North Sea Whitefish Survey: 2012

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Executive summary

The North Sea Whitefish (NSW) survey sailed on 03 June 2012, fishing operations began on 04 June and were completed after four fishing trips on 14 July. Each of the specified fishing grounds was visited and tows were conducted 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.

In 2009, throughout the survey area, catch rates of cod, whiting and haddock were higher on hard ground than on soft. This difference in catch rates has subsequently been observed for haddock in all years; haddock are caught in greater numbers but similar proportions on hard relative to soft ground. After 2009, whiting catch rates settled into the opposite relationship to haddock, better on soft ground, with a similar proportionality of catch rates at age recorded on soft and hard ground. Cod catch rates have varied between the hard ground catch rates being higher in 2009, soft ground catch rates in 2010 and similar rates on each ground type in 2011. The difference between ground types was constant across ages until 2012. In 2012, though, catches of cod at older ages were greater on soft ground, especially in the south, whereas in the north and at younger ages, catch rates were similar between ground types.

Despite the substratum differences in NSW catch rates, when averaged at an overall North Sea scale, the relative indices at age of cod, haddock and whiting abundance from the NSW survey compare well with the ICES IBTSq3 survey data. However, the IBTS has greater selectivity at the youngest ages due to the smaller mesh size and therefore detects incoming year-class strength earlier than that of the NSW. Nevertheless, catches of older fish are more common and exhibit less noise in the NSW data than in the IBTSq3.

The results continue to demonstrate the value in developing a time-series for gadoids based on commercial vessels. The NSW time-series shows consistent agreement with the IBTS survey, but with higher, less noisy catch rates at the oldest ages. As such a time-series develops the results would allow differences in stock dynamics on hard and soft ground to be examined in detail and determination made of whether substratum type can affect survey estimates of stock abundance, especially as the stocks of cod and whiting rebuild under the current management regime, providing valuable input to the debate on the dynamics of the stocks and survey practices.

The stocks of cod and whiting are currently depressed relative to historical abundance, but they are increasing, and as they increase, substratum preferences can be monitored using the NSW survey design.

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 ($53^{o}30'$N–62^{o}N, 0^{o}–7^{o}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. The first type was

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

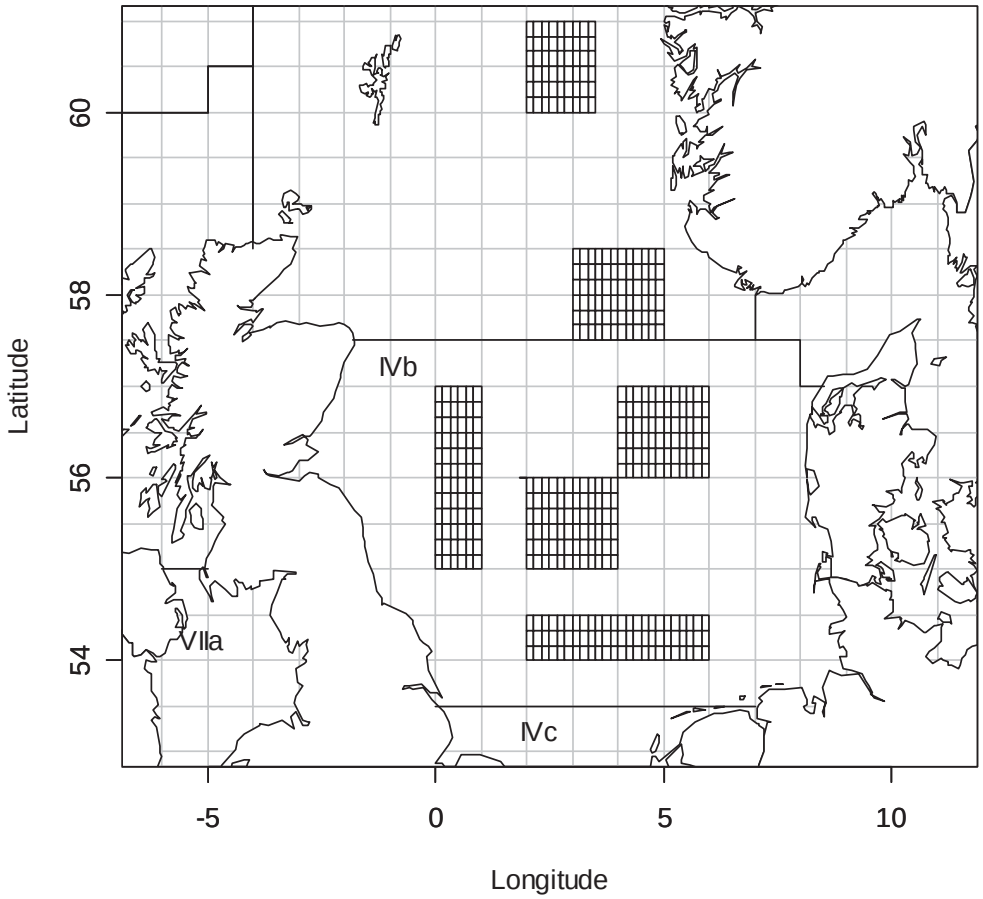

Figure 1. Map of the six representative fishing grounds within which fishing is required, in each year of the survey, on hard and soft substratum.

Real Time Closures

Tow length was specified as 2 h in the design of the survey protocol (Annex C). However in recent years within the NSW survey area, Real Time Closed areas (RTCs) have been specified as part of the Scottish Conservation Credits Scheme and English management of cod bycatch. In order to avoid controversy while operating within the closed areas, but also to maintain the survey objectives, it was agreed in discussions with the MMO and Marine Scotland that tow length would be shortened to 1 h with the gear fishing in the appropriate configuration. This precludes the criticism that the survey avoided areas in which cod were abundant.

The 2012 survey

Fishing began on 04 June and was completed after four fishing trips on 14 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. All fishing operations, as specified within the detailed operations plan (Annex C), were recorded and observed by the Cefas observers whose fishing trip reports are appended as Annex B.

Each of the specified fishing grounds was visited and a total of 18 tows was completed on hard and soft substratum (nine on each). 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 2012 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 2012 survey included many more small fish than 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 cod have been abundant in the Fair Isle area and that this might reflect a redistribution or expansion of the cod stock or a local abundance that is not included within the survey area. Catches have been good in that area in recent years, which has also been noted by other fishing skippers in the North Sea. The area would therefore be worth considering for inclusion if the survey time-series is continued.

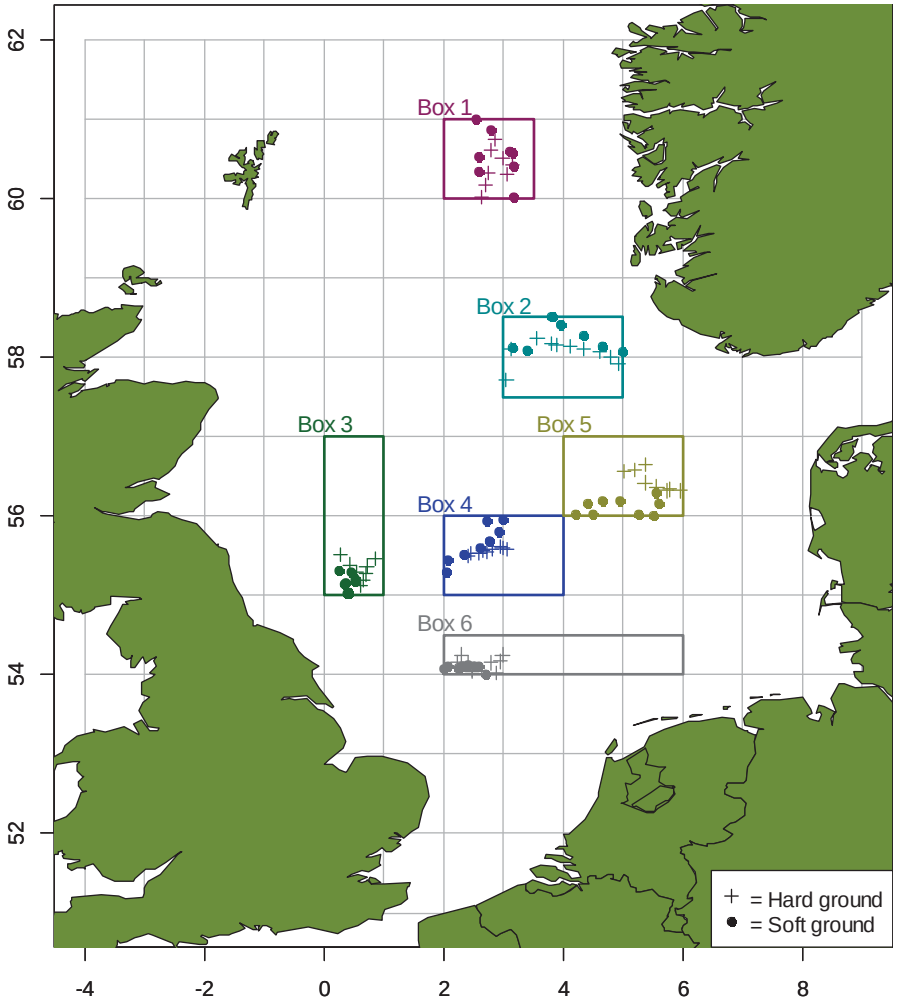

Figure 2. Starting positions of the 2012 North Sea Whitefish (NSW) survey fishing stations.

Results

Table 1 presents the 2012 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 2012 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.

	Weight (kg)			Percentage	
Species	**Total**	**Retained**	**Discarded**	**Retained**	**Discarded**
Cod	5 646	5 053	594	89	11
Haddock	3 733	3 366	368	90	10
Whiting	4 080	2 463	1 616	60	40
Saithe	18 463	18 404	59	100	0
Plaice	8 779	7 012	1 767	80	20
Hake	1 245	1 155	90	93	7
Lemon sole	2 797	974	1 823	35	65
Ling	1 736	1 555	181	90	10
Monk	1 396	1 396	0	100	0
Witch	156	55	101	35	65
Dab	4 887	3	4 884	0	100
Norway Pout	59	0	59	0	100

Cod

The age of the cod caught ranged from 0 to 10+ years, with most aged 1–3, as in previous years (Table 2). Older fish are taken mainly in the north, in boxes 1 and 2, and in box 6 in the south. In 2012 there was a noticeable expansion of the age range relative to those recorded in 2010 and 2011, especially in box 6, the most southern area.

In 2009, cod catch rates were approximately three times higher on hard ground than on soft; the ratio was much higher 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 better than soft. In 2012, catch rates of cod were better on hard ground at ages 1–3 and on soft ground at older ages. The ratio of hard to soft ground catch rates is dominated by the higher catch rates at the oldest ages in box 6; in the other areas the catch rates were similar. The reason for variation in the year effects is as yet unknown but will be evaluated as the time-series develops and patterns can be fully determined.

In 2009, 2010 and 2011, although there were differences in the absolute catch rates on hard and soft ground, the relative strength of the year classes caught in each area was generally the same, independent of substratum type. In 2010, on the northern and western grounds (boxes 1–3), the distributions had strong differences in relative catch rates at age one, but older ages had similar age distributions. In 2012 (Figure 3), relative catch rate distribution at age showed strong differences in box 6 with more older fish caught on the soft ground and only immature cod on the hard ground. In box 4 there appears to

have been a wider spread of immature fish on hard ground, but this is generated by noise within low catch rates.

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, compared with the NSW survey, catches of cod aged 0, 1 and possibly 2 would be expected to be higher relative to older fish.

From 2009 to 2011, the distributions at age were similar, with just age 1 showing the expected difference between gears. In 2012, the relative age distributions are again similar between surveys on soft ground, but on hard ground in area 2 and soft ground in area 6, a broader range of age groups was caught by the NSW survey. As the time-series develops, changes in year-class strength from year to year in each area and ground type will be used to make direct comparisons between surveys.

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 the years 2009–2012 (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. In previous years, the NSW survey showed a faster rate of decline in age classes at ages 3–6+, but in 2012 this is not the case; the catch rates of older cod by the NSW survey were better on soft ground. On hard ground, however, similar relative age distributions are seen as in previous years. Both surveys are recording proportionally better catch rates at the older ages, indicating increased survivorship of the stock.

Figure 5b compares the indices at age from the two surveys observed for 2009–2012 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. In 2012 the catch rates on soft ground exceeded those on hard ground at the older ages (lower abundance catch rates), the first year in which there has been a noticeable departure from linearity. The majority of this difference resulted from the better catch rates on soft ground in box 6; an area-specific effect.

