

North Sea Whitefish Survey: 2011

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Executive summary

The North Sea Whitefish (NSW) survey sailed on 11 June 2011, fishing operations began on 12 June and were completed after four fishing trips on 27 July. Each of the specified fishing grounds was visited and 18 tows were completed on hard and soft substratum. Length distributions from cod, haddock, whiting, saithe and plaice, and the volume of the catch of all other species, were recorded. Otolith samples were collected from cod, haddock and whiting for age determination at Cefas.

The results from the three NSW surveys are starting to provide a valuable evaluation of the dynamics of the three target species on hard and soft ground in the North Sea.

In 2009 and 2011 catch rates of the target gadoid species were higher on hard ground than on soft; in 2010 catch rates between the substrata were reversed in many areas for cod and whiting. Differences in catch rates result from differences in local abundance, substratum preferences and/or differences in gear catchability. The reversal in catch rates between substratum type between years was unexpected and will require more detailed analysis as the time-series develop. Overall, the age structure recorded on soft ground was similar to that on hard in all years, with differences in the age distribution related to the area of fishing rather than the substratum fished.

When compared at an overall North Sea scale, the relative indices at age of cod, haddock and whiting abundance from the NSW and IBTSq3 surveys show good correlation in all years, better for cod than haddock and whiting. Catches of older fish were more frequent and showed less noise in the NSW survey data than in the IBTSq3, particularly for cod. In addition, differences in the relative catch rates of older whiting between the two surveys will require analysis as the time-series develops.

The results demonstrate the value in developing a time-series for gadoids based on a commercial vessel, derived across the areas surveyed. The NSW time-series are showing consistent agreement with the IBTS survey indicating that it could with time form the basis for an assessment tuning series for the three main target species. The results will allow industry questions about potential differences in stock dynamics on hard and soft ground to be evaluated, to determine whether substratum type can affect survey estimates of stock abundance, especially as the stock of cod rebuilds under the current management regime, providing a valuable input to the debate on the dynamics of the stocks and survey practices.

Provenance

The Fisheries Science Partnership (FSP) was established between the UK Department for Environment, Food and Rural Affairs (Defra, which provided the funding), the Centre for Environment, Fisheries and Aquaculture Science (Cefas) and the National Federation of Fishermen's Organisations (NFFO) in 2003, and continued with an objective of enabling the fishing industry to demonstrate the results of commercial fishing in a number of priority fishing areas nominated by the NFFO. To do this, fishing vessels are chartered to fish commercially to obtain new data on catch rate and size distribution of target species, and in some cases on bycatch species. Charter of suitable fishing vessels is arranged through an open tendering procedure, and workplans are developed in line with the agreed and commissioned project, between Cefas and the vessel skippers and managers. Cefas deploys seagoing staff to record raw data that are subsequently returned to the laboratory at Lowestoft for input and analysis. Cefas acknowledges the help of the NFFO and skippers during the conduct of these studies. The data and results are the intellectual property of the vessel skippers, Cefas and Defra.

Background

The North Sea whitefish (NSW) survey is designed to provide a time-series of information on commercial vessel catch per unit effort from representative fishing grounds within the North Sea. Each year, data gathered by the survey are supplied to the ICES Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, initially for evaluating comparative catch rates at age, for example against research vessel catches, and if and when the time-series is of sufficient length, to support the estimation of stock trends.

The vessel uses a combination of traditional English fishing gears appropriate to hard and soft ground in order to provide information on comparative catch rates. The tows are distributed over subareas defined to provide information on catch rate, size/age composition and species catch composition from as many different locations as feasible, given time and cost constraints, within the area where the fishery takes place, and not necessarily at constant locations each year. The size of the whole catch is recorded, but detailed measurements are made of the catches of cod, whiting and haddock, and of plaice if resources permit.

Survey design

The survey is designed to cover representative fishing grounds within a large part of the North Sea (53°30'N – 62°N, 0° – 7°E) during June and/or July. Figure 1 shows the selected fishing grounds divided into 10' longitude × 10' latitude rectangles. To obtain as much information as possible from the core fishing grounds, the 10' × 10' rectangles were classified, by the fishing skipper, according to two seabed types during the initial survey; hard ground,

with potentially the better catch rates of cod, where a Whitby Jet type of trawl is used, and soft seabed over which a scraper-type trawl is used. Steaming and fishing time considerations restricted fishing within each ground to nine hard and nine soft tows with the specified gear type.

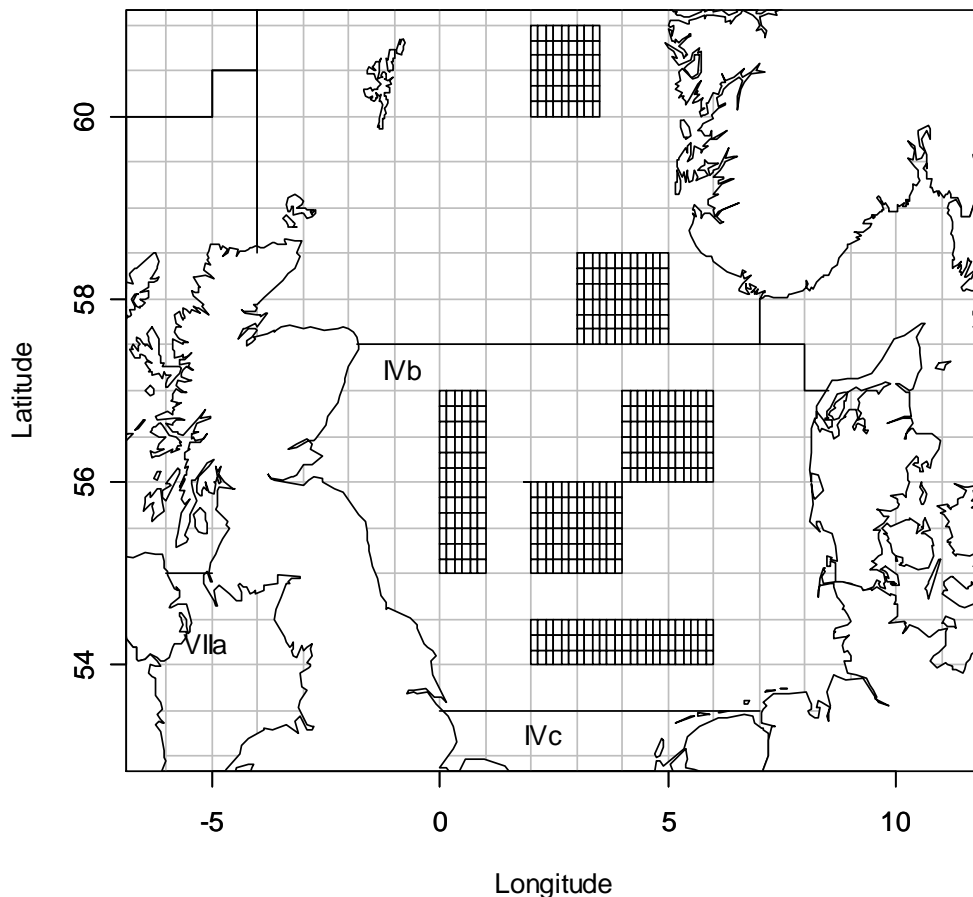


Figure 1. Map of the six representative fishing grounds within which fishing is required, in each year of the survey, on hard and soft substratum.

Real Time Closures

Tow length was specified as 2 h in the design of the survey protocol (Annex C). However, during June and July, a number of Real Time Closed areas (RTC) were specified as part of the Scottish Conservation Credits Scheme for cod, within areas that the NSW survey was required to fish. In order to avoid controversy while operating within the closed areas, but also to maintain the survey objectives, it was agreed in discussion that tow length would be shortened to 1 h with the gear fishing in the appropriate configuration. This precluded the criticism that the survey avoided areas in which cod were abundant. In reality, the areas specified during the survey reopened by the time the vessel reached the areas designated. However, the newly agreed protocol will be maintained in future surveys under the programme.

The 2011 survey

Fishing operations began on 12 June and were completed after three fishing trips on 27 July. The skipper's report from the survey is presented as Annex A. The vessel used for the survey was the *Allegiance*, a trawler operating out of Peterhead and skippered by Danny Normandale. Its grt was 145 t, length overall 18.26 m, and 309 bhp. All fishing operations were recorded and observed by the Cefas observer; a report from the second fishing trip is presented as Annex B.

Each of the specified fishing grounds was visited and a total of 18 tows was completed on hard and soft substratum. Two-hour fishing tows were conducted with each gear type by night and day. Tow direction and speed were specified by the fishing skipper on the basis of experience with the conditions within each ground; tow positions from the 2011 survey are plotted on Figure 2. Tows that resulted in damaged gear or which came fast on the seabed were repeated in the same area.

Length distributions of cod, haddock, whiting, saithe and plaice, and the volume of the catch of all other species, were recorded. Some 200 otoliths were collected from a specified size range of cod, haddock and whiting for age determination at Cefas. The size range of whiting collected in the 2011 survey included many more small fish (from 12 cm) than previously observed in previous years, outside the range of the pre-specified sample regime. Consequently otoliths from the NSW survey were combined with those from the Cefas third quarter RV survey, which was conducted immediately after the FSP survey. The combination of Cefas and FSP survey otoliths provided full coverage of the observed length distributions. As required, at the end of each fishing trip, EU logbook sheets were submitted to the appropriate fisheries agency, annotated to indicate that the catches were not required to count directly against quota.

Following the survey and during collation of the report the fishing skipper remarked that in recent years there has been an abundance of cod in the Fair Isle area and that this might reflect a redistribution or expansion of the stock or a local abundance that is not included within the survey area. Apparently, catches have been good in that area in recent years, which has also been noted by other fishing skippers in the North Sea, so this area might well be worth considering for inclusion if the survey time-series is to be continued.

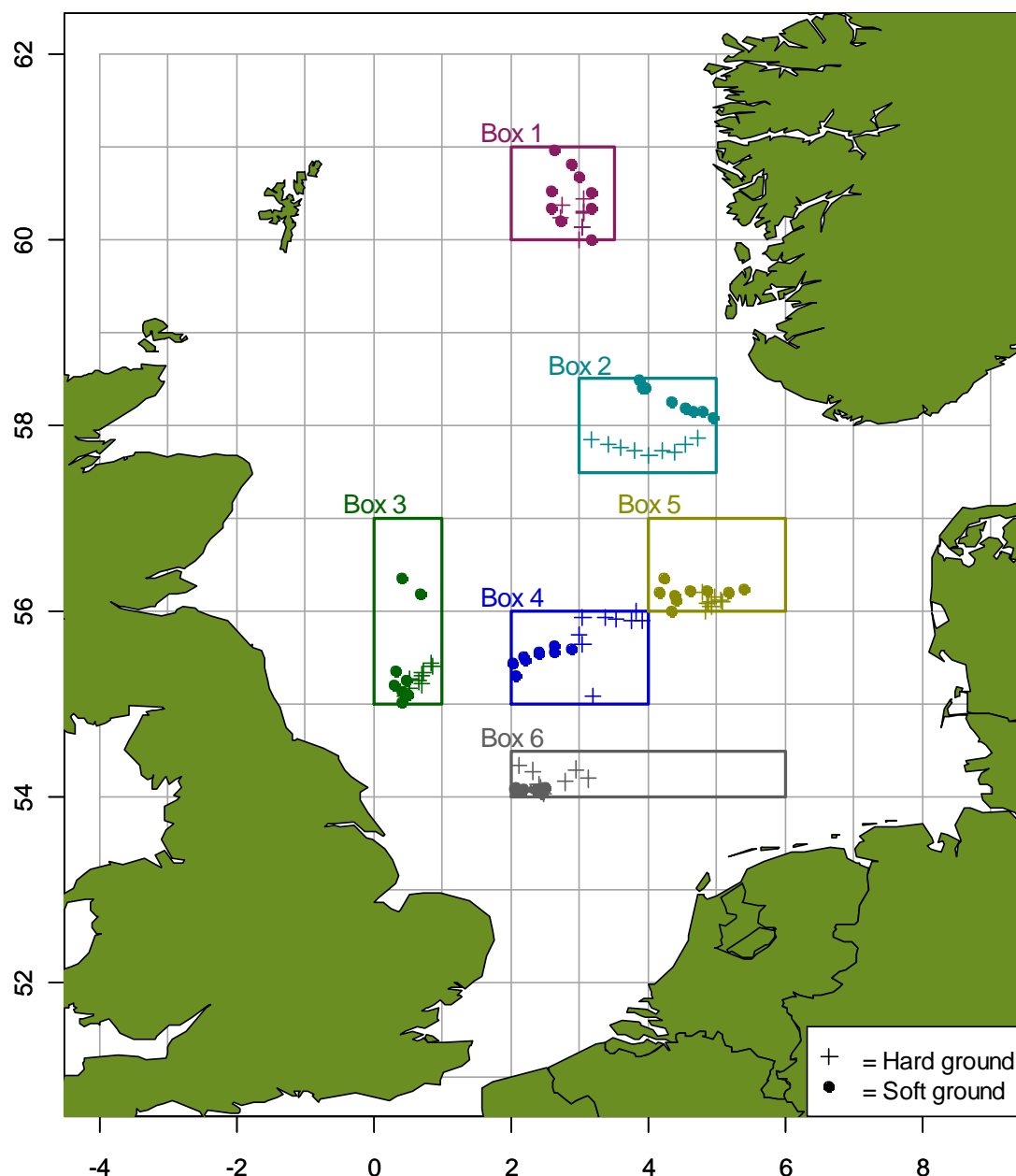


Figure 2. Starting positions of the 2011 North Sea Whitefish (NSW) survey fishing stations.

