South West of England Regional Development Agency

Wave Hub

Appendix K to the Environmental Statement

June 2006

Halcrow

South West *of* England
Regional Development Agency

South West Wave Hub

EIA BASELINE FISHERIES SURVEYS

Survey No. 1 (July 05) Report

July 2005

REPORT No. 05/J/1/06/0782/0521

Client :
Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Emu Ltd
Head Office
1 Mill Court
The Sawmills
Durley
Southampton
Hampshire
SO32 2EJ

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1. INTRODUCTION

1.1 This report presents the findings from the first of four fisheries resource surveys undertaken by Emu Ltd on behalf of Halcrow Group Ltd as part of the Environmental Impact Assessment (EIA) process being undertaken in relation to the South West Wave Hub project.

1.2 Halcrow Group Ltd is managing the EIA process for this development, which is being funded by the South West Regional Development Agency (SWRDA).

2. STUDY OBJECTIVES

2.1 The main objectives of the fisheries surveys are detailed below:

- To collect baseline data on the composition of fish resources within the study area in order to inform the EIA process being undertaken for the South West Wave Hub project;
- To collect baseline data on the spatial and temporal distribution of fish resources within the study area in order to inform the EIA process being undertaken for the South West Wave Hub project;
- To involve the local fishing community in the data gathering process for the EIA.
- **The surveys are in no way to be intended as a detailed stock assessment of any fishery species.**

2.2 In addition to these fish resource surveys, a commercial fisheries intensity study has also been commissioned. This study will describe commercial fishing activity and patterns in the study area.

3. METHODOLOGY

3.1 The surveys were designed and planned following consultation and meetings with members of the local fishing community and representatives of Cornwall Sea Fisheries Committee (CSFC). Following discussions, it was agreed to undertake a series of four fish resource surveys in order to develop some understanding of the seasonal changes in the fishery.

3.2 The surveys were undertaken aboard local commercial fishing vessels with experienced local skippers who were always consulted during the field work with respect to sampling strategy. Emu Ltd. was represented on each survey by an experienced marine ecologist, with the exception of the hand-lining for mackerel, where data was recorded directly by the skipper.

3.3 The gear used for otter trawling, potting and hand-lining was the same as that employed during commercial fishing activities.

3.4 The first survey was undertaken on Tuesday 12th and Wednesday 13th July 2005. Table 1 summarises the schedule for the first survey.

Date	Survey Undertaken	Vessel (Skipper)	Emu Staff aboard
12/07/05	Potting Survey (offshore)	*Swift* (John Carter)	Alec Moore
12/07/05	Potting Survey (inshore)	*Chloe Estelle* (Reg Easterbrook)	Jo Weir
13/07/05	Otter trawling	*Girlinda* (Chris Stevens)	Alec Moore
13/07/05	hand-lining	*Ellie V* (Michael Veale)	Jo Weir
1st survey not yet undertaken	hand-lining for mackerel	*Sally Ann of Navax* (Peter Ghey)	NA

Table 1 Summary of sampling events (July 2005)

3.5 The preliminary positions for the survey stations were chosen in order to sample locations within and outside the proposed wave hub exclusion zone and also along the proposed route of the site to shore cable. Co-ordinates were calculated using a GIS system and issued to the skippers via post prior to the surveys so that they could input these into their vessel's GPS. This provided them with an opportunity to comment as to whether any stations selected by Emu were not suitable for any reason, i.e. in an area of beam trawling activity (unsuitable for pots) or on hard ground (unsuitable for trawling).

3.6 Where some stations were indeed inappropriate, the skippers suggested more appropriate locations which were agreed by Emu staff. On the actual day of the survey, all survey positions were recorded on the vessel using the vessel's own GPS system. All GPS systems used were based on the WGS84 datum.

3.7 For the potting surveys, the positions when hauling began and ended were noted, whilst for the trawling the start and end positions of each tow were noted. With respect to the hand-lining on wrecks and hard ground, a single position was noted, around which fishing was concentrated for 30 minutes.

3.8 Survey logs and positions are appended. Weather, sea state and other information (e.g. other vessels) were also recorded as appropriate.

Specific Survey Methodologies

(1) Potting Surveys

3.9 Two separate potting surveys were undertaken in order to obtain data from the offshore wave hub area and closer inshore in the area of the site to shore cable route. The offshore area was fished by *Swift* whilst the inshore area was fished by *Chloe Estelle*.

3.10 For both vessels, strings of 25 pots were shot on the afternoon of Sunday 10th July. All pots were new & parlour-type, and baited with both dogfish (*Scyliorhinus* sp.) and scad (*Trachurus trachurus)*. The pots were subsequently retrieved on 12th July, resulting in a soak time of approximately 48 hours.

3.11 Upon retrieval, the following was noted for every pot:

- The numbers of sized, under-sized and soft brown crab;
- The numbers of sized, under-sized and soft spider crab; and
- The numbers of sized under-sized and berried lobsters.

On every 5th pot, measurements were taken on the carapace width of crabs and carapace length of lobsters.

3.12 The positions of the stations fished by *Swift are* shown in Figure 1 whilst the stations fished by *Chloe* Estelle are shown in Figure 2.

(2) Otter Trawling Survey

3.13 A commercial otter trawl gear was used, with approximately 85ft spread & 9ft lift. The trawl was fitted with a 85mm cod-end mesh. Tow lengths varied from 5 minutes to 15 minutes.

3.14 Upon retrieval of the catch, all fish species caught were recorded and length measurements taken. Where large catches were landed, sub-samples were taken to undertake length measurements and an estimate of numbers landed.

3.15 Photographs were also taken of the catch upon being landed.

3.16 The positions of the tows are shown in Figure 3.

(3) Hand-lining Survey

3.17 The commercial hand-lining gear comprised of a set of seven hooks baited with rubber eels. Hand-lining was undertaken for 30 minutes at each site.

3.18 Each time the line was under tension due to fish being caught, the hand-lining gear was brought to the surface, and the fish were released. The hand-line was then placed back into the water. This was repeated until the 30 minutes period was completed.

3.19 Upon retrieval of catch, species were identified, enumerated and total length measurements were taken. Photographs of the species caught (pollack only) were taken.

3.20 The positions of the hand-lining locations are shown in Figure 4.

4. RESULTS

4.1 The following section of the report presents the key results from the first fisheries surveys undertaken on 12-13th July 2005. Summary data sheets are included in the Appendix I.

Potting Survey aboard Swift

4.2 Potting was carried out at a total of 7 sites. The main species recorded in the pots were brown crab (*Cancer pagurus*), with smaller numbers of spider crab (*Maja squinado*) and lobster (*Homarus*) also recorded.

4.3 All catches of crab species and lobster were recorded and identified as sized/under-sized or soft. Over the total number of pots, under-sized brown crabs were the highest number recorded, with over 200 individuals noted.

4.4 The catch ratio (numbers per pot) was calculated for each of the key species captured. The catch ratios for each survey station are shown in Figure 5.

4.5 In addition to the species listed above, several other species were recorded in the pots. The common whelk (*Buccinum undatum*) provided the highest numbers of individuals but this was attributed to large numbers at a single site. Other species of note included velvet swimming crab (*Macropipus puber*), conger eel (*Conger conger*), and the hermit crab (*paguridae*). Smaller individuals of spiny starfish (*Marthasterias glacialis*), greater spotted dogfish (*Scyliorhinus stellaris*), bib (*Trisopterus luscus*) and small spotted dogfish (*Scyliorhinus canicula*) were also recorded.

Plate 1: Retrieval of pots aboard *Swift*, 12th July 2005

Potting Survey aboard Chloe Estelle

4.6 Strings of 25 pots were retrieved after a 48 hour soak on Tuesday 12th July 2005. The main species recorded in the pots were the brown crab (*Cancer pagurus*), the spider crab (*Maja squinado*) and the common lobster (*Hommarus gammarus*), with sized brown crab being recorded at every station.

4.7 The catch ratio (numbers per pot) was calculated for each of the key species captured. The catch ratios for each survey station are shown in Figure 6.

4.8 From Figure 6 it is possible to note that of all the survey stations, Station 6 had the highest catch ratio for sized and under-sized lobsters, although catch ratios of sized brown and spider crab from this station were low.

4.9 The highest catch ratio for sized brown crab was recorded at Station 5 which lies close to the proposed cable route.

4.10 The highest recorded catch ratio for sized spider crabs was recorded at Station 1 which was inshore and relatively adjacent to the proposed cable route.

4.11 The ratio of sized brown crabs to sized spider crabs caught at all stations was almost exactly 50:50.

4.12 Lobsters were recorded at 4 of the seven sites, with twice as many under-sized individuals recorded as sized.

Otter trawl survey aboard Girlinda

4.13 A total of 8 sites were trawled on 13th July 2005. The sites were distributed within Saint Ives Bay and included sites adjacent to the proposed site to shore cable route.

4.14 The total number of species recorded at each station is shown in Figure 7 with the total abundance of all species shown in Figure 8.

4.15 A total of 32 different species were recorded in the trawls, with the most abundant species recorded being the spider crab (*Maja squinado)* which was recorded at all 8 sites. The high abudance of this species noted during the trawl surveys was largely due to the landings taken at Stations 3 and 5, where the number of individuals was very high and estimates were taken based on the number of crabs per basket.

Plate 2:
Catch of spider crab (*Maja squinado)* landed aboard *Girl Linda*

4.16 Other species recorded in high numbers include red gurnard (*Aspitrigla cuculus)*, the lesser spotted dogfish (*Scyliorhinus canicula*) and squid (*Loligo sp*.).

4.17 Several high value commercial species were also recorded including monkfish *(Lophius piscatorius)*, plaice (*Pleuronectes platessa)*, cod (*Gadus morhua*) and john dory (*Zeus faber*).

Plate 3:
Monkfish (*Lophius piscatorius*) landed aboard *Girl Linda* at Station 8

4.18 Several species of rays were also captured included thornback rays (*Raja clavata*), spotted rays (*Raja montagui*), blonde rays (*Raja brachyura*) and small-eyed rays (*Raja microcellata).*

Hand-lining Survey aboard Ellie V

4.19 A total of 8 sites were fished aboard *Ellie V* on 13th July 2005. The only species recorded during this survey was pollack (*Pollachius pollachius*). No fish at all were captured at 4 of the 8 stations.

4.20 The abundance of pollack caught at each survey station is shown in Figure 9. From this, it can be noted that the greatest abudance of pollack was landed at Station 8, where 20 individuals were recorded.

Plate 4:
pollack (*Pollachius pollachius*) landed aboard *Ellie V*

4.21 The size distribution of all the pollack caught is shown below in Figure 10. From this it can be noted the majority of fish fell within the 51-55cm size class. This quite distinct cohort suggests that these fish comprise a distinct year class.

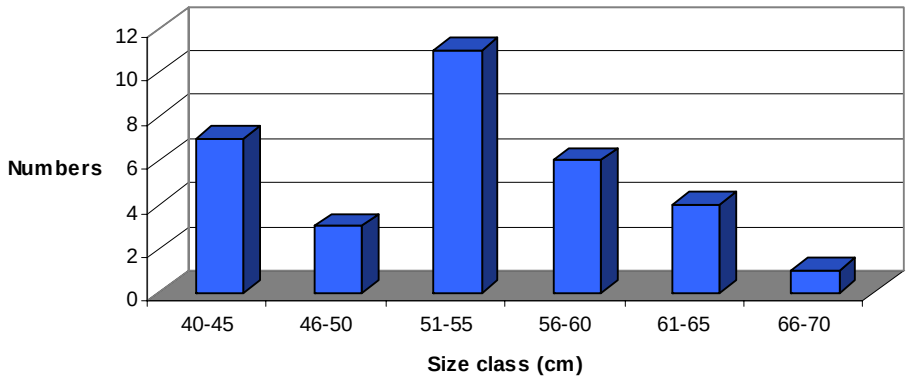


Figure 10: Size distribution of pollack caught in July 2005 survey

Mackerel hand-lining aboard Sanny Ann of Navax

4.22 At the time of preparing this report, the first hand-lining survey for mackerel had not taken place as the local skipper had reported that the mackerel had not yet moved onto the inshore grounds where we asked him to fish. This in itself is a valuable source of data which illustrates the highly seasonal and spatially variable nature of mackerel resource in this area.

4.23 The results from the first survey will be included in the next survey report, due on September 20th 2005.

Other Observations

4.24 During the two days of survey, a number of interesting marine ecological observations were made by the Emu field staff. On 13th July, whilst aboard *Ellie V*, a basking shark (*Cetorhinus maximus*) was viewed, along with several common dolphins (*Delphinius delphis*). In addition, the ocean sunfish (*Mola mola*) was also sighted.

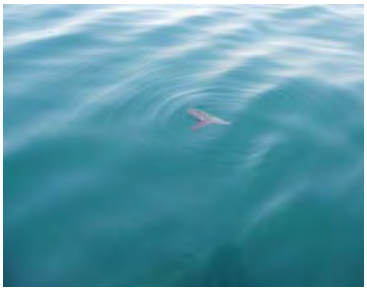


Plate 5:
Sunfish (*Mola mola*) sighted aboard *Ellie V*

Plate 6:
Basking shark (*Cetorhinus maximus*) sighted aboard *Ellie V*

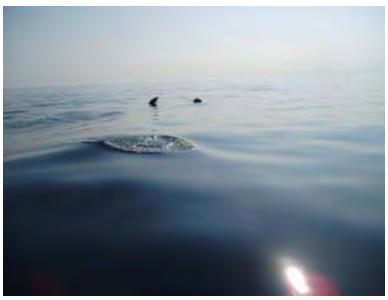


Plate 7:
Common dolphins (*Delphinius delphis*) sighted aboard *Ellie V*

5.0 DISCUSSION

5.1 The initial set of fish resource surveys undertaken offshore of Hayle, Cornwall indicate that the area supports a diverse fishery, with a wide range of fish and shellfish species recorded.

5.2 Data from the potting surveys and also, to a lesser degree, from the inshore otter trawl survey, indicate that at this time of the year spider crab (*Maja squinado*) exists at relatively high levels within the inshore part of the study area. In contrast, only 2 under-sized specimens of this species were recorded in the offshore potting survey.

5.3 It is known from discussions with local fishermen, that the spider crab is a key component of the commercial fishery off Hayle, especially during summer months when this species moves onto inshore grounds.

5.4 Brown crab and lobster were also recorded in both the inshore and offshore potting surveys, which indicate that these species are distributed widely throughout the study area.

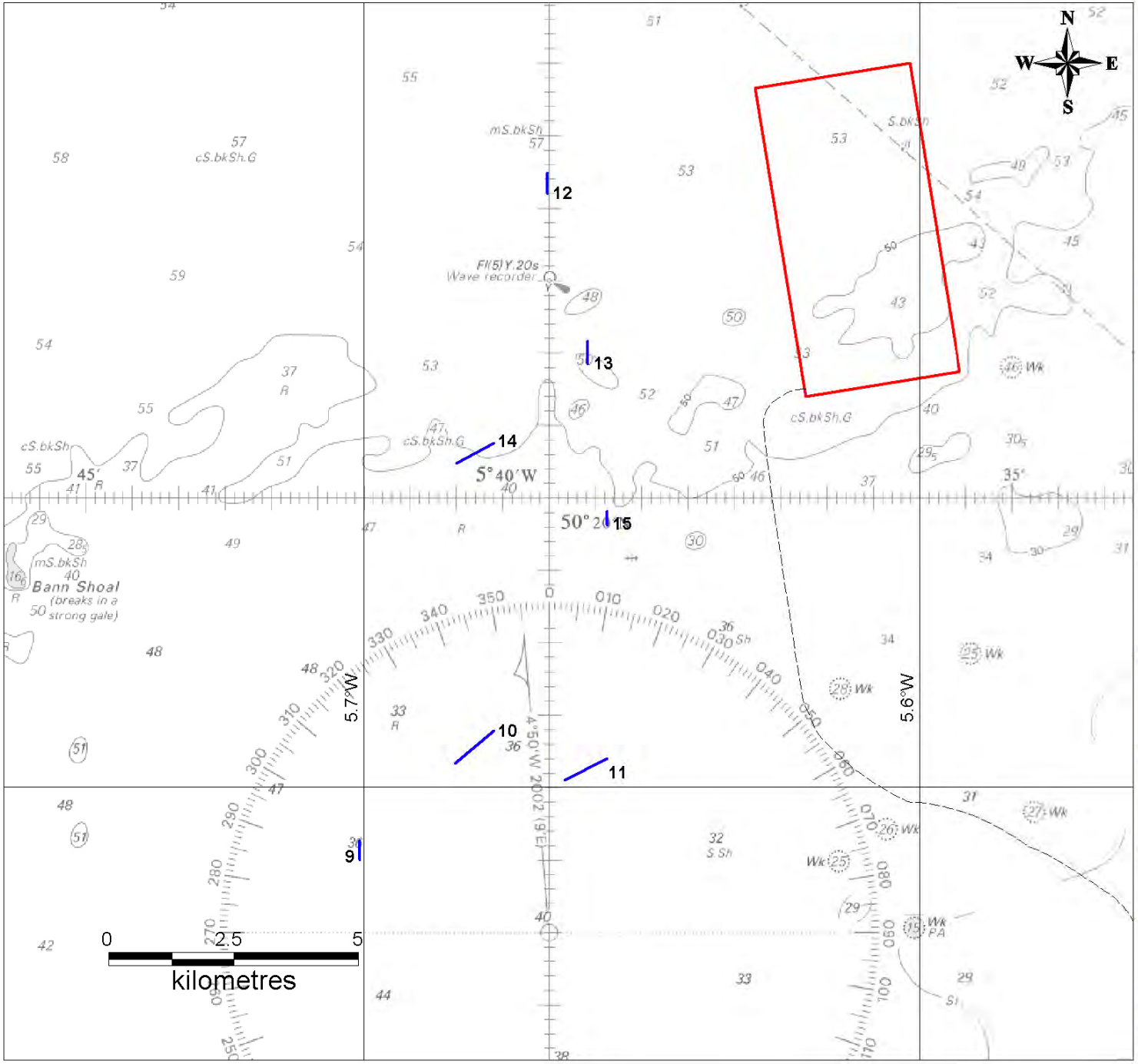
5.5 With respect to finfish, pollack (*Pollachius pollachius*) was the only species recorded at some of the hard ground/wreck areas fished by hand-lining. A greater diversity of species was recorded from the otter trawling survey within Saint Ives Bay. In total, 24 species of finfish were recorded during this survey, including a number of high value commercial species such as john dory (*Zeus faber*), bass (*Dicentrarchus labrax*) and monkfish (*Lophius piscatorius*).

5.6 The range of species recorded from this first set of surveys is fairly typical of the type and location of grounds fished and the time of year (July). A further survey will be carried out in late August which will complement this first survey and provide additional information on any seasonal changes to fish resources in this area.

6.0 AUDIT TRAIL

Title: South West Wave Hub Project – EIA Baseline Fisheries Surveys			
Report No: 05/J/1/06/0782/0521 **Job No:** J/1/06/0782 **Client Name:** Halcrow Group Ltd **Client Contact:** Steve Challinor			
		Initials	**Date**
Project Manager:	Dr N.S. Thomas		
Data Analysis undertaken by:	Alec Moore / Jonny Lewis		
Report written by:	Jonny Lewis		
Report checked by:	Claire Espinasse		
Report Authorised by:	Dr N.S. Thomas		

FIGURES



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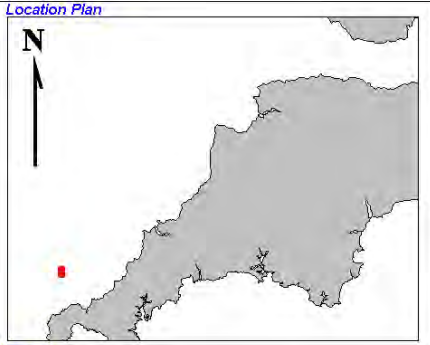

Legend

- Potting Sampling Transects
- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)

July Survey 2005

Notes

Coordinate System:
WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Offshore Potting Survey Stations
(Swift)

Job No.	Date Issued	Figure 1		
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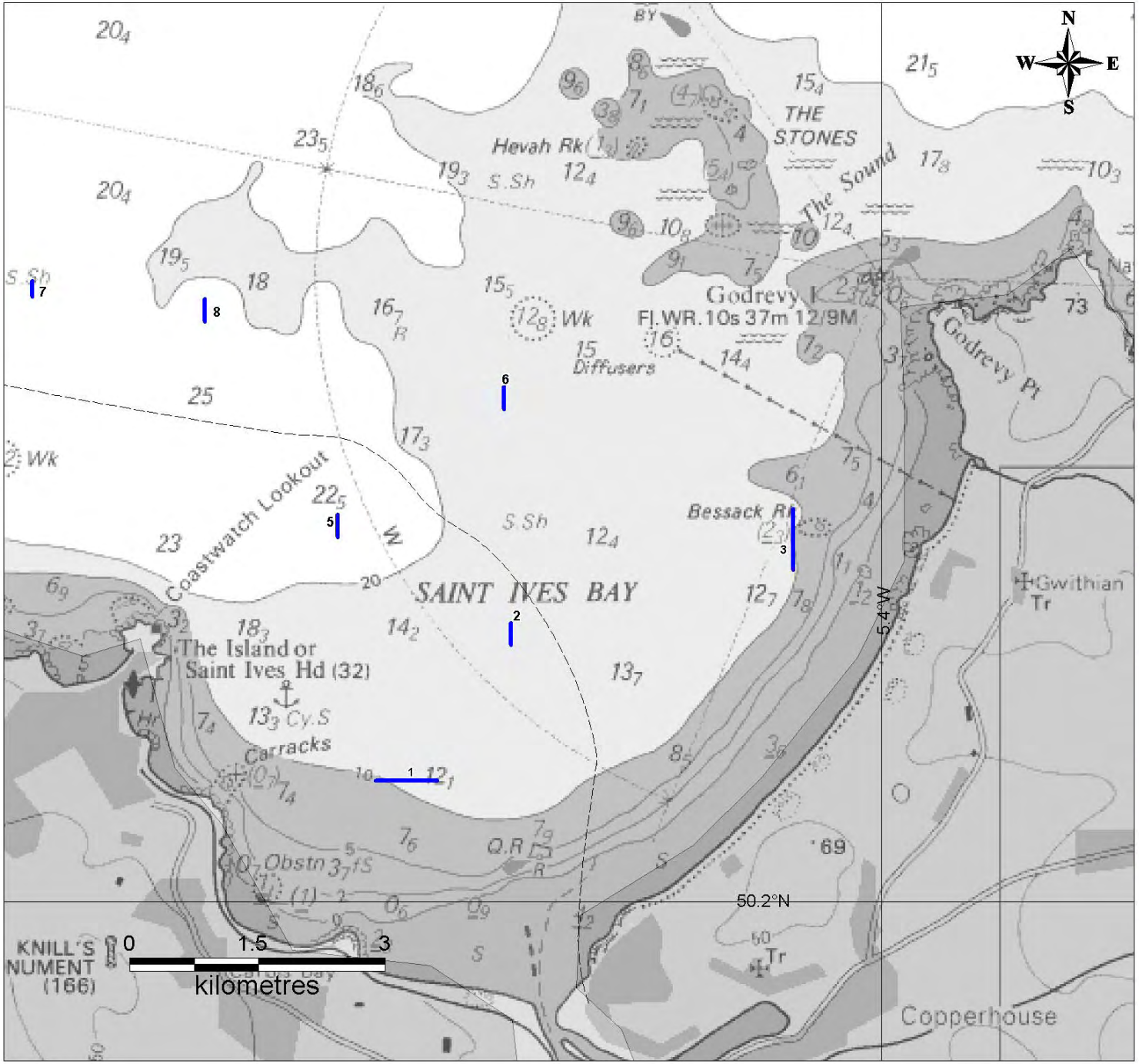

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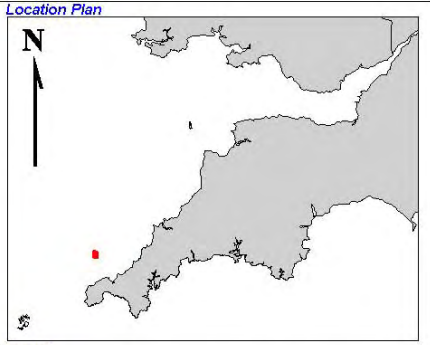

Legend

- Potting Sampling Transects
- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)

July Survey 2005

Notes

Coordinate System: WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Inshore Potting Survey Stations
(Chloe Estelle)

Job No.	Date Issued			
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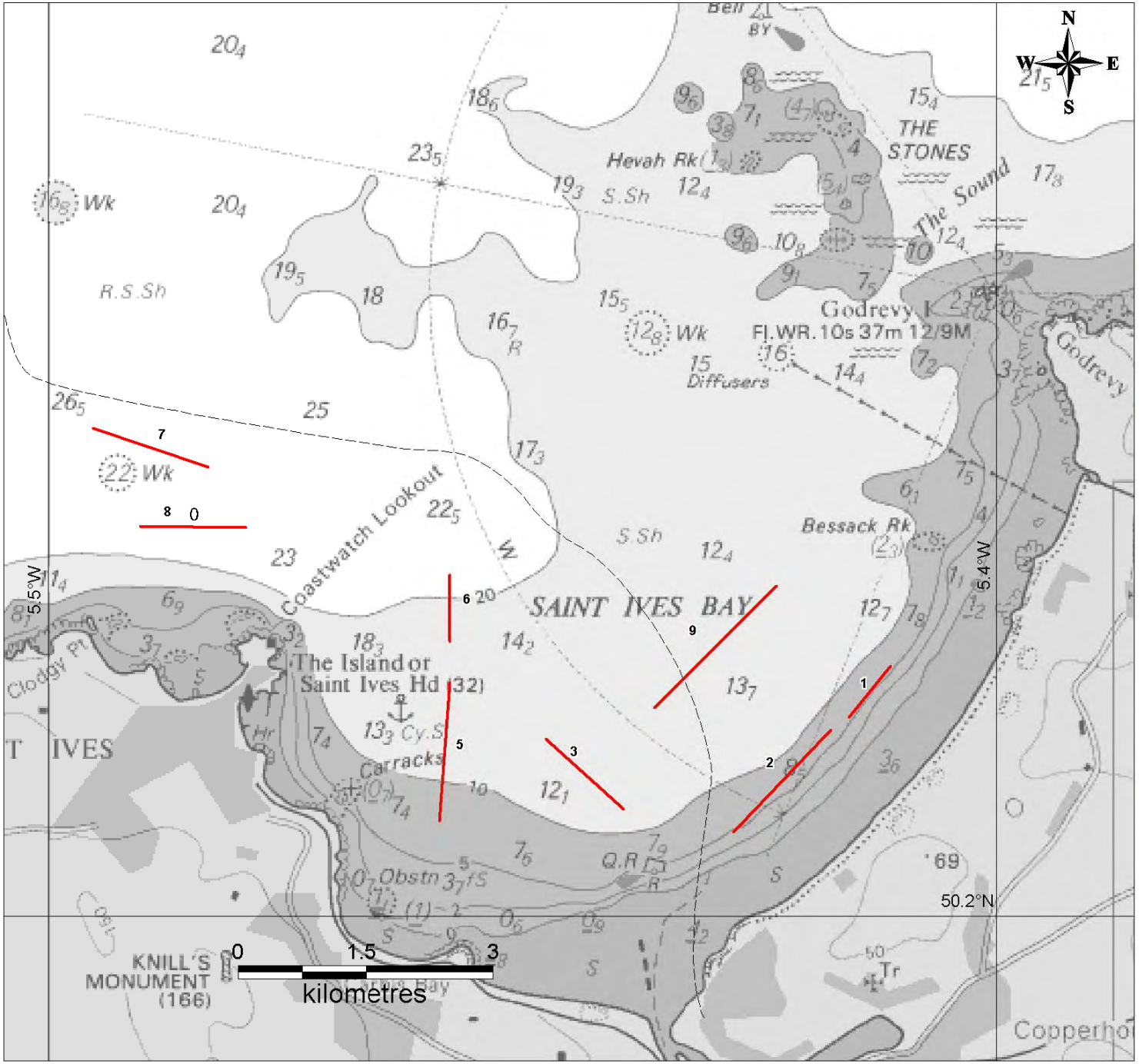

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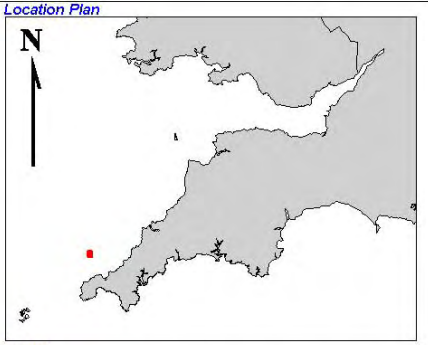

Legend

- Otter Trawling Sampling Tows
- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)

July Survey 2005

Notes

Coordinate System:
WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Otter Trawling Survey Tows
(Girl Linda)

Job No.	Date Issued	Figure 3		
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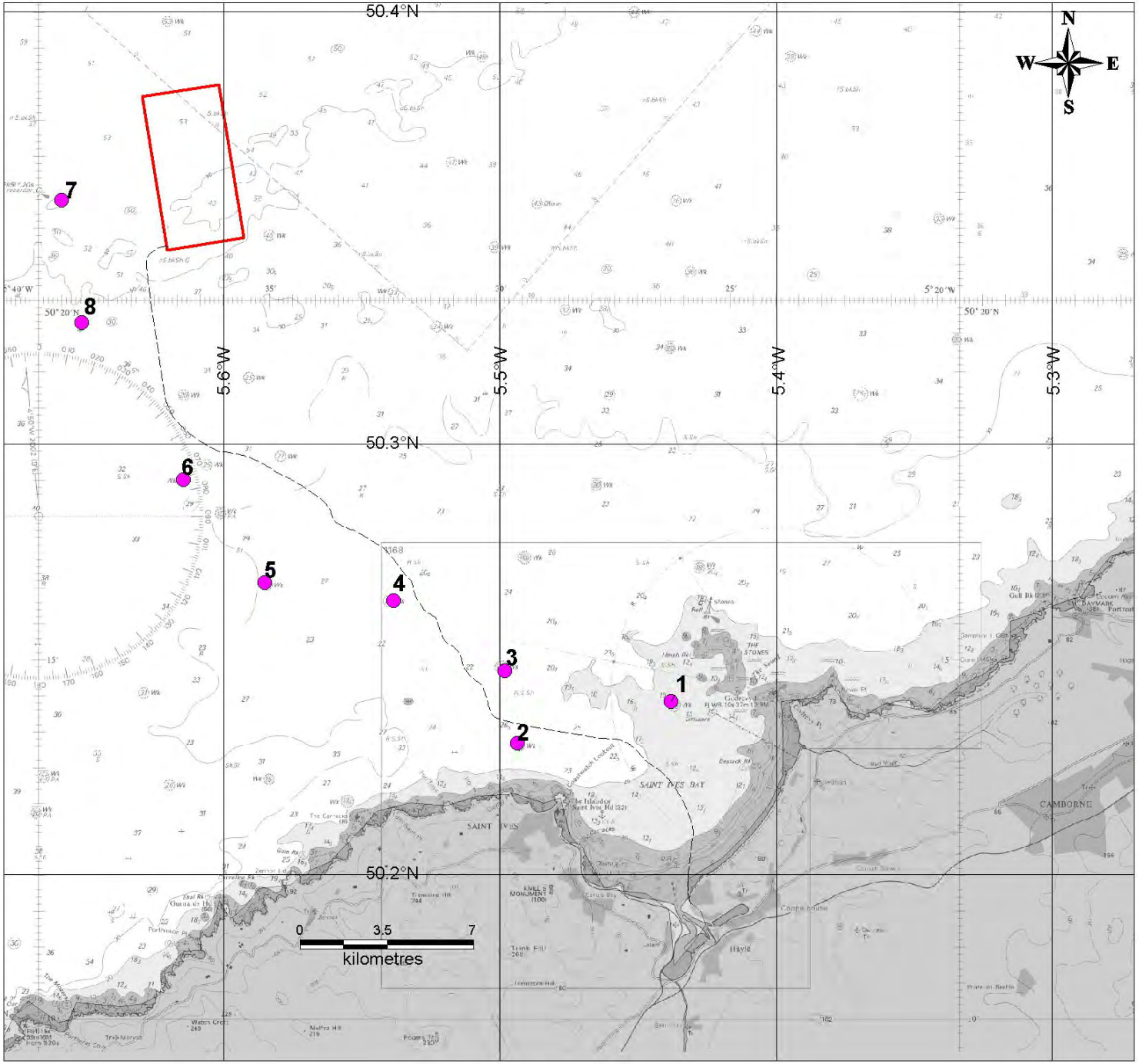

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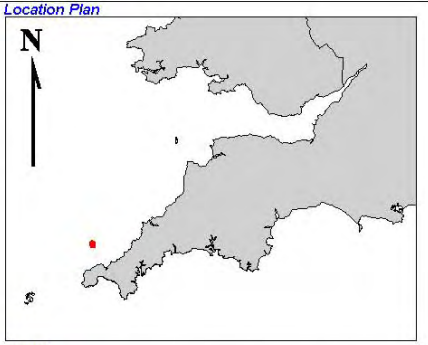

Legend

- Hand Lining Sampling Locations
- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)

July Survey 2005

Notes

Coordinate System:
WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Handlining Survey Locations
(Ellie V)

Job No.	Date Issued	Figure 4		
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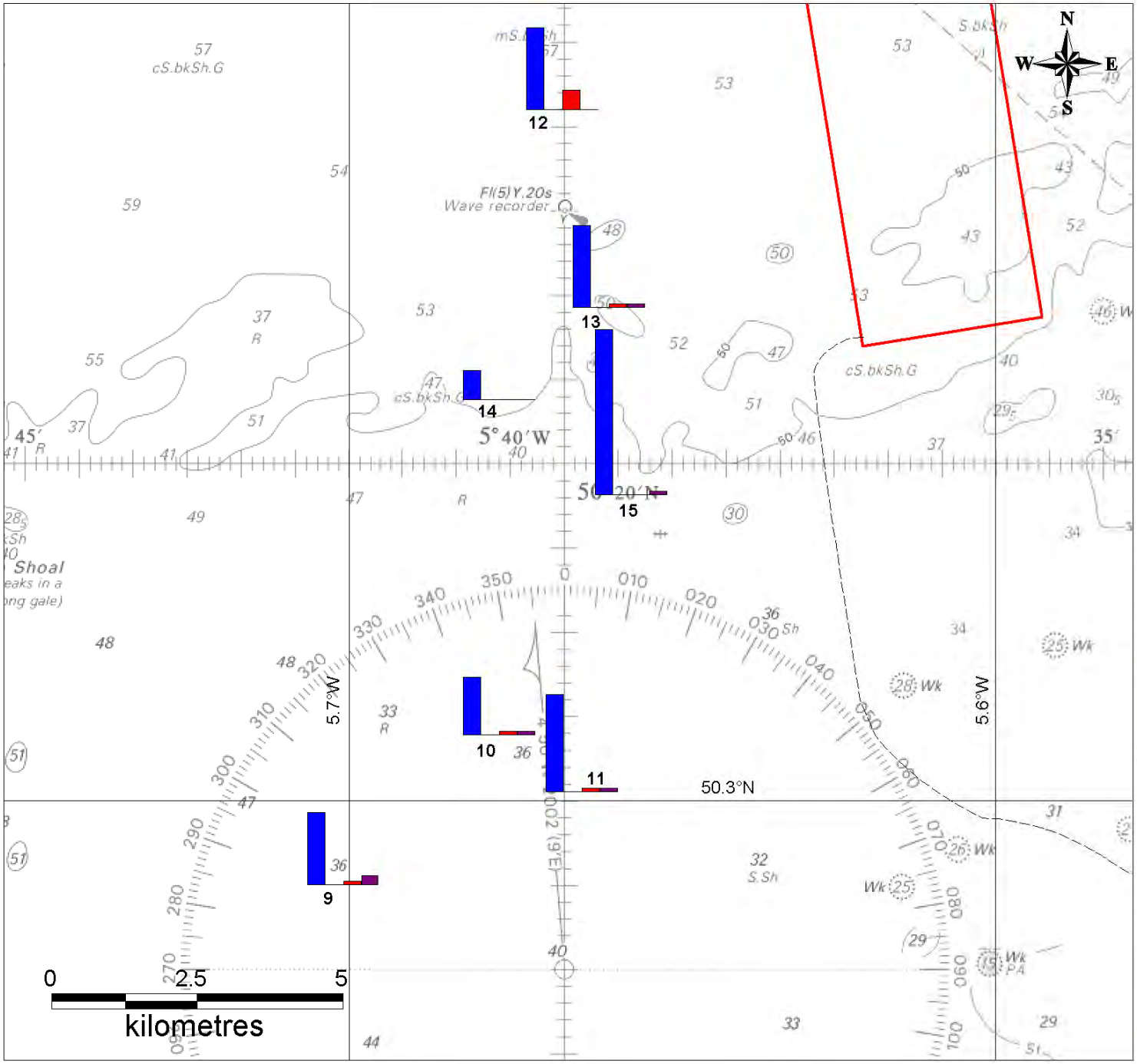

Legend

Proposed Site to Shore Cable Route

Proposed Wave Hub Site (New Deployment Area)

1.4

Brown crabs sized
Spider crabs sized
Sized lobsters
Undersized lobsters

July Survey 2005

Notes

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WGS 84

Client

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU Ltd.
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Offshore Potting Catch Ratio of Main Species

Job No.	Date Issued	Figure 5		
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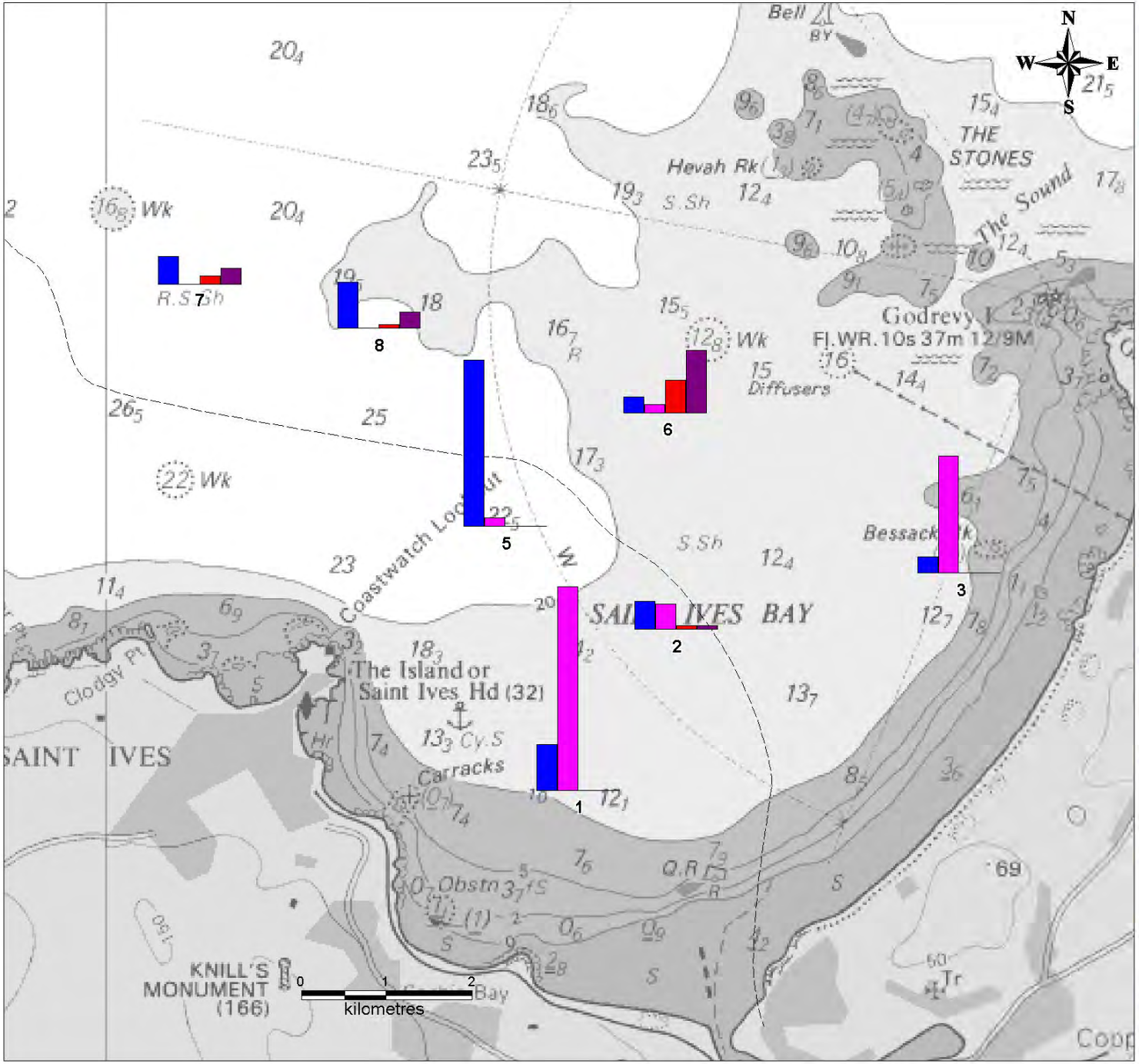

Legend

Proposed Site to Shore Cable Route

Proposed Wave Hub Site (New Deployment Area)

Bar Chart of potting_ratios

July Survey 2005

Notes

Coordinate System:
WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU Ltd.
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Inshore Potting Catch Ratio for Main Species
(Chloe Estelle)

