

A trial to study the effectiveness of a Sort V grid in a cod end whilst twin rigging for Atlantic Cod (*Gadus morhua*) in NAFO division 3M

Following the request from the Fisheries Commission Working groups in July 2015 to the Scientific Council to analyse and provide advice on management measures that could improve selectivity in the 3M cod and redfish fisheries, the SC responded that the implementation of sorting grids would, to a large extent, prevent catches of fish below MLS (41cm) as well as reduce bycatches.

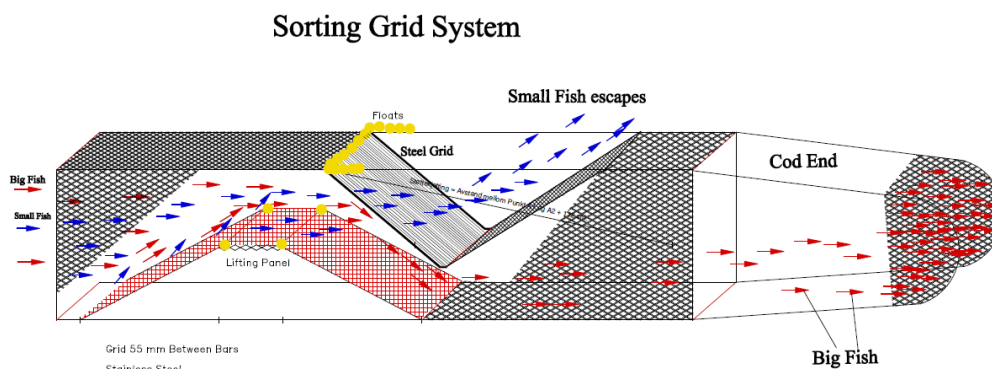
In February 2016 the UK freezer vessel Kirkella H7 commenced 28 days of fishing in NAFO 3M targeting cod. Prior to sailing the vessel's skipper was provided with a sampling protocol which has been summarised below.

*Twin Rig- Grid to be used in one Cod End only. A random sample will need to be taken from each of the cod ends for each haul that is undertaken using twin rig. Using a 20kg fish basket take 4 samples from each cod end. One from the top, two from the middle and one from the bottom. Measure and record fish length for all fish sampled using the sampling table.*

*Length and weight of any undersized Cod to be measured and recorded from the total haul, regardless of the sampled fish, then returned.*

*Results to be sent into the office via email daily.*

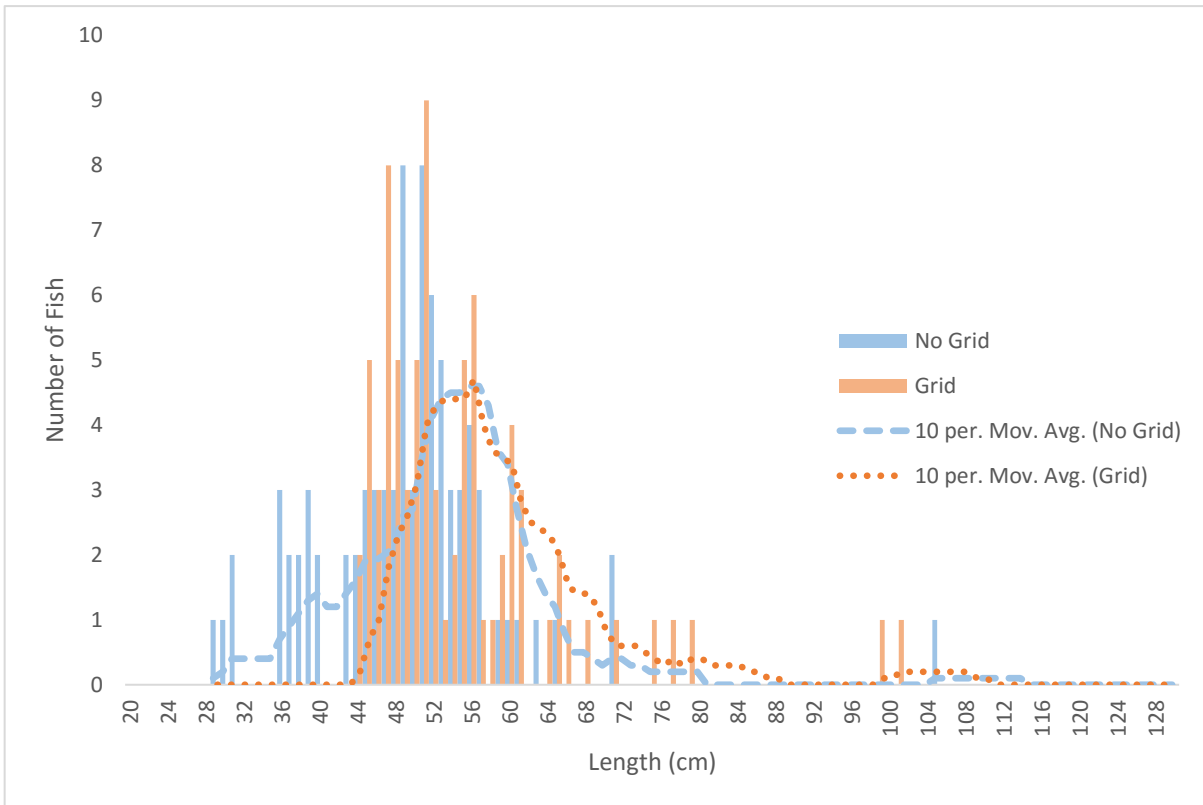
When the vessel was twin rigging one of the cod ends was fitted with a Sort V grid system. The grid is made from Stainless steel, measuring 1.7m x 1.2 m with 50 – 55 mm between the bars, mounted in a 20 m long Netting Section.



