

# London Array Offshore Wind Farm

Spring 2010

## Pre-Construction Fish Survey

Undertaken by

**Brown & May Marine Ltd**

Ref	Issue Date	Issue Type	Checked	Approved
LALOWFS/03	21.04.2010	FINAL	SX/LJ	SJA

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## 1.0 Introduction

The following report details the findings of the 2010 spring pre-construction juvenile and adult fish survey undertaken for the London Array Offshore Wind Farm development.

The survey methodology, gear and vessel used were agreed in consultation with Cefas, Lowestoft.

## 2.0 Scope of Work

The scope of the survey included the following elements:

- Otter trawling
  - Twelve tows within the London Array site and seven control tows in areas adjacent to it.
- Beam trawling
  - Twelve tows within the London Array site and seven control tows in areas adjacent to it.
- Otter Trawl Sample Analysis
  - Number of individuals and species
  - Sex ratio by species
  - Spawning condition
    - Finfish species (except herring): Cefas General Maturity Key - Five Stage Standard
    - Herring: Cefas Herring Maturity Key
    - Ray and shark species: Cefas Standard Elasmobranch Maturity Key- Four Stage.
  - Length distribution by species
    - Finfish: individual lengths to centimetre below
    - Rays: individual lengths & wing width to centimetre below
    - Crabs: carapace width (mm)
    - Nephrops: carapace length (mm)
    - Whelks: shell height
    - Scallops: shell width
    - Cephalopods: mantle length
- Beam Trawl Sample Analysis
  - Number of individuals and length to centimetre below for fish species
  - Number of individuals for invertebrate species
  - Note the presence of species where counts are inappropriate

### 3.0 Methodology

#### 3.1 Vessel

The vessel chartered for the survey (Figure 3.1), the “Jubilee Spirit”, is a Grimsby based commercial trawler whose skipper has experience of fishing in the southern North Sea and Thames Estuary. The specifications of the vessel are given in Table 3.1 below.



Figure 3.1 Survey Vessel

Table 3.1 Survey Vessel Specifications

SURVEY VESSEL SPECIFICATIONS	
Length	21.2 m
Beam	6.9m
Draft	2.3m
Main engine	Caterpillar Type 340TA 475 BHP
Gearbox	Hydraulic 6: reduction
Propeller	4 Blade Manganese Bronze Fixed Pitch 1.7m diameter
GPS	2-Furuno GP80
Plotter	Sodena Plotter with Electronic Charts
Sounder	Furuno Daylight Viewing

### 3.2 Sampling Gears

#### 3.2.1 Commercial Otter Trawl

A commercial demersal trawl (Figure 3.2) with a 100mm cod-end liner was used for sampling. The specifications of the gear are given in Table 3.2 below.



Figure 3.2 Otter Trawl Gear Used

Table 3.2 Otter Trawl Specifications

OTTER TRAWL SPECIFICATIONS	
Towing Warp	18 mm, 6x19+1
Depth: Payout Ratio	5:1
Trawl Doors	Perfect B 84
Net	100mm mesh cod-end, square mesh panel 7m from cod-end on top
Ground line length	45.7m
Footrope	Rock-hopper with 8 to 6 inch bobbins
Headline height (est.)	2.4
Distance between doors (est.)	51m

### 3.2.2 Scientific Beam Trawl

The juvenile fish/epibenthic survey was undertaken using a 2-metre scientific beam trawl (Figure 3.3), the specifications for which are given in Table 3.3 below.



Figure 3.3 Scientific Beam Trawl Used

Table 3.3 Beam Trawl Specifications

BEAM TRAWL SPECIFICATIONS	
Beam width	2m
Headline height	55cm
Shoe length	77cm
Shoe width	15cm
Cod-end liner	5mm



### 3.3 Positioning and Navigation

The position of the vessel was tracked at all times using a GPS (Garmin GPSMap 278) with an EGNOS differential connected to an external antenna (Garmin GA29). Trawl start times and positions were taken when the winch had stopped after paying out the gear. Similarly, trawl end times and positions were taken when hauling of the gear commenced.

### 4.0 Sampling Operations

The survey was undertaken from the 20<sup>th</sup> to the 25<sup>th</sup> March 2010. A summarised log of events is given in Table 4.1 below.

It should be noted that Brown & May Marine Ltd were instructed to omit station 13 (OT13 & BT13) and relocate station 01 (OT01 & BT01) in this survey in view of the risk of damaging potential *Sabellaria spinulosa* reefs with fishing gear. In addition, no beam trawl sample (BT15) was collected at station 15 after the first attempt damaged the net.

Table 4.1 Summarised Log of Events

<b>Saturday 20<sup>th</sup> March 2010</b>
Vessel in transit to Lowestoft
<b>Sunday 21<sup>st</sup> March 2010</b>
Leave Lowestoft Port and steam to the study area
Overnight at sea
<b>Monday 22<sup>nd</sup> March 2010</b>
Otter Trawl: OT06 - OT10; OT16 & OT17
Beam Trawl: BT06 - BT10; BT16 & BT17
Overnight at sea
<b>Tuesday 23<sup>rd</sup> March 2010</b>
Otter Trawl: OT01 - OT04; OT12 and; OT18 - OT19
Beam Trawl: BT01 - BT04; BT12 and; BT18 - BT19
Overnight at sea
<b>Wednesday 24<sup>th</sup> March 2010</b>
Otter Trawl: OT05; OT11; OT14 & OT15
Beam Trawl: BT05; BT11; BT14 & BT15
Overnight at sea
<b>Thursday 25<sup>th</sup> March 2010</b>
Steam back to Lowestoft
Vessel in transit to Grimsby



#### 4.1 Otter Trawl Sampling

The whole catch of each trawl was retained. The samples were then boxed, labelled, photographed, iced and stored at +2 °C before transportation to Cefas laboratories, Lowestoft for analysis.

The start and end times, coordinates and duration of each otter trawl undertaken are given in Table 4.2 below, and illustrated in Figure 4.1 overleaf.

**Table 4.2 Start and End Times, Coordinates and Duration of each Otter Trawl**

Trawl	Start					End				Duration hh:mm:ss
	Date	Time	Latitude	Longitude	Depth (m)	Time	Latitude	Longitude	Depth (m)	
OT01	24/03/10	15:04:53	51° 41.736	01° 32.870	21.9	15:24:23	51° 42.474	01° 33.356	22.1	00:19:30
OT02	22/03/10	07:58:09	51° 41.388	01° 32.928	20.8	08:19:12	51° 40.722	01° 34.291	19.6	00:21:03
OT03	22/03/10	10:08:14	51° 39.588	01° 34.159	22.3	10:27:56	51° 40.314	01° 33.232	19.8	00:19:42
OT04	22/03/10	11:23:38	51° 38.808	01° 32.371	23.6	11:43:21	51° 39.426	01° 31.213	20.3	00:19:43
OT05	22/03/10	13:07:41	51° 38.280	01° 30.998	23.8	13:27:57	51° 37.806	01° 32.297	27.2	00:20:16
OT06	24/03/10	13:10:19	51° 37.320	01° 29.694	24.1	13:30:14	51° 36.870	01° 30.995	27.6	00:19:55
OT07	24/03/10	11:54:51	51° 35.934	01° 28.268	24.5	12:14:06	51° 35.388	01° 29.338	25.6	00:19:15
OT08	23/03/10	15:36:47	51° 35.178	01° 26.963	24.7	15:57:12	51° 34.626	01° 28.210	28.0	00:20:25
OT09	22/03/10	17:20:38	51° 35.886	01° 33.100	19.2	17:41:48	51° 35.136	01° 33.581	12.6	00:21:10
OT10	22/03/10	14:18:33	51° 36.918	01° 32.945	22.3	14:38:16	51° 36.312	01° 32.078	19.2	00:19:43
OT11	22/03/10	15:48:16	51° 36.864	01° 33.847	17.7	16:08:00	51° 36.168	01° 34.424	16.1	00:19:44
OT12	23/03/10	07:46:47	51° 40.572	01° 38.447	15.4	08:06:19	51° 39.816	01° 39.532	26.0	00:19:32
OT14	24/03/10	07:45:23	51° 43.656	01° 29.922	23.6	08:05:10	51° 43.056	01° 29.308	24.0	00:19:47
OT15	24/03/10	09:20:26	51° 40.242	01° 25.484	24.3	09:41:02	51° 39.606	01° 24.720	22.5	00:20:36
OT16	23/03/10	14:33:24	51° 33.828	01° 26.978	26.2	14:54:28	51° 34.026	01° 28.514	17.9	00:21:04
OT17	23/03/10	12:43:44	51° 33.642	01° 30.737	19.4	13:04:48	51° 33.504	01° 32.179	22.9	00:21:04
OT18	23/03/10	10:58:57	51° 34.962	01° 36.524	25.8	11:18:50	51° 35.610	01° 37.250	27.1	00:19:53
OT19	23/03/10	09:46:34	51° 37.974	01° 39.711	25.1	10:08:00	51° 37.002	01° 38.761	24.7	00:21:26

