Wee Bankie	56.2225	-2.0549	56.2288	-2.0534	2319
320	09/12/2022	43	3	Wee Bankie	56.2250	-2.0577	56.2320	-2.0564	4154
321	09/12/2022	43	3	Wee Bankie	56.2221	-2.0513	56.2287	-2.0514	2404
322	09/12/2022	46	4	Wee Bankie	56.2399	-2.0436	56.2469	-2.0427	3159
323	11/12/2022	45	SG1	Seagreen OWF	56.6742	-1.9061	56.6713	-1.9179	80
324	11/12/2022	50	SG1	Seagreen OWF	56.6693	-1.9211	56.6720	-1.9108	34
325	11/12/2022	46	SG1	Seagreen OWF	56.6719	-1.9078	56.6688	-1.9185	104
326	11/12/2022	52	SG2	Seagreen OWF	56.6692	-1.7100	56.6656	-1.7004	17
327	11/12/2022	55	SG2	Seagreen OWF	56.6664	-1.7000	56.6707	-1.7093	75
328	11/12/2022	53	SG2	Seagreen OWF	56.6713	-1.7081	56.6673	-1.6978	23
329	11/12/2022	48	10	Marr Bank	56.3629	-1.6990	56.3694	-1.6996	2546
330	11/12/2022	47	10	Marr Bank	56.3712	-1.6990	56.3650	-1.6972	554
331	11/12/2022	48	10	Marr Bank	56.3624	-1.6949	56.3695	-1.6956	1823
332	11/12/2022	51	9	Marr Bank	56.4650	-1.7327	56.4718	-1.7299	34
333	11/12/2022	54	9	Marr Bank	56.4728	-1.7311	56.4660	-1.7349	12
334	11/12/2022	53	9	Marr Bank	56.4687	-1.7354	56.4752	-1.7304	6
335	12/12/2022	67	55	Stendysen	56.0453	-0.8789	56.0505	-0.8694	0
336	12/12/2022	64	55	Stendysen	56.0512	-0.8716	56.0464	-0.8811	11
337	12/12/2022	66	55	Stendysen	56.0490	-0.8802	56.0543	-0.8668	14
338	12/12/2022	65	54	Stendysen	56.0776	-0.9444	56.0736	-0.9545	291
339	12/12/2022	62	54	Stendysen	56.0763	-0.9555	56.0800	-0.9448	333
340	12/12/2022	64	54	Stendysen	56.0789	-0.9457	56.0742	-0.9560	114
341	12/12/2022	48	17	Berwick Bank	56.0672	-1.3255	56.0599	-1.3262	491
342	12/12/2022	52	17	Berwick Bank	56.0599	-1.3288	56.0670	-1.3277	1219
343	12/12/2022	49	17	Berwick Bank	56.0662	-1.3304	56.0597	-1.3300	1438
344	12/12/2022	48	1	Berwick Bank	56.1016	-1.3468	56.0953	-1.3456	4193