When combined across the hard and soft ground types, the NSW catch rates at age are consistent with those from the IBTS survey (Figure 5b, top right), the NSW consistently outfishing the IBTS in all years (points above the line), with a fixed effect across the range of catch rates and ages. The surveys

agree well in terms of the relative strengths of 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 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 and at the youngest ages (Figure 6). The difference in the years 2010–2012 was considerably weaker than observed in 2009, when 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 defined emphatically. In 2010 the distributions at age in the north and east on hard relative to soft ground differed, especially catch rates at age 1, which were better on soft ground (similar to those of cod). In 2011 and 2012, the age structure on soft ground was similar to that on hard. It is noticeable that the 2009 year class is dominant in the age structure in all areas on both soft and hard ground and that the subsequent year classes have been much weaker.

Figure 7 presents the 2012 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 consequently better selection for young fish. It is noticeable from the IBTS results that a relatively strong 0 group is appearing in the fishery, which is encouraging given the low 2010 and 2011 year-class abundances. Catch rate distribution at age on the soft and hard ground recorded by the NSW is comparable with that of the IBTSq3, consistent with previous year's results.

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 2009–2012 (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 2010 IBTS had better catch rates than the NSW, but in all other years, the relative catch rates in the NSW survey have been better.

Figure 8b compares the indices at age from the two surveys observed for 2009–2012 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 yielded better 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. There is 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 relative to the noisier soft ground catches, which are affected by the relatively poorer catch rates in 2009.

Whiting

The age of whiting caught during the survey ranged from 0 to 8 years, with most fish aged 1–4 (Table 4, Figure 9). In 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 2009, 2010 and again in 2012 there was a broad range 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 between substrata in the south and west. In 2010 and 2011, the differences between substrata were less noticeable and more variable. In 2012 catch rates on soft ground were higher by a factor of 4; as yet, therefore, no clear pattern is emerging.

Figure 10 presents the 2012 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, relative to age 2, the catch indices at age derived for the whole of the North Sea from the IBTSq3 with those from the NSW for the years 2009–2012. The Figure highlights 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 2009–2012 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 higher for the majority of ages, and they were substantially higher again in 2012. This difference between the NSW survey catch rates 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 evident, but this will hopefully be determined as the time-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.

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 catch rates were substantially better in areas 2 and 3 than the previous year (Figure 12), by a factor of around 10. Those better catch rates were maintained in area 3 in 2011, but not in area 2. In 2012 the only area in which plaice were not caught was on hard ground in box 1. Catch rates in all areas are increasing consistent with the known increase in abundance in the stock. The differences in distributions at length between hard and soft ground noted in 2009 were not as apparent between 2010 and 2012.

Saithe were only caught in the northern areas, 1 and 2 in 2012 (Figure 13). The length distributions for saithe caught by the two gear types are broadly similar on hard and soft ground.

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

The NSW survey is beginning to provide time-series of indices across a functional range of ages for all North Sea target species. The abundance at age of the individual species in the North Sea has exhibited variation between hard and soft substrata and from north to south.

In 2009, throughout the survey area, catch rates of cod, whiting and haddock were better on hard ground than on soft, a difference recorded for haddock in all years. The survey has established that in the years monitored, haddock were caught in larger numbers but similar proportions on hard ground relative to soft. The years surveyed to date have not seen the strong year classes that this stock occasionally delivers, so the results from the limited years covered to date cannot be extended to all situations that the stock has exhibited.

After 2009, the first year of the survey, which may have been anomalous for this species, whiting catch rates settled into a relationship opposite to that of haddock, i.e. better on soft ground than hard. As with haddock, though, similar proportionality of catch rates at age are recorded on soft and hard ground. The stock is currently low relative to historical abundance, but it is increasing, so as the biomass increases, the survey will allow the development and monitoring of substratum preferences.

After the higher catch rates of cod on hard ground in 2009, cod catch rates varied between soft ground catch rates all being higher in 2010 and similar rates on each ground type in 2011. The difference between ground types has been constant, i.e. all catch rates at age on hard ground higher or vice versa, until 2012. In the 2012 results, catches of older cod were better on soft ground, especially in the south, but in the north and at younger ages, catch rates were similar between ground types. The design of the survey has been specified to analyse such variation, and as the time-series develops and more data become available, the causes underlying the differences will become clearer.

Despite the substratum differences in NSW catch rates, when averaged at the scale of the whole North Sea, the relative indices of abundance at age of cod, haddock and whiting from the NSW compare well with the ICES IBTSq3 survey data. Of course, the IBTS has better selectivity at younger ages because of the smaller mesh size, so detects incoming year-class strength earlier than the NSW survey. Catches of older fish are better and seem to exhibit less noise in the NSW data than in the IBTSq3, however.

On individual grounds there are differences between years, especially in the southern boxes in which the IBTS does not catch the range of cod and haddock ages recorded on the NSW survey. As the time-series develops, these differences can be separated out and the data collected will allow testing of a number of questions related to substratum, gear and spatial distribution of stocks.

The results continue to 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, but with higher and less noisy catch rates at older ages. There has been an expansion in the age range of cod caught in the north and south of the North Sea, although the latter has not yet been observed in the IBTS data. As the time-series develops, however, the results should allow differences in stock dynamics on hard and soft ground to be examined in detail and 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

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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 2012.

Cod		Average number caught at age per hour											
Area	**Ground**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10 +**	**Total**
1	Hard	0.00	0.02	7.13	15.45	2.58	1.65	0.04	0.07	0.06	0.00	0.00	26.95
1	Soft	0.00	0.08	1.38	3.80	0.58	0.52	0.03	0.03	0.05	0.00	0.05	6.42
2	Hard	0.00	0.41	1.10	2.57	0.42	0.73	0.10	0.05	0.03	0.00	0.00	5.38
2	Soft	0.00	6.26	9.34	4.25	0.59	0.76	0.11	0.13	0.02	0.00	0.00	21.44
3	Hard	0.00	0.13	2.73	1.11	0.09	0.00	0.00	0.00	0.00	0.00	0.00	4.06
3	Soft	0.00	1.11	2.50	2.17	0.09	0.04	0.00	0.00	0.00	0.00	0.00	5.91
4	Hard	0.00	1.92	0.58	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.61
4	Soft	0.00	3.99	1.38	0.22	0.00	0.07	0.00	0.00	0.00	0.00	0.00	5.66
5	Hard	0.00	0.23	0.48	0.52	0.02	0.00	0.00	0.00	0.00	0.00	0.00	1.25
5	Soft	0.00	4.17	0.55	0.35	0.00	0.04	0.00	0.00	0.00	0.00	0.00	5.11
6	Hard	0.00	21.32	36.62	26.50	3.31	0.69	0.13	0.01	0.01	0.00	0.00	88.58
6	Soft	0.00	0.59	7.24	24.92	8.28	8.12	5.82	0.54	0.48	0.00	0.00	55.50

Mean	Hard	0.00	4.01	8.11	7.71	1.07	0.51	0.04	0.02	0.02	0.00	0.00
Mean	Soft	0.00	2.70	3.73	5.95	1.59	1.59	0.99	0.12	0.09	0.00	0.01
Ratio		0.00	1.48	2.17	1.30	0.67	0.32	0.04	0.19	0.18	0.00	0.00

Cum %	Hard	0%	19%	56%	92%	97%	100%	100%	100%	100%	100%	100%
Cum %	Soft	0%	16%	38%	74%	83%	93%	99%	99%	100%	100%	100%

Table 3. 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 2012.

Haddock		Average number caught at age per hour											
Area	**Ground**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10 +**	**Total**
1	Hard	0.00	0.00	0.32	5.26	2.01	1.12	1.91	0.76	0.00	0.00	0.09	11.38
1	Soft	0.15	0.26	0.98	6.27	1.92	0.96	1.40	0.78	0.00	0.00	0.04	12.71
2	Hard	0.00	1.02	16.31	49.98	10.47	4.03	5.10	5.00	0.00	0.00	0.00	91.90
2	Soft	0.00	0.08	3.82	11.75	2.42	0.88	1.17	0.97	0.00	0.00	0.03	21.08
3	Hard	0.00	1.44	51.18	192.55	31.05	13.27	17.78	12.41	0.00	0.00	0.00	319.69
3	Soft	1.16	0.02	15.94	86.60	20.75	7.01	10.35	7.19	0.00	0.00	0.00	149.02
4	Hard	0.00	0.00	0.19	0.88	0.08	0.07	0.07	0.04	0.00	0.00	0.00	1.33
4	Soft	0.00	0.00	1.50	2.46	0.48	0.10	0.17	0.18	0.00	0.00	0.00	4.89
5	Hard	0.00	0.00	0.51	0.96	0.12	0.07	0.04	0.12	0.00	0.00	0.00	1.81
5	Soft	0.00	0.00	0.04	0.24	0.12	0.02	0.06	0.02	0.00	0.00	0.00	0.49
6	Hard	0.00	0.08	8.69	26.90	4.55	1.57	1.70	2.10	0.00	0.00	0.00	45.59
6	Soft	0.00	0.00	0.01	0.36	0.09	0.02	0.08	0.05	0.00	0.00	0.00	0.61

Mean	Hard	0.00	0.42	12.87	46.09	8.05	3.35	4.43	3.41	0.00	0.00	0.01
Mean	Soft	0.22	0.06	3.72	17.95	4.30	1.50	2.20	1.53	0.00	0.00	0.01
Ratio		0.00	7.09	3.46	2.57	1.87	2.24	2.01	2.23	0.00	0.00	1.29

Cum %	Hard	0%	1%	17%	76%	86%	90%	96%	100%	100%	100%	100%
Cum %	Soft	1%	1%	13%	70%	83%	88%	95%	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 2012.

Whiting		Average number caught at age per hour											
Area	**Ground**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
1	Hard	0.00	0.06	1.22	4.18	2.45	1.34	0.56	0.21	0.08	0.00	0.00	10.10
1	Soft	0.00	0.01	0.93	3.47	2.79	1.98	0.73	0.19	0.09	0.00	0.00	10.20
2	Hard	0.00	0.25	1.78	3.78	1.70	0.84	0.30	0.06	0.05	0.00	0.00	8.75
2	Soft	0.00	0.29	2.02	4.26	2.23	1.31	0.47	0.22	0.08	0.00	0.00	10.89
3	Hard	8.27	54.81	53.31	45.08	13.90	7.18	0.78	0.21	0.65	0.00	0.00	184.19
3	Soft	0.00	34.25	163.85	218.92	77.30	37.08	7.97	2.04	3.43	0.00	0.00	544.84
4	Hard	0.00	0.23	0.88	0.49	0.00	0.07	0.00	0.00	0.00	0.00	0.00	1.67
4	Soft	0.03	15.95	20.90	4.99	0.67	1.91	0.01	0.00	0.02	0.00	0.00	44.49
5	Hard	0.06	5.87	8.71	2.20	0.50	0.72	0.03	0.01	0.01	0.00	0.00	18.13
5	Soft	0.54	12.68	7.51	0.24	0.22	0.15	0.00	0.00	0.00	0.00	0.00	21.35
6	Hard	0.80	15.63	14.07	6.79	1.42	1.49	0.08	0.02	0.06	0.00	0.00	40.36
6	Soft	1.02	17.07	7.48	1.54	0.72	0.60	0.17	0.03	0.01	0.00	0.00	28.65

Mean	Hard	1.52	12.81	13.33	10.42	3.33	1.94	0.29	0.09	0.14	0.00	0.00
Mean	Soft	0.27	13.38	33.78	38.90	13.99	7.17	1.56	0.42	0.61	0.00	0.00
Ratio		5.73	0.96	0.39	0.27	0.24	0.27	0.19	0.21	0.24	0.00	0.00

Cum %	Hard	3%	33%	63%	87%	94%	99%	99%	100%	100%	100%	100%
Cum %	Soft	0%	12%	43%	78%	91%	98%	99%	99%	100%	100%	100%