Job No.	Date Issued	Figure 6		
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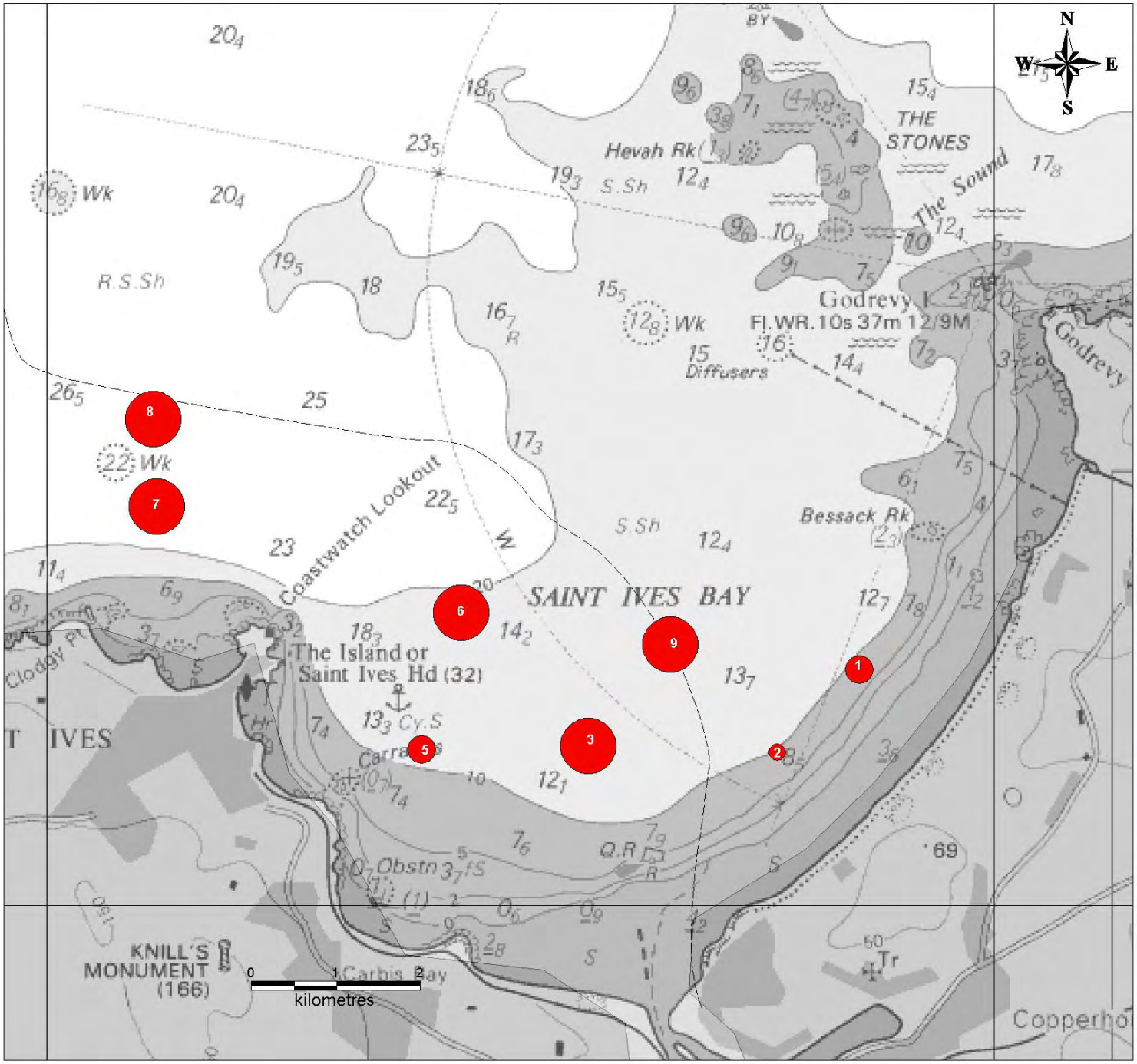

Legend

- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)
- Total Species Numbers (11-15)
- Total Species Numbers (6-10)
- Total Species Numbers (1-5)
- 4 — Station Number

July Survey 2005

Notes

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Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

Emu

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Otter Trawling
Total Numbers of Species per Tow

Job No.	Date Issued	Figure 7		
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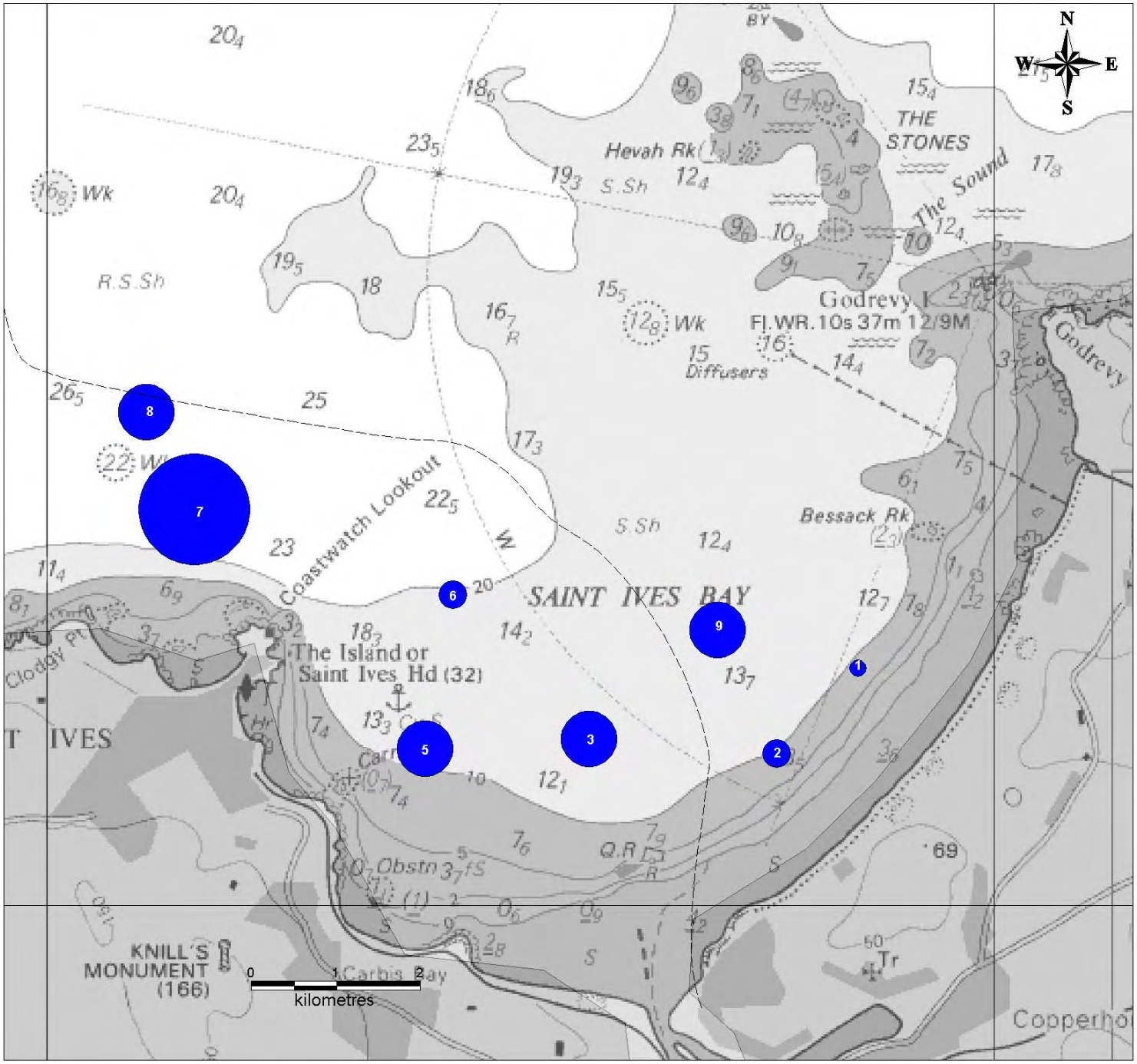

Legend

- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)
- Total Individuals (201-500)
- Total Individuals (101-200)
- Total Individuals (51-100)
- Total Individuals (1-50)
- 4 — Station Number

July Survey 2005

Notes

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Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Otter Trawling
Total Numbers of Individuals per Tow

Job No.	Date Issued	Figure 8		
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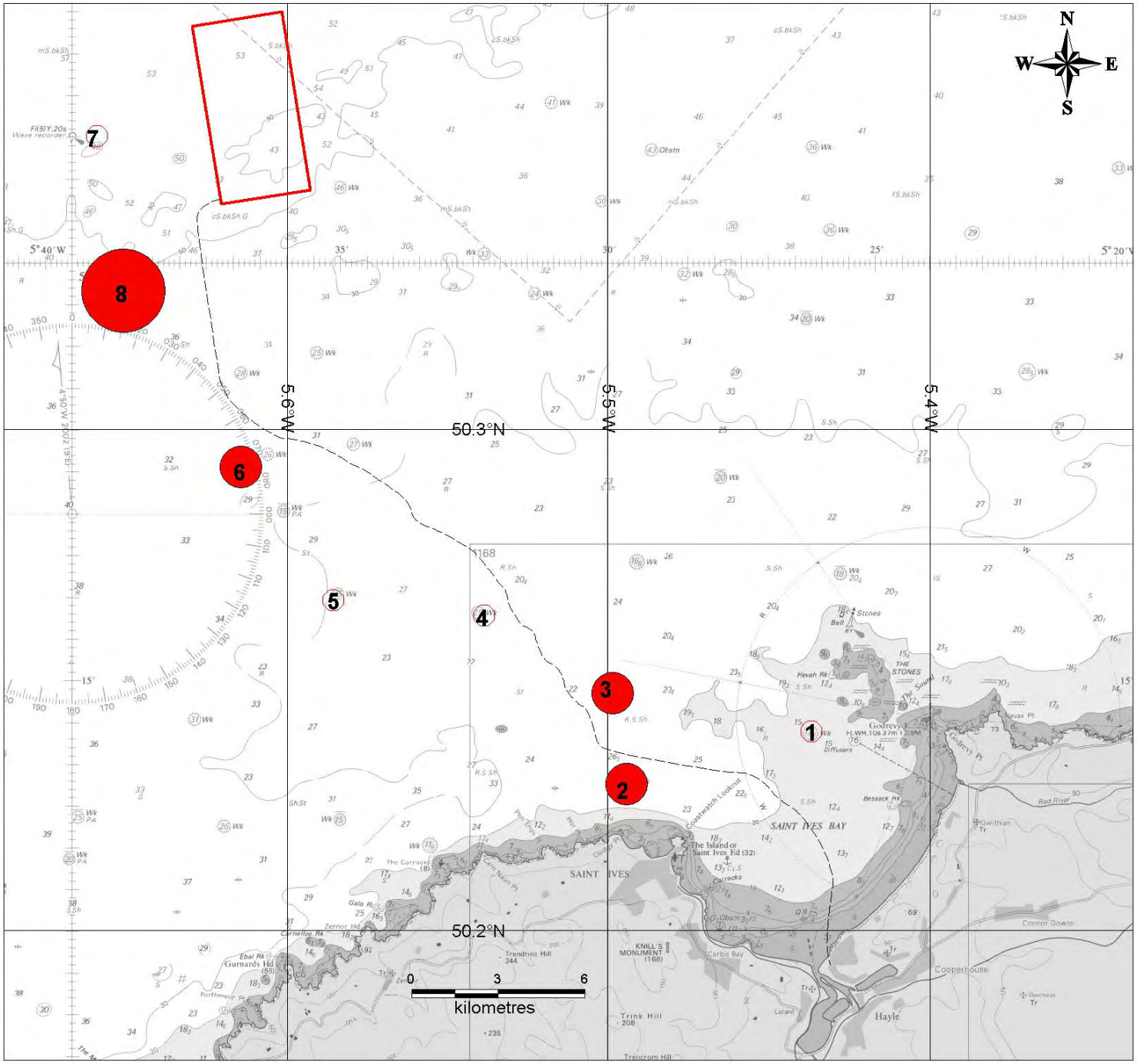


Legend

- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)
- Number of Individuals >20
- Number of Individuals 6-10
- Number of Individuals 1-5
- 4 — Station Number

July Survey 2005

Notes

Coordinate System:

WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

Emu

Emu Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Total Numbers of Pollack Caught at Handlining Stations

Job No.	Date Issued	Figure 9		
J/1/06/0782	2/5/06			
Sheet Size	**Scale**	**Drawn by**	**Checked by**	**Revision No.**
A4	1: 1.211 km	RLC	JXL	

APPENDICES

APPENDIX I – Survey Logs

South West Wave Hub Fisheries Surveys

Potting Survey Tuesday 12th July 2005

Vessel: *Swift* (9.9m)

Skipper: John Carter
Emu Surveyor: Alec Moore
+ 2 crew

Pots were shot on the afternoon of Sunday 10th July. All pots were new & parlour-type, and baited with both dogfish *Scyliorhinus* spp. & scad *Trachurus trachurus*.

Weather: Wind 0. Sea state: smooth. Visibility excellent. Clear skies (0/8 cloud cover).

Note that all positions are in WGS84 datum.

1050	Haul string number 12. Start: 50^0 22.093 N, 05^0 40.355 W.
1105	Finish hauling. End: 50^0 22.240 N, 05^0 40.013 W.
1120	Haul string number 13. Start: 50^0 20.921 N, 05^0 40.183 W.
1135	Finish hauling. End: 50^0 21.080 N, 05^0 39.896 W.
1144	Haul string number 15 (approx 175ft depth). Start: 50^0 19.808 N, 05^0 39.937 W.
1203	Finish hauling. End: 50^0 19.902 N, 05^0 39.579 W.
1236	Haul string number 11. Start: 50^0 18.048 N, 05^0 39.829 W.
1257	Finish hauling. End: 50^0 18.194 N, 05^0 39.374 W.
1319	Haul string number 14 (approx 172ft depth). Start: 50^0 20.375 N, 05^0 40.594 W.
1332	Finish hauling. End: 50^0 20.234 N, 05^0 40.997 W.
1348	Haul string number 10 (approx 129ft depth). Start: 50^0 18.385 N, 05^0 40.644 W. Single unidentified dolphin seen within 100m of vessel at commencement of hauling.
1407	Finish hauling. End: 50^0 18.162 N, 05^0 41.009 W.
1422	Haul string number 9 (approx 136ft depth). Start: 50^0 17.495 N, 05^0 42.293 W.
1438	Finish hauling. End: 50^0 17.682 N, 05^0 42.048 W. End of survey.
1600-1800	(approx.) Vessel hauls 3 strings of commercial (non-survey) pots on the Eastern side of Hayle Bay, in shallow (ca. 4-5m) water (sandy bottom). Catch consists largely of spider crabs *Maja squinado*, although many are returned as they are soft. Three triggerfish *Balistes capriscus* (approx 30cm TL) caught as bycatch.

Total catch for the day (excluding non-survey pots lifted):
Brown crab: 91kg
Lobster: 11kg

1828	Alongside at Hayle.

South West Wave Hub Fisheries Surveys

Otter Trawling Survey Wednesday 13th July 2005

Vessel: *Girl Linda*

Skipper: Chris Stevens
Emu Surveyor: Alec Moore
Mate: Chris Care

Weather: Wind 0, occasional light NW breeze. Sea state: smooth. Thick fog (visibility <50m) until approximately 1200, burning off to clear skies (0/8 cloud cover).

Otter trawl gear used; approx 85ft spread & 9ft lift. 85mm cod-end mesh.

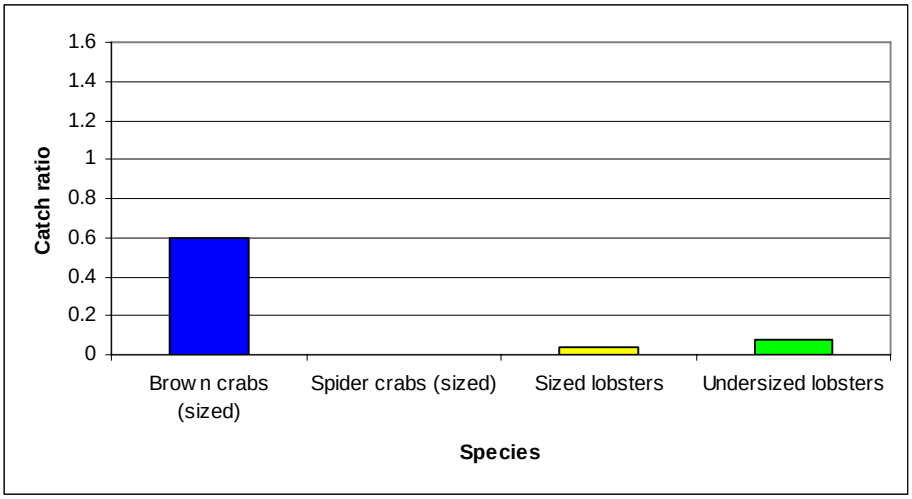
Note that all positions are in WGS84 datum. Note all depths approximated by skipper; echosounder inoperative.

1120	Otter trawl Station 6. Start: 50^0 13.115 N, 05^0 27.460 W. 2.4Kts; COG 053^0; 60ft.
1130	Haul Station 6 (50^0 13.386 N, 05^0 27.051 W) 5 minutes early as vessel has trawled through potting gear (visibility greatly affected by thick fog). Crew spend nearly an hour cutting loose & correcting tangles with assistance from a mackerel hand-lining dinghy & skipper.
1246	Otter trawl Station 7. Start: 50^0 13.983 N, 05^0 29.717 W. 1.8Kts; COG 158^0; 70ft.
1301	Haul Station 7 (50^0 13.825 N, 05^0 28.988 W). Ocean sunfish *Mola mola* (ca. 1m TL) observed at surface, approaching to within 20m of vessel.
1349	Otter trawl Station 8. Start: 50^0 13.583 N, 05^0 29.421W. 1.8Kts; COG 090^0; 30ft.
1404	Haul Station 8 (50^0 13.577 N, 05^0 28.750 W). Survey vessel Wessex Explorer stationary nearby (<50m).
1522	Otter trawl Station 5. Start: 50^0 12.949 N, 05^0 27.785W. 2.6Kts; COG 152^0; 25ft. Could not fish directly over station due to the presence of pot strings (indicated by dan buoys).
1537	Haul Station 5 (50^0 12.387 N, 05^0 27.527 W). Huge haul (ca. 0.5 tonne) of spider crab *Maja squinado* that fills both cod-end and belly of net. Approximately half an hour spent removing them.
1640	Otter trawl Station 1. Start: 50^0 13.016 N, 05^0 24.669W. 2.6Kts; COG 235^0; 25ft. Could not fish directly over station due to the presence of pot strings (indicated by dan buoys)- fished parallel to beach between strings & beach. Designated co-ordinates for station in inaccessibly shallow water. Only a 5 minute trawl was performed on advice from skipper that the station would also have large numbers of spider crab present.
1645	Haul Station 1 (50^0 12.808 N, 05^0 24.937 W).
1723	Otter trawl Station 2. Start: 50^0 12.758 N, 05^0 25.050W. 2.6Kts; COG 230^0; 25ft. Tow restricted by pot strings in area.
1738	Haul Station 2 (50^0 12.341 N, 05^0 25.664 W).
1818	Otter trawl Station 9. Start: 50^0 12.847 N, 05^0 26.168W. 2.6Kts; COG 062^0; 50ft. Tow moved inshore as the designated station was on hard, unfishable ground.
1833	Haul Station 2 (50^0 13.340 N, 05^0 25.394 W).
1946	Otter trawl Station 3. Start: 50^0 12.435 N, 05^0 26.358W. 2.6Kts; COG 320^0; 30ft. Tow restricted by numerous pot strings in area, therefore not exactly on mark. Ten minute trawl performed as precaution against catching large numbers of spider crab.
1956	Haul Station 3 (50^0 12.721 N, 05^0 26.853 W. Approximately 300+ spider crab *M. squinado* (ca. 160kg estimated on basis of 1 basket=20kg=40 animals) hauled.
2115	Alongside at Hayle.

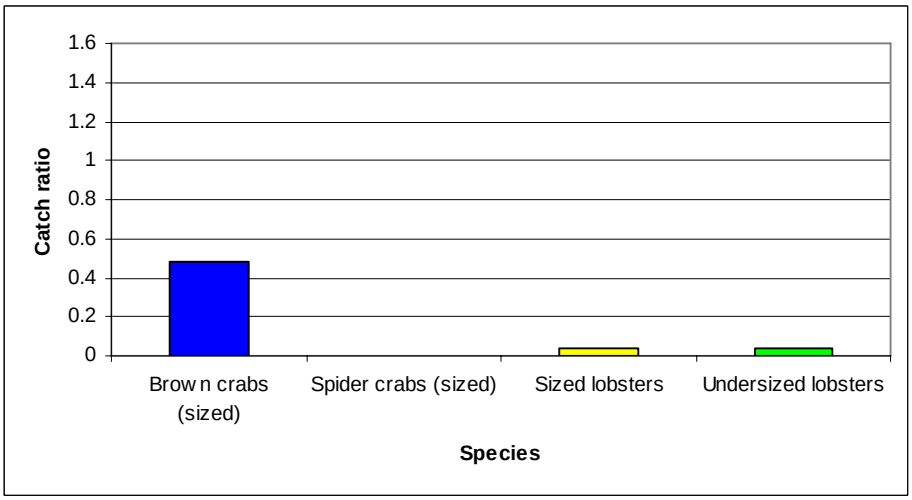
APPENDIX II – Survey Data

CATCH RATIO OF KEY SPECIES RECORDED DURING JULY 2005 OFFSHORE POTTING SURVEY (*Swift*)

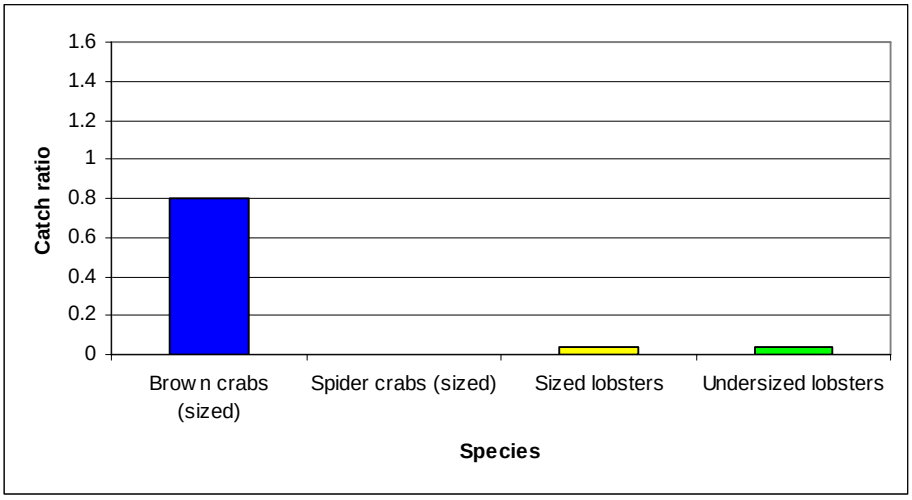
Station 9



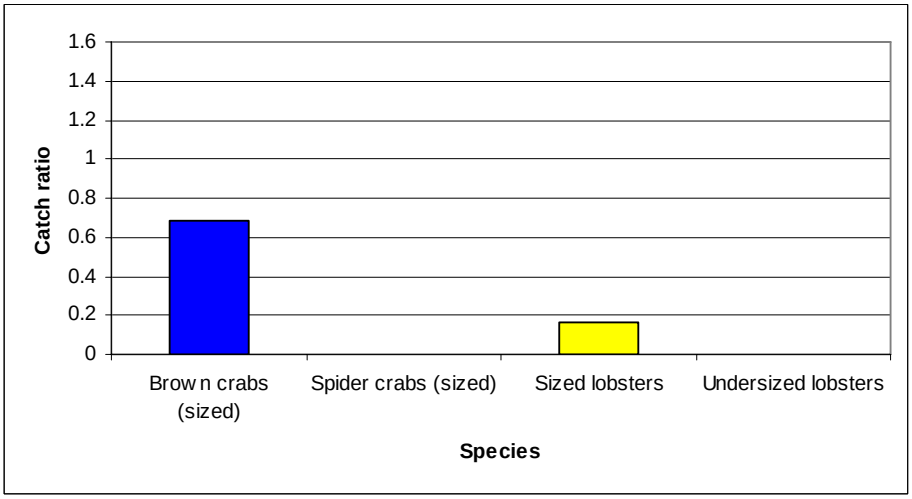
Station 10



Station 11



Station 12



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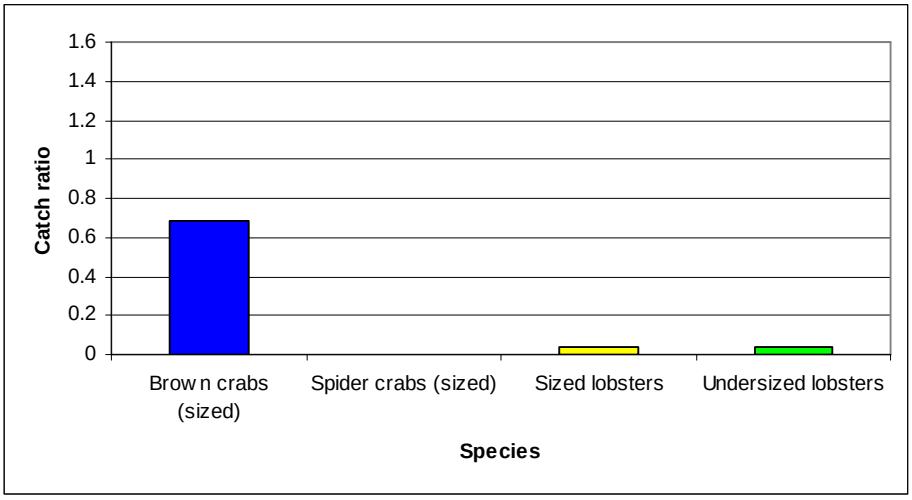

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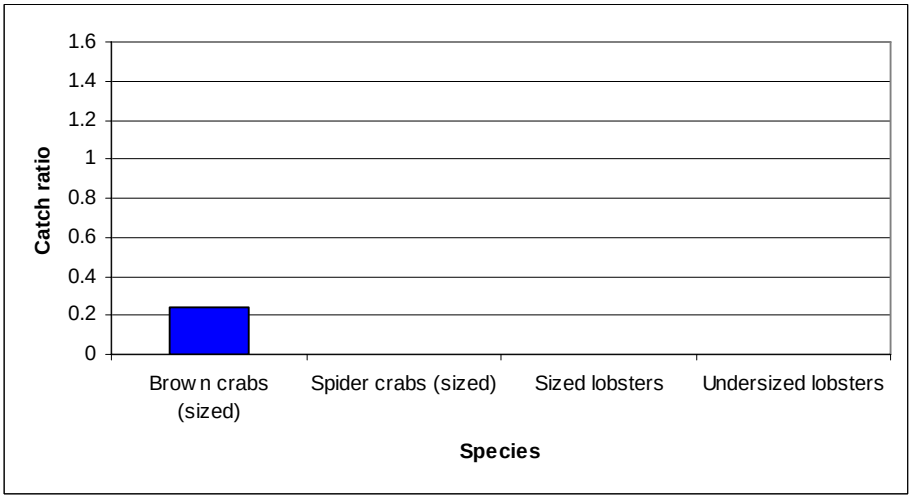

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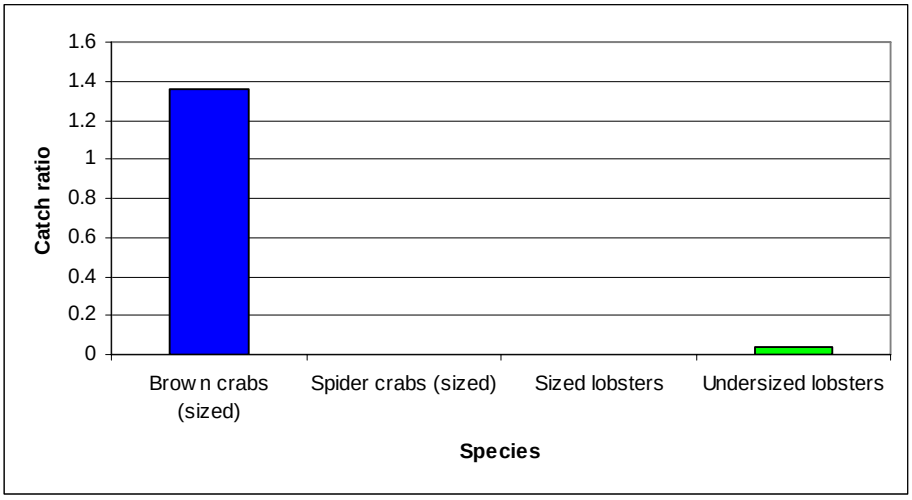
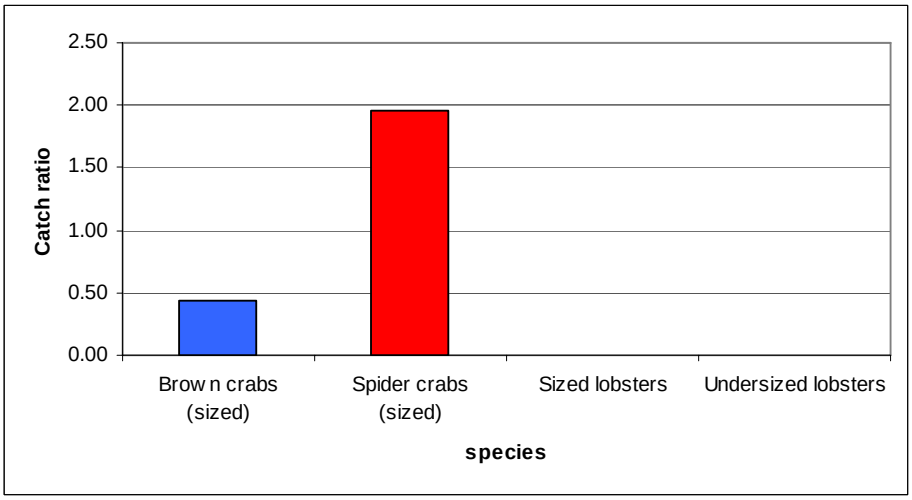
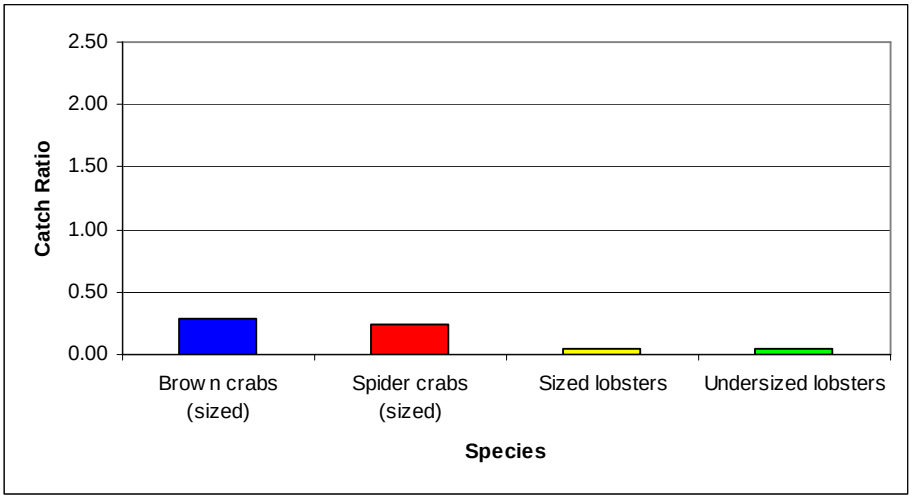


CATCH RATIO OF KEY SPECIES RECORDED DURING JULY 2005 INSHORE POTTING SURVEY (*Chloe Estelle*)

Station 1



Station 2



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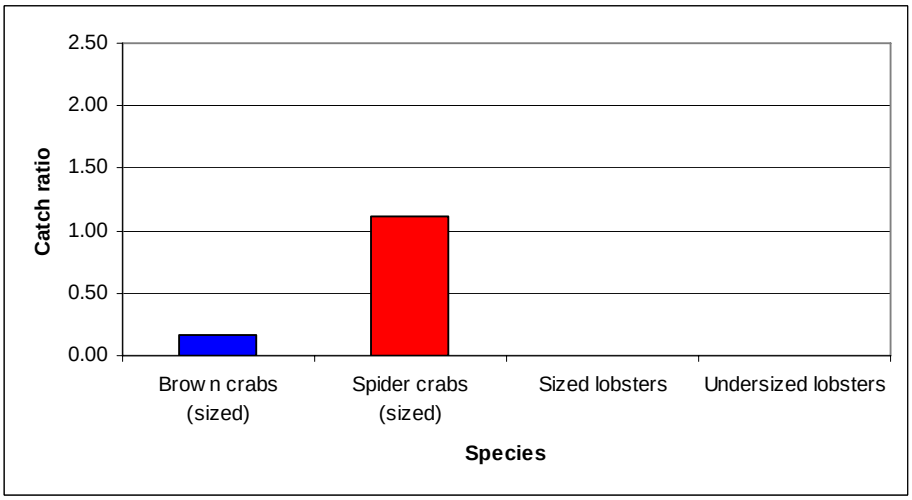

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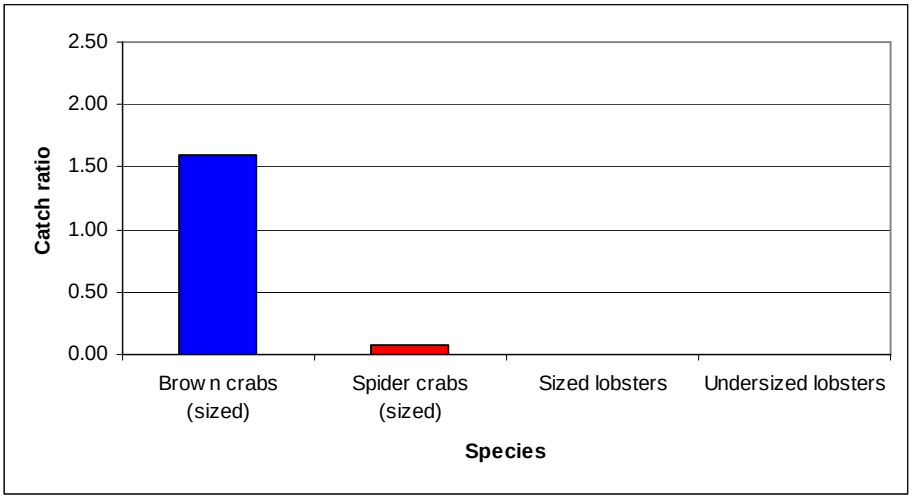

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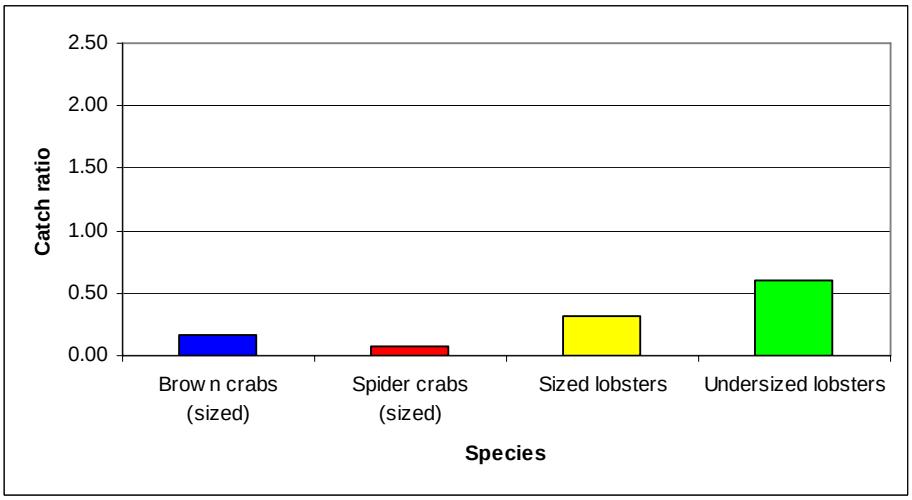

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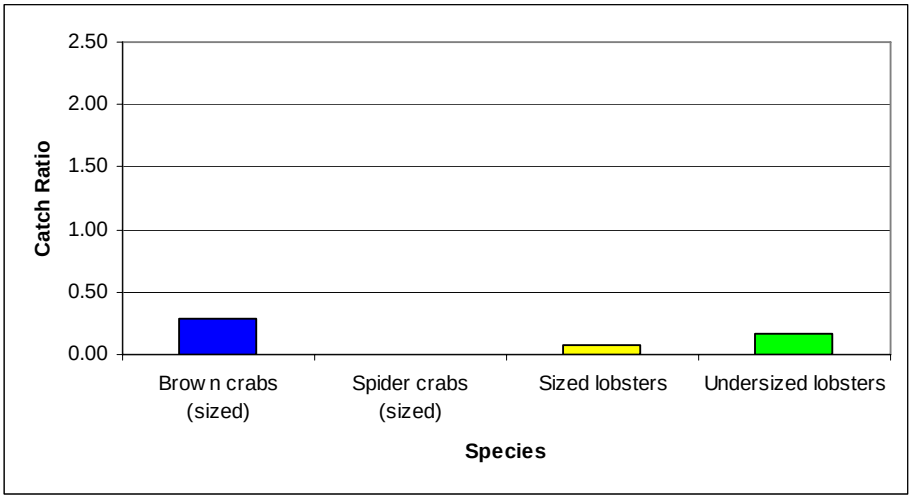

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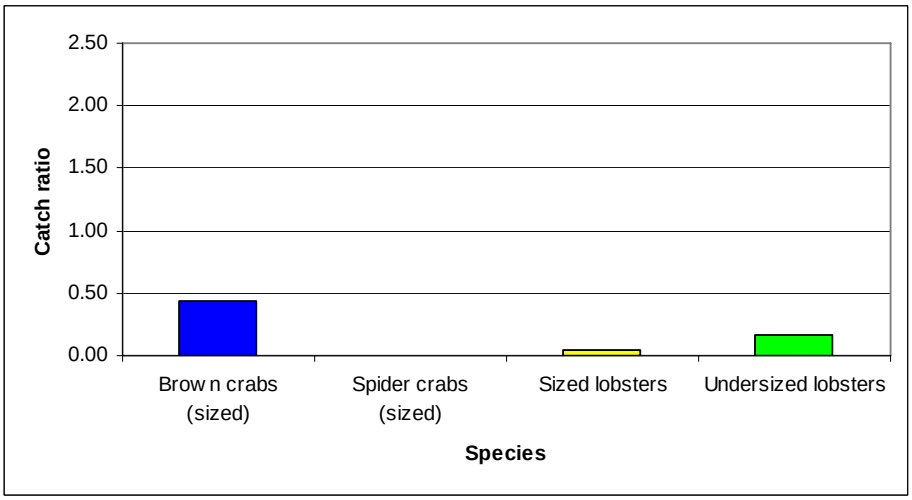
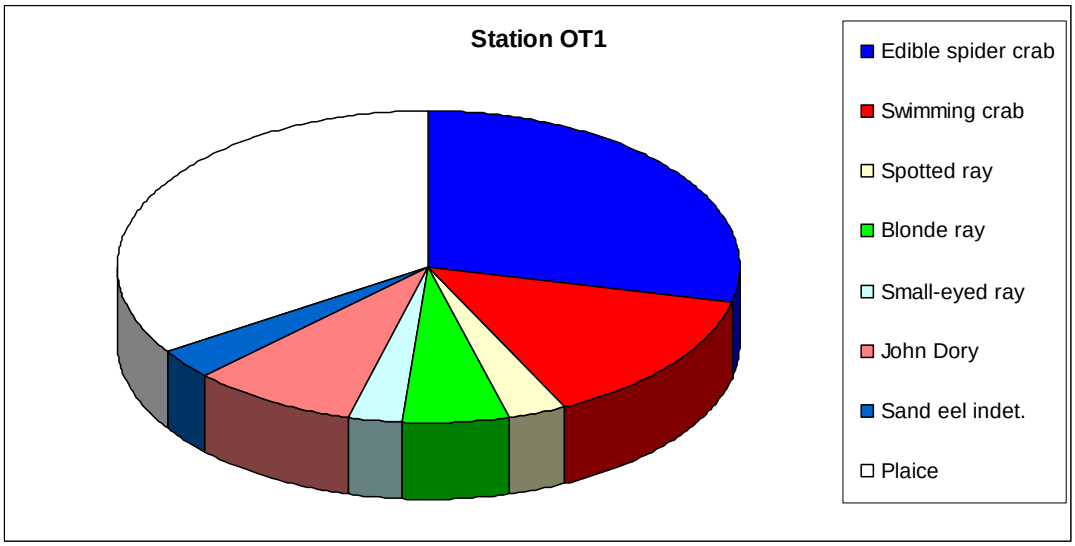
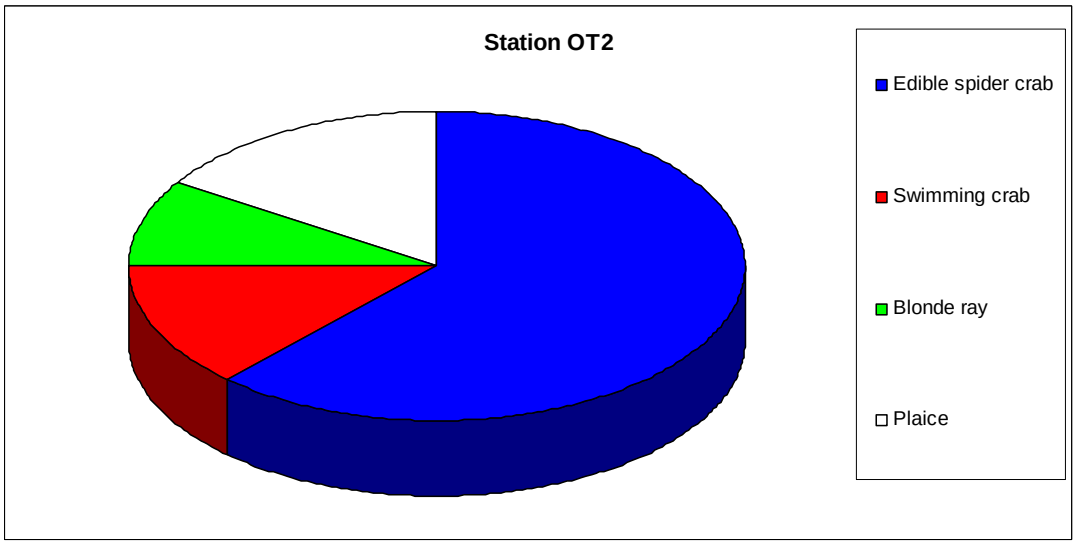


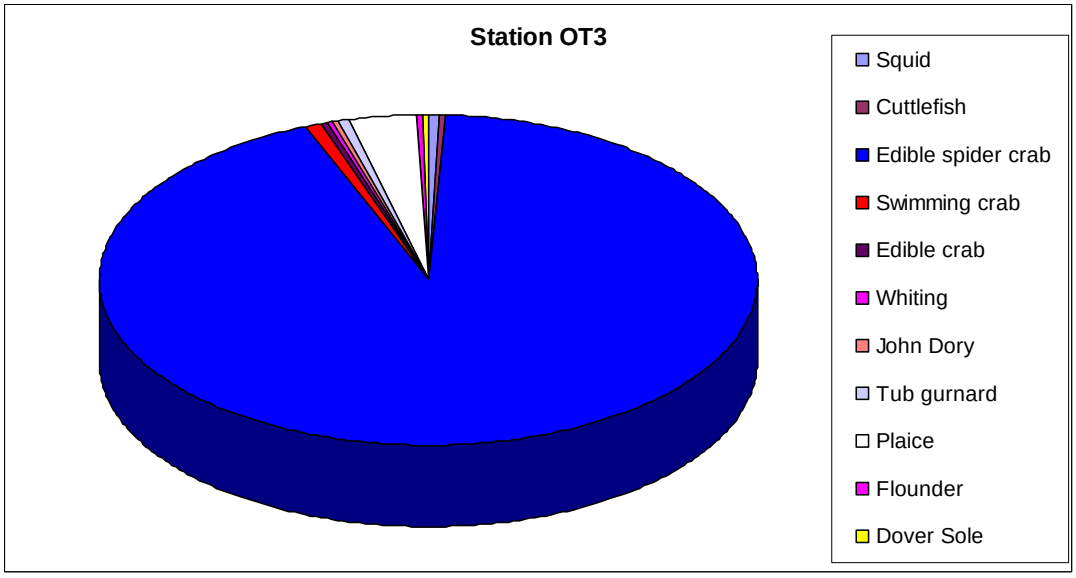
Otter trawl July 2005		South-West Wave Hub: Station Number								
Species	**Latin Name**	**OT1**	**OT2**	**OT3**	**OT5**	**OT6**	**OT7**	**OT8**	**OT9**	**Total Recorded**
Squid	*Alloteuthis* sp.			2		1				3
Squid	*Loligo* sp.					22	3	17		42
Scallop	*Pecten maximus*					3				3
Cuttlefish	*Sepia officinalis*			1	1					2
Edible spider crab	*Maja squinado*	10	47	320	800	13	7	30	50	1277
Swimming crab	*Liocarcinus holsatus*	5	10	3		1				19
Brown crab	*Cancer pagurus*			1				5		6
Spiny seastar	*Marthasterias glacialis*							1		1
Lesser spotted dogfish	*Scyliorhinus canicula*					4	75	92		171
Thornback ray	*Raja clavata*								2	2
Spotted ray	*Raja montagui*	1				8			4	13
Blonde ray	*Raja brachyura*	2	7			3				12
Small-eyed ray	*Raja microocellata*	1				2				3
Cod	*Gadus morhua*				1		3	9		13
Whiting	*Merlangius merlangus*			1						1
Monkfish	*Lophius piscatorius*							1		1
John Dory	*Zeus faber*	3		1	1	5	6	2	2	20
Grey gurnard	*Eutrigla gurnardus*						1	1		2
Red gurnard	*Aspitrigla cuculus*				2	5	80	122		209
Tub gurnard	*Trigla lucerna*			2	1	6	1		9	19
Streaked gurnard	*Trigloporus lastoviza*						1	1		2
Bass	*Dicentrarchus labrax*					1				1
Striped red mullet	*Mullus surmuletes*						1			1
Sand eel indet.	*Ammodytes* sp.	1								1
Common dragonet	*Callionymus lyra*					1		1		2
Brill	*Scophthalmus rhombus*					1				1