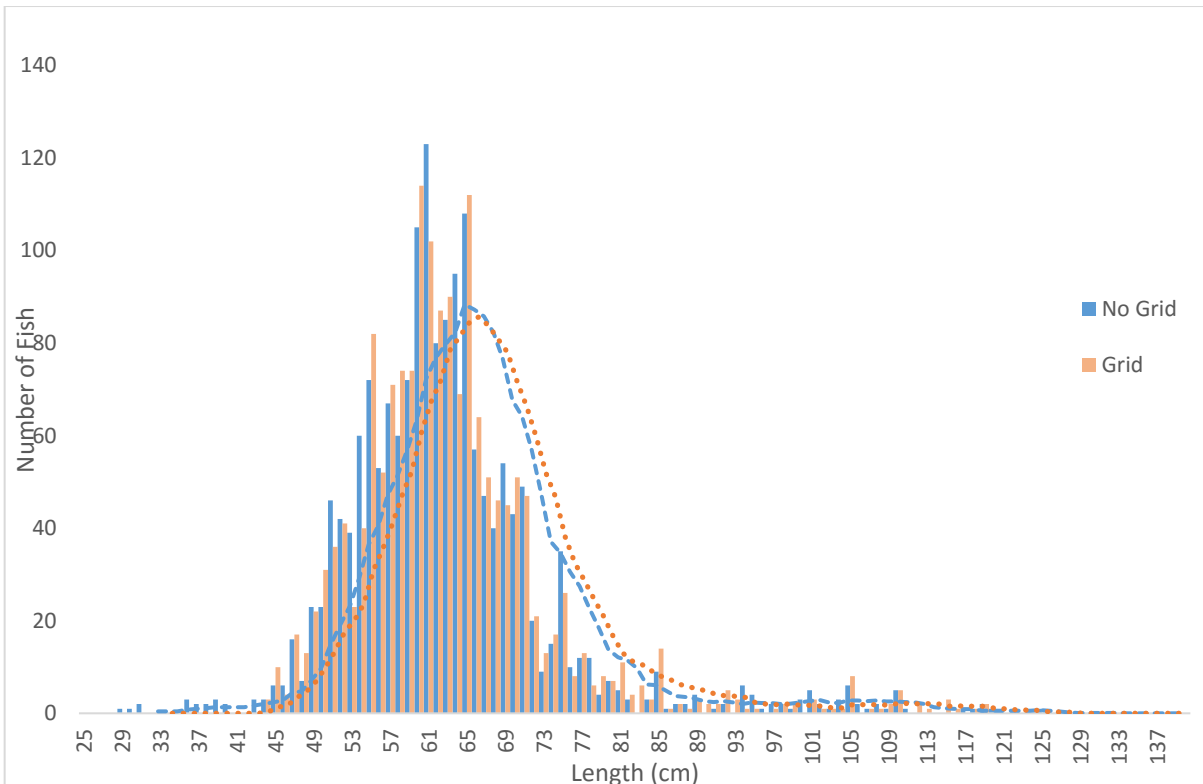
**Figure 1. Sort V grid system in a cod end.**

Due to adverse sea conditions during the trip the vessel was able to operate a twin rig for only 30 of the 93 total hauls. From these 30 hauls lengths were recorded for 3397 individual fish.