Results

Table 1 presents the 2011 survey total catch weight by species and category for the main commercial species. Estimates were derived from raised observer length sampling and a length–weight relationship, so they approximate the landings recorded within the vessel logbook. Tables 2–4 present, for each area and substratum, the average catch rates per hour by age of the target species, i.e. cod, haddock and whiting, respectively.

Table 1. North Sea Whitefish survey 2011 total catch weight by species and category for the main commercial species. The estimates are derived from raised observer length sampling and a length–weight relationship, so approximate the landings recorded in the vessel’s logbook.

Species	Weight (kg)			Percentage	
	Total	Retained	Discarded	Retained	Discarded
Cod	5646	5053	594	89%	11%
Haddock	3733	3366	368	90%	10%
Whiting	4080	2463	1616	60%	40%
Saithe	18463	18404	59	100%	0%
Plaice	8779	7012	1767	80%	20%
Hake	1245	1155	90	93%	7%
Lemon sole	2797	974	1823	35%	65%
Ling	1736	1555	181	90%	10%
Monk	1396	1396	0	100%	0%
Witch	156	55	101	35%	65%
Dab	4887	3	4884	0%	100%

Cod

The age of the cod caught ranged from 0 to 8 years with most fish aged 1–3 (Table 2). In 2009, older fish were taken predominantly in the north on both hard and soft substrata and almost exclusively on hard ground in the south; juveniles dominated in the south on the hard ground. In 2010 and 2011, the north/south divide in catch rates was still apparent.

Catch rates of one-year-old fish were higher on soft ground in all areas, but the highest rates differed according to ground in to 2009 and again in 2011. In 2009, cod catch rates were approximately three times higher on hard ground than on soft, but the ratio was much larger in the south. In 2010, catch rates on soft ground were on average three times higher than on hard ground. In 2011 hard ground catch rates were marginally higher than soft. The same gear types were used for each substratum during both survey years, and as yet the reason for the year effects is unknown; it will be investigated further.

In 2009, although there were differences in the absolute catch rates on hard and soft ground, the relative strength of the year classes caught was generally independent of substratum type. In 2010 catch distributions at age on the southern and eastern grounds (4–6) were consistent between substrata (Figure 3). On the northern and western grounds, the distributions had strong differences in relative catch rates at age one, but for ages 2 and older very similar age distributions. In 2011 the age distributions the age distributions were almost identical in all areas (Figure 3).

Figure 4 presents the 2011 North Sea International Bottom Trawl Survey quarter 3 (IBTSq3) average cod catch rates at ages 0–6+ for the areas surrounding and containing the grounds surveyed by the NSW survey. At the youngest ages, comparison between results is complicated by the three different gear types used; the IBTS gear deploys smaller mesh with a liner, and is designed primarily as a gear to catch young fish. Therefore, when compared with the NSW survey, catches of cod aged 0, 1 and possibly 2 would be expected to be higher relative to older fish. It will be a number of years of the current surveys before changes in year-class strength from year to year can be used to make direct comparisons. In 2009, both surveys caught a wider range of ages in the north, with differences in the relative age distributions between surveys. In 2010 and 2011 the distributions at age were similar with only age 1 showing a difference. In the other areas, cod aged 1 and 2 dominated both survey's catch rates in all years. In box 6, to the east of England, the NSW survey has caught a range of fish whereas the IBTS has recorded very low catch rates..

Figure 5a compares the catch rates at age derived for the whole of the North Sea from the IBTSq3 with those from the NSW for 2009 to 2011 (the estimates for each age are plotted relative to the catch rate for age 2 to allow comparison). When derived across all areas, the IBTSq3 survey index has similar coverage of the age range to that of the NSW survey. The NSW survey showed a faster rate of decline in age classes at ages 3–6+ in all years, which may be related to the catchability of the gears, which will be evaluated as the series develops.

Figure 5b compares the indices at age from the two surveys observed for 2009–2011 from the differing ground types. There is a linear relationship when comparing the catch rates of the NSW on hard and soft ground and between the two surveys, indicating good agreement between the two series. The main difference between the NSW survey on hard and soft ground is year effects (Figure 5b top left). In 2009 hard ground catch rates exceeded those on soft ground (points above the line), but this was reversed in 2010 and catch rates are similar in 2011. As yet, there appears to be no fixed effect of ground type, but this will be determined as the series develops and more data are available for the individual ages.

When combined, the NSW catch rates at age are consistent with those from the IBTS survey (Figure 5b top right), the NSW consistently out-fishing the IBTS in all years (points above the line), with a fixed effect across the range of catch rates and ages. The surveys show good agreement in the relative strengths of the cod age classes across all ages and catch rates.

Haddock

The age of haddock caught ranged from 0 to 11 years, with most fish aged 1–5 (Table 3, Figure 6). As expected from the known distribution of the species, most of the catches were recorded in the northern North Sea on grounds 1–4, with very low catch rates in the south from area 6.

Consistent with the previous years, there was a difference between catch rates on hard and soft ground, in the ratio ~2 : 1 in all areas and stronger in the north than the south (Figure 6), the difference in 2010 and 2011 was considerably weaker than that observed in 2009 in which the ratio was 20 : 1 in the north across all ages. As with cod, the difference in catch rates may result from substratum preferences or differences in gear catchability, but at this stage, the cause cannot be distinguished. In 2009 and 2011 the age structure recorded on soft ground was similar to that on hard, In 2010 there were differing distributions at age in the north and east on hard compared with soft ground, especially the catch rates at age 1, which were better on soft ground (similar to those of cod).

Figure 7 presents the preliminary 2011 IBTSq3 survey average haddock catch rates at ages 0–6+ for the areas surrounding and containing the grounds surveyed by the NSW survey. At the youngest ages, the IBTS gear has smaller mesh and better selection for young fish, so catches of age 1 fish are higher relative to older ages. Catch rate distribution at age on the soft ground from the NSW is similar to that of the IBTSq3 for boxes 1 and 2, consistent with previous year's results. As the time-series develops, the dynamics of the individual ages on hard and soft ground can be used to determine whether this is related to a gear dependent catchability or differing dynamics of the stock on the different substrata.

Figure 8a compares the catch rates at age derived for the whole of the North Sea from the IBTSq3 with those from the NSW for 2009 to 2011 (the estimates for each age are plotted relative to the catch rate for age 3 to allow comparison). The figure illustrates the expected difference in gear selectivity at the youngest ages, with the IBTSq3 catching relatively more haddock aged 1 and 2. At older ages, relative to age 3, the correspondence between the IBTS and NSW was good in 2009 and 2011, but variable in 2010, with the IBTS having higher catch rates at ages 4 and 5 relative to age 3.

Figure 8b compares the indices at age from the two surveys observed for 2009–2011 from the differing ground types. There is a linear relationship between the catch rates of the NSW on hard and soft ground (Figure 8b top left). Hard ground has higher catch rates than soft at all ages in all but one year/age, and the anomaly of the very high 2009 hard ground catch rates is clear. The main difference between the NSW survey on hard and soft ground appears to be year effects rather than differences in proportions at age. As yet, there appears to be no fixed effect of ground type, but this will hopefully be determined as the series develops and more data become available for the individual ages. There is a reasonable agreement between the IBTS and NSW surveys (Figure 8b top right) when both ground types are used in calculating the NSW haddock index. The correlation improves when the IBTS results are compared with the NSW hard ground catches compared with the noisy soft ground catches, which may be a gear-related effect.

Whiting

The age of the whiting caught during the survey ranged from 0 to 10 years, with most fish aged 1–6 (Table 4, Figure 9). In 2009 and 2011, catches in the north and west (areas 1–3) had a broad range of ages, whereas those in the south and east were mainly aged 1 and 2. In 2010 there was a broad range and similar distribution of ages in the catches from all areas.

In 2009 substantially higher catch rates were recorded in the east and north on hard ground, with comparable rates in the south and west. In 2010 and 2011, the differences between substrata were less noticeable and more variable. As yet no clear pattern is emerging. In 2011 in all areas, catch rates were dominated by ages 2–4, in agreement with the previous year's high catch rates at ages 1–3. The survey appears to be tracking year classes consistently from year to year, as required for assessment purposes.

Figure 10 presents the 2011 IBTSq3 survey average whiting catch rates of ages 0–6+ for the areas surrounding and containing the grounds surveyed by the NSW survey. At the youngest ages, the IBTS gear has smaller mesh and better selection for young fish, so catches of ages 0 and 1 are high relative to those of older ages. For the older ages, the distributions were similar between the IBTSq3 areas and the NSW.

Figure 11a compares the catch rates at age derived for the whole of the North Sea from the IBTSq3 with those from the NSW for 2009–2011 (the estimates for each age are plotted relative to the catch rate for age 2 to allow comparison). The figure illustrates the expected difference in gear selectivity at the youngest ages, with the IBTS catching relatively more whiting aged 0. At the other ages, a comparison of the IBTS and NSW results shows that, relative to age 2, the IBTS catches a greater proportion of younger fish and fewer older fish than the NSW.

Figure 11b compares the indices at age from the two surveys observed for 2009–2011 from the differing ground types. There is a linear relationship between the catch rates of the NSW on hard and soft ground (Figure 11b top left). Hard ground had substantially better catch rates than soft at all ages in 2009, but in 2010 and 2011, soft ground catch rates were better for the majority of ages. The difference between the NSW survey on hard and soft ground appears to be year effects in the survey rather than differences behaviour of individual ages. As yet, there appears to be no fixed effect of ground type, but this will hopefully be determined as the series develops and more data become available. There is noisy agreement between the IBTS and NSW surveys (Figure 11b top right) when both ground types are used in calculating the NSW whiting index. The correlation improves when the IBTS results are compared with the NSW hard ground catches compared with the noisy soft ground catches that may be a gear-related effect. This is a similar result to the haddock catch rates.

Plaice and saithe

The frequency distributions at length of plaice and saithe catches by area are shown in Figures 12 and 13, respectively. In all three years, as would be expected from the known distribution of the stocks, plaice were caught primarily in the south, in areas 4–6. In 2010 substantially better catch rates were recorded in areas 2 and 3 than the previous year (Figure 12), by a factor of around 10. The higher catch rates were maintained in area 3 in 2011, but not in area 2. For saithe (Figure 13), catch rates were notable only in the north in areas 1 and 2 (only area 2 in 2009 and area 1 in 2010).

The length distributions for saithe caught by the two gear types are broadly similar on hard and soft ground. For plaice, the differences in distributions at length between hard and soft ground noted in 2009 were not as apparent in 2010 or 2011. Owing to the limited sampling time available, plaice and saithe otoliths were not taken during the survey. As the time-series develops, however, age/length keys will be sought from other surveys conducted within the North Sea in the third quarter, in order to evaluate the potential of the data for use in the assessment process.

Discussion and conclusions

As for the 2009 and 2010 surveys, the 2011 results and the combined analysis of all three surveys are encouraging. The NSW survey observes a good range of ages for all target species in all areas surveyed. The variations on hard and soft ground and from north to south in the North Sea, which differ between years, raise issues that will allow testing of a number of questions related to substratum, gear and spatial distribution as the time-series develops. As yet, three years is too short a series to establish patterns given that in one year soft ground outfishes hard and that the situation was reversed a year later. It has also taken time for the skipper to become familiar with the survey and to utilize his vessel optimally towards the objectives, so that situation currently cannot be ruled out as a determinant without more years of data.

Throughout the survey area in 2009, catch rates of the target gadoid species were better on hard ground than on soft. In 2010 and 2011, the difference was less marked, and for cod and whiting in some areas reversed. Although the difference in catch rates may result from substratum preferences or differences in gear catchability, changes from one year to the next may be related to spatial differences in the fishing pattern and the distribution of fish. Overall in 2010 and 2011, the age structure recorded on soft ground was similar to that on hard ground in most of the areas surveyed.

When compared at an overall North Sea scale, the relative indices at age of cod, haddock and whiting abundance at age from the NSW and IBTSq3 surveys are similar. In all years, however, catches of older fish were more frequent and showed less noise in the NSW data than in the IBTSq3. As noted during the first two annual surveys, differences in the relative catch

rates of older whiting between the two surveys will require analysis as the time-series develops.

The results demonstrate the value in developing a time-series for gadoids based on a commercial vessel, derived across the areas surveyed. The NSW time-series are showing consistent agreement with the IBTS survey, indicating that they could with time form the basis for an assessment tuning series for the three main target species. The results will allow differences in stock dynamics on hard and soft ground to be examined in detail and the determination of whether substratum type can affect survey estimates of stock abundance, especially as the stock of cod rebuilds under the current management regime, providing valuable input to the debate on the dynamics of the stocks and survey practices.