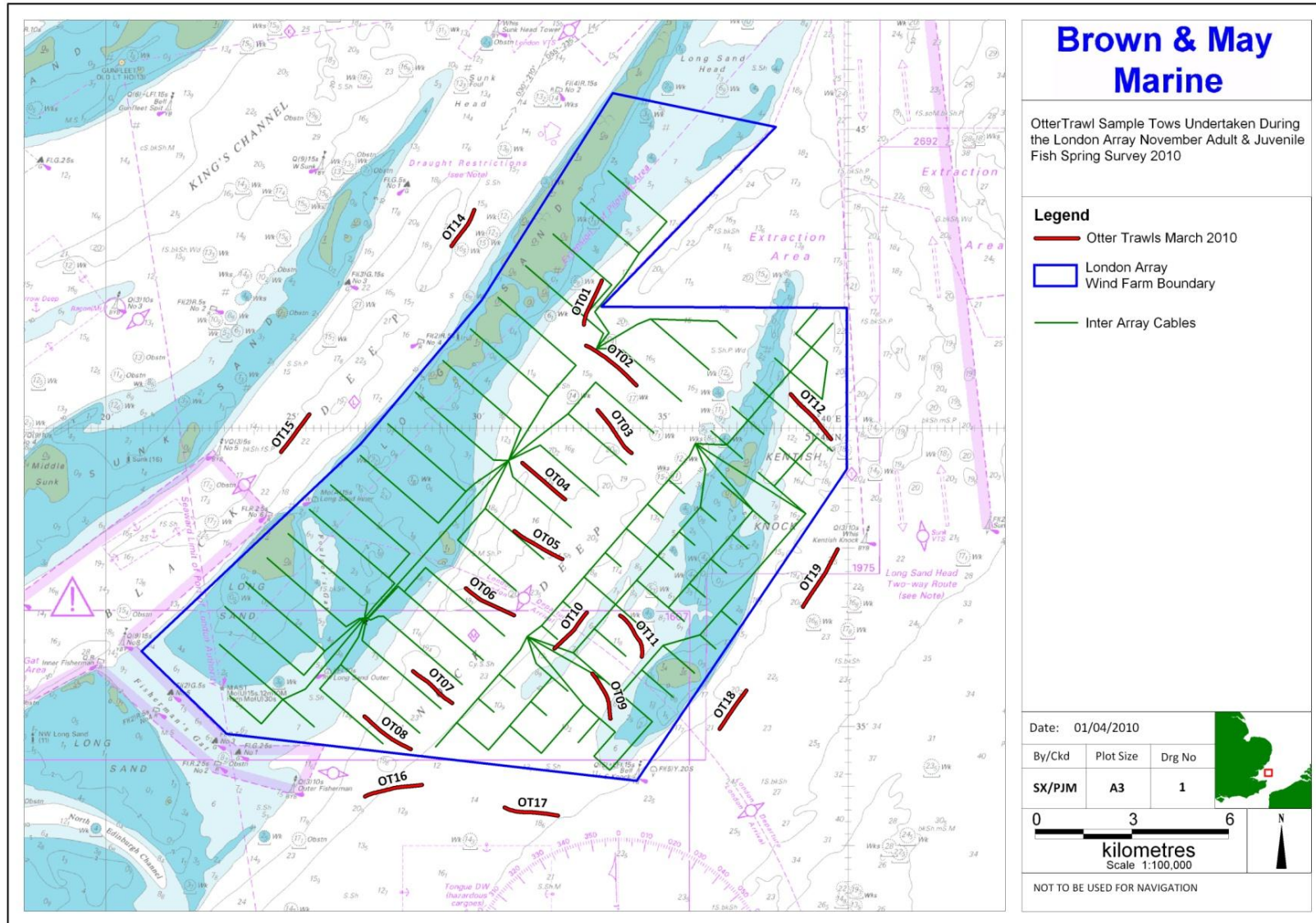


Figure 4.1 Otter Trawl Tow Tracks

## 4.2 Beam Trawl Sampling

The whole catch of each tow was retained, placed in plastic pots, labelled and photographed. Sub-sampling was applied when large homogenous samples were caught. The samples were fixed using a 4% seawater buffered formalin solution for preservation prior to their analysis.

The start and end times, coordinates and duration of each beam trawl undertaken are given in Table 4.3 and the tracks illustrated in Figure 4.2 overleaf.

**Table 4.3 Start and End Times, Coordinates and Duration of each Beam Trawl**

Trawl	Start					End				Duration hh:mm:ss
	Date	Time	Latitude	Longitude	Depth (m)	Time	Latitude	Longitude	Depth (m)	
BT01	24/03/2010	14:37:51	51° 41.844	01° 33.111	21.6	14:47:41	51° 42.024	01° 33.217	20.7	00:09:50
BT02	22/03/2010	07:29:51	51° 41.280	01° 32.470	21.2	07:39:55	51° 41.454	01° 31.996	18.8	00:10:04
BT03	22/03/2010	09:41:00	51° 40.020	01° 33.701	22.1	09:51:20	51° 39.768	01° 34.051	21.9	00:10:20
BT04	22/03/2010	10:56:52	51° 39.138	01° 31.801	22.3	11:07:54	51° 38.880	01° 32.126	21.8	00:11:02
BT05	22/03/2010	12:43:55	51° 38.130	01° 31.712	26.5	12:53:11	51° 38.268	01° 31.268	23.2	00:09:16
BT06	24/03/2010	12:43:53	51° 36.924	01° 30.694	27.6	12:53:37	51° 37.122	01° 30.133	24.7	00:09:44
BT07	24/03/2010	11:28:29	51° 35.718	01° 28.865	25.8	11:38:06	51° 35.946	01° 28.355	24.3	00:09:37
BT08	23/03/2010	15:11:17	51° 34.542	01° 28.012	27.6	15:21:02	51° 34.800	01° 27.425	27.4	00:09:45
BT09	22/03/2010	16:55:45	51° 35.472	01° 33.379	17.4	17:05:24	51° 35.814	01° 33.147	19.0	00:09:39
BT10	22/03/2010	13:51:10	51° 37.032	01° 33.035	21.4	14:01:25	51° 36.810	01° 32.716	20.7	00:10:15
BT11	22/03/2010	15:24:02	51° 36.324	01° 34.507	17.4	15:34:29	51° 36.648	01° 34.156	17.7	00:10:27
BT12	23/03/2010	07:21:37	51° 40.098	01° 38.837	20.7	07:31:13	51° 40.398	01° 38.542	16.5	00:09:36
BT14	24/03/2010	07:22:25	51° 42.948	01° 29.182	24.7	07:32:09	51° 43.488	01° 29.690	22.9	00:09:44
BT15	24/03/2010	08:49:01	51° 40.368	01° 25.813	26.2	08:56:42	51° 40.308	01° 25.678	26.2	00:07:41
BT16	23/03/2010	13:40:28	51° 33.822	01° 28.492	17.4	13:50:02	51° 33.912	01° 27.726	22.3	00:09:34
BT17	23/03/2010	12:18:59	51° 33.744	01° 32.386	19.6	12:28:45	51° 33.780	01° 31.528	19.4	00:09:46
BT18	23/03/2010	10:30:45	51° 35.784	01° 37.625	27.8	10:34:14	51° 35.688	01° 37.500	26.9	00:03:29
BT19	23/03/2010	09:23:48	51° 37.500	01° 39.301	24.5	09:33:25	51° 37.896	01° 39.684	24.7	00:09:37