Prior to the trip, following communications with vessels from other Member States it was apparent that higher numbers of smaller individual fish were being landed in shallower water. When the Kirkella moved to shallower water for hauls 22-23, ~290m depth compared to the average fishing depth of ~450m for other hauls, 14 individual undersized fish were measured and recorded, all having been caught in the trawl using no grid. Whilst operating in the shallower water the average length for all fish recorded was 51.86cm in the cod end with no grid and 56.23cm with the use of the sorting grid. Average fish length for the complete trip was; No grid: 63.05cm, Grid: 63.41cm. Only during these shallower hauls were any cod below MLS caught, so for vessels not using a grid, or operating a smaller mesh size, incidental bycatch of small fish could be avoided by operating in deeper waters.



**Figure 2. Length Frequency distribution of Gadus morhua in hauls 22-23 ~290m depth.**



**Figure 3. Length Frequency distribution of Gadus morhua for full trip.**

Table below shows catch and effort information on a haul by haul basis.

**Catch and Effort Information by Haul**

Haul #	Gear #	Date (YYYYM MDD)	NAFO Division	START				FINISH				Log Book Figures (kg)						Haul Total (kg)	
				Latitude (decimal)	Longitude (decimal)	Depth (m)	Time (UTC) (HHMM)	Latitude (decimal)	Longitude (decimal)	Depth (m)	Time (UTC) (HHMM)	Cod	Redfish	Halibut	Catfish	Haddock	Plaice		
1	1	20160201	M3	46.30.00 N	45.54.27 W	395	05:49	46.29.20 N	46.02.90 W	427	09:45	10735							10735
2	1	20160201	M3	46.28.58 N	45.59.56 W	424	10:40	46.32.48 N	45.52.23 W	394	14:39	7003	109						7112
3	1	20160201	M3	46.31.51 N	45.51.49 W	408	15:31	46.29.48 N	45.52.26 W	406	18:58	9713							9713
4	1	20160201-02	M3	46.30.47 N	45.53.08 W	405	19:56	46.33.21 N	45.51.44 W	390	00:28	7816	191					28	8035
5	1	20160202	M3	46.31.42 N	45.52.29 W	422	01:21	46.32.08 N	45.53.02 W	438	05:57	6365	55						6420
6	1+2	20160202	M3	46.30.19 N	45.53.43 W	434	07:45	46.26.46 N	45.51.33 W	464	11:38	10598	437						11035
7	1+2	20160202	M3	46.29.03 N	45.32.35 W	431	13:12	46.28.04 N	45.51.33 W	419	17:48	9360							9360
8	1+2	20160202-03	M3	46.29.21 N	45.51.57 W	400	18:56	46.29.29 N	46.10.23 W	414	00:13	18673	382					196	19251
9	1+2	20160203	M3	46.30.40 N	46.08.03 W	447	00:57	46.30.31 N	46.00.08 E	450	06:33	14368	273					196	14837
10	1+2	20160203	M3	46.31.12 N	46.03.32 W	450	08:36	46.31.12 N	46.05.28 W	464	15:20	15444	164					140	15748
11	1+2	20160203-04	M3	46.29.01 N	46.15.34 W	440	16:14	46.31.50 N	46.15.45 W	450	00:36	21294	1065					140	22499
12	1+2	20160204	M3	46.31.43 N	46.14.29 W	450	02:04	46.32.22 N	46.16.44 W	446	09:08	22464	437					56	22957
13	1+2	20160204	M3	46.38.00 N	46.21.23 W	455	12:55	46.29.24 N	46.06.40 W	430	17:04	3744							3744
14	3	20160204-05	M3	46.29.24 N	46.06.40 W	456	22:58	46.29.10 N	46.02.02 W	444	04:32	3604	27						3631
15	1+2	20160205	M3	46.27.09 N	45.59.23 W	435	06:10	46.32.48 N	46.16.33 W	458	10:14	11934	55					14	12003
16	1+2	20160205	M3	46.32.29 N	46.16.07 W	448	11:50	46.26.32 N	46.01.07 W	431	15:30	7114	328					14	7456
17	1+2	20160205	M3	46.28.23 N	46.01.25 W	394	16:32	46.35.10 N	46.19.40 W	448	20:36	9594							9594
18	1+2	20160205-06	M3	46.32.28 N	46.15.25 W	444	21:57	46.30.61 N	46.09.09 W	452	00:15	6238	519					42	6799
19	1+2	20160206	M3	46.34.16 N	46.08.50 W	452	03:25	46.28.56 N	46.07.06 W	453	08:51	14040	300					42	14382