Acknowledgements

Skipper Danny Normandale, boat owner Fred Normandale and the crew of the Allegiance are thanked for their help, advice and willing cooperation throughout this project. All Cefas staff involved in data and otolith processing, and in project administration and quality assurance, are thanked for their valuable contribution to the success of this project, which was funded by Defra. Thanks are also due to Andy Payne for reviewing the report.

Table 2. North Sea cod catch numbers per hour at age recorded from nine hard and soft ground tows in each of the fishing areas surveyed by the North Sea Whitefish survey in June 2011.

Cod		Average number caught at age per hour													
Area	Ground	0	1	2	3	4	5	6	7	8	9	10	11	12	Total
1	Hard	0.00	0.98	34.66	6.49	1.95	1.05	0.50	0.24	0.00	0.00	0.00	0.00	0.00	45.88
1	Soft	0.00	2.58	14.04	1.51	0.37	0.14	0.04	0.03	0.00	0.00	0.00	0.00	0.00	18.71
2	Hard	0.00	1.43	4.83	0.51	0.17	0.08	0.10	0.04	0.06	0.00	0.00	0.00	0.00	7.22
2	Soft	0.00	3.92	9.60	1.08	0.34	0.16	0.05	0.04	0.00	0.00	0.00	0.00	0.00	15.20
3	Hard	0.00	7.50	22.33	0.95	0.11	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	30.92
3	Soft	0.00	5.23	17.42	1.08	0.01	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.78
4	Hard	0.00	1.98	2.74	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.78
4	Soft	0.00	4.22	0.99	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.25
5	Hard	0.00	0.84	2.17	0.09	0.03	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	3.17
5	Soft	0.00	6.09	10.51	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.62
6	Hard	0.00	18.92	39.98	3.82	0.40	0.10	0.07	0.00	0.00	0.00	0.00	0.00	0.00	63.30
6	Soft	0.00	11.50	38.17	4.73	0.67	0.23	0.15	0.06	0.00	0.00	0.00	0.00	0.00	55.51

Mean	Hard	0.00	5.28	17.78	1.99	0.44	0.21	0.12	0.05	0.01	0.00	0.00	0.00	0.00
Mean	Soft	0.00	5.59	15.12	1.41	0.23	0.10	0.04	0.02	0.00	0.00	0.00	0.00	0.00
	Ratio		0.94	1.18	1.41	1.91	2.19	3.04	2.03					
Hard	Cum %	0%	20%	89%	97%	99%	99%	100%	100%	100%				
Soft	Cum %	0%	25%	92%	98%	99%	100%	100%	100%	100%				

Table 4. North Sea whiting catch numbers per hour at age recorded from nine hard and soft ground tows in each of the fishing areas surveyed by the North Sea Whitefish survey in June 2011.

Whiting		Average number caught at age per hour													
Area	Ground	0	1	2	3	4	5	6	7	8	9	10	11	12+	Total
1	Hard	0.00	0.00	0.40	1.03	2.47	0.95	1.32	0.96	0.00	0.12	0.02	0.00	0.00	7.28
1	Soft	0.00	0.00	2.70	2.42	2.84	0.44	0.98	0.53	0.00	0.06	0.08	0.00	0.00	10.04
2	Hard	0.00	0.40	24.30	12.87	10.26	0.75	1.09	1.12	0.00	0.01	0.29	0.00	0.00	51.11
2	Soft	0.00	0.00	1.42	0.72	0.46	0.06	0.06	0.03	0.00	0.01	0.01	0.00	0.00	2.76
3	Hard	0.02	0.64	31.28	18.20	20.34	1.01	2.12	3.32	0.00	0.11	0.54	0.00	0.00	77.58
3	Soft	0.14	15.14	162.20	87.65	77.21	5.68	5.04	10.05	0.00	0.02	1.49	0.00	0.00	364.61
4	Hard	0.08	0.51	2.28	0.63	0.25	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	3.78
4	Soft	0.19	3.36	7.29	0.50	0.25	0.03	0.00	0.02	0.00	0.00	0.01	0.00	0.00	11.64
5	Hard	0.00	0.18	0.62	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83
5	Soft	0.13	2.09	8.86	5.02	1.55	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.22
6	Hard	17.50	148.44	84.24	9.07	2.19	0.27	0.13	0.13	0.00	0.01	0.01	0.00	0.00	261.98
6	Soft	12.98	99.66	77.27	8.92	1.99	0.05	0.01	0.17	0.00	0.00	0.01	0.00	0.00	201.06
Mean	Hard	2.93	25.03	23.85	6.97	5.92	0.50	0.78	0.92	0.00	0.04	0.14	0.00	0.00	
Mean	Soft	2.24	20.04	43.29	17.54	14.05	1.14	1.02	1.80	0.00	0.01	0.26	0.00	0.00	
	Ratio	1.31	1.25	0.55	0.40	0.42	0.44	0.77	0.51		2.88	0.55			
Hard	Cum %	4%	42%	77%	88%	96%	97%	98%	100%	100%	100%	100%	100%	100%	
Soft	Cum %	2%	22%	65%	82%	96%	97%	98%	100%	100%	100%	100%	100%	100%	

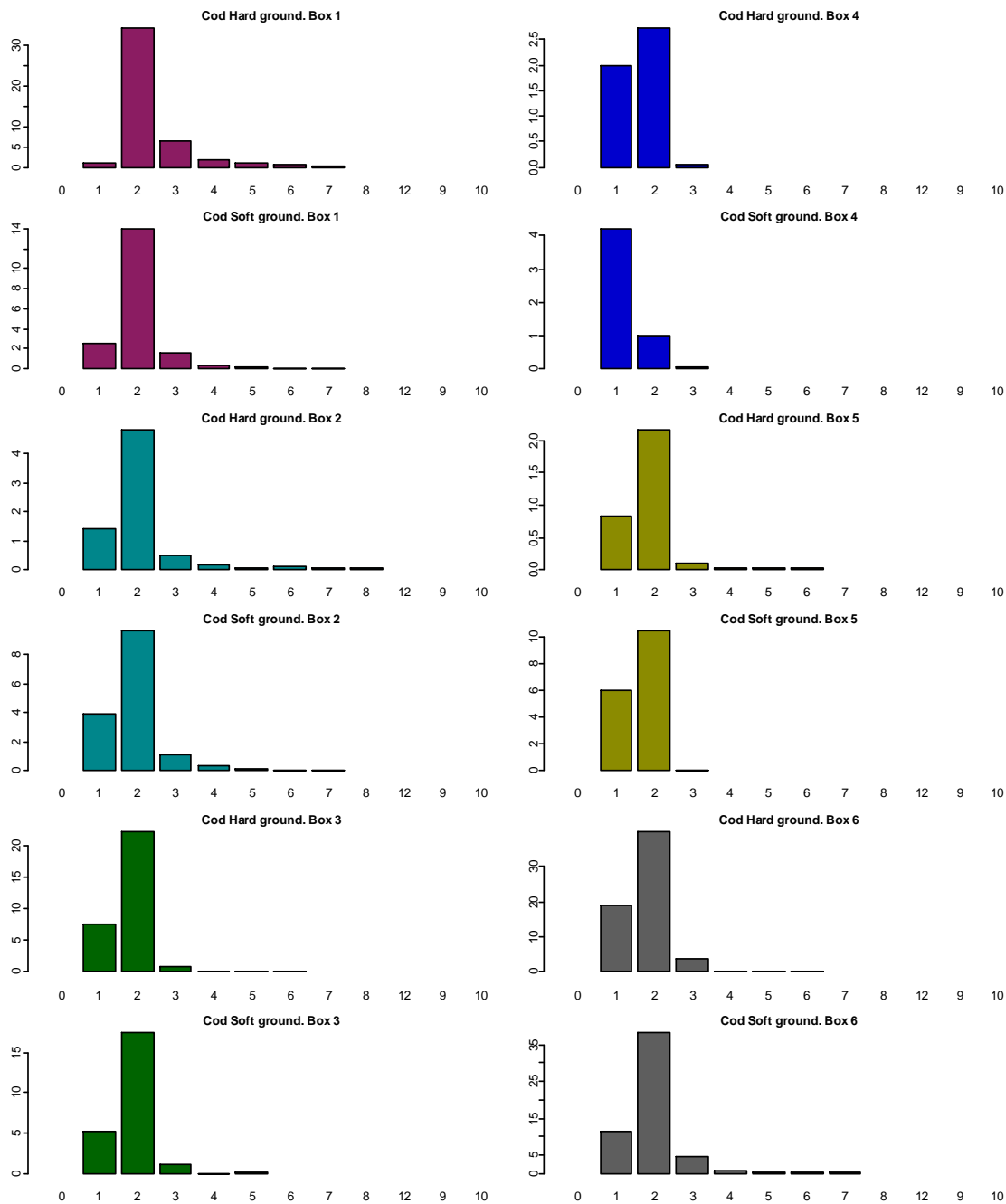


Figure 3. North Sea cod catch numbers per hour at age recorded from nine hard and soft ground tows in each of the fishing areas surveyed by the North Sea Whitefish survey in June 2011.

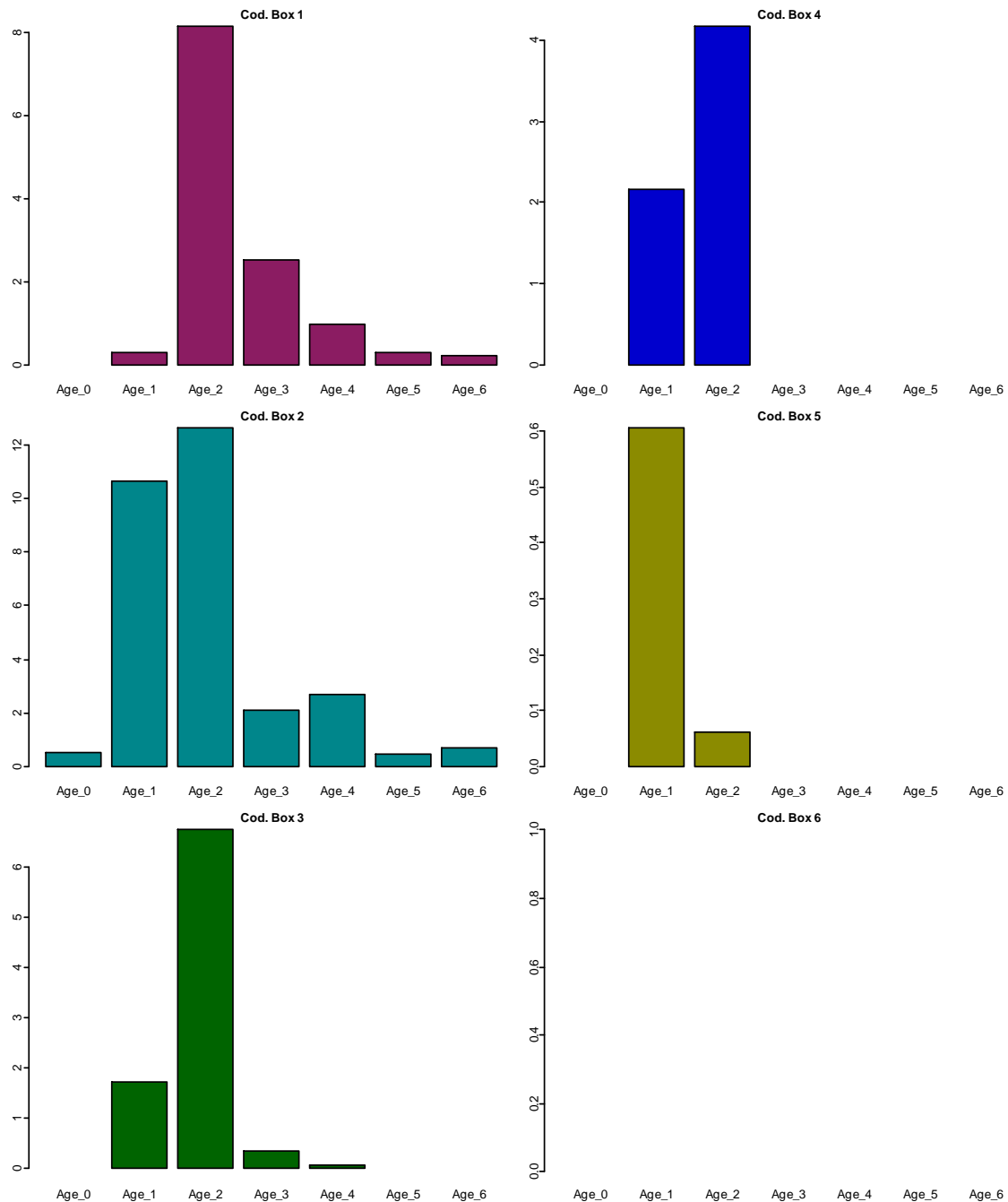


Figure 4. North Sea cod catch numbers per hour at age recorded by the ICES IBTS quarter three survey tows surrounding and within each of the fishing areas surveyed by the North Sea Whitefish survey in June 2011 (age 6 is a plus group). The bottom right figure results from very low catch rates.