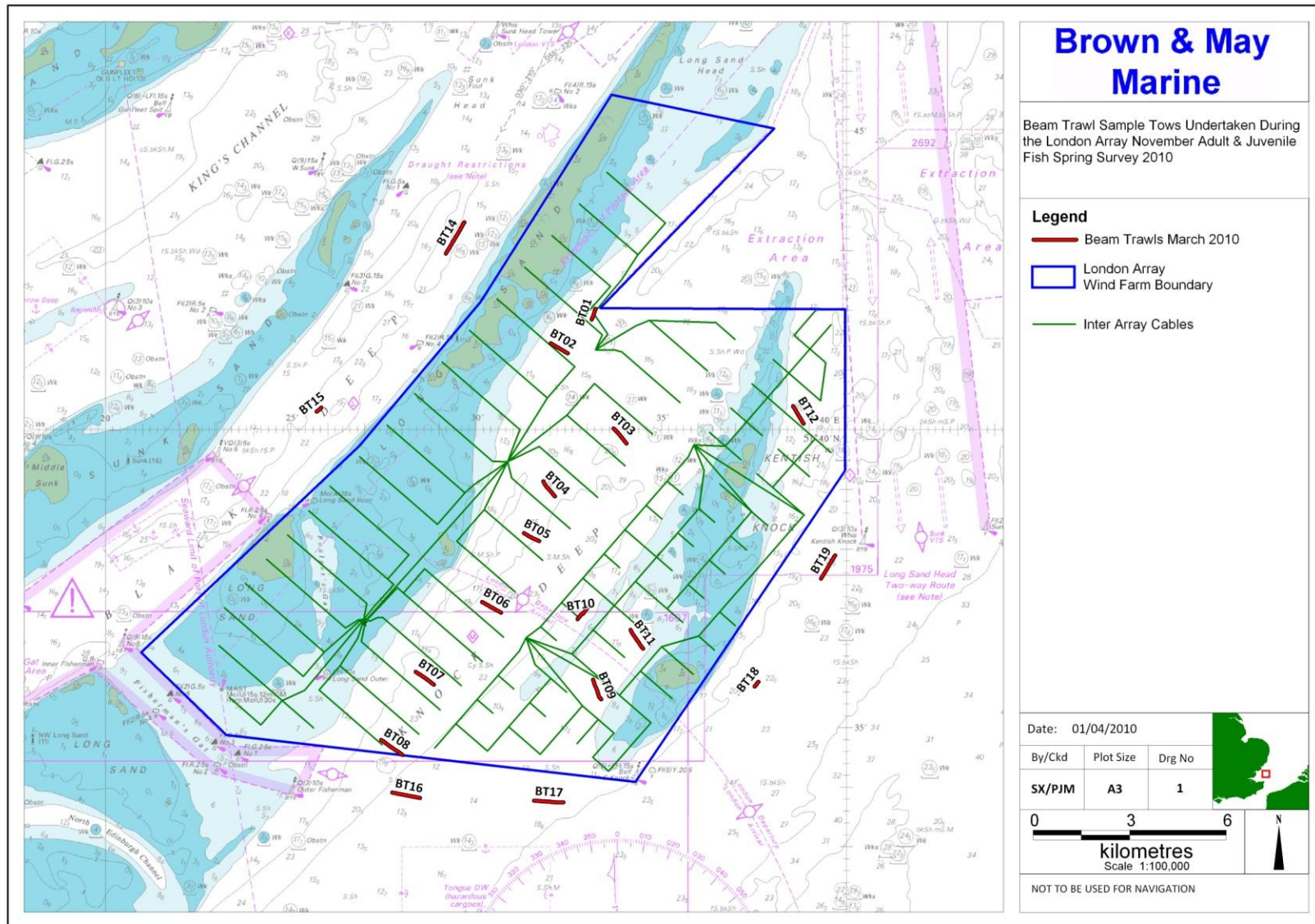


Figure 4.2 Beam Trawl Tow Tracks

## 5.0 Otter Trawl Results

### 5.1 Catch Rates and Species Distribution

The total number of individuals caught by species and the catch rate, expressed as the number of individuals caught per hour, are given in Table 5.1 and illustrated in Figure 5.1 overleaf.

A total of 21 species were caught, 19 within the wind farm site and 15 at control locations. At both the control locations and within the wind farm site thornback ray was the species caught in the greatest numbers.

Within the wind farm cod and sole constituted the second and third highest number of species caught, respectively, and whiting and sole in the control sites, respectively.

The catch rates for these species were, in general terms, higher at control locations than in the wind farm site (Table 5.1 & Figure 5.1). The remaining species were caught in relatively low numbers.

**Table 5.1 Total Numbers of Individuals Caught and Catch Rate by Species and Sampling Area**

Species		No. of Individuals Caught			Catch Rate	
Common Name	Scientific Name	Control	Wind Farm	Total	Control	Wind Farm
Thornback Ray	<i>Raja clavata</i>	111	245	356	64.0	61.3
Whiting	<i>Merlangius merlangius</i>	57	11	68	32.9	2.8
Sole	<i>Solea solea</i>	25	20	45	14.4	5.0
Cod	<i>Gadus morhua</i>	8	21	29	4.6	5.3
Plaice	<i>Pleuronectes platessa</i>	6	8	14	3.5	2.0
Dab	<i>Limanda limanda</i>	10	4	14	5.8	1.0
Herring	<i>Clupea harengus</i>	7	4	11	4.0	1.0
Sprat	<i>Sprattus sprattus</i>	3	6	9	1.7	1.5
Lesser Spotted Dogfish	<i>Scyliorhinus canicula</i>	5	3	8	2.9	0.8
Bib	<i>Trisopterus luscus</i>	4	1	5	2.3	0.3
Starry Smooth Hound	<i>Mustelus asterias</i>	2	0	2	1.2	0.0
Solenette	<i>Buglossidium luteum</i>	0	2	2	0.0	0.5
Bass	<i>Dicentrarchus labrax</i>	1	1	2	0.6	0.3
Lemon Sole	<i>Microstomus kitt</i>	1	1	2	0.6	0.3
Brill	<i>Scophthalmus rhombus</i>	1	1	2	0.6	0.3
Flounder	<i>Platichthys flesus</i>	0	2	2	0.0	0.5
Pogge	<i>Agonus cataphractus</i>	0	1	1	0.0	0.3
Edible Crab	<i>Cancer pagurus</i>	1	0	1	0.6	0.0
Spotted Ray	<i>Raja montagui</i>	0	1	1	0.0	0.3
Lesser sand eel	<i>Ammodytes tobianus</i>	0	1	1	0.0	0.3
Lobster	<i>Homarus gammarus</i>	0	1	1	0.0	0.3

The percentage distribution by species for both the control locations and the wind farm site are shown in Figure 5.2 and Figure 5.3 respectively.