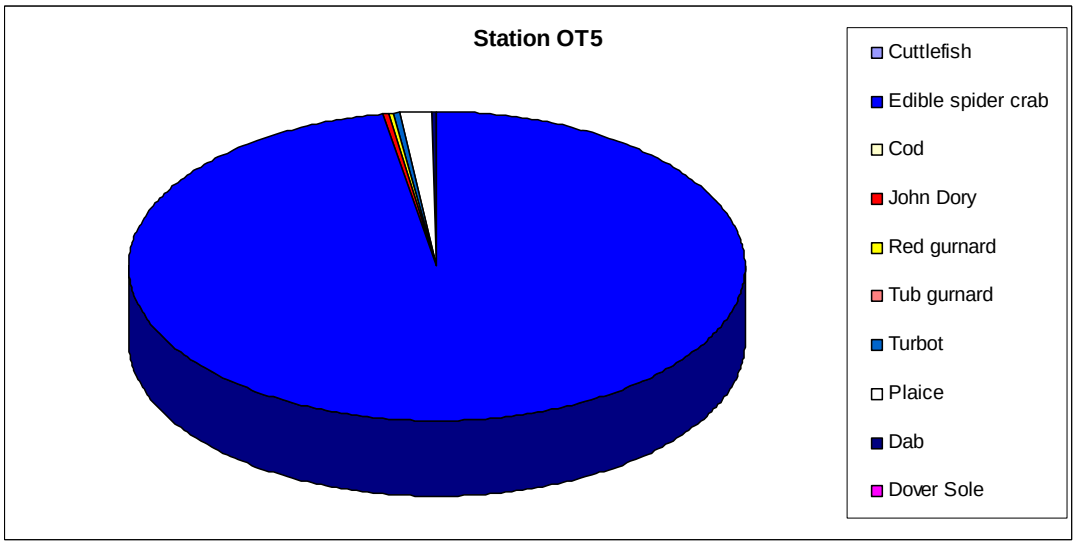
Otter trawl July 2005		**South-West Wave Hub: Station Number**								
Species	**Latin Name**	**OT1**	**OT2**	**OT3**	**OT5**	**OT6**	**OT7**	**OT8**	**OT9**	**Total Recorded**
Turbot	*Psetta maxima*				1	1			1	3
Plaice	*Pleuronectes platessa*	12	12	11	14	67		1	59	176
Dab	*Limanda limanda*				2	2		1	3	8
Flounder	*Platichthys flesus*			1						1
Lemon Sole	*Microstomus kitt*					3	4	11		18
Dover Sole	*Solea solea*			1	1	1				3
Total all individuals		35	76	344	824	150	182	295	130	**254.5**
Total all species		8	4	11	10	20	11	15	8	**10.9**
Total fish individuals		20	19	17	23	110	172	242	80	**85.4**
Total fish species		6	2	6	8	15	9	11	7	**8**

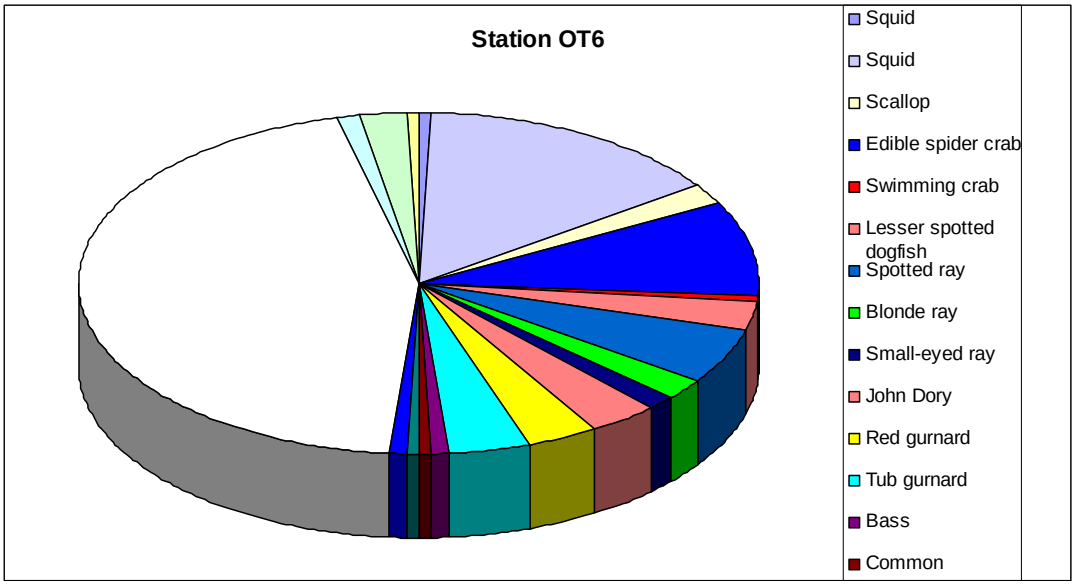
Distribution of species at each station from July otter trawl survey (*Girl Linda*)

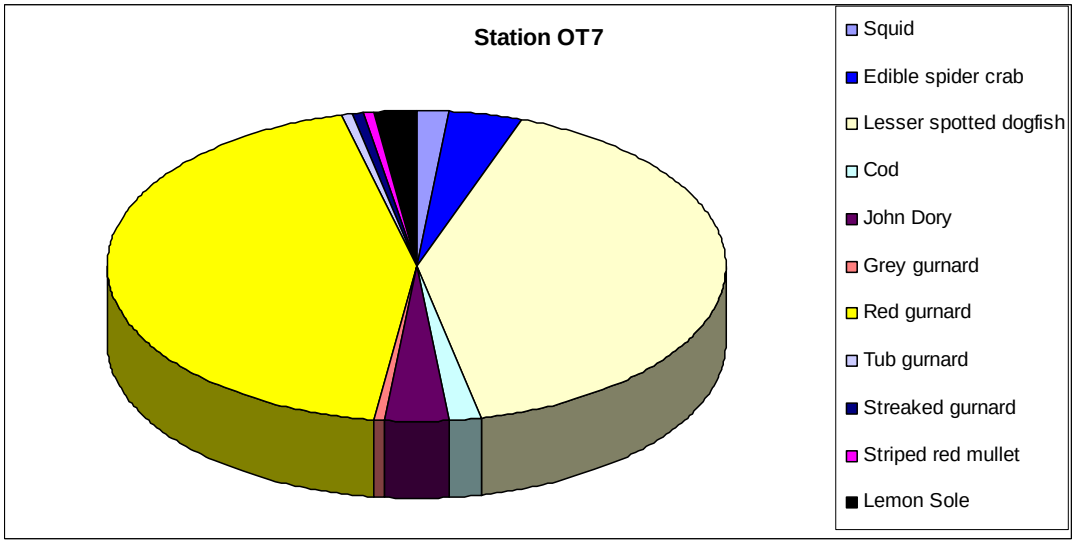


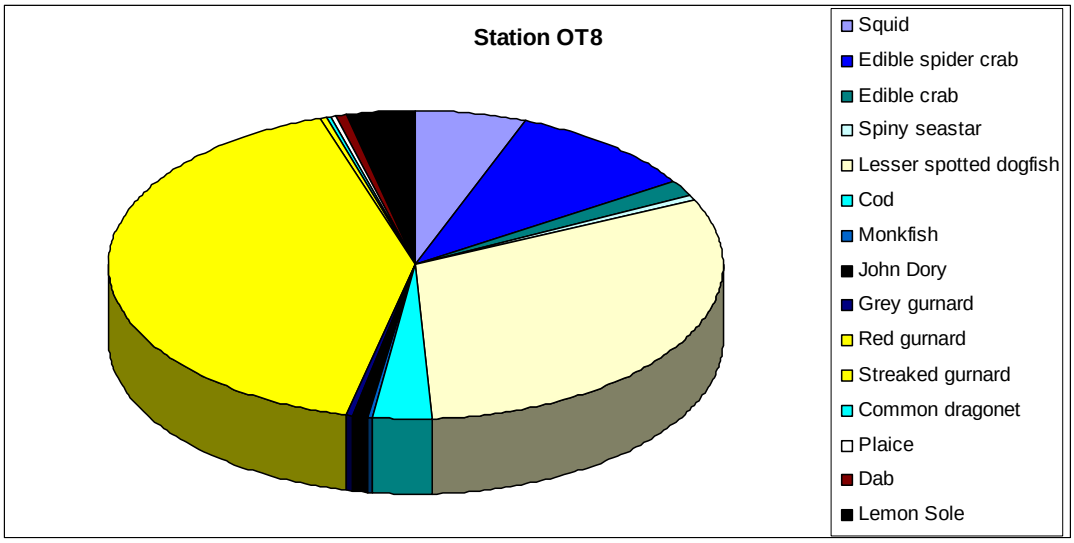


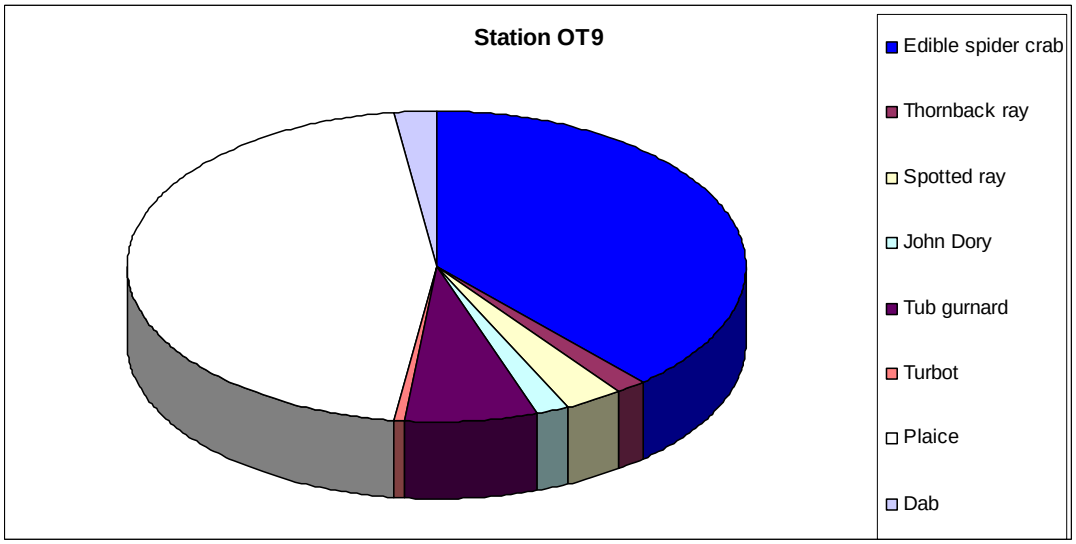

Station OT3
Squid
Cuttlefish
Edible spider crab
Swimming crab
Edible crab
Whiting
John Dory
Tub gurnard
Plaice
Flounder
Dover Sole


Station OT5
Cuttlefish
Edible spider crab
Cod
John Dory
Red gurnard
Tub gurnard
Turbot
Plaice
Dab
Dover Sole

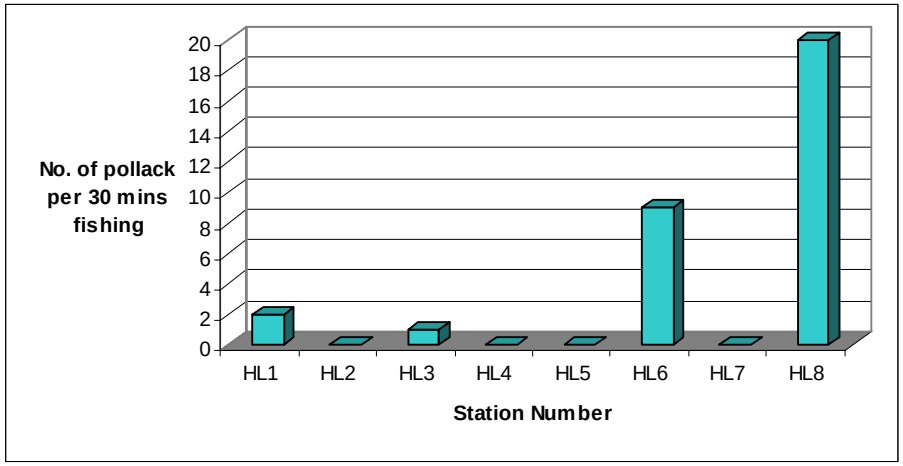

Station OT6
Squid
Squid
Scallop
Edible spider crab
Swimming crab
Lesser spotted dogfish
Spotted ray
Blonde ray
Small-eyed ray
John Dory
Red gurnard
Tub gurnard
Bass
Common


Station OT7
Squid
Edible spider crab
Lesser spotted dogfish
Cod
John Dory
Grey gurnard
Red gurnard
Tub gurnard
Streaked gurnard
Striped red mullet
Lemon Sole


Station OT8
Squid
Edible spider crab
Edible crab
Spiny seastar
Lesser spotted dogfish
Cod
Monkfish
John Dory
Grey gurnard
Red gurnard
Streaked gurnard
Common dragonet
Plaice
Dab
Lemon Sole


Station OT9
Edible spider crab
Thornback ray
Spotted ray
John Dory
Tub gurnard
Turbot
Plaice
Dab

	Position (WGS84)					
Station Number	**Latitude**	**Longitude**	**Number / Type of Hooks**	**Time Start**	**Time End**	**Site description**
HL1	50o14.413N	005o26.294W	7 rubber eels	10:29	10:59	Low lying wreck ~ 1.5m high
HL2	50o13.830N	005o29.625W	7 rubber eels	11:27	11:57	low lying wreck ~ 1.5m high
HL3	50o14.843N	005o29.902W	7 rubber eels	12:06	12:36	Low lying wreck ~ 0.5m high on hard seabed
HL4	50o15.820N	005o32.304W	7 rubber eels	13:07	13:37	Hard seabed rising from ~31m (BSL) to ~28m (BSL)
HL5	50o16.073N	005o35.116W	7 rubber eels	13:47	14:17	Small low lying wreck ~ 2m at highest point
HL6	50o17.500N	005o36.881W	7 rubber eels	14:31	15:01	Low lying wreck ~ 1.5m high on hard seabed
HL7	50o21.389N	005o39.520W	7 rubber eels	16:56	17:26	Hard seabed rising from ~54m (BSL) to ~50m (BSL)
HL8	50o19.685N	005o39.089W	7 rubber eels	15:42	16:12	Hard outcrop banking up from ~48m (BSL) to ~42m (BSL)



South West Wave Hub

EIA BASELINE FISHERIES SURVEYS

Survey No. 2 (September 05) Report

September 2005

REPORT No. 05/J/1/06/0782/0540

Client :
Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Emu Ltd
Head Office
1 Mill Court
The Sawmills
Durley
Southampton
Hampshire
SO32 2EJ

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Appendices

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1. INTRODUCTION

1.1 This report presents the findings from the second of four fisheries resource surveys undertaken by Emu Ltd on behalf of Halcrow Group Ltd as part of the Environmental Impact Assessment (EIA) process being undertaken in relation to the South West Wave Hub project.

1.2 Halcrow Group Ltd is managing the EIA process for this development, which is being funded by the South West Regional Development Agency (SWRDA).

2. STUDY OBJECTIVES

2.1 The main objectives of the fisheries surveys are detailed below:

- To collect baseline data on the composition of fish resources within the study area in order to inform the EIA process being undertaken for the South West Wave Hub project;
- To collect baseline data on the spatial and temporal distribution of fish resources within the study area in order to inform the EIA process being undertaken for the South West Wave Hub project;
- To involve the local fishing community in the data gathering process for the EIA.
- **The surveys are in no way to be intended as a detailed stock assessment of any fishery species.**

3. METHODOLOGY

3.1 The surveys were designed and planned following consultation and meetings with members of the local fishing community and representatives of Cornwall Sea Fisheries Committee (CSFC). Following discussions, it was agreed to undertake a series of four fish resource surveys in order to develop some understanding of the seasonal changes in the fishery.

3.2 The surveys were undertaken aboard local commercial fishing vessels with experienced local skippers who were always consulted during the field work with respect to sampling strategy. Emu Ltd. was represented on each survey by an experienced marine ecologist.

3.3 The gear used for otter trawling, potting and hand-lining was the same as that employed during commercial fishing activities.

3.4 Following the first survey in July, the second first survey was undertaken on Wednesday 21st and Thursday 22nd September 2005. Table 1 summarises the schedule for the second survey. The second survey aboard *Swift* (offshore potting) was not undertaken until 6th October 2005 due to a family bereavement.

3.5 The first mackerel hand-line survey was only completed on 07.08.05 due to weather constraints. Therefore the data from this survey was not included within the July survey report. The data from this survey is included within this report.

Date	Survey Undertaken	Vessel (Skipper)	Emu Staff aboard
21/09/05	Otter trawling	*Girl Linda* (Chris Stevens)	Ian Campbell
21/09/05	Hand-lining	*Ellie V* (Michael Veale)	Jonny Lewis
22/09/05	Potting Survey (inshore)	*Chloe Estelle* (Reg Easterbrook)	Jonny Lewis
06.10.05	Potting Survey (offshore)	*Swift* (John Carter)	Ian Campbell
1st survey completed 07.08.05	Hand-lining for mackerel	*Sally Ann of Navax* (Peter Ghey)	N/A
2nd survey not yet undertaken			

Table 1 Summary of sampling events (September 2005)

3.5 The preliminary positions for the survey stations were chosen in order to sample locations within and outside the proposed wave hub exclusion zone and also along the proposed route of the site to shore cable. Co-ordinates were calculated using a GIS system and issued to the skippers via post prior to the surveys so that they could input these into their vessel's GPS. This provided them with an opportunity to comment as to whether any stations selected by Emu were not suitable for any reason, i.e. in an area of beam trawling activity (unsuitable for pots) or on hard ground (unsuitable for trawling).

3.6 Where some stations were indeed inappropriate, the skippers suggested more appropriate locations which were agreed by Emu staff. On the actual day of the survey, all survey positions were recorded on the vessel using the vessel's own GPS system. All GPS systems used were based on the WGS84 datum.

3.7 For the potting surveys, the positions when hauling began and ended were noted, whilst for the trawling the start and end positions of each tow were noted. With respect to the hand-lining on wrecks and hard ground, a single position was noted, around which fishing was concentrated for 30 minutes.

3.8 Survey positions are appended.

Specific Survey Methodologies

(1) Potting Surveys

3.9 As for the July survey, two separate potting surveys were initially planned in order to obtain data both from the offshore wave hub area and closer inshore in the area of the site to shore cable route. The offshore potting was undertaken by Swift with the inshore area fished, as before, by *Chloe Estelle*.

3.10 Strings of 25 pots were hauled by *Swift* on the 6th October, following 24 hours soak time (ideally this would be 48 hours, but this was constrained by the weather). All pots were baited with scad (*Trachurus trachurus*).

3.11 Strings of 25-30 pots were hauled by the *Chloe Estelle* on the 22nd September, following 24 hours soak time All pots were either of inkwell or parlour type, and baited with both scad *()* and mackerel *(Scomber scombrus)*.

3.12 Upon retrieval, the following was noted for every pot:

- The numbers of sized, under-sized and soft brown crab (*Cancer pagurus*);
- The numbers of sized, under-sized and soft spider crab (*Maja squinado*); and
- The numbers of sized, under-sized and berried lobsters (*Homarus gammarus*).
- Numbers of velvet swmming crabs (*Necora puber*)

On every 5th pot, measurements were taken on the carapace width of crabs and carapace length of lobsters.

3.13 The positions of the offshore stations (pending survey no 2) are shown in Figure 1; inshore stations fished by *Chloe Estelle* are shown in Figure 2.

(2) Otter Trawling Survey

3.14 A commercial otter trawl gear was used, with approximately 85ft spread & 9ft lift. The trawl was fitted with an 85mm cod-end mesh. Tow lengths varied from 5 minutes to 15 minutes.

3.15 Upon retrieval of the catch, all fish species caught were recorded and length measurements taken. Where large catches were landed, sub-samples were taken to undertake length measurements and an estimate of numbers landed.

3.16 Photographs were also taken of the catch upon being landed.

3.17 The positions of the tows are shown in Figure 3.

(3) Hand-lining Survey over hard ground and wrecks

3.18 The commercial hand-lining gear comprised of a set of six plastic red-gill eels on 80lb monofilament. Hand-lining was undertaken for 30 minutes at each site, with the vessel drifting over each mark with the tide for approximately 5 minutes and then returning to the original position to begint the drift once again.

3.19 Each time the line was under tension due to fish being caught, the gear was brought to the surface, and the fish landed. The hand-line was then placed back into the water. This was repeated until the 30 minutes period was completed.

3.20 Upon retrieval of catch, species were identified, enumerated and total length measurements were taken. Photographs of the species caught were taken.

3.21 The positions of the hand-lining locations are shown in Figure 4.

(3) Hand-lining Survey for mackerel

3.22 The first mackerel handline survey was undertaken on 07.08.05 by Peter Ghey, skipper and owner of *Sally Ann of* Navax. The position of the survey stations enabled the fishery to be examined in a repeatable progression from the Port of Hayle to off St. Ives Head. An added advantage of this method was that the proposed track for the offshore cable would be crossed and recrossed and observations of mackerel carried out using sonar.

3.23 The mackerel lines used basically consist of a weight, a trace of twenty eight hooks each bearing a length of coloured plastic tubing attached to a heavier backline. A Spanish modelled stripper system and manually operated `gurdie` were used to pay out and recover the line and remove fish from the hooks.

3.24 The echo sounder and GPS were operated continually in order to identify fish marks, with the location noted as is normal fishing practice.

3.25 Each Emu survey station was initially searched by sonar for any evidence of mackerel and a search pattern developed up and down the line of the tide through the station of approximately 200m x 100m. The vessel steamed at tickover (2.5-2.8kts) over each survey station.

3.26 Approximately 20 minutes were spent looking for mackerel in the immediate area and 30 minutes actively fishing for them at increasing distances from the station out to 200m.

3.27 If mackerel were detected the fishing gear was deployed with the vessel performing continous tight circles drifting with the tide over the shoal. Mackerel from individual stations were kept separate for weighing and measurement.

4. RESULTS

4.1 The following section of the report presents the key results from the second set of fisheries surveys undertaken on 21st-22nd September 2005. Summary data sheets are included in Appendix I.

Potting Survey aboard Swift

4.2 Strings of 25 pots were retrieved after a 24 hour soak on 6th October July 2005. The main species recorded in the pots were the brown crab (*Cancer pagurus*), the spider crab (*Maja squinado*), the common lobster (*Hommarus gammarus*) and the velvet swimming crab (*Necora puber*).

4.3 Brown crab was the most important species in terms of abundance, accounting for 89% of the total individuals (brown crab, spider crab, lobster and velvet swimming crab) recorded in all the pots.

4.4 The catch ratio (number per pot) was calculated for each of the key species captured. The catch ratios for each survey station are shown in Figure 5a.

4.5 From this figure it can be noted that the greatest catch ratio for sized, hard brown crabs was recorded at Station 14 which lies on the south western edge of the proposed Wave Hub site. The next highest ratio of sized, hard brown crabs was recorded at Station 13 which actually lies within the proposed Wave Hub site.

4.6 Lareg number of undersized and soft brown crabs were recorded at Stations 10 and 11 which lie to the south of the Wave Hub site but adjacent to the proposed cable route.

4.7 Spider crabs were only recorded at 3 of the 7 survey stations and in low numbers.

4.8 Lobsters were recorded at 4 of the 7 stations with a total of 6 sized lobsters being retained by the skipper.

4.9 The most common species recorded as by-catch in the pots were the common whelk (*Buccinum undatum*) and conger eel (*Conger conger*).

Potting Survey aboard Chloe Estelle

4.10 Strings of 25-30 pots were retrieved after a 24 hour soak on 22nd September 2005. The main species recorded in the pots were the brown crab (*Cancer pagurus*), the spider crab (*Maja squinado*), the common lobster (*Hommarus gammarus*) and the velvet swimming crab (*Necora puber*).

4.11 Brown crab was the most important species in terms of abundance, accounting for 91% of all sized individuals (of the three main species) caught, and 74% of the total individuals (of the three main species).

4.12 The catch ratio (numbers per pot) was calculated for each of the key species captured. The catch ratios for each survey station are shown in Figure 5.

4.13 Both sized & undersized brown crabs were caught at every station. The highest catch ratio for sized brown crab was recorded at Station 1, adjacent to St. Ives.

4.14 Sized and hard spider crabs were only present at three of the stations, totalling only five animals; in contrast, undersized/soft spider crabs (164 in total) were caught at all stations. The vast majority (128) of these were caught at station 2, on the cable route.

4.15 Lobsters were recorded at 4 of the seven sites, totalling 18 (7 of which were sized and retained by the fishermen).

4.16 Lesser & greater spotted dogfish (*Scyliorhinus canicula* & *S. stellaris*) were the most common bycatch within pots, along with a handful of other species.

Otter trawl survey aboard Girl Linda

4.17 A total of 8 sites were trawled on the 1st September 2005. The sites were distributed within Saint Ives Bay and included sites adjacent to the proposed site to shore cable route.

4.18 The total number of species recorded at each station is shown in Figure 6 with the total abundance of all species shown in Figure 7.

4.19 A total of 35 different species were recorded in the trawls.

4.20 In terms of abundance, the invertebrate catch (comprising 11 species in total) was dominated by the small, non-commercial swimming crab *Liocarcinus*, and the larger edible spider crab *Maja squinado*. The latter was absent at stations 1 & 2, and most abundant at station 7.

Plate 1
***Girl Linda* carrying out trawl survey within St. Ives Bay**

4.21 A total of 24 fish species were caught, reflecting the diverse nature of this mixed fishery. Of interest is the high proportion of commercial, marketable species within the catches and relative absence of small, "trash" species (e.g. dragonet) that are discarded, in comparison to e.g. North Sea ichthyofauna.

4.22 Fish catches were dominated by two species, the most common of which was the lesser spotted dogfish (*Scyliorhinus canicula*). This low-value fish was particularly abundant at stations 7 & 8 outside of St Ives Bay. Plaice, of greater value, was the next most abundant and dominated catches on the clean sand stations of relatively low diversity at 1 & 2. Other fish species forming significant contributions to the overall catch total were red & grey gurnard (*Aspitrigla cuculus* & *Eutrigla gurnardus*), dab (*Limanda limanda*), brill (*Scophthalmus rhombus*), and cod (*Gadus morhua*), the latter two being important commercial species. Like the July survey, a smaller number of other high value species were also caught (e.g. John Dory *Zeus faber*, lemon sole *Microstomus kitt* and Dover sole *Solea solea*).

4.23 Three species of ray were also recorded: spotted (*Raja montagui*), blonde (*Raja brachyura*) and small-eyed (*Raja microocellata).*

4.24 In terms of changes since the July survey, it is interesting to note that the total number of individuals at Stations 3 and 5 (both inshore sites) had decreased significantly since the July survey. In July, the high number of individuals at these two stations was largely due to the high number of spider crabs (*Maja squinado*) recorded within the trawls (320 and 800 at Stations 3 and 5 respectively). However, in the September survey, only 171 spider crabs were recorded at Station 3 and 68 at Station 5. This indicates that by September, the majority of spider crabs in the inshore area have moved offshore to deeper waters.

Hand-lining Survey aboard Ellie V

4.25 A total of 8 sites were fished aboard *Ellie V* on 21st September 2005. In addition to a total of 21 pollack (*Pollachius pollachius* - the only species caught on the July survey), one John Dory (*Zeus faber*) and two mackerel (*Scomber scombrus*) were caught. No fish were caught at 2 of the 8 stations.

4.26 The abundance of pollack caught at each survey station is shown in Figure 8.

4.27 The size distribution of all the pollack caught is shown below in Figure 9; the majority of fish were within the 46-50 and 51-55cm size classes.

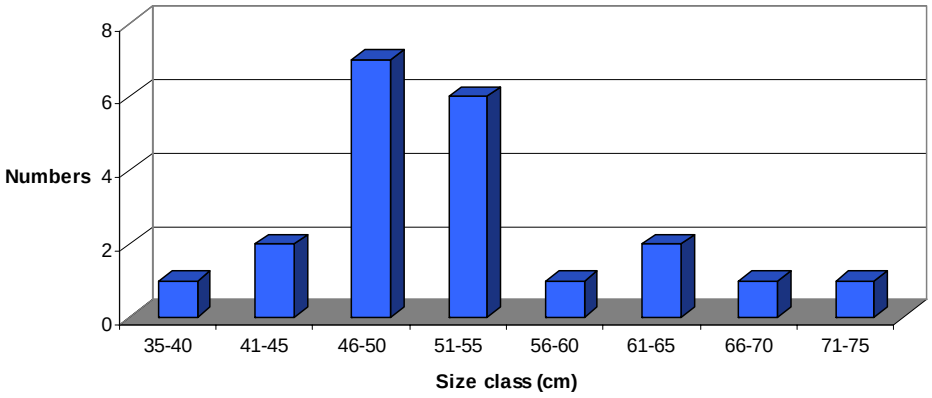


Figure 9 Size distribution of pollack caught in September 2005 survey

4.28 As with the July survey, the greatest number of Pollack were captured from Station 8 which is an area comprised of a hard outcrop banking up from approximately 48m below sea level to 42m below sea level.

4.29 Fish were also captured at Stations 3 and 6 during the September survey, as they were in the July survey. Both these stations lie on the proposed cable route.

Mackerel hand-lining aboard Sanny Ann of Navax

4.30 The results from the first mackerel survey (07.08.05) are presented below in Table 2.

Survey Station	Notes	Mackerel captured	Other species
1	- Depth 19.2 to 18.1m - Sand and gravel substrate	38kg	-
2	- Depth 17.6 to 18.0m - Sand substrate	40kg (20kg measured)	-
3	- Depth 23.1 to 24.4m - Sand and gravel substrate - Typical potting area	4kg	-
4	- Depth - unrecorded - Hard rocky ground	0kg	-
5	- Depth 13.8 to 14.8m - Sand substrate	0kg	Sand smelt (*Atherina presbyter*)

Table 2 Results from 1st mackerel hand-line survey (07.08.05)

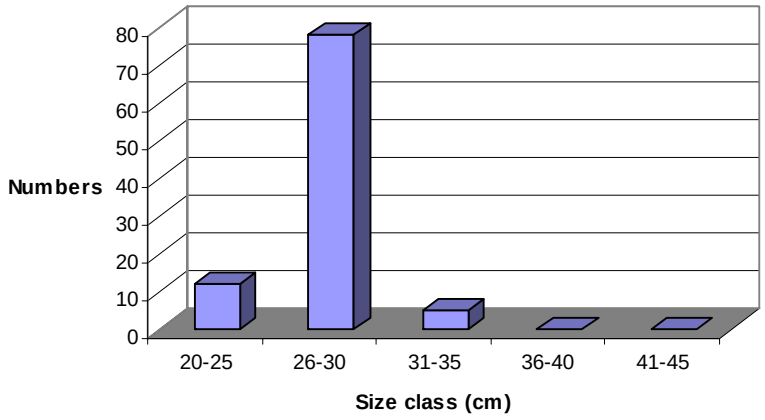
4.31 In total, 82kg of mackerel were captured at the survey stations. This is shown in Figure 10. Mackerel were observed throughout the total survey area, although not necessarily at the specific co-ordinates.

4.32 Representative length measurements were taken of mackerel from survey stations 1, 2 and 3. The length distributions of fish from these stations are shown below in Figure 11.

4.33 Figure 11 indicates that there were at least two year classes of mackerel present within St. Ives Bay during the August survey. These two year classes were particularly noticeable from the landings at Station 2, with several fish in the 26-30cm class and others in the 31-35cm class.

4.34 It is also clear that smaller number of fish from other size classes were also present during this time. It is likely that during August, mackerel from numerous year classes are present within the wider study area.

Station 1



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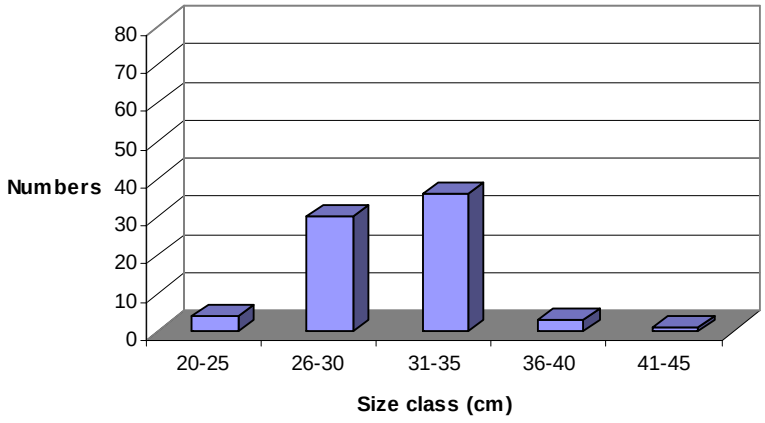

Station 3

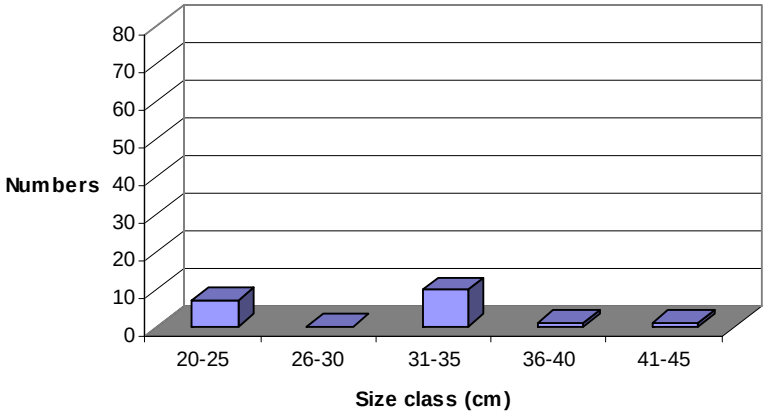

Figure 11 Length distribution of mackerel captured during Survey No. 1 (07.08.05)

Other Observations

4.35 A single harbour porpoise (*Phocoena phocoena*) was sighted at Station 8 ($50^0$19.685 N, $005^0$39.089 W) on the handlining survey; several ocean sunfish (*Mola mola*) were also observed during the two days of the survey. In addition, a lamnid shark (almost certainly porbeagle *Lamna nasus*) was observed at the surface while attacking a pollack being retrieved during the handlining survey, also at Station 8. The pollack, with evident shark bites, is shown in Plate 3 and the ocean sunfish in Plate 4.

Plate 3
Pollack (*Pollachius pollachius*) captured at Station 8 of hand-line survey which had been bitten by shark

Plate 4
Ocean sunfish (*Mola mola*) observed at various locations during Survey #2

4.36 Bird species noted during the mackerel survey included herring gulls (*Larus argentatus*), two greater black-backed gulls (*Larus marinus*), manx shearwaters (*Puffinus puffinus*), sandwich terns (*Sterna sandvicensis*), guillemots (*Uria aalge*) and razorbills (*Alca torda*).

5.0 DISCUSSION

5.1 The second of the fish resource surveys undertaken off Hayle further indicates that the area supports a diverse fishery, with a wide range of fish and shellfish species recorded.

5.2 Spider crab, an important fishery resource, remains seasonally abundant inshore in September, along with brown crab and some lobster. However, a large proportion of the spider crab resource no appears to have moved offshore and greater proportions of `soft` spider crabs were recorded in the inshore area.

5.3 Pollack were again the principal species caught by handlining over wrecks & hard ground.

5.4 The trawl survey again yielded catches of generally high diversity, and with a high proportion of marketable species. Valuable commercial species included plaice, brill and cod.

5.5 Large marine wildlife species (harbour porpoise, sunfish, porbeagle shark) observed on this survey add to that already recorded in the July survey (grey seal, basking shark, dolphin sp.).

5.6 The observation of what was identified as a porbeagle shark indicates that the study area supports a range of fish species, including large elasmobranch species.