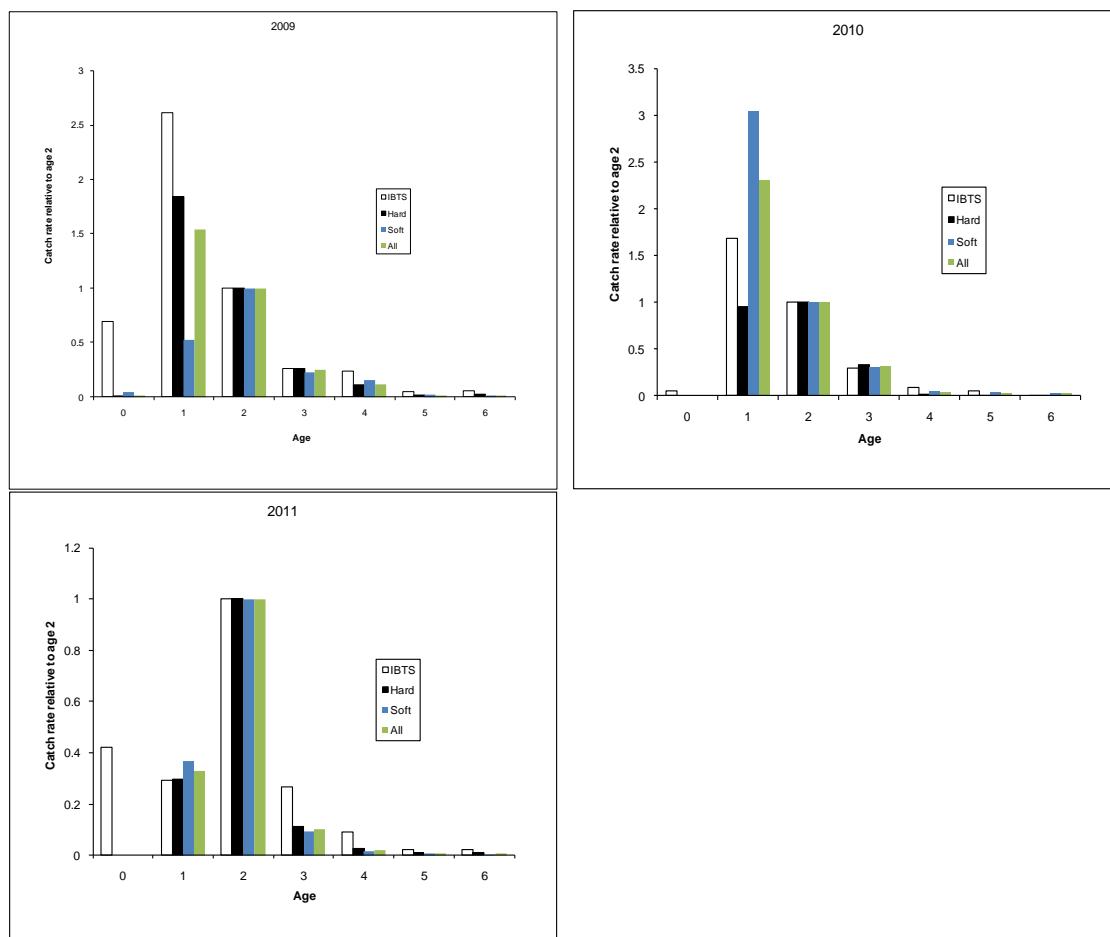


Figure 5a. North Sea cod comparison of the relative (to age 2) catch numbers per hour at age recorded in 2009, 2010 and 2011 by the FSP NSW survey and the ICES IBTS quarter three survey across the whole of the North Sea.

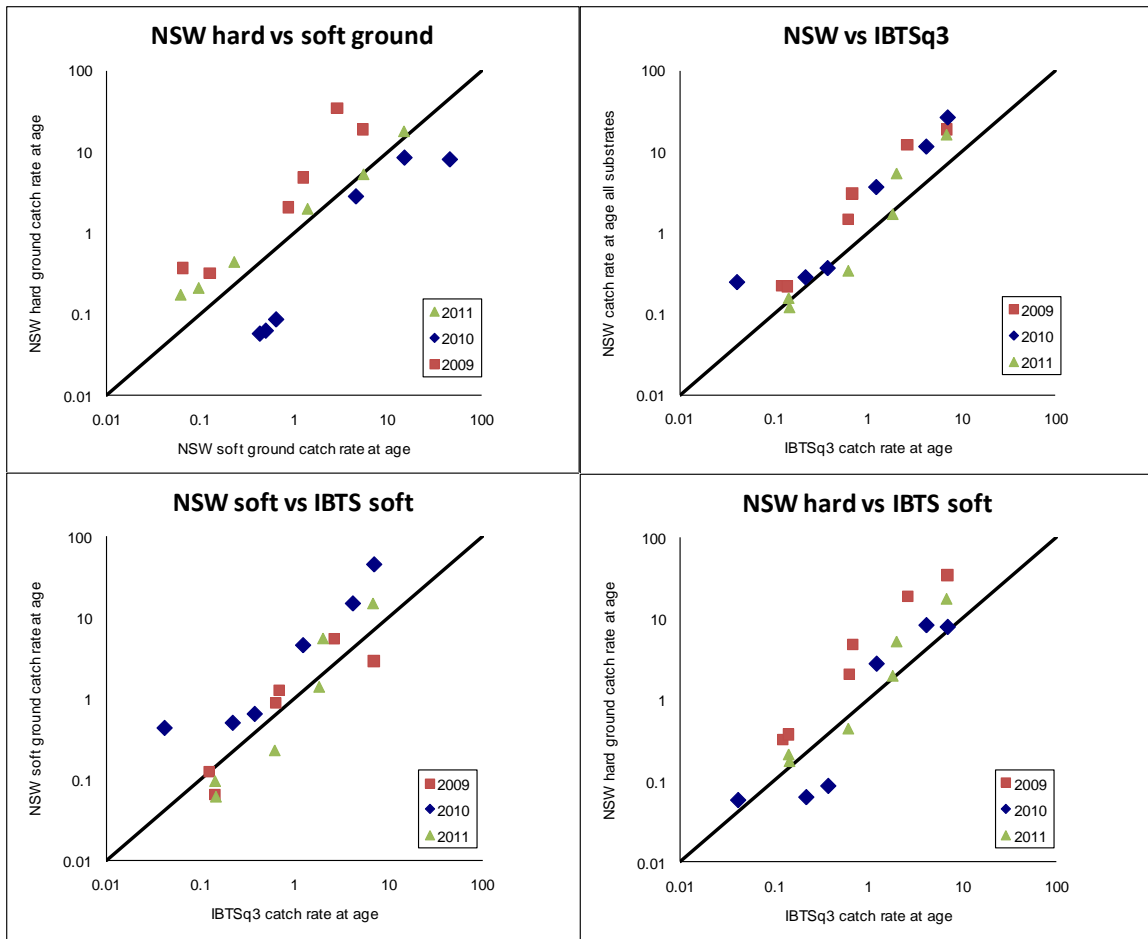


Figure 5b. North Sea cod comparison of the catch numbers per hour at age (log scale) recorded in 2009, 2010 and 2011 by the FSP NSW survey and the ICES IBTS quarter three survey across the whole of the North Sea.

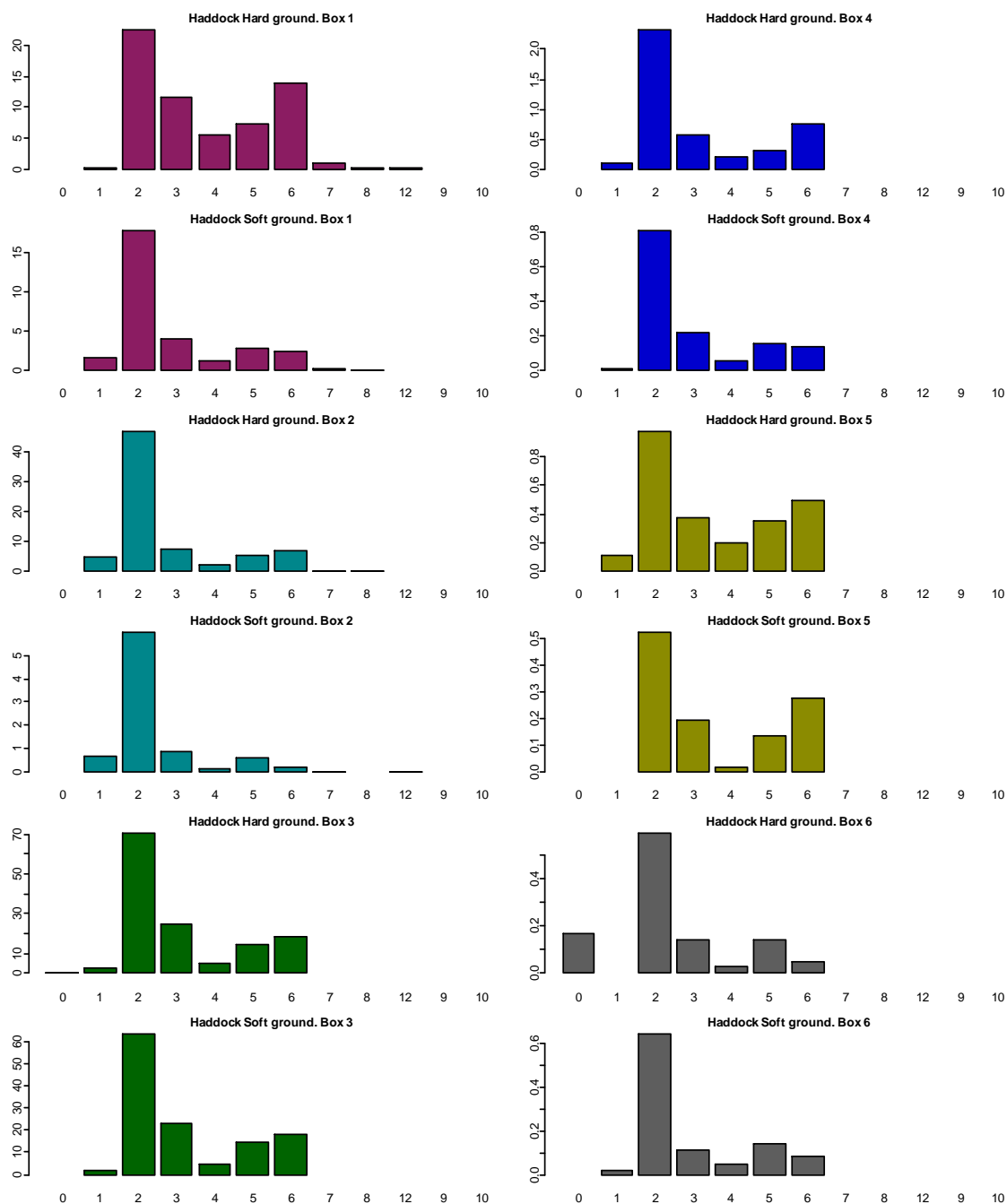


Figure 6. North Sea haddock catch numbers per hour at age recorded from nine hard and soft ground tows in each of the fishing areas surveyed by the North Sea Whitefish survey in June 2011.

