

# *North Sea Whitefish Survey: 2010*

Prepared by

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## **Executive summary**

The North Sea Whitefish (NSW) survey sailed on 31 May 2010, fishing operations began on 1 June and were completed after three fishing trips on 30 June. 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 first two surveys are encouraging. The NSW recorded a good range of ages for all target species in all of the areas surveyed. Variations in the distributions and catch rates across the North Sea will, as the time series develops, allow the testing of a number of questions related to substratum, gear and spatial distribution of the target species.

In 2009 catch rates of the target gadoid species were higher on hard ground than on soft; in 2010 catch rates between the substrates 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 between years is 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 both years with differences in age distribution related to the area of fishing rather than the substrate 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 were similar in 2009 and 2010. Catches of older fish were more frequent and showed less noise in the NSW 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 indicate the potential for a time-series based on commercial vessels, derived across the areas surveyed. Such a series could be used to follow the development of the stock dynamics of key North Sea species and to investigate the dynamics of each on soft and hard substrata as population abundance changes over time.

## **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 the 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**

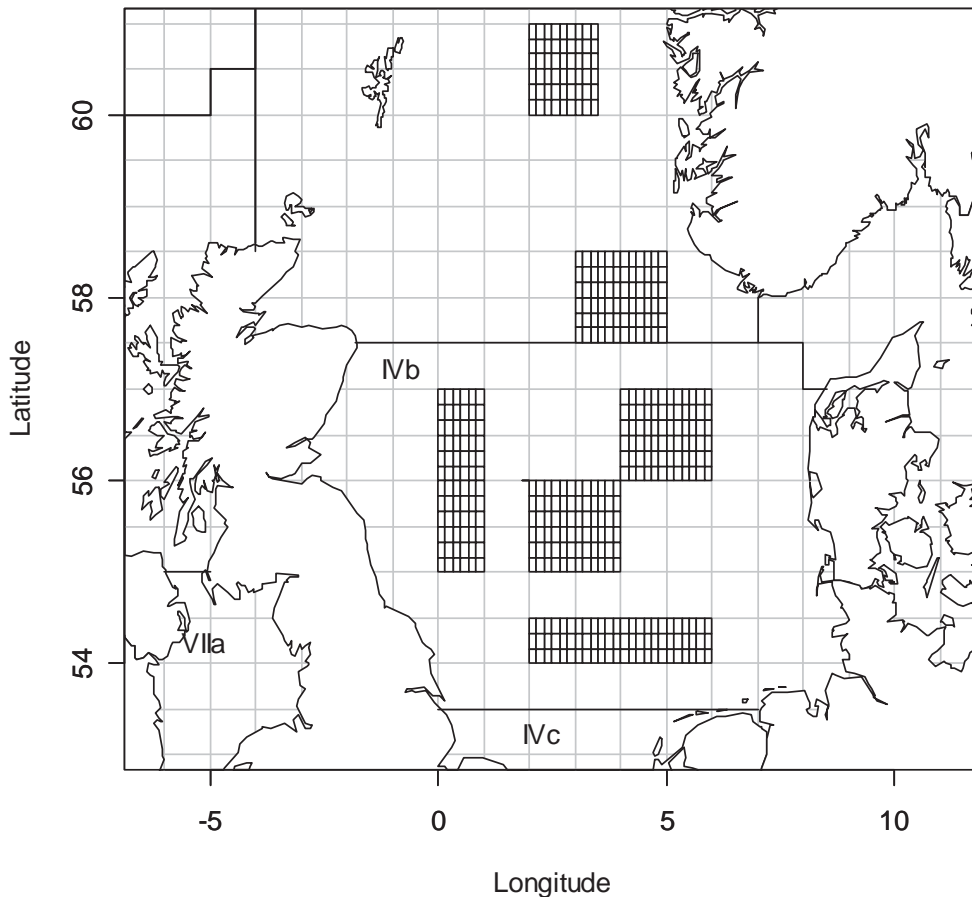
The North Sea whitefish (NSW) survey is designed to provide a time-series of information on commercial vessel catch per unit effort from representative fishing grounds within the North Sea. Each year, data gathered by the survey will be supplied to the ICES Working Group on the Assessment of Demersal 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 sub-areas 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 highest 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 hours 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 any 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 hour 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 agreed protocol will be maintained in future.

## **The 2010 survey**

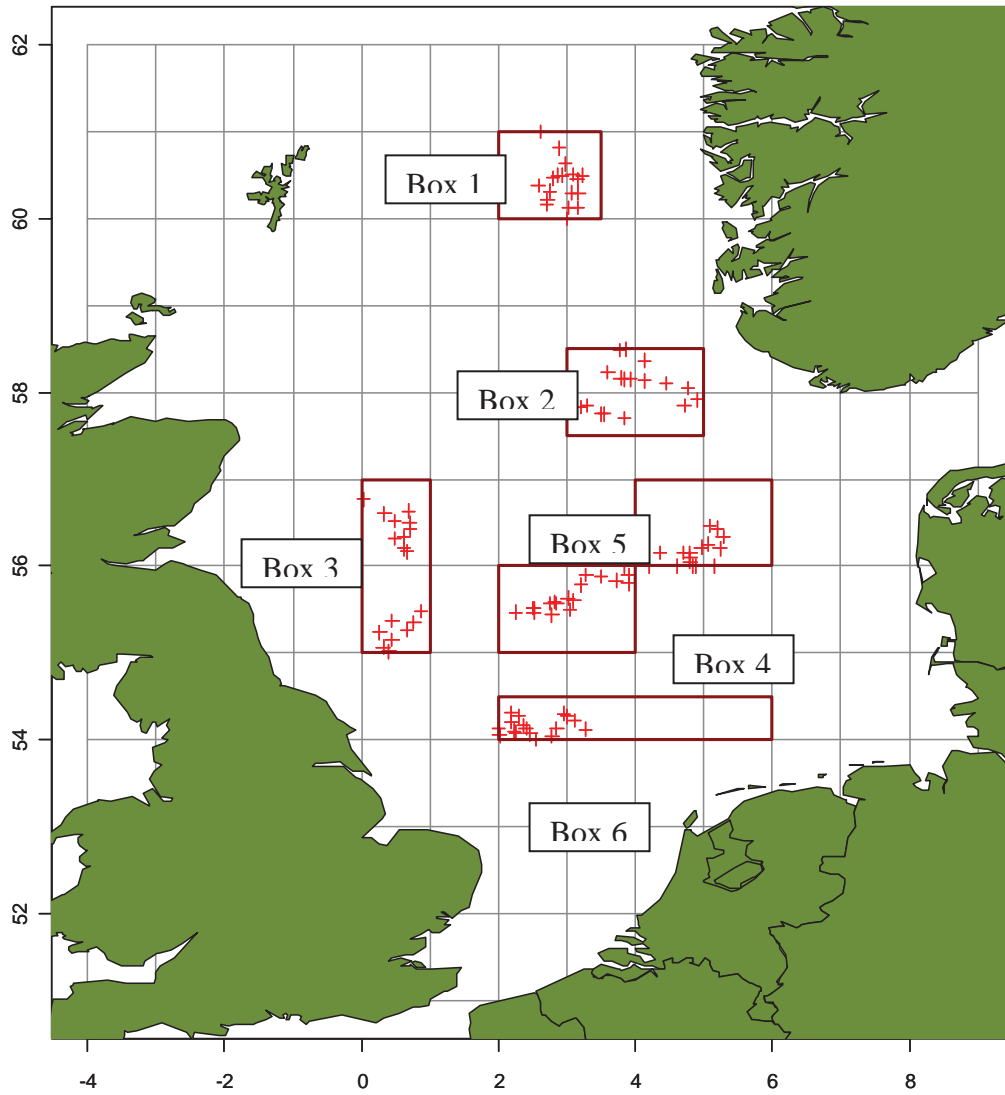
Fishing operations began on 1 June and were completed after three fishing trips on 30 June. The skipper's report from the survey is presented as Annex A. The vessel used for the survey was the Allegiance, a trawler operating of Peterhead and skippered by Danny Normandale. Its grt was 145t, length overall 18.26m, and 309 bhp. All fishing operations were recorded and observed by the two Cefas observers that covered the trips, their reports from the three fishing trips are presented as Annex B.

Each of the specified fishing grounds was visited and a total of 18 tows were completed on hard and soft substratum. Two-hour fishing tows were conducted with each gear type by night and day, with appropriate breaks for the Cefas observers. 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 2010 survey are plotted on Figure 2.

Length distributions of cod, haddock, whiting, saithe and plaice, and the volume of the catch of all other species, were recorded. 200 otoliths were collected from the full size range of cod, haddock and whiting for age determination at Cefas. This was a change from the 2009 survey in which fewer NSW survey otoliths were combined with those from the Cefas third quarter survey which was conducted immediately after the FSP survey. The combination of Cefas and FSP survey otoliths were used to provide full coverage of the length distributions and keep age reading costs to the minimum necessary within the budgeted allocation to the project. However missing otoliths for some lengths resulted in difficulties in raising the data in 2009 and therefore this year a full range of otoliths were collected on the NSW survey. Comparisons between the two procedures will be made to design a suitable protocol for future surveys.

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.