6.0 AUDIT TRAIL

Title: South West Wave Hub Project – EIA Baseline Fisheries Surveys			
Report No: 05/J/1/06/0782/0540 **Job No:** J/1/06/0782 **Client Name:** Halcrow Group Ltd **Client Contact:** Steve Challinor			
		Initials	**Date**
Project Manager:	Dr N.S. Thomas		
Data Analysis undertaken by:	Alec Moore		
Report written by:	Alec Moore / Jonny Lewis		
Report checked by:	Claire Espinasse		
Report Authorised by:	Simon Shaw (Director)		

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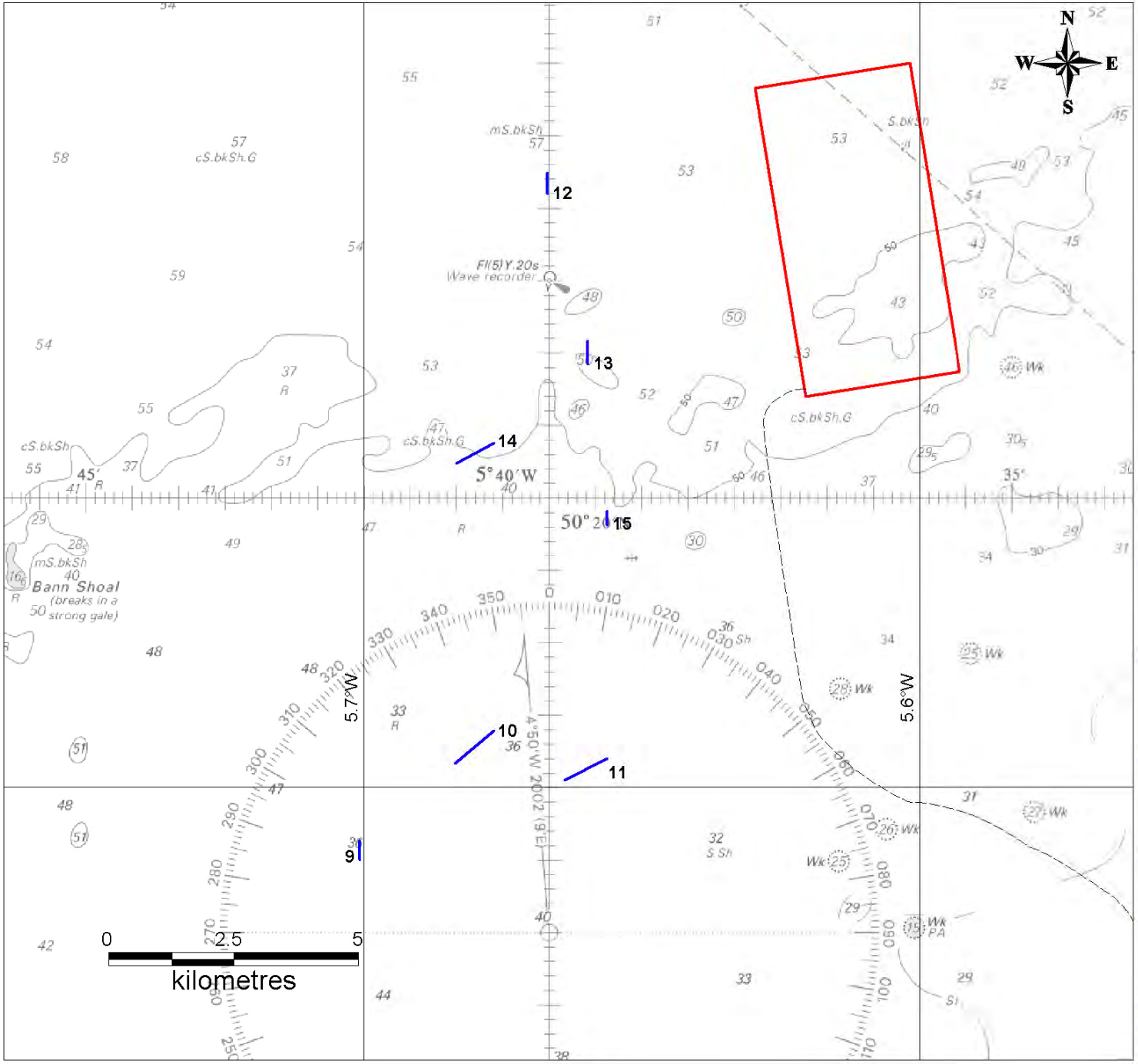
FIGURES



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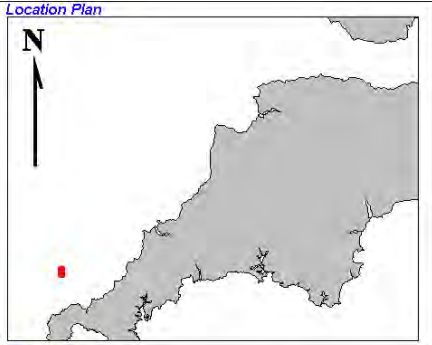

Legend

- Potting Sampling Transects
- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)

September Survey 2005

Notes

Coordinate System:
WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Offshore Potting Survey Stations
(Swift)

Job No.	Date Issued	Figure 1		
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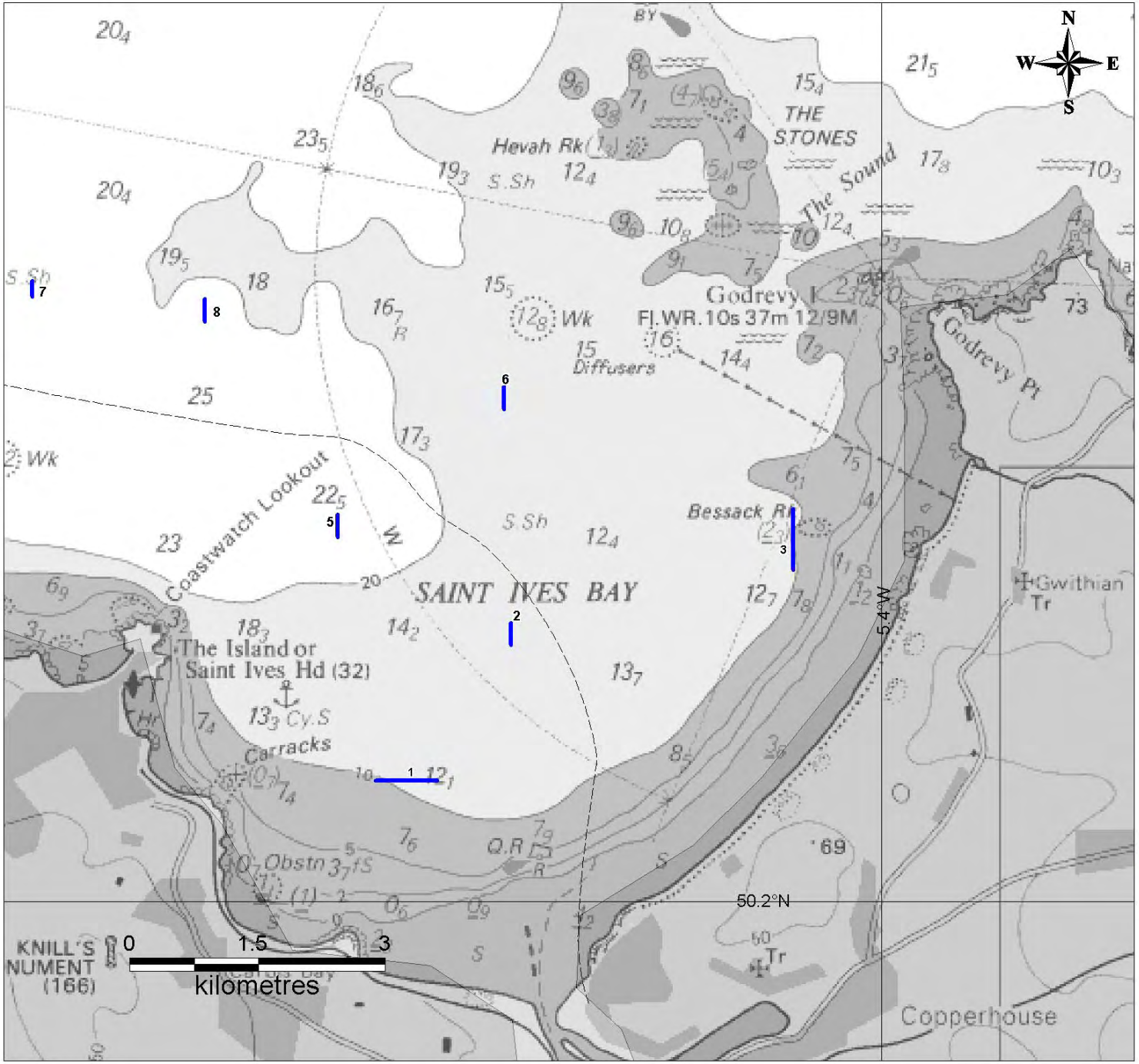

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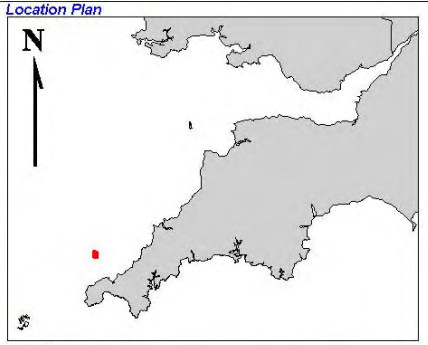

Legend

- Potting Sampling Transects
- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)

September Survey 2005

Notes

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WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

Emu

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Inshore Potting Survey Stations
(Chloe Estelle)

Job No.	Date Issued	Figure 2		
J/1/06/0782	2/5/06			
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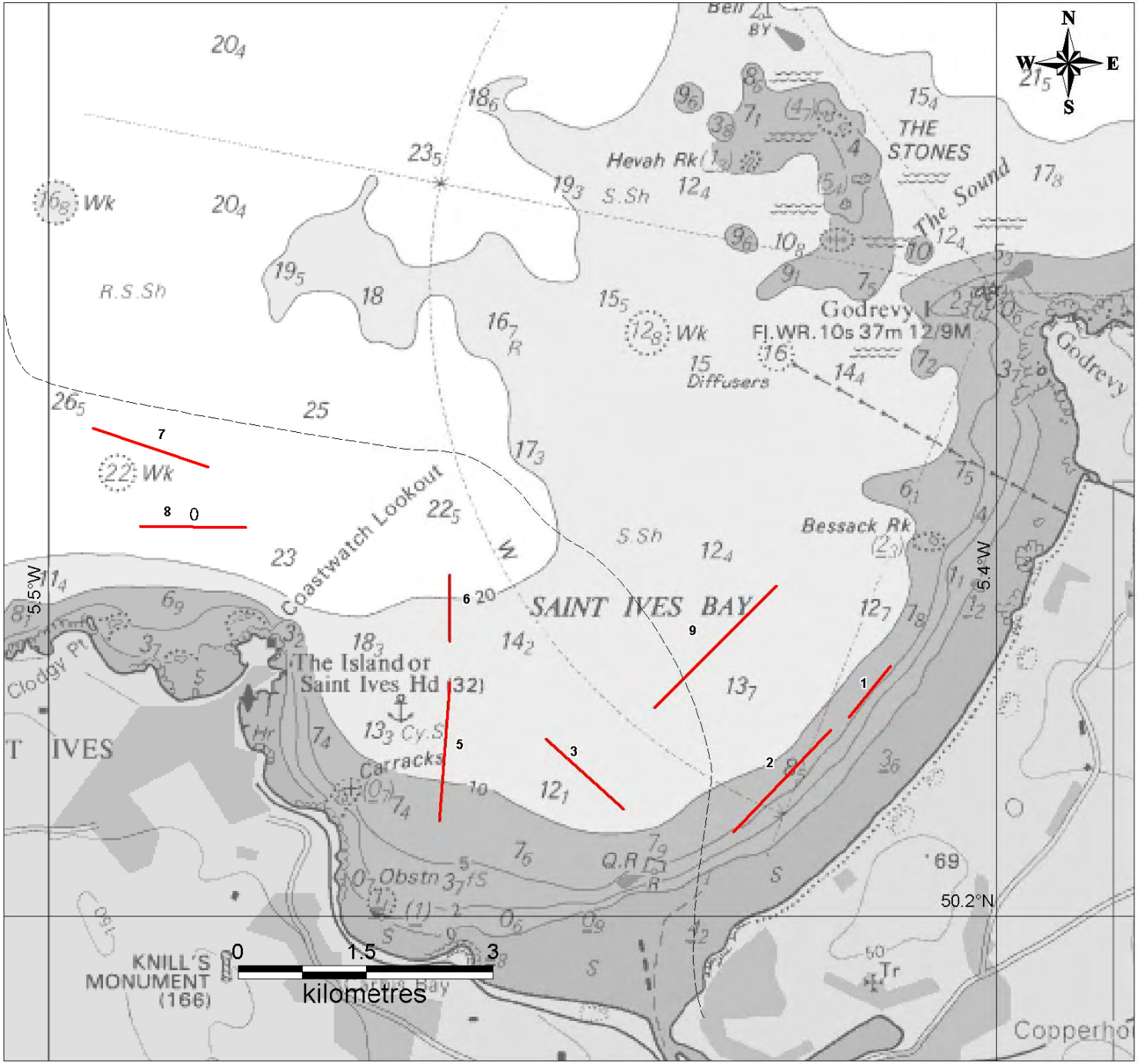

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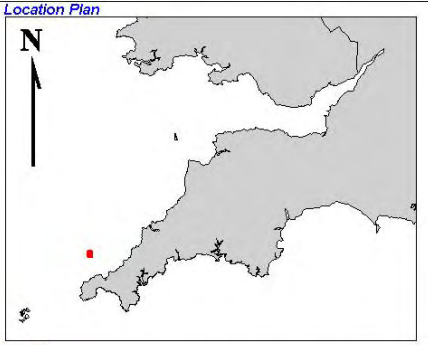

Legend

- Otter Trawling Sampling Tows
- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)

September Survey 2005

Notes

Coordinate System: WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Otter Trawling Survey Tows
(Girl Linda)

Job No.	Date Issued	Figure 3		
J/1/06/0782	2/5/06			
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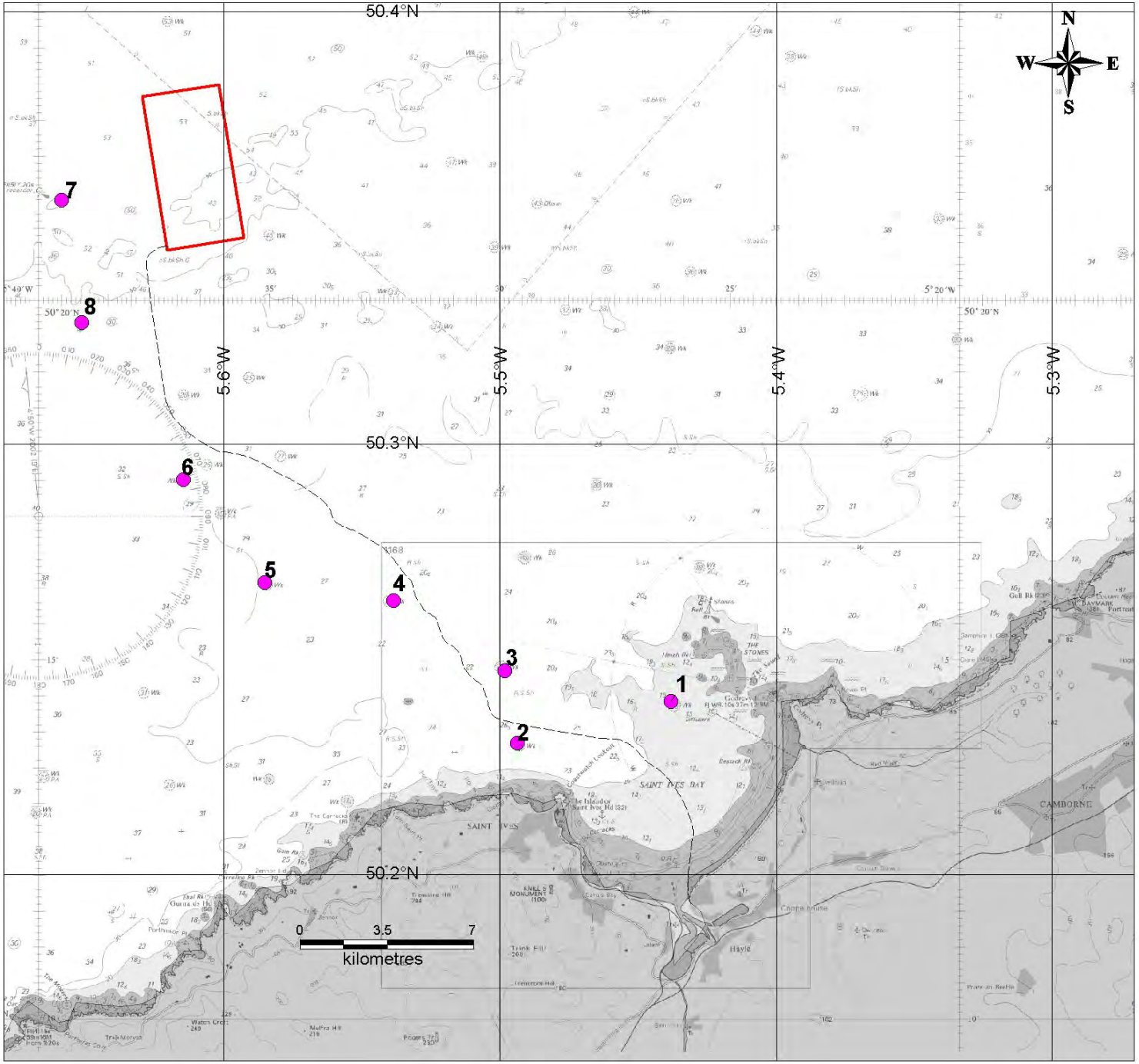

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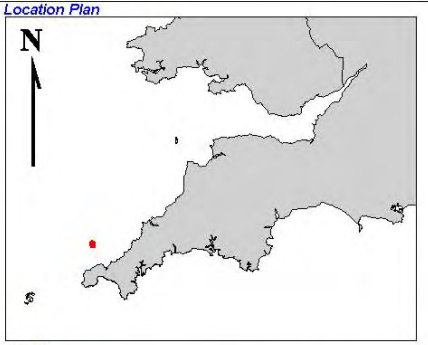

Legend

- Hand Lining Sampling Locations
- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)

September Survey 2005

Notes

Coordinate System:

WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Handlining Survey Locations
(Ellie V)

Job No.	Date Issued	Figure 4		
J/1/06/0782	2/5/06			
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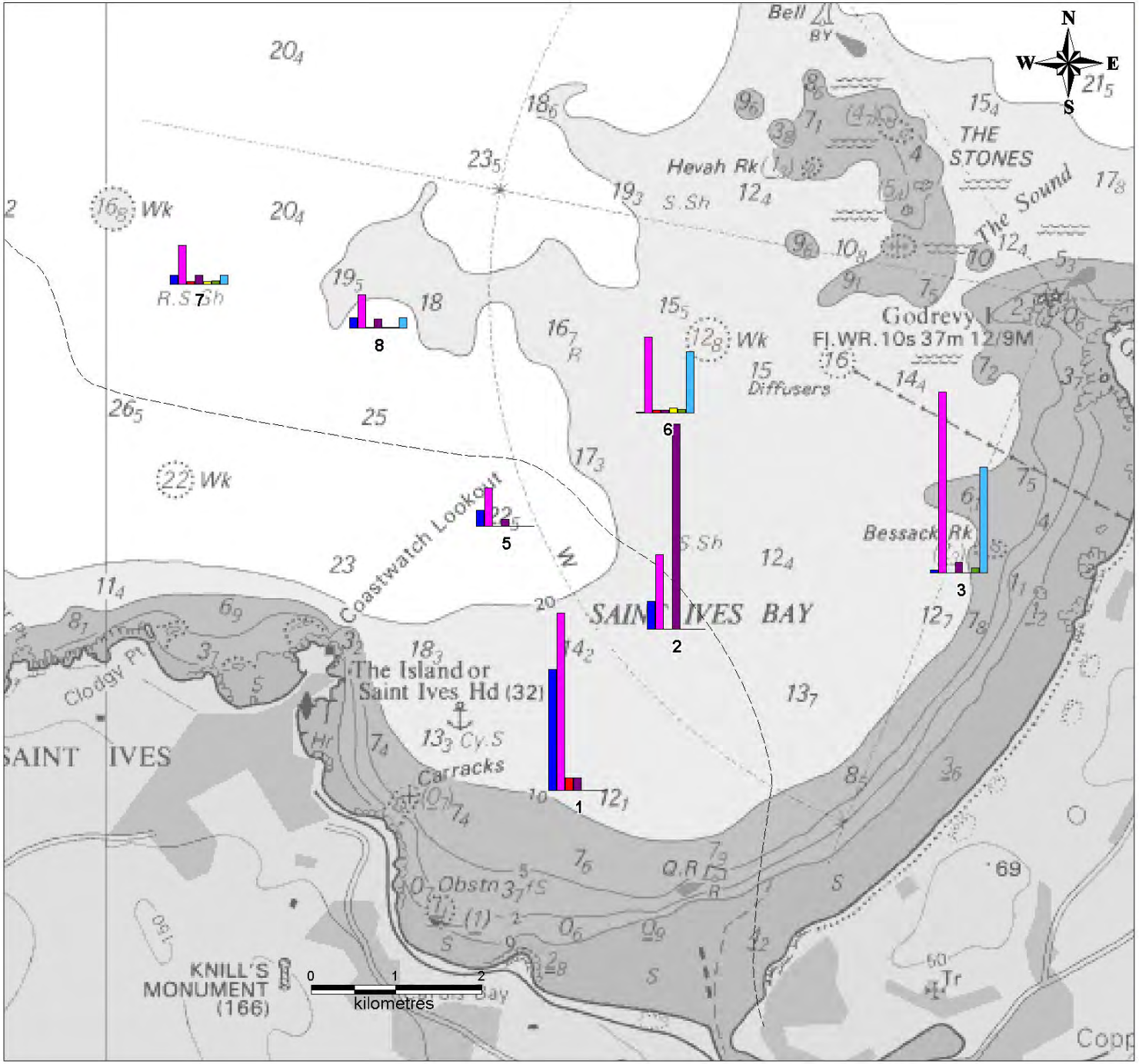

Legend

Proposed Site to Shore Cable Route

Proposed Wave Hub Site (New Deployment Area)

5.2

- Brown crabs sized
- Brown crabs undersized
- Spider crabs sized
- Spider crab undersized
- Sized lobsters
- Undersized lobsters
- VSC

September Survey 2005

Notes

Coordinate System: WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

Emu

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Inshore Potting Catch Ratio for Main Species

(Chloe Estelle)

Job No.	Date Issued	Figure 5		
J/1/06/0782	2/5/06			
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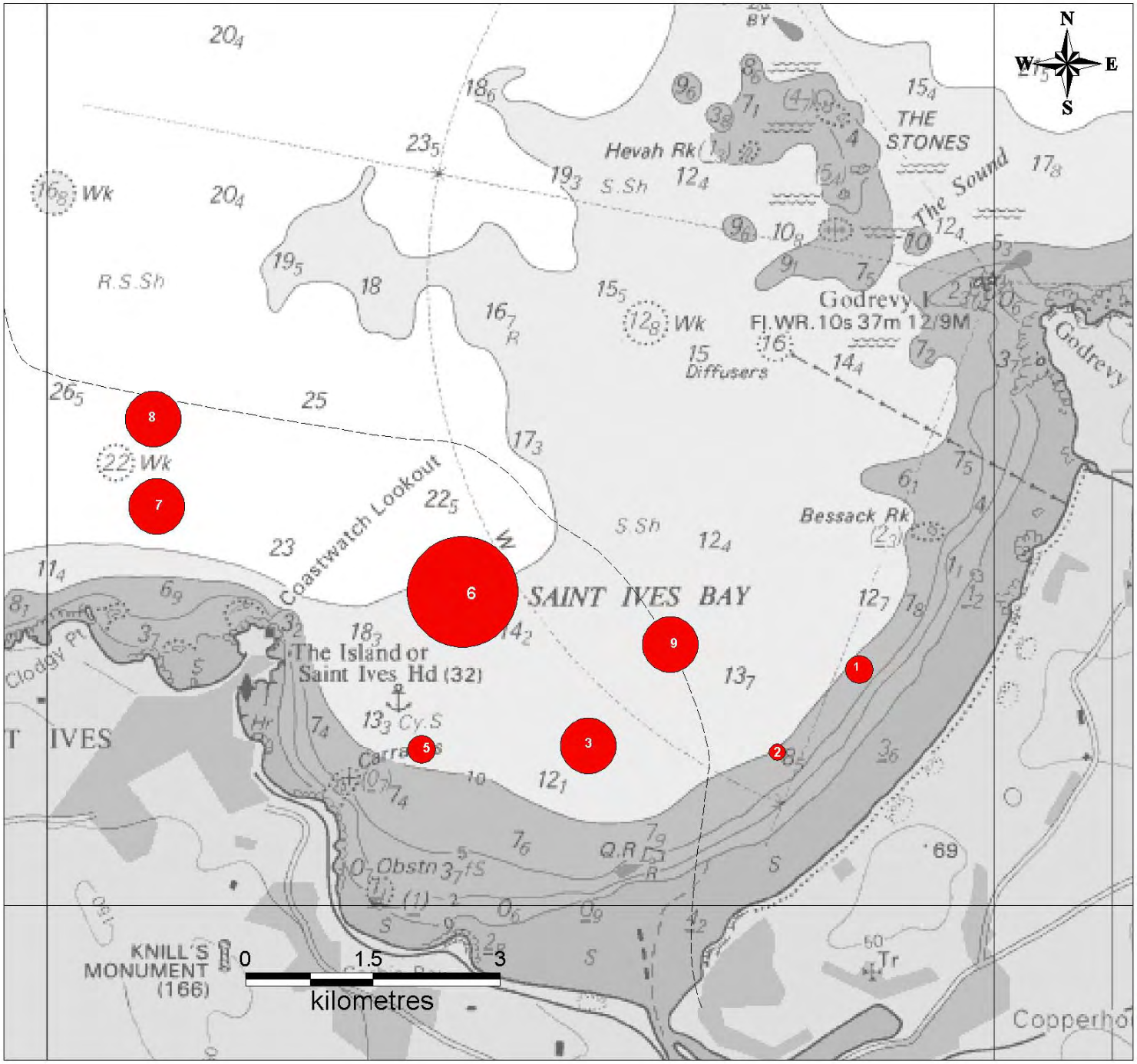

Legend

- Total Species Numbers (21-25)
- Total Species Numbers (11-14)
- Total Species Numbers (6-10)
- Total Species Numbers (1-5)
- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)
- (6) Station Number

September Survey 2005

Notes

Coordinate System:
WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Otter Trawling Survey Tows

Job No.	Date Issued	Figure 6		
J/1/06/0782	2/5/06			
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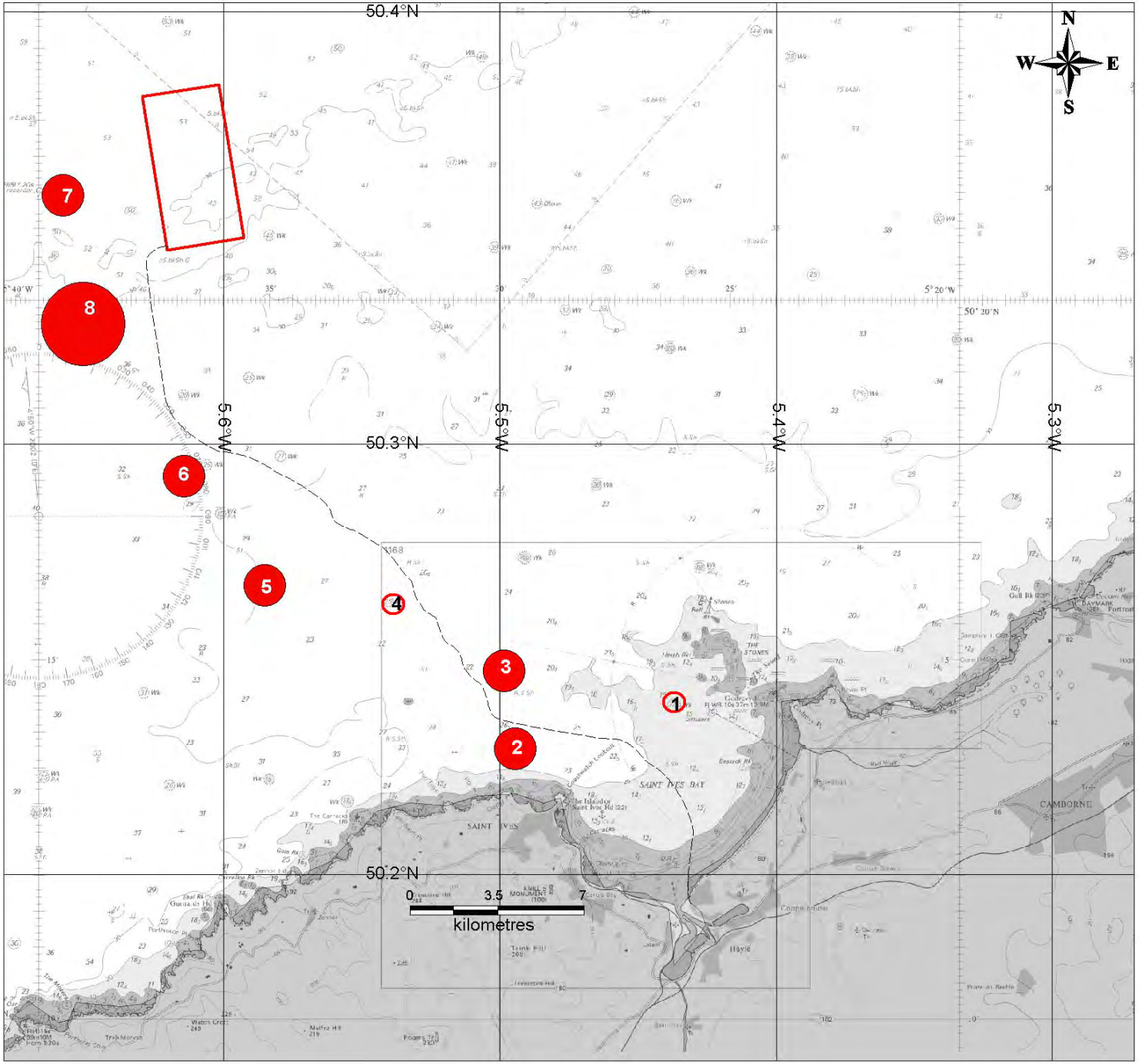

Legend

- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)
- No. Individuals (6-10)
- No. Individuals (1-5)
- No. Individuals = 0
- 1 Station Number

September Survey 2005

Notes

Coordinate System:
WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Total Number of Pollack Caught at Handlining Stations

Job No.	Date Issued	Figure 8		
J/1/06/0782	2/5/06			
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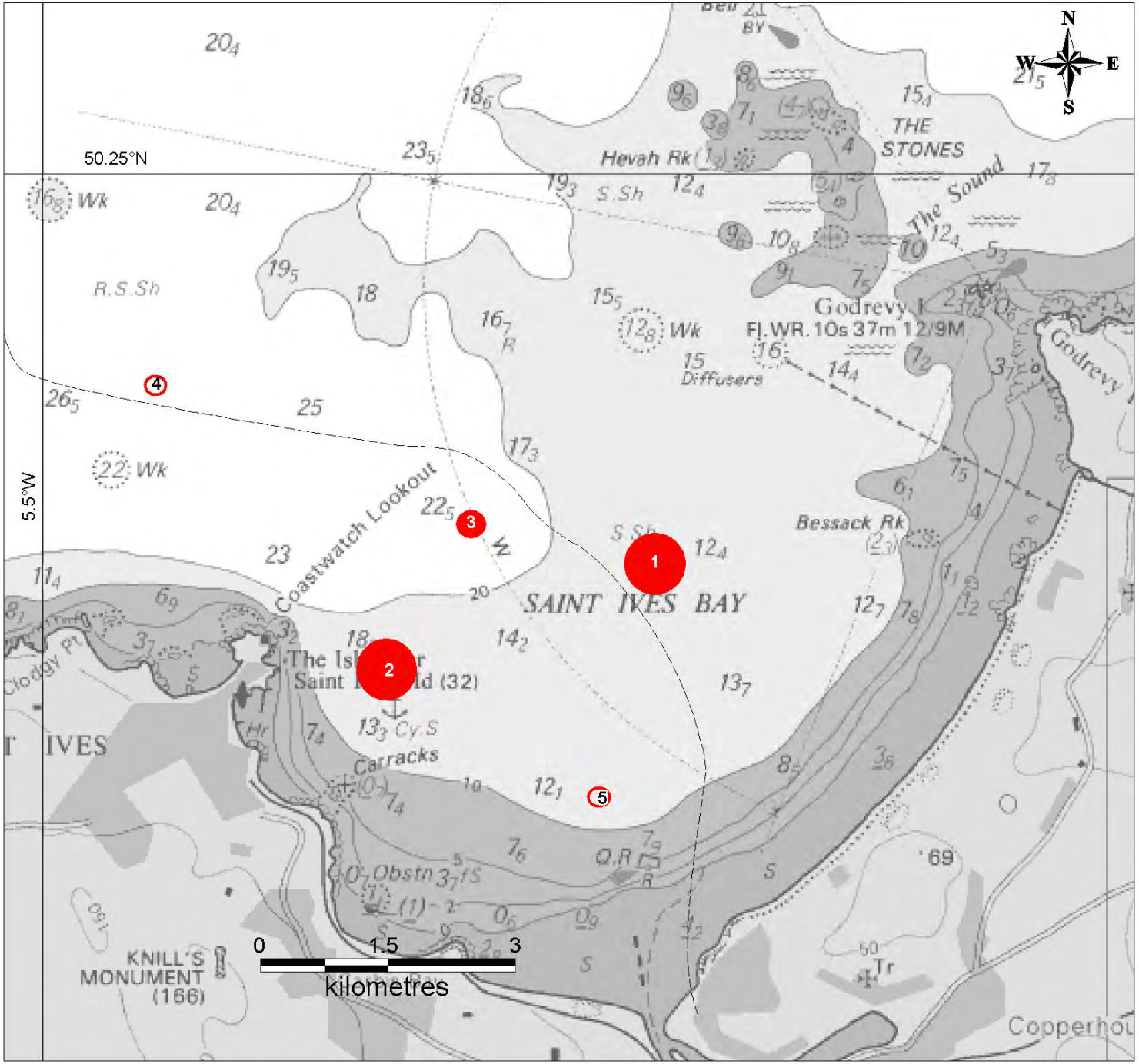


Legend

Proposed Site to Shore Cable Route

Proposed Wave Hub Site (New Deployment Area)

Total Kg Mackerel (11-50)

Total Kg Mackerel (1-10)

Total Kg Mackerel (0)

4 Station Number

September Survey 2005

Notes

Coordinate System: WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

Emu

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

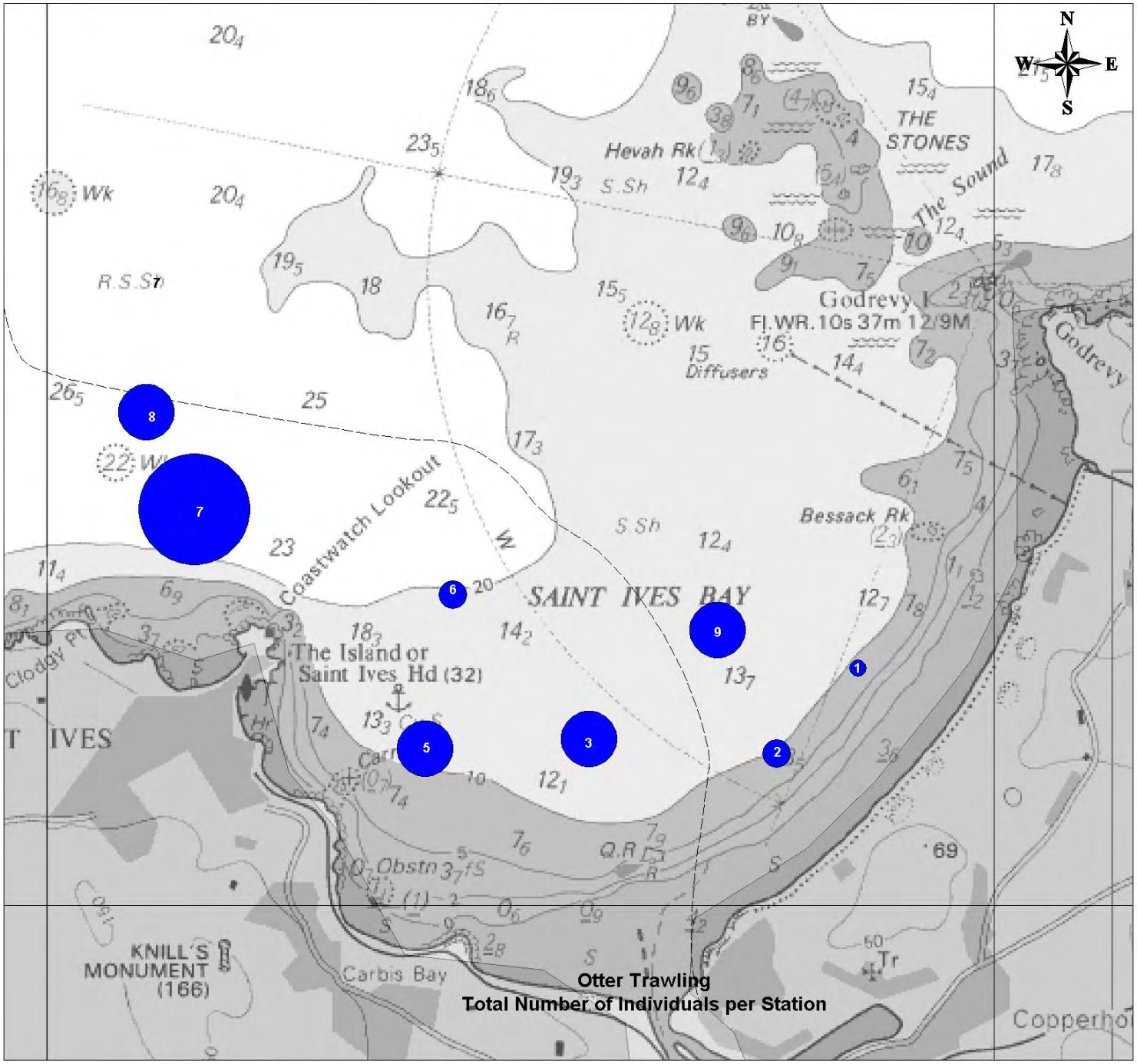
EIA Baseline Fisheries Surveys

Drawing Title

Mackerel Catch (kg) at Wave Hub Survey Stations

Sally Rose at Navax

Job No.	Date Issued			
J/1/06/0782	2/5/06	**Figure 10**		
Sheet Size	Scale	Drawn by	Checked by	Revision No.
A4	1: 0.41 km	RLC	JXL	



Legend

- Total Individuals (201-500)
- Total Individuals (101-200)
- Total Individuals (1-50)
- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)
- 4 — Station Number

September Survey 2005

Notes

Coordinate System: WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Otter Trawling
Total Number of Individuals per Station

Job No.	Date Issued	Figure 7		
J/1/06/0782	2/5/06			
Sheet Size	**Scale**	**Drawn by**	**Checked by**	**Revision No.**
A4	1: 0.41 km	RLC	JXL	

APPENDICES

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APPENDIX I

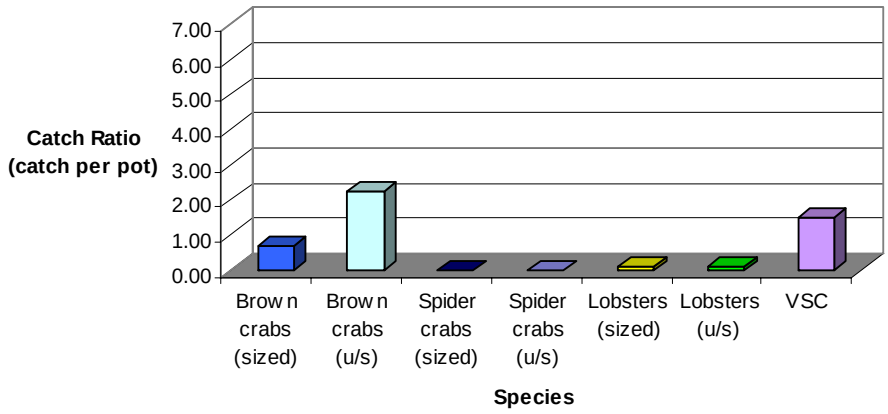
Otter Trawl Start and Haul Positions from Survey No. 2 - 21/09/05

Station Number	Start Position	Haul Position	Other Info
1	50^0 12.792 N	50^0 13.0700 N	2.4Kts
	05^0 24.9963 W	05^0 24.625 W	COG 050^0
2	50^0 12.363 N	50^0 12.782 N	2.3Kts
	05^0 25.666 W	05^0 25.046 W	COG 069^0
3	50^0 12.724 N	50^0 12.393 N	2.6Kts
	05^0 26.853 W	05^0 26.297 W	COG 130^0
5	50^0 12.927 N	50^0 12.366 N	2.6Kts
	05^0 27.776 W	05^0 27.532 W	COG 176^0
6	50^0 13.116 N	50^0 13.390 N	2.4 Kts
	05^0 27.446 W	05^0 27.0415 W	COG 081^0
7	50^0 13.982 N	50^0 13.782 N	2.4 Kts
	05^0 29.692 W	05^0 28.858 W	COG 075^0
8	50^0 13.589 N	50^0 13.570 N	1.7Kts
	05^0 29.654 W	05^0 28.764 W	COG 130^0
9	50^0 12.846 N	50^0 13.401 N	2.4Kts
	05^0 26.099 W	05^0 25.276 W	COG 050^0

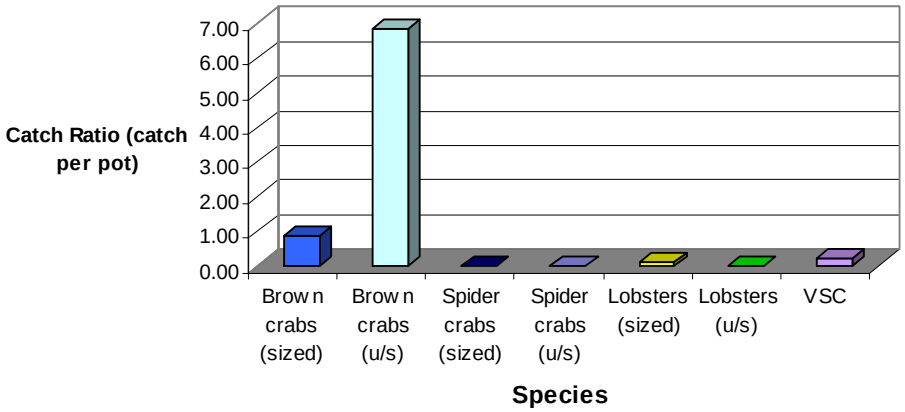
APPENDIX II – Survey Data

CATCH RATIO OF KEY SPECIES RECORDED DURING SEPTEMBER 2005[1] OFFSHORE POTTING SURVEY (*Swift*)

Station 9

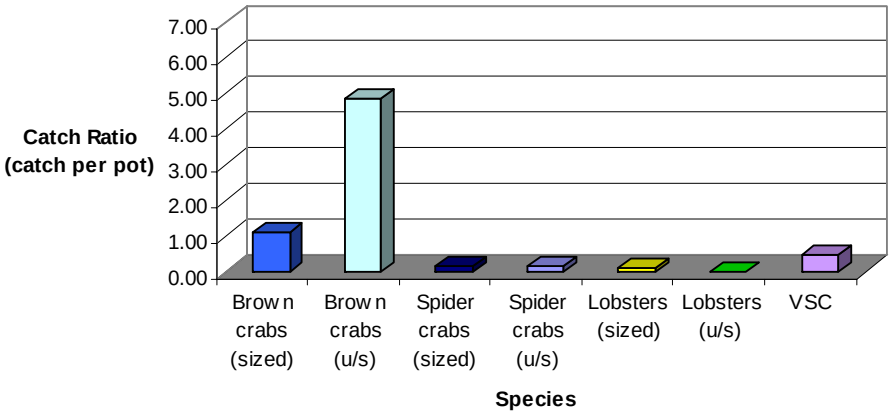


Station 10



[1] Survey aboard *Swift* actually undertaken October 6th 2005 due to family bereavement and weather

Station 11



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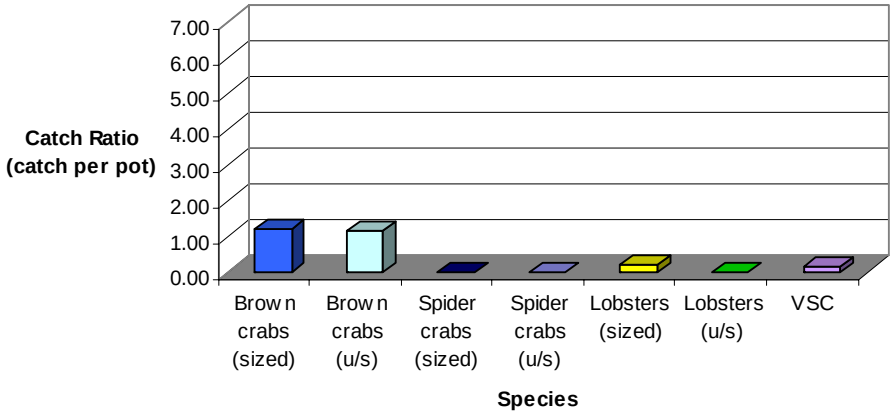

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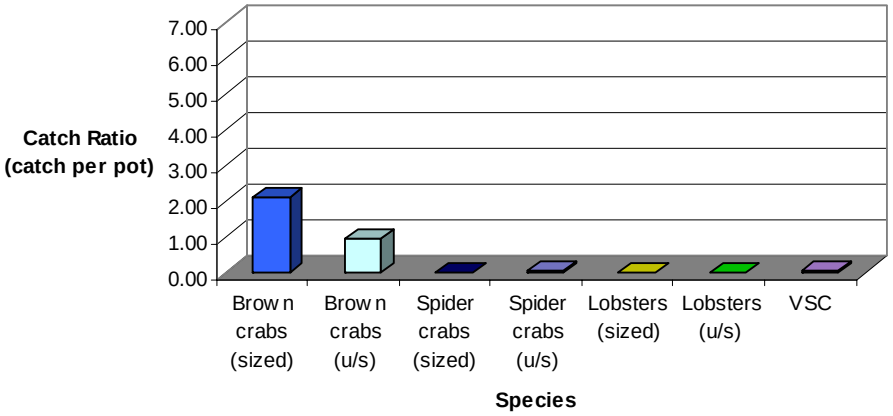
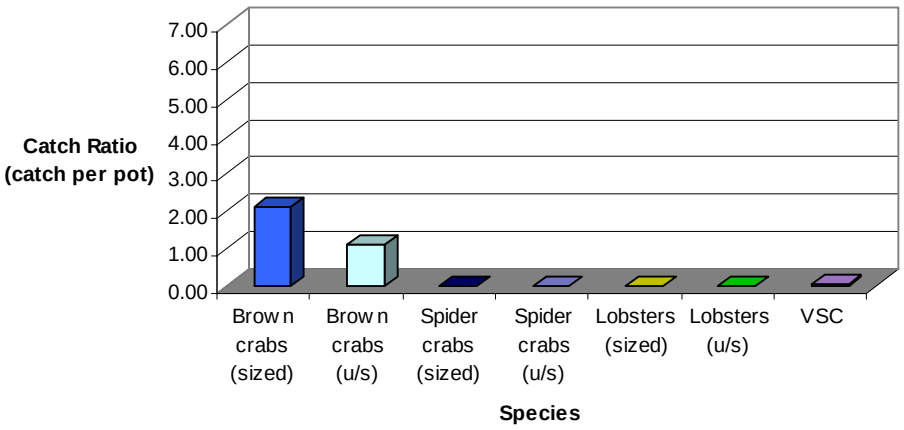
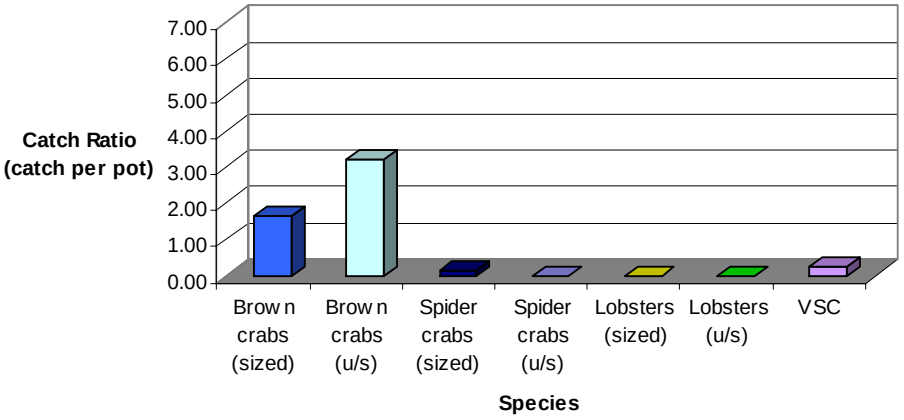