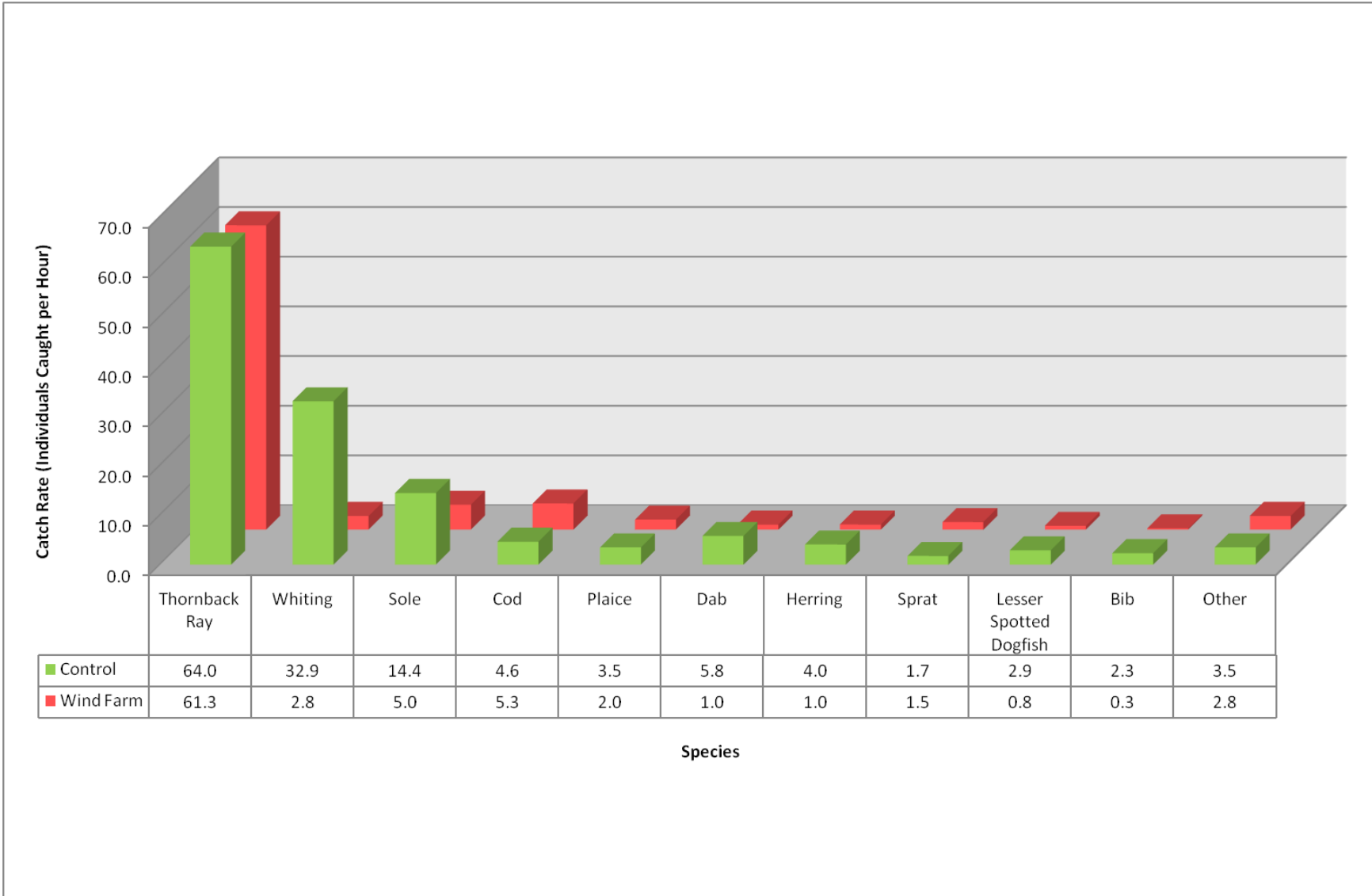


Figure 5.1 Individuals Caught per Hour by Species by Sampling Area

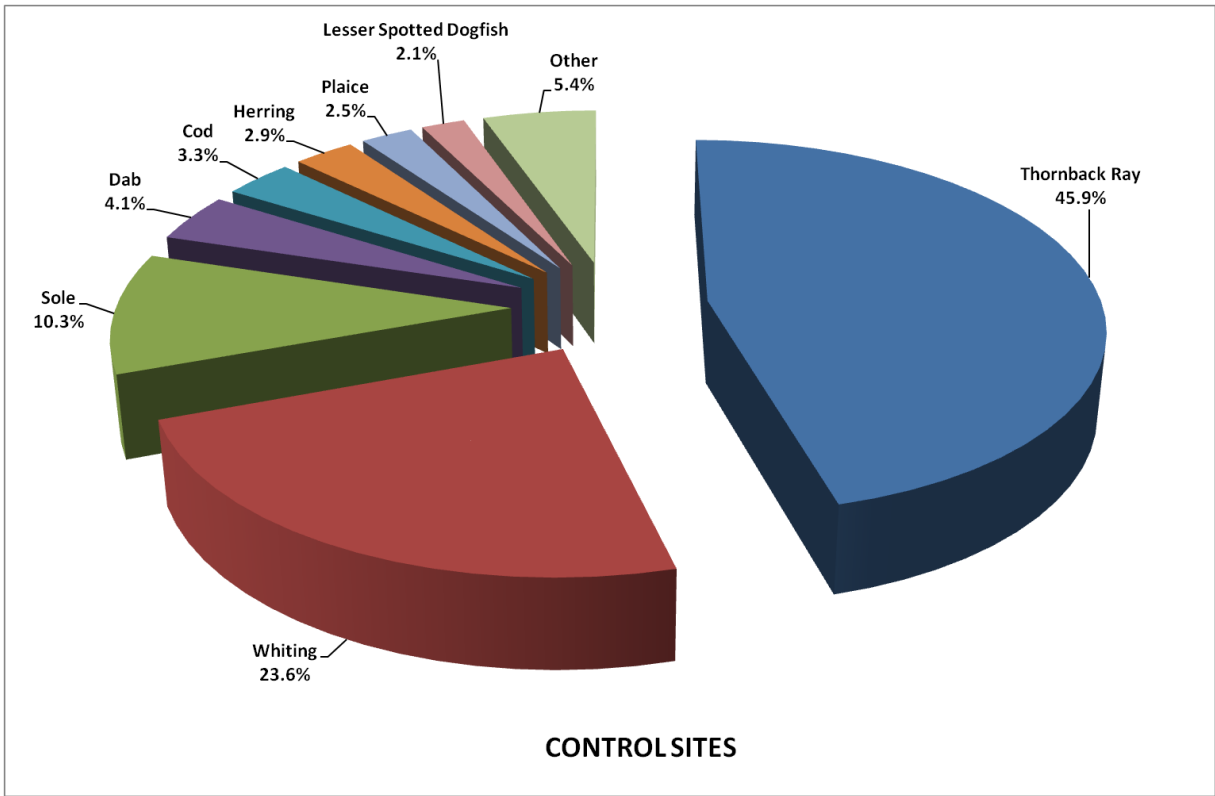


Figure 5.2 Percentage Distribution of Species Caught at Control Locations

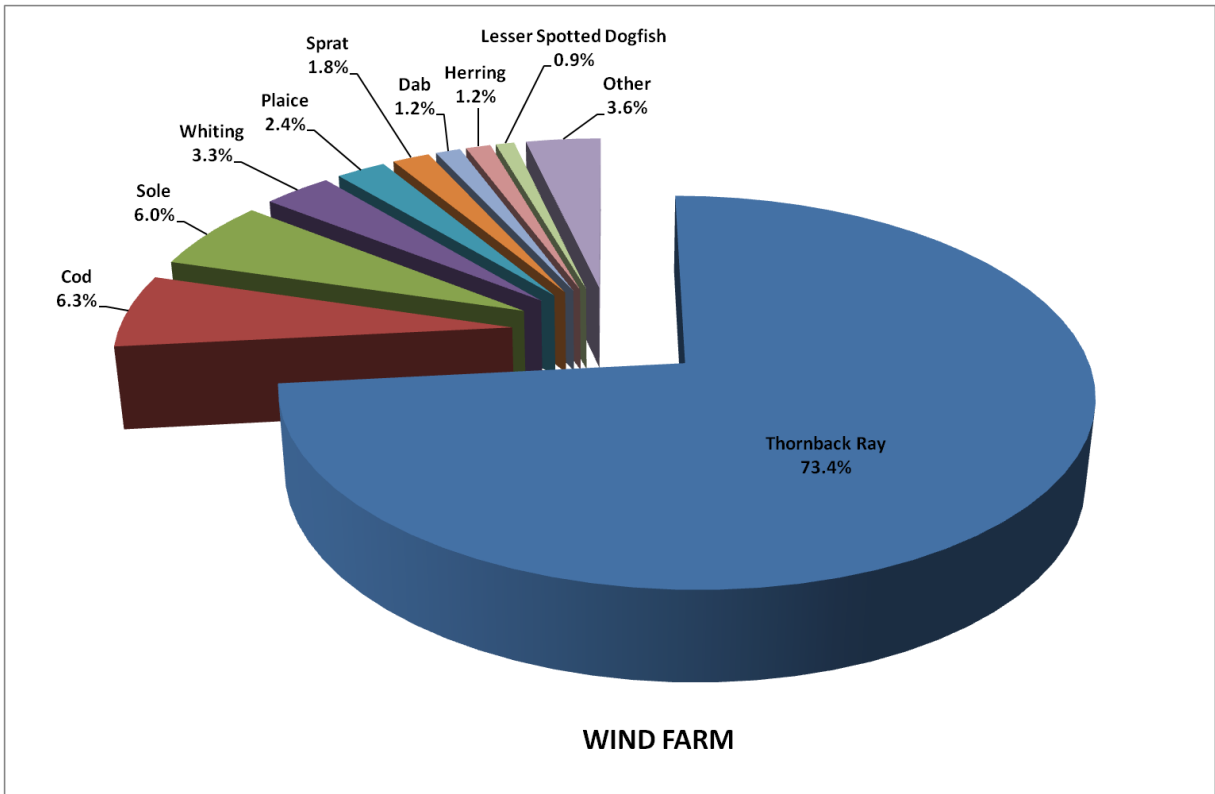


Figure 5.3 Percentage Distribution of Species Caught in the Wind Farm Site



## 5.2 Length Distributions

The length distributions of the most abundant species, expressed as the number of individuals caught per unit of time (hr) and length (cm) by sampling area (control and wind farm), are shown in Figure 5.4 to Figure 5.7 below.