## Map of ALLEGIANCE 1/10 Station positions



**Figure 2.** Starting positions of the 2010 North Sea Whitefish (NSW) survey fishing stations.

## Results

Table 1 presents the 2010 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 2010 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	7547	5503	2044	73%	27%
Haddock	4591	3873	718	84%	16%
Whiting	3847	2348	1499	61%	39%
Saithe	4460	4248	212	95%	5%
Plaice	7463	6659	804	89%	11%
Hake	669	596	72	89%	11%
Lemon sole	3191	2930	261	92%	8%
Ling	646	508	138	79%	21%
Monk	43	39	4	91%	9%
Witch	179	119	61	66%	34%
Dab	4164	384	3780	9%	91%

### Cod

The age of the cod caught ranged from 0 to 10 years, with the majority of fish aged 1–3 (Table 2). In 2009 older fish were taken predominantly in the north on both hard and soft substrates and almost exclusively on hard ground in the south; juveniles dominated in the south on the hard ground. In 2010 the North south divide in catch rates was still apparent but the distribution of catch rates on hard and soft substrates was more even with highest catch rates in areas 2,3 and 6 on soft ground. Catch rates of one year old fish were higher on soft ground in all areas. Overall, 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. The same gear types were used for each substrate and as yet the reason for the reversal is unknown; it will be investigated further.

In 2009, although there were differences in the absolute catch rates on hard and soft ground types, the relative strength of the year classes caught was generally independent of substrate type. In 2010 catch distributions at age on



the southern and eastern grounds (4–6) were consistent between substrates (Figure 3), on the northern and western grounds, the distributions in Figure 3 indicate strong differences in relative catch rates at age one but for ages 2 and older very similar age distributions.

Figure 4 presents the preliminary 2010 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 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 areas 1 and 2, but with different age distributions, in 2010 the range of ages caught in those areas is not as great and differences in the distribution at age are not as clear. In the other areas, cod aged 1 and 2 dominated both sets of catch rates in 2009 and 2010. Also, whereas the NSW survey caught older fish in 2009 where the IBTS recorded zeroes in the age distribution, this is not as apparent in 2010.

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 and 2010 (the estimates for each age are plotted relative to the catch rate for age 2 to allow comparison). When derived across all ages, the IBTSq3 survey index has similar coverage of the age range to that of the NSW survey. The figure demonstrates the expected difference in gear selectivity at the youngest two ages at least, with the IBTS catching relatively more cod aged 0 and 1; at older ages, relative to age 2, the NSW survey showed a greater rate of decline in age classes at ages 3–6+ in 2009 and 2010. Figure 5b compares the indices at age from the two surveys observed for 2009 and 2010. There is a linear relationship between the two surveys indicating good agreement between the two series.

### ***Haddock***

The age of haddock caught ranged from 0 to 11, 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 the grounds 1–4, with very low catch rates in the south from area 6.

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



age in the North and east (boxes 1,2,5) on hard compared to soft ground especially the catch rates at age 1 which were higher on soft ground (similar to those of cod).

Figure 7 presents the preliminary 2010 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 higher selection for young fish, so catches of ages 1 are higher relative to the older ages; catch rate distribution at age on the soft ground from the NSW is very similar to that of the IBTSq3 for boxes 1 and 2 which differs from the distribution of catch rates on hard ground.

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 and 2010 (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 but more problematic 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 and 2010. There is an approximately linear relationship between the two surveys but a greater range of year classes will be needed to confirm it.

### ***Whiting***

The age of the whiting caught during the survey ranged from 0 to 13, with the majority of fish aged 1–6 (Table 4, Figure 9). In 2009 catches in the north and west (areas 1–3) had a broad range of ages, those in the south and east were predominantly ages 1 and 2. In 2010 there was a broad range and very similar distribution of ages in the catches from all areas.

In 2009 a substantial difference between catch rates on hard and soft ground was recorded in the ratio 20 : 1 – 40 : 1 in the east (areas 4 and 5), 3 : 1 – 4 : 1 in the northern areas 1 and 2, and comparable rates in areas 3 and 6. In 2010, as for cod and haddock the differences between substrates are less noticeable. Area 5 and 6 recorded a substantially higher catch on hard ground (2 & 3:1); in area 3 soft ground catches were substantially higher (1:6) and in all other areas catch rates were comparable. In all areas catch rates were dominated by ages 1 - 3 showing good recent recruitment.

Figure 10 presents the preliminary 2010 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 higher selection for young fish, so catches of ages 0 and 1 are higher relative to those of older ages. For the older ages, the distributions were similar between the IBTSq3 areas and the NSW, although the NSW caught very low proportions of whiting age 4. Both surveys record the dominance of young fish in the south and east with a broader age range in the north and west.

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 and 2010 (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 and 2010. There is a linear relationship between the two surveys indicating good agreement between the two series in 2009 but less so in 2010.

### ***Plaice and saithe***

The frequency distributions at length of plaice and saithe catches by area are shown in Figures 12 and 13. In 2009, as would be expected from the known distribution of the stocks, plaice were caught primarily in south, areas 4–6. In 2010 substantially higher catch rates were recorded in areas 2 and 3 than the previous year (Figure 12), by a factor of around 10. For saithe (Figure 13) catch rates were significant only in the north in area 1 (area 2 in 2009).

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. 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 with the 2009 survey the 2010 results are encouraging. The NSW observed 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 the 2009 and 2010 surveys raise questions that will allow testing of a number of questions related to substratum, gear and spatial distribution as the time series develops.

Throughout the survey area, in 2009 catch rates of the target gadoid species were better on hard ground than on soft. In 2010 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 more related to spatial differences in the fishing pattern and the distribution of fish. Overall in 2010, the age structure recorded on soft ground was similar to that on hard 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 were similar. In both years catches of older fish were more frequent and showed less noise in the NSW data than in the IBTSq3. As noted last year, differences in the relative catch rates of older whiting between the two surveys will require analysis as the time-series develops.

The results indicate the value in developing a time-series for gadoids based on a commercial vessel, derived across the areas surveyed. The series could be used to assess the development of stock dynamics of key North Sea species and to investigate the dynamics of each species on soft and hard substrata as population abundance changes over time. It could also provide valuable input to the debate on the dynamics of the stocks and survey practices.

**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 2010.

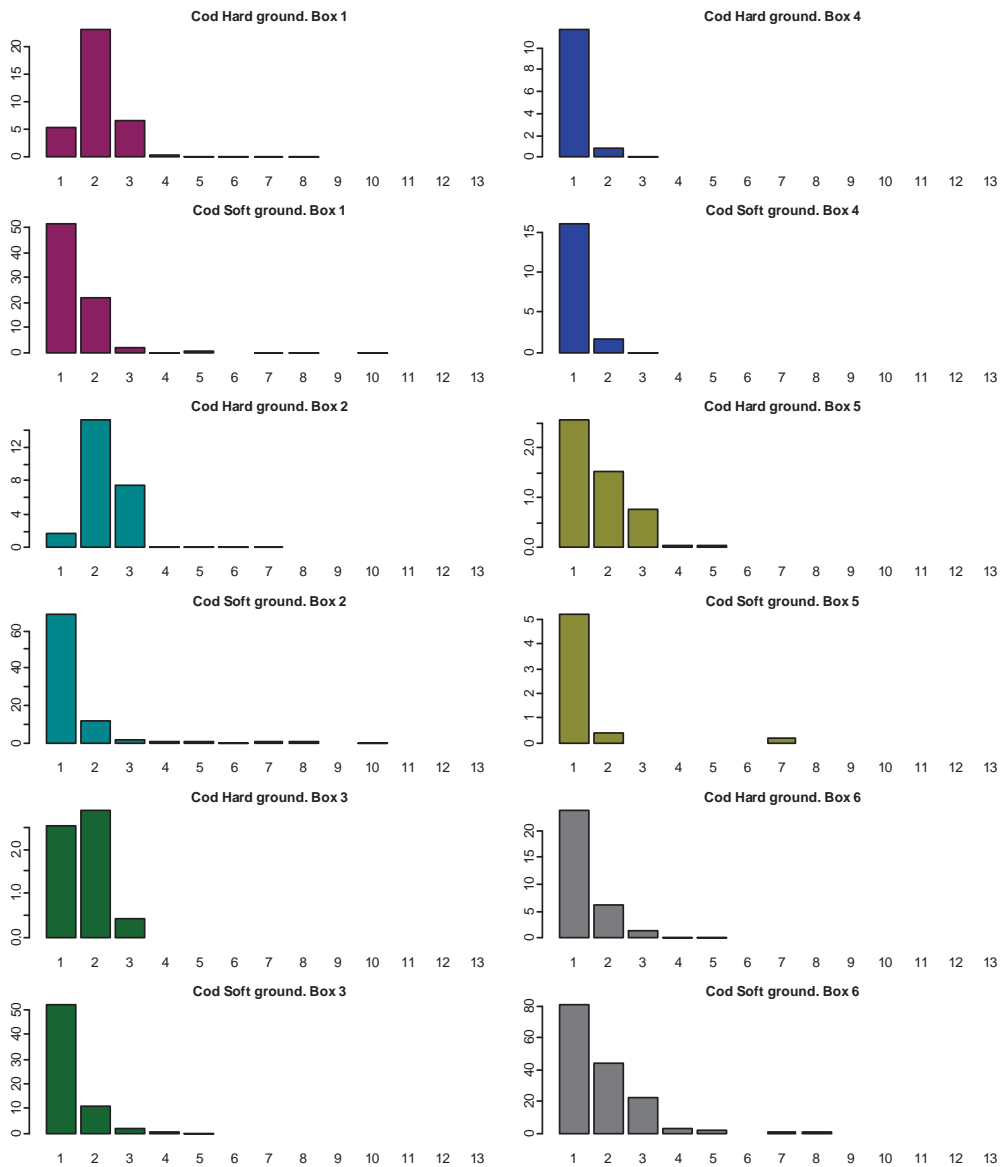
Cod Area	Ground	Average number caught at age per hour												Total			
		0	1	2	3	4	5	6	7	8	9	10	11		12		
1	Hard	0.00	5.31	23.33	6.74	0.27	0.18	0.04	0.04	0.05	0.00	0.00	0.00	0.00	0.00	0.00	35.95
1	Soft	0.00	51.40	21.77	1.68	0.13	0.20	0.00	0.07	0.04	0.00	0.02	0.00	0.00	0.00	0.00	75.31
2	Hard	0.00	1.63	15.36	7.35	0.15	0.12	0.09	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.83
2	Soft	0.00	68.77	11.85	1.58	0.46	0.83	0.14	0.31	0.27	0.00	0.02	0.00	0.00	0.00	0.00	84.22
3	Hard	0.00	2.51	2.89	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.82
3	Soft	0.00	51.91	10.60	1.99	0.27	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	64.89
4	Hard	0.00	11.76	0.81	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.64
4	Soft	0.00	16.02	1.75	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.78
5	Hard	0.00	2.57	1.53	0.78	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.96
5	Soft	0.00	5.20	0.40	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.80
6	Hard	0.00	23.91	6.22	1.45	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.69
6	Soft	0.00	80.98	43.67	22.13	2.99	1.84	0.00	0.94	0.57	0.00	0.00	0.00	0.00	0.00	0.00	153.11