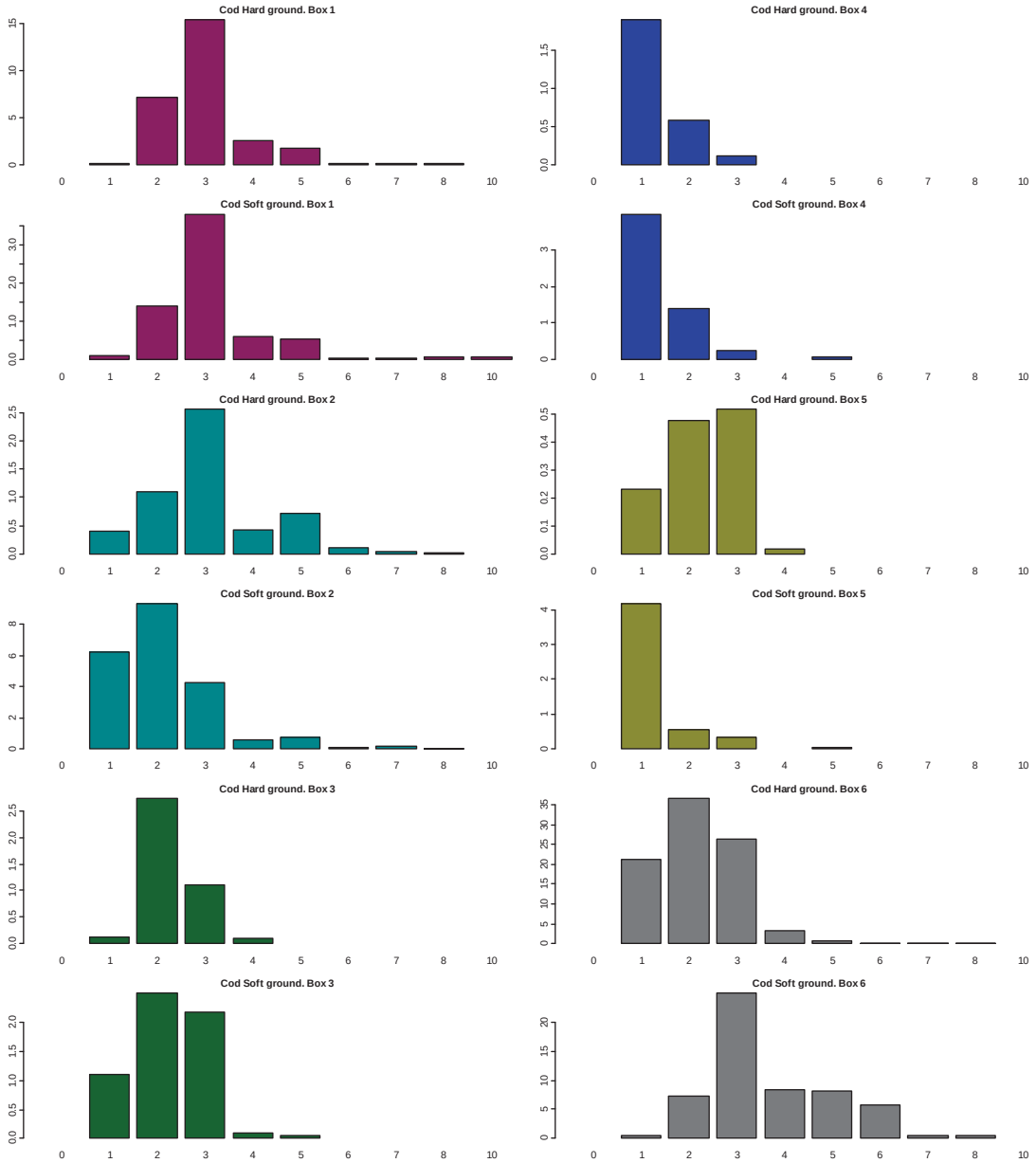

Figure 3. North Sea cod catch numbers per hour at age recorded from nine hard and soft ground tows in each of the fishing areas surveyed by the North Sea Whitefish survey in June 2012.

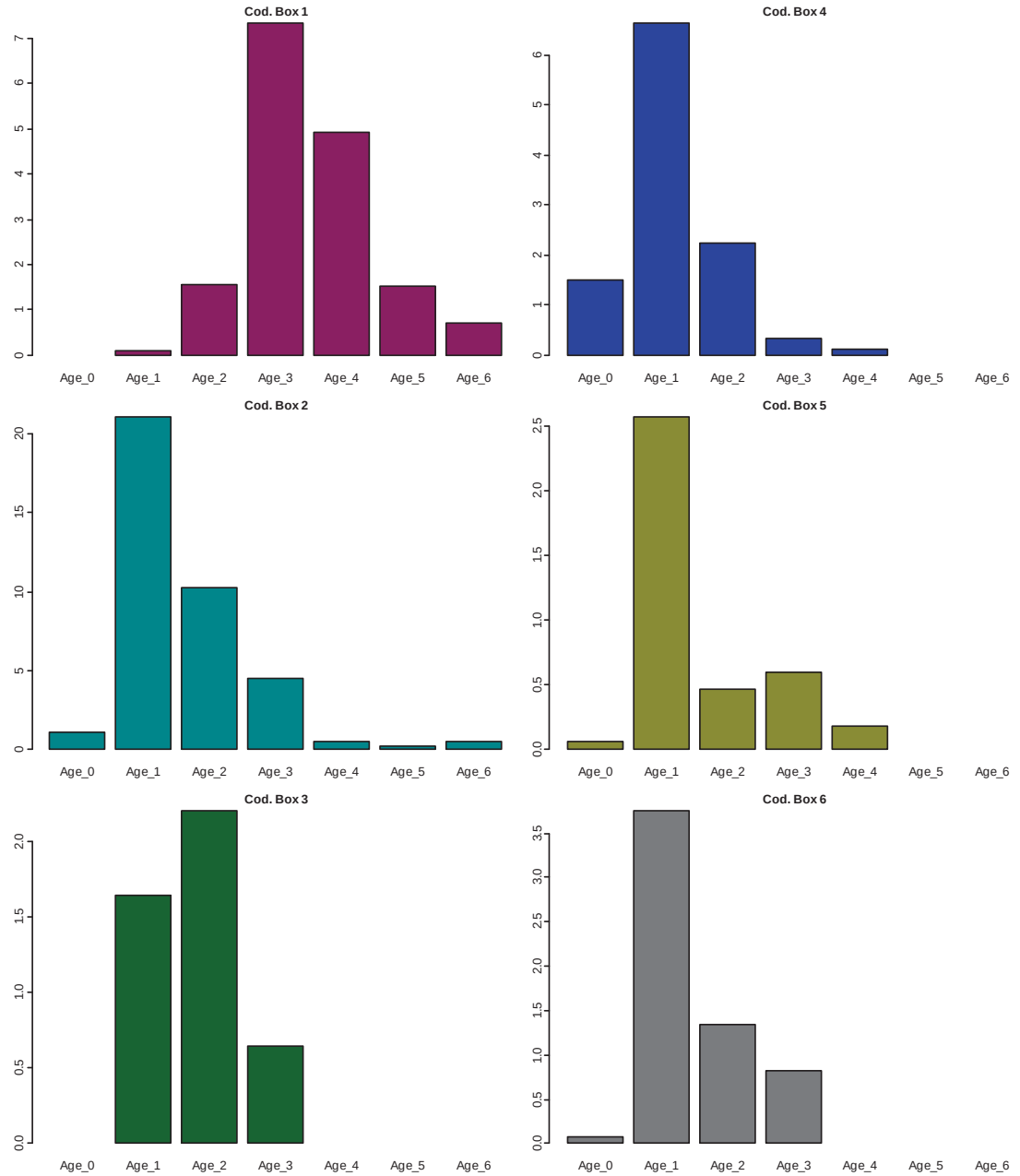

Figure 4. North Sea cod catch numbers per hour at age recorded by the ICES IBTS quarter three survey tows surrounding and within each of the fishing areas surveyed by the North Sea Whitefish survey in July and August 2012 (age 6 is a plus group).

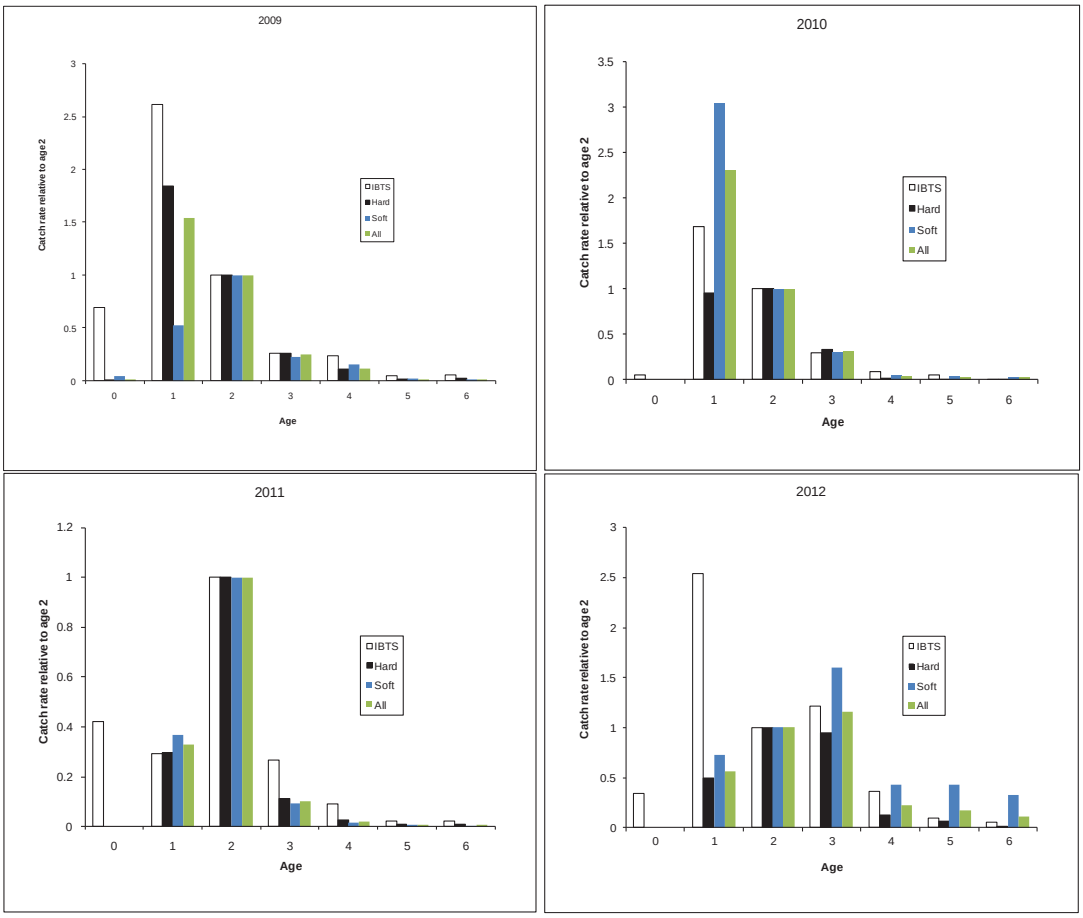

Figure 5a. North Sea cod comparison of the relative (to age 2) catch numbers per hour at age recorded from 2009 to 2012 by the FSP NSW survey and the ICES IBTS quarter three survey index.

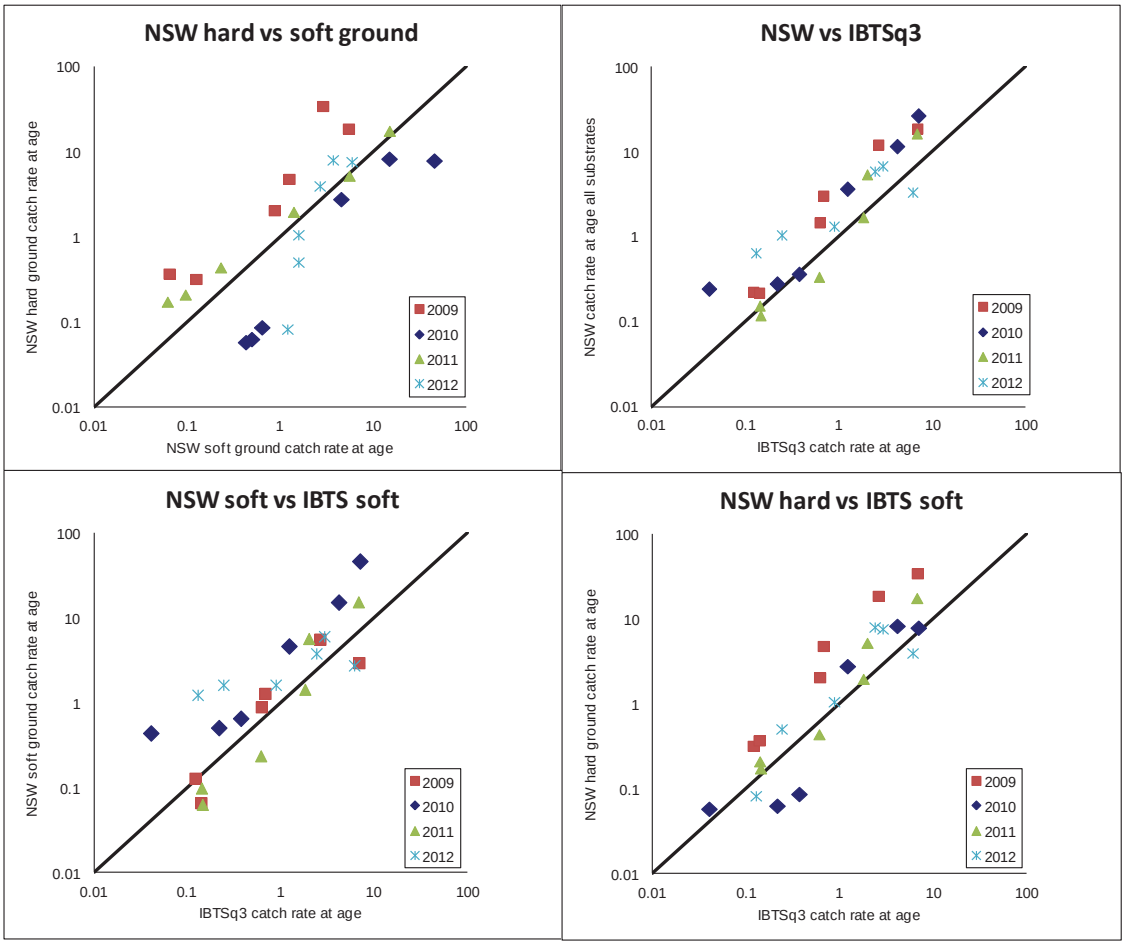

Figure 5b. North Sea cod comparison of the catch numbers per hour at age (log scale) recorded from 2009 to 2012 by the FSP NSW survey and the ICES IBTS quarter three survey index.