345	12/12/2022	50	1	Berwick Bank	56.0952	-1.3443	56.1019	-1.3457	2903
346	12/12/2022	49	1	Berwick Bank	56.1013	-1.3439	56.0952	-1.3424	2283
347	12/12/2022	55	2	Berwick Bank	56.1196	-1.3965	56.1137	-1.3911	702
348	12/12/2022	55	2	Berwick Bank	56.1143	-1.3900	56.1205	-1.3943	366
349	12/12/2022	56	2	Berwick Bank	56.1212	-1.3921	56.1151	-1.3853	443
350	13/12/2022	65	30	Turbot Bank East	57.3691	-0.7012	57.3738	-0.7012	73
351	13/12/2022	64	30	Turbot Bank East	57.3738	-0.6866	57.3700	-0.6965	215
352	13/12/2022	65	30	Turbot Bank East	57.3692	-0.6959	57.3729	-0.6863	114
353	13/12/2022	67	24	Turbot Bank East	57.3968	-0.6994	57.4039	-0.6996	104
354	13/12/2022	68	24	Turbot Bank East	57.4038	-0.7013	57.3968	-0.7021	115
355	13/12/2022	68	24	Turbot Bank East	57.4004	-0.7026	57.4082	-0.7025	61
356	13/12/2022	72	31	Turbot Bank Central	57.4090	-0.8002	57.4014	-0.8040	95
357	13/12/2022	71	31	Turbot Bank Central	57.4023	-0.8075	57.4091	-0.8070	39
358	13/12/2022	73	31	Turbot Bank Central	57.4074	-0.8102	57.4000	-0.8114	21
359	13/12/2022	76	34	Turbot Bank Central	57.4124	-0.8748	57.4189	-0.8759	28
360	15/12/2022	97	28	Ratray Head	57.6806	-1.5839	57.6878	-1.5873	69
361	15/12/2022	91	28	Ratray Head	57.6880	-1.5863	57.6820	-1.5819	51
362	15/12/2022	98	28	Ratray Head	57.6816	-1.5774	57.6884	-1.5826	63
363	15/12/2022	88	27	Ratray Head	57.7068	-1.5967	57.7140	-1.5967	147
364	15/12/2022	80	27	Ratray Head	57.7182	-1.5932	57.7116	-1.5938	126
365	15/12/2022	89	27	Ratray Head	57.7114	-1.5914	57.7176	-1.5897	205
366	15/12/2022	81	21	Aeroplane Bank	57.7059	-1.2228	57.7133	-1.2232	11
367	15/12/2022	75	21	Aeroplane Bank	57.7145	-1.2177	57.7080	-1.2169	0
368	15/12/2022	78	21	Aeroplane Bank	57.7062	-1.2188	57.7132	-1.2200	0
369	15/12/2022	95	22	Belgar Head	57.7369	-1.4257	57.7433	-1.4261	0
370	15/12/2022	83	23	Belgar Head	57.7705	-1.4723	57.7773	-1.4724	45
371	15/12/2022	79	23	Belgar Head	57.7772	-1.4735	57.7706	-1.4744	29
372	15/12/2022	84	23	Belgar Head	57.7710	-1.4772	57.7779	-1.4751	104
373	16/12/2022	67	33	Turbot Bank Central	57.3620	-0.9390	57.3691	-0.9392	541
374	16/12/2022	65	33	Turbot Bank Central	57.3697	-0.9432	57.3628	-0.9453	468
375	16/12/2022	67	33	Turbot Bank Central	57.3620	-0.9488	57.3695	-0.9484	162
376	16/12/2022	63	36	Turbot Bank West	57.3948	-1.0302	57.4023	-1.0310	178
377	16/12/2022	67	36	Turbot Bank West	57.4023	-1.0338	57.3953	-1.0365	58
378	16/12/2022	61	36	Turbot Bank West	57.3967	-1.0392	57.4037	-1.0406	116
379	16/12/2022	68	35	Turbot Bank West	57.4192	-1.1057	57.4261	-1.1064	121
380	16/12/2022	72	35	Turbot Bank West	57.4277	-1.1078	57.4210	-1.1098	150
381	16/12/2022	70	35	Turbot Bank West	57.4200	-1.1136	57.4265	-1.1137	69
382	17/12/2022	38	101	Buckie	57.7640	-2.9155	57.7664	-2.9031	764
383	17/12/2022	37	101	Buckie	57.7664	-2.8987	57.7628	-2.9098	204
384	17/12/2022	38	101	Buckie	57.7654	-2.9193	57.7672	-2.9076	533
385	17/12/2022	49	29	Aberdour Bay	57.7217	-2.2198	57.7215	-2.2065	771

386	17/12/2022	49	29	Aberdour Bay	57.7203	-2.2031	57.7201	-2.2157	262
387	17/12/2022	49	29	Aberdour Bay	57.7191	-2.2184	57.7187	-2.2055	191
388	18/12/2022	51	52	Fraserburgh	57.7274	-1.9829	57.7237	-1.9733	262
389	18/12/2022	47	52	Fraserburgh	57.7223	-1.9725	57.7262	-1.9835	205
390	18/12/2022	48	52	Fraserburgh	57.7250	-1.9877	57.7199	-1.9774	123
391	18/12/2022	48	52	Fraserburgh	57.7180	-1.9761	57.7224	-1.9858	158
392	19/12/2022	41	102	Cullen	57.7334	-2.7028	57.7402	-2.7039	128
393	19/12/2022	48	102	Cullen	57.7390	-2.7065	57.7329	-2.7083	268
394	19/12/2022	41	102	Cullen	57.7331	-2.7106	57.7401	-2.7124	117
395	19/12/2022	29	106	Lossiemouth	57.7424	-3.0624	57.7358	-3.0624	280
396	19/12/2022	24	106	Lossiemouth	57.7348	-3.0645	57.7410	-3.0565	188
397	19/12/2022	29	106	Lossiemouth	57.7429	-3.0662	57.7365	-3.0664	837
398	19/12/2022	27	107	Lossiemouth	57.7427	-3.1703	57.7498	-3.1698	23
399	19/12/2022	26	107	Lossiemouth	57.7539	-3.1732	57.7473	-3.1750	35
400	19/12/2022	27	107	Lossiemouth	57.7471	-3.1767	57.7535	-3.1782	18
401	19/12/2022	31	105	Lossiemouth	57.7688	-3.0942	57.7753	-3.0945	0
402	19/12/2022	32	105	Lossiemouth	57.7755	-3.0922	57.7689	-3.0915	0
403	20/12/2022	51	103	Mithcowie Bank	57.9099	-2.4587	57.9035	-2.4575	111
404	20/12/2022	46	103	Mithcowie Bank	57.9044	-2.4595	57.9109	-2.4604	205
405	20/12/2022	50	103	Mithcowie Bank	57.9071	-2.4503	57.9075	-2.4636	240
406	20/12/2022	48	103	Mithcowie Bank	57.9070	-2.4676	57.9065	-2.4538	182
407	20/12/2022	49	103	Mithcowie Bank	57.9083	-2.4508	57.9089	-2.4629	207