Mean	Hard	0.00	7.95	8.36	2.80	0.09	0.06	0.02	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean	Soft	0.00	45.71	15.01	4.56	0.64	0.50	0.02	0.25	0.15	0.00	0.01	0.00	0.00	0.00	0.00	0.00
	Ratio		0.17	0.56	0.61	0.14	0.13	0.89	0.12	0.06							
Hard	Cum %	0%	41%	84%	99%	99%	100%	100%	100%	100%							
Soft	Cum %	0%	68%	91%	98%	99%	99%	99%	100%	100%							



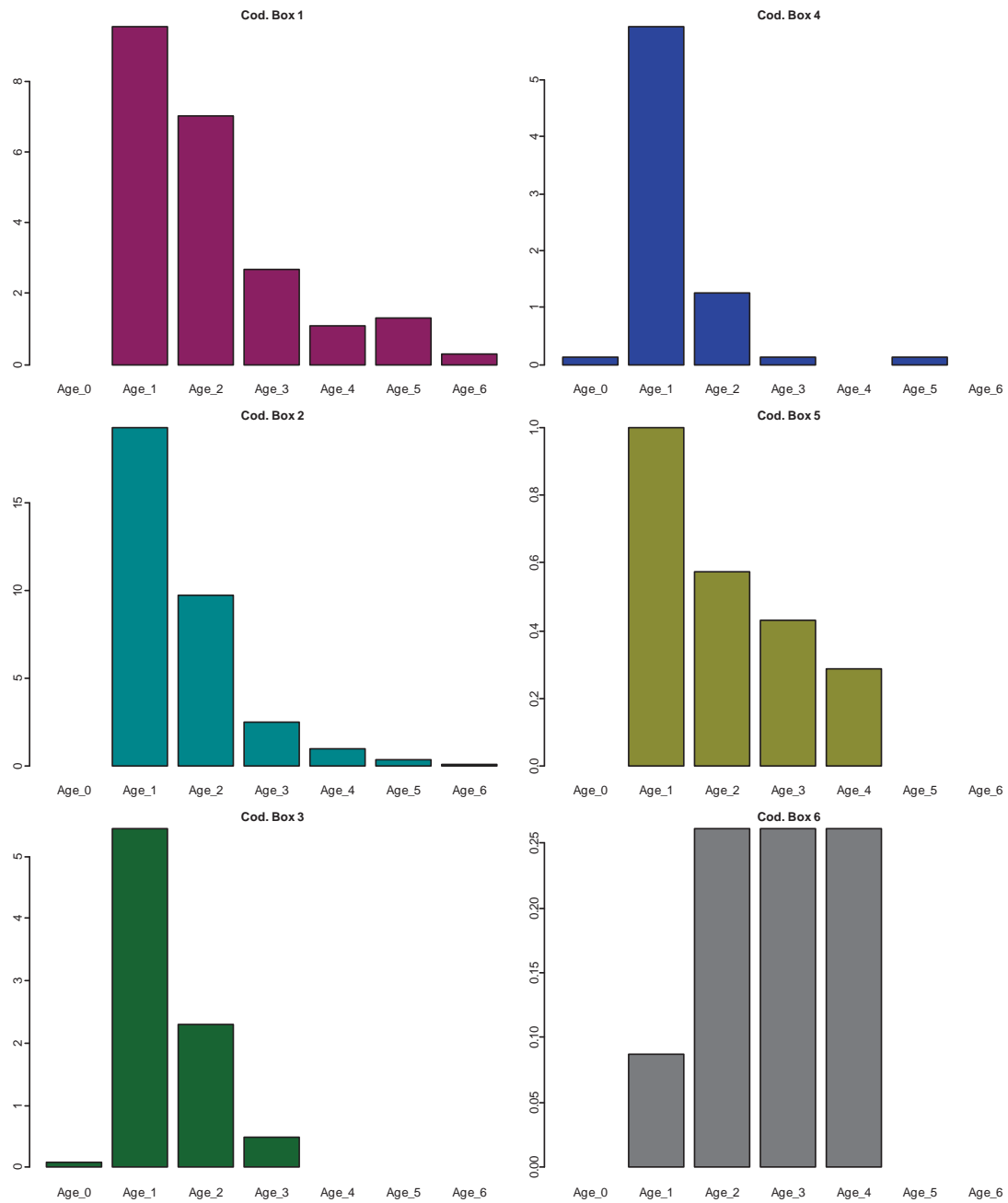
**Table 4.** North Sea whiting catch numbers per hour at age recorded from nine hard and soft ground tows in each of the fishing areas surveyed by the North Sea Whitefish survey in June 2010.

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	0.01	2.71	4.80	2.22	4.59	2.13	0.23	0.33	0.00	0.32	0.00	0.00	17.33
1	Soft	0.00	1.48	7.25	7.80	1.12	3.02	1.69	0.27	0.44	0.00	0.33	0.00	0.07	23.47
2	Hard	0.00	3.00	8.34	7.22	0.26	1.88	0.76	0.18	0.25	0.00	0.25	0.00	0.25	22.39
2	Soft	0.00	13.37	19.92	16.56	1.59	4.50	2.45	0.91	0.61	0.00	0.48	0.00	0.40	60.80
3	Hard	0.00	1.57	11.54	12.27	2.06	4.34	1.98	1.09	0.65	0.00	0.55	0.00	0.07	36.12
3	Soft	0.00	6.56	66.51	73.34	10.63	24.33	8.57	5.18	3.46	0.00	3.16	0.00	0.70	202.44
4	Hard	0.00	6.43	13.47	12.30	1.05	3.30	1.66	0.49	0.47	0.00	0.44	0.00	0.29	39.90
4	Soft	0.00	11.10	14.89	7.06	0.28	1.58	1.10	0.16	0.16	0.00	0.16	0.00	0.58	37.07
5	Hard	0.00	1.91	4.99	2.98	0.14	0.80	0.45	0.05	0.05	0.00	0.05	0.00	0.15	11.57
5	Soft	0.00	1.51	2.13	1.43	0.18	0.52	0.24	0.08	0.02	0.00	0.02	0.00	0.07	6.20
6	Hard	0.00	55.40	93.09	59.15	1.35	12.78	8.20	0.63	1.36	0.00	1.36	0.00	2.73	236.07
6	Soft	0.00	18.73	36.03	24.56	0.55	5.31	4.78	0.14	0.39	0.00	0.38	0.00	0.96	91.82
Mean	Hard	0.00	11.39	22.36	16.45	1.18	4.61	2.53	0.44	0.52	0.00	0.50	0.00	0.58	
Mean	Soft	0.00	8.79	24.45	21.79	2.39	6.54	3.14	1.12	0.85	0.00	0.75	0.00	0.46	
	Ratio		1.29	0.91	0.75	0.49	0.71	0.81	0.40	0.61		0.66		1.26	
Hard	Cum %	0%	19%	56%	83%	85%	92%	97%	97%	98%	98%	99%	99%	100%	
Soft	Cum %	0%	13%	47%	78%	82%	91%	95%	97%	98%	98%	99%	99%	100%	

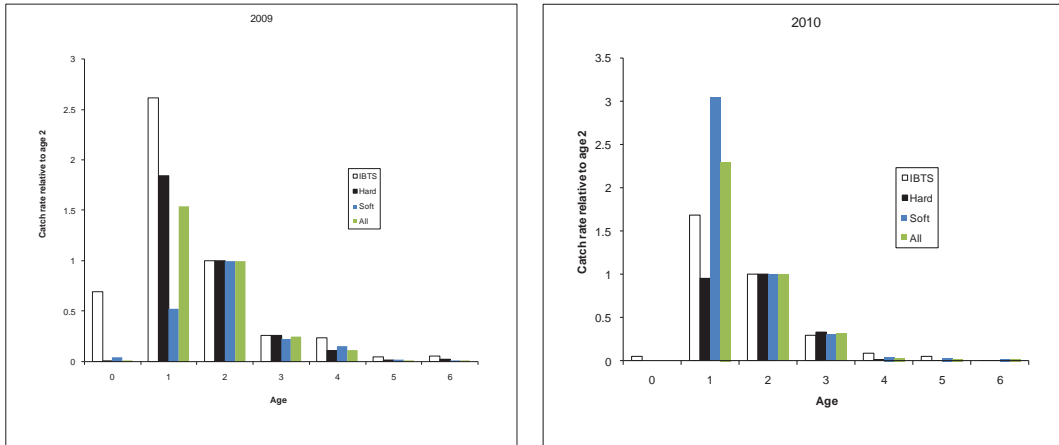


**Figure 3.** North Sea cod catch numbers per hour at age recorded from nine hard and soft ground tows in each of the fishing areas surveyed by the North Sea Whitefish survey in June 2010.