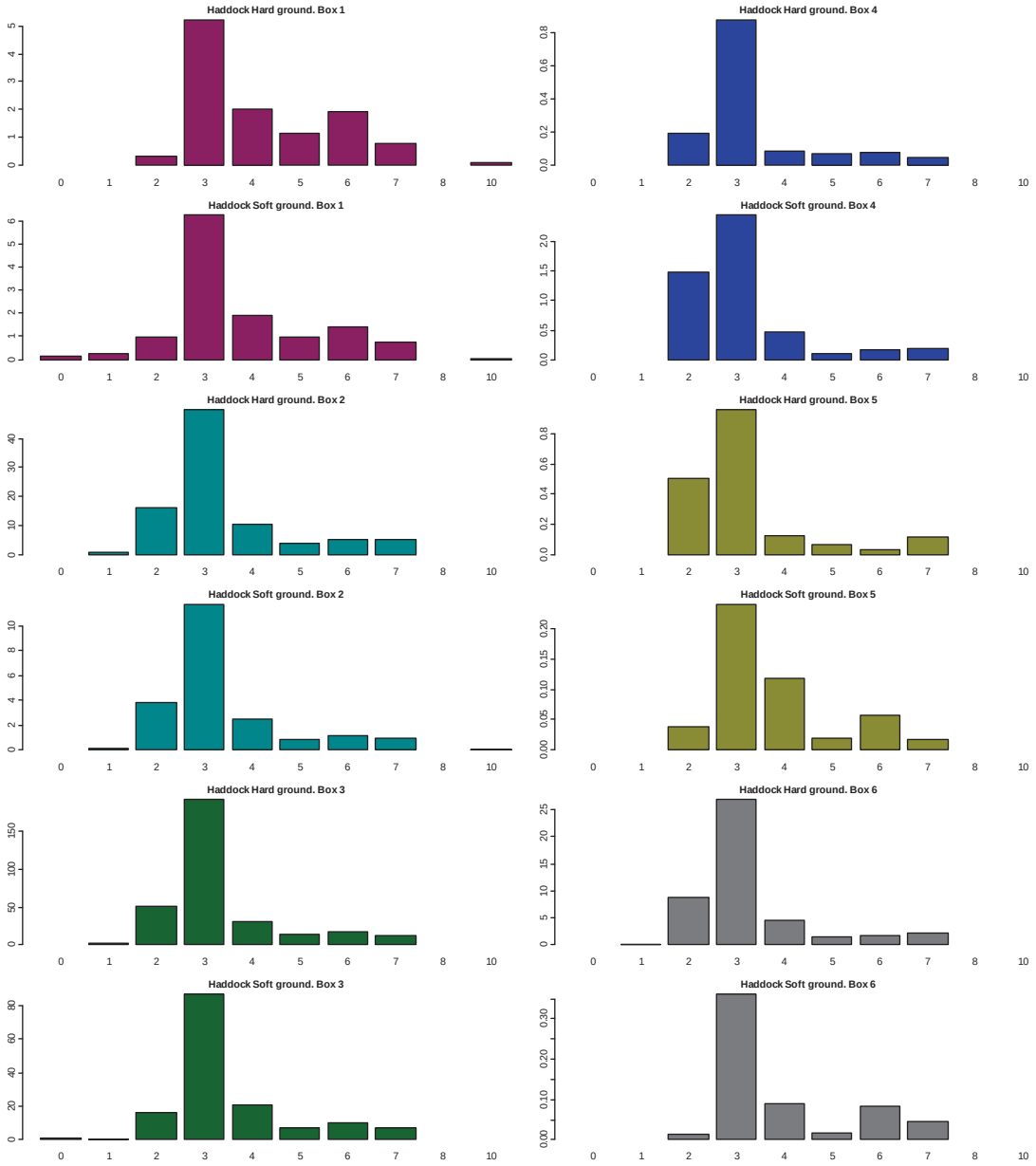

Figure 6. North Sea haddock catch numbers per hour at age recorded from nine hard and soft ground tows in each of the fishing areas surveyed by the North Sea Whitefish survey in June 2012.

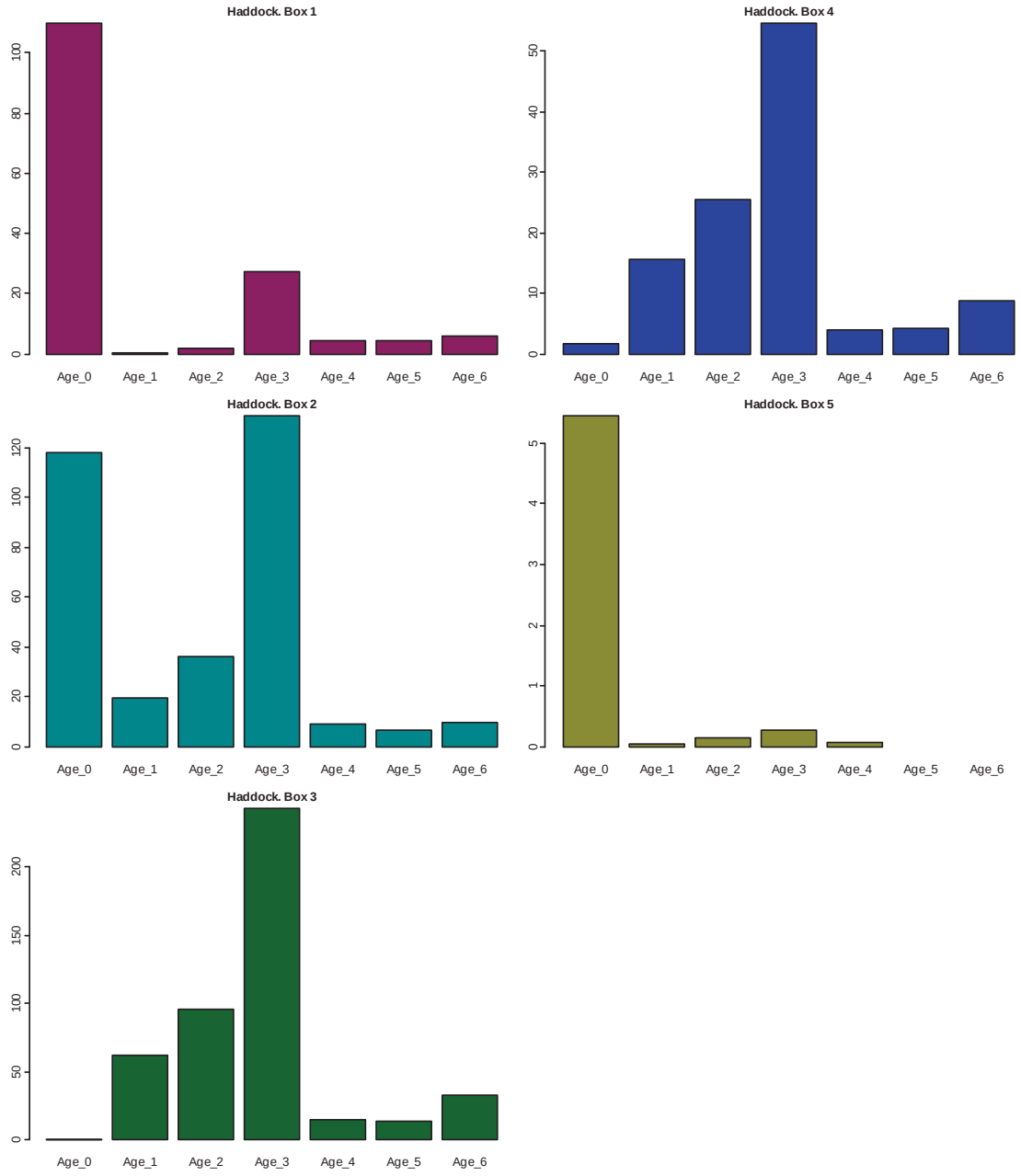

Figure 7. North Sea haddock catch numbers per hour at age recorded by the ICES IBTS quarter three survey tows surrounding and within each of the fishing areas surveyed by the North Sea Whitefish survey in July and August 2012 (age 6 is a plus group). No haddock were caught in Box 6 (bottom right).

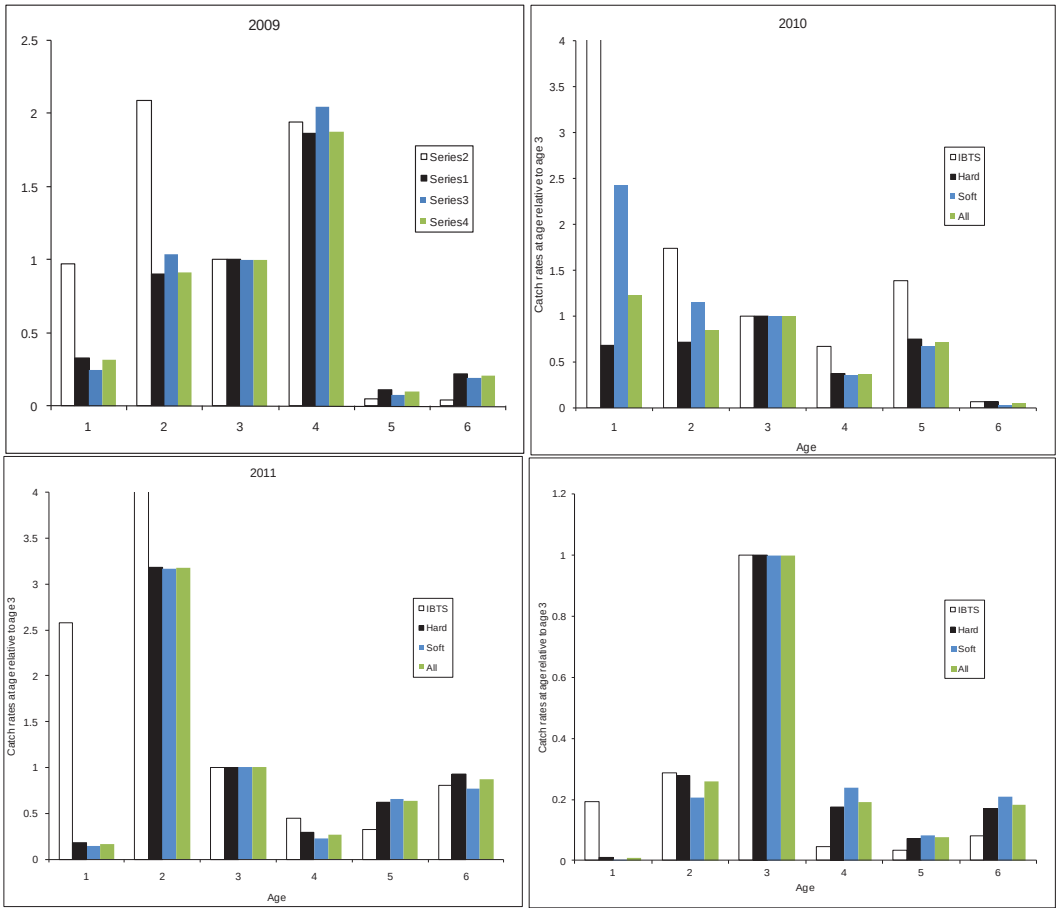

Figure 8a. North Sea haddock comparison of the relative (to age 3) catch numbers per hour at age from 2009 to 2012 recorded by the FSP NSW survey and the ICES IBTS quarter three survey index.