At each station, fish were measured, and for a sub-sample, weight was measured, sex was determined and otoliths were extracted following the stratified protocol as follows:

7.0 – 8.5 cm	=	five otoliths per station set
9.0 – 15.5 cm	=	eight otoliths per station set
≥16.0 cm	=	ten otoliths per station set

Collected otoliths were pooled, with stations in close proximity to each other aggregated into the same tray. Age readings were carried out on board by two readers, using a binocular microscope and reflected light. Each tray is read twice – any differences in assigned age estimates leads to further readings until an agreement is reached. A total of 610 otoliths from the Firth of Forth region and 529 from the Turbot Bank region were extracted and read.

The targeted stations (Figure 1) include historically important sandeel grounds at the Wee Bankie. Station Numbers 3 and 4 form part of a time series that ran from 1999-2003 and was restarted in 2008. Repeat sampling at these locations is considered a priority of the survey. Some of these stations were successfully sampled during this year's cruise. New stations started in 2021, on which commercial sandeel fishing happened in recent years, have also been included. Figures 1 shows the relative quantities of *A. marinus* estimated for each station sampled during survey 2022A.

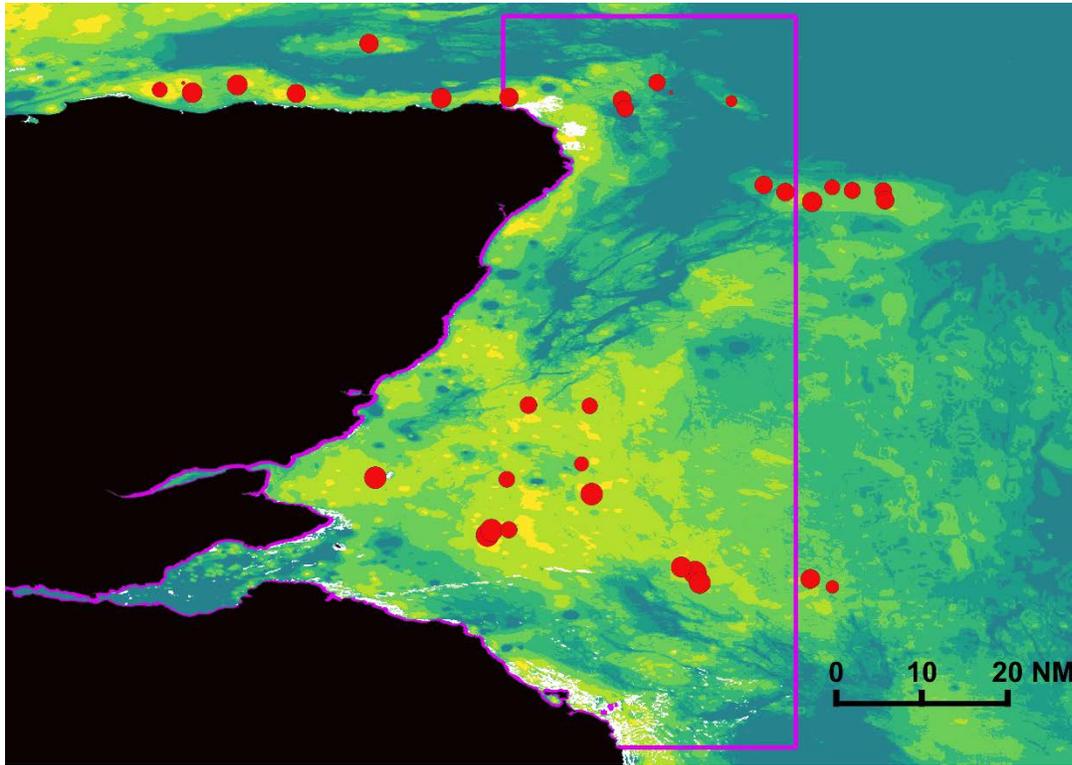


Figure 1: Stations sampled during 2022A. The size of the points is defined by the Average Catch per Hour. The purple line correspond to the sandeel area closed to fishing and the background layer correspond to sandeel suitable habitat from Langton *et al.* 2021 (yellow is the most suitable habitat). Langton, R & Boulcott, Philip & Wright, Peter. (2021). A verified distribution model for the lesser sandeel, *Ammodytes marinus*. Marine Ecology Progress Series. 667. 10.3354/meps13693.

2. Samples of sandeel and other fish bycatch (known seabird prey) were collected and frozen for further analyses.
3. 610 sandeels from the southern region and 529 sandeels from the Northern region, selected for age estimation, were dissected and macroscopically assessed for sex and maturity status.
4. The presence of moorings at planned locations of the tows restricted sampling within the NNG OWF, however, two stations were sampled within the Seagreen OWF.

We would like to express our deepest gratitude and appreciation to the crew and captain of the *Alba na Mara*.

T Régnier, 22 December 2022