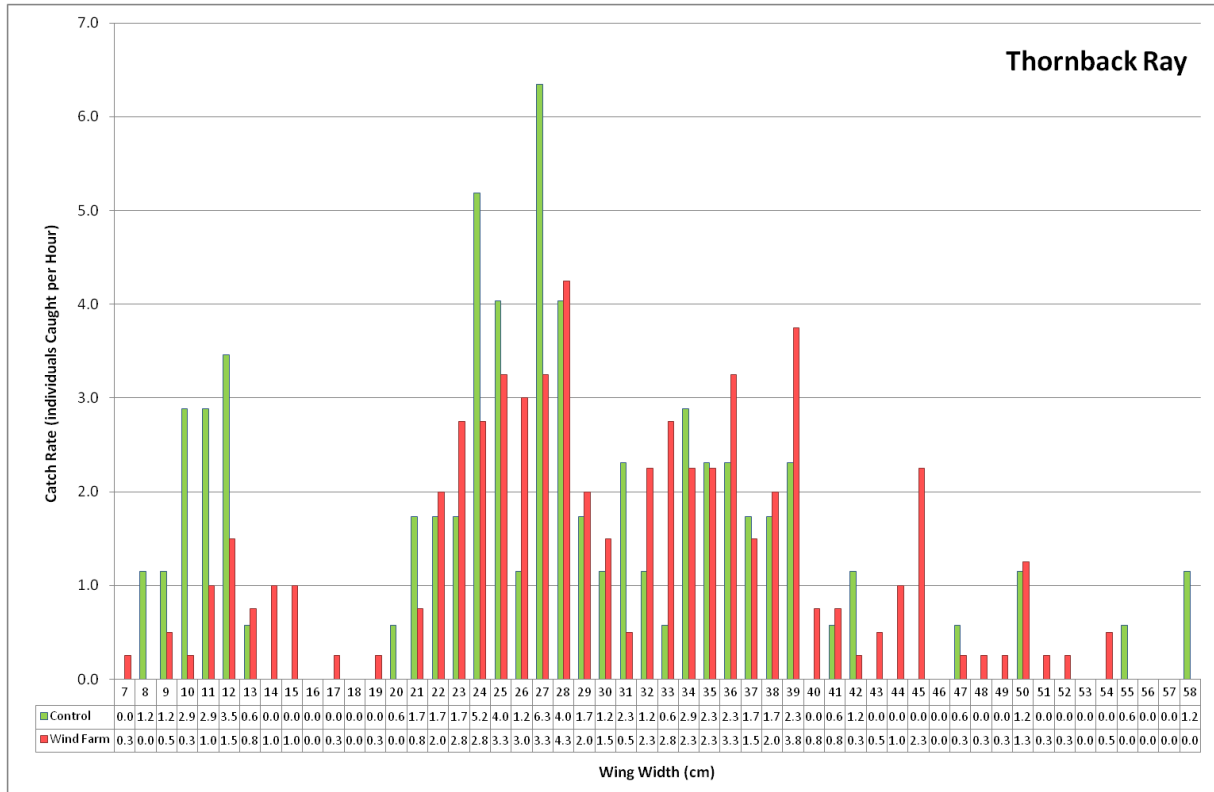


Figure 5.4 Thornback Ray Length Distribution

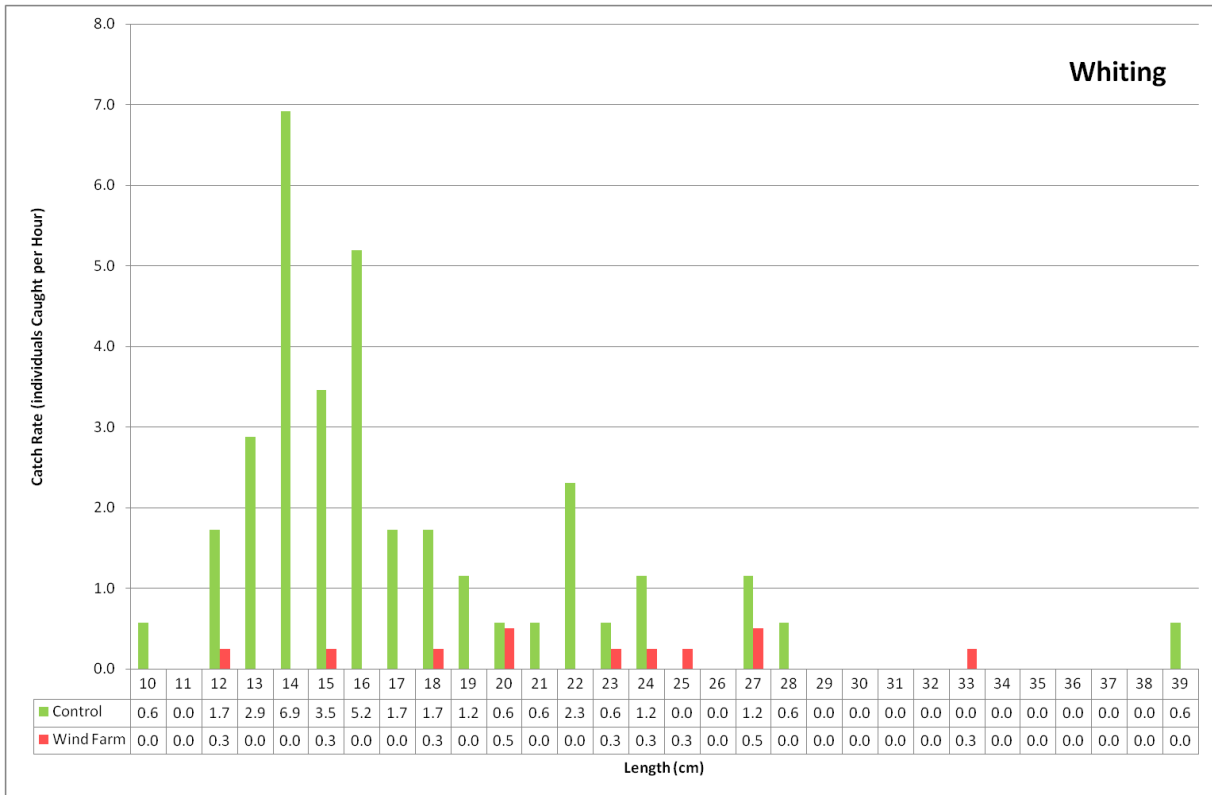


Figure 5.5 Whiting Length Distribution

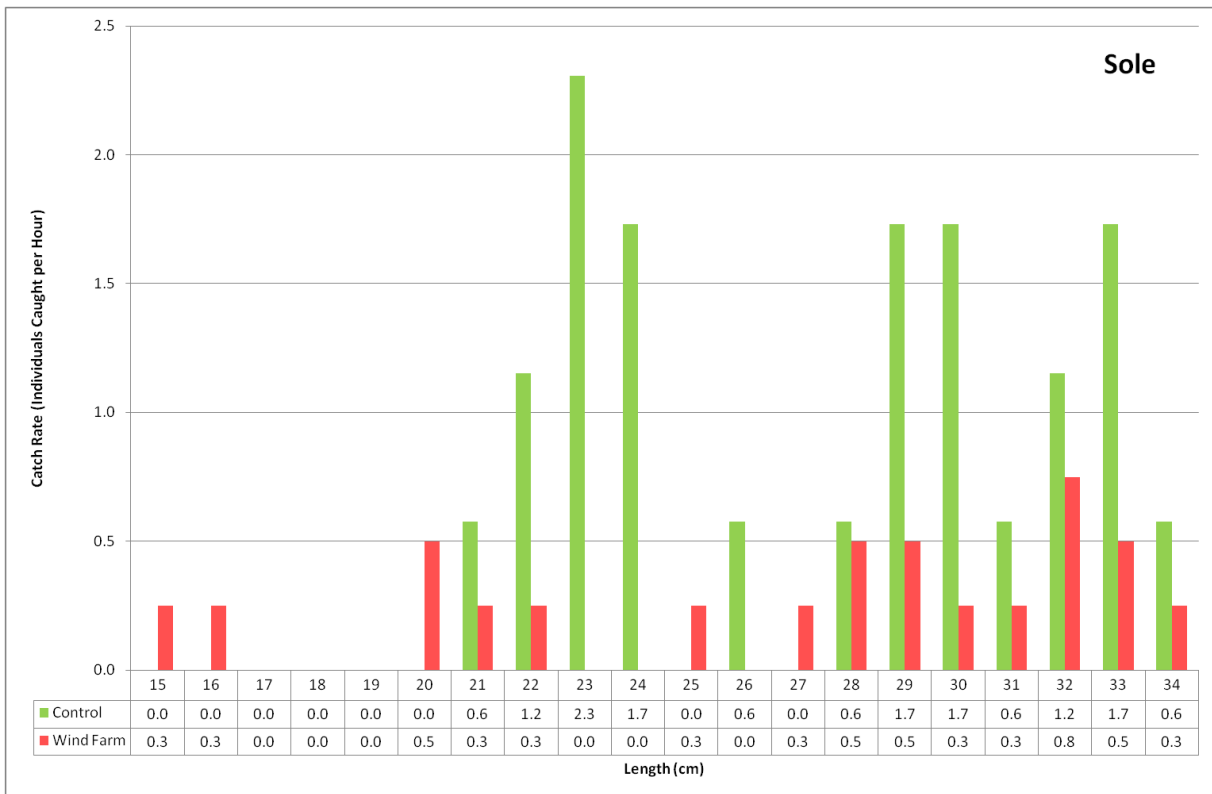


Figure 5.6 Sole Length Distribution



Figure 5.7 Cod Length Distribution

### 5.3 Minimum Landing Sizes

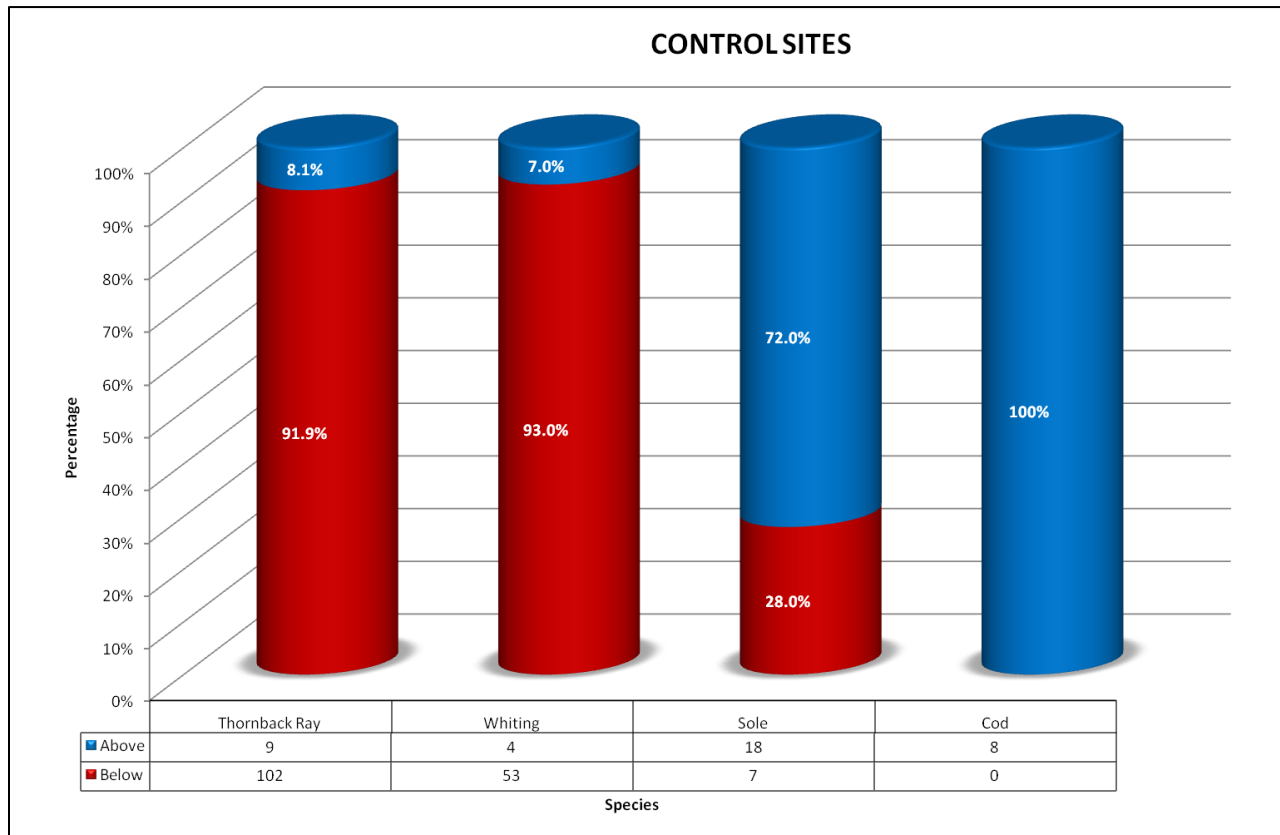
The statutory minimum landing sizes (MLS) for fish and shellfish species are set by the EC Council Regulations 850/98 (Annex XII). Minimum landing sizes are also specified by local sea fisheries committees in waters within their jurisdictions. The London Array development area is located within the boundaries of the Kent & Essex Sea Fisheries Committee (K&ESFC); hence, MLSs set by the committee also apply. The nine species caught for which a MLS has been set are given in Table 5.2 below.

Table 5.2 Species with a set MLS by Site

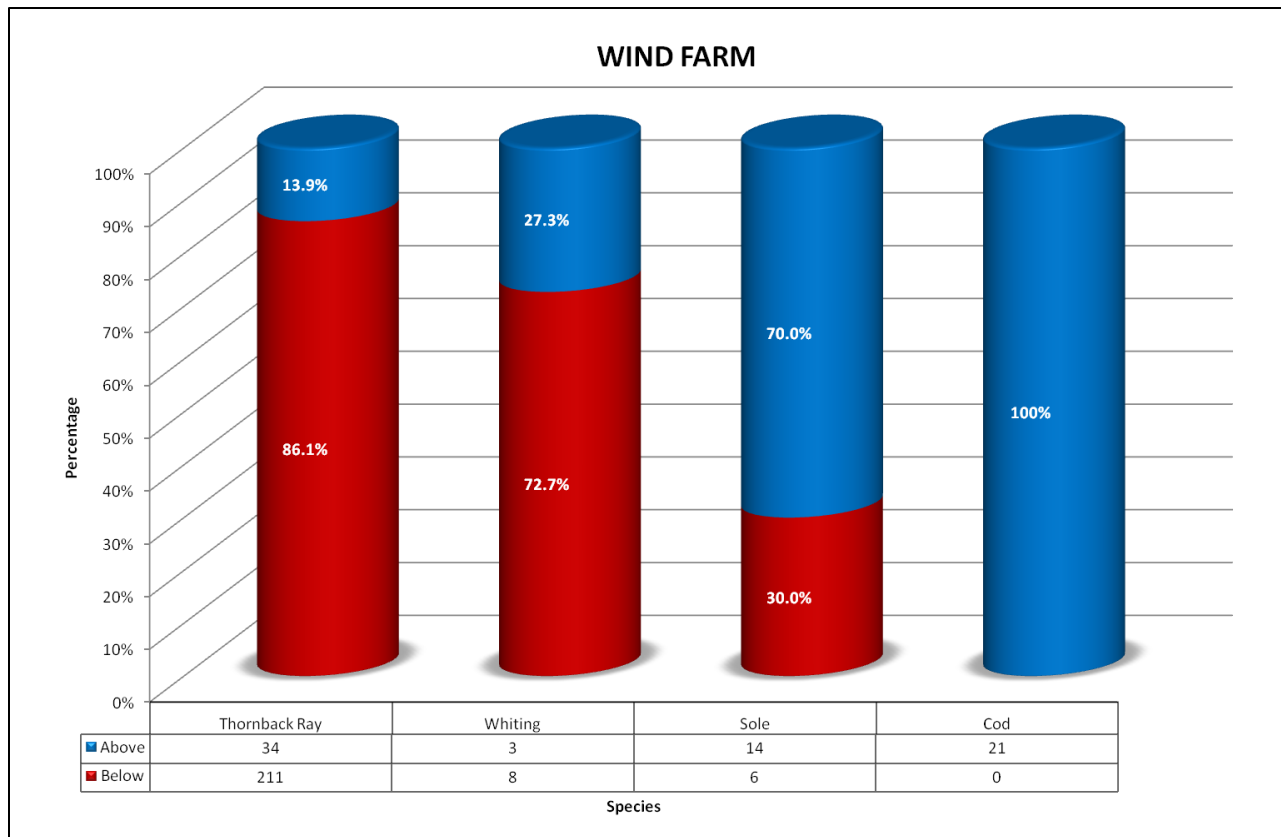
Species	K & ESFC	EC	Presence (✓)	
			Control	Wind Farm
Whiting	27	27	✓	✓
Rays	40 (*wing width)	n/a	✓	✓
Plaice	27	27	✓	✓
Cod	35	35	✓	✓
Sole	24	24	✓	✓
Bass	36	36	✓	✓
Herring	20	20	✓	✓
Edible Crab	13	13	✓	
Lobster	8.7	8.7		✓

The percentage of catch above and below the MLS by species for both the control locations and the wind farm site are shown in Figure 5.8 and Figure 5.9, respectively.

At both the control locations and those within the wind farm site the majority of thornback ray and whiting caught were undersized, whilst most of the sole and cod were above their MLS. The rest of the species for which a MLS has been set were all caught in relatively low numbers.



**Figure 5.8 Percentage of Catch Above and Below their MLS by Species at Control Locations**



**Figure 5.9 Percentage of Catch Above and Below their MLS by Species within the Wind Farm Site**

#### 5.4 Sex Ratios

The sex ratios of the most abundant species caught at both the control locations and those within the wind farm site are shown in Figure 5.10 and Figure 5.11, respectively.

At control locations the majority of sole (76.0%), dab (80.0%) and plaice (66.7%) were female, whilst for thornback ray, cod and herring the sex ratios were approximately 50:50.

Similarly, within the wind farm site the majority of sole (60.0%), dab (100%) and lesser spotted dogfish (100%) were female, whilst for thornback ray, plaice, cod and herring the sex ratios were approximately 50:50.

A majority of the whiting caught at both control locations (59.6%) and within the wind farm (18.2%) were too small to allow for accurate sex identification.