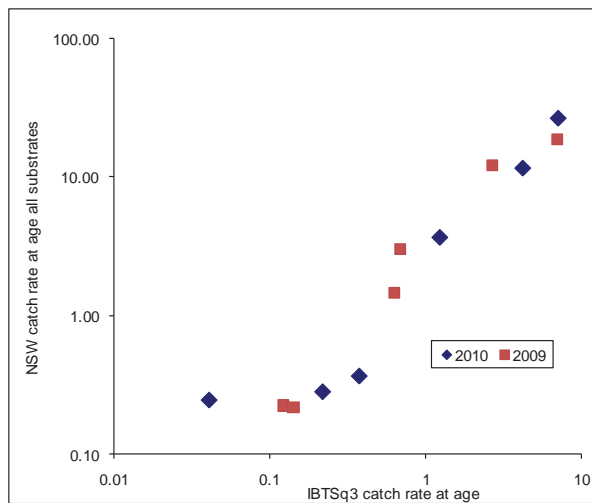




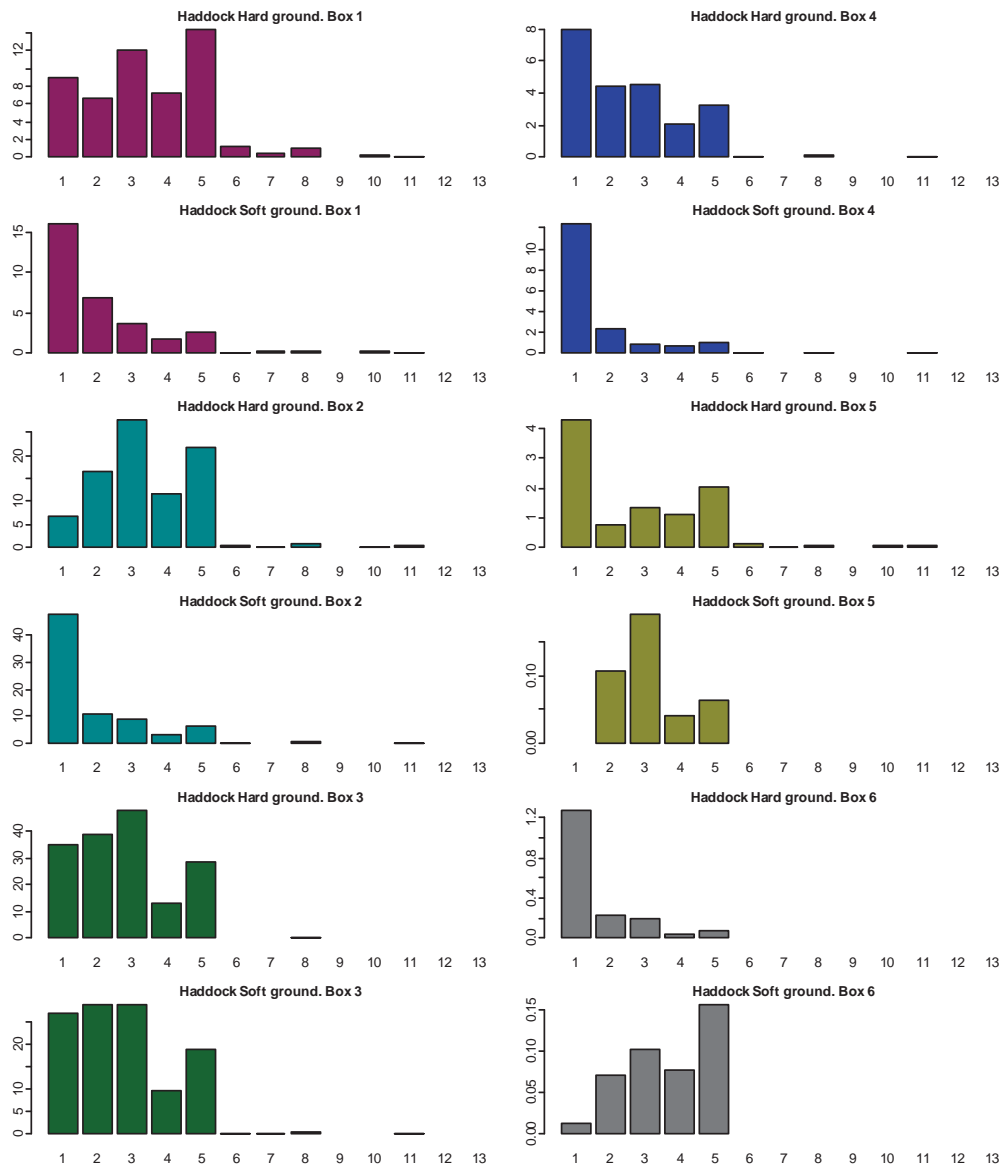
**Figure 4.** North Sea cod catch numbers per hour at age recorded by the ICES IBTS quarter three survey tows surrounding and within each of the fishing areas surveyed by the North Sea Whitefish survey in June 2010 (age 6 is a plus group). Note the y axis of the bottom right figure which results from very low catch rates.



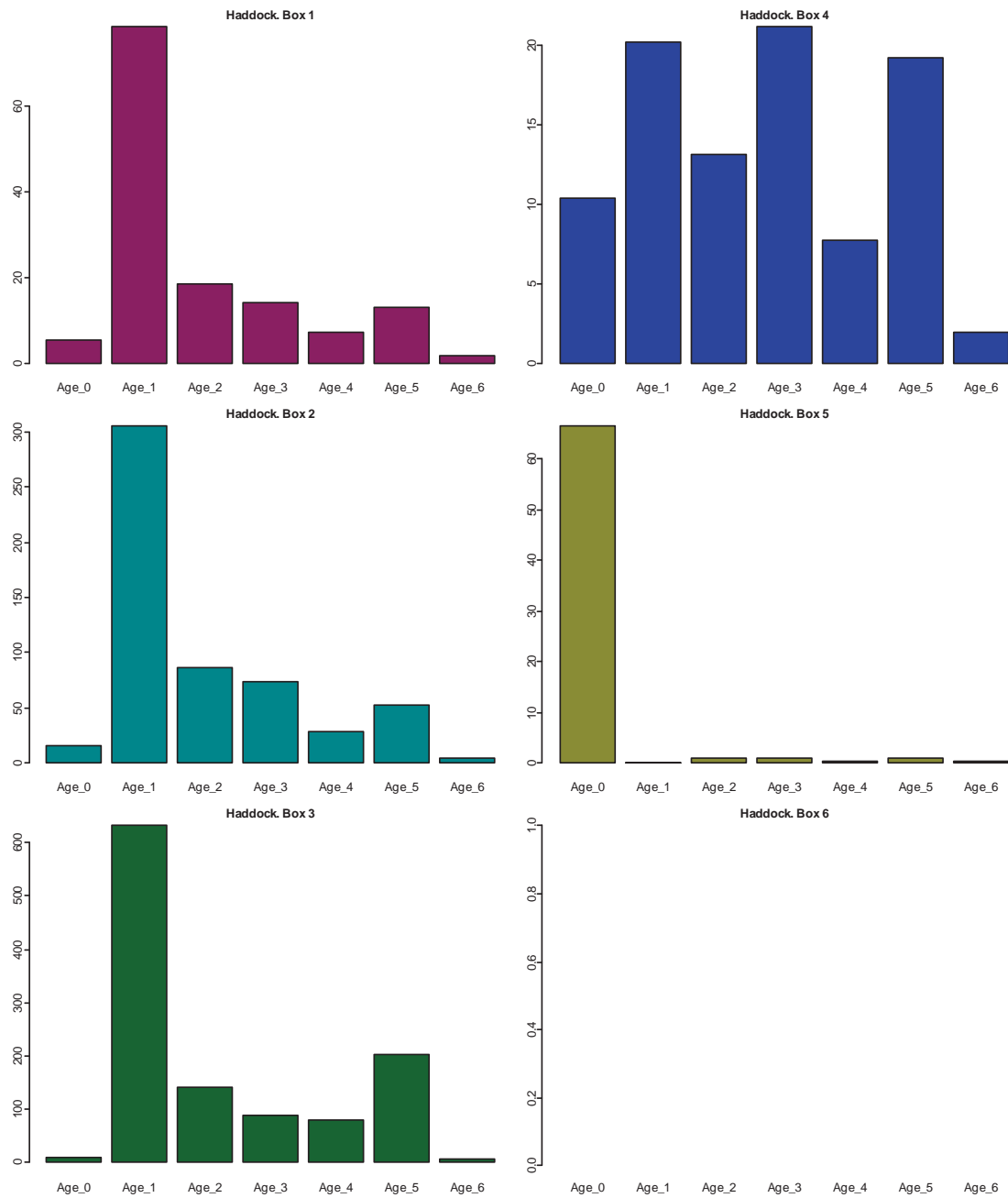
**Figure 5a.** North Sea cod comparison of the relative (to age 2) catch numbers per hour at age recorded in 2009 and 2010 by the FSP NSW survey and the ICES IBTS quarter three survey across the whole of the North Sea.