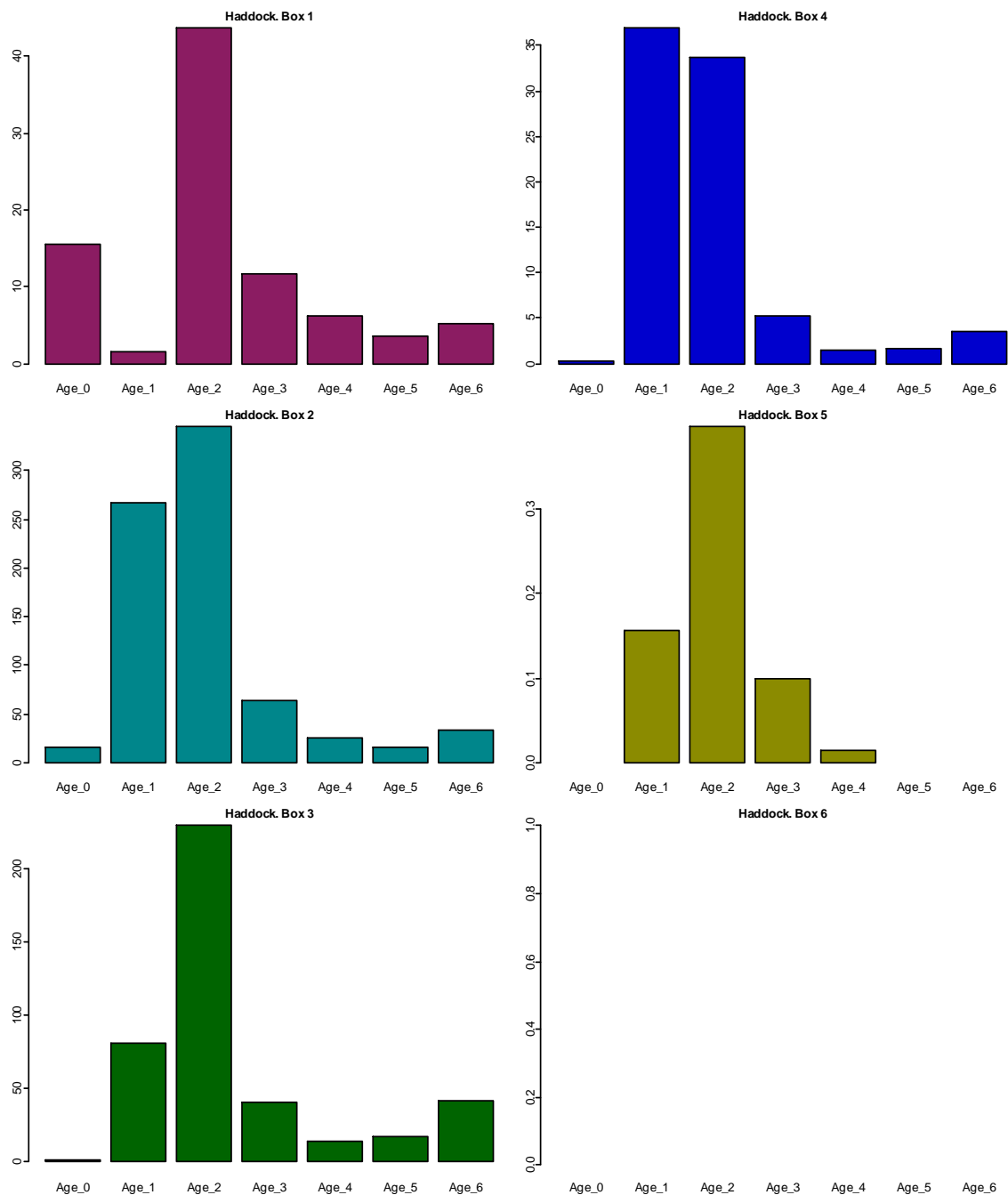


Figure 7. North Sea haddock catch numbers per hour at age recorded by the ICES IBTS quarter three survey tows surrounding and within each of the fishing areas surveyed by the North Sea Whitefish survey in June 2011 (age 6 is a plus group). The bottom right figure results from very low catch rates.

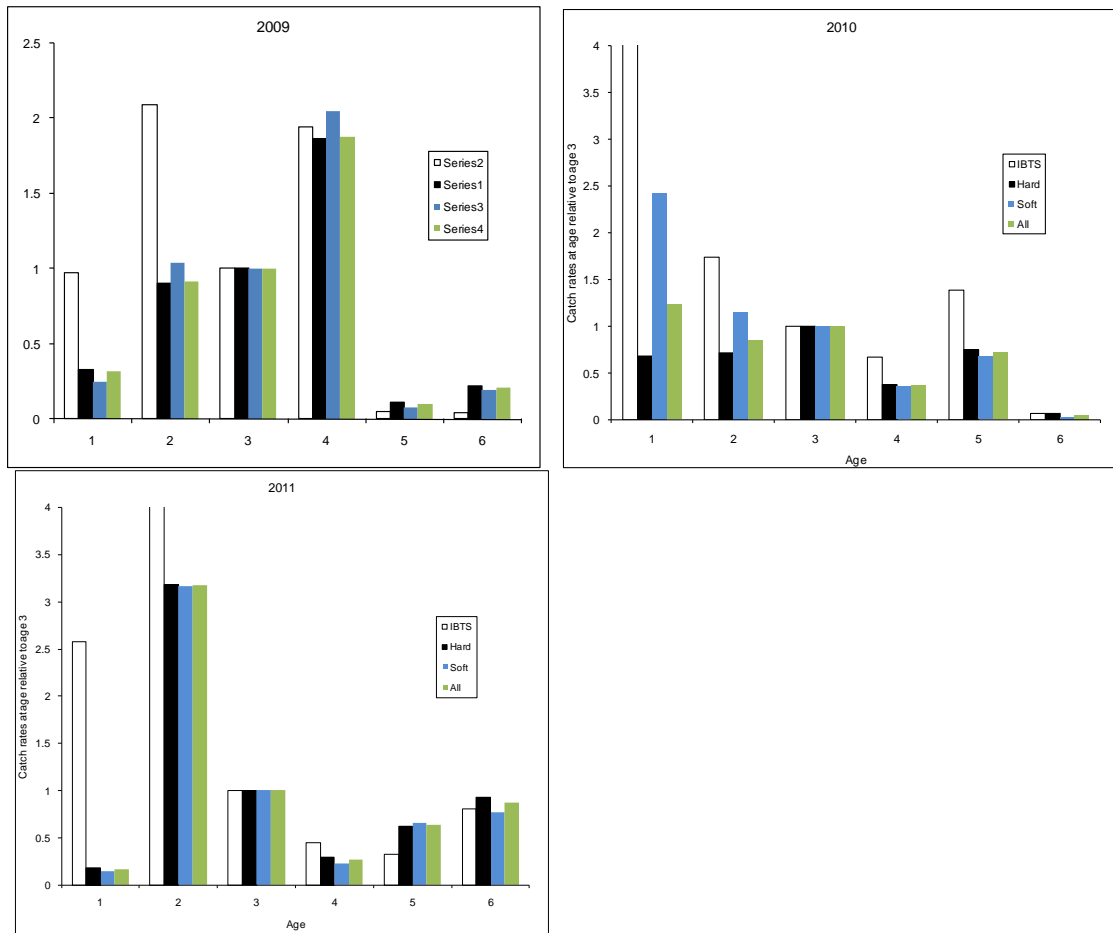


Figure 8a. North Sea haddock comparison of the relative (to age 3) catch numbers per hour at age in 2009, 2010 and 2011 recorded by the FSP NSW survey and the ICES IBTS quarter three survey across the whole of the North Sea.

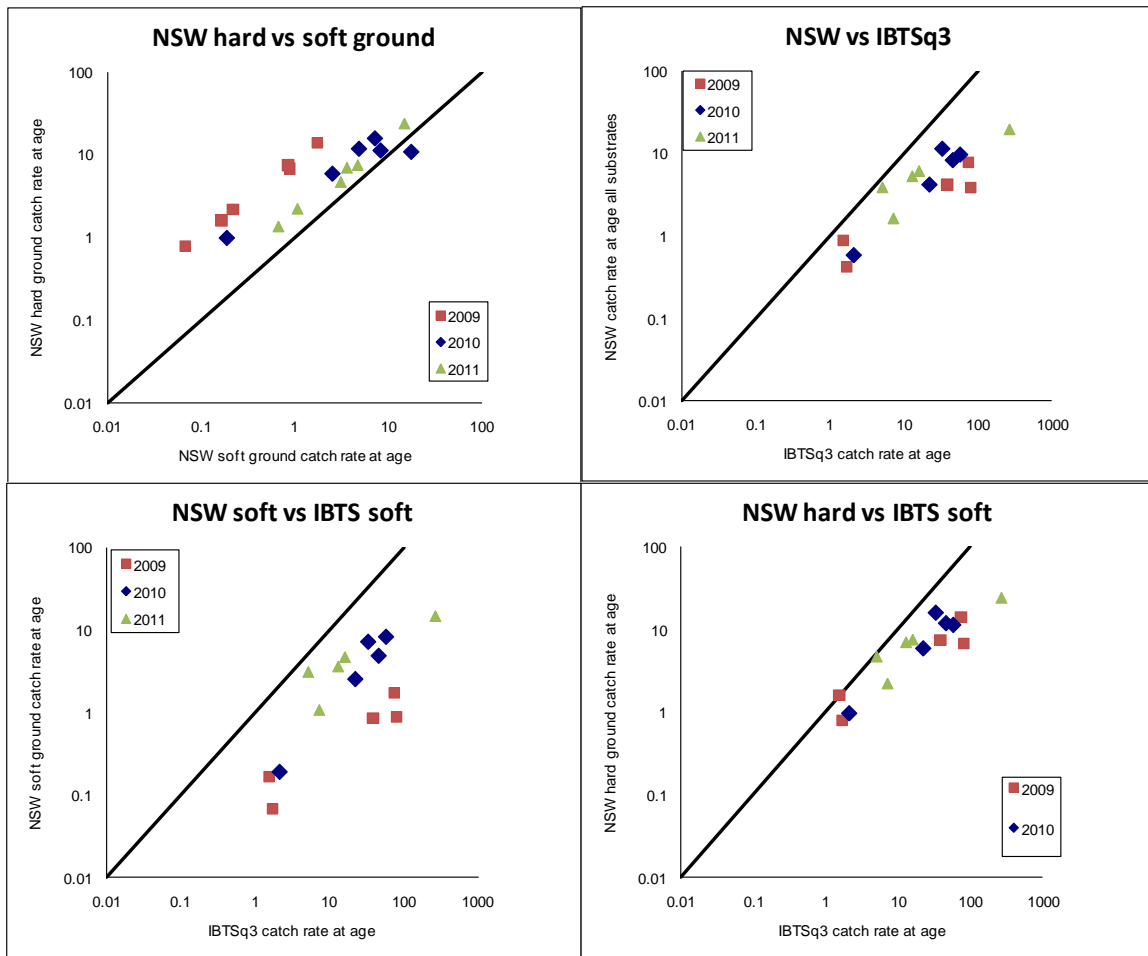


Figure 8b. North Sea haddock comparison of the catch numbers per hour at age (log scale) in 2009, 2010 and 2011 recorded by the FSP NSW survey and the ICES IBTS quarter three survey across the whole of the North Sea.

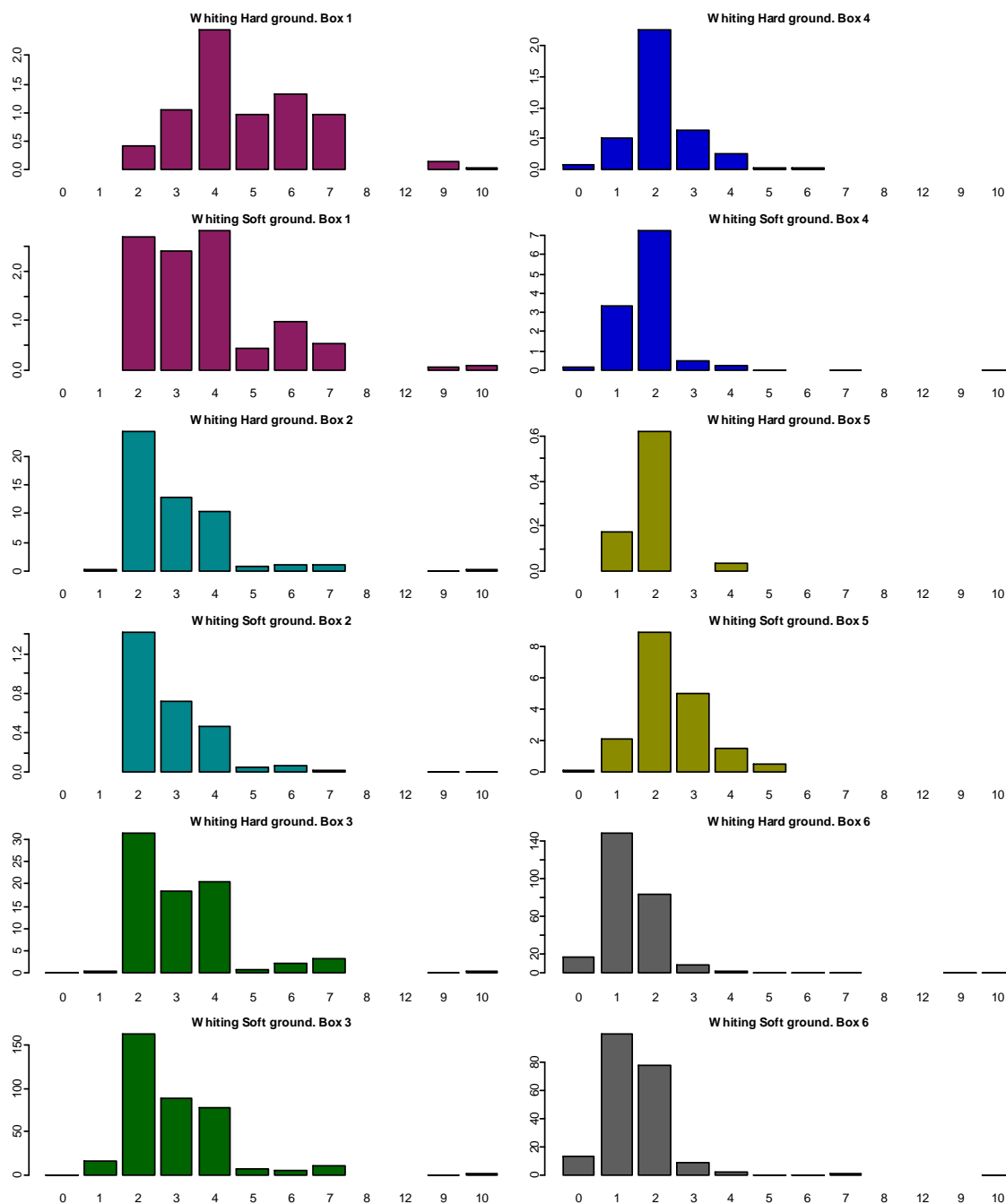


Figure 9. North Sea whiting catch numbers per hour at age recorded from nine hard and soft ground tows in each of the fishing areas surveyed by the North Sea Whitefish survey in June 2011.