20	1+2	20160206	M3	46.29.29 N	46.03.49 W	428	10:56	46.32.46 N	46.14.18 W	438	13:51	2647	109						2756
21	3	20160207	M3	46.58.28 N	45.52.16 W	297	02:58	47.01.51 N	45.48.23 W	289	08:31	2106	164					28	2298
22	1+2	20160207	M3	47.03.59 N	45.48.33 W	290	09:12	46.56.19 N	45.51.08 W	294	14:00	13338				111	56	13505	
23	1+2	20160207	M3	46.56.41 N	45.49.14 W	295	14:55	46.59.30 N	45.49.14 W	290	20:10	9126							9126
24	1+2	20160207-08	M3	47.00.22 N	45.52.12 W	300	21:16	46.59.17 N	45.52.32 W	298	01:05	3931	82		220	111	56	4400	
25	3	20160208	M3	47.00.06 N	45.50.06 W	294	02:46	47.03.05 N	45.51.12 W	298	08:03	3978					56	4034	
26	1+2	20160208	M3	46.28.06 N	45.55.58 W	429	11:57	46.31.16 N	46.12.49 W	445	15:30	19656							19656
27	1+2	20160208-09	M3	46.28.16 N	46.16.22 W	455	18:07	46.41.49 N	46.23.45 W	440	00:58	22745	573					84	23402
28	1+2	20160209	M3	46.38.35 N	46.22.38 W	430	02:41	46.29.56 N	46.11.43 W	455	06:16	19656	82						19738
29	1+2	20160209	M3	46.29.10 N	45.56.16 W	461	11:18	46.29.47 N	46.09.14 W	455	13:45	14040							14040
30	1+2	20160209-10	M3	46.37.44 N	46.20.47 W	440	19:00	46.29.83 N	46.11.05 W	455	01:35	13619	137					14	13770
31	1+2	20160210	M3	46.28.24 N	46.03.37 W	453	02:14	46.32.45 N	46.16.20 W	453	05:02	16520	27						16547
32	1+2	20160210	M3	46.36.05 N	46.19.13 W	440	07:09	46.28.57 N	46.06.33 W	447	10:59	14274	82						14356
33	1+2	20160210	M3	46.27.58 N	45.59.23 W	416	14:49	46.30.57 N	46.13.27 W	453	18:02	7488							7488
34	3	20160210-11	M3	46.28.59 N	45.55.21 W	451	23:15	46.30.11 N	46.11.19 W	453	02:24	9734	246	80				42	10102
35	3	20160211	M3	46.31.09 N	46.13.58 W	430	03:23	46.29.48 N	46.11.12 W	455	09:17	14414	55	78				14	14561
36	3	20160211	M3	46.29.24 N	46.09.42 W	443	12:49	46.28.35 N	46.07.37 W	450	16:42	8892	191	55					9138
37	1+2	20160211	M3	46.28.35 N	46.07.37 W	439	19:01	46.30.51 N	46.13.19 W	457	22:04	16380		88					16468
38	1+2	20160212	M3	46.30.16 N	46.11.00 W	450	00:12	46.28.22 N	45.56.11 W	456	03:24	22370	491	78				126	23065
39	1+2	20160212	M3	46.27.06 N	45.52.18 W	455	11:14	46.27.44 N	46.03.45 W	423	13:29	14040							14040
40	1+2	20160212-13	M3	46.33.36 N	46.17.27 W	450	18:44	46.26.28 N	45.52.58 W	439	00:39	14695	109					98	14902
41	1+2	20160213	M3	46.27.17 N	45.51.32 W	435	02:41	46.27.10 N	46.04.43 W	447	05:41	19890	27						19917
42	1+2	20160213	M3	46.26.36 N	45.50.73 W	446	12:47	46.26.54 N	45.54.61 W	445	13:25	6552	27						6579
43	1+2	20160213	M3	46.28.26 N	46.04.51 W	450	18:16	46.26.04 N	45.54.36 W	441	20:34	16380	55	72					16507
44	1+2	20160214	M3	46.26.46 N	45.53.10 W	429	05:17	46.26.52 N	46.00.85 W	453	07:42	23634						98	23732
45	1+2	20160214	M3	46.26.28 N	45.51.26 W	442	15:43	46.26.08 N	45.58.19 W	458	17:02	11232							11232
46	1+2	20160214-15	M3	45.26.21 N	45.53.26 W	440	21:13	46.27.28 N	45.57.55 W	451	00:41	16661	27					28	16716
47	1+2	20160215	M3	46.27.26 N	45.52.21 W	432	03:17	46.26.17 N	45.57.20 W	455	04:20	13572	27						13599
48	1+2	20160215	M3	46.25.26 N	45.51.53 W	448	09:38	46.25.59 N	45.59.10 W	458	11:08	14040							14040
49	3	20160216	M3	45.26.49 N	45.52.19 W	435	07:50	46.26.52 N	46.01.45 W	454	09:44	22183							22183
50	3	20160216	M3	46.26.32 N	45.51.41 W	445	15:09	46.26.26 N	46.00.23 W	455	16:54	8424	27						8451
51	3	20160216	M3	46.26.43 N	45.56.33 W	443	17:55	46.26.43 N	46.07.37 W	462	20:05	14040							14040
52	3	20160217	M3	46.26.57 N	45.58.06 W	448	01:21	46.27.22 N	46.06.11 W	458	02:48	13198	82					56	13336
53	3	20160217	M3	46.25.31 N	45.52.17 W	453	07:14	46.26.30 N	46.02.25 W	457	09:15	14976							14976