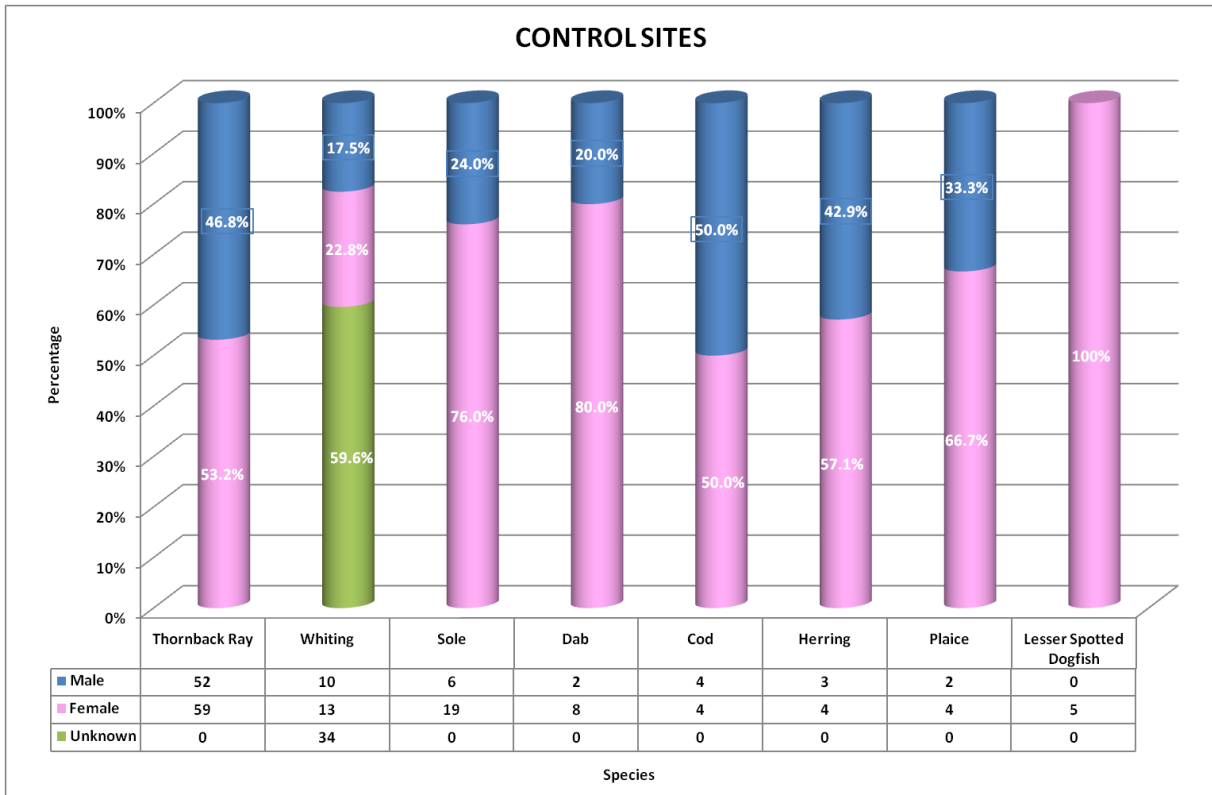


Figure 5.10 Sex Ratios by Species at Control Locations

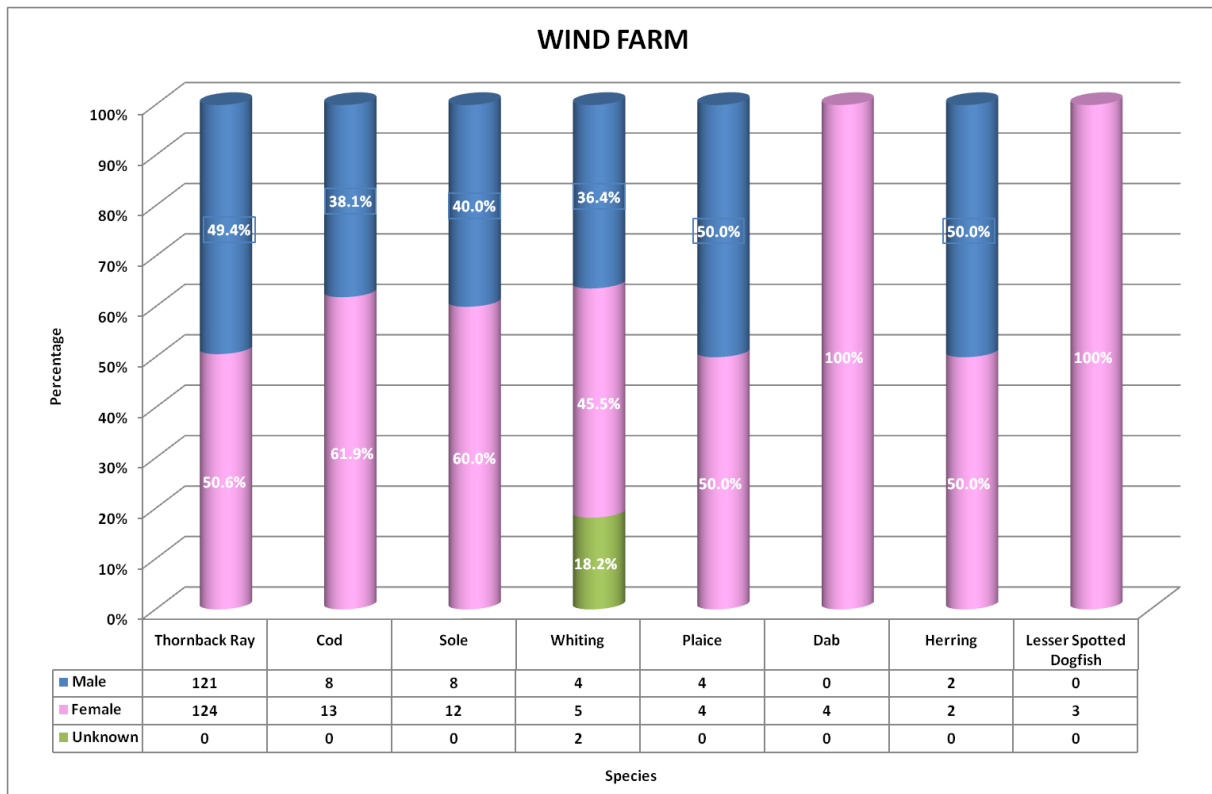


Figure 5.11 Sex Ratio by Species within the Wind Farm Site

## 5.5 Spawning Condition

The spawning condition, sex and length range of the most abundant species are given in Table 5.3 to Table 5.10 below. Where a stage was not recorded for a species it has not been included in the following tables.

Table 5.3 Thornback Ray Maturity

THORNBAC RAY									
Sex	Maturity	Site		Total	% of Total Catch	Length Range		Wing Width Range	
		Control	Wind Farm			Min.	Max.	Min.	Max.
Female	Immature	48	88	136	38.2%	13	62	8	42
	Maturing	9	25	34	9.6%	49	79	32	55
	Fully Mature	2	10	12	3.4%	67	83	43	58
	Active	0	1	1	0.3%	72	72	48	48
Male	Immature	48	101	149	41.9%	12	61	7	39
	Maturing	4	12	16	4.5%	52	70	34	43
	Fully Mature	0	5	5	1.4%	69	71	44	45
	Active	0	3	3	0.8%	64	72	41	45

Table 5.4 Whiting Maturity

WHITING							
Sex	Maturity	Site		Total	% of Total Catch	Length Range	
		Control	Wind Farm			Min.	Max.
Female	Immature	3	2	5	7.4%	15	23
	Maturing	10	3	13	19.1%	16	39
Male	Immature	1	1	2	2.9%	19	24
	Maturing	8	3	11	16.2%	16	27
	Spent	1	0	1	1.5%	23	23
Unknown	Immature	34	2	36	52.9%	10	17

Table 5.5 Sole Maturity

SOLE							
Sex	Maturity	Site		Total	% of Total Catch	Length Range	
		Control	Wind Farm			Min.	Max.
Female	Immature	1	0	1	2.2%	22	22
	Maturing	18	12	30	66.7%	21	34
Male	Maturing	6	5	11	24.4%	15	29
	Spent	0	3	3	6.7%	20	22



Table 5.6 Cod Maturity

COD							
Sex	Maturity	Site		Total	% of Total Catch	Length Range	
		Control	Wind Farm			Min.	Max.
Female	Maturing	2	2	4	13.8%	53	71
	Spent	2	11	13	44.8%	60	73
Male	Maturing	3	4	7	24.1%	55	83
	Spent	1	4	5	17.2%	57	70

Table 5.7 Plaice Maturity

PLAICE							
Sex	Maturity	Site		Total	% of Total Catch	Length Range	
		Control	Wind Farm			Min.	Max.
Female	Immature	2	1	3	21.4%	19	21
	Maturing	1	1	2	14.3%	25	31
	Spent	1	2	3	21.4%	26	29
Male	Maturing	1	4	5	35.7%	19	37
	Spent	1	0	1	7.1%	27	27

Table 5.8 Dab Maturity

DAB							
Sex	Maturity	Site		Total	% of Total Catch	Length Range	
		Control	Wind Farm			Min.	Max.
Female	Immature	5	2	7	50.0%	13	23
	Maturing	3	2	5	35.7%	13	23
Male	Maturing	2	0	2	14.3%	14	22

Table 5.9 Herring Maturity

HERRING							
Sex	Maturity	Site		Total	% of Total Catch	Length Range	
		Control	Wind Farm			Min.	Max.
Female	Early Spent	3	2	5	45.5%	27	29
	Late Spent	1	0	1	9.1%	30	30
Male	Early Spent	2	1	3	27.3%	27	28
	Late Spent	1	1	2	18.2%	26	28

Table 5.10 Lesser Spotted Dogfish Maturity

LESSER SPOTTED DOGFISH							
Sex	Maturity	Site		Total	% of Total Catch	Length Range	
		Control	Wind Farm			Min.	Max.
Female	Immature	2	1	3	37.5%	27	36
	Maturing	0	2	2	25.0%	36	49
	Fully Mature	3	0	3	37.5%	56	60

## 6.0 Beam Trawl Results

### 6.1 Abundance & Species Distribution

The number of individuals caught by sampling area for fish, elasmobranch and invertebrate species are given in Table 6.1 and Table 6.2, respectively. The presence of species by sampling area, where counts were inappropriate, is given in Table 6.3.

A total of 17 fish species were caught, eight at control locations and 15 within the wind farm site. Solenette and Dover sole were the most abundant species in the wind farm site and at control locations. One elasmobranch species, the lesser spotted dogfish, was caught at both the wind farm and control locations.

