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FRV *Scotia*

Cruise 0323S

Report

Dates

14 February – 7 March 2023

Half-landing: Campbeltown, 27 February

Personnel

F Burns	SIC
M Kinghorn	(Deck)
R Gillespie-Mules	
J Dooley	
M Gault	
A Neeson	(Part 1)
L Barnwall	
R Nichol	(Part 1)(SPAN)
J Lucas	(Part 2)(SPAN)
T West	(Visitor, SFF)

Out-turn days: 21 – IBTSWC/20672, 1 – RE004/20231

Fishing Gear: GOV Trawl (BT 137) fitted with ground gear D.
Hydrographic Gear: RBR Concerto^3 CTD

Objectives

1. Demersal trawling survey (SCOWCGFS-Q1) on the grounds off the North and West of Scotland and within ICES Subarea 6a.

2. To obtain temperature and salinity data from the surface and seabed at each trawling station.

3. Collect additional biological data in connection with the UK Workplan and EU Data Collection /EUMap regulation.

4. Retrieval and re-deployment of passive acoustic moorings located at discrete sites within the survey area and are part of the Scotland Passive Acoustic Network (SPAN).

5. Deploy 21 acoustic smolt tracker tag receiver moorings North of Cape Wrath as part of a MSS/AST collaborative project.

Narrative

Part 1: 14-27 February 2023

Scotia departed Aberdeen at 1700 on 14 February. Sailing had been delayed for several hours due to repairs being undertaken on the engines as well as some steel work taking place on the stern around the starboard castle. Due to the delay in departing no shakedown haul was completed, instead after the muster *Scotia* proceeded North in an effort to make up some of the time lost due to the later departure. Conditions and times for navigating the Pentland Firth were favourable and *Scotia* arrived at the first trawl station *(S17)* at around 0920 on 15 February. Subsequent to its successful completion, *Scotia* then headed North in order to deploy the two most easterly Smolt tracker moorings that were practically enroute to the next trawl station at P1. A fresh south-westerly wind was pushing *Scotia* on during the remainder of this as well as the following day with surveying taking place on the northern stations within the Windsock and Rising Ground areas. Good progress was made within this northern region, however, a fleet of Spanish longline vessels also with gear in the same area resulted on one occasion in *Scotia* abandoning her intended primary trawl station, utilising instead a nearby secondary station also within stratum R1. With the weather situation deteriorating markedly during 17 February, *Scotia* steamed south overnight and into the relative calm of the North Minch and successfully completed three trawl stations during daylight on 17 February. With the forecast improving over the next couple of days *Scotia* made good progress back completing the majority of the remaining trawl stations up North as well as the successful night-time deployment of the remaining 19 Smolt tracker moorings at locations sitting above the North Coast (see Figure 1). South-westerly gales this time once more forced *Scotia* into the Minch during the afternoon of 19 February. After an overnight steam South, the following day was spent in and around the Small Isles in the South Minch before heading back North overnight to complete the remaining stations Northwest of the Butt of Lewis. Further progress was made thereafter and helped by a generally favourable weather outlook that although delivering moderate to fresh wind nevertheless provided no real barrier to *Scotia* in terms of her ability to steam or trawl. By 24 February *Scotia* was south of Barra Head and with the weather and sea-state further improving was able to make her way into Irish waters and towards the southwestern survey boundary off the Donegal Coast during 25 and 26 February. With a large area of high pressure sat firmly over Scotland and providing calm and settled conditions *Scotia* headed overnight to Campbeltown during the evening of 26 February and marking the end of what had been a long but ultimately very productive first half and with almost 75% (46/62) of the total GOV stations having already been completed. *Scotia* was alongside in Campbeltown at just after 0800 on Monday 27 February for the mid-cruise break during which a partial changeover of scientific staff also took place.