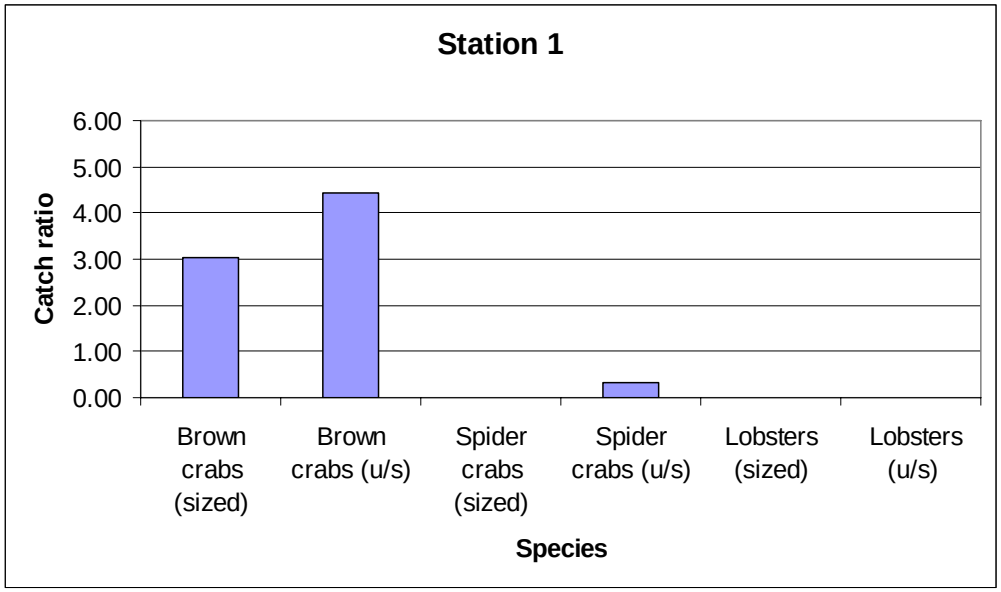
Station 14

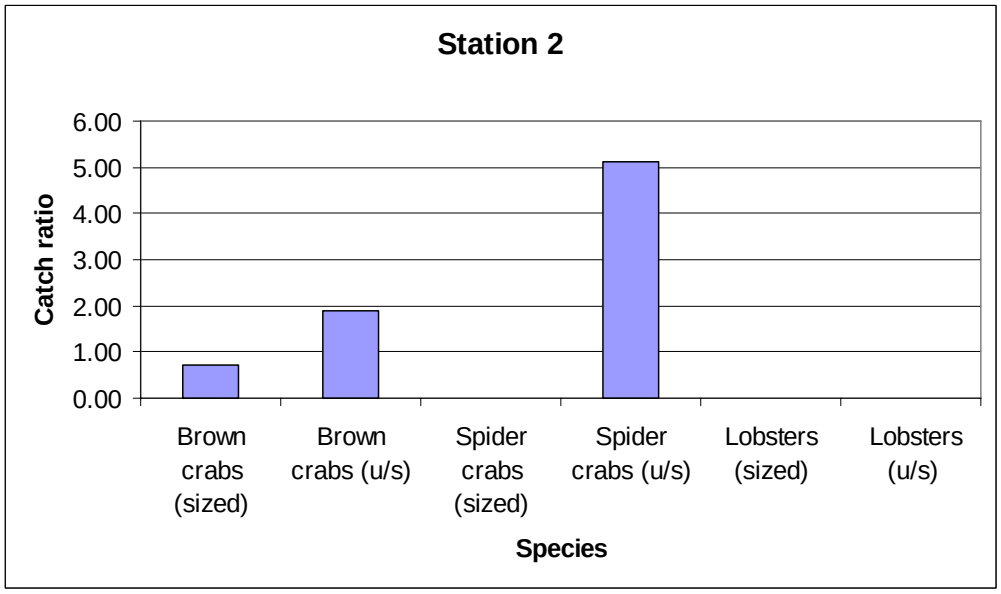


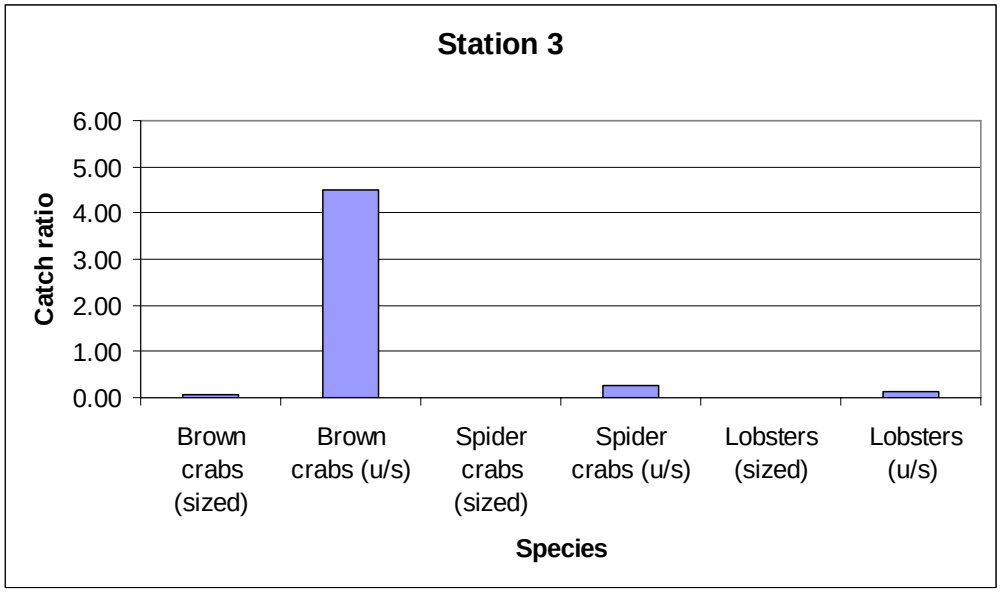
Station 15

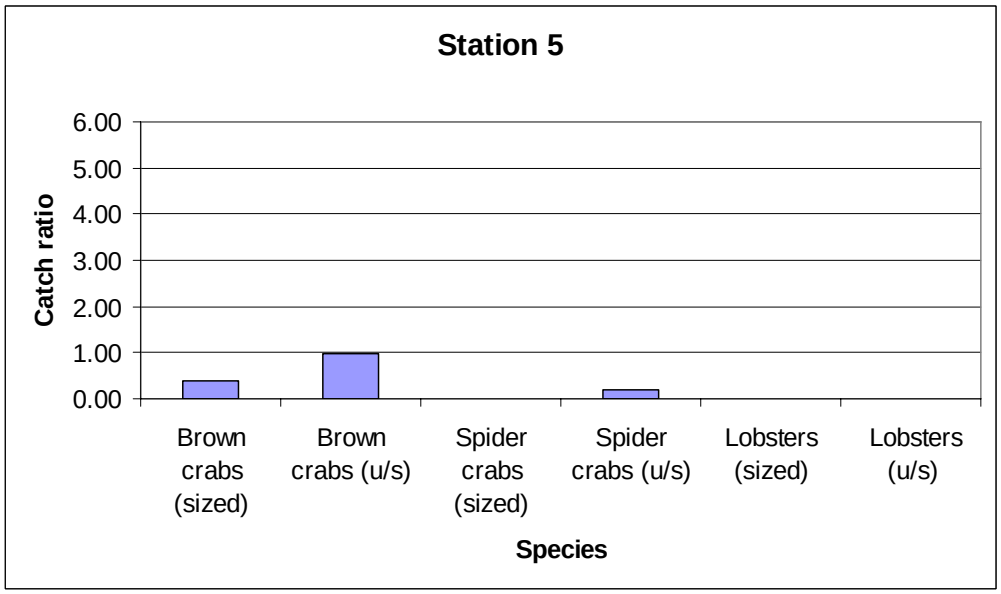


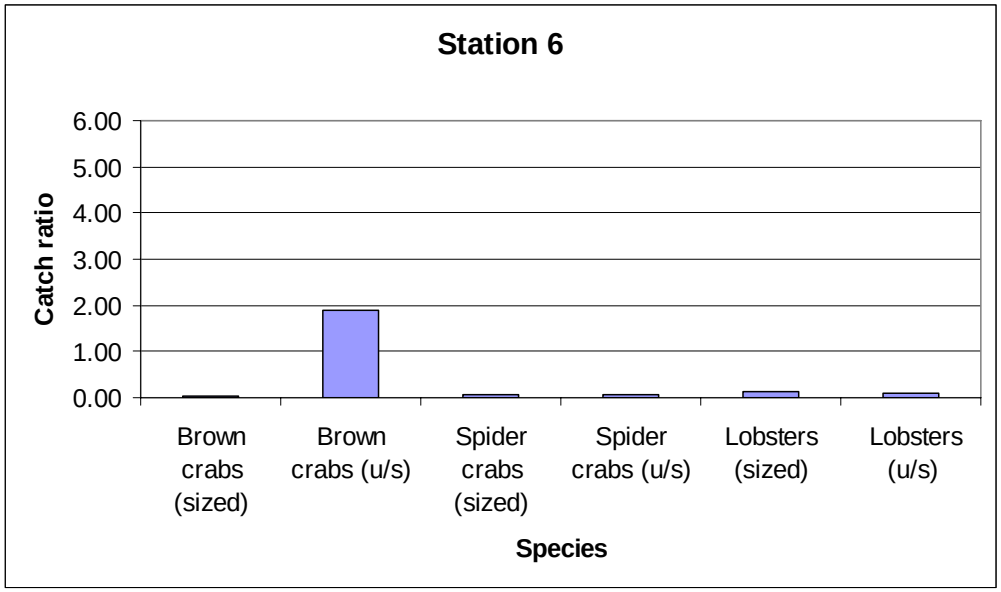
CATCH RATIO OF KEY SPECIES RECORDED DURING SEPTEMBER 2005 INSHORE POTTING SURVEY (*Chloe Estelle*)

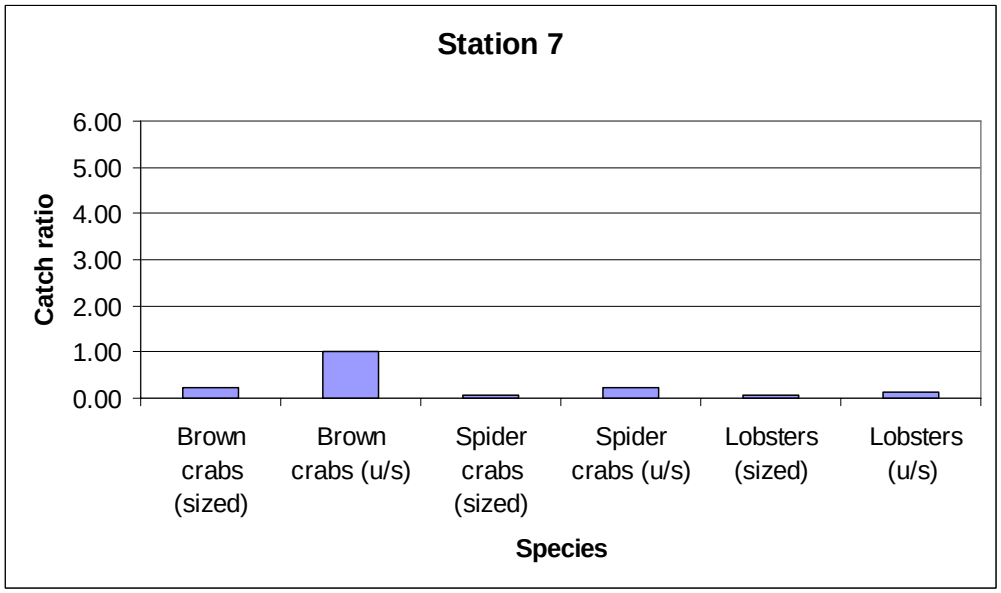


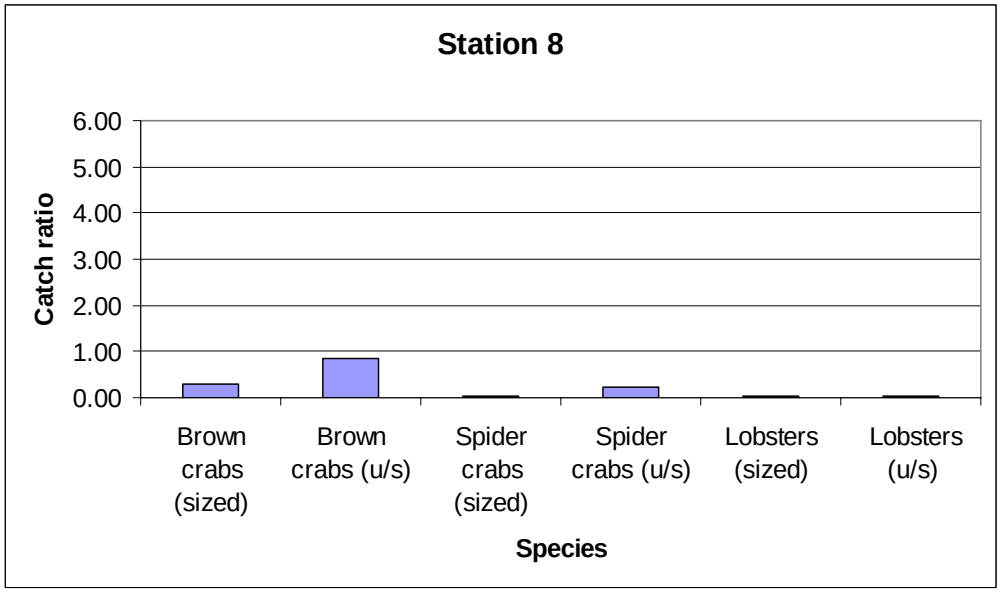



Station 3
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Catch ratio
Brown crabs (sized)
Brown crabs (u/s)
Spider crabs (sized)
Spider crabs (u/s)
Lobsters (sized)
Lobsters (u/s)
Species


Station 5
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Catch ratio
Brown crabs (sized)
Brown crabs (u/s)
Spider crabs (sized)
Spider crabs (u/s)
Lobsters (sized)
Lobsters (u/s)
Species


Station 6
Catch ratio
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Brown crabs (sized)
Brown crabs (u/s)
Spider crabs (sized)
Spider crabs (u/s)
Lobsters (sized)
Lobsters (u/s)
Species


Station 7
Catch ratio
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Brown crabs (sized)
Brown crabs (u/s)
Spider crabs (sized)
Spider crabs (u/s)
Lobsters (sized)
Lobsters (u/s)
Species


Station 8
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Catch ratio
Brown crabs (sized)
Brown crabs (u/s)
Spider crabs (sized)
Spider crabs (u/s)
Lobsters (sized)
Lobsters (u/s)
Species

Wave Hub Fisheries Survey - J/1/03/0782

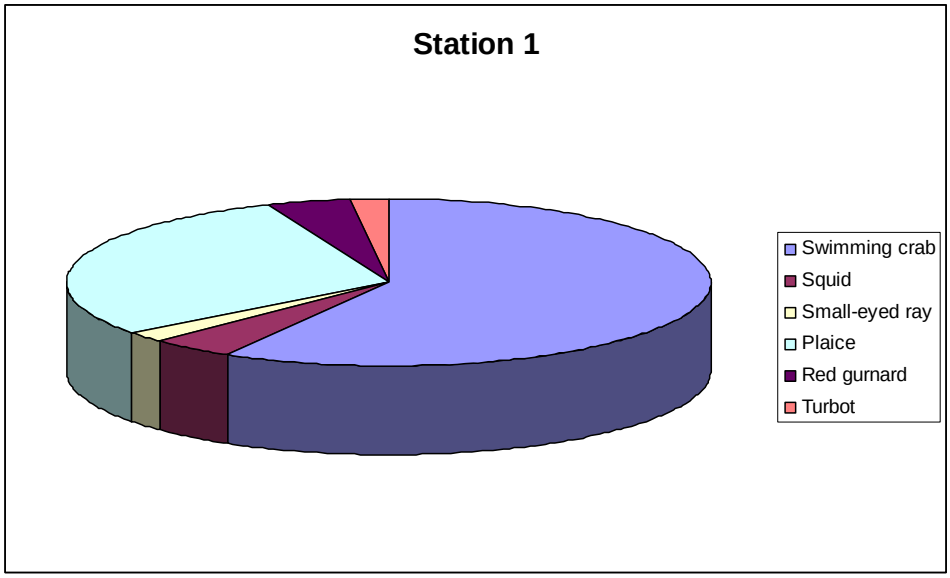
Otter Trawl - September 2005

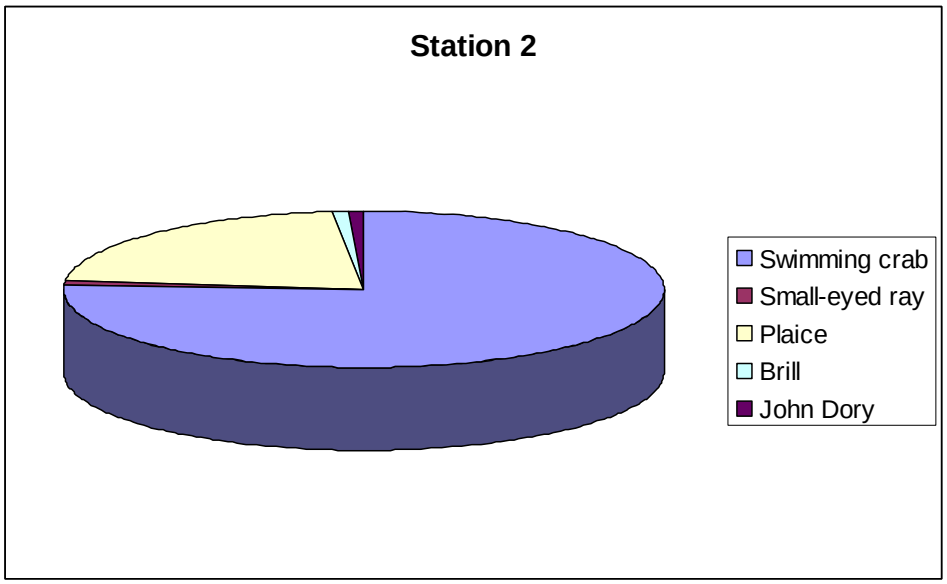
South-West Wave Hub:
Station Number

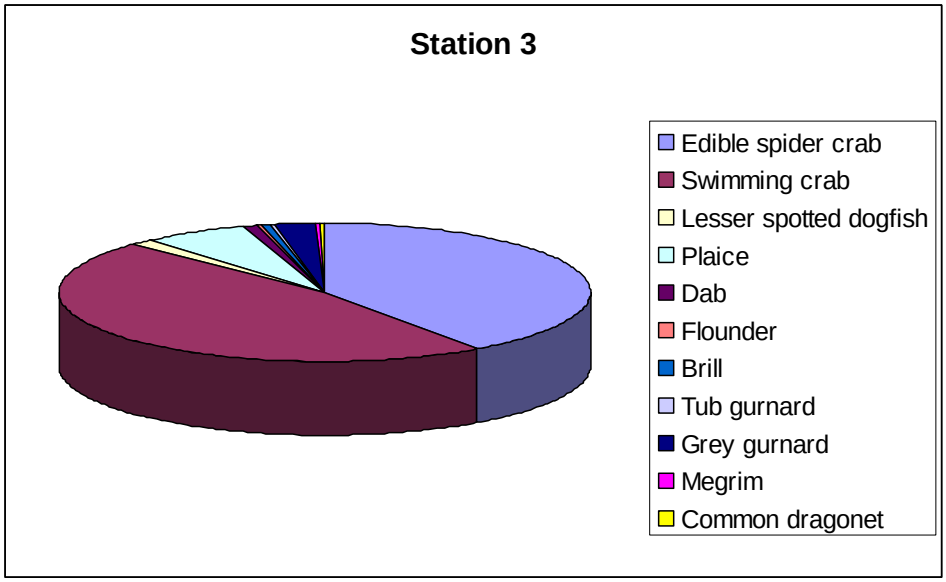
Species		MCS code	OT1	OT2	OT3	OT5	OT6	OT7	OT8	OT9	Total
Edible spider crab	*Maja squinado*	S 1515			171	68	18	270	43	42	**612**
Edible crab	*Cancer pagurus*	S 1566				1	4	3	12	2	**22**
Swimming crab	*Liocarcinus* sp.	S 1577	28	88	201	208	38			102	**665**
Cuttlefish	*Sepiola* sp.	W 2322					3				**3**
Squid	*Loligo* sp.	W 2336						3	20		**23**
Squid	*Alloteuthis* sp.	W 2339	2								**2**
Queen scallop	*Aequipecten opercularis*	W1773					6				**6**
Hermit crab	*Pagurus bernhardus*	S 1457					1	1			**2**
Common starfish	*Asterias rubens*	ZB 100							3		**3**
Spiny seastar	*Marthasterias glacialis*	ZB 104						7			**7**
Sea urchin	*Echinus* sp.	ZB 195						3			**3**
Lesser spotted dogfish	*Scyliorhinus canicula*	ZF 28			5	13	19	164	181	2	**384**
Blonde ray	*Raja brachyura*	ZF 87					2				**2**
Small-eyed ray	*Raja microocellata*	ZF 93	1	1			5				**7**
Spotted ray	*Raja montagui*	ZF 94					3				**3**
Anglerfish	*Lophius piscatorius*	ZG 94					1				**1**
Cod	*Gadus morhua*	ZG 116						22	3		**25**
Bass	*Dicentrarchus labrax*	ZG 312						1		1	**2**
Scad	*Trachurus trachurus*	ZG 338					1				**1**
Black Sea-bream	*Spondyliosoma cantharus*	ZG 364						1			**1**
Red mullet	*Mullus surmuletus*	ZG 374					1			1	**2**
Plaice	*Pleuronectes platessa*	ZG 578	14	25	28	15	31		3	37	**153**
Dab	*Limanda limanda*	ZG 572			3	3	6		1	9	**22**
Lemon sole	*Microstomus kitt*	ZG 574					1	2	3		**6**
Flounder	*Platichthys flesus*	ZG 576			1					2	**3**
Brill	*Scophthalmus rhombus*	ZG 556		1	3		8	3		7	**22**
Dover sole	*Solea solea*	ZG 591					1			3	**4**
Red gurnard	*Aspitrigla cuculus*	ZG 262	2			5	1	41	24	5	**78**
Tub gurnard	*Trigla lucerna*	ZG 269			1	3				3	**7**
Grey gurnard	*Eutrigla gurnardus*	ZG 265			11		5			6	**22**
Streaked gurnard	*Trigloporus lastoviza*	ZG 272						3			**3**

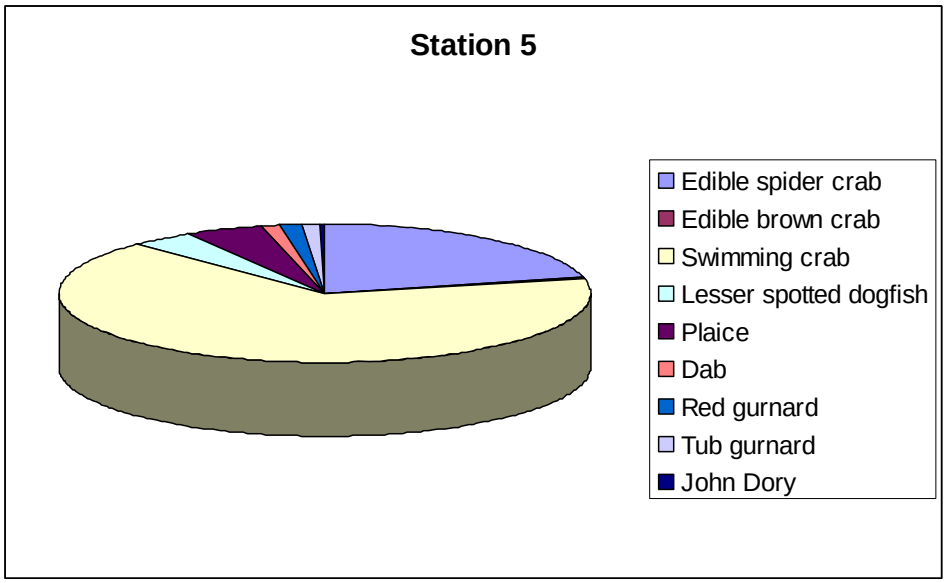
Species		MCS code	OT1	OT2	OT3	OT5	OT6	OT7	OT8	OT9	Total
Megrim	*Lepidorhombus whiffiagonis*	ZG 549			1						**1**
Common dragonet	*Callionymus lyra*	ZG 450			1						**1**
Turbot	*Psetta maxima*	ZG 554	1								**1**
John Dory	*Zeus faber*	ZG 208		1		1	2		1		**5**
Total			**48**	**116**	**426**	**317**	**157**	**524**	**294**	**222**	

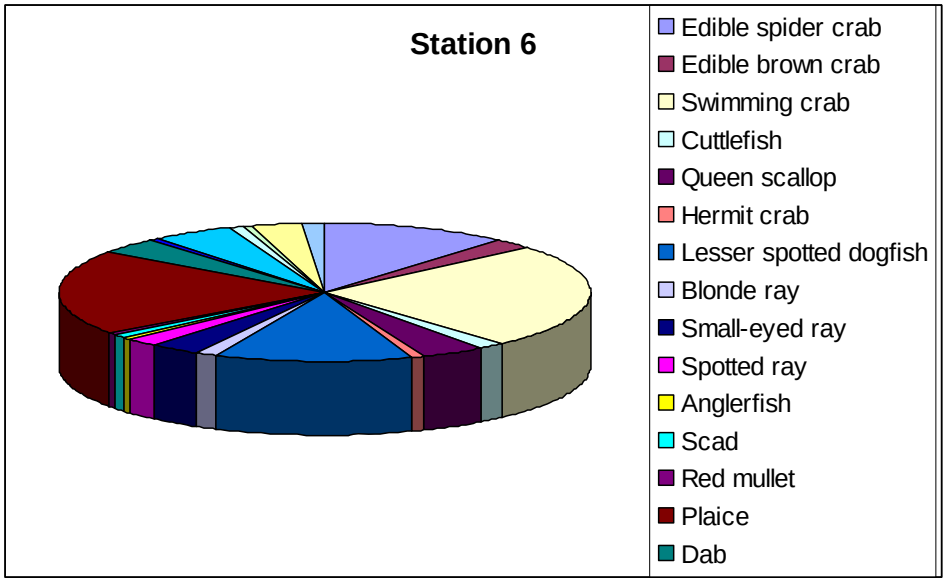
Species abundance at each station from September otter trawl survey (*Girl Linda*)

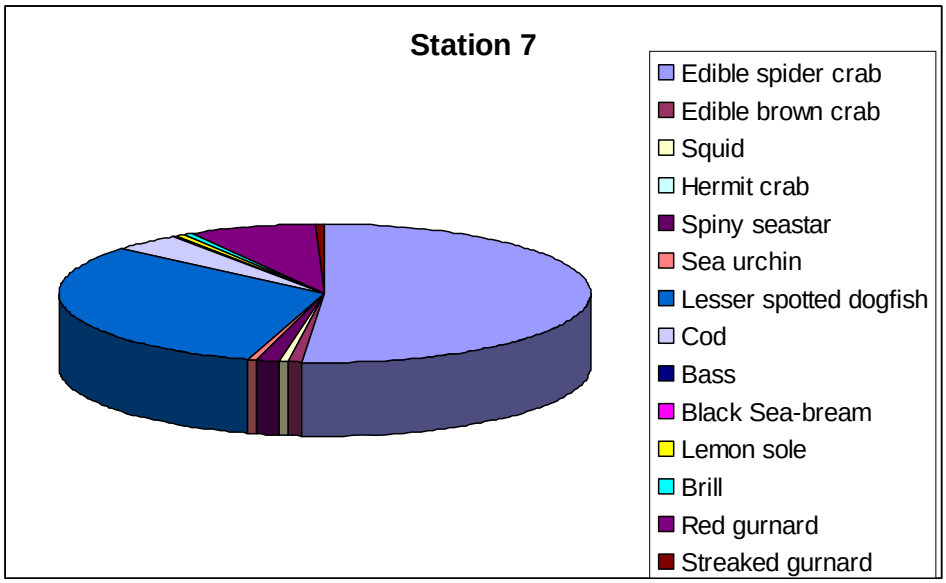


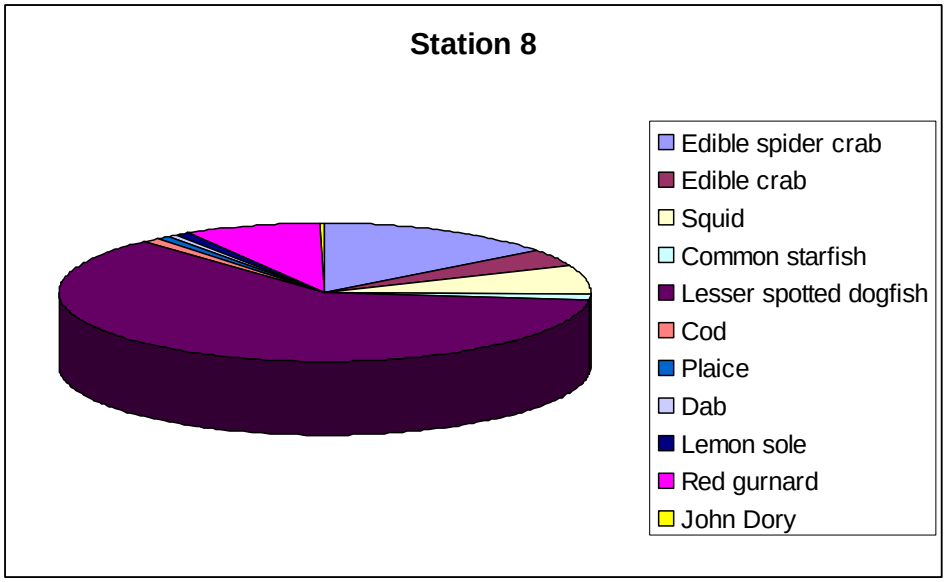


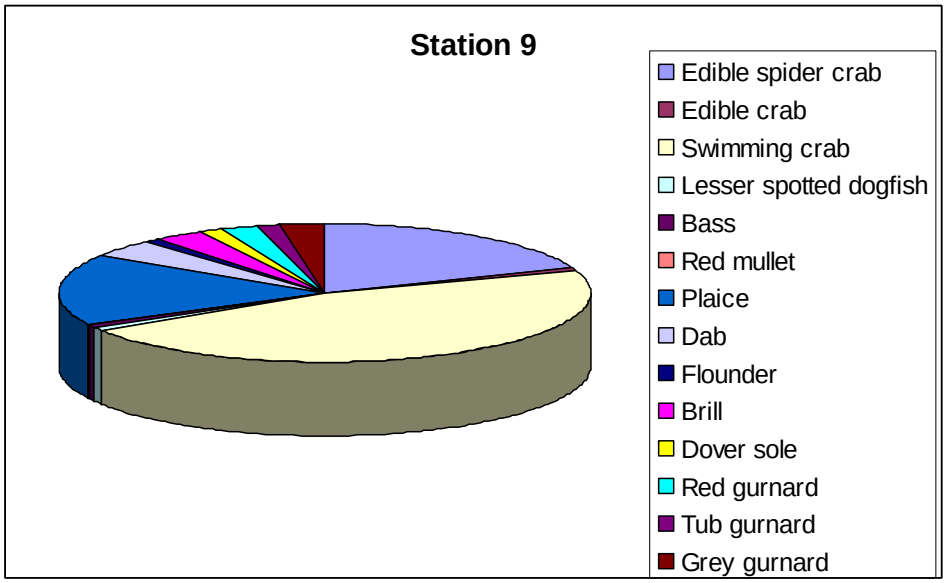

Station 3
Edible spider crab
Swimming crab
Lesser spotted dogfish
Plaice
Dab
Flounder
Brill
Tub gurnard
Grey gurnard
Megrim
Common dragonet


Station 5
Edible spider crab
Edible brown crab
Swimming crab
Lesser spotted dogfish
Plaice
Dab
Red gurnard
Tub gurnard
John Dory


Station 6
Edible spider crab
Edible brown crab
Swimming crab
Cuttlefish
Queen scallop
Hermit crab
Lesser spotted dogfish
Blonde ray
Small-eyed ray
Spotted ray
Anglerfish
Scad
Red mullet
Plaice
Dab

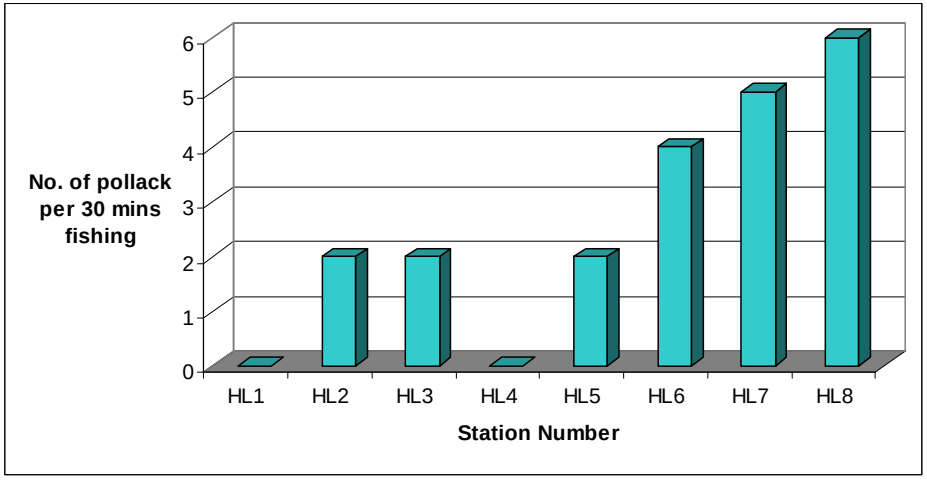

Station 7
Edible spider crab
Edible brown crab
Squid
Hermit crab
Spiny seastar
Sea urchin
Lesser spotted dogfish
Cod
Bass
Black Sea-bream
Lemon sole
Brill
Red gurnard
Streaked gurnard


Station 8
Edible spider crab
Edible crab
Squid
Common starfish
Lesser spotted dogfish
Cod
Plaice
Dab
Lemon sole
Red gurnard
John Dory


Station 9
Edible spider crab
Edible crab
Swimming crab
Lesser spotted dogfish
Bass
Red mullet
Plaice
Dab
Flounder
Brill
Dover sole
Red gurnard
Tub gurnard
Grey gurnard

Handlining survey aboard *Ellie V* 21.9.05

	Position (WGS84)					
Station Number	**Latitude**	**Longitude**	**Number / Type of Hooks**	**Time Start**	**Time End**	**Site description**
HL1	50o14.413N	005o26.294W	6 rubber eels	14:55	15:24	Low lying wreck ~ 1.5m high
HL2	50o13.830N	005o29.625W	6 rubber eels	14:07	14:37	low lying wreck ~ 1.5m high
HL3	50o14.843N	005o29.902W	6 rubber eels	13:25	13:55	Low lying wreck ~ 0.5m high on hard seabed
HL4	50o15.820N	005o32.304W	6 rubber eels	12:38	13:08	Hard seabed rising from ~31m (BSL) to ~28m (BSL)
HL5	50o16.073N	005o35.116W	6 rubber eels	11:52	11:22	Small low lying wreck ~ 2m at highest point
HL6	50o17.500N	005o36.881W	6 rubber eels	10:56	11:26	Low lying wreck ~ 1.5m high on hard seabed
HL7	50o21.389N	005o39.520W	6 rubber eels	09:13	09:43	Hard seabed rising from ~54m (BSL) to ~50m (BSL)
HL8	50o19.685N	005o39.089W	6 rubber eels	10:04	10:34	Hard outcrop banking up from ~48m (BSL) to ~42m (BSL)



South West Wave Hub

EIA BASELINE FISHERIES SURVEYS

Survey No. 3 (November 05) Report

November 2005

REPORT No. 05/J/1/06/0782/0560

Client :
Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Emu Ltd
Head Office
1 Mill Court
The Sawmills
Durley
Southampton
Hampshire
SO32 2EJ

CONTENTS

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Appendices

1. INTRODUCTION

1.1 This report presents the findings from the third of four fisheries resource surveys undertaken by Emu Ltd on behalf of Halcrow Group Ltd as part of the Environmental Impact Assessment (EIA) process being undertaken in relation to the South West Wave Hub project.

1.2 Halcrow Group Ltd is managing the EIA process for this development, which is being funded by the South West Regional Development Agency (SWRDA).

2. STUDY OBJECTIVES

2.1 The main objectives of the fisheries surveys are detailed below:

- To collect baseline data on the composition of fish resources within the study area in order to inform the EIA process being undertaken for the South West Wave Hub project;
- To collect baseline data on the spatial and temporal distribution of fish resources within the study area in order to inform the EIA process being undertaken for the South West Wave Hub project;
- To involve the local fishing community in the data gathering process for the EIA.
- **The surveys are in no way to be intended as a detailed stock assessment of any fishery species.**

2.2 In addition to these fish resource surveys, a commercial fisheries intensity study has also been commissioned. This study will describe commercial fishing activity and patterns in the study area.

3. METHODOLOGY

3.1 The surveys were designed and planned following consultation and meetings with members of the local fishing community and representatives of Cornwall Sea Fisheries Committee (CSFC). Following discussions, it was agreed to undertake a series of four fish resource surveys in order to develop some understanding of the seasonal changes in the fishery.

3.2 The surveys were undertaken aboard local commercial fishing vessels with experienced local skippers who were always consulted during the field work with respect to sampling strategy. Emu Ltd. was represented on each survey by an experienced marine ecologist, with the exception of the hand-lining for mackerel, where data was recorded directly by the skipper.

3.3 The gear used for otter trawling, potting and hand-lining was the same as that employed during commercial fishing activities.

3.4 The third set of surveys was undertaken on Tuesday 22nd November and Wednesday 23rd November 2005. Table 1 summarises the schedule for the third set of surveys.

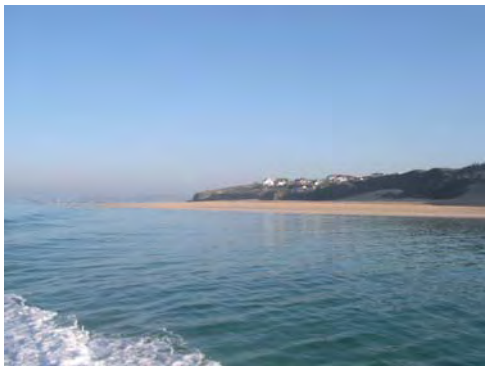


Plate 1 Returning to Hayle after November 2005 survey

Date	Survey Undertaken	Vessel (Skipper)	Emu Staff aboard
22/11/05	Otter trawling	*Girlinda* (Chris Stevens)	Alec Moore
23/11/05	Potting Survey (inshore)	*Chloe Estelle* (Reg Easterbrook)	Jonny Lewis
23/11/05	Hand-lining	*Ellie V* (Michael Veale)	Jeremey Shottin
23/11/05	Potting Survey (offshore)	*Swift* (John Carter)	Alec Moore
23/11/05	Hand-lining for mackerel	*Sally Ann of Navax* (Peter Ghey)	NA

Table 1 Summary of sampling events (November 2005)

3.5 The preliminary positions for the survey stations were chosen in order to sample locations within and outside the proposed wave hub exclusion zone and also along the proposed route of the site to shore cable. Co-ordinates were calculated using a GIS system and issued to the skippers via post prior to the surveys so that they could input these into their vessel's GPS. This provided them with an opportunity to comment as to whether any stations selected by Emu were not suitable for any reason, i.e. in an area of beam trawling activity (unsuitable for pots) or on hard ground (unsuitable for trawling).

3.6 The stations fished in November 2005 were the sames as those fished on the previous two survey occasions (July and September 2005). On the actual day of the survey, all survey positions were recorded on the vessel using the vessel's own GPS system. All GPS systems used were based on the WGS84 datum.

3.7 For the potting surveys, the positions when hauling began and ended were noted, whilst for the trawling the start and end positions of each tow were noted. With respect to the hand-lining on wrecks and hard ground, a single position was noted, around which fishing was concentrated for 20 minutes.

3.8 Survey logs and positions are appended. Weather, sea state and other information (e.g. other vessels) were also recorded as appropriate.

Specific Survey Methodologies

(1) Potting Surveys

3.9 Two separate potting surveys were undertaken in order to obtain data from the offshore wave hub area and closer inshore in the area of the site to shore cable route. The offshore area was fished by *Swift* whilst the inshore area was fished by *Chloe Estelle*.

3.10 For both vessels, strings of 25-30 pots were shot on the morning of Tuesday 22nd November 2005. All pots were new & parlour-type, and baited with dogfish (*Scyliorhinus* sp.), scad (*Trachurus trachurus)* and salted mackerel (*Scomber scombrus*). The pots were subsequently retrieved on 23rd November, resulting in a soak time of approximately 24 hours. This soak time is less than those used on previous surveys due to weather constraints.

3.11 Upon retrieval, the following was noted for every pot:

- The numbers of sized, under-sized and soft brown crab;
- The numbers of sized, under-sized and soft spider crab; and
- The numbers of sized under-sized and berried lobsters.
- Numbers of other species (including velvet swimming crabs).

On every 5th pot, measurements were taken on the carapace width of crabs and carapace length of lobsters.

3.12 The positions of the stations fished by *Swift are* shown in Figure 1 whilst the stations fished by *Chloe* Estelle are shown in Figure 2.

(2) Otter Trawling Survey

3.13 A commercial otter trawl gear was used, with approximately 85ft spread & 9ft lift. The trawl was fitted with a 85mm cod-end mesh. Tow lengths varied from 5 minutes to 15 minutes.

3.14 Upon retrieval of the catch, all fish species caught were recorded and length measurements taken. Where large catches were landed, sub-samples were taken to undertake length measurements and an estimate of numbers landed.

3.15 Photographs were also taken of the catch upon being landed.

3.16 The positions of the tows are shown in Figure 3.

(3) Hand-lining Survey

3.17 The commercial hand-lining gear comprised of a set of seven hooks baited with rubber eels. Hand-lining was undertaken for 20 minutes at each site. On previous surveys, 30 minutes fishing was undertaken on each station. However, due to weather and tidal conditions it was decided to reduce fishing time at each station to 20 minutes. The data analysis reflects this reduced fishing effort.

3.18 Each time the line was under tension due to fish being caught, the hand-lining gear was brought to the surface, and the fish were released. The hand-line was then placed back into the water. This was repeated until the 30 minutes period was completed.

3.19 Upon retrieval of catch, species were identified, enumerated and total length measurements were taken. Photographs of the species caught (pollack only) were taken.