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				Latitude (decimal)	Longitude (decimal)	Depth (m)	Time (UTC) (HHMM)	Latitude (decimal)	Longitude (decimal)	Depth (m)	Time (UTC) (HHMM)	Cod	Redfish	Halibut	Catfish	Haddock	Plaice	
54	3	20160217	M3	46.26.39 N	46.00.16 W	450	13:49	46.30.40 N	46.12.22 W	450	16:19	8892						8892
55	3	20160217	M3	46.30.37 N	46.10.45 W	441	17:02	46.26.25 N	46.00.31 W	453	19:22	11700						11700
56	3	20160218	M3	46.28.28 N	45.50.59 W	446	00:21	46.28.13 N	45.54.56 W	446	02:13	17597	737				42	18376
57	3	20160218	M3	46.27.21 N	45.50.42 W	453	07:44	46.29.56 N	46.00.01 W	425	11:01	13104						13104
58	3	20160218	M3	46.28.33 N	45.50.36 W	448	15:05	46.23.24 N	45.50.49 W	460	16:33	15210						15210
59	3	20160218-19	M3	46.29.80 N	45.50.81 W	448	23:15	46.27.31 N	45.50.41 W	458	00:05	15304	82				14	15400
60	3	20160219	M3	46.30.16 N	45.50.15 W	460	06:59	46.28.39 N	45.50.24 W	483	07:25	8845						8845
61	3	20160219	M3	46.30.38 N	45.50.13 W	466	12:10	46.28.17 N	45.50.25 W	465	12:51	9828						9828
62	3	20160219	M3	46.31.02 N	45.49.59 W	453	16:43	46.28.47 N	45.50.07 W	464	17:22	15210						15210
63	3	20160220	M3	46.30.39 N	45.50.29 W	452	00:18	46.27.23 N	45.50.38 W	475	01:30	10015	27					10042
64	3	20160220	M3	46.29.42 N	45.50.08 W	482	05:26	46.26.41 N	45.50.13 W	455	06:16	12215						12215
65	3	20160220	M3	46.24.04 N	45.50.17 W	464	11:15	46.26.53 N	45.50.27 W	462	12:06	15210						15210
66	3	20160220	M3	46.30.94 N	45.49.78 W	483	17:03	46.28.24 N	45.49.53 W	460	17:43	6084						6084
67	3	20160220-21	M3	46.26.14 N	45.51.00 W	474	20:48	46.31.25 N	45.50.15 W	470	00:22	16754	27					16781
68	3	20160221	M3	46.24.20 N	45.51.29 W	460	04:14	46.27.08 N	45.50.51 W	481	05:00	11232						11232
69	3	20160221	M3	46.30.28 N	45.50.10 W	482	11:10	46.27.00 N	45.49.58 W	455	12:06	7582						7582
70	3	20160221	M3	46.24.27 N	45.50.37 W	480	14:02	46.28.11 N	45.50.21 W	465	15:10	12168						12168
71	3	20160221-22	M3	46.25.41 N	45.51.52 W	462	21:23	46.33.41 N	45.49.55 W	448	00:19	15397	164					15561
72	3	20160222	M3	46.24.26 N	45.50.42 W	448	04:01	46.26.57 N	45.50.28 W	428	04:41	11466						11466
73	3	20160222	M3	46.28.51 N	46.04.18 W	437	09:47	46.26.10 N	45.51.43 W	445	12:23	19092	109				42	19243
74	3	20160222	M3	46.28.44 N	45.58.33 W	426	18:38	46.23.57 N	45.51.17 W	478	20:41	14040						14040