Part 2: 28 February – 7 March 2023

Scotia departed Campbeltown a little after 8am on 28 February and proceeded to complete the three scheduled trawl stations within the Firth of Clyde. These were completed without issue and with calm and settled conditions continuing for the rest of the week *Scotia* headed out of the Clyde and Northwards to complete a trawl station south of Gigha before heading west to complete further stations located not far off the Northern Irish coast. Over the next three days and with the fine weather continuing *Scotia* was well placed to be able to pick off the remaining trawl stations in the South Minch and Stanton Bank area and successfully serviced the Hyskier SPAN mooring on the afternoon of 4 March. With the trawls completed the final operational survey day on 5 March was spent back up in the North Minch servicing the remaining SPAN moorings at locations around the Shiants and Tolsta. This was successfully completed by just after 1400 and with the wind finally strengthening from the North, *Scotia* plotted a course for Aberdeen and was alongside by afternoon on Monday 6

March. Unloading of all scientific and fishing gear took place early on the morning of Tuesday 7 March.

Results

Trawl Survey – gear performance

The 2021 survey utilised the random-stratified survey design which randomly allocates 62 primary trawl locations distributed within 11 sampling strata (see Figure 1). Trawls were undertaken on suitable ground as near to the specified sampling position as was practicable and aims to find trawls within a radius of not more than five nautical miles from the random trawl position. If the trawl was unable to be undertaken at the primary site or within a reasonable distance from it then a suitable replacement was chosen from a list of secondary random positions located within the relevant survey stratum. All the trawl stations were conducted outwith marine protected areas (MPA's) or special areas of conservation (SAC) containing management measures that restrict the use of mobile fishing gears.

A Scanmar receiver unit together with the MSS RADOS system was used to monitor headline height, wing spread, door spread and distance covered during each tow with SS4 distance units being deployed to monitor wing and door spread. An MSS built bespoke bottom contact sensor was attached to the trawl's groundgear during each tow to monitor ground contact as well as to validate record of touch-down (TD) and lift-off (LO) of the groundgear. This was downloaded and analysed subsequent to every haul in order to verify and cross-check trawl TD and LO times against the RADOS trawl summary output.

Hauls were typically of 30 minutes duration, however, various factors (large fish marks of shoaling species such as herring and boarfish, hard/rocky/muddy terrain with net coming fast, close proximity to static gear) resulted in lesser durations for 13 hauls (haul numbers. 76, 80, 83, 90, 107, 108, 109, 112, 113, 121, 124, 126, 133). None of the hauls were of a duration shorter than 15 minutes thus complying with recommendations pertaining to minimum haul duration referenced in the 2009 IBTSWG report.

The GOV(BT137) was deployed on 65 occasions during 0323S with short 47 m sweeps where the seabed depth was 80 m or less being deployed on 12 occasions, the long 97 m sweeps being utilised on the remaining 51 deeper hauls. There were no invalid hauls recorded during survey 0323S. Primary stations were utilised on 55 occasions *(out of possible 62)* with secondary replacement stations being utilised on seven occasions. The settled conditions experienced during most of the survey provided the opportunity to add a further three secondary stations, thereby, lifting the total number of successful deployments for the survey up to 65. The locations utilised for the valid trawl positions during this survey were a combination of established MSS survey tows, commercial trawl tracks and also completely new areas. On 21 occasions grounds were successfully utilised that previously were unfished by MSS. All of the trawl deployments were completed during daylight hours. See Figure 1 for a plot of all survey tows.

Catch Results *(there was no survey in 2022 so instead 2021 results presented in parenthesis for comparison)*

A total of 85 species were recorded for an overall catch weight of ~47.6 tonnes (92, 37.5). Major species components in approximate tonnes included: haddock *Melanogrammus aeglefinus* – 16.4 (5.77), mackerel *Scomber scombrus* – 3.1 (10.6), cod *Gadus morhua* – 0.65 (0.3), Norway pout *Trisopterus esmarkii* – 2.27 (6.17), whiting *Merlangius merlangus* – 2.09 (1.87), herring *Clupea harengus* – 3.65 (2.41), and scad *Trachurus trachurus* – 2.23 (2.84). Scotia was able to achieve slightly more valid hauls (65) than were undertaken during this survey in 2021 (63), however, effort in hours fished was broadly similar in terms of hours fished

(2021:29.5, 2023:30.5) so catch estimates are comparable. Haddock are the headline story of this survey with an unprecedented 280% increase in total catchweight compared to 2021 with over 16 tonnes of haddock being caught. Cod catchweight (0.65T) is also up more than 100% on 2021 albeit this was from a very low level in 2021 of 0.3T. Catches of Norway Pout and mackerel were both down 270% and 340% respectively on 2021. Table 1 provides overall catch rates per unit effort (CPUE) of the above species and several other major species.