3.20 The positions of the hand-lining locations are shown in Figure 4.

(4) Hand-lining Survey for mackerel

3.21 The third mackerel handline survey was also undertaken on 23rd November 2005 by Peter Ghey, skipper and owner of *Sally Ann of* Navax. The position of the survey stations enabled the fishery to be examined in a repeatable progression from the Port of Hayle to off St. Ives Head. An added advantage of this method was that the proposed track for the offshore cable would be crossed and recrossed and observations of mackerel carried out using sonar.

3.22 The mackerel lines used basically consist of a weight, a trace of twenty eight hooks each bearing a length of coloured plastic tubing attached to a heavier backline. A Spanish modelled stripper system and manually operated `gurdie` were used to pay out and recover the line and remove fish from the hooks.

3.23 The echo sounder and GPS were operated continually in order to identify fish marks, with the location noted as is normal fishing practice.

3.24 Each Emu survey station was initially searched by sonar for any evidence of mackerel and a search pattern developed up and down the line of the tide through the station of approximately 200m x 100m. The vessel steamed at tickover (2.5-2.8kts) over each survey station.

3.25 Approximately 20 minutes were spent looking for mackerel in the immediate area and 30 minutes actively fishing for them at increasing distances from the station out to 200m.

3.26 If mackerel were detected the fishing gear was deployed with the vessel performing continous tight circles drifting with the tide over the shoal. Mackerel from individual stations were kept separate for weighing and measurement.

4. RESULTS

4.1 The following section of the report presents the key results from the third set of fisheries surveys undertaken on 22nd-23rd November 2005.

Potting Survey aboard Swift

4.2 Potting was carried out at a total of 7 sites. The main species recorded in the pots were brown crab (*Cancer pagurus*), with smaller numbers of spider crab (*Maja squinado*) and lobster (*Homarus gammarus*) also recorded.

4.3 The catch was dominated by undersized and soft brown crabs, with an average ratio across all the pots of 2.6:1 undersized/soft vs sized (retained) crab. This compares to a ratio from the second survey aboard *Swift* (undertaken 05.10.05) of 2.1:1.

4.4 All catches of crab species and lobster were recorded and identified as sized/under-sized or soft. Over the total number of pots, under-sized and soft brown crabs were the highest number recorded, with 358 individuals noted.

4.5 The catch ratio (numbers per pot) was calculated for each of the key species captured. The catch ratios for each survey station are shown in Figure 5.

4.6 From Figure 5 it is possible to note that the highest catch ratio of sized brown crabs was recorded at Station 12 whilst the highest catch ratio of undersized/soft brown crabs was recorded at Station 10.

4.7 There were only limited numbers of spider crab and lobster recorded during this survey, with only 39 sized.undersized.soft spider crabs noted and 8 lobsters (7 sized, 1 undersized).

4.8 In addition to the species listed above, several other species were recorded in the pots, including the spiny starfish, *Marthasterias glacialis*, velvet swimming crab, *Necora puber*, conger eel (*Conger conger*), and the hermit crab (Paguridae). At Station 11, a catch ratio of 3.0 was recorded for *Necora puber*.

Potting Survey aboard Chloe Estelle

4.9 Strings of 25 pots (apart from Stations 3 (30), 5 (29) and 6 (30)) were retrieved after a 24 hour soak on Wednesday 23rd November 2005. The main species recorded in the pots were the brown crab (*Cancer pagurus*), the spider crab (*Maja squinado*), the common lobster (*Hommarus gammarus*) and velvet swimming crabs (*Necora puber*).

Plate 2 Hauling pots aboard *Chloe Estelle*, St Ives Bay, November 2005

4.10 The catch was dominated by undersized and soft brown crab, with an average ratio across all the pots of 3:1 undersized/soft vs sized (retained) crab. This compares to a ratio recorded in September of almost 1:1 for sized vs undersized/soft crabs.

4.11 The catch ratio (numbers per pot) was calculated for each of the key species captured. The catch ratios for each survey station are shown in Figure 6.

4.12 From Figure 6 it is possible to note that the highest catch ratio for sized brown crab was recorded at Station 5 which lies close to the proposed cable route. This site also recorded the highest catch ratio of sized brown crabs in the July survey.

4.13 The highest catch ratio for undersized and soft brown crab was recorded at Station 3. This station also recorded the highest catch ratio for these crabs in the September survey.

4.14 Catch ratios of spider crab were much lower than in previous survey, reflecting the fact that this species tends to move offshire into deeper water at this time of year and is rarely found in these shallower, inshore waters.

4.15 With regard to the catch ratio for sized and under-sized lobsters, very few sized or undersized lobsters were recorded on this surevy, with only 3 sized and 19 undersized lobsters recorded in a total of 189 pots.

Otter trawl survey aboard Girlinda

4.16 A total of 9 sites were trawled on 22nd November 2005. The sites were distributed within Saint Ives Bay and included sites adjacent to the proposed site to shore cable route. The sites covered the same areas trawled in July and September 2005.

4.17 The total number of species recorded at each station is shown in Figure 7 with the total abundance of all species shown in Figure 8.

4.18 A total of 26 different species were recorded in the trawls, with the most abundant species recorded being the swimming crab (*Liocarcinus* spp), which was recorded at 6 of the 9 sites.

4.19 Of these 26 species, 21 were fish species, including many commercially valuable species such as plaice (*Pleuronectes platessa)*, cod (*Gadus morhua*) and red mullet (*Mullus surmuletes*).

4.20 Plaice was actually the most abundant species recorded during this survey, with a total of 115 fish recorded from all the trawls.

4.21 The next most abundant fish species were the grey gurnard (*Eutrigla gurnardus*), red mullet (*Mullus surmuletes*), dab (*Limanda limanda*) and small eyed ray (*Raja microcellata*).

4.22 The overall species abundance (493) was markedly decreased from both the July (2036) and September (2104) surveys, reflecting the fact that many fish would have moved offshore into deeper water to over-winter. The total number of species recorded (26) was also lower than the July (32) and September (35) surveys.

Hand-lining Survey aboard Ellie V

4.23 A total of 8 sites were fished aboard *Ellie V* on 23rd November 2005. Species recorded during this survey were pollack (*Pollachius pollachius*), bib /pouting (*Trisopterus luscus*) and squid (*Loligo* spp.). No fish at all were captured at 2 of the 8 stations.

4.24 In total, only 8 fish and one squid were caught during the entire survey. Of these, 4 were Pollack and 4 were bib.

4.25 The abundance of pollack and bib caught at each survey station is shown in Figure 9. From this, it can be noted that the greatest abundance of pollack was landed at Station 7, whilst the greatest abundance of bib were caught at Station 5.

4.26 The size distribution of all the pollack and bib caught is shown below in Figure 10.

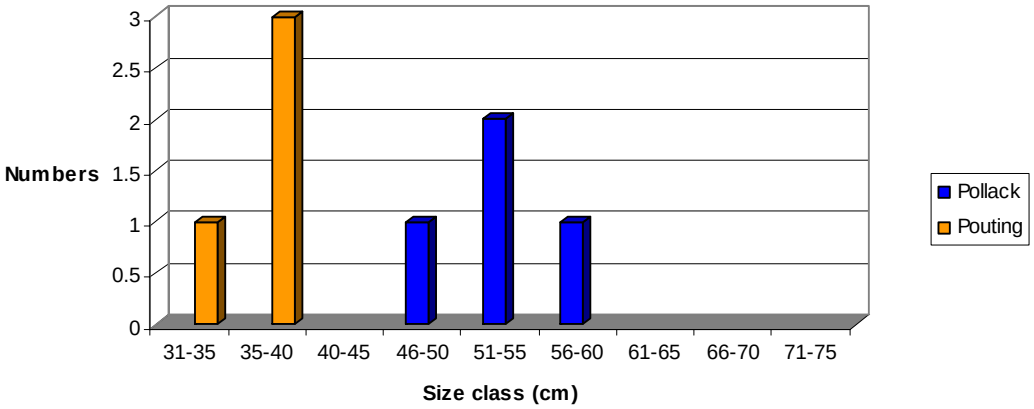


Figure 10 Size distribution of bib and pollack caught in November 2005 survey

Mackerel hand-lining aboard Sanny Ann of Navax

4.27 The results from the 2nd mackerel survey (03/04.10.05) are presented below in Table 2.

Survey Station	Notes	Mackerel captured	Other species
1	- Depth 19.2 to 18.1m - Sand and gravel substrate	42kg (20kg measured)	-
2	- Depth 17.6 to 18.0m - Sand substrate	37kg (20kg measured)	-
3	- Depth 23.1 to 24.4m - Sand and gravel substrate - Typical potting area	10kg (10kg measured)	Garfish (*Belone belone*)
4	- Depth - unrecorded - Hard rocky ground	3kg (3kg measured)	Squid (*Loligo* spp.)
5	- Depth 13.8 to 14.8m - Sand substrate	26kg (20kg measured)	Sand smelt (*Atherina presbyter*)

Table 2 Results from 2nd mackerel hand-line survey (07.08.05)

4.28 In total, 118kg of mackerel were captured during the second (October) mackerel survey, an increase on the 82kg captured during the first (August) survey. Catches from Stations 1 to 5 from the first two surveys are shown below in Figure 11.

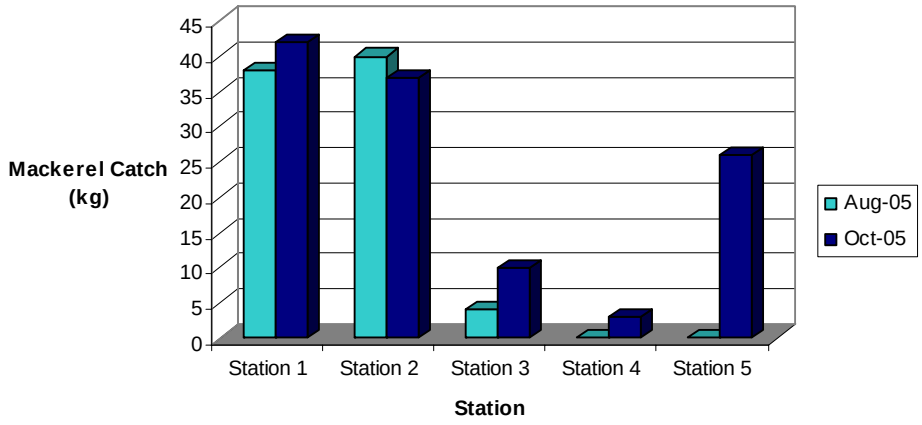


Figure 11 Catches of mackerel from Wave Hub survey stations (August and October 2005 surveys

4.29 Representative length measurements were taken of mackerel from all 5 survey stations. The length distribution of these fish is shown on Figure 12.

Station 1

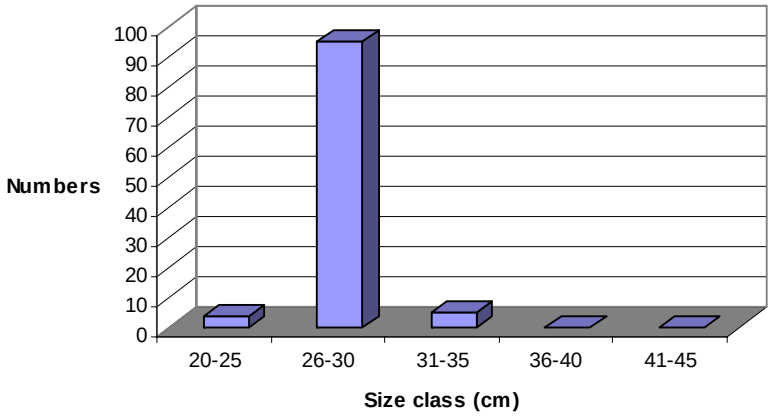
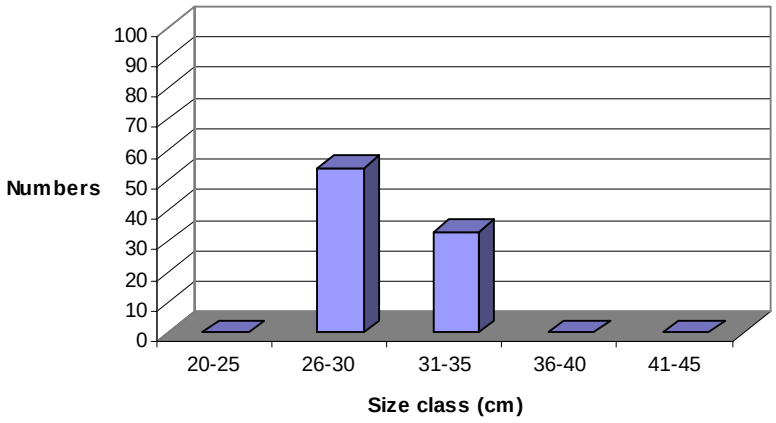


Figure 12 Length distribution of mackerel captured during survey No. 2 (October 2005)

Station 2



Station 3

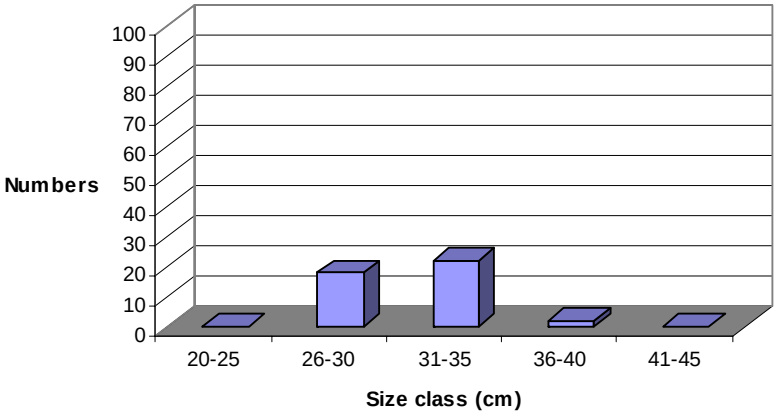
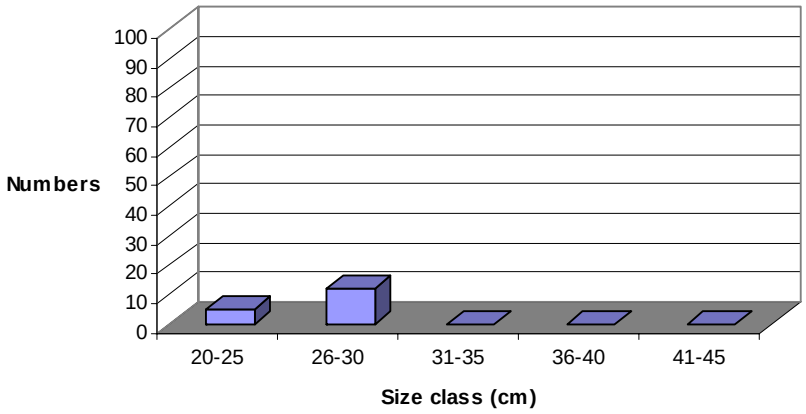


Figure 12 (Cont'd)

Station 4



Station 5

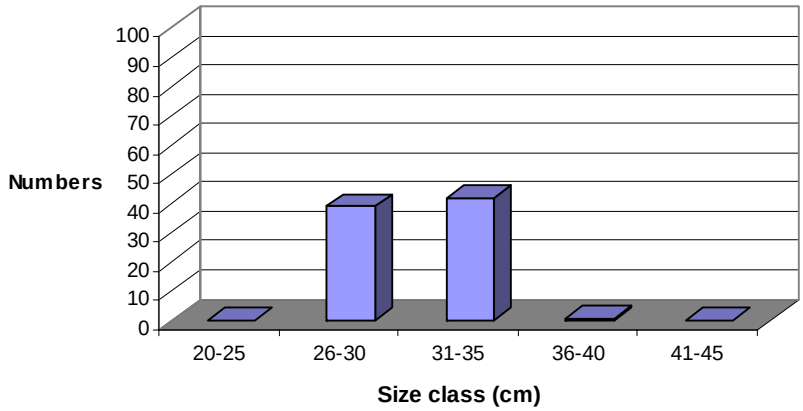


Figure 12 (Cont'd)

4.30 Figure 12 indicates that there are at least two distinct year classes of fish present within St. Ives Bay in October; one in the size range 26-30cm and the other in the range 31-35cm. These year classes correspond to those noted in the August survey.

5.0 DISCUSSION

5.1 The third set of fish resource surveys undertaken offshore of Hayle, Cornwall confirm the findings of the first two surveys that the area supports a diverse fishery, with a wide range of fish and shellfish species recorded.

5.2 The key difference from this November data is that the abundance and species diversity recorded on the majority of surveys was less than those recorded in the July and September surveys. This indicates that at this time of year (November), many species move offshore out of St. Ives Bay into deeper water.

5.3 As was noted in the September surveys, the high number of spider crabs noted in the original July survey have decreased further, with only small amounts recorded in either the trawl or potting surveys.

5.4 It was also possible to note that there were a higher proportion of soft or undersized brown crabs compared to hard, sized crabs thoughout the study area. This is likely to be due to the fact that many adult crabs move offshore to over-wintering grounds at this time of year.

5.5 With respect to finfish, the otter trawl survey recorded a lower number of both species and individual fish than the two previous surveys in July and September. Plaice was the most abundant species in all the otter trawl stations.

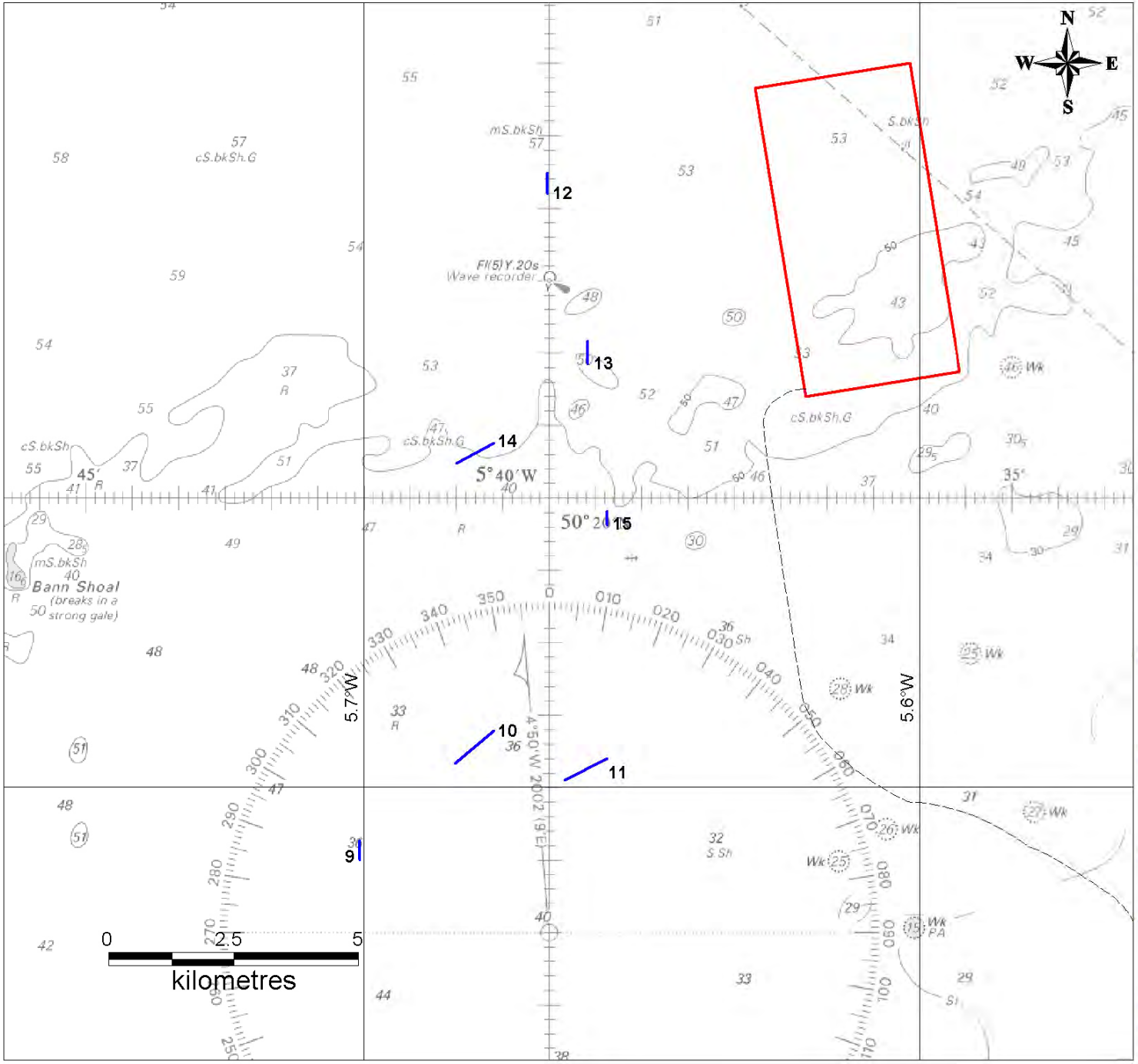
5.6 Fewer pollack were captured during the handlining survey compared to the previous two surveys but this may have been as much a function of the weak tidal currents on the day of survey as a lack of fish, as many distinct `marks` were noted on the survey boats sounder.

5.7 The results of the third survey in November appears to confirm observations made by local fishermen that the winter months are a `quieter` time in terms of fishing due to the fact that many species appear to move offshore into deeper water as part of over-wintering or spawning strategies.

6.0 AUDIT TRAIL

Title: South West Wave Hub Project – EIA Baseline Fisheries Surveys			
Report No: 05/J/1/06/0782/0560 **Job No:** J/1/06/0782 **Client Name:** Halcrow Group Ltd **Client Contact:** Steve Challinor			
		Initials	**Date**
Project Manager:	Dr N.S. Thomas		
Data Analysis undertaken by:	Jonny Lewis		
Report written by:	Jonny Lewis		
Report checked by:	Claire Espinasse		
Report Authorised by:	Dr N.S. Thomas		

FIGURES



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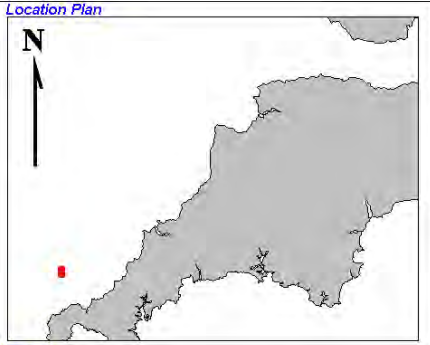

Legend

- Potting Sampling Transects
- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)

November Survey 2005

Notes

Coordinate System:
WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Offshore Potting Survey Stations
(Swift)

Job No.	Date Issued	Figure 1		
J/1/06/0782	2/5/06			
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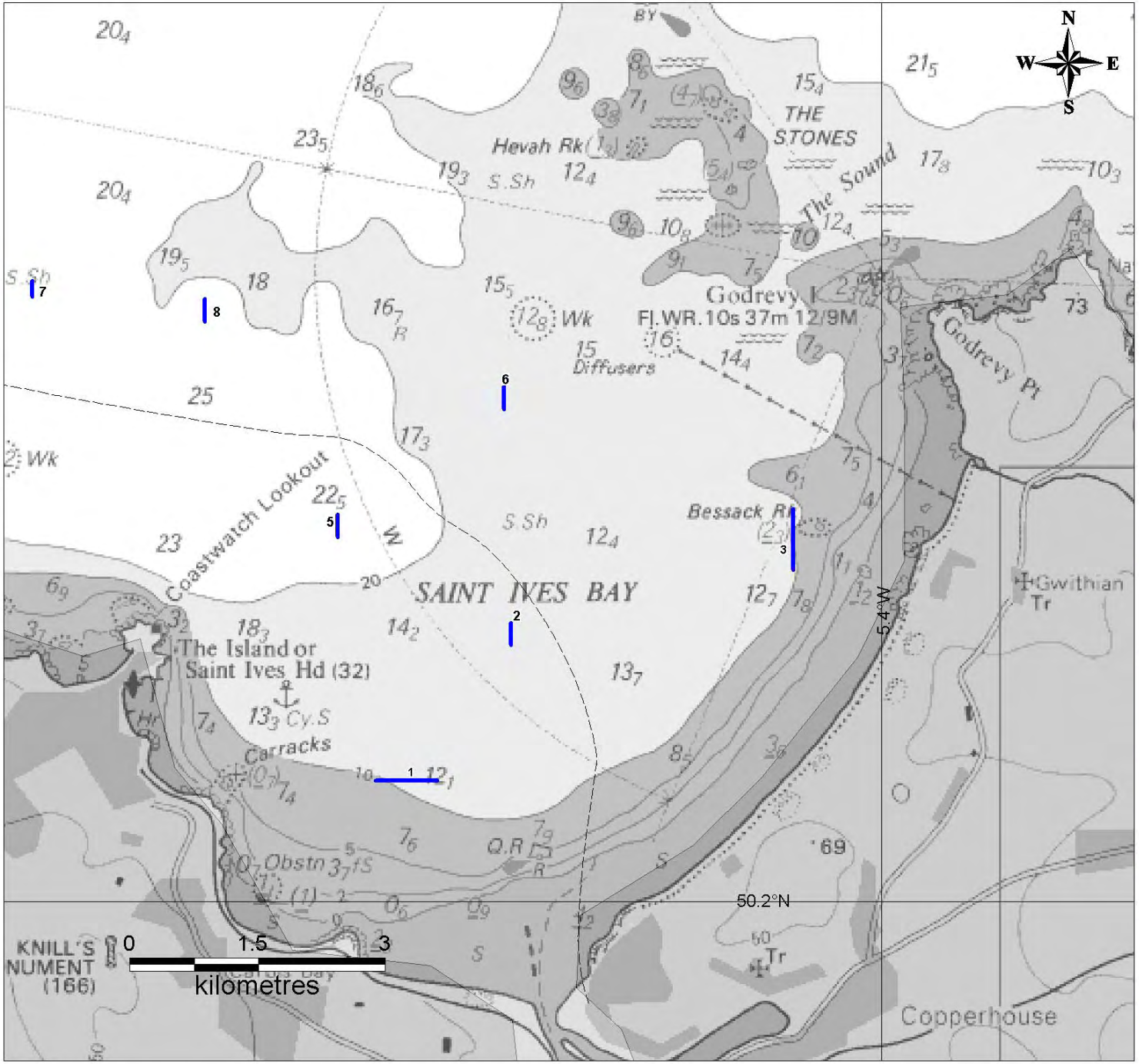

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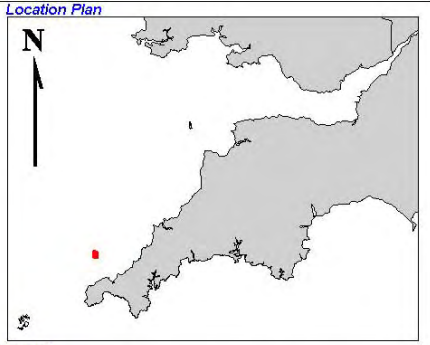

Legend

- Potting Sampling Transects
- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)

November Survey 2005

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Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Inshore Potting Survey Stations
(Chloe Estelle)

Job No.	Date Issued	Figure 2		
J/1/06/0782	2/5/06			
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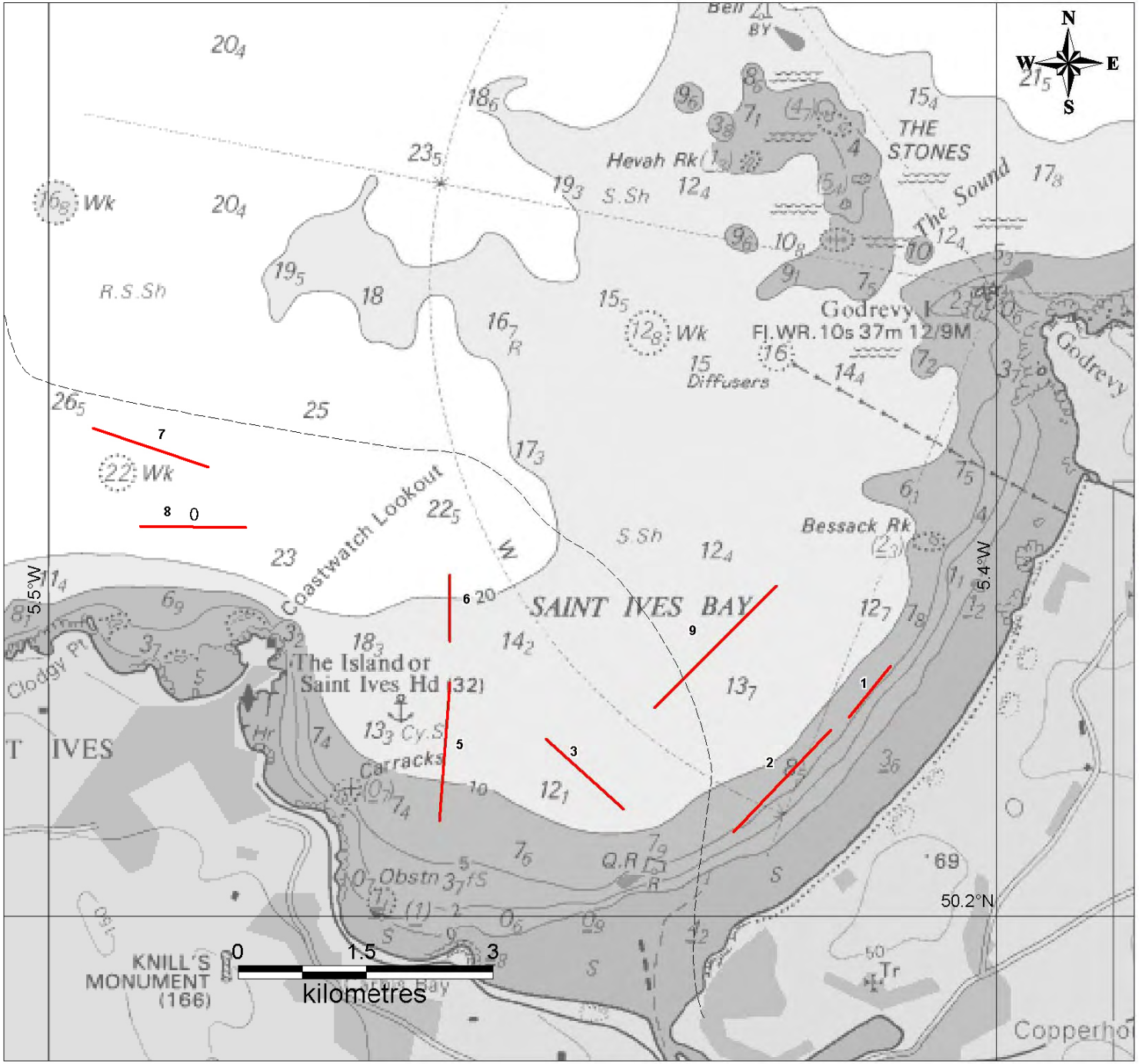
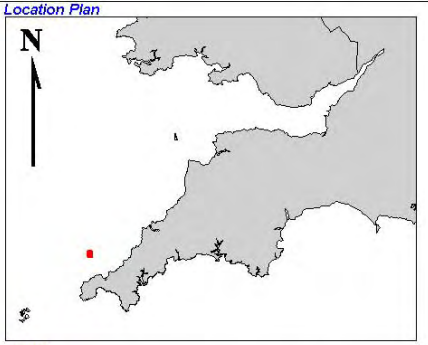


Location Plan



Legend

- Otter Trawling Sampling Tows
- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)

November Survey 2005

Notes

Coordinate System:
WGS 84

Client

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Otter Trawling Survey Tows
(Girl Linda)

Job No.	Date Issued	Figure 3		
J/1/06/0782	2/5/06			
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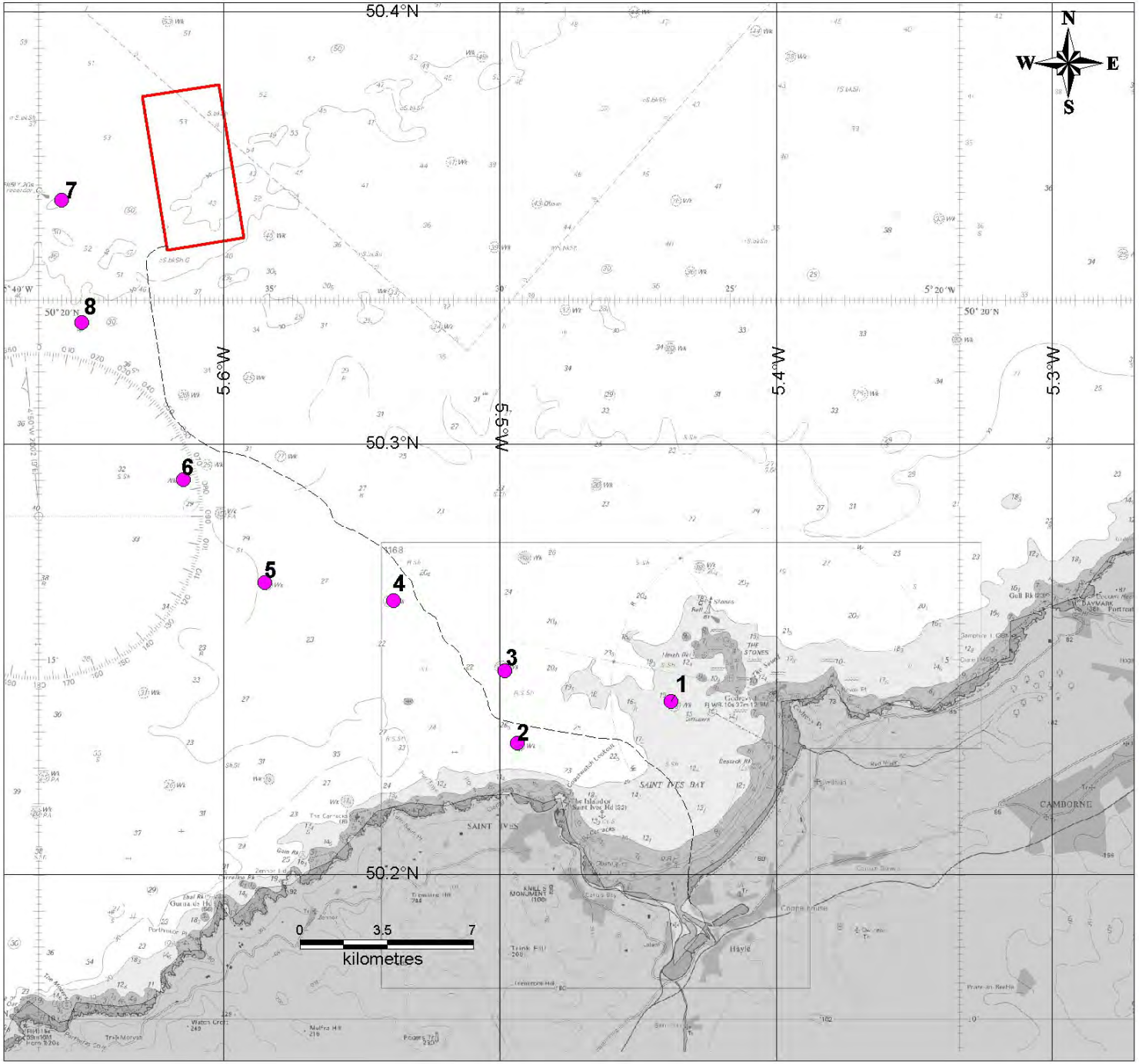

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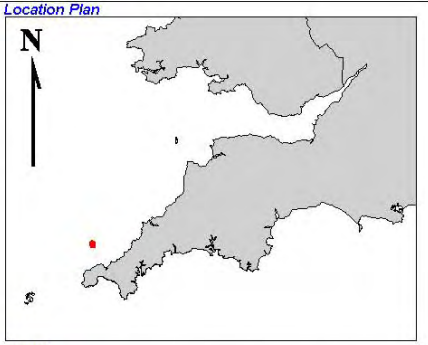

Legend

- Hand Lining Sampling Locations
- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)

November Survey 2005

Notes

Coordinate System:

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Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Handlining Survey Locations
(Ellie V)

Job No.	Date Issued	Figure 4		
J/1/06/0782	2/5/06			
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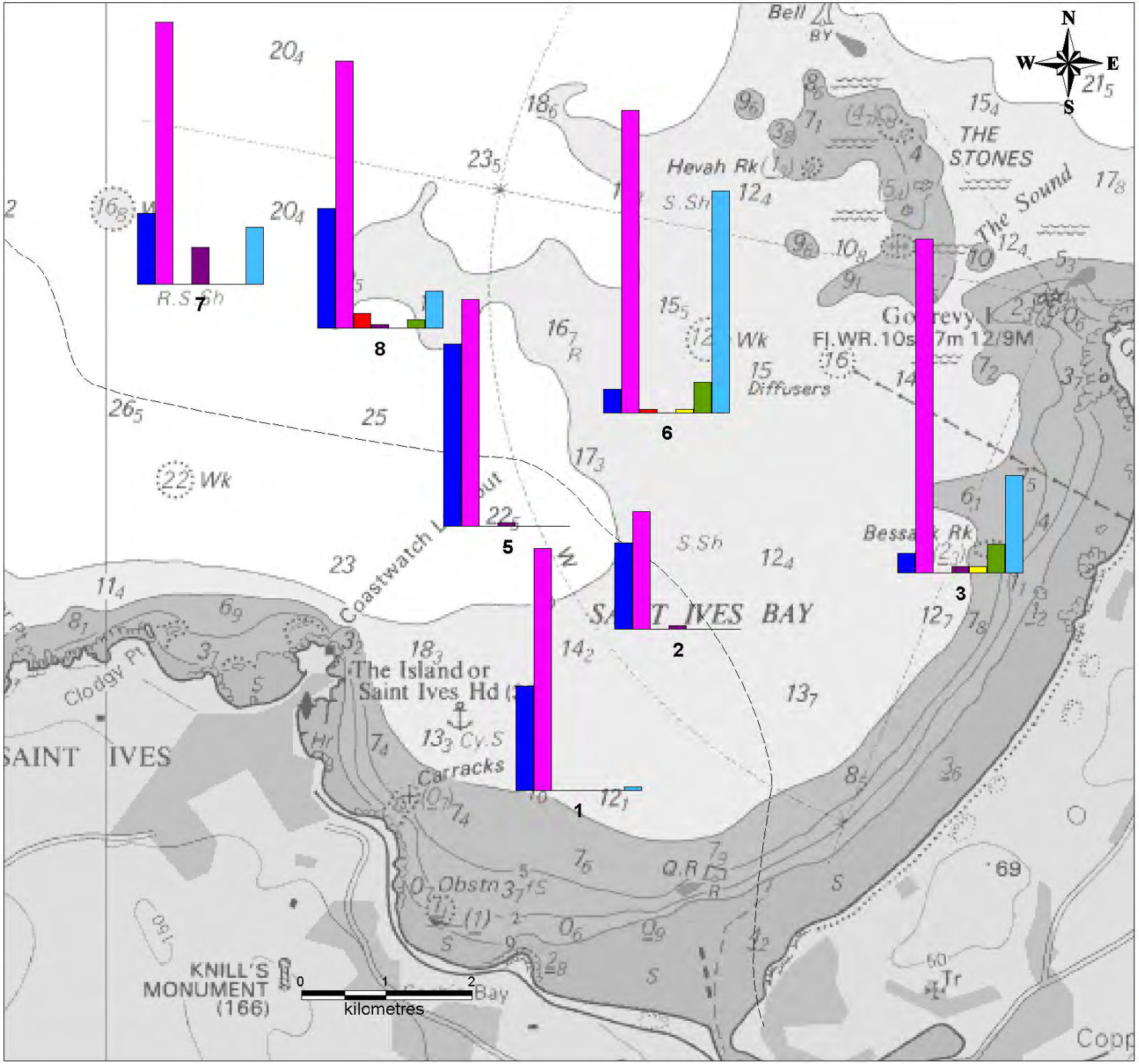
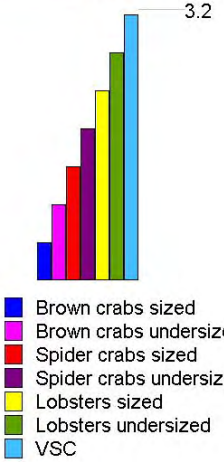


Legend

Proposed Site to Shore Cable Route

Proposed Wave Hub Site (New Deployment Area)



November Survey 2005

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Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Inshore Potting Catch Ratio for Main Species
(Chloe Estelle)

Job No.	Date Issued	Figure 6		
J/1/06/0782	2/5/06			
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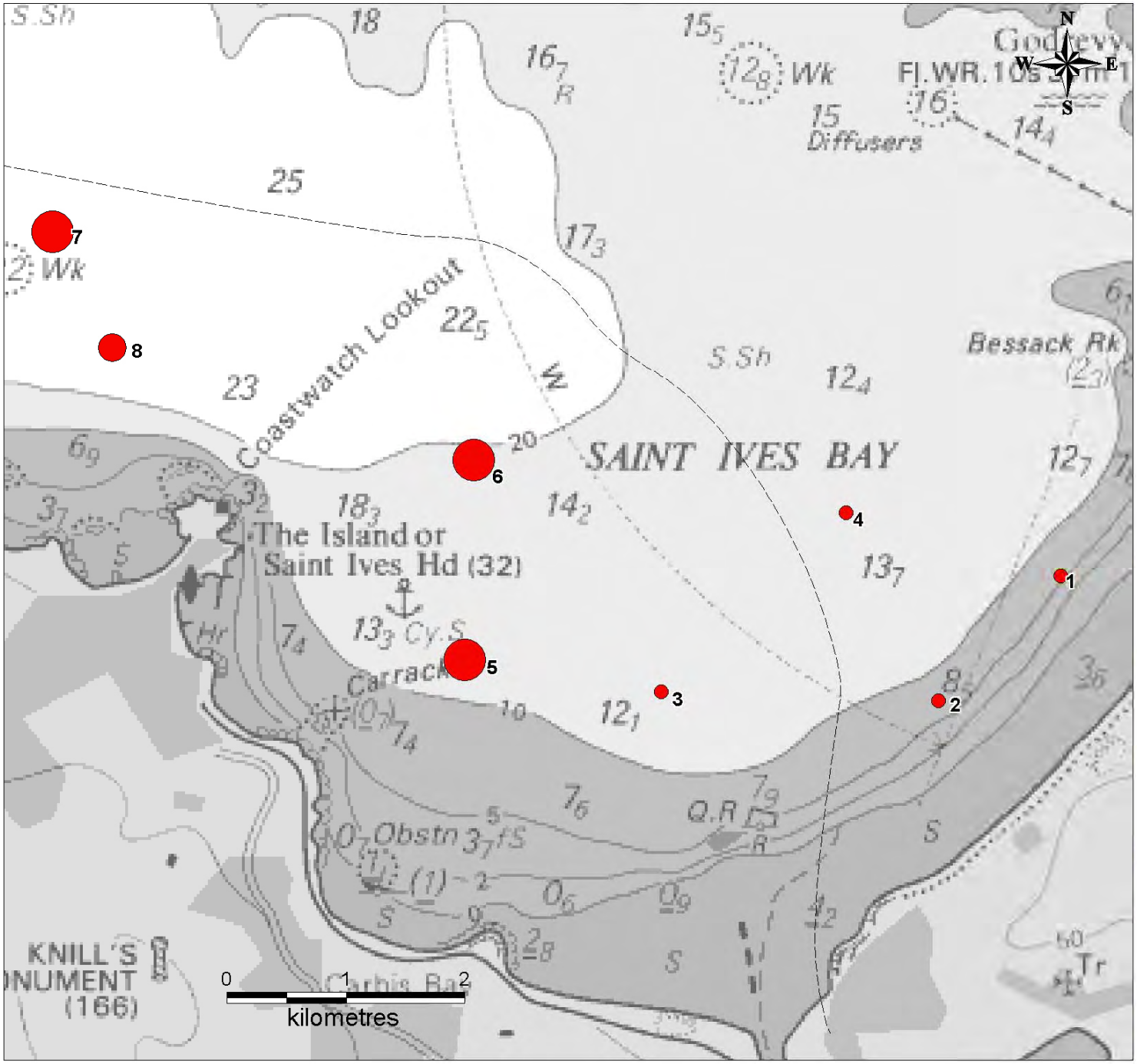