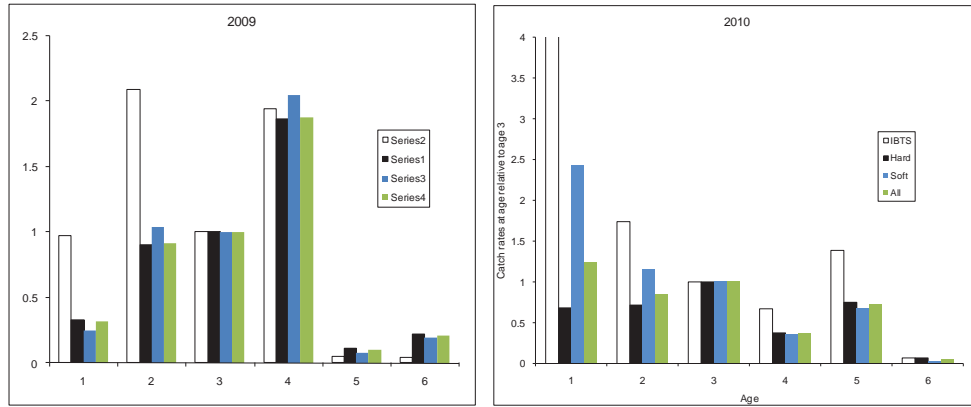
**Figure 5b.** North Sea cod comparison of the catch numbers per hour at age (log scale) recorded in 2009 and 2010 by the FSP NSW survey and the ICES IBTS quarter three survey across the whole of the North Sea.



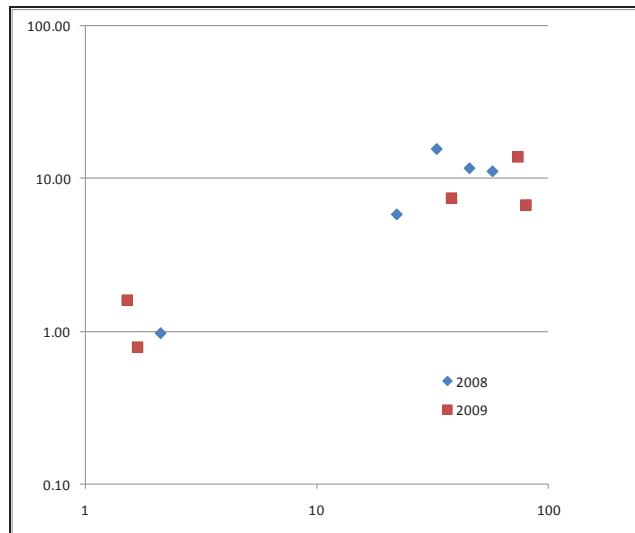
**Figure 6.** North Sea haddock catch numbers per hour at age recorded from nine hard and soft ground tows in each of the fishing areas surveyed by the North Sea Whitefish survey in June 2010.



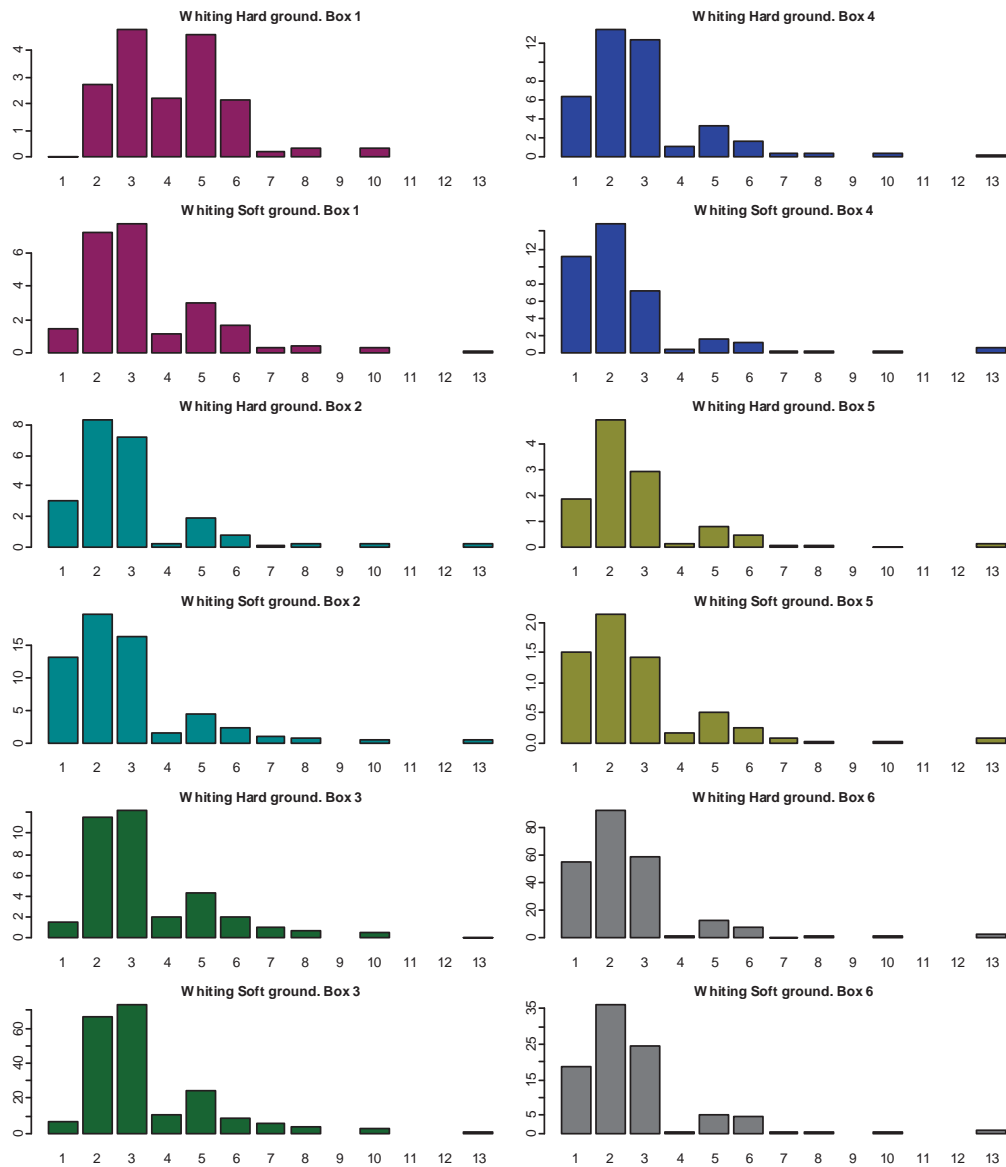
**Figure 7.** North Sea haddock catch numbers per hour at age recorded by the ICES IBTS quarter three survey tows surrounding and within each of the fishing areas surveyed by the North Sea Whitefish survey in June 2010 (age 6 is a plus group).



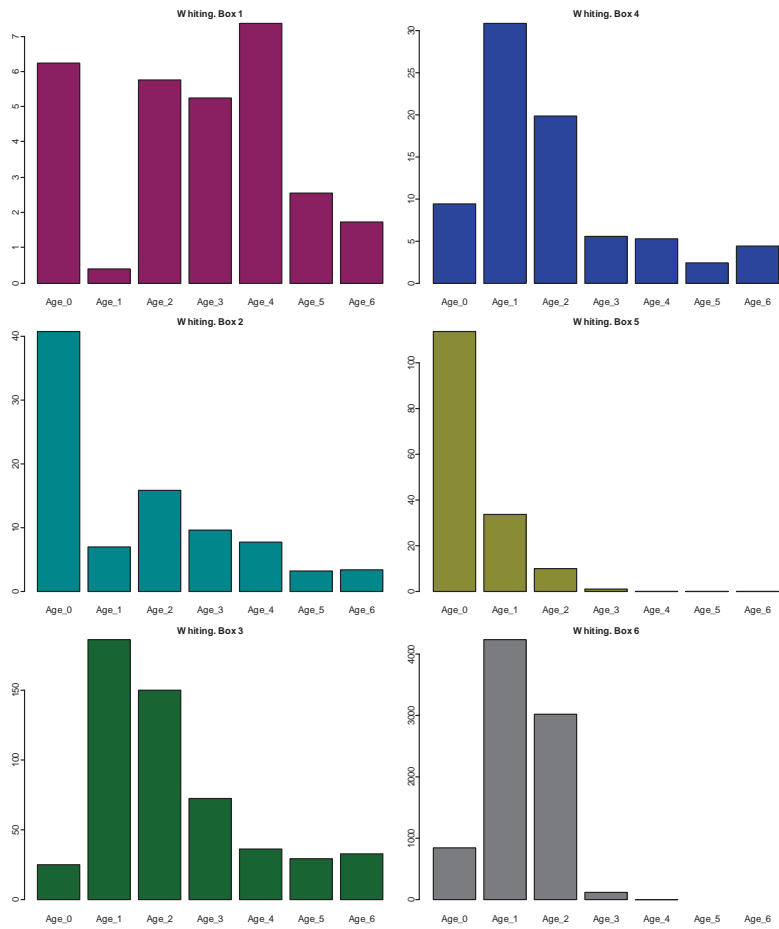
**Figure 8a.** North Sea haddock comparison of the relative (to age 3) catch numbers per hour at age in 2009 and 2010 recorded by the FSP NSW survey and the ICES IBTS quarter three survey across the whole of the North Sea.