The CPUE index (numbers caught per hour fishing) for 1-group gadoids (cod, haddock, whiting and saithe) weights the indices for each of the 11 sampling strata by the surface area of said stratum. These are then pooled to produce the index for ICES Subarea 6a. Results for Q1 2023 for all age classes of the major commercial gadoid species are shown in Table 2 while those of 1-groups only for period 2015-2023 are shown in Table 3. Species CPUE by weight (all ages) for the survey over a similar period are displayed in Table 4.

Although overall survey CPUE indices provided mostly positive or neutral estimates for the main target species including a record survey high for haddock the 1- group abundance indices more of a mixed bag for the same species. Haddock were down 50% on 2021 estimates and cod are also down 25% when compared with 2021 and crucially both also well below the 10 year average for the survey. The 1-group estimate for cod is less than 0.1 fish per hour which is a record low for the survey. In the case of haddock these results are unsurprising given the very large adult biomass (*comprised largely of 4 year olds*) currently observed within subarea 6a. Estimates of 1 group whiting meanwhile are up over 80% on 2021 albeit still some way short of the ten year survey average. For the fourth survey in succession no one group saithe were recorded and despite an increase in the overall CPUE for saithe during the survey in 2023. Also to note, over 70% of the entire saithe caught during survey 0323S were from two stations (*hauls 125 and 131*) within the South Minch and dominated by two year old fish. Overall survey CPUE by weight (kg/hr) was down for Norway Pout compared to 2021 although there was a small increase in the estimate for one group individuals albeit they are still some way below the tne year survey average. Notable species encountered during the survey included a garfish (*Belone belone*) that was recorded from the shelf edge NW of Orkney (Station 74). Large numbers of Spurdog *(Squalus acanthias*) were encountered from two stations (*79 and 82*) NE of the Butt of Lewis that combined, contained almost three tonnes of spurdog. Spurdog numbers from this survey have been rising steadily during the last few years.A pod of ten common dolphin (*Delphinus delphis*) were spotted whilst deploying the trawl on station 122, 15 nm NE of Tory Island with another pod of around 15 animals being spotted W of Tiree in the South Minch just prior to shooting the trawl at station 132.

Hydrography

The CTD recorder (RBR Concerto^3) was successfully deployed on 62 out of the 65 trawling stations in order to obtain a temperature and salinity profile from the surface to within approximately 5 m of the seabed. Hauls 81, 90 and 105 had no associated hydrography data. These were dropped in order to save time thus allowing the completion of another trawl station within the daylight period.

SPAN Acoustic Moorings Deployments/Retrieval

During survey 0323S 3 moorings from the Hyskier location were retrieved as well as one from Tolsta. These had been deployed during 1722S back in early December 2022. Unfortunately and once again the Shiants mooring could not be retrieved despite communication being established and the release command having activated. It appeared to have become fouled during the release phase and remained suspended in midwater approximately 30 metres from the surface. A similar situation was encountered during another attempted retrieval within the same location back in early December during survey 1722S. In addition two of the moorings

slipped/lost their anchor line and chain weights on account of what would appear to have been a weak quick release clip being used to attach the triangle to the dyneema retrieval line. This is something that requires to be looked at prior to the next tranche of deployments as it was clear that this clip is not suitable for securing the dyneema when under strain with the chain weights attached. Five moorings were deployed back onto the same three locations but this time with only a single mooring being deployed at both Hyskier and Shiants whilst three moorings in a triangular configuration (similar to those retrieved from Hyskier) were deployed at the Tolsta location. See Figure 1 for location of span moorings deployed during survey 0323S. Exact positions of the deployed moorings are provided in Table 5.

Marine Scotland Science (MSS)/Atlantic Salmon Trust (AST) Smolt Tracking Moorings

Twenty one tag receiver moorings were successfully deployed over two nights and along a 50 nm transect running east to west and located North of Cape Wrath. The tracking units are being deployed to monitor the movements of Atlantic salmon (*Salmo salar*) post-smolts through the Atlantic Ocean and northwest of the Scottish mainland. These moorings were deployed as part of a collaborative project between MSS and the AST. See Figure 1 for the mooring locations.