Legend Species Numbers

- 21 to 25 (0)
- 15 to 20 (0)
- 11 to 14 (3)
- 6 to 10 (1)
- 1 to 5 (4)

Proposed Site to Shore Cable Route

Proposed Wave Hub site (New Deployment Area)

6 Station Number

November Survey 2005

Notes

Coordinate System: WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Otter Trawling Surveys
Total Number of Species per Tow

Job No.	Date Issued	Figure 7		
J/1/06/0782	2/5/06			
Sheet Size	Scale	Drawn by	Checked by	Revision No.
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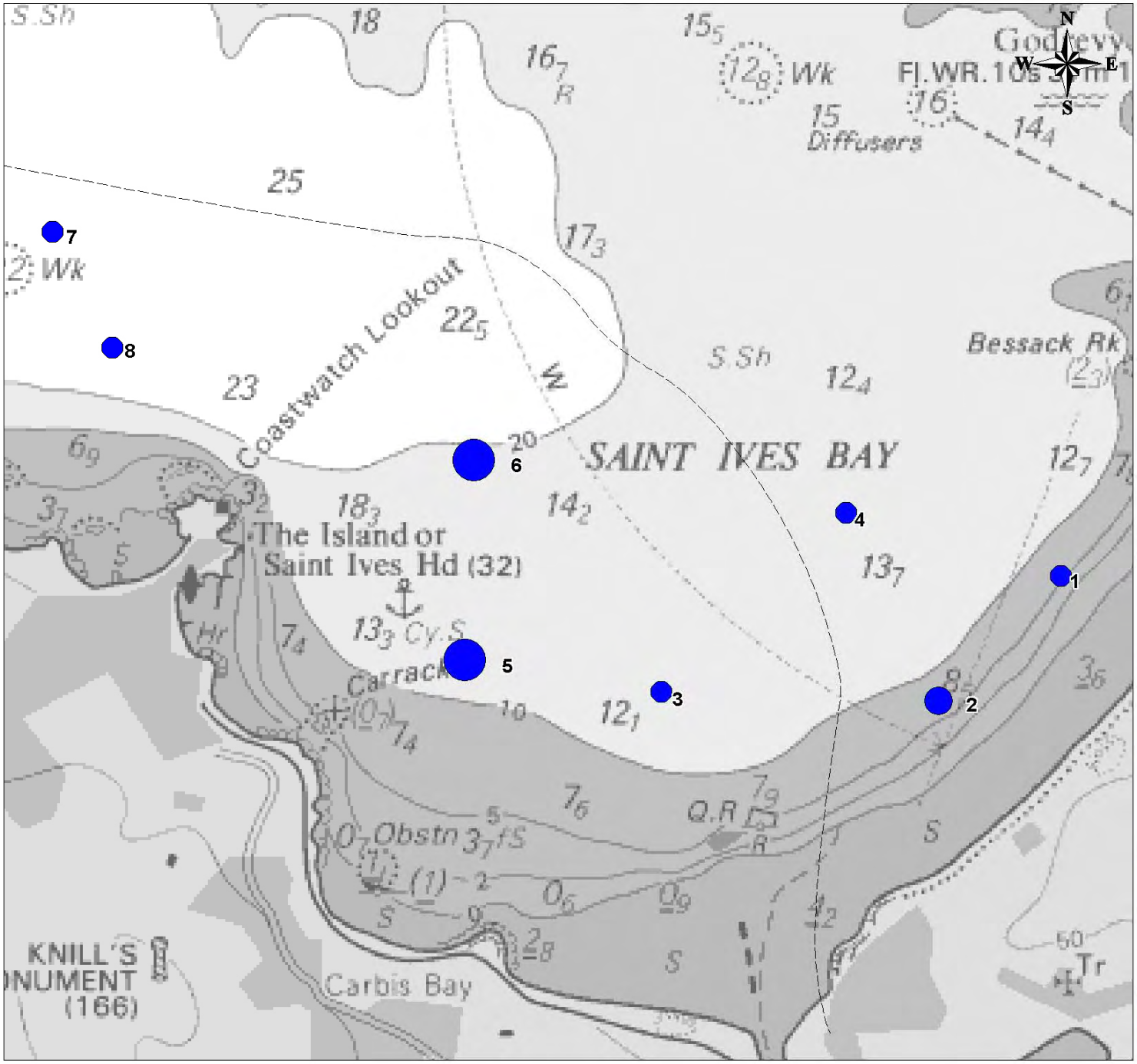

Legend No. of Individuals

- 501 to 1,000 (0)
- 201 to 500 (0)
- 101 to 200 (2)
- 51 to 100 (1)
- 1 to 50 (5)

Proposed Site to Shore Cable Route

Proposed Wave Hub Site (New Deployment Area)

⑥ Station Number

November Survey 2005

Notes

Coordinate System:
WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Otter Trawling Surveys
Total Number of Species Per Station

Job No.	Date Issued	Figure 8		
J/1/06/0782	2/5/06			
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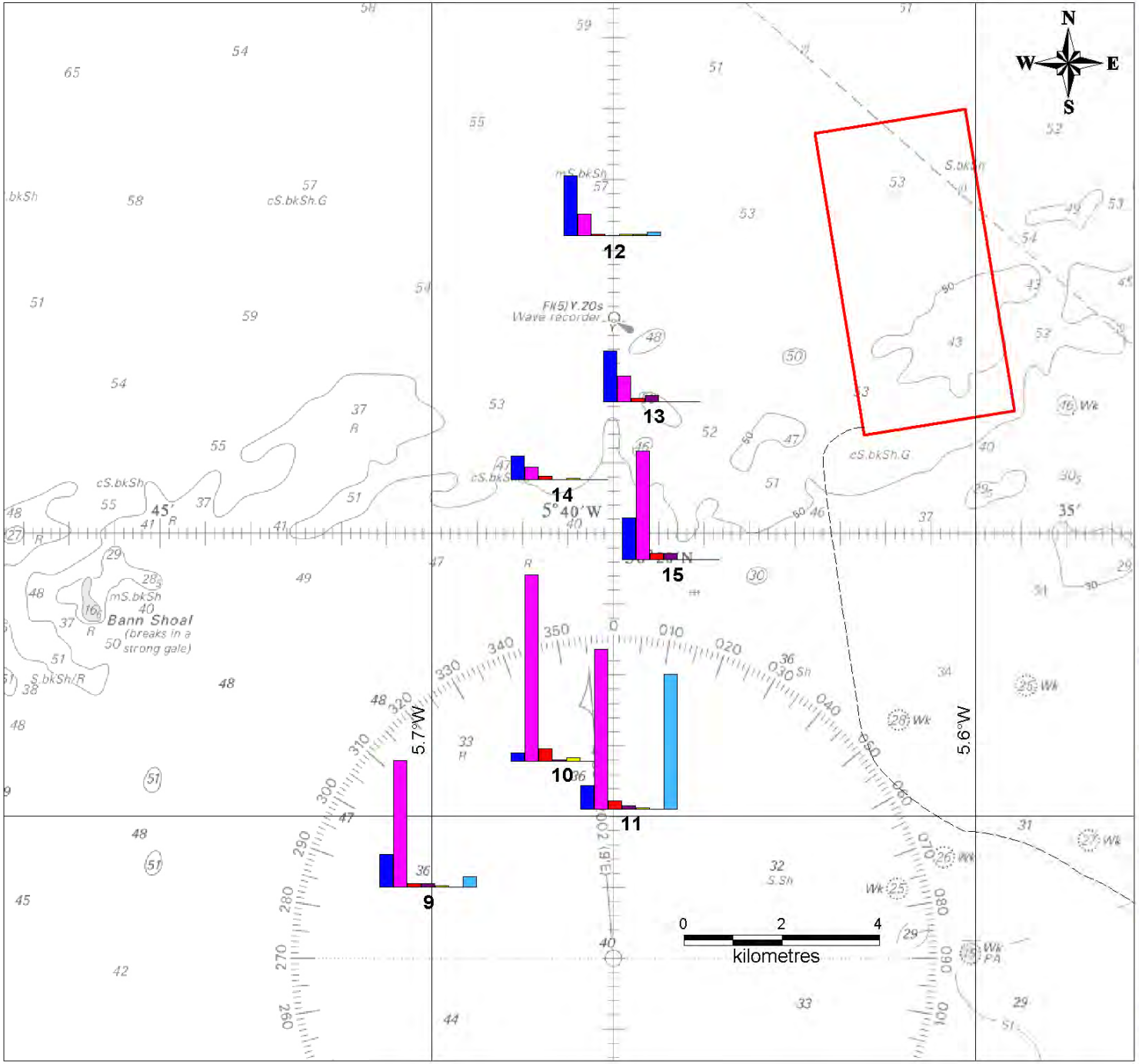

Legend

Proposed Site to Shore Cable Route

Proposed Wave Hub Sit (New Deployment Area)

4.2

- Brown crabs sized
- Brown crabs undersized
- Spider crabs sized
- Spider crabs undersized
- Lobsters sized
- Lobsters undersized
- VSC

November Survey 2005

Notes

Coordinate System:

WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Offshore Potting Catch Ratio for Main Species *(Swift)*

Job No.	Date Issued	Figure 5		
J/1/06/0782	2/5/06			
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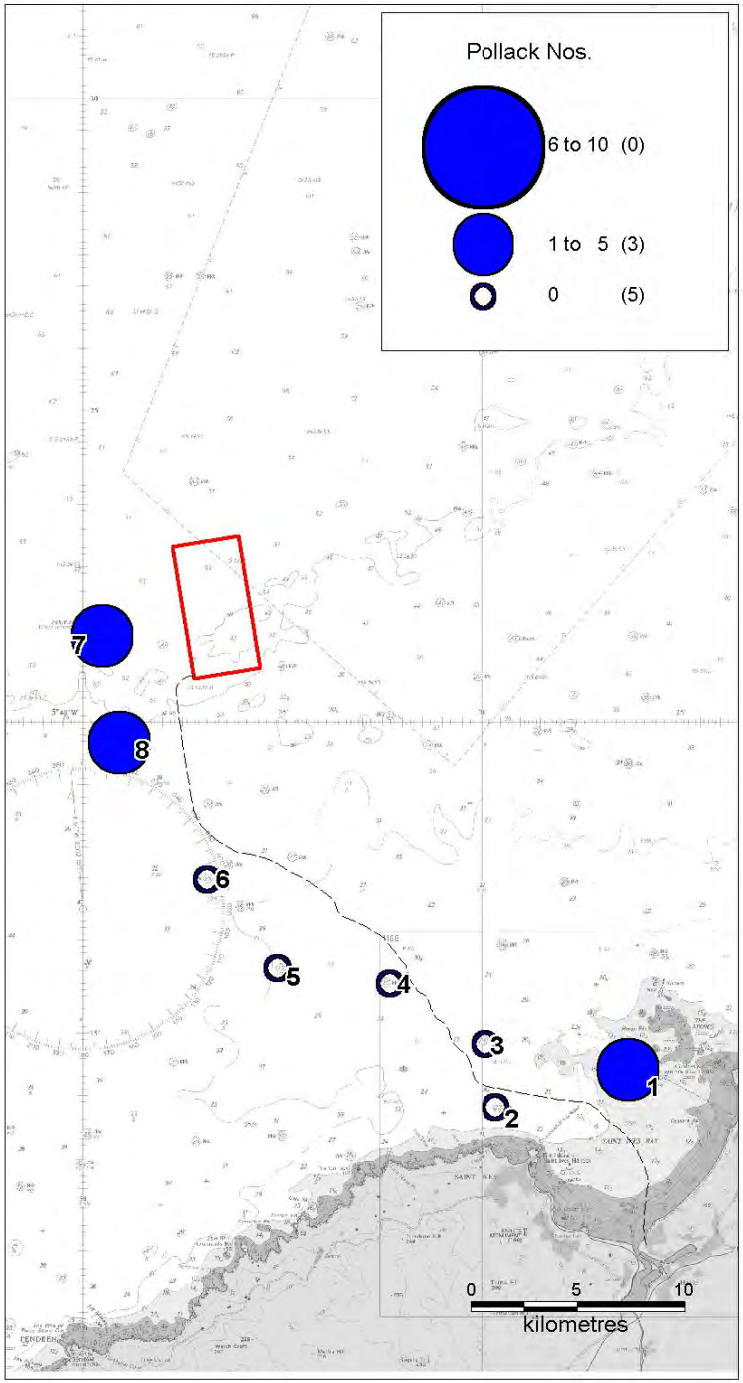
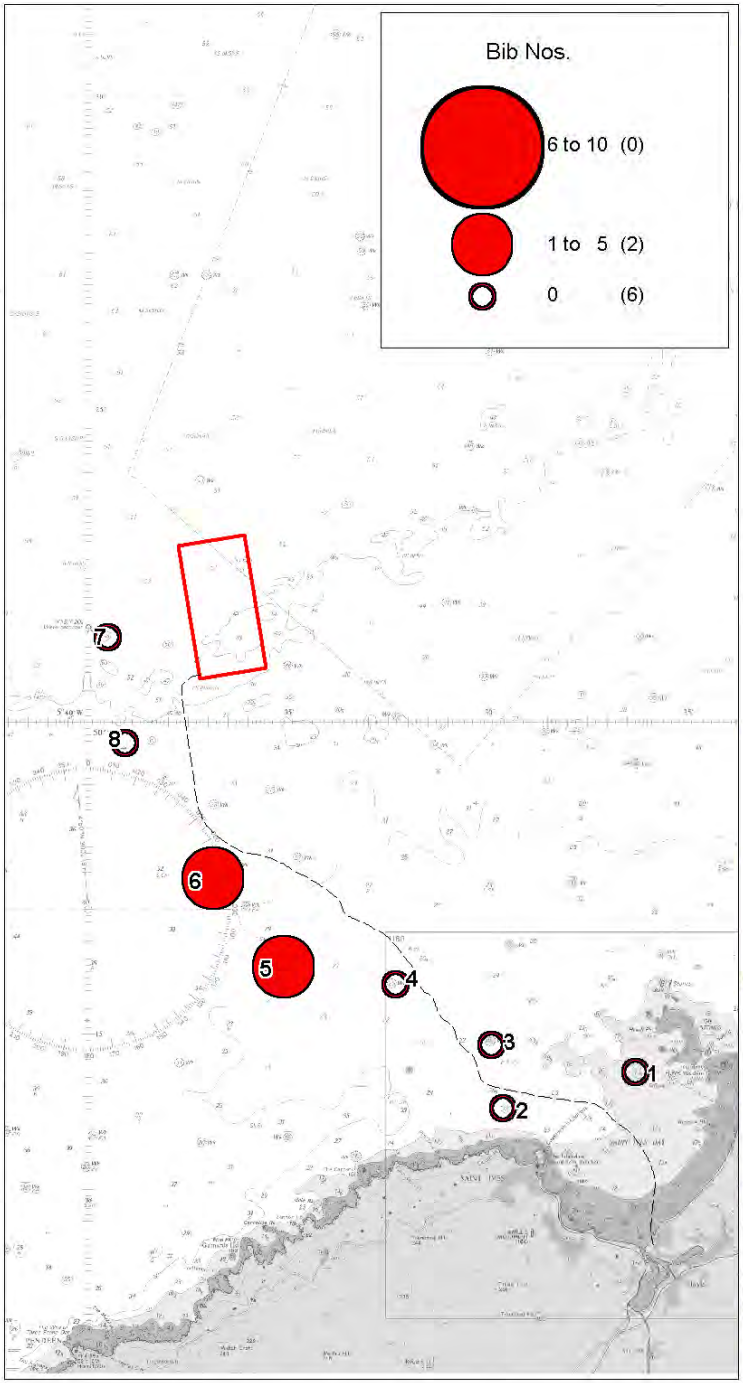




Legend

Proposed Site to Shore Cable Route

Proposed Wave Hub Site (New Deployment Area)

November Survey 2005

Notes

Coordinate System:

WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Total Numbers of Pollack and Bib Caught Per Station Handlining Survey

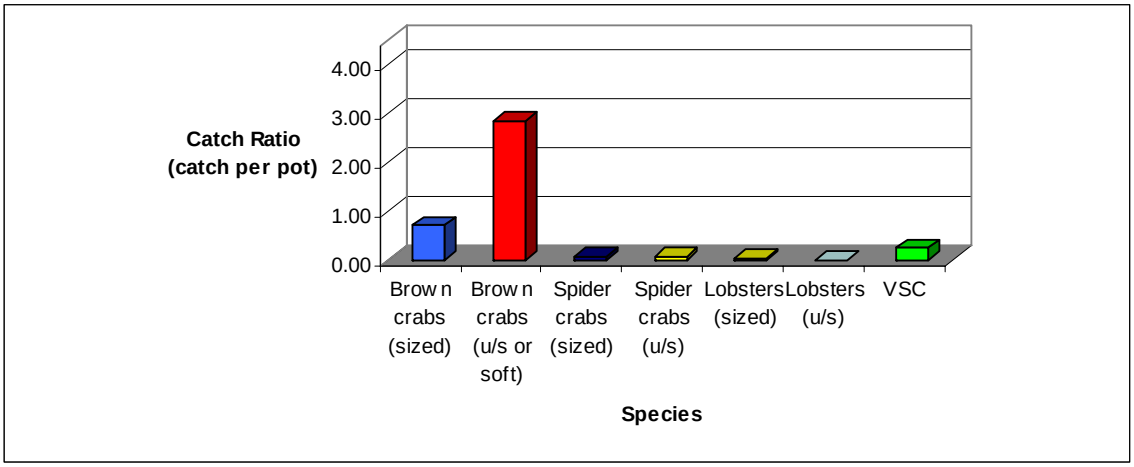
Job No.	Date Issued	Figure 9		
J/1/06/0782	2/5/06			
Sheet Size	**Scale**	**Drawn by**	**Checked by**	**Revision No.**
A4	1: 2.114 km	RLC	JXL	

APPENDICES

APPENDIX I – Survey Data

CATCH RATIO OF KEY SPECIES RECORDED DURING JULY 2005 OFFSHORE POTTING SURVEY (*Swift*)

Station 9



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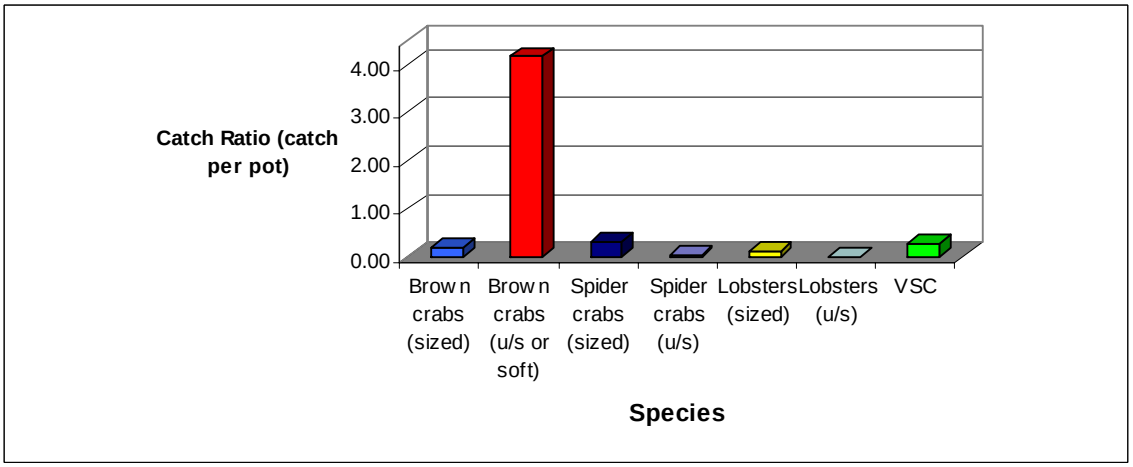

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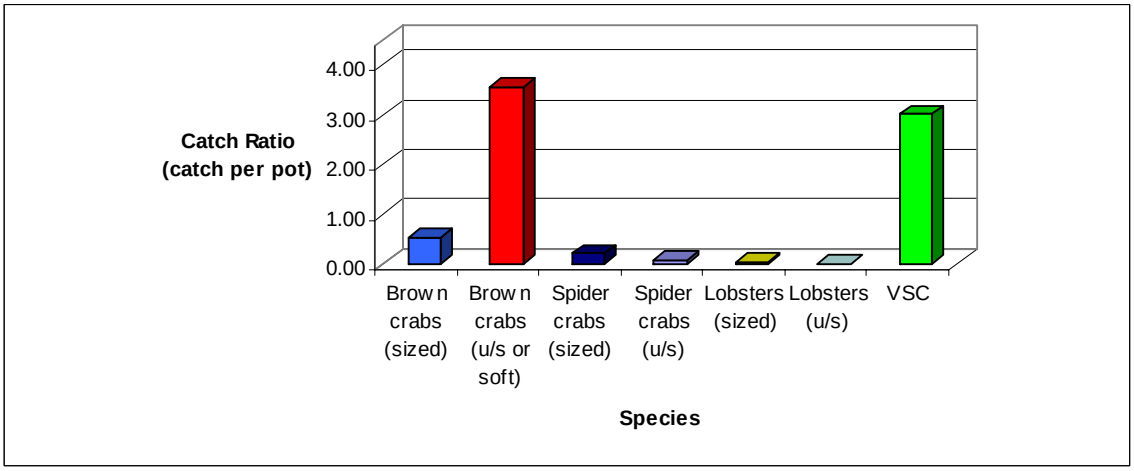

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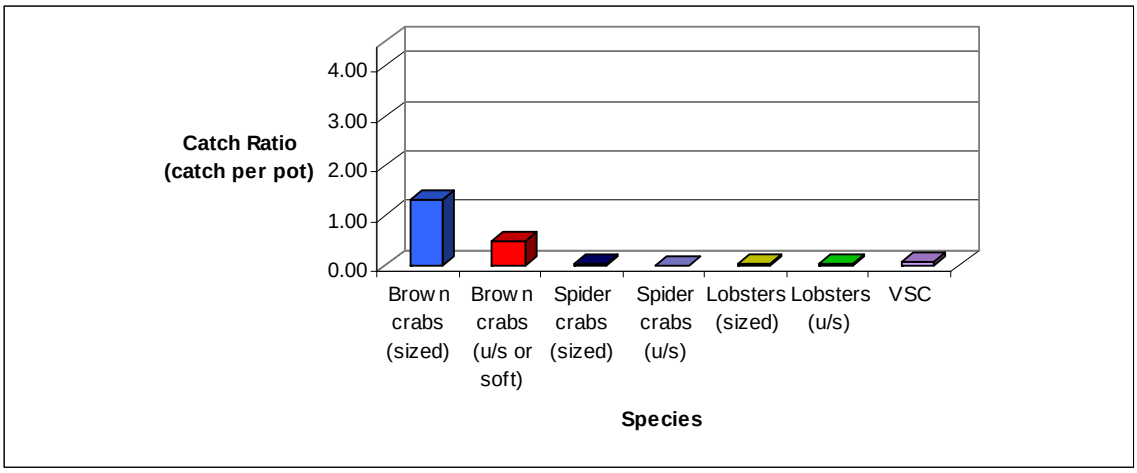

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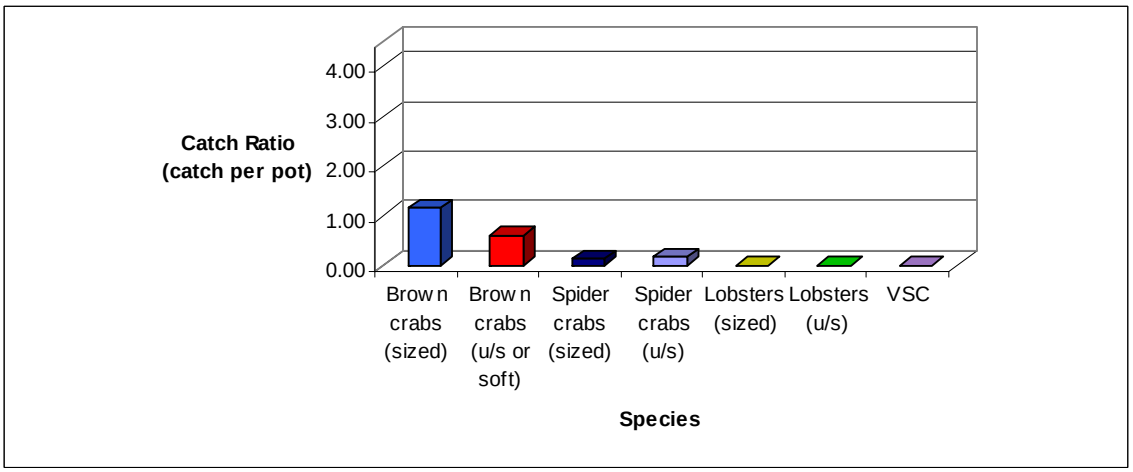

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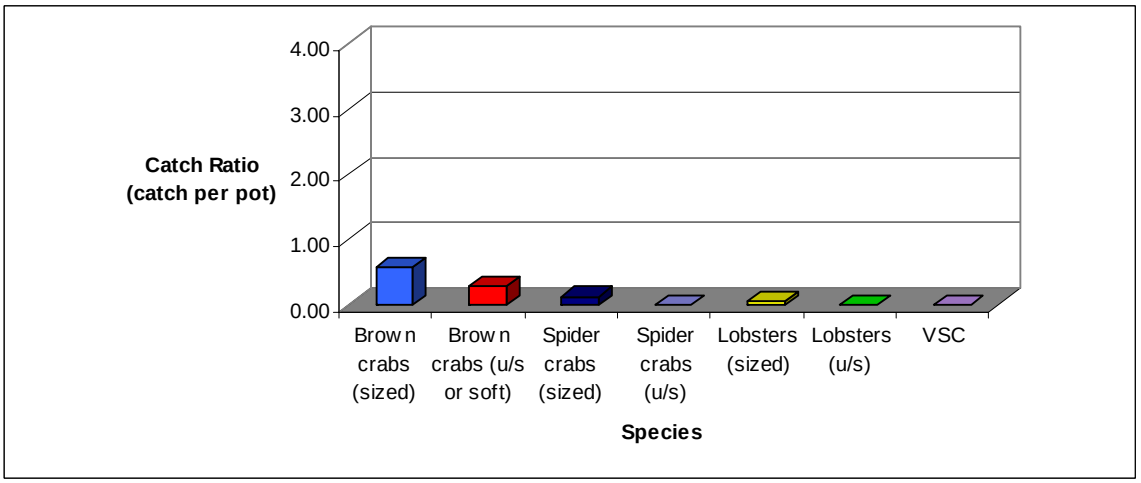

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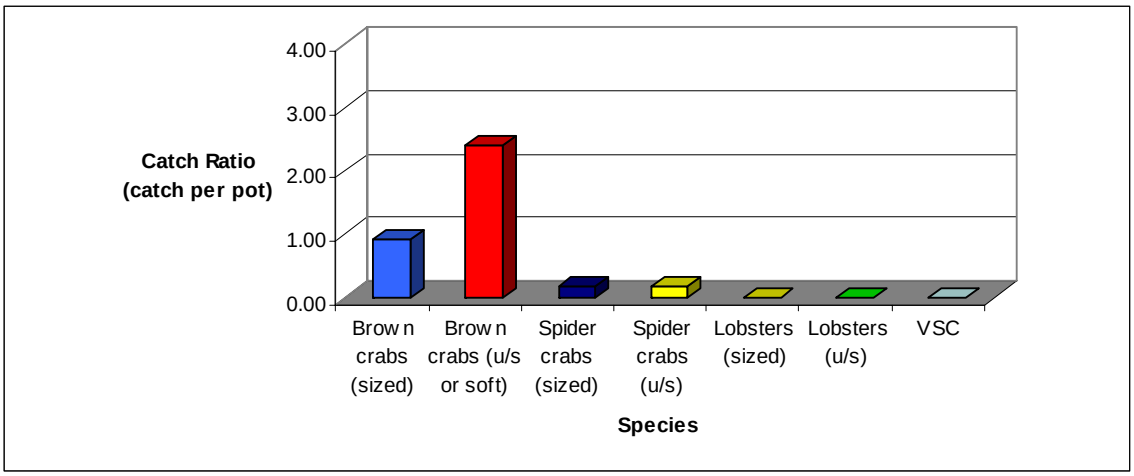
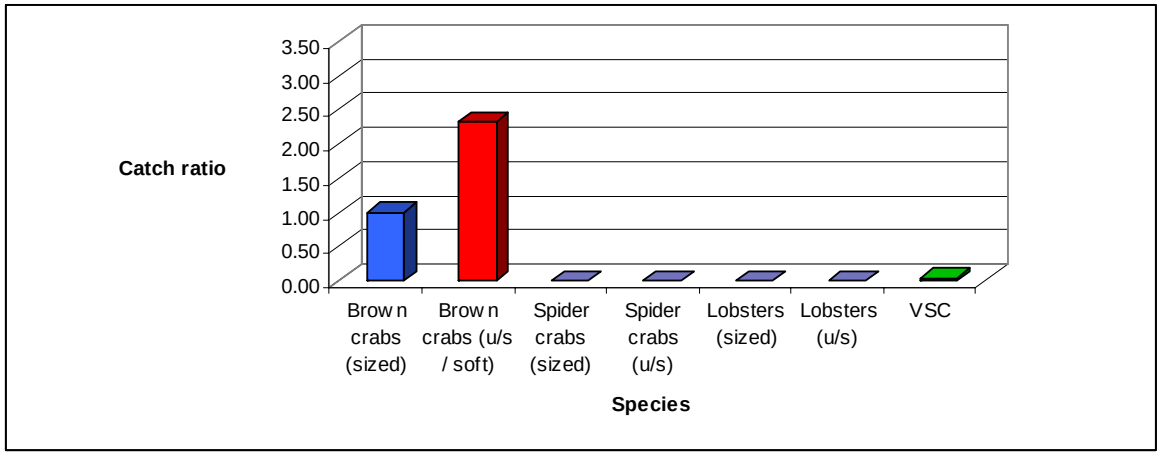

Catch Ratio
(catch per pot)
4.00
3.00
2.00
1.00
0.00
Brown crabs (sized)
Brown crabs (u/s or soft)
Spider crabs (sized)
Spider crabs (u/s)
Lobsters (sized)
Lobsters (u/s)
VSC
Species

CATCH RATIO OF KEY SPECIES RECORDED DURING JULY 2005 INSHORE POTTING SURVEY (*Chloe Estelle*)

Station 1



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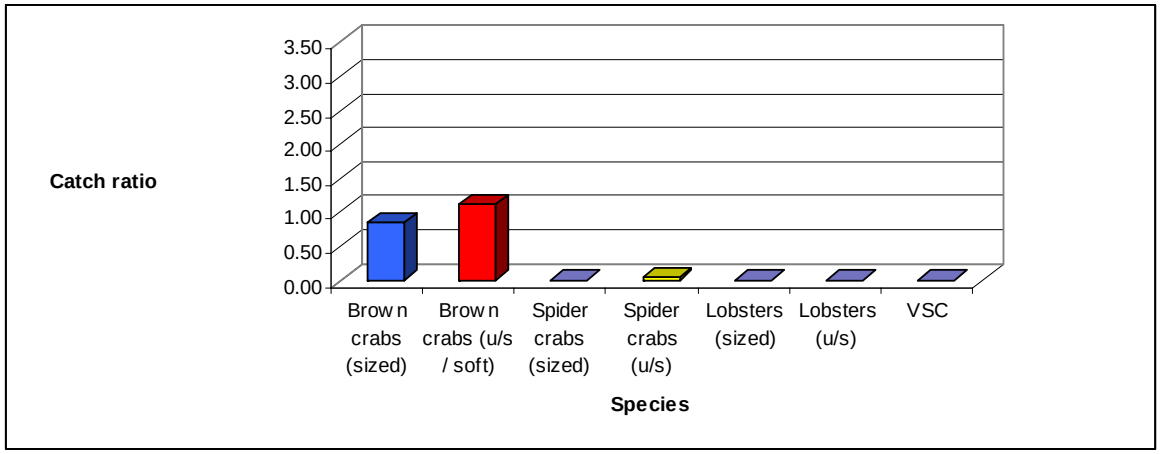

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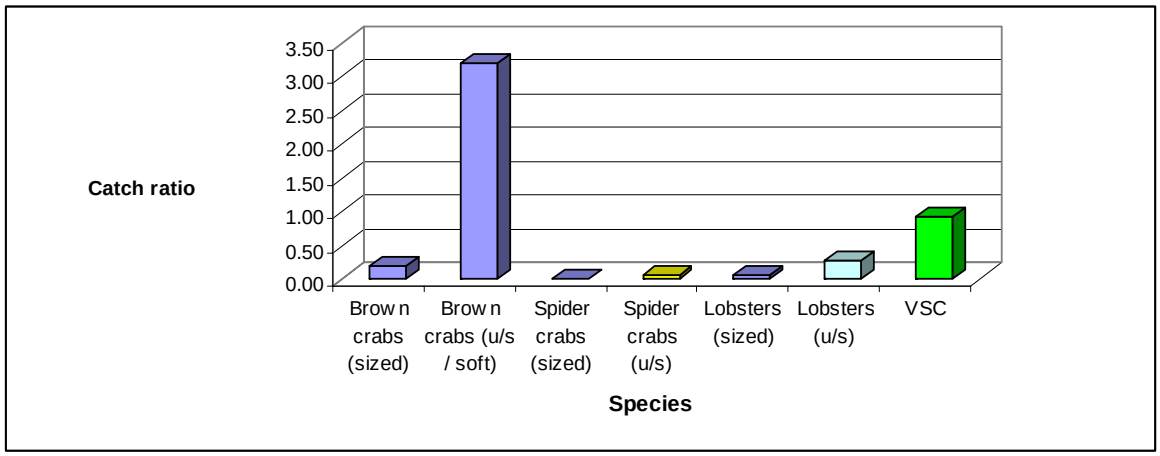

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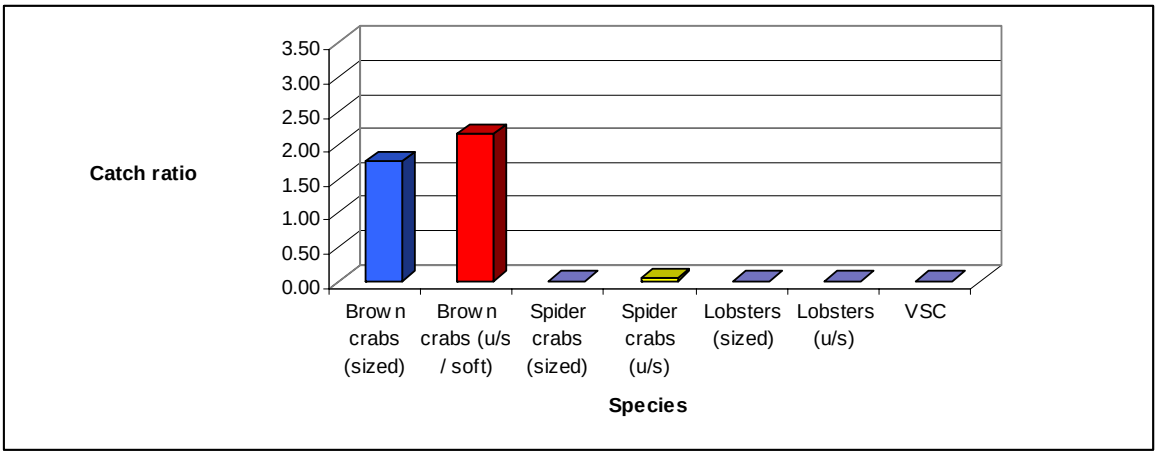

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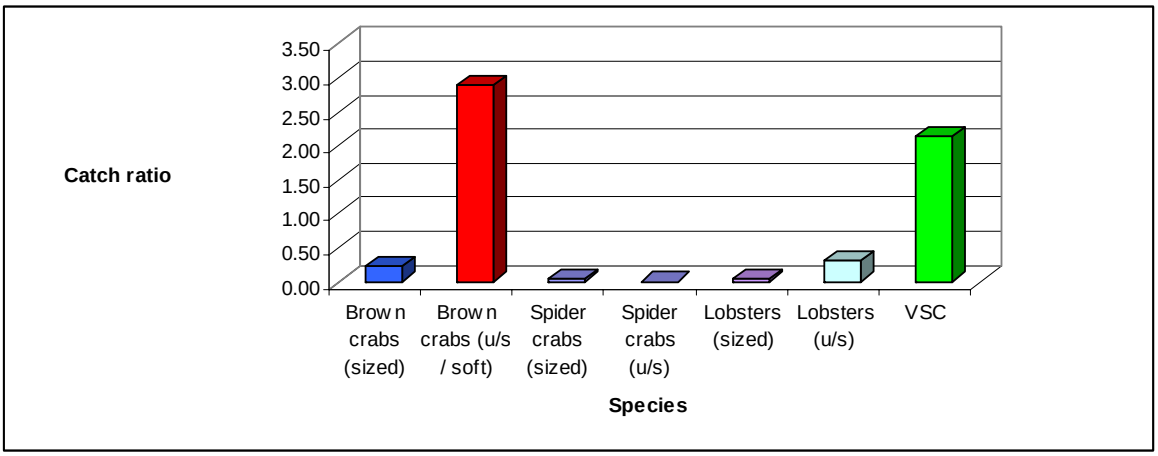
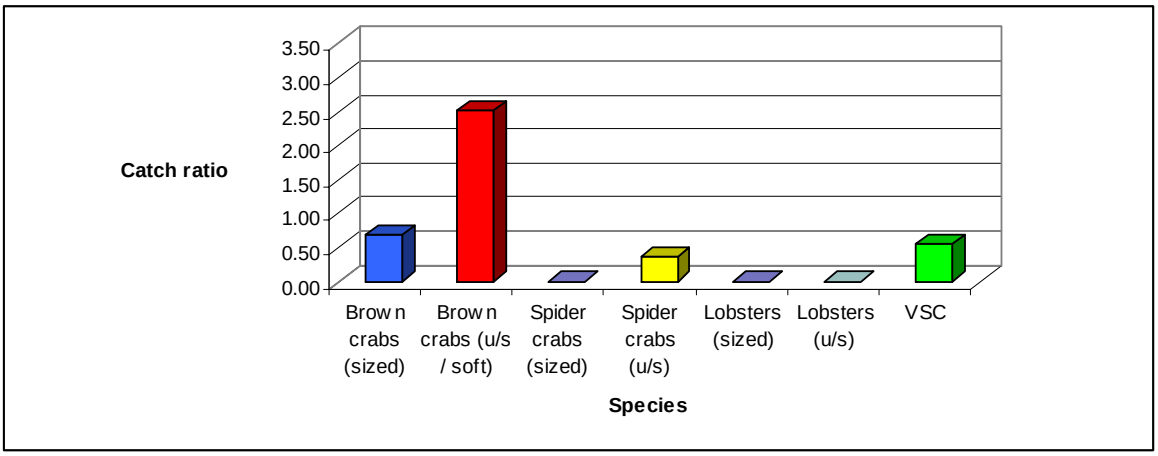
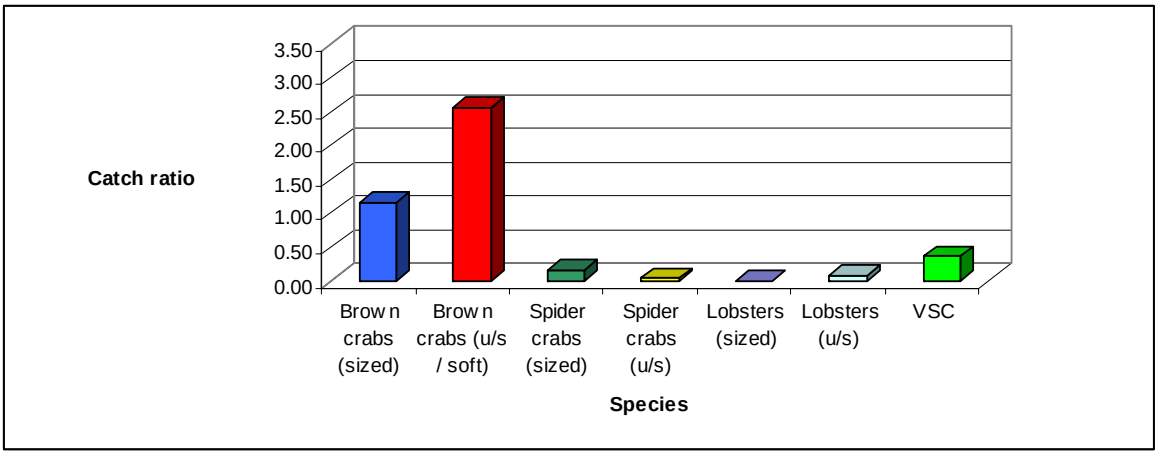


Station 7



Station 8

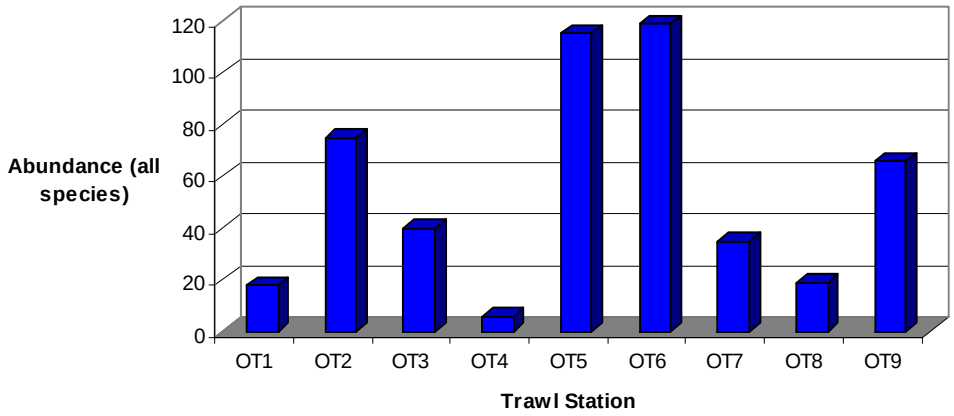

Catch ratio
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Brown crabs (sized)
Brown crabs (u/s / soft)
Spider crabs (sized)
Spider crabs (u/s)
Lobsters (sized)
Lobsters (u/s)
VSC
Species