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

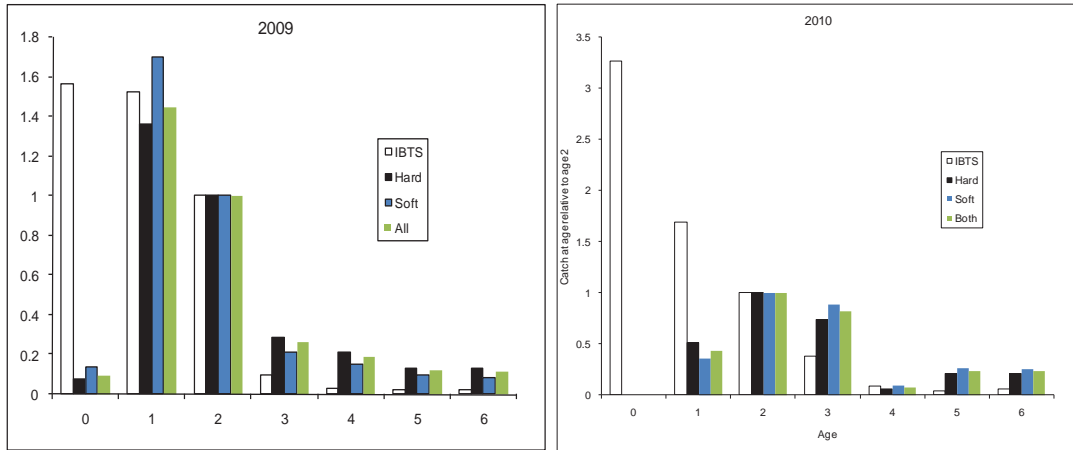


**Figure 9.** North Sea whiting catch numbers per hour at age recorded from nine hard and soft ground tows in each of the fishing areas surveyed by the North Sea Whitefish survey in June 2010.

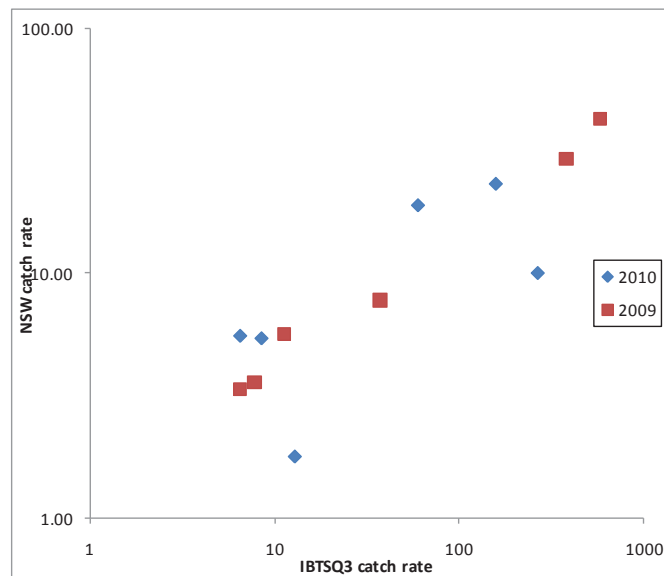


**Figure 10.** North Sea whiting catch numbers per hour at age recorded by the ICES IBTS quarter three survey tows surrounding and within each of the fishing areas surveyed by the North Sea Whitefish survey in June 2009 (age 6 is a plus group).

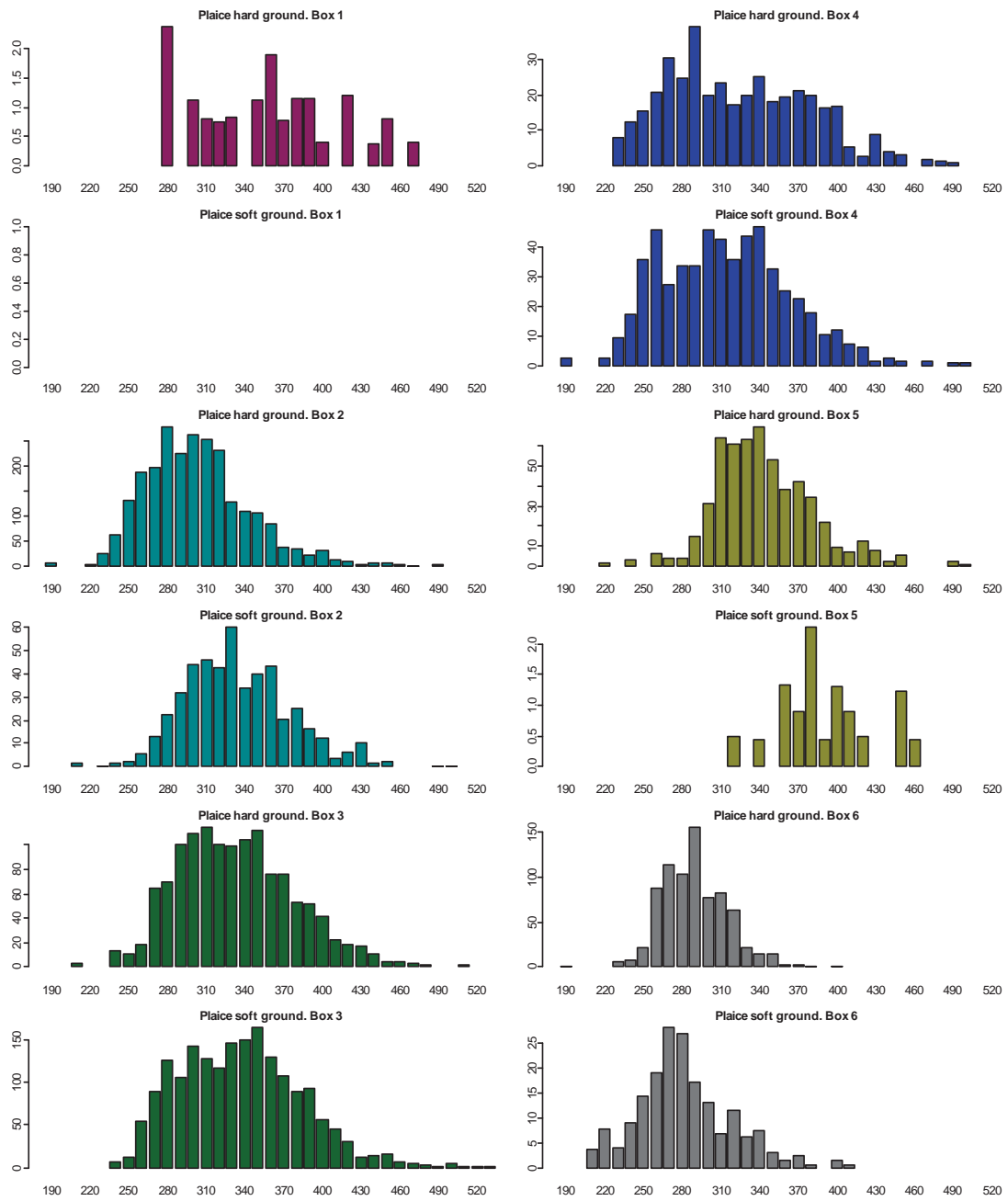




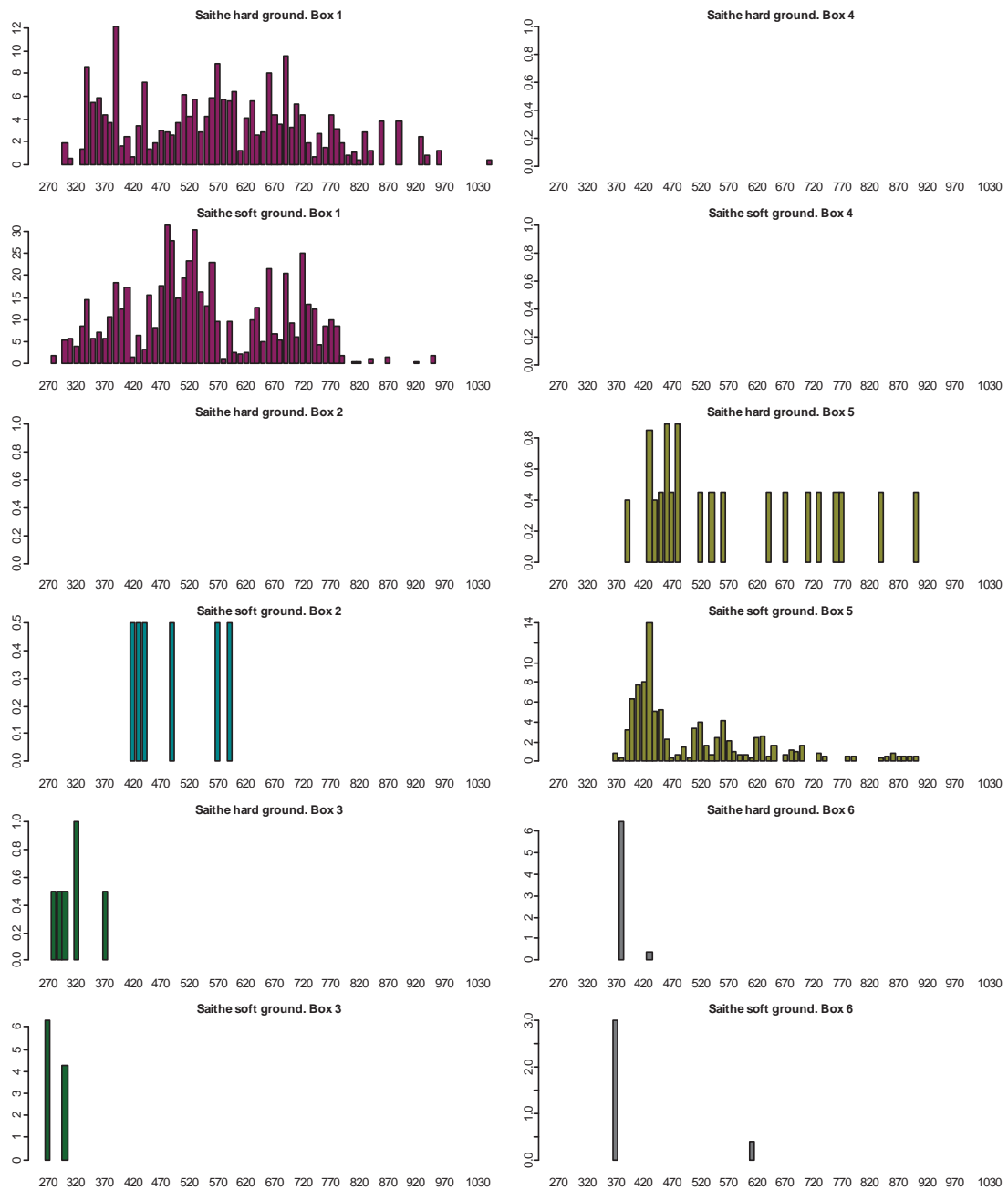
**Figure 11a.** North Sea whiting comparison of the relative (to age 2) catch numbers per hour at age recorded by the FSP NSW survey and the ICES IBTS quarter three survey across the whole of the North Sea.