75	3	20160223	M3	46.29.48 N	45.54.58 W	410	00:51	46.28.26 N	45.59.04 W	434	01:44	14691	27					14718
76	3	20160223	M3	46.29.39 N	45.54.58 W	406	07:38	46.28.17 N	45.58.24 W	435	08:21	19094						19094
77	3	20160223	M3	46.25.02 N	45.51.30 W	440	13:43	46.25.37 N	45.57.07 W	463	14:54	20966						20966
78	3	20160223-24	M3	46.27.36 N	45.51.22 W	440	22:41	46.27.41 N	45.59.27 W	464	00:33	5066	27				28	5121
79	3	20160224	M3	46.26.23 N	45.58.17 W	459	01:30	46.24.44 N	45.53.57 W	466	02:28	13467						13467
80	3	20160224	M3	46.27.44 N	45.50.51 W	447	08:47	46.23.58 N	45.52.34 W	475	10:26	6084						6084
81	3	20160224	M3	46.25.29 N	45.50.06 W	462	12:18	46.24.40 N	45.51.45 W	464	13:27	4399						4399
82	3	20160224	M3	46.26.11 N	45.51.46 W	446	15:03	46.25.40 N	45.58.48 W	465	16:41	19635						19635
83	3	20160225	M3	46.28.53 N	45.50.35 W	459	00:38	46.23.38 N	45.53.04 W	485	02:08	14052	164				14	14230
84	3	20160225	M3	46.24.53 N	45.49.11 W	477	05:59	46.23.21 N	45.52.14 W	488	06:53	15664						15664
85	3	20160225	M3	46.25.41 N	45.49.12 W	495	15:07	46.23.42 N	45.51.43 W	482	16:03	12636						12636
86	3	20160225	M3	46.25.41 N	45.49.11 W	492	20:02	46.23.51 N	45.55.06 W	489	21:47	15444						15444
87	3	20160226	M3	46.25.12 N	45.49.21 W	474	02:03	46.23.32 N	45.54.08 W	488	03:14	12287	273					12560
88	3	20160226	M3	46.25.59 N	45.49.10 W	493	11:15	46.23.54 N	45.55.05 W	480	13:05	16380						16380
89	3	20160226	M3	46.24.03 N	45.50.13 W	481	20:17	46.22.11 N	45.56.40 W	487	22:45	12168						12168
90	3	20160227	M3	46.23.41 N	45.50.50 W	486	02:05	46.24.16 N	45.55.49 W	487	03:01	13244	109				14	13367
91	3	20160227	M3	46.23.39 N	45.53.40 W	481	09:08	46.23.51 N	45.56.22 W	488	09:39	13572						13572
92	3	20160227	M3	46.23.39 N	45.53.40 W	477	16:30	46.23.41 N	45.58.01 W	491	17:17	15912						15912
93	3	20160228	M3	46.24.23 N	45.52.42 W	467	00:17	46.24.13 N	45.58.19 W	485	01:19	19779						19779

Trawl Gear Information

Gear #	Gear Type	Gear Make	Mesh Size (mm)												Attachments
			Wings			Body			Lengthening Piece			Codend			
			High	Low	Average	High	Low	Average	High	Low	Average	High	Low	Average	
1*	OTB	baccalao	165	155	160	160	152	157	161	156	158	147	138	142	Legal
2	OTB	baccalao	162	154	159	165	162	162	168	158	162	150	140	143	legal
3	OTB	baccalao	162	156	160	157	152	155	156	150	153	146	137	141	Legal

\*Grid used in Gear # 1