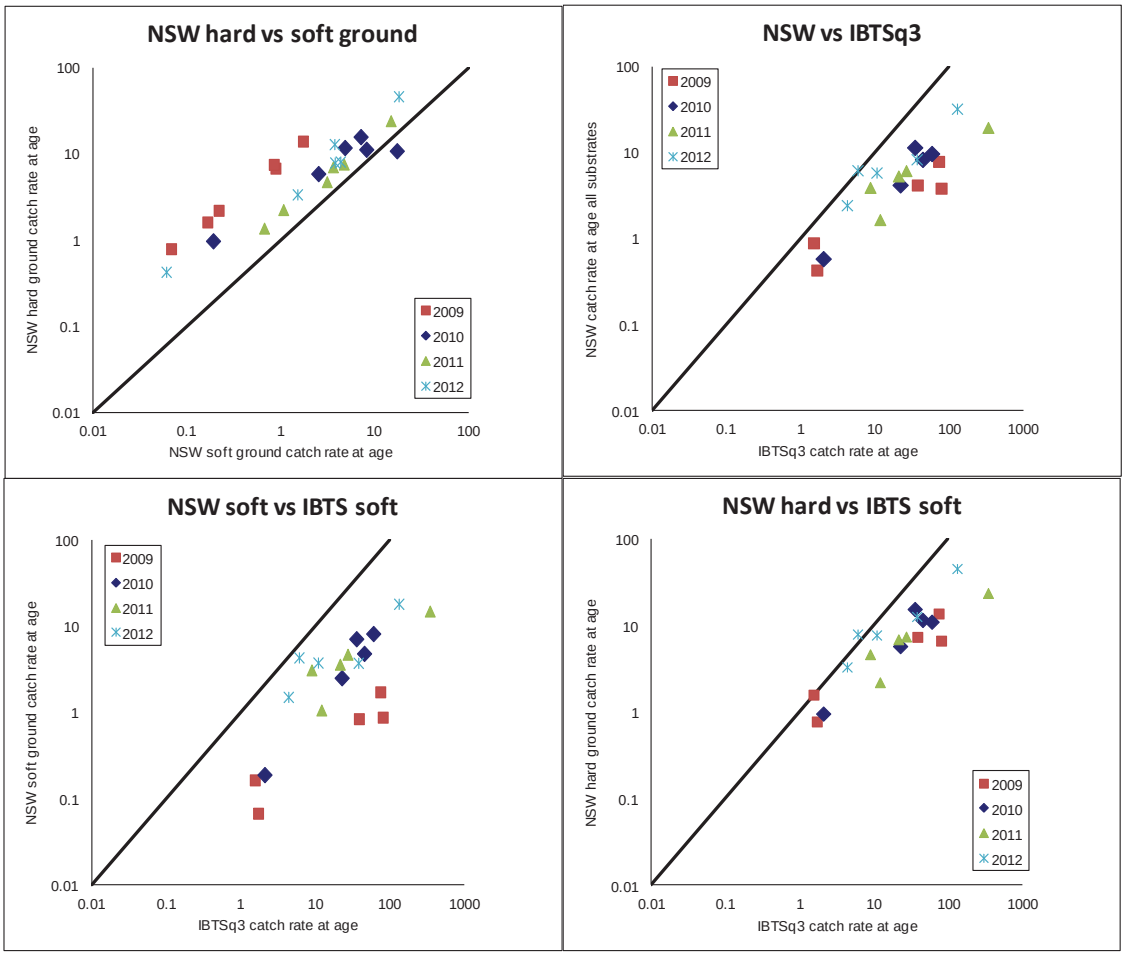

Figure 8b. North Sea haddock comparison of the catch numbers per hour at age (log scale) from 2009 to2012 recorded by the FSP NSW survey and the ICES IBTS quarter three survey index.

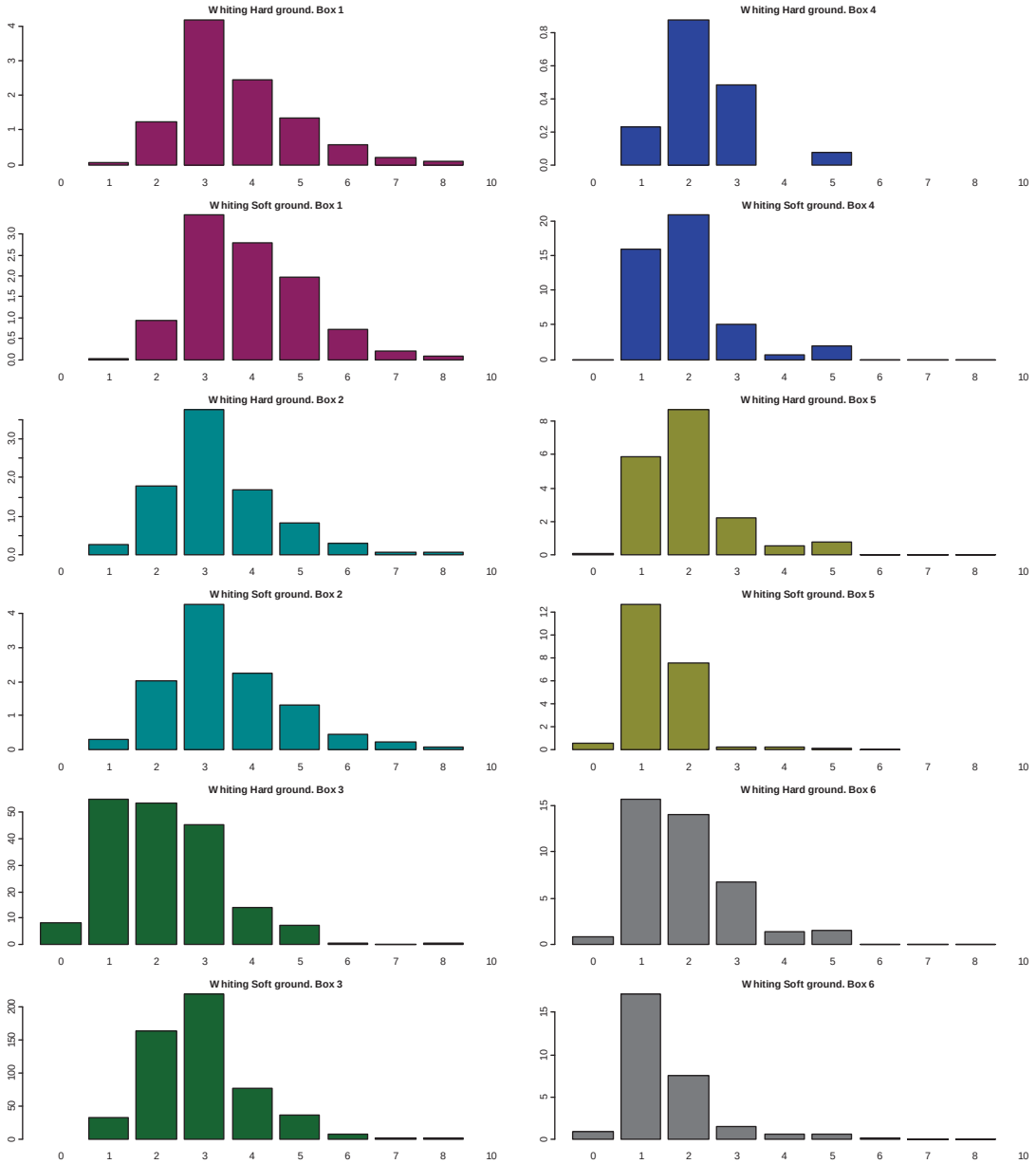

Figure 9. North Sea whiting catch numbers per hour at age recorded from nine hard and soft ground tows in each of the fishing areas surveyed by the North Sea Whitefish survey in June 2012.

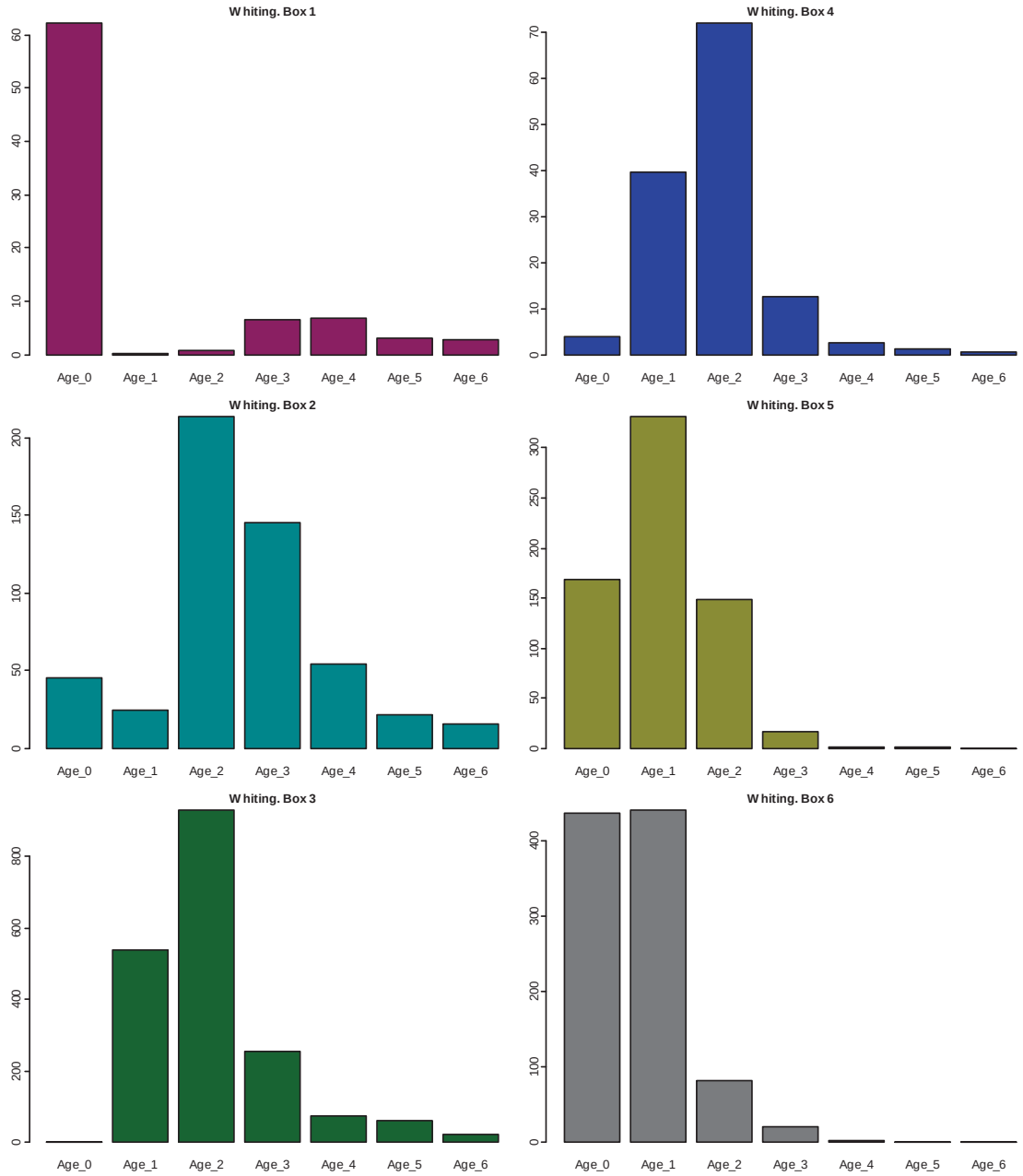

Figure 10. North Sea whiting catch numbers per hour at age recorded by the ICES IBTS quarter three survey tows in July and August 2012 surrounding and within each of the fishing areas surveyed by the North Sea Whitefish survey (age 6 is a plus group).