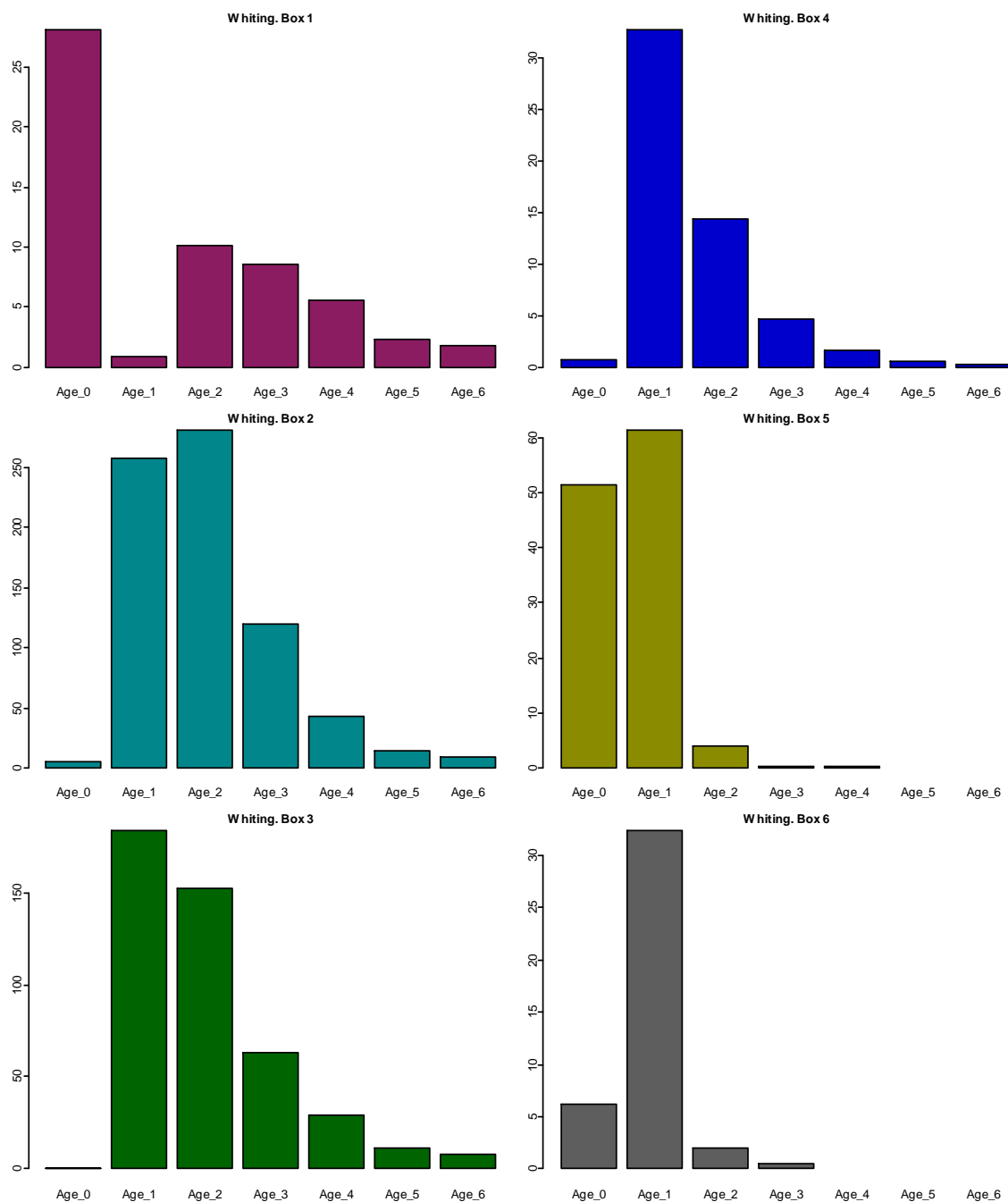


Figure 10. North Sea whiting catch numbers per hour at age recorded by the ICES IBTS quarter three survey tows surrounding and within each of the fishing areas surveyed by the North Sea Whitefish survey in June 2011 (age 6 is a plus group).

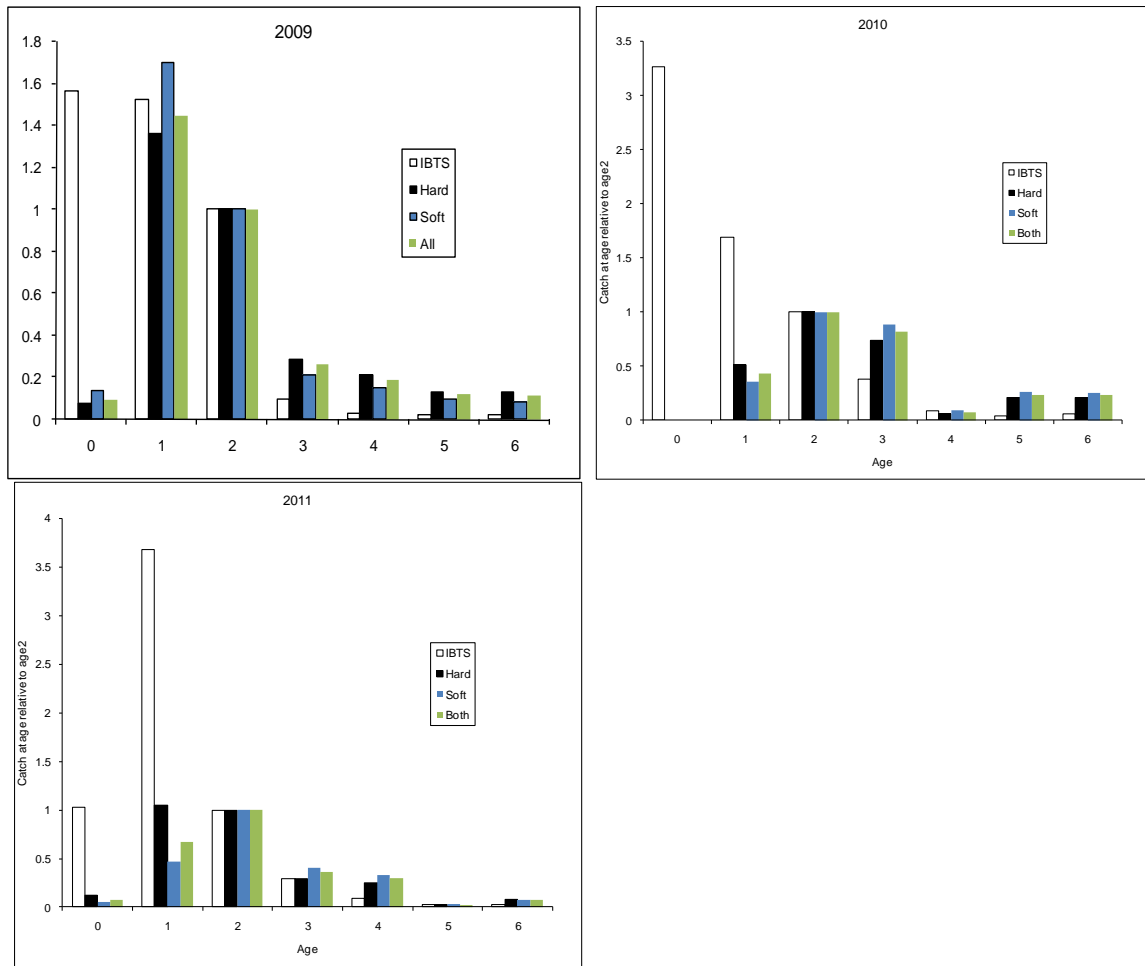


Figure 11a. North Sea whiting comparison of the relative (to age 2) catch numbers per hour at age recorded in 2009, 2010 and 2011 by the FSP NSW survey and the ICES IBTS quarter three survey across the whole of the North Sea.

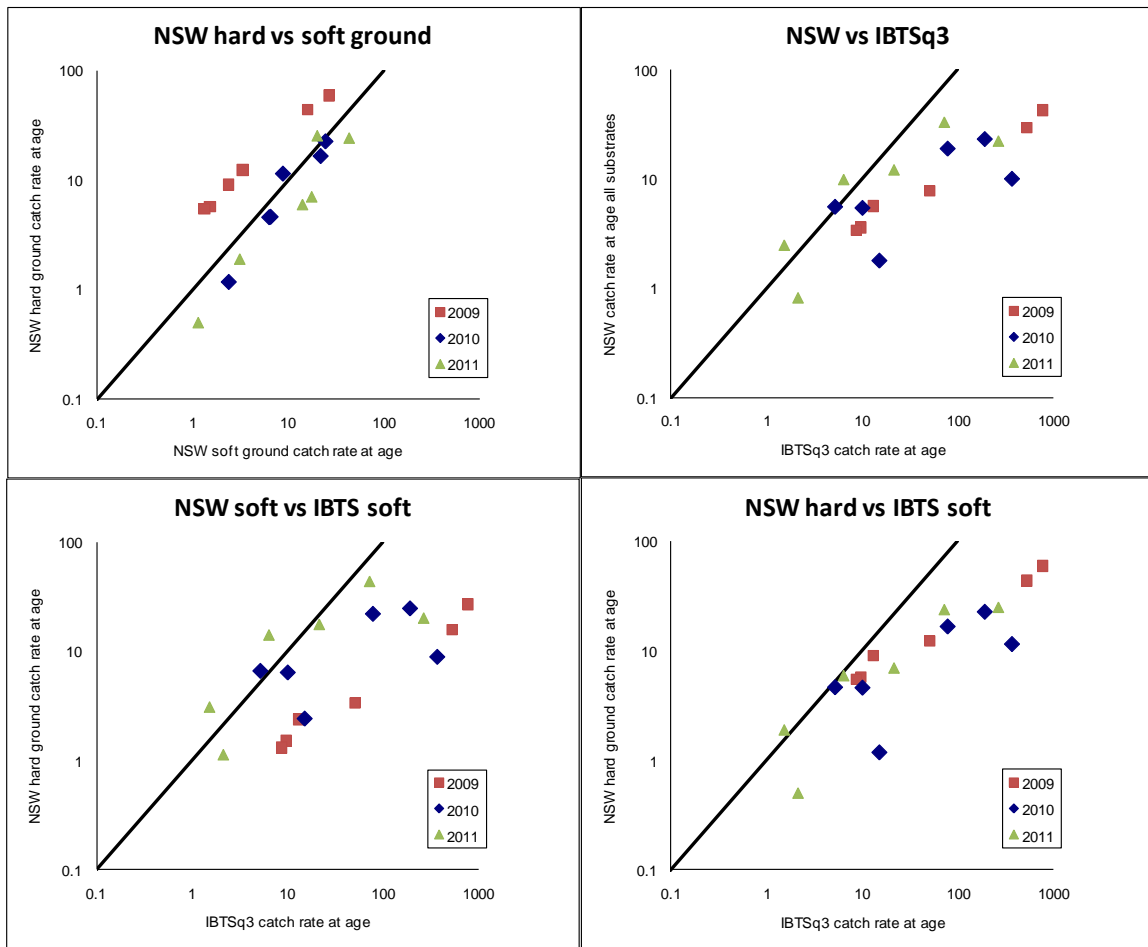


Figure 11b. North Sea whiting comparison of the catch numbers per hour at age (log scale) recorded in 2009, 2010 and 2011 by the FSP NSW survey and the ICES IBTS quarter three survey across the whole of the North Sea.