Biological Sampling

In total 7443 biological observations on selected species were collected in support of the UK Workplan and also the EU Data Collection Regulation. A summary of numbers collected for all sampled species is displayed in Table 6. All otoliths were aged upon return to the marine laboratory.

Monitoring of Non Indigenous Invasive Species (NIS)

All catches were screened for the presence of selected NIS species with the results being reported back to the project coordinator at CEFAS.

Marine litter

All litter picked up in the trawl was classified, quantified, recorded and retained for appropriate disposal ashore. The data is uploaded to the MSS database from where it will eventually be uploaded to DATRAS.

Additional sampling undertaken during 0323S

- Genetic tissue samples for Anglerfish and hake from area ICES subarea 6A – *Gecka project.*
- Whole juvenile mackerel retained for investigations into variations in field metabolic rate (FMR) proxy using sagittal otoliths – *Clive Trueman* (Southampton University).
- Pelagic fish sample collection – Retention of 7 kg each of mackerel and herring from the Minch area for environmental monitoring (CRCE Scotland, Glasgow).
- Retention of Phakellid and Craniella sponges. Collaborative phylogenic study between MSS and the Natural History Museum.
- Bobtail squid identification. All bobtail squid (Sepiolida) caught frozen for identification at Naturalis Biodiversity Centre, Leiden.
- 5 litre sample of raw offshore sub-surface (<10 m) water to serve as an inoculum in experiments. *Heriot Watt University.*

- Whole herring retained for genetics analysis from hauls containing spawning individuals to enhance ongoing stock discrimination work within subarea 6A - Ongoing collaboration involving MSS

- All shelled molluscs retained for the Mackay reference collection.

Summary

Despite the weather during Part 1 being extreme for periods, *Scotia* was successful in that during these occasions in managing to divert survey operations to areas that allowed the vessel to keep working. The result being that only minimal time was lost to weather and *Scotia* was able to trawl during every operational survey day she needed to. There were no invalid hauls during 0323S and this can at least in part be attributed to luck but also almost certainly calm weather conditions experienced during the latter stages of Part 1 and for pretty much all of the second half. This also allowed excellent progress to be made resulting in all of the survey's objectives being met if not exceeded including the successful deployment of threee additional trawl stations. MSS continues to foster a good working relationship with several static gear vessels operating within the survey footprint with the result that MSS were able to plot creel positions from within the Windsock and South Minch as well as off the Irish and Northern Ireland coast. This yielded significant benefits for the survey in providing additional confidence when trawling within these areas that in the past have often proved problematic. MSS hopes to build on this cooperation during future surveys and is extremely grateful for the cooperation received from the many creel vessels that were able to provide positional information during the survey. A massive thank you also to all the officers, engineers and crew of the *Scotia* for ensuring the success of what was an extremely enjoyable and successful survey.