Table 6.1 Number of Individuals Caught by Fish Species and Sampling Area

Class	Species		No. of Individuals by Site		Total
	Common Name	Scientific Name	Control	Wind Farm	
Actinopterygii	Solenette	<i>Buglossidium luteum</i>	87	65	152
	Dover sole	<i>Solea solea</i>	31	77	108
	Sand goby	<i>Pomatoschistus minutus</i>	25	25	50
	Lesser sandeel	<i>Ammodytes tobianus</i>	7	43	50
	Sprat	<i>Sprattus sprattus</i>	5	26	31
	Common dragonet	<i>Callionymus lyra</i>	15	11	26
	Lemon sole	<i>Microstomus kitt</i>	7	16	23
	Greater sandeel	<i>Hyperoplus lanceolatus</i>	0	8	8
	Transparent goby	<i>Aphia minuta</i>	3	5	8
	(blank)	<i>Ammodytes marinus</i>	0	4	4
	Lesser weever	<i>Echiichthys vipera</i>	0	4	4
	Scaldfish	<i>Arnoglossus laterna</i>	0	3	3
	Whiting	<i>Merlangius merlangus</i>	0	2	2
	Reticulated dragonet	<i>Callionymus reticulatus</i>	0	3	3
	Hooknose	<i>Agonus cataphractus</i>	0	2	2
	Goby sp	<i>Pomatoschistus juv.</i>	1	0	1
	Dab	<i>Limanda limanda</i>	0	1	1
Elasmobranchii	Lesser spotted dogfish	<i>Scyliorhinus canicula</i>	1	2	3

A total of 58 invertebrate species were caught, 40 at control locations and 50 within the wind farm site.

At control locations the most abundant species was *Ophiura albida* followed by *Psammechinus miliaris* (green sea urchin) and then *Pagurus bernhardus* (common hermit crab). *Ophiura albida* was caught in the greatest numbers in the wind farm site, followed by *Pagurus bernhardus* (common hermit crab) and then *Ophiura ophiura* (brittlestar).

Overall asteroidean and malacostraca were the most prevalent classes in both sampling areas (control locations and wind farm site).

Table 6.2 Number of Individuals Caught by Invertebrate Species and Sampling Area

Phylum	Class	Species		No. of Individuals by Site		Total
		Common Name	Scientific Name	Control	Wind Farm	
Annelida	Polychaeta	n/a	<i>Nephtys caeca</i>	3	50	53
		Sea mouse	<i>Aphrodite aculeata</i>	12	11	23
		n/a	<i>Polynoidae sp. indet</i>	2	19	21
			<i>Ophelia sp.</i>	0	13	13
			<i>Lagis koreni</i>	0	10	10
			<i>Nereis juv.</i>	2	1	3
			<i>Terebellida indet.</i>	2	0	2
Arthropoda	Malacostraca	Common hermit crab	<i>Pagurus bernhardus</i>	183	889	1072
		Brown shrimp	<i>Crangon crangon</i>	116	238	354
		n/a	<i>Pontophilus trispinosus</i>	146	168	314
			<i>Crangon allmani</i>	147	117	264
			<i>Idotea emarginata</i>	5	149	154
			<i>Macropodia sp.</i>	8	139	147
		Swimming crab	<i>Liocarcinus holsatus</i>	15	78	93
		Circular crab	<i>Atelecyclus rotundatus</i>	42	13	55
		n/a	<i>Mysidacea indet.</i>	31	1	32
		Blue-legged swimming crab	<i>Liocarcinus depurator</i>	6	21	27
		Hermit crab	<i>Paguridae juv.</i>	13	14	27
		n/a	<i>Liocarcinus pusillus</i>	14	13	27
			<i>Ebalia tuberosa</i>	20	0	20
			<i>Hyas coarctatus</i>	18	1	19
		Scorpion spider-crab	<i>Inachus dorsettensis</i>	12	0	12
		n/a	<i>Ampelisca spinipes</i>	8	2	10
			<i>Pandalina brevisrostris</i>	3	7	10
			<i>Corystes cassivelaunus</i>	1	6	7
			<i>Ampelisca tenuicornis</i>	6	1	7
			<i>Palaemon serratus</i>	0	4	4
			<i>Liocarcinus sp.</i>	2	1	3
			<i>Ampelisca sp. indet</i>	2	0	2
			<i>Axius stirhynchus</i>	2	0	2
<i>Ebalia tumefacta</i>	2		0	2		
<i>Liocarcinus arctuatus</i>	0		2	2		
<i>Pandalus montagui</i>	0		2	2		
<i>Processa parva</i>	0		2	2		
<i>Gammaridea juv.</i>	0		1	1		
<i>Idotea linearis</i>	1	0	1			
<i>Palaemon sp.</i>	0	1	1			

Species				No. of Individuals by Site		Total
Phylum	Class	Common Name	Scientific Name	Control	Wind Farm	
			<i>Processidae sp. indet</i>	0	1	1
Cnidaria	Anthozoa	n/a	<i>Actinaria sp.</i>	13	2	15
	Hydrozoa		<i>Sertulariidae sp</i>	4	0	4
Echinodermata	Asteroidea	n/a	<i>Ophiura albida</i>	1469	1888	3357
		Green sea-urchin	<i>Psammechinus miliaris</i>	331	35	366
		Brittlestar	<i>Ophiura ophiura</i>	19	303	322
		Common starfish	<i>Asterias rubens</i>	117	190	307
		Brittlestar	<i>Ophiura juv.</i>	0	1	1
			<i>Ophiuroidea juv.</i>	0	1	1
Mollusca	Bivalvia	n/a	<i>Spisula solida</i>	2	13	15
			<i>Maत्रacea sp.</i>	0	3	3
			<i>Abra alba</i>	1	2	3
			<i>Spisula sp.</i>	0	2	2
		Dog cockle	<i>Glycymeris glycymeris</i>	0	1	1
	Cephalopoda	Little cuttlefish	<i>Sepiolo atlantica</i>	0	1	1
	Gastropoda	Common whelk	<i>Buccinum undatum</i>	30	12	42
		n/a	<i>Euspira pulchella</i>	3	10	13
			<i>Euspira catena</i>	0	2	2
<i>Hinia reticulata</i>			0	2	2	
Nemertina	n/a	n/a	<i>Nemertina sp.</i>	1	3	4
Porifera	n/a	n/a	<i>Porifera indet.</i>	0	1	1

A total of 10 invertebrate species for which counts were inappropriate were recorded, six at control locations and six within the wind farm site. The arthropods *Macropodia* sp. and *Balanus crenatus*, the bryozoans *Flustra foliacea* and the cnidarian *Sertulariidae* sp. were recorded at both the wind farm site and control locations.

**Table 6.3 Presence of Individuals Caught by Invertebrate Species by Sampling Area (P = Present)**

Species				No. of Individuals by Site	
Phylum	Class	Common Name	Scientific Name	Control	Wind Farm
Annelida	Polychaeta	n/a	<i>Pomatoceros</i> sp.	P	
			Reef (polychaetes incl. <i>Polydora</i> sp.)		P
Arthropoda	Malacostraca	n/a	<i>Macropodia</i> sp.	P	P
			<i>Gammaridea</i> sp.		
	Maxillipoda	Acorn barnacle	<i>Balanus crenatus</i>	P	P
Bryozoa	Gymnolaemata	n/a	<i>Electra pilosa</i>	P	
			<i>Flustra foliacea</i>	P	P
Cnidaria	Hydrozoa	n/a	<i>Hydrozoa</i> indet.		
			<i>Sertulariidae</i> sp.	P	P
Ctenophora	Nuda	Sea gooseberry	<i>Ctenophora</i> indet.		P

## 7.0 Summary

The four most abundant species caught within in the sampling area (control locations and wind farm site) were thornback ray, whiting, sole and to a lesser extent cod. The species caught within the wind farm site and control locations showed a broadly similar composition. The results of the species caught in the greatest numbers are summarised in Table 7.1.

The majority of the thornback ray and whiting caught in the sampling area were below their MLS and identified as immature. Most of the sole were above their MLS and found to be maturing for both sexes. All the cod caught in the sampling area were above their MLS, although the majority of females were spent and the males were maturing (Table 7.1).

It should be noted that none of the species caught in the sampling area were considered to be spawning at the time the survey was carried out.

**Table 7.1 Summary of Otter Trawl Results**

Species		Total	MLS	Maturity (highest % by sex)
Common Name	Scientific Name			
Thornback Ray	<i>Raja clavata</i>	356	Majority of individuals were undersized	38.2% Immature Females; 41.9% Immature Males
Whiting	<i>Merlangius merlangius</i>	68	Majority of individuals were undersized	52.9% Immature Unknown (too small for accurate sex identification)
Sole	<i>Solea solea</i>	45	Majority of individuals were above their MLS size	66.7% Maturing Females; 24.4% Maturing Males
Cod	<i>Gadus morhua</i>	29	Majority of individuals were above their MLS size	44.8% Spent Females; 24.1% Maturing Males