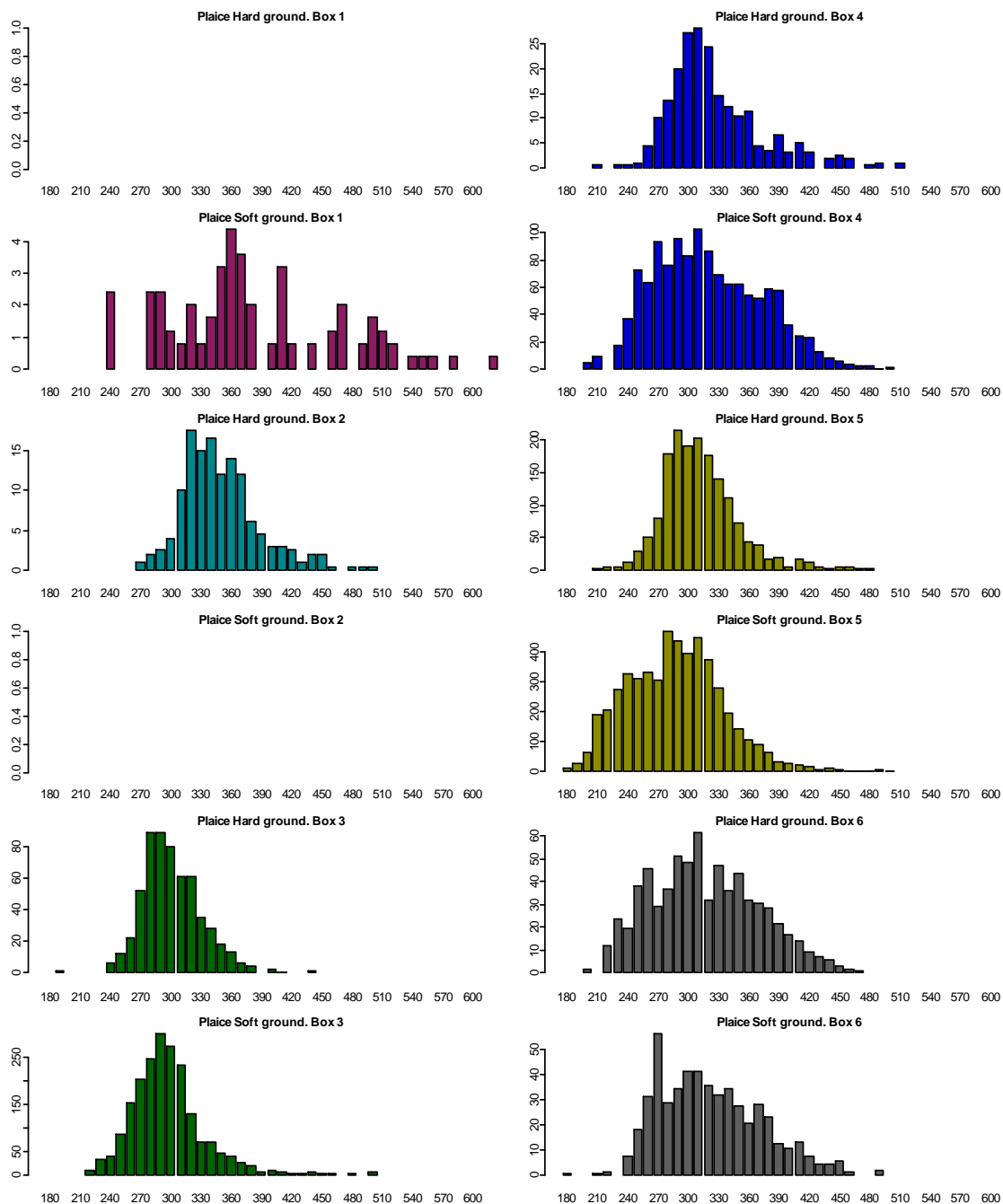


Figure 12. North Sea plaice catch numbers per hour at length recorded from nine hard and soft ground tows in each of the fishing areas surveyed by the North Sea Whitefish survey in June and July 2011

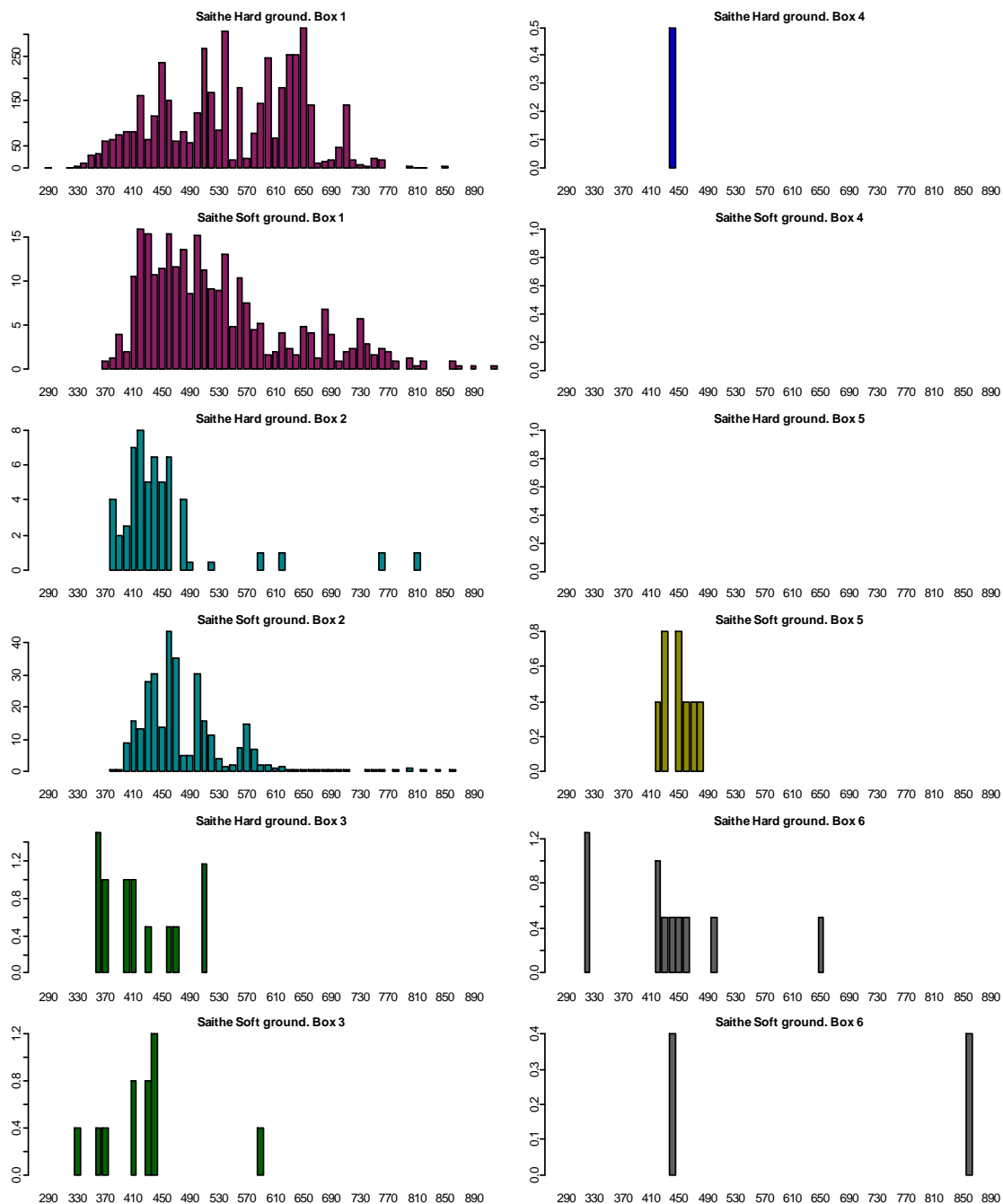


Figure 13. North Sea saithe catch numbers per hour at length recorded from nine hard and soft ground tows in each of the fishing areas surveyed by the North Sea Whitefish survey in June and July 2011

Annex A North Sea whitefish survey 2010 skippers report.

Allegiance SH 90 CEFAS North Sea survey, June/July 2011.

Danny Normandale

All scraper tows are 2.5 hours, hopper tows are 2 hours duration.

Allegiance SH 90 North Sea Cod Survey 2011

All hopper net tows are 2 hours. Scraper net tows are of 2 hours 30 minutes.

We sailed from Peterhead on Saturday 11th June. The weather was fine, wind North-east 1-2 with no swell. We steamed off 170 miles to start the survey in Area 2 while the tides began to lift. Last years survey showed that when the tides were slack the fishing wasn't very good in Area 1. The fishing in Area 2 has been the same every year, regardless of tidal strength.

Area 2

We arrived on station at 0900 and commenced fishing with the hopper net. The first tow was very poor and that set the stage for the rest of the day. We did 5 tows for only 8 boxes to send to the fish room.

The highlight of the day was when we were boarded by the Norwegian coastguard vessel, Aalusund. They didn't know about the survey, but were content for us to continue when they'd made enquires.

The following day we continued working and had another 4 hauls with the hopper net. This brought the hopper net tows to an end for this area. These were all very poor, only producing 3-4 boxes of bulk each haul.

We steamed 10 miles North-east to the deep water to start the scraper net tows and managed to get 2 tows in before finishing for the evening. These gave more bulk in the net, but still very little to go down to the fish room. The total for the 6 hauls was 20 boxes.

We lay overnight giving the observer a chance to sleep then started again at 0400 next day. We shot the scraper net in 105 fathoms and towed North-west for the following 5 tows, which produced 22 boxes for the day. We only had a short sleep that evening, as we only had 2 tows left to do the following day before steaming 100 miles to the next area. These final tows in Area 2 produced good fishing with 30 boxes filled. The fishing from Area 2 filled 81 boxes in the fish room. We took the net aboard, steaming North for 12 hours to start the fishing in Area 1.

Area 1

We arrived in Area 1 that same evening and shot away the scraper net, catching 8-9 boxes of bulk, which gave 6 boxes for the fish room. We then lay overnight.

We started the following day with the hopper net working a favourite piece of ground that always produces good results. This lived up to expectations when the codends came up at the same time as the trawl doors, so I knew there was a large amount of fish in the net. We filled the receiving hopper with fish. This holds 90 boxes and we still had fish over the side. We had to lay and clear this fish before taking more onboard. We did this 3 times before the net was empty.

This was a good days fishing, producing 263 boxes in the fish room from 1 haul. We finished clearing the deck and all had a night in bed.

We started the following day in the same area, catching 43 boxes then 45 boxes, by which time we had run out of ice, so we made our way into Lerwick to land our catch. We landed 440 boxes, most of which was caught in 3 hauls in Area 1.

We arrived in to Lerwick at 0900 Saturday morning and landed our catch on to a lorry in the afternoon, sending it to Peterhead fish market. We had the night in then sailed at 1300 hours on Sunday, steaming off North-east for 120 miles to the Norwegian trench. We did 5 tows that day in the deep water with the scraper net, all of which produced 10-12 boxes of bulk each. This filled 40 boxes in the fish room. We took the net aboard and lay overnight.

We did 4 tows on the hard ground with the hopper net, all of which gave 20 boxes of bulk. This produced 75 boxes of saveable, bonny fish for the day. We stopped fishing at around 1800 hours so everyone had a chance to sleep. We started the next day bright and early, shooting the scraper net on a shallow bank in 45 fathoms of water. We had 3 tows, which completed the scraper net hauls in Area 1, catching 20 boxes of good quality fish. We then steamed 3 miles east to the hard ground to shoot the hopper net away. This was also in shallow water around 50 fathoms. We caught 43 boxes from the remaining 2 tows with the hopper net so we took the net aboard, steaming 211 mile to catch Friday's market in Peterhead. We had caught 178 boxes from our second trip to complete Area 1.

Area 5

We sailed from Peterhead at midday on Sunday 26th June. The weather was fine with a slight swell. We had a 200-mile steam to where we intended to start this area. We arrived on station on Monday evening and shot the hopper net away at 2015 hours. The first haul contained 4 boxes of bulk and so did the second, giving 3 boxes of plaice below. We stopped fishing for the night.

We shot again the following morning in roughly the same area, at the 'Coffee Soil'. We had 7 hauls with the hopper net, completing that area by the end of the day. Each of these gave around 4-5 boxes of bulk, filling 18 boxes of plaice.

We steamed 25 miles east during the night then started fishing at 0630 next morning. We towed West all day, getting 5 hauls in with the scraper net, taking the last haul aboard at 2300 hours. Each of these tows produced 25-30 boxes of bulk in the cod end and from these we filled 40 boxes with plaice.

Next night we steamed 15 miles North so we could tow South for the remaining 4 scraper hauls. Each of these hauls produced good fishing with 20-25 boxes of bulk, giving 37 boxes to go below. This completed Area 5, so we dodged across to Area 4 then lay for the night.

Area 4

The weather had freshened a little overnight to about North-west 5, so we shot the hopper net, as there's never much to catch in this area. We did 7 hauls in Area 4 during the day, putting only 3 boxes in the fish room. Apart from the 1st haul where we caught around 3-4 boxes of bulk, the remaining hauls resulted in less than a box each go. The fishing was so poor that by the time the net was down the deck was clear and the observer was in the galley drinking coffee, complaining that he was tired.

The following day we again started with the hopper net. The first haul of the day produced 1 box of bulk and the 2nd haul the same, but by 1000 hrs the hopper net tows in Area 4 were completed.

We started with the scraper net tows with a little more success, catching 8 boxes our first go then continued to take similar hauls each go after that. The last haul of the day was the best, as the swell had begun to fall away by then. This produced 10 boxes for the fish-room. There were 5 tows remaining to do the following day.

We shot the scraper net away and started the day with 6 boxes, then towed more to the North-west into deeper water to see if the fishing would improve, but the next 2 hauls proved no better. We finally towed south up onto the 'Dogger Bank' but the results were much the same. We ended the day with 24 boxes of fish below completing Area 4. We only had 45 miles to steam to Area 3 and set off about 1900hrs dodging slowly West, giving everybody a chance to rest.

Area 3 Hopper net

We shot the hopper net away the following morning at the 'Pot Holes'. The first 2 hauls we caught 6-7 boxes of bulk each go but these produced only 4 boxes to go below. The third go was slightly better. We put 8 boxes below from 10 boxes of bulk. The next 4 tows resulted in 5-6 boxes of bulk each go and this filled 14 boxes for the fish room.