Submitted
Finlay Burns
7 May 2023

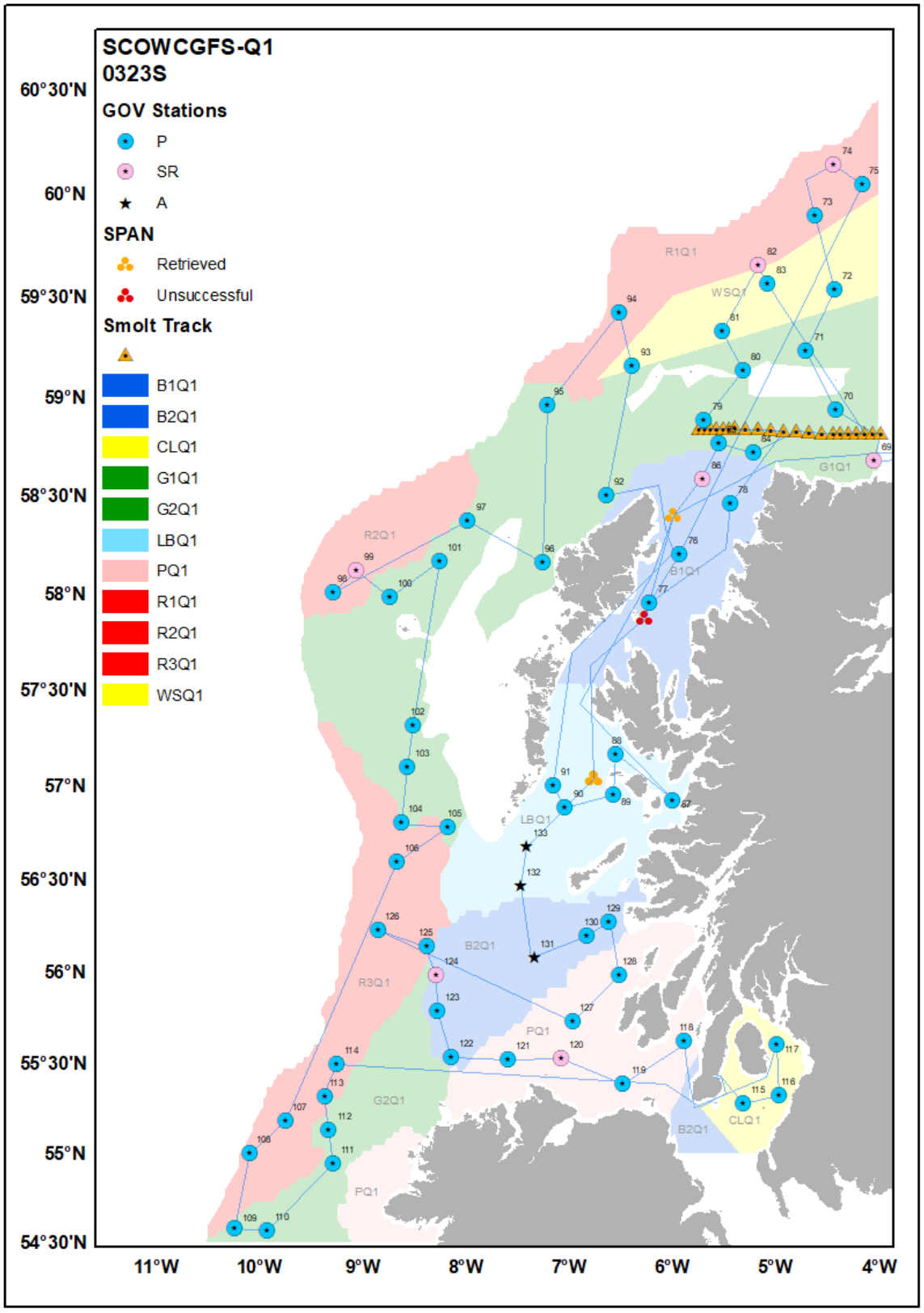

Figure 1: 0323S GOV deployments denoted by station type utilised (P – Primary, SR – Secondary Replacement, A – Additional). Also provided are locations of both SPAN and also smolt tracker moorings deployed. Survey track for 0323S is also shown.

Table 1: Overall CPUE of major components of combined catch 0323S - Q1 2023.

Species	Common name	kg/hr	no/hr
Melanogrammus aeglefinus	Haddock	540	1622
Scomber scombrus	Mackerel	101	955
Gadus morhua	Cod	21.3	9.2
Trisopterus esmarkii	Norway Pout	74.7	4201
Merlangius merlangus	Whiting	68.8	378
Clupea harengus	Herring	112	1084
Trachurus trachurus	Horse Mackerel	73.1	337
Scyliorhinus canicula	Lesser Spotted Dogfish	59.5	131.6
Pleuronectes platessa	Plaice	13.6	71
Eutrigla gurnardus	Grey Gurnard	10.5	96.5
Capros aper	Boar Fish	206.4	6746.7
Squalus acanthias	Spurdog	125.4	50.2
Pollachius virens	Saithe	10.1	11.2
Merluccius merluccius	Hake	5.2	37.2
Dipturus intermedia	Flapper Skate	10.7	1.9
Loligo ssp	Long Finned Squid	8.2	56.3
Raja montagui	Spotted Ray	8.1	9.6
Lophius piscatorius	Angler	1.6	1.1
Sprattus sprattus	Sprat	26.6	4507
Raja clavata	Thornback Ray	7.2	5.8
Chelidonichthys cuculus	Red Gurnard	6.9	22.5
Micromesistius poutassou	Blue Whiting	39.2	1440
Limanda limanda	Common Dab	12.5	313
Microstomus kitt	Lemon Sole	4.3	31.3
Lepidorhombus whiffiagonis	Megrim	1.8	5.2

Table 2: CPUE indices (nos/hr) by year class of major demersal species Q1 2023.