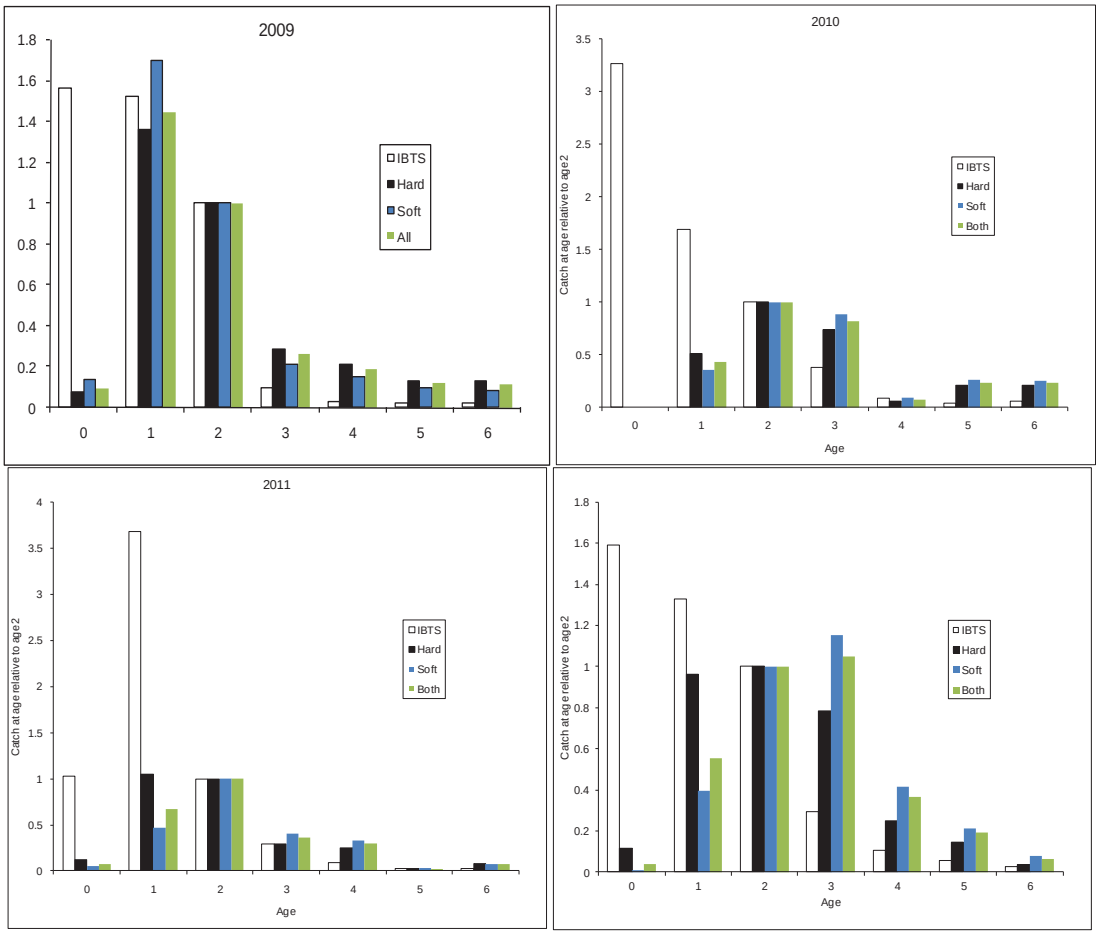

Figure 11a. North Sea whiting comparison of the relative (to age 2) catch numbers per hour at age recorded in 2009, 2010 and 2011 by the FSP NSW survey and the ICES IBTS quarter three survey index.

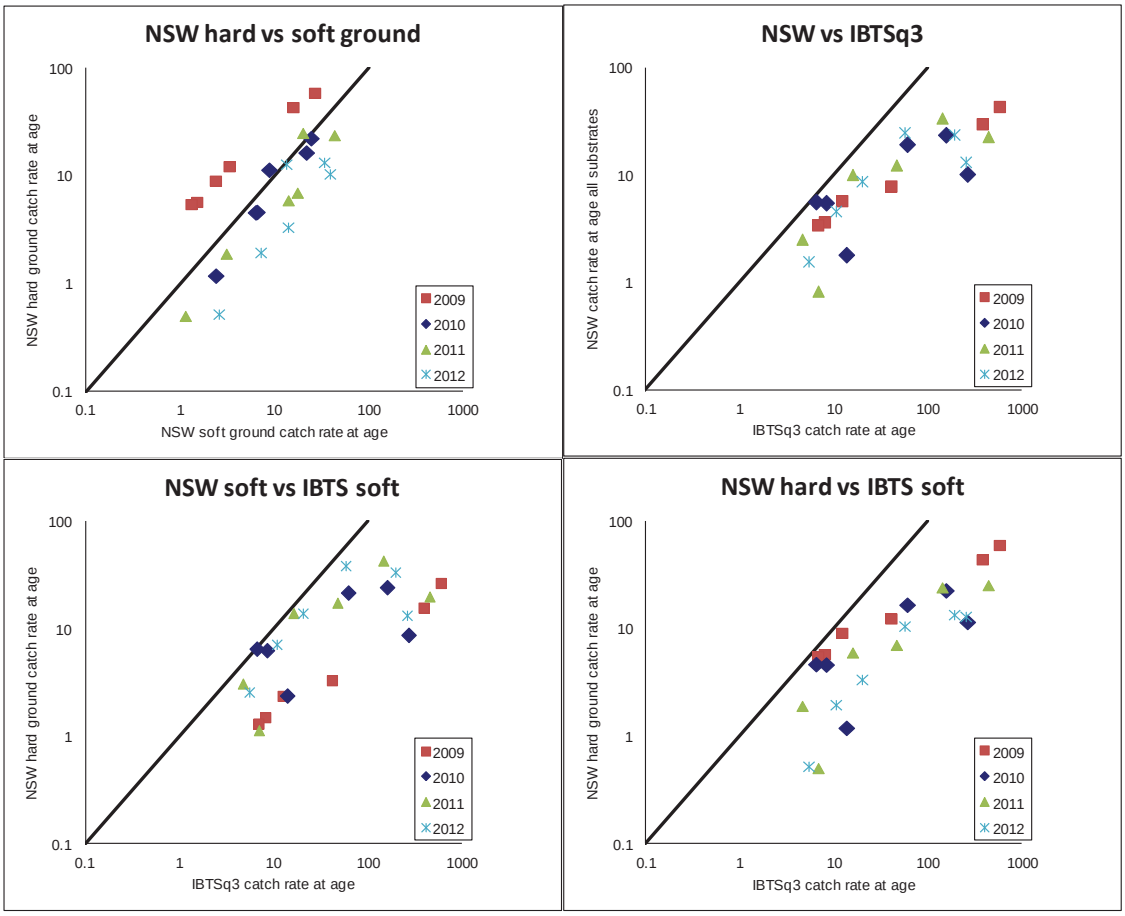

Figure 11b. North Sea whiting, comparison of the catch numbers per hour at age (log scale) recorded from 2009 to2012 by the FSP NSW survey and the ICES IBTS quarter three survey index.

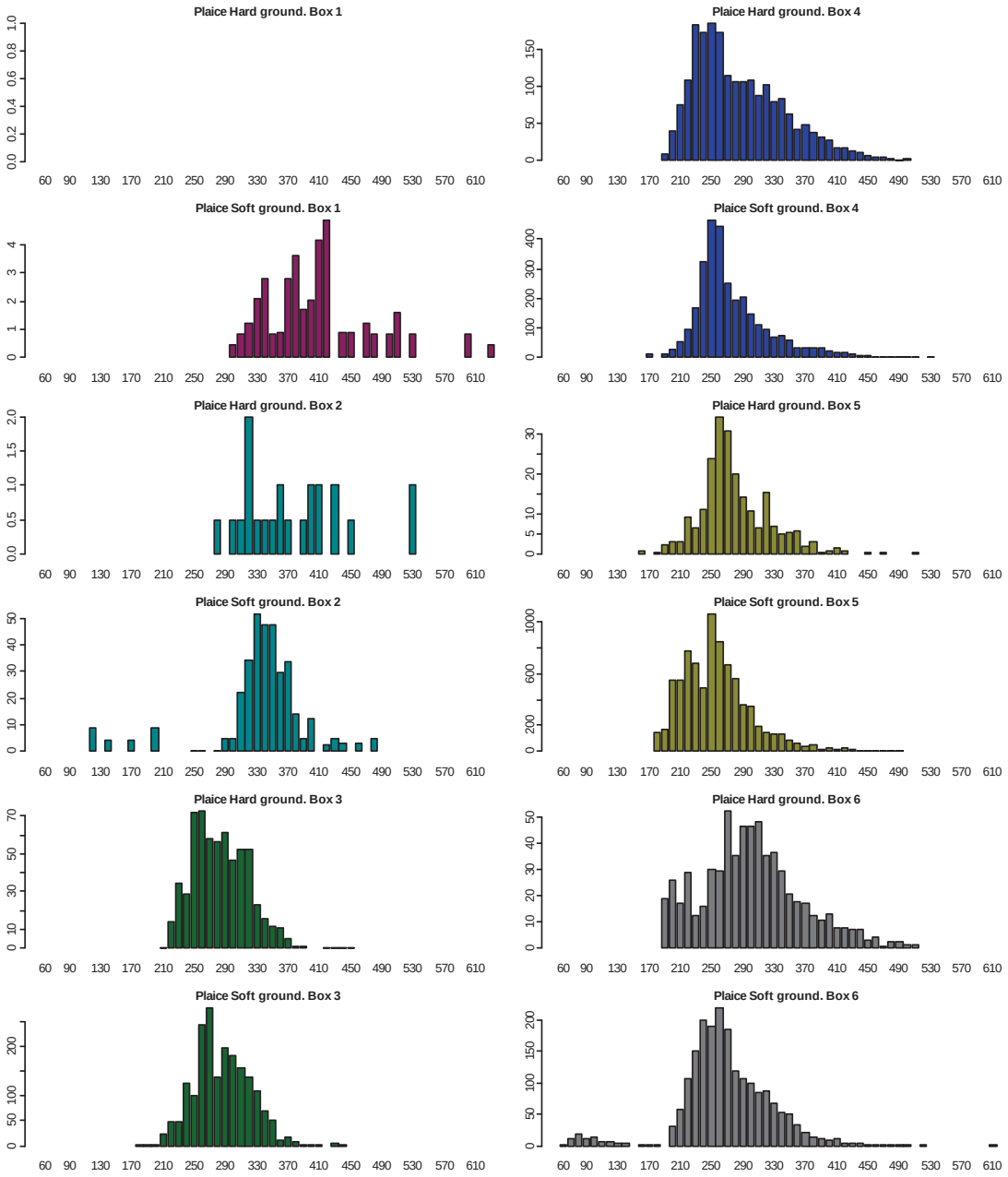

Figure 12. North Sea plaice catch numbers per hour at length recorded from nine hard and soft ground tows in each of the fishing areas surveyed by the North Sea Whitefish survey in June and July 2012

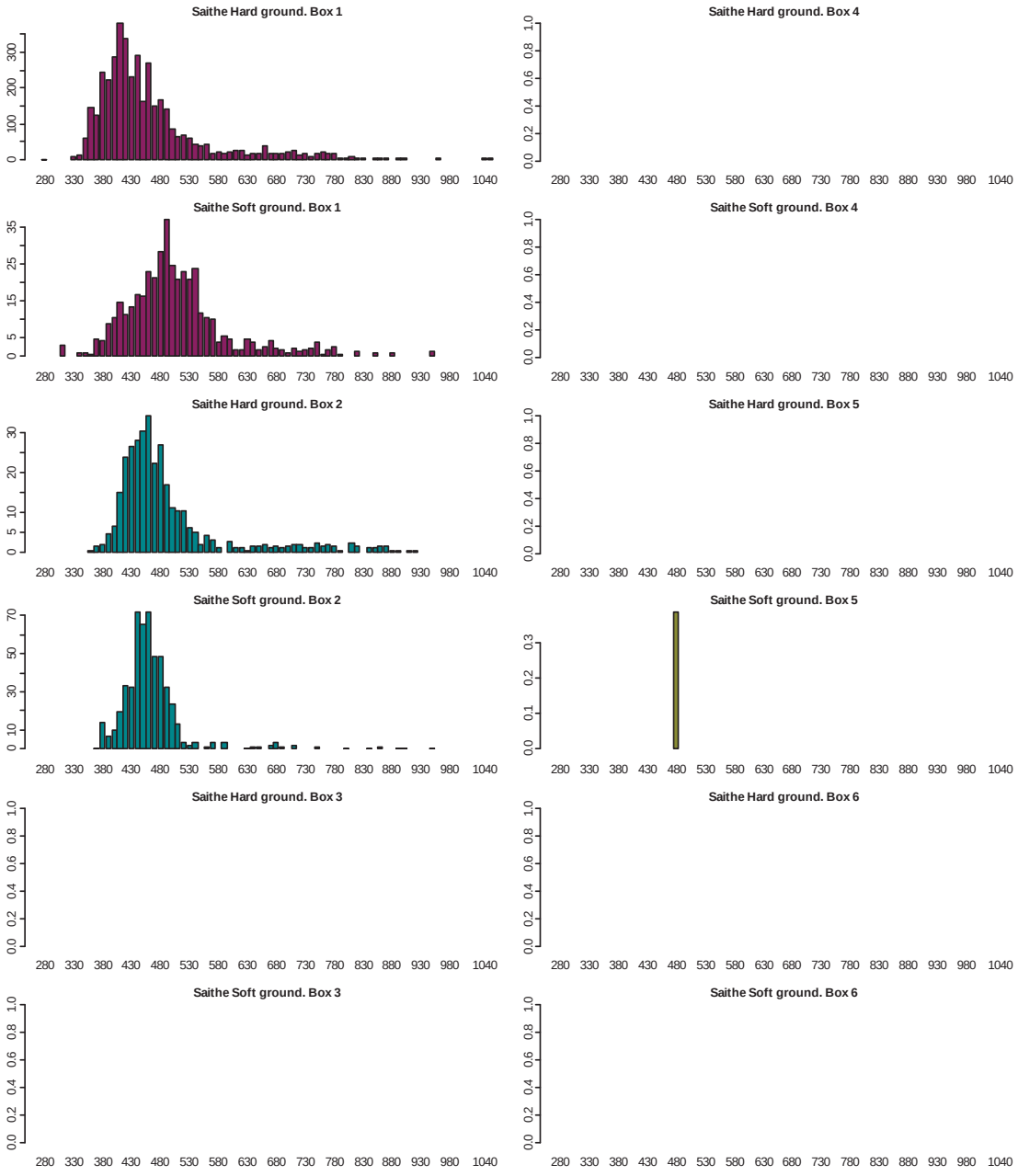

Figure 13. North Sea saithe catch numbers per hour at length recorded from nine hard and soft ground tows in each of the fishing areas surveyed by the North Sea Whitefish survey in June and July 2012

Annex A North Sea whitefish survey 2010 skippers report.