After discussions with the observer I decided that as there were only two hauls remaining with the hopper net we would work late and finish these so we could make our way into Scarborough for a long weekend. We finished these tows in Area 3 with a 14-box haul, a pleasure to see come aboard. We then steamed 65 miles to port allowing everyone to get 9 hours sleep on passage.

Area 6

We sailed from Scarborough at 1800 hours on Monday 18th July, a fine evening with a slight swell and hardly any wind, to steam 100 miles East to the 'Silver Pits'. We arrived the next morning at 0830 hrs, a fine day and shot the hopper net on a ridge of hard ground. We towed North-west for the first watch, catching 7 boxes of fine cod. Continuing along the same ridge we took 46 boxes of bonny cod for the second haul. The following 2 hauls weren't so good but we put down 7 boxes below. This finished the day and we lay for the night.

The following morning we shot the scraper net and managed 6 hauls for the day. The best hauls were the dawning and darkening ones, both taking about 18 boxes of bulk. We filled 26 boxes for the day with some quality prawns among the catch.

During the night we steamed East to the 'Cleaver Bank'. We shot the hopper net but the results were very poor and we picked up some big stones, doing lots of damage to the net. We steamed back to the 'Silver Pits' and finished off the scraper tows. The weather had started to freshen from the North-west making a large uncomfortable swell. The forecast was predicted to get much worse but as we only had 2 hauls remaining we decided to stay and get these done.

Next morning we shot the hopper net and did the remaining hauls on the hard ground. These 2 hauls with the hopper net were very good with 12 boxes then 16 boxes to go below. This completed Area 6 and we set off for Scarborough.

Area 3 Scraper trawl

We sailed from Scarborough about 10.00 and steamed North-east for 55 miles to start in Area 3 with the scraper net. We shot later that evening and completed 2 hauls for 17 boxes before stopping for the night. The next day we managed 5 more hauls for a further 62 boxes, so the fishing was very steady in this area. After taking the net aboard for the night, I decided to steam North for 55 miles to the '95-Mile Hole, giving everyone a chance to sleep and also to shorten the distance to Peterhead. We shot the scraper net in 100 fathoms and did the first tow for only 4 boxes, very poor. We dodged 5 miles to the West, then towed 7 miles North-west for the last tow. This haul contained 10 boxes of mixed fish.

This completed the 2011 FSP survey.

Danny Normandale

Annex B North Sea whitefish survey 2011 2nd observer report.

North Sea Whitefish survey: July 2011

VESSEL

FV Allegiance (SH90)
Skipper: Danny Normandale

OBSERVER

Samantha Elliott

DEPARTURE DATE AND LOCATION

18th July 2011, Peterhead

OBJECTIVE

To repeat the survey of North Sea Whitefish carried out in 2009 and 2010 in order to provide information on distribution, relative abundance and size/age composition of cod, haddock and whiting, and the catch compositions throughout the survey area.

FISHING GEAR

Fishing Gear for use on hard and soft ground:

1) A whitefish otter trawl for fishing hard ground:

Net: 130 ft Caley trawl

Ground Gear: 130 ft total, 80ft rock-hoppers, 25ft wing chains, headline 100 ft.

Sweeps: 45 fathom total, 30 fm splits, 10 fm rubber sweeps, 5 fm 5/8 chain.

2) A scraper trawl for fishing soft ground:

Net: 160ft Falcon trawl

Ground Gear: 160ft total, 8" Discs in central 50ft section, 6" discs in the 55ft section on either side.

Sweeps (Bridles): 142 fathom total, 10 fm splits, 10 fm rubber sweep, 120 fm combination, 2 fm 5/8 chain

Doors: 76" Patent B Perfect Doors, 600kg. For both gear types.

NARRATIVE: (All times are in BST. Approximate catch results are expressed as number of baskets based on crew estimates).

The FV Allegiance sailed from Scarborough at 1800 on Monday 18th July 2011 and steamed south-east to Area 6 to resume the survey.

The Hopper gear was shot on Tuesday 19th July in fine weather on hard ground in an area known as the Silver Pits. 4 tows were completed with some good clean catches of Cod, including a 45 box haul. Fishing ceased at approx 2100 hrs so the vessel could steam a couple of miles to new ground and laid to for the night in order for the observer to rest.

Fishing recommenced the next day (20/07/2011) at approximately 0400hrs, this time using the scraper trawl on soft ground with a total 6 tows being completed. More NEP was observed through these hauls. After an overnight rest period, the Hopper gear was shot and 3 tows were completed. The trawl suffered some damage here due to stones tearing the net; fishing was poor with very little bulk. The vessel Steamed 20 miles to new ground and the gear was changed back to the scarper trawl and the final three scraper tows were carried out taking us into Friday (22/07/2011).

The vessel steamed back to hard ground to complete the last two Hopper tows. These hauls again showed hauls of, typically good quality Cod with a large size range. These hauls completed area 6, weather was freshening and the forecast was poor in the next fishing area. It was decided, we would steam back to Scarborough. The vessel landed in Scarborough at midnight Friday 22nd July.

FV sailed from Scarborough on Monday 25th July at 1000 to carry out the remaining 9 tows in area 3 and complete the survey for this year. The scraper gear was shot away at 1900 hrs in moderate weather, (force 6 North Westerly's), two tows were completed and showed good catches of HAD and WHG. Fishing ceased for the evening and the vessel laid to for the night.

Fishing resumed the next day (26/07/2011) at 0400 and completed 5 hauls for the day. These hauls had consistently good catches of whiting. The weather had been poor throughout the day and began freshening in the evening, the vessel steamed further North and the observer turned in.

On 27/07/2011, the final two scraper tows were shot away early, completing the survey before 1000. The bulk in these final tows was much reduced compared to previous hauls in this area.

The vessel steamed to Peterhead, landing at approximately 2300hrs 27th July 2011.

Annex C North Sea whitefish survey detailed operations plan.

FISHERIES SCIENCE PARTNERSHIP: FSP (2011-12) (7)

North Sea Whitefish survey: 1 June - 31 July 2011

Detailed Operation Plan (June 2011)

VESSEL

FV Allegiance S
Skipper: Danny Normandale

OBSERVERS

Robert Phillips, Samantha Elliot

DEPARTURE DATE AND LOCATION

10th June Peterhead

OBJECTIVE

The survey has been agreed between the NFFO and Cefas. It will cover representative fishing grounds within a large part of the North Sea from 53°30'N – 62°N, 0° - 7°E during June and or July. The vessel will use a combination of traditional English fishing gears to cover both hard and soft grounds. The whole catch will be recorded, but detailed measurements will be made of the catches of cod, whiting and haddock, and of plaice if resources permit.

FISHING GEAR

Fishing Gear will comprise two gear types for use on hard and soft ground:

1) A whitefish otter trawl:

Net: 130 ft Caley trawl

Ground Gear: 130 ft total, 80ft rock-hoppers, 25ft wing chains, headline 100 ft.

Sweeps: 45fathom total, 30 fm splits, 10 fm rubber sweeps, 5 fm 5/8 chain.

Doors: 76" Patent B Perfect Doors, 600kg.

2) A scraper trawl for fishing soft ground:

Net: 160ft Falcon trawl

Ground Gear: 160ft total, 8" Discs in central 50ft section, 6" discs in the 55ft section on either side.

Sweeps (Bridles): 142 fathom total, 10 fm splits, 10 fm rubber sweep, 120 fm combination, 2 fm 5/8 chain

Doors: 76" Patent B Perfect Doors, 600kg.

AREA OF OPERATION and TOW POSITIONS

Fishing operations will be carried out on specified fishing grounds in the area 53°30'N – 62°N, 0° - 7°E (see attached chart). The tows will be distributed over the sub-areas defined within each of the boxes to provide information on catch rate, size/age composition and species catch composition from as many different locations as possible within the area where the fishery takes place, and not necessarily at locations identical to where tows were made in earlier surveys.

Annex 1 shows the survey sub-areas divided into 10-minute (longitude) x 10-minute (latitude) rectangles. To obtain as much information as possible from the core fishing areas, while ensuring that there is enough information from surrounding areas to allow the distribution pattern to be mapped adequately, the survey will be designed as follows. Each 10-minute by 10-minute rectangle is classified according to two seabed types:

1. Rectangles covering harder seabed types, with potentially the highest catch rates of cod, where the Caley trawl will be used;
2. A surrounding area of softer seabed in which catch rates of cod are expected to be lower than in the core area, where the Falcon Scraper trawl will be used.

Within each sub-area, nine hard and nine soft rectangles will be selected, and a tow with the specified gear type carried out in each on the appropriate seabed type. The rectangles selected for fishing will be retained for future surveys.

PERIOD OF SURVEY

The vessel will depart on 10 June. The duration of the trip will be 30 days of fishing. Trips will be of approximately 10 days per trip and a maximum of two days between fishing trips in port to land fish, refuel and change scientist if necessary.

WORKING PATTERN

Tow duration (net on bottom): 2 h on average for the Caley Jet trawl, 2.5 h on average for the Falcon Scraper trawl. Tow time will be reduced to one hour per tow in Real Time Closure cod conservation areas.

The observer, with help from the crew, must have adequate time to carry out the scientific work on a catch before the next catch is brought aboard.

The survey will take place during day and night.

The observer must have sufficient rest periods (up to 8 h per day in one or two periods).

All tows will form part of the survey (i.e. no un-sampled tows should be made) and all must be sampled by the observer according to the sampling requirements provided to him.

The crew should be available to help the observer when requested to do so.

It is expected that some 130 tows will be carried out over the 30 days of fishing, depending on the weather.

SORTING AND RECORDING THE CATCH

It is important that the catches of cod, haddock, whiting and other commercial species be quantified as accurately as possible. The crew will be required to assist in sorting the catch as required by the observer as well as preparing any fish for sale on landing. Standard Cefas methods for sorting and measuring commercial fish catches at sea will be followed.

The entire catch should be available to the observer for sampling, and none should be discarded without being recorded. Generally, the catch will be sorted into three general categories:

1. Large and rare fish e.g. congers and skates, which may be landed or discarded, but which can be counted and measured (i.e. raising factor of 1.0).
2. The retained catch of other individuals of commercial species. The observer must be able to record the total number of boxes or baskets of retained fish of each species from each tow, and will carry out length

measurements on either the whole catch (raising factor = 1.0) or a known sample of the catch (raising factor >1.0).

3. Discarded fish of commercial and non-commercial species, other than those in category (1). It is crucial that the total quantity of discarded fish is known, and that the observer can obtain a representative, random sample to be sorted to species and measured for length. This is best achieved by placing all the discarded fish in baskets, counting the baskets, and taking a random sample of the baskets for sorting and measuring. The raising factor is the total number of baskets of discarded fish divided by the number of baskets taken at random for sorting and measuring.

The observer will collect samples of large cod, haddock and whiting for age determination, and will remove both otoliths from each fish sampled where possible and record the cruise reference number, tow number, species, fish length, and (if possible) sex. Target numbers of otoliths will be:

Cod: 250 otoliths

Haddock: 250 otoliths

Whiting 250 otoliths

These are to be spread out over the entire area. Collections should be made across the length range of larger fish at each tow to supplement the otoliths taken by the autumn Cefas Endeavour survey. For cod, the sampling should aim for 10 otoliths per 5-cm length class from 15cm to 120cm with 5 at 120cm+, but no more than 3 otoliths per length class per sub area. For haddock, 10 otoliths per 2 cm length class are to be collected from 20 to 69 with 5 at 70cm+, but no more than 3 otoliths per length class per sub area. For whiting from 20 to 60+, but no more than 3 otoliths per length class per sub area. The observer will maintain an otolith tally with station numbers allocated to each otolith packet.

DATA TO BE RECORDED BY SKIPPER

The observer will provide recording sheets on which the skipper will record the following details for each tow:

Date

Tow number

Shooting and hauling times

Shooting and hauling positions (latitude and longitude)

Time and position at any significant change in tow direction

Other relevant information e.g. tidal state, weather conditions, seabed type (hard or soft)

The skipper should provide full details of the gear and its rigging. At the end of the survey, the skipper should provide an electronic copy of the tow tracks from the plotter.

DATA TO BE RECORDED BY OBSERVER

The observer must ensure that all catch compositions, length frequencies and raising factors are fully and correctly entered on the recording sheets, and that all bridge log sheets and biological sampling sheets are collated at the end of each sampling day.

Any significant deviations from the survey plan should be reported to Cefas by the observer.

CRUISE REPORT

The observers will maintain a diary of activities, including an electronic copy where possible, and a draft cruise report in standard Cefas format will be prepared for submission to Cefas immediately after the cruise. The cruise narrative should be written at sea and read and agreed by the skipper (the report will bear the sentence “seen in draft by skipper”).

Signed

.....(Cefas).....(Date)

.....(Cefas).....(Date)

.....(owner/skipper).....(Date)

Annex 1: Map of the six sub-areas within which sampling will be required, together with current information on the substratum. Further information on the rectangles without data is being collected and the map will be updated as the survey progresses.