Age	Cod	Haddock	Whiting	Saithe	N. Pout
1	0.09	78.37	140.78	0.00	2954.41
2	3.36	148.02	80.93	0.80	1391.06
3	2.37	394.29	67.04	8.05	210.88
4	1.53	655.27	56.30	0.34	1.87
5	0.71	191.18	9.81	0.49	0.00
6	0.15	16.12	2.86	0.11	0.00
7	0.10	11.39	2.06	0.03	0.00
8	0.00	0.43	0.00	0.03	0.00
9	0.00	21.51	0.03	0.08	0.00
10	0.00	0.25	0.00	0.12	0.00
11	0.00	0.00	0.00	0.03	0.00
12	0.00	0.00	0.00	0.03	0.00
13	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00

Table 3: CPUE indices (nos/hr fishing) of 1-groups of major demersal species since 2015.

Species	2015	2016	2017	2018	2019	2020	2021	**2023**	% change from 2021	10 Yr Av.
Cod	0.82	0.47	0.29	0.17	1	1.44	0.12	**0.09**	-25	0.8
Haddock	680	56	217	39.8	763	95.8	152	**78.4**	-48.4	214.0
Whiting	254	323	497	196	323	380	77.3	**140.78**	82.1	277.7
Saithe	0	0	0	1.28	0	0	0	**0**	NA	0.1
N. Pout	4649	3245	4370	538	4693	3698	2271	**2954**	30.1	3279.2

Table 4: CPUE indices (kg/hr fishing) of major demersal species since 2013.

Species	2013	2014	2015	2016	2017	2018	2019	2020	2021	2023
Cod	29.3	11.6	72.5	44.1	190	20.4	4.5	10.4	10.2	21.3
Haddock	180	114	169	191	325	206	189	198	196	540
Whiting	63.8	35.0	58.7	96.9	110	100	56	103	63.7	68.8
Saithe	15.2	25.0	24.0	17.1	16.2	42.5	2.18	16	1.9	10.1
N. Pout	131	126	65.4	73.9	127	44.1	58.6	165	210	74.7

Table 5: Positions of SPAN moorings deployed during 0323S.

Location name	Latitude (deg dec min)	Longitude (deg dec min)	Mooring Depth (m)
Tolsta	58° 23.68 N	6° 00.74 W	95
Tolsta b	58° 24.023 N	6° 00.343 W	94
Tolsta c	58° 23.665 N	5° 59.975 W	96
Hyskier	57° 02.172 N	6° 45.314 W	46
Shiants	57° 52.567' N	6° 16.361' W	69

Table 6: Numbers of biological observations per species collected during 0323S. These consist of length, weight, sex and age, unless:
* length, weight, sex, maturity and otoliths retained (to be aged at a later date)
** length, weight, sex, maturity
*** length, weight and age
† length, weight, sex and externally determined maturity only

Species	No.	Species	No.
Melanogrammus aeglefinus	*1823*	***Scophthalmus rhombus*	1
Merlangius merlangus	*1086*	*†Dipturus flossada*	11
Gadus morhua	*274*	*†Dipturus intermedia*	58
Pollachius virens	*125*	*†Leucoraja naevus*	27
Trisopterus esmarkii	*497*	*†Mustelus asterias*	21
Clupea harengus	*699*	*†Raja brachyura*	1
****Sprattus sprattus*	*227*	*†Raja clavata*	177
Scomber scombrus	*303*	*†Raja montagui*	273
**Merluccius merluccius*	*220*	*†Squalus acanthias*	373
Pleuronectes platessa	*233*	*†Galeorhinus galeus*	1
Glytopcephalus cynoglossus	*37*	*†Scyliorhinus caniculus*	919
†Galeus melastomus	*16*		