**Figure 11b.** North Sea whiting comparison of the catch numbers per hour at age (log scale) recorded in 2009 and 2010 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 2010



**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 2010

## **Annex A North Sea whitefish survey 2010 skippers report.**

**Allegiance SH 90 CEFAS North Sea survey, June 2010.**

**Danny Normandale**

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

Observer onboard for the first trip, Peter Randall.

### **Area 1**

We sailed from Lerwick at 1830 hrs on the 31 May. The weather was fine with a calm sea and no swell. We arrived on station the following day at around 11.30. Shooting the scraper trawl in 100 fathoms we managed to get 3 hauls before the end of the day. Each of these hauls resulted in a full codend but we only managed 29 boxes of saveable fish from these. I was disappointed with this as in these areas we would hope for much better catches. Unfortunately the tides were taking off and that's when the Gurnards set in.

The following morning we shot the scraper trawl again keeping only 6 boxes of fish from a full codend. The discards were all Gurnards. We dodged a few miles to the west into shallower water around 60/70 fathoms, shooting the hopper trawl for the first time in the trip. We managed 4 hauls during the remainder of the day producing 63 boxes, so better results in the shoal water.

We lay for a few hours during the night then started in the deep water again next morning, shooting the scraper trawl. This was not good as we were taking 2 lifts of fish each haul, 30-35 boxes of bulk but again only retaining 5-8 boxes each go. There were seven big freezer trawlers of about 40-65 metres in length in the area. These ships were towing at about 5 knots while we were towing at 3 knots. I suspect these vessels were targeting coley and had speeded up the fish to such an extent that we couldn't catch any, so we moved to shallower water again. We finished the day shooting the hopper net catching 28 boxes for 2 hauls.

The following morning we shot the scraper net and had 2 hauls in the soft. This completed the scraper tows. Early next morning we shot the Hopper net and towed it south for 3 hauls, completing all of Area 1. We then seamed 80-miles to Area 2.

### **Area 2**

We shot the scraper net at 0515 and had 2 tows with poor results so steamed SE into 130 fathoms, shooting the scraper trawl again. We came fast after an hour

for 2 boxes then took the scraper net aboard and steamed 10 miles SW to some hard ground where we could work the hopper net. We had 2 hauls here but came fast after 1 hour each time. We took the net aboard and lay for the rest of the night.

We started early next day to allow us to get all 7 of the hopper tows in by the end of the day, which we achieved. The fish caught during these hauls was mainly haddock, but very good, well-fed fish.

We steamed 20 miles during the dark to a large area of soft ground and began fishing early to get all 6 of the scrapper tows completed by the end of the day. These 6 tows were done in fairly shallow water with lots of warp out to increase our spread. This produced some very good fish though not enough of it. (46 boxes). This was an area we hadn't tried to before, but will return at some point with the twin rig trawls. Towing for 5 hours should produce some good results.

This completed Area 2, and we headed for Peterhead to land our catch, which was good quality fish.

## Area 5

Observer onboard for second trip, Samantha Elliott.

We had a couple days in Peterhead while changing observers, sailing late evening on 10<sup>th</sup> June. The steam to Area 5 took around 30 hours and the weather was fine during this passage.

The scraper net was shot at 0230 and we worked through till late evening, getting 5 hauls in. We took only 30 boxes fish for the day but this was good-sized quality plaice. The weather began to freshen from the NW, 6/7 creating a big swell. This stayed with us for around 48hours. During this time the observer did very well and attended every haul.

We began the following morning with the scraper trawl, completing the last 4 hauls with that net in that area by mid afternoon. We ended the day with 2 hauls using the hopper net with very poor results.

Next day we started with a haul of really good fish but again not enough. These results continued for the remainder of the day. We finished Area 5 that evening.

We had a 7-8 mile steam west to Area 4 during the dark.

#### Area 4

The day started with poor weather and a large swell from the NW, force 6. We shot the hopper net around 0440 and did 6 tows then 1 with the scraper net. The hopper net tows were so poor that some hauls didn't fill a single box. The scraper net produced significantly better results with 9 boxes filled.

Around 1700 we observed the first fishing boat we'd seen during 4 days at sea. We completed the day around midnight.

The weather eased off considerably overnight and we shot the scraper trawl at 0430 in a slight northerly swell. The next 6 tows were quite good, producing 52 boxes, which was a welcome sight after the previous days fishing. We ended the day around midnight again.

The last day in Area 4 began at around 0430, again shooting the scraper net with good results for the last 3 hauls. Around mid afternoon we shot the hopper net for the remaining 2 tows. I was pleasantly surprised to see 2 x 7 boxes.

This concluded the trip and we set off to Scarborough with 200 boxes of mainly plaice aboard. This fish was landed on Grimsby market in the early hours of Monday morning.

#### Area 6

Observer onboard for the third trip, Peter Randall.

We sailed from Grimsby at 0100 as the lock gates opened, heading 80 miles east to the Silver Pits. On arrival we shot the scrapper net catching some big cod but not enough so we shifted 3 miles to a shady bit of bottom running NW/SE with much improved results. This haul consisting of 36 boxes of big, sprag cod. We carried on towing NW for the following haul but only managed 7 boxes. This was also cod but of a smaller run. We finished the day around 2300 and steamed 20 miles east to where we intended to work the following morning.

At 0500 we shot the hopper net with mixed results, not much fish but of good quality. We managed 6 tows for the remainder of that day.

The next morning we shot the hopper net in the Botney Cut area, which is very hard ground. We had 4 hauls in this area with the hopper net and 2 further hauls with the scraper net, ending the day with 36 boxes of good quality fish and a few boxes of prawns.

Next morning we finished the remainder of the scraper tows, which again produced some good fish. We hauled for the last time and set off for

Scarborough, arriving at around 1800 hours with 110 boxes of fish onboard though didn't land.

### Area 3

Observer onboard for the 4<sup>th</sup> trip, Peter Randall.

We sailed from Scarborough at 1600 and steamed NNE for 40 miles to Dab Hole. We shot the scraper net late that night and worked right through to lunchtime the following day, catching 33 boxes.

We steamed 16 miles NE to the Pot Holes next where we shot the hopper net, getting 3 hauls in before the end of the day. The fish we caught was mainly haddock and whiting.

The first haul next day we shot at the Sixty Five-Mile Hole, catching 12 boxes. Following that we took the net aboard steaming 40-miles north to the Ninety Five-Mile Hole where we had 3 hauls. The 2 hauls with the scraper net were good but the results with the hopper net were again disappointing.

From there we worked through the night with the hopper net till midday with poor results. We finished the trip with 2 scraper net tows. During the final tow we caught a large stone and spent three hours recovering the gear. We eventually managed to get the net to the surface but while lifting the bag up the side of the boat the codline parted. We lost the stone and a full bag of fish. Fortunately there was additional fish in the belly of the trawl and we managed to recover 11 boxes from this part of the net. This completed the trip in Area 3 and we steamed for Peterhead, landing 220 boxes on 30<sup>th</sup> June for our time in these 2 areas. This completed the 2010 CEFAS Survey.

Danny Normandale

#### *Additional observation post survey.*

The skipper Danny Normandale commented that: "Before the start of survey we did 2 days fishing at Fair Isle for 250 boxes of cod, since the survey finished we have been back to fish off Fair Isle with huge fishing results, so much so that we have only been able to get 1 trip a month due to not enough cod quota, in September we did 8 days with a massive 30 tons of cod caught."





## Annex B North Sea whitefish survey 2010 observers reports.

### **North Sea Whitefish survey part 1: June 2010**

<b>VESSEL</b>	FV Allegiance (SH90)
<b>SKIPPER</b>	Danny Normandale
<b>OBSERVER</b>	Peter Randall
<b>DEPARTURE DATE AND LOCATION</b>	31 May, Lerwick

#### **OBJECTIVE**

To repeat the survey of North Sea Whitefish carried out in 2009 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 will comprise two gear types 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 proposed sailing on the 30/05/10 was not possible due to the Lerwick fish market being full & as a result the FV Allegiance could not land its catch from the previous fishing trip. Landing commenced at approximately 15:30 on the 31/05/10. After landing the vessel collected empty boxes and ice before sailing.

The FV Allegiance sailed from Lerwick at 18:30 on Monday 31/05/10. Set sail in calm conditions, minimal swell and light winds. Vessel sailed northeast from the north end of Shetland to begin the survey in area 1.

The survey began in Area 1 (NSW1) with Haul 1 at 11:30 (01/06/10) using the Scraper trawl over soft ground. There were 2 further Scraper tows before taking a break for several hours. Fishing resumed with a 4<sup>th</sup> Scraper tow before switching to the Hopper net (09:45, 02/06/10) for 4 hard ground tows.