CEFAS 2012 Survey on MV Allegiance SH 90
Skipper's report.

All hard ground tows are 2 hours, all soft ground tows are 2.5 hour.
Species and discards are reported separately by the CEFAS observer.

AREA 1

We sailed from Lerwick at 2200hrs on the 3rd June and steamed NE for 120 miles to Area 1. The wind was northerly force 5-6. We shot the Scraper net at 1430hrs in about 100 fms. We had 3 tows in the deep water before stopping for the night. These tows produced a total of 34 boxes of good quality fish.

We started the following morning at 0700 hours, shooting the scraper net in the deep water again for a haul of 7 boxes. There were 5 or 6 large trawlers working in the deep water, which would have had a detrimental effect on our fishing. For the second tow we dodged 3 miles NW to a patch of hard ground where we shot the hopper net. This haul was much better, resulting in 49 boxes. Following this we took 38 then 14 boxes. Next we steamed East for 4 miles and shot the scraper net in 95 fathoms for the last haul of the day, taking 9 boxes.

Steaming 20 miles to the SW to shallower water, we shot the hopper net at 0600 hrs.
The first haul of the day netted 71 boxes of coley, followed by 2 hauls of 34 boxes. Next we dodged East for 6 miles to shoot the hopper net, towing it into the deep water, where we took a haul of 18 boxes. For the last haul of the day we shot the scraper and towed in 100 fms, but only took 5 boxes. The following morning we used the scraper net again, producing 15 boxes. Next we dodged NW for 4 miles to shoot the hopper net in the deep water with the intention of towing it up into shoaler water. This haul was good yielding 36 boxes of good fish. Shooting back, we carried on towing SW and took 20 boxes, but the belly of the trawl was missing.
For the remaining 2 hauls we steamed West for 8 miles and shot the scraper nets on a shallow, 45 fathom bank. The first haul was very poor, giving only 5 boxes of bulk The second was better, filling 10 boxes for the fishroom.
This completed Area 1.

AREA 2

We started at 1730hrs, shooting the hopper net on hard ground in 57fms hoping for some haddocks. Almost on hauling time we parted the chain on the port sweep so had to haul the net back single ended. We lost most of the fish in the net, ending up with 3 boxes. The second tow was better filling 9 boxes for the fishroom. Catches were poor following this and we only filled 12 boxes for the next 6 hauls.

We hauled took the net aboard that evening, having experienced hydraulic problems which were getting worse and set off for Hanstholm in Denmark to get these rectified. We also landed the catch on the Monday morning market.

We had 1 hopper tow and 9 scraper tows remaining to complete Area 2. Our departure from Hanstholm was delayed due to a necessary component having to be imported from Italy, which took 5 days. We sailed on 15/6/12 and steamed back to area 2, arriving at 0930 on 16th, where we commenced fishing again with the scraper net, shooting in 110 fms. The first haul took about 10 boxes of bulk, but only 2 boxes for the fishroom. The second and third hauls gave a similar amount of bulk, filling 5 boxes from the two hauls.
We steamed West for 6 miles to shoot the scraper net in 80fms. The next 4 hauls produced much better results. From a similar amount of bulk taken we filled 43 boxes for the fishroom with much fewer discards.

From here we took the net aboard steaming 30 miles SW, giving the observer a chance to sleep and also change grounds for the survey. We had 2 scraper and 1 hopper net tows remaining. We shot away the scraper net for 2 hauls taking 11 boxes of mostly quality flatfish with little to discard. The remaining hopper net tow filled 5 boxes for the fishroom, mostly round fish. This completed Area 2.

AREA 5

We steamed 105 miles overnight to Area 5 arriving at midday, where we shot the hopper net. We managed 5 tows that day, but these were really poor, not even fill 1 box for the fish room from the 5 hauls.

The following day was just as poor with the hopper net. The remaining 4 tows with the hopper gear didn't fill a box of fish to keep, so we hauled the hopper net aboard at 1030, having completed the hopper tows. We shot away the scraper net next, getting 4 hauls in before the end of the day. This was slightly better filling 19 boxes, but this was mostly plaice with hardly any round fish. Following discussions with the observer, we agreed to carry on working through the night to see if the fishing was any better in the dark. The dark tow was better, resulting in 14 full boxes. The next 4 hauls resulted in 20 boxes to go below in total. This completed Area 5.

We steamed to Scarborough to exchange observers.

AREA 3

We left Scarborough at 0100 hours on the 2nd July and steamed 55 miles to the south end of Area 3. The weather was calm when we sailed. On location we shot away the scraper net in 47fms. The first two hauls produced 7 boxes and 5 boxes respectively. The fishing improved and after 5 hauls we'd put 39 boxes below. We took the net aboard and lay overnight enabling the observer to rest.
We shot again at 04.00hrs. The remaining four hauls with the scraper net produced better results giving 10 boxes, 15 boxes, 7 boxes, and finished with 10 boxes, which was very

pleasing. The scraper net tows totalled 81 boxes. We'd finished the four remaining scraper tows in good time, which allowed us to get 2 hopper tows before the end of the day but these tows only produced 4 boxes and 6 boxes.

We started the hopper net tows early next morning, aiming to get all 7 tows completed that day. The first haul was very poor, giving only 3 boxes but the next 4 hauls were better. These produced 7 boxes, 8 boxes, 7 boxes and 8 boxes, so was pleased with these results. It's always nice to see fish going down the fishroom. Unfortunately the finishing 2 hauls were not so good with only 8 boxes for the 2 tows.

We sailed for Scarborough at 2230hrs with 122 boxes from Area 3, so I was pleased with this result.

AREA 4

We sailed from Scarborough at 1900hrs on Sunday in a slight northerly swell, but nothing uncomfortable. It was a 120 mile steam to Area 4, which assured everyone of a good rest before the survey started. We arrived on station and shot the scraper net at 0915.

The fishing in this area was poor, probably due to the northerly swell in the water. The first 5 hauls only filled 15 boxes, this mainly consisted of plaice and lemons but included 1 box of hake. This was the total caught for the day and we took the gear aboard just after midnight and lay for a few hours.

We started the following day again with the scraper net and had completed the remaining 4 hauls by 1600hrs but only filled 19 boxes for these tows. We took the scraper net aboard and shot the hopper net away. We had 3 hauls with the hopper net before the end of the day but these where poor also. I discussed with our observer, Emma the possibility of us fishing through the night to get this area completed. Emma was happy for us to do this so we continued fishing, finished the area at 1600 hrs the following day. We only managed to take 25 boxes from the 9 hauls with the hopper net. I think the fishing was poor, mainly due to the deep swell in these shallow waters. Shallow water fishing is very weather sensitive.

We set off for Area 6 at 1630hrs.

AREA 6

We arrived on station at 0115hrs and shot the hopper net. The weather wasn't very good, so the fishing was poor. By midday the swell had fallen away and the fishing improved slightly. We had 2 hauls after noon, which produced 33 boxes of good cod. We managed to get all 9 hauls with the hopper net before the end of the day and put 53 boxes below.
With Emma's agreement we carried on fishing and worked through the night, making inroads into the scraper net tows. The fishing with the scraper net wasn't as good. We

only averaged 5 boxes per haul. We did see a good showing of prawns during the dark, but very few in after daylight.

The boats close by, about 2-3 miles to the west, on the edge of Area 6 were taking prawns and flats. Speaking to these skippers they said they hadn't seen the usual cod on the grounds as expected at this time of year. We worked through until we'd finished the scraper net tows, from which we caught 46 boxes, finishing about 0500 and set off for Scarborough, having caught 170 boxes from the 2 areas.

This completed the 2012 survey.

I would like to say a special thank you to all the observers. John, Sam and Emma were a pleasure to work with and without their willing cooperation the survey would have taken much longer.

Footnote

We went back the south end of Area 3 on Tuesday 17th July and fished until 21st July. We had 17 hauls for 447 boxes.

This consisted of

Cod 11 boxes
Haddock 168 boxes
Whiting 180 boxes
Plaice 63 boxes
Monk 5 boxes
Prawns 10 boxes
Halibut 3 boxes
Turbot 1 box
Lemon sole 5 boxes
Hake 1 box
Total 447 boxes

This is an average result of a 4-day fishing trip in this area doing longer tows.

Danny Normandale July 2012

Annex B North Sea whitefish survey 2012 observer reports.

North Sea Whitefish survey: June2012 part 1

VESSEL

FV Allegiance (SH90)
Skipper: Danny Normandale

OBSERVER

Samantha Elliott

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

The observer met the FV Allegiance in Peterhead on 31st May 2012. As the vessel has been on guard work for an extended period, a short fishing trip was carried out prior to the FSP starting in order to ensure everything was in working order. The observer sampled this trip for the DCF programme. The vessel landed in Lerwick on Sunday 3rd June 2012.

The FV Allegiance sailed from Lerwick at approx 2200hrs on Sunday 3rd June 2012 and steamed east overnight to Area 1 to begin the survey.

Fishing began on 4th June 2012, the first scraper tow being shot away at 1430hrs. A total of 3 hauls were carried out, all reasonable hauls of POK but with very little COD/HAD/WHG, most hauls yielding less than a basket of each. The vessel laid to overnight. Fishing began again the next day (5/06/2012) with a total of 2 soft ground tow and 3 hard ground tows completed. The Hopper net fished well, although very little COD was caught, catches of HAD improved with larger HAD and WHG showing through. We also took a couple of good hauls (17-24 boxes) of Saithe. Fishing continued the next day (06/06/2012) in calm conditions, towing the hopper net north then south-east into deeper water. Catches of POK were still high, and although catches of WHG and HAD remained low, more COD was showing through (up to 3.5 baskets). The last haul of the day which was carried out on soft ground, produced approx half a basket of very large NEP. The vessel laid to overnight to allow the observer to rest. The following day (07/06/2012), 3 soft ground tows and 3 hard ground tows were carried out, completing Area 1. The hopper net appeared to fish better than the scarper net, catches of Cod were much higher on the hard ground with a good size range. Purse seiners were observed fishing in this area.

The vessel steamed overnight to area 2, arriving late afternoon the next day (08/06/2012). Two tows were completed using the Hopper net. There was not a lot of Bulk in these hauls, however catches of HAD were improved (2.25-2.75 baskets caught). After a suitable rest period, fishing continued (09/06/2012), 5 hauls were completed using the

hopper net. The bulk in these catches remained low, getting steadily lower throughout the day. There was more HAD here though, with a good size range from very small 20cm to large 50+cm individuals.

There had been problems with the main winch hydraulics which had been steadily performing more and more poorly throughout the survey. Hauling was taking much longer than was usual, and there was some concern that it was affecting the fishing efficiency. The skipper decided to cease fishing and head for port in order to get them repaired.

The vessel landed in Hanstholm at approx 1830hrs on Sunday 10th June 2012.

The observer would like to thank the skipper and crew of the Allegiance for their assistance in completing this leg of the survey.