Haul 9 (02:00, 03/06/10) and the next 2 hauls were on soft ground using the Scraper trawl. This was followed by 2 hard ground tows before completing the remaining two area 1 soft ground hauls, beginning at the end of the 03/06/10.

The survey of area 1 was completed with the outstanding 3 hard ground tows. The vessel then steamed south to area 2, allowing a break for several hours.

The survey of area 2 (NSW2) began (05:15, 05/06/10) with 3 Scraper tows. The fishing gear was then changed to the Hopper Net (19:15, 05/06/10) and all area 2's hard ground tows were completed by the end of 06/06/10. After a break, the survey resumed the following morning (06:00, 07/06/10). The remaining 6 soft ground tows being completed by the end of that same day.

The FV Allegiance sailed for Peterhead, landing on 08/06/10 at approximately 19:00.

## **North Sea Whitefish survey part 2: June 2010**

<b>VESSEL</b>	FV Allegiance (SH90)
<b>SKIPPER</b>	Danny Normandale
<b>OBSERVER</b>	Samantha Elliott
<b>DEPARTURE DATE AND LOCATION</b>	10 <sup>th</sup> June, Peterhead

### **OBJECTIVE**

To repeat the survey of North Sea Whitefish carried out in 2009 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 will comprise two gear types 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 Peterhead at approximately 23:30 on Thursday 10<sup>th</sup> June 2010 in good weather, steaming east to area 5 to resume the survey.

Fishing began in rough weather 12/06/10 at approximately 02:00 using the Scrapper trawl on soft ground, with a total 5 tows being made before taking a break for several hours.

Fishing resumed the next day (13/06/10) at 03:30, as the weather eased throughout the day, the fishing improved slightly. The remaining 4 Scrapper trawls were completed and the gear was changed over in order to carry out 2 hard ground tows using the Hopper Net before taking a break.

The next day fishing resumed with the Hopper Net (14/06/10 03:30) completing the final 7 tows in area 5. Catches with this gear were generally much reduced, though the fish was typically bigger and of a better quality.

After a rest period, we moved the short distance to area 4. We began fishing approximately 4:40 (15/06/10) in poor weather (force 6 north westerly's with a significant swell), using the Hopper Net, completing 7 tows. The Hopper Net fished poorly, the worst haul produced only 1 basket of fish. After a break, the gear was changed over to the Scrapper net and fishing resumed at 04:30 16/06/10 completing 6 tows. The weather and the fishing improved greatly.

The final 3 Tows with the Scrapper trawl were completed on 17/06/10, the first of which suffered slight damage to the sleeve which required repair. The gear was changed over in order to complete the final 2 tows using the Hopper Net the last being hauled at 19:45.

The FV Allegiance sailed for Scarborough coming into port on 18<sup>th</sup> June 2010 at 11:30. The catch was landed to Grimsby for the market on Monday 21<sup>st</sup> June 2010.

## **North Sea Whitefish survey part 3: June 2010**

<b>VESSEL</b>	FV Allegiance (SH90)
<b>SKIPPER</b>	Danny Normandale
<b>OBSERVER</b>	Peter Randall
<b>DEPARTURE DATE AND LOCATION</b>	21 June, Grimsby

### **OBJECTIVE**

To repeat the survey of North Sea Whitefish carried out in 2009 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 will comprise two gear types 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 observer met the vessel on the evening of Monday 21/06/2010. The FV Allegiance sailed from Grimsby at approximately 01:30 on Tuesday 22/06/10. Set sail in calm conditions, minimal swell and light winds. Vessel sailed east from Grimsby steaming to the Eastern end of Area 6 (NSW6) to resume the survey.

The survey began in Area 6 with Haul 1 at 12:30 (22/06/10) using the Scraper trawl over soft ground. There were 2 further Scraper tows before taking a break for several hours. Fishing resumed with the Hopper net (05:00, 23/06/10) for 6 hard ground tows which was followed by a further break. Haul 8 within this run of 6 tows with the Hopper net, came up fouled with no catch. This tow was not repeated.

The survey resumed with Haul 10 (04:30, 24/06/10) and the next 2 hauls were on soft ground using the Scraper trawl. This was followed by the remaining 3 hard ground tows in Area 6 completed by 21:00, 24/06/10.

The survey of area 6 was concluded with the outstanding 3 soft ground tows, finishing at 07:40, 25/06/10. The vessel then steamed west to dock in Scarborough at approximately 18:30 that same day. FV Allegiance was in port overnight for various parts that had been ordered and to pick up a set of scales that had been repaired.

The FV Allegiance set sail again at approximately 17:00, heading north to resume the survey in the southern end of survey of Area 3 (NSW3). The survey resumed in Area 3 at (23:30, 26/06/10) with 4 Scraper tows on soft ground. The fishing gear was then changed to the Hopper Net and then steamed for a couple of hours before fishing on hard ground (15:40, 27/06/10) for 3 hauls; the first of these tows resulted in damage to the port wing of the trawl, which required repair.

After a few hours rest, the survey continued with 3 soft ground tows with the Scraper trawl (05:30, 28/06/10). The remaining 6 hard ground tows in Area 3 were completed by the afternoon of the 29/06/10. The survey concluded with the remaining 2 soft ground tows. The final haul resulted in some complications due to weight of material in the net. Using the combined power of the net hauler, the power block and the Gilson, it was not possible to recover the net. The net was towed for some time to wash out a great deal of mud, and reduce the weight. On a further attempt to retrieve the net, a large stone parted the cod line resulting in the loss of that lift of fish. A further lift of fish was recovered.

The FV Allegiance sailed for Peterhead, tying up on 29/06/10 at approximately 11:30; catch was landed later that day.

## **ADDITIONAL POINTS**

### **CATCHES**

The skipper informed me that catches were down on last year's survey. In fact, we did not see a full lift of fish in all of Area 1 or in Area 2 until the final haul. Early on the skipper suggested that the lower catches may be due to the tides slacking off. He later expressed some concerns that some minor adjustments that had been made to the net since last year may not have been done correctly, and planned to check before the second sailing for the survey.

Area 4 and Area 5 were also deficient in big lifts, with the Scraper tow yielding the biggest lifts and the only Full lifts being made in area 4 using this gear. Cod, haddock and whiting were encountered infrequently with only one good haul of haddock (2.7 Baskets) caught in area 5 and no substantial quantities seen in area 4.

Similarly there were very few big lifts of fish in Areas 3 and 6. There was a 30 plus box of cod lift, for the second haul in Area 6 on soft ground. The only large lift of fish in Area 3 was the final haul in the area. Again this was a soft ground tow, but retrieval of the net was hampered by excess mud and a large stone which resulted in parting the cod line and subsequently losing the first lift of fish. From early discussion with the skipper it was apparent that species frequency would differ greatly from area to area. As such otolith sampling was maximised where possible in Area 1 where all 3 prime species (cod, haddock, whiting), were present in good quantities. Otolith sampling was reduced in Area 2 to avoid excessive numbers of otoliths to process. Discussions with the observer for Areas 4 and 5 indicated that cod especially was encountered infrequently in those areas. Otolith sampling was maximised again in Area 6 in the hopes of making up any short fall in otolith numbers, however haddock were almost absent in this area. Haddock was common in Area 3, and so this species received extra attention in this area.

## **SKIPPER**

The observers would like to thank the skipper Danny Normandale who was very helpful throughout all 3 surveys. He discussed the likely catches for each area allowing the observer to plan ahead for meeting otolith targets. He kept the observer informed on grounds he previously had experience of (and likely catch details) and of any grounds that were novel. Danny detailed the pros and cons of each trawl type, used in the survey. The skipper also kept the observer apprised of the fishing schedule, and any possible delays due to gear damage, allowing the observer to get rest periods. Danny was also kind enough to inform the observer of any points of interest throughout the 3 surveys.

## **CREW**

Other than the skipper, there were 4 to 5 crewmen on board. For the first part of the survey 5 crew were onboard (Rob, Seno, Beng, Tommy & Tonny). 1 crewman (Rob) left the vessel after the first survey. All the crew were very helpful, though the Filipino crew were initially quite shy. Both Rob & Seno had taken part in the previous year's survey and were quick to get up to speed with the rhythm of it & guided the remaining crew as to what was required. Seno kept track of the catch & could provide the volume of any species that had not been put in baskets before going to the fish room. Tommy would wash the fish, but would always check with the observer before removing any fish for washing. The crew were also very patient allowing the observer to fully complete his sampling before transferring fish below.

## **WORK AREAS**

Two good work areas were present for the observer, in the factory. For sampling of retained catch, it was possible to work on top of hatch to the fish hold. By



measuring fish on top of a fish basket meant that observer could work at an ideal height, with minimal bending. This area was adjacent to where the crew sorted the catch and therefore minimised the need to move baskets of fish any distance. The only minor fault in this area was the nearest light source did not work. Improved light would have assisted in otolith removal and in the external sex determination of plaice. Once the catch was sorted, the crew would deposit the selected discard sample on the factory conveyer. Again the conveyer was at an ideal height for work. The space provided by the conveyer allowed the discard sample to be spread out and sorted by species allowing easy sampling or sub-sampling if necessary. There was good lighting in this area.

**Annex C North Sea whitefish survey detailed operations plan.**

**FISHERIES SCIENCE PARTNERSHIP: FSP (2008-9) (7)**

**North Sea Whitefish survey: 1 June - 31 July 2010**

***Detailed Operation Plan (May 2010)***

**VESSEL**

FV Allegiance S  
Skipper: Danny Normandale

**OBSERVERS**

Peter Randall, Samantha Elliot

**DEPARTURE DATE AND LOCATION**

1<sup>st</sup> June Lerwick

**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 1 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.

#### **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.