(Seen and agreed in draft by skipper Danny Normandale).

North Sea Whitefish survey: June2012 part 2

Second leg (Area 2 and Area 3)

Vessel: - Allegiance SH90
Skipper: - Danny Normandale
Observer: - Jon Ashworth

Crew: - Zeno, "Noggins", "Paddy", Tommy, Frances, Liam and Andy

Monday 11th June to Thursday 21st June

Gear

Objective

Narrative

Monday 11th to Friday 15th June

Allegiance landed in Hanstholm (Northern Denmark) as this was much closer to Area 2 than Peterhead. The vessel had issues with the main winch hydraulics, this had slowed the hauling process down so much that area 2 remained incomplete, Skipper Normandale had hoped that Hanstholm would provide a good place to get this fixed. The quality of the hydraulic engineers was not in question; however, the repair required a full day to diagnose and a new part that needed to be imported from the manufacturer in Italy. On arrival of the part the engineers had it fitted within 2hrs and the allegiance sailed from Hanstholm at approximately 1730 (BST). Skipper Normandale shot the scraper net on leaving Hanstholm haven to put the system through its paces, all tested well and the vessel continued on passage to pick up the soft ground tows in area 2.

Area 2 (Saturday 16th to Sunday 17th June)

A total of 7 soft ground tows were conducted in deep water on the edge of the Norwegian trench, catch composition was noticeably different as we towed further north. The first tow produced a mixed bag of flat and whitefish, mainly Witches and Saithe and a large number of discarded Cod. Second haul resulted in smaller numbers of Saithe but similar numbers of Witch. Of note was the large number of Velvet bellies in the discarded catch. Haul 4 and 5 produced 1.5 and 2 baskets of very large Nephrops respectively and good numbers of Cod across the length range but concentrated between 35 and 50cm. Gear came aboard at 10:00hrs and the Allegiance steamed to the south of area 2 to complete the soft ground tows and finish off the last hard ground tow. As expected the catch composition in the shallower waters was different again, Haddock began to figure more highly as did Plaice and Lemons. The final tow in area 2 was with the Hopper net and the Allegiance had the gear aboard and was under way for area 5 by 23:00 on the Sunday night.

Area 5 (Monday 18th to Wednesday 20th June)

First of the hard ground tows was shot at midday on the Monday and the last was hauled on Tuesday at 10:30. None of these hauls produced much fish, often amounting to 1 or 2 baskets in total. Several hauls produced an amount of small Herring, an amount of this was taken by the Phillipino crew and made into Sushi, a most welcome and delicious treat.

On completion of the hard ground tows the Allegiance steamed west to complete area 5 with the scraper net. Catch rates for flatfish saw an immediate improvement although the whitefish catch rates remained low. Discard rates on where also very high, particularly on Dab and Plaice. On Wednesday morning during tow 6 a number of large Rorquals were observed alongside the vessel in calm conditions, numbers estimated to be at least 4-6 animals and were thought to be Sei whales. The last soft ground tow was completed at 16:00 on the Wednesday and the Allegiance then proceeded to make passage to Scarborough to land on Thursday 21st June.

The observer would like to extend his thanks to the skipper and crew of the Allegiance for their hospitality and assistance in completing this part of the survey.

Jon Ashworth

(Seen and agreed in Draft by Skipper, Danny Normandale)

North Sea Whitefish survey: June2012 part 3

VESSEL

FV Allegiance (SH90)

Skipper: Danny Normandale

OBSERVER

Emma Lane

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

Area 3

Summery Table

Primary Haul Number	Net	Net Number	Date of shooting	Time of shooting	Comments
1	Scraper	1	02/07/2012	07:45	
2	Scraper	2	02/07/2012	11:05	
3	Scraper	3	02/07/2012	14:15	
4	Scraper	4	02/07/2012	17:30	
5	Scraper	5	02/07/2012	20:45	Laid to
6	Scraper	6	03/07/2012	03:50	
7	Scraper	7	03/07/2012	07:15	
8	Scraper	8	03/07/2012	10:30	
9	Scraper	9	03/07/2012	13:45	
10	Hopper	1	03/07/2012	17:25	
11	Hopper	2	03/07/2012	20:25	Laid to
12	Hopper	3	04/07/2012	04:00	
13	Hopper	4	04/07/2012	06:45	
14	Hopper	5	04/07/2012	09:30	
15	Hopper	6	04/07/2012	12:10	
16	Hopper	7	04/07/2012	14:45	
17	Hopper	8	04/07/2012	18:00	
18	Hopper	9	04/07/2012	20:30	

Observer met the FV Allegiance on 01/07/12 in Scarborough and commenced sailing at 2100hrs, the vessel steamed east overnight to Area 3 to shoot the first trawl on soft ground with the Scrapper net at 0745hrs on 02/07/12. Tows on the soft ground continued through the day totalling five, when the vessel laid to for approximately 5h. Catches across these hauls where consistent, being relatively high in bulk due to high amounts of discards (9-15 Baskets) but with reasonable numbers of HAD and WHG and some COD being present in each haul. Discards included high numbers of small flat fish, predominantly DAB, with LEM also being well represented.

Figure 1: Showing a haul from area 3 with COD present, but in low numbers

Fishing got underway again at 0350hrs 03/07/12, continuing with the Scrapper net tows, catch remained similar to previous soft ground tows. At 1615hrs the Scrapper net tows where completed and the hopper net shot at 1725hrs. Two hard ground tows where carried out before a rest break of approximately 5hrs. Catch composition was similar to that of the soft ground tows with noticeably fewer discards.

The hard ground tows continued through the next day beginning at 0400hrs 04/07/12 the first of which was very similar to the previous hauls, however as of the fourth hard ground tow a marked difference could be seen in the discards, which became very minimal, often less than a basket, predominantly consisting round fish notably WHG, HAD and GUG.

The last of the hard ground tows was completed at 2230hrs and the FV Allegiance Steamed for Scarborough landing around 1000hrs on the 05/07/12.
Observer spent three nights ashore.

Area 4

Summary Table

Primary Haul Number	Net	Net Number	Date of shooting	Time of shooting	Comment
1	Scraper	1	09/07/2012	09:15	
2	Scraper	2	09/07/2012	12:30	
3	Scraper	3	09/07/2012	15:35	
4	Scraper	4	09/07/2012	18:50	
5	Scraper	5	09/07/2012	21:45	Laid to
6	Scraper	6	10/07/2012	03:45	
7	Scraper	7	10/07/2012	06:50	

8	Scraper	8	10/07/2012	10:00	
9	Scraper	9	10/07/2012	13:10	
10	Hopper	1	10/07/2012	17:20	Caught netting gear
11	Hopper	2	10/07/2012	20:15	
12	Hopper	3	10/07/2012	23:00	
13	Hopper	4	11/07/2012	01:45	
14	Hopper	5	11/07/2012	04:30	Net snagged - hauled early - belly out
15	Hopper	6	11/07/2012	06:20	Netting gear entangled
16	Hopper	7	11/07/2012	09:00	
17	Hopper	8	11/07/2012	11:30	
18	Hopper	9	11/07/2012	14:00	

Observer rejoined FV Allegiance in Scarborough and sailed at 1900hrs on 08/07/12 steaming east to Area 4. Soft ground tows began at 0915hrs 09/07/12 and continued until 0015hrs 10/07/12 when they were stopped for a rest break of approximately 3hrs. Catch composition was characterised by high numbers of flat fish, namely PLE and LEM in addition to relatively high discard quantities (10-15 baskets) consisting again of high numbers of small flats, mainly DAB.

Figure 2: Typical haul from area 4 showing PLE and LEM

Fishing resumed at 0345hrs on 10/07/12 and continued till completion of soft ground tows at 1540hrs, catch composition remained similar to that of previous Scrapper hauls in this area. After a short steam (around 2h) the hard ground tows began at 1720hrs (10/07/12). The first trawl caught some netting gear, which delayed hauling whilst it was freed from the hopper net; however no damage was done to the survey gear. The next three hauls were carried out without incident moving into the morning of the 11/07/12. Catch composition also heavily weighted towards flat fish, namely PLE and LEM, with

relatively high variation in the amount of discards although species composition remained similar.

The 5th hard ground tow became snagged, indicated by a decrease in speed, decision made to haul early to find the net had been damaged, ‘’belly out’’. Volume of catch effected and solely PLE and LEM in retained catch. The following haul became entangled with netting gear on the ground. The volume of the catch was severely affected due to net damage totalling approximately 2 baskets. The net required mending once free from the foreign gear. The remaining three hard ground tows where completed without problem, finishing at 1600hrs on 11/07/12. These tows showed very consistent catch quantities with the proportion of PLE remaining high.

On completion of Area 4 FV Allegiance began steaming to Area 6 for approximately 8hrs.

Area 6

Summary Table

Primary Haul Number	Net	Net Number	Date of shooting	Time of shooting	Comment
1	Hopper	1	12/07/2012	01:15	
2	Hopper	2	12/07/2012	03:45	
3	Hopper	3	12/07/2012	06:20	
4	Hopper	4	12/07/2012	09:00	
5	Scraper	1	12/07/2012	11:45	
6	Hopper	5	12/07/2012	14:45	Lots of COD
7	Hopper	6	12/07/2012	17:40	Lots of COD
8	Hopper	7	12/07/2012	20:30	
9	Hopper	8	12/07/2012	23:10	
10	Scraper	2	13/07/2012	02:15	
11	Scraper	3	13/07/2012	05:25	Dead Seal
12	Scraper	4	13/07/2012	08:40	Seal vertebrae in discard
13	Scraper	5	13/07/2012	11:40	
14	Hopper	9	13/07/2012	14:50	
15	Scraper	6	13/07/2012	18:00	
16	Scraper	7	13/07/2012	20:50	Small NEP
17	Scraper	8	13/07/2012	23:50	Small NEP
18	Scraper	9	14/07/2012	02:45	Small NEP. Net snagged hauled early

FV Allegiance arrived at Area 6 and began the first hard ground trawl at 0330 on 12/07/12. And continued with this gear for four tows, the species diversity appeared higher compared to the previous area. This was particularly noticeable in the discards. Bulk began very high with the first haul but became lower over the tows; however species composition and the quantity of retained catch appeared consistent over these four hauls, all including numbers of COD, WHG, PLE and LEM in the retained catch, however only the 4th haul contained NEP. The gear was then changed for one haul due to an area of soft ground and at 1145 the first Scrapper tow was shot. This haul contained similar species but a higher proportion of PLE.

The next four hauls starting at 1445hrs were carried out using the hopper net. The first two of these hauls showed a marked increase in the proportion, number and size range of COD (9 Boxes retained in one haul), however the following hard ground tows produced little COD and once again a higher proportion of

PLE was seen. This went through to the morning of 13/07/12 when at 0215hrs the scrapper net was shot once again and continued for four hauls.

Figure 3 Showing the first haul containing higher numbers of COD

The volume of these hauls started particularly high but the bulk did reduce as they continued, although the retained catch remained relatively consistent in composition and volume. The main proportion of retained catch consisted of PLE, however COD where represented in low numbers in each haul. The second of these soft ground tows lifted a dead seal, however the crew managed to remove most of this before it reach the cod end and the observer have contact with it, however a proportion of its back bone was present in the discards of the following haul.

At 1450hrs the last hard ground tow was shot. This showed an obvious increase in COD and a distinct decrease in PLE in the retained catch compared with the scrapper net. At 1800hrs work with the Scrapper net resumed and continued to completion at 0455hrs on 14/07/12. These tows showed a very similar catch composition to the previous soft ground trawls in this area, however bulk and therefore discards where more consistent in amount and relatively low and the last three contained obvious numbers of NEP. The last of these tows came fast and was hauled 20mins early however the catch composition remained consistent with previous trawls.

The FV Allegiance steamed for Scarborough and landed around 1500hrs on 14/07/12.

I'd like to thank the skipper and crew of the FV Allegiance for all their help and patience during this survey.

Annex C North Sea whitefish survey detailed operations plan.

FISHERIES SCIENCE PARTNERSHIP: FSP (2012-13)

North Sea Whitefish survey: 1 June - 31 July 2012

Detailed Operation Plan (June 2012)

VESSEL

FV Allegiance S
Skipper: Danny Normandale

OBSERVERS

Samantha Elliot

DEPARTURE DATE AND LOCATION

31st May 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 $53^{o}30'$N – 62^{o}N, 0^{o} - 7^{o}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 $53^{o}30'N$ – $62^{o}N$, 0^{o} - $7^{o}E$ (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 start on the fishing ground at the beginning of 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 substrate. Further information on the rectangles without data is being collected and the map will be updated as the survey progresses.