Otter Trawl Survey aboard *Girl Linda* – November 2005

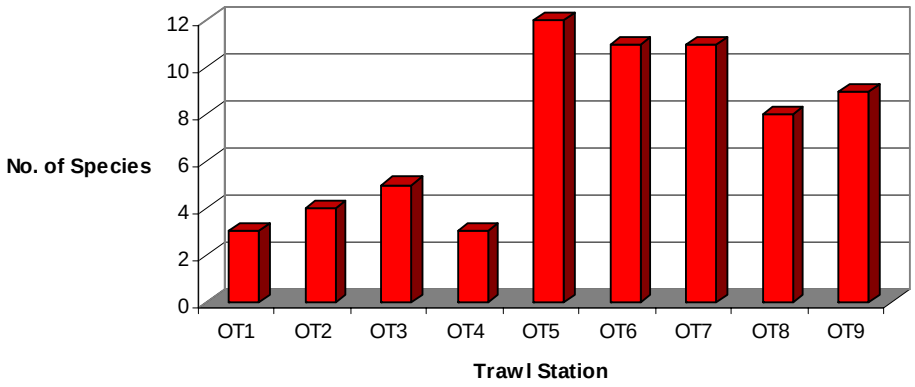
Otter trawl 22 November 2005		**South-West Wave Hub-station**									
Species	**Latin Name**	**OT1**	**OT2**	**OT3**	**OT4**	**OT5**	**OT6**	**OT7**	**OT8**	**OT9**	**Total Recorded**
Squid	*Alloteuthis* sp.										**0**
Squid	*Loligo* sp.							8	4		**12**
Scallop	*Pecten maximus*										**0**
Cuttlefish	*Sepia officinalis*										**0**
Edible spider crab	*Maja squinado*					1		2		1	**4**
Swimming crab	*Liocarcinus sp.*		70	25		60	50	10	3		**218**
Edible crab	*Cancer pagurus*					1		3	1		**5**
Spiny seastar	*Marthasterias glacialis*						2	1	2		**5**
Lesser spotted dogfish	*Scyliorhinus canicula*					1					**1**
Thornback ray	*Raja clavata*										**0**
Spotted ray	*Raja montagui*						3				**3**
Blonde ray	*Raja brachyura*										**0**
Small-eyed ray	*Raja microocellata*	3	2	2			4			2	**13**
Cod	*Gadus morhua*							2			**2**
Whiting	*Merlangius merlangus*										**0**
Five bearded rockling	*Ciliata mustela*				1						**1**
Monkfish	*Lophius piscatorius*										**0**
John Dory	*Zeus faber*					1		4			**5**
Grey gurnard	*Eutrigla gurnardus*	6	2			17	13			11	**49**
Red gurnard	*Aspitrigla cuculus*						2	2	4		**8**
Tub gurnard	*Trigla lucerna*					1		1			**2**
Streaked gurnard	*Trigloporus lastoviza*										**0**
Short-spined sea scorpion	*Myoxocephalus scorpius*									1	**1**
Bass	*Dicentrarchus labrax*										**0**
Scad	*Trachurus trachurus*									1	**1**
Black bream	*Spondyliosoma cantharus*							1		2	**3**

Otter trawl 22 November 2005		South-West Wave Hub-station									
Species	**Latin Name**	**OT1**	**OT2**	**OT3**	**OT4**	**OT5**	**OT6**	**OT7**	**OT8**	**OT9**	**Total Recorded**
Striped red mullet	*Mullus surmuletes*					2				17	**19**
Sand eel indet.	*Ammodytes* sp.										**0**
Common dragonet	*Callionymus lyra*						2		3		**5**
Brill	*Scophthalmus rhombus*			1		1	1				**3**
Turbot	*Psetta maxima*			1			1				**2**
Megrim	*Lepidorhombus whiffiagonis*				1						**1**
Plaice	*Pleuronectes platessa*	9	1	11	4	25	34	1		30	**115**
Dab	*Limanda limanda*					4	7		1	1	**13**
Flounder	*Platichthys flesus*										**0**
Lemon Sole	*Microstomus kitt*								1		**1**
Dover Sole	*Solea solea*					1					**1**
Total all individuals		18	75	40	6	115	119	35	19	66	**54.8**
Total all species		3	4	5	3	12	11	11	8	9	**7.3**
Total fish individuals		18	5	15	6	53	67	11	9	65	**27.7**
Total fish species		3	3	4	3	9	9	6	4	8	**5.44**

Abundance at each otter trawl station (Nov 05)

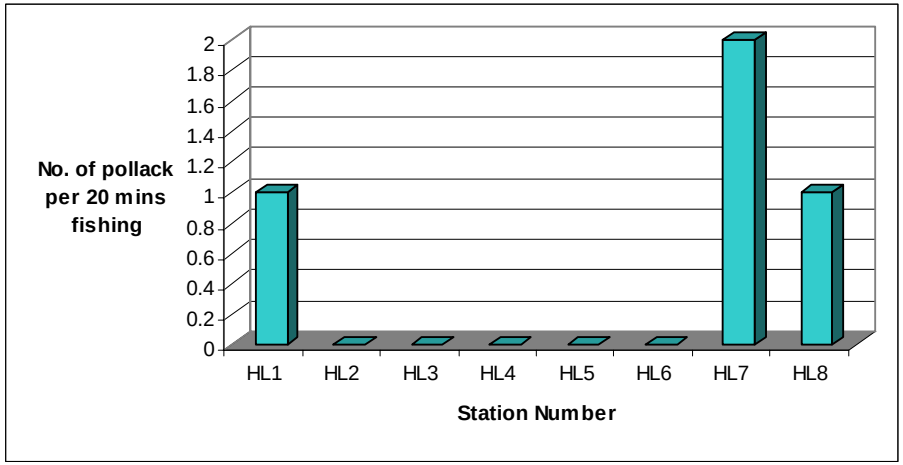


Number of Species at each otter trawl station (Nov 05)



Hand-Lining aboard *Ellie Vee* – November 2005

	Position (WGS84)					
Station Number	**Latitude**	**Longitude**	**Number / Type of Hooks**	**Time Start**	**Time End**	**Site description**
HL1	50o14.413N	005o26.294W	6 rubber eels	11:40	12:00	Low lying wreck ~ 1.5m high
HL2	50o13.830N	005o29.625W	6 rubber eels	11:07	11:27	low lying wreck ~ 1.5m high
HL3	50o14.843N	005o29.902W	6 rubber eels	10:40	11:00	Low lying wreck ~ 0.5m high on hard seabed
HL4	50o15.820N	005o32.304W	6 rubber eels	10:12	10:32	Hard seabed rising from ~31m (BSL) to ~28m (BSL)
HL5	50o16.073N	005o35.116W	6 rubber eels	09:41	10:01	Small low lying wreck ~ 2m at highest point
HL6	50o17.500N	005o36.881W	6 rubber eels	09:06	09:26	Low lying wreck ~ 1.5m high on hard seabed
HL7	50o21.389N	005o39.520W	6 rubber eels	07:53	08:13	Hard seabed rising from ~54m (BSL) to ~50m (BSL)
HL8	50o19.685N	005o39.089W	6 rubber eels	08:29	08:49	Hard outcrop banking up from ~48m (BSL) to ~42m (BSL)



South West Wave Hub

EIA BASELINE FISHERIES SURVEYS

Survey No. 4 (April 06) Report

April 2006

REPORT No. 06/J/1/06/0782/0584

Client :
Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Emu Ltd
Head Office
1 Mill Court
The Sawmills
Durley
Southampton
Hampshire
SO32 2EJ

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Appendices

1. INTRODUCTION

1.1 This report presents the findings from the fourth of four fisheries resource surveys undertaken by Emu Ltd on behalf of Halcrow Group Ltd as part of the Environmental Impact Assessment (EIA) process being undertaken in relation to the South West Wave Hub project.

1.2 Halcrow Group Ltd is managing the EIA process for this development, which is being funded by the South West Regional Development Agency (SWRDA).

2. STUDY OBJECTIVES

2.1 The main objectives of the fisheries surveys are detailed below:

- To collect baseline data on the composition of fish resources within the study area in order to inform the EIA process being undertaken for the South West Wave Hub project;
- To collect baseline data on the spatial and temporal distribution of fish resources within the study area in order to inform the EIA process being undertaken for the South West Wave Hub project;
- To involve the local fishing community in the data gathering process for the EIA.
- **The surveys are in no way to be intended as a detailed stock assessment of any fishery species.**

2.2 In addition to these fish resource surveys, a commercial fisheries intensity study has also been commissioned. This study will describe commercial fishing activity and patterns in the study area.

3. METHODOLOGY

3.1 The surveys were designed and planned following consultation and meetings with members of the local fishing community and representatives of Cornwall Sea Fisheries Committee (CSFC). Following discussions, it was agreed to undertake a series of four fish resource surveys in order to develop some understanding of the seasonal changes in the fishery.

3.2 The surveys were undertaken aboard local commercial fishing vessels with experienced local skippers who were always consulted during the field work with respect to sampling strategy. Emu Ltd. was represented on each survey by an experienced marine ecologist, with the exception of the hand-lining for mackerel, where data was recorded directly by the skipper.

3.3 The gear used for otter trawling, potting and hand-lining was the same as that employed during commercial fishing activities.

3.4 The fourth set of surveys was undertaken over the period Wednesday 5th April to Friday 7th April 2006. Table 1 summarises the schedule for the fourth set of surveys.

3.5 For the April 2006 survey, the survey aboard *Swift* (offshore potting), was not undertaken as the skipper was not in a position to participate in the survey. It is hoped that this survey can be undertaken in the near future in order to gather data from the revised Wave Hub deployment area.

Date	Survey Undertaken	Vessel (Skipper)	Emu Staff aboard
05/04/06	Otter trawling	*Girlinda* (Chris Stevens)	Martin Esseen
06/04/06	Potting Survey (inshore)	*Chloe Estelle* (Reg Easterbrook)	Martin Esseen
07/04/06	Hand-lining	*Ellie V* (Michael Veale)	Martin Esseen

Table 1 Summary of sampling events (April 2006)

3.6 The preliminary positions for the survey stations were chosen in order to sample locations within and outside the proposed wave hub exclusion zone and also along the proposed route of the site to shore cable. Co-ordinates were calculated using a GIS system and issued to the skippers via post prior to the surveys so that they could input these into their vessel's GPS. This provided them with an opportunity to comment as to whether any stations selected by Emu were not suitable for any reason, i.e. in an area of beam trawling activity (unsuitable for pots) or on hard ground (unsuitable for trawling).

3.7 The stations fished in April 2006 by *Chloe Estelle* and *Girl Linda* were the sames as those fished on the previous three survey occasions (July 2005, September 2005 and November 2005). For the April 2006 survey, previous stations 7 and 8 from the handline survey undertaken by *Elle V* were replaced by two new sites. This was done in order to obtain data from within the revised Wave Hub deployment area. On the actual day of the survey, all survey positions were recorded on the vessel using the vessel's own GPS system. All GPS systems used were based on the WGS84 datum.

3.8 For the potting surveys, the positions when hauling began and ended were noted, whilst for the trawling the start and end positions of each tow were noted. With respect to the hand-lining on wrecks and hard ground, a single position was noted, around which fishing was concentrated for 20 minutes.

3.9 Survey logs and positions are appended. Weather, sea state and other information (e.g. other vessels) were also recorded as appropriate.

Specific Survey Methodologies

(1) Potting Survey

3.10 Only the inshore potting survey aboard Chloe Estelle was undertaken during the April 2006 survey. Strings of 25-30 pots were shot on the morning of Wednesday 5th April 2006. All pots were new & parlour-type, and baited with dogfish (Scyliorhinus sp.), scad (Trachurus trachurus) and salted mackerel (Scomber scombrus). The pots were subsequently retrieved on Thursday 6th April 2006, resulting in a soak time of approximately 24 hours.

3.11 Upon retrieval, the following was noted for every pot:

- The numbers of sized, under-sized and soft brown crab;
- The numbers of sized, under-sized and soft spider crab; and
- The numbers of sized under-sized and berried lobsters.
- Numbers of other species (including velvet swimming crabs).

On every 5th pot, measurements were taken on the carapace width of crabs and carapace length of lobsters.

3.12 The positions of the stations fished by *Chloe Estelle are* shown in Figure 1.

(2) Otter Trawling Survey

3.13 A commercial otter trawl gear was used, with approximately 85ft spread & 9ft lift. The trawl was fitted with a 85mm cod-end mesh. Tow lengths varied from 5 minutes to 15 minutes.

3.14 Upon retrieval of the catch, all fish species caught were recorded and length measurements taken. Where large catches were landed, sub-samples were taken to undertake length measurements and an estimate of numbers landed.

3.15 Photographs were also taken of the catch upon being landed.

3.16 The positions of the tows are shown in Figure 2.

(3) Hand-lining Survey

3.17 The commercial hand-lining gear comprised of a set of six hooks baited with rubber eels. Hand-lining was undertaken for 20 minutes at each site. On previous surveys, 30 minutes fishing was undertaken on each station. However, due to weather and tidal conditions it was decided to reduce fishing time at each station to 20 minutes. The data analysis reflects this reduced fishing effort.

3.18 Each time the line was under tension due to fish being caught, the hand-lining gear was brought to the surface, and the fish were released. The hand-line was then placed back into the water. This was repeated until the 20 minutes period was completed.

3.19 Upon retrieval of catch, species were identified and enumerated, and total length measurements were taken. Photographs of the species caught (pollack only) were taken.

3.20 The positions of the hand-lining locations are shown in Figure 3. **Please note the two `new` sites (HL7 and HL8) located in the revised Wave Hub deployment area.**

4. RESULTS

4.1 The following section of the report presents the key results from the fourth set of fisheries surveys undertaken from 5th to 7th April 2006.

Potting Survey aboard Chloe Estelle

4.2 Strings of 25 pots were retrieved after a 24 hour soak on Thursday 6th April 2006. The main species recorded in the pots were the brown crab (*Cancer pagurus*), the spider crab (*Maja squinado*), the common lobster (*Hommarus gammarus*) and velvet swimming crabs (*Necora puber*).

4.3 The catch was dominated by undersized and soft brown crab, with an average ratio across all the pots of 24:1 undersized/soft vs sized (retained) crab. This compares to previous ratios of undersized v sized brown crab of 1:1 (Sep 05) and 3:1 (Nov 05).

4.4 The catch ratio (numbers per pot) was calculated for each of the key species captured. The catch ratios for each survey station are shown in Figure 4.

4.5 From Figure 4 it is possible to note that the catch ratios for sized brown crab were low across all the survey stations. The highest catch ratios for undersized crab were recorded at Stations 5 and 6. Stations 5 and 6 also recorded some of the highest catch ratios of undersized/soft brown crab in the November 05 survey.

4.6 As with the November 2005 survey, catch ratios of spider crab were low, reflecting the fact that this species tends to move offshore into deeper water at this time of year and is rarely found in these shallower, inshore waters until early summer.

4.7 With regard to the catch ratio for sized and under-sized lobsters, very few sized or undersized lobsters were recorded on this survey, with only 5 sized and no undersized lobsters recorded in a total of 175 pots.

Otter trawl survey aboard Girlinda

4.8 A total of 8 sites were trawled on Wednesday 5th April 2006. The sites were distributed within Saint Ives Bay and included sites adjacent to the proposed site to shore cable route. The sites covered the same areas trawled in the three previous surveys.

4.9 The total number of species recorded at each station is shown in Figure 5 with the total abundance of all species shown in Figure 6.

4.10 A total of 23 different species were recorded in the trawls, with the most abundant species recorded being the swimming crab *Liocarcinus holstatus*, which was recorded at all of the 8 sites.

4.11 Of the 23 species recorded, 14 were fish species, including many commercially valuable species such as plaice (*Pleuronectes platessa)* and cod (*Gadus morhua*).

4.12 Plaice was actually the most abundant fish species recorded during this survey, with a total of 153 fish recorded from all the trawls.

4.13 The next most abundant fish species were lesser spotted dogfish *Scyliorhinus canicula* (60), lemon sole *Microstomus kitt* (10) and brill *Scophthalmus rhombus* (10).

4.14 The overall abundance of all individuals retained (985) was greater than that recorded in the November 05 survey (493) but markedly less than both the July 05 survey (2036 individuals) and the September 05 survey (2104 individuals). The total number of all species (fish and shellfish) recorded in this survey (23) was the lowest recorded from all the surveys done to date – July 05 (32), September 05 (35), November 05 (26).

Hand-lining Survey aboard Ellie V

4.15 A total of 8 sites were fished aboard *Ellie V* on Friday 7th April 2006. The only species recorded during this survey was pollack (*Pollachius pollachius*). No fish at all were captured at 3 of the 8 stations. In total, 16 pollack were caught during the entire survey.

4.16 The total abundance of pollack caught at each survey station (20 mins fishing) is shown in Figure 7. From this, it can be noted that the greatest abundance of pollack was landed at Station 8, which was a new station fished for this survey within the revised Wave Hub deployment area.

4.17 The size distribution of all the pollack caught in the April 2006 survey is shown below in Figure 8.

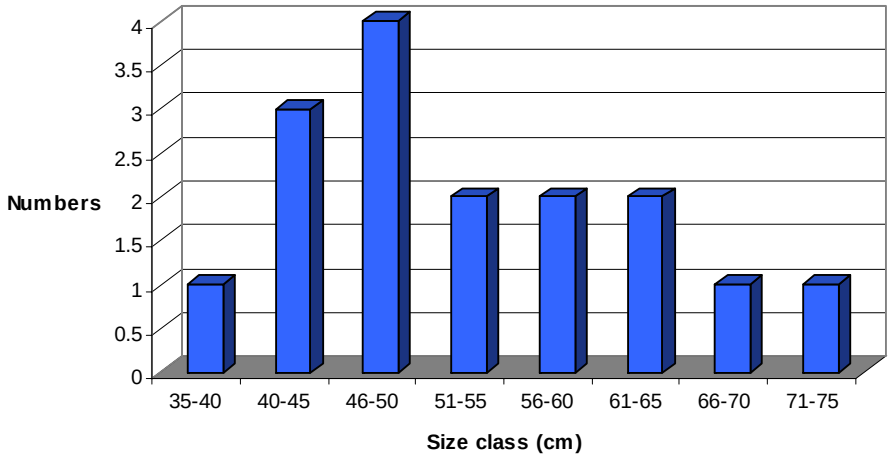


Figure 8 Size distribution of pollack caught in April 2006 survey

5.0 DISCUSSION

5.1 The fourth set of fish resource surveys undertaken offshore of Hayle, Cornwall confirms the findings of the first three surveys, i.e. the area supports a diverse fishery, with a wide range of fish and shellfish species recorded.

5.2 The previous set of surveys (Nov 05), in particular the otter trawl survey, recorded low abundances and species diversity amongst the fish and shellfish fauna of the wider study area compared to previous surveys in July 05 and September 05. This appeared to show that in the winter period, many species move offshore out of St. Ives Bay into deeper water.

5.3 This most recent survey indicates that the overall abundance of individuals recorded in the otter trawl survey had increased once again from 493 in November 05 to 985 in April 06. This appears to confirm the pattern highlighted to Emu Ltd by local fishermen in which the numbers of fish increase in spring as the water temperature increases. Many of the species recorded will also undertake spawning activity in nearshore waters from February to April; numbers increase during this period as fish move onto nearshore spawning grounds.

5.4 Previous surveys had noted a sharp reduction in the number of spider crabs recorded between the July and November surveys. This trend confirms observations made by local fishermen who informed Emu that, following the major increase in spider crab on inshore grounds during summer months, these crabs move offshore to overwinter, returning again in late Spring/early Summer.

5.5 This April 06 survey indicated that the catch ratio of spider crabs was at similarly low levels to those recorded in the November 05 survey, indicating that the spider crabs have not yet undergone their annual migration into the shallower water of St. Ives Bay.

5.6 Another important observation is that the catch ratio of soft or undersized brown crabs at some stations was the highest recorded in all four surveys. This appears to demonstrate the fact that certain areas covered by this survey programme represent nursery grounds for juvenile brown crab, where high densities of juvenile crabs spend time growing before being recruited to the adult stock.

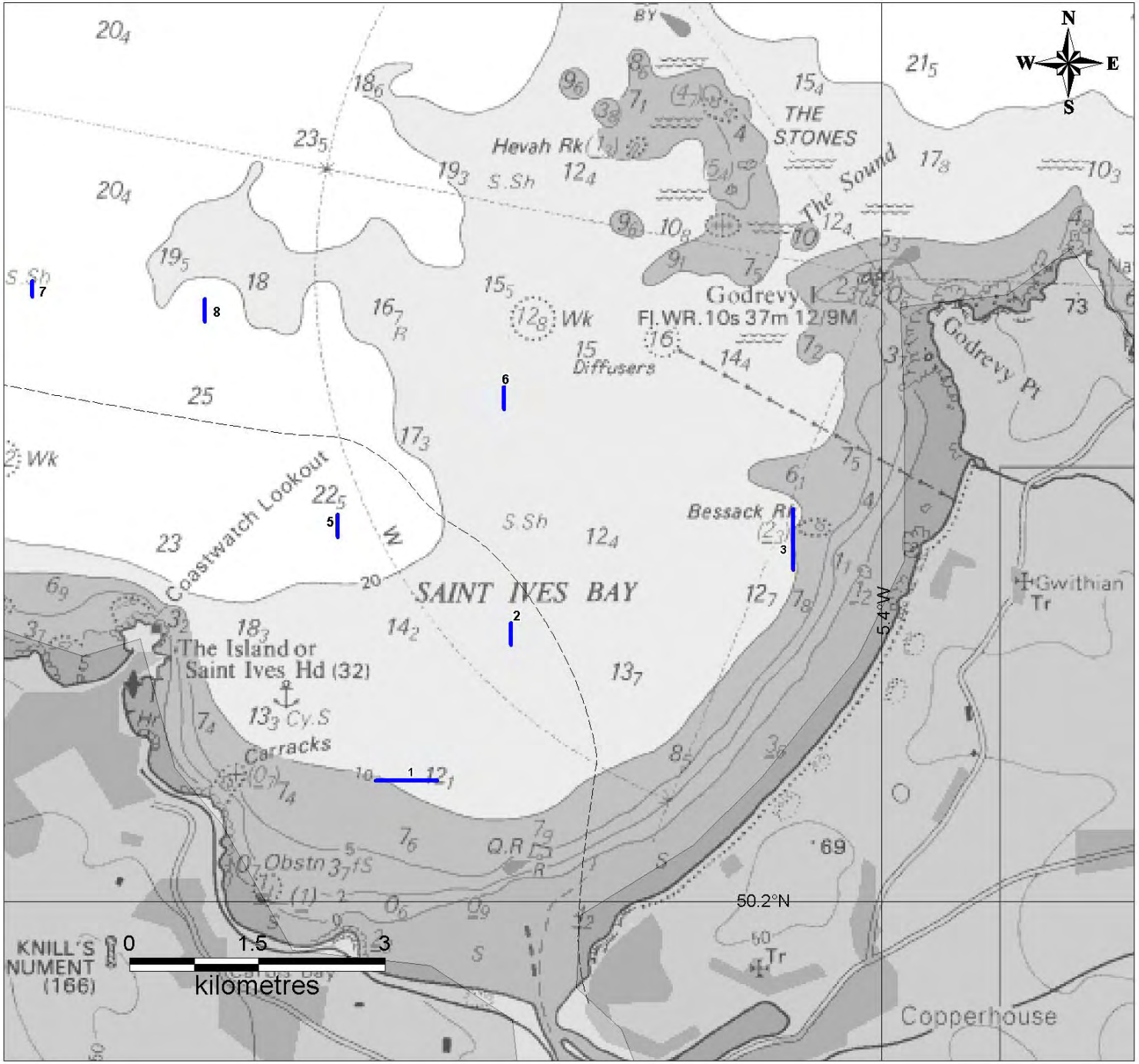
5.7 With respect to finfish, this April 06 survey recorded the lowest overall number of species of the previous three surveys. However, the overall abundance of all individuals recorded (fish and shellfish), had increased by over 100% compared to the value recorded in the November 05 survey. This suggests that the abundance of fish within the study area is reduced over winter months but then starts to increase as spring arrives, followed by a constant increase through to summer to levels recorded previously in the July 05 survey.

5.8 The species composition recorded during the otter trawl surevy was similar to that noted in all previous surveys, indicating that although seasonal variation in species numbers does exist, the wider study area contains a relatively diverse fishery represented by a number of key species that can be found all year round.

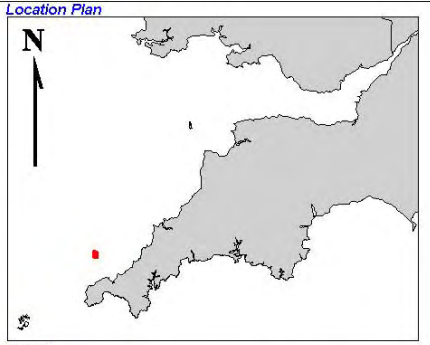
6.0 AUDIT TRAIL

Title: South West Wave Hub Project – EIA Baseline Fisheries Surveys			
Report No: 05/J/1/06/0782/0584 **Job No:** J/1/06/0782 **Client Name:** Halcrow Group Ltd **Client Contact:** Steve Challinor			
		Initials	**Date**
Project Manager:	Dr N.S. Thomas		
Data Analysis undertaken by:	Jonny Lewis		
Report written by:	Jonny Lewis		
Report checked by:	Claire Espinasse		
Report Authorised by:	Dr N.S. Thomas		

FIGURES



Location Plan



Legend

- Potting Sampling Transects
- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)

April Survey 2006

Notes

Coordinate System:
WGS 84

Client

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Inshore Potting Survey Stations
(Chloe Estelle)

Job No.	Date Issued	Figure 1		
J/1/06/0782	2/5/06			
Sheet Size	**Scale**	**Drawn by**	**Checked by**	**Revision No.**
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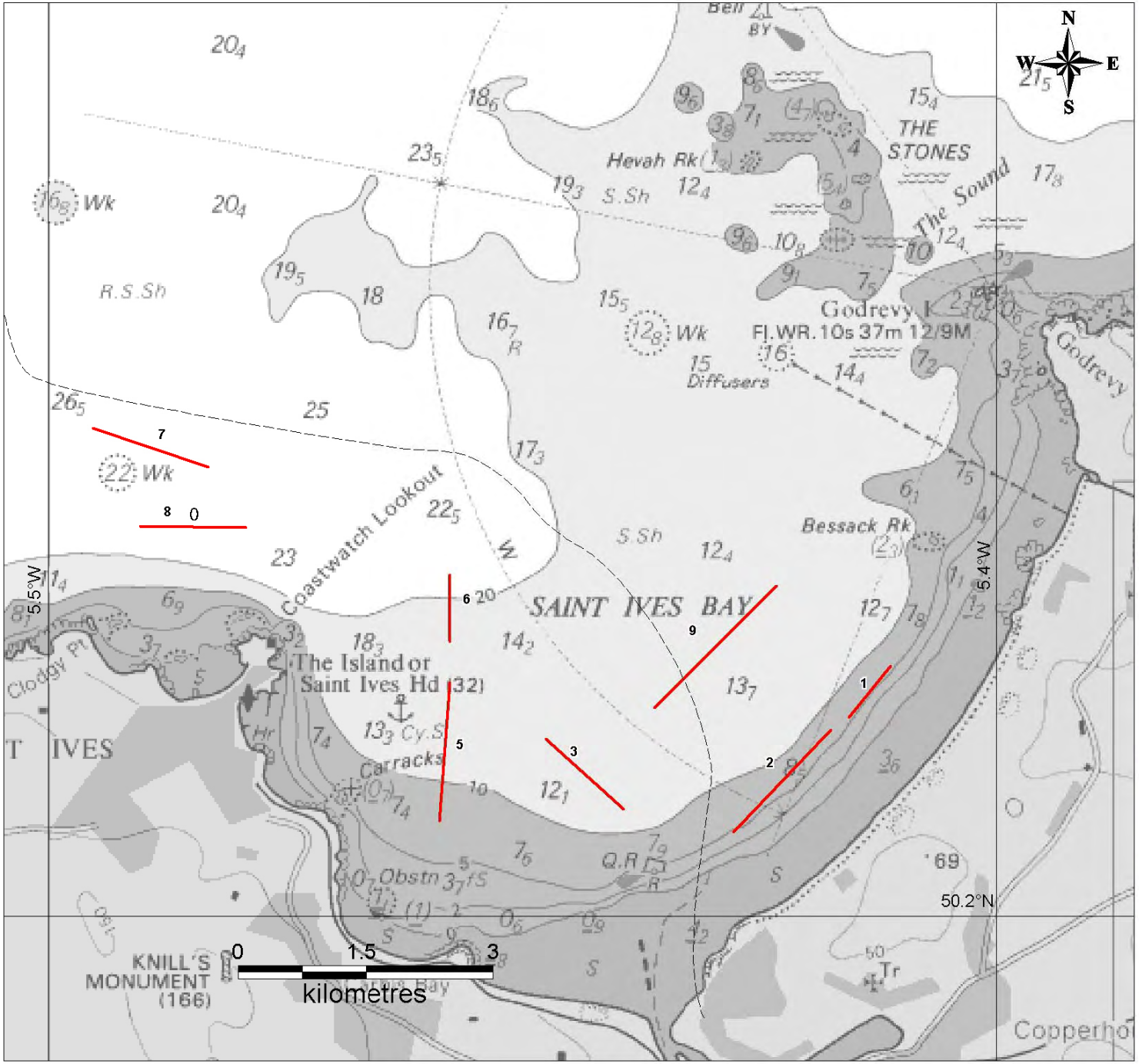
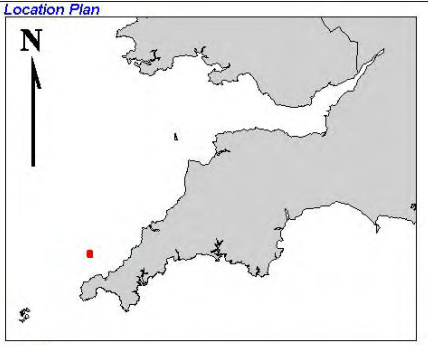


Location Plan



Legend

- Otter Trawling Sampling Tows
- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)

April Survey 2006

Notes

Coordinate System: WGS 84

Client

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Otter Trawling Survey Tows
(Girl Linda)

Job No.	Date Issued	Figure 2		
J/1/06/0782	2/5/06			
Sheet Size	Scale	Drawn by	Checked by	Revision No.
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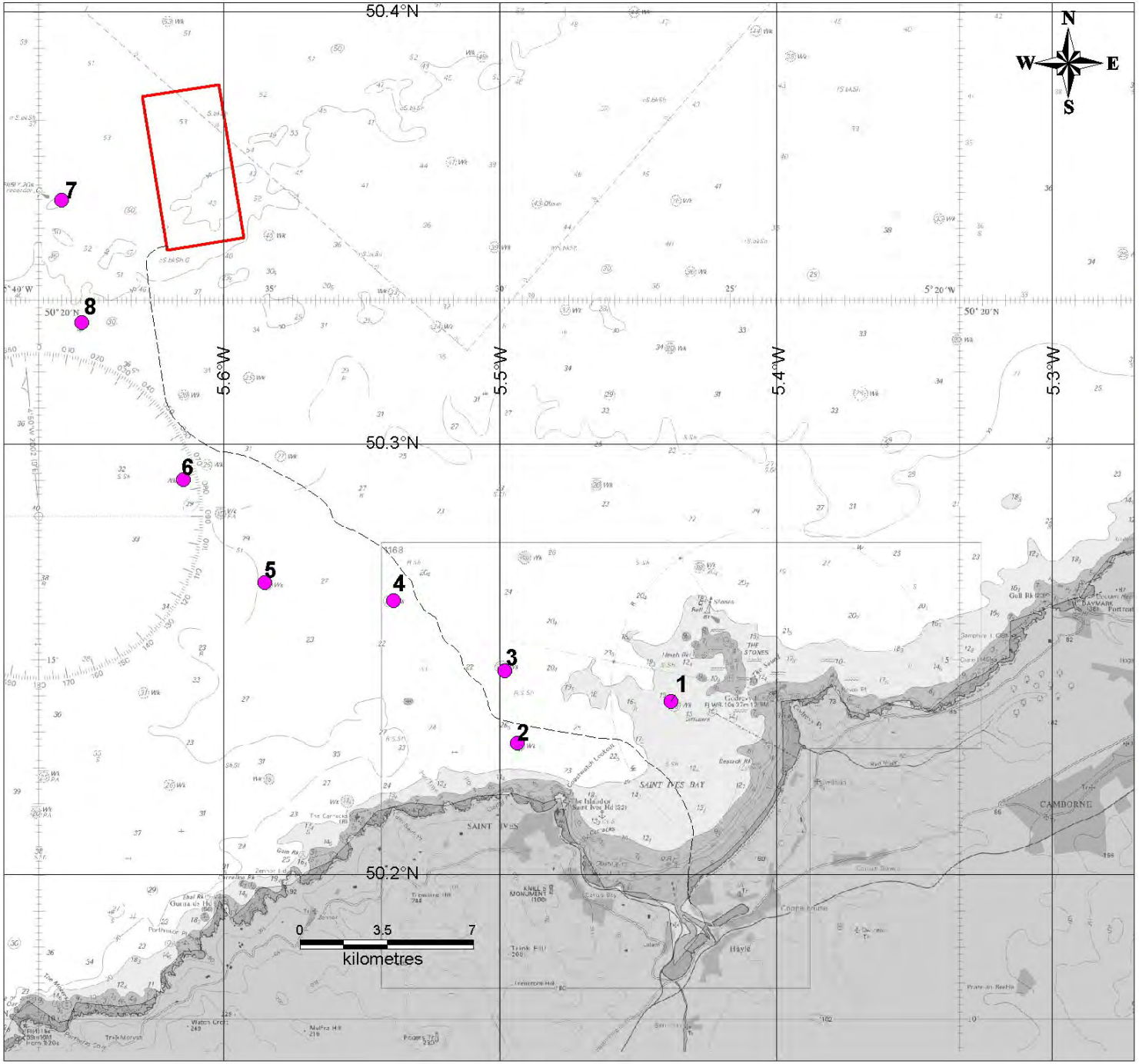
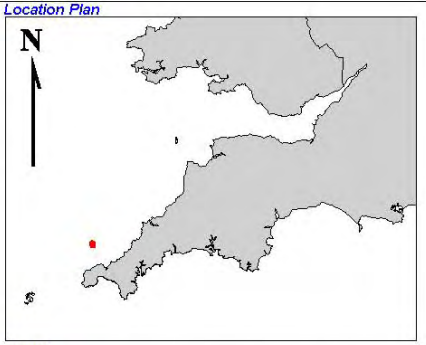


Location Plan



Legend

- Hand Lining Sampling Locations
- Proposed Site to Shore Cable Route
- Proposed Wave Hub Site (New Deployment Area)

April Survey 2006

Notes

Coordinate System:
WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Handlining Survey Locations
(Ellie V)

Job No.	Date Issued	Figure 3		
J/1/06/0782	2/5/06			
Sheet Size	**Scale**	**Drawn by**	**Checked by**	**Revision No.**
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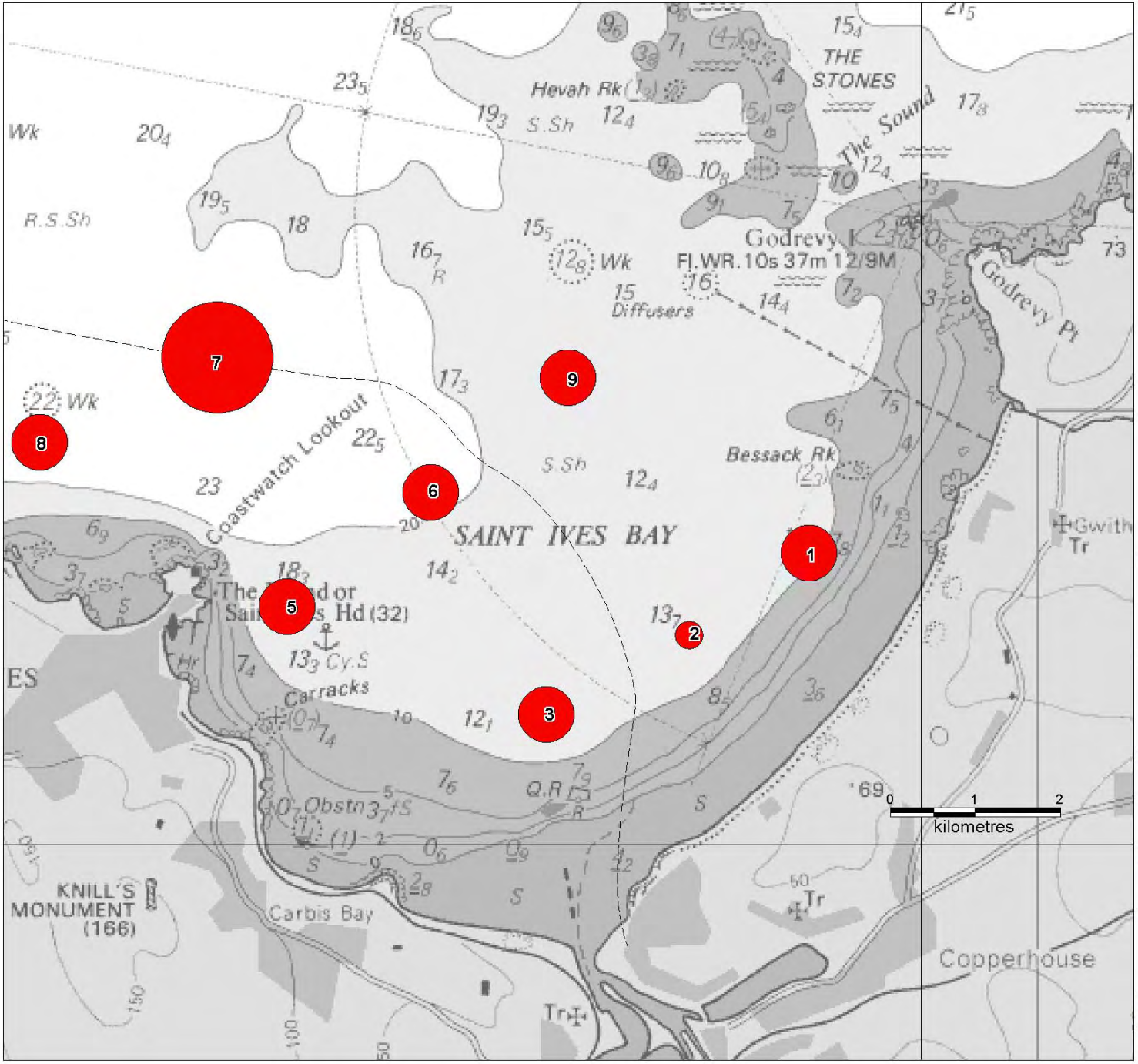

Legend

Number of Individuals

1-5

6-10

11-15

1 Station Number

Proposed Site to Shore Cable Route

Proposed Wave Hub Site (New Deployment Area)

April Survey 2006

Notes

Coordinate System:

WGS 84

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Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Total Numbers of Species per Station (Otter Trawling)

Job No.	Date Issued	Figure 5		
J/1/06/0782	2/5/06			
Sheet Size	**Scale**	**Drawn by**	**Checked by**	**Revision No.**
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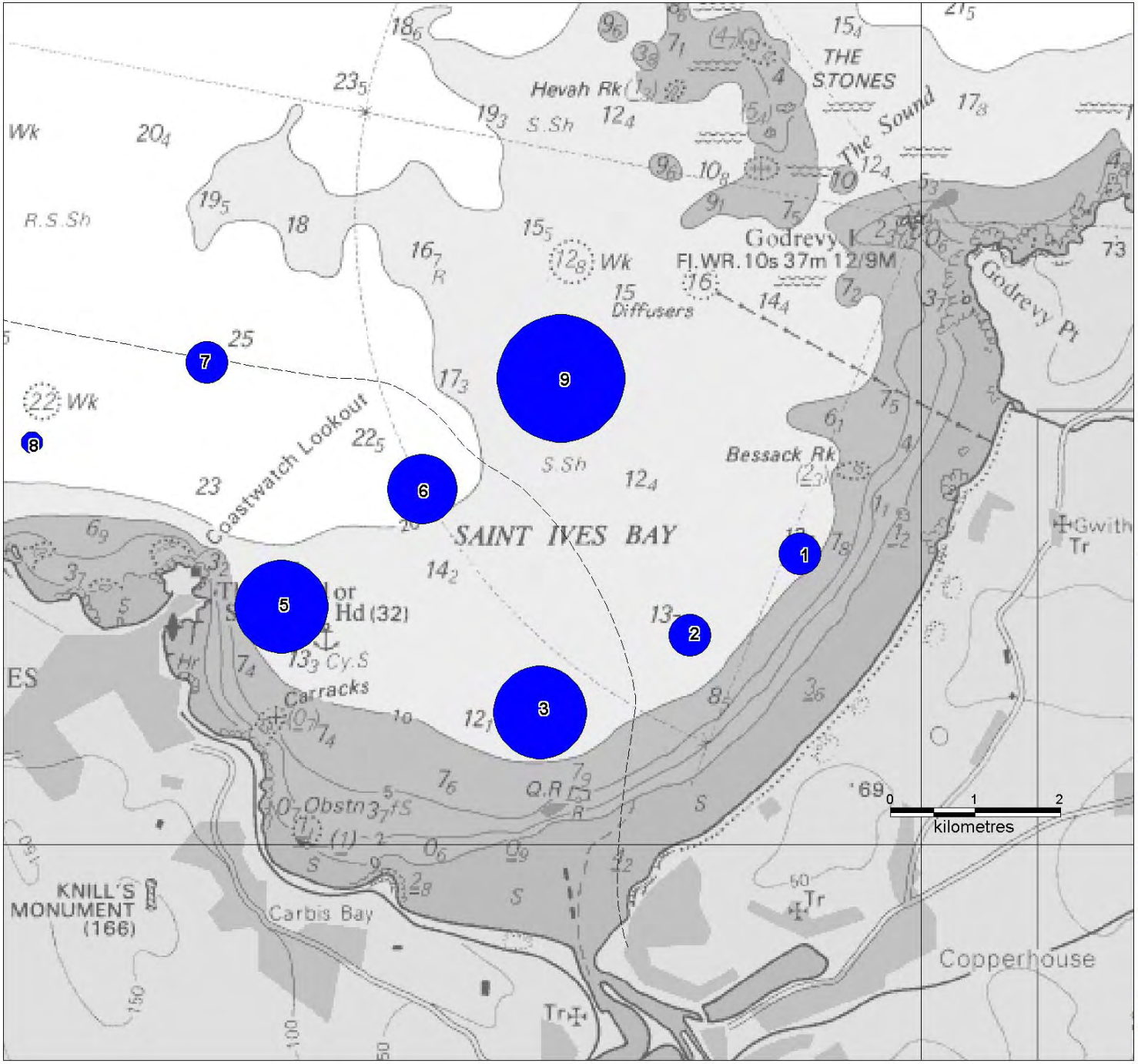


Legend

Number of Individuals

- 1-50
- 51-100
- 101-150
- 151-200

1 Station Number

Proposed Site to Shore Cable Route

Proposed Wave Hub Site (New Deployment Area)

April Survey 2006

Notes

Coordinate System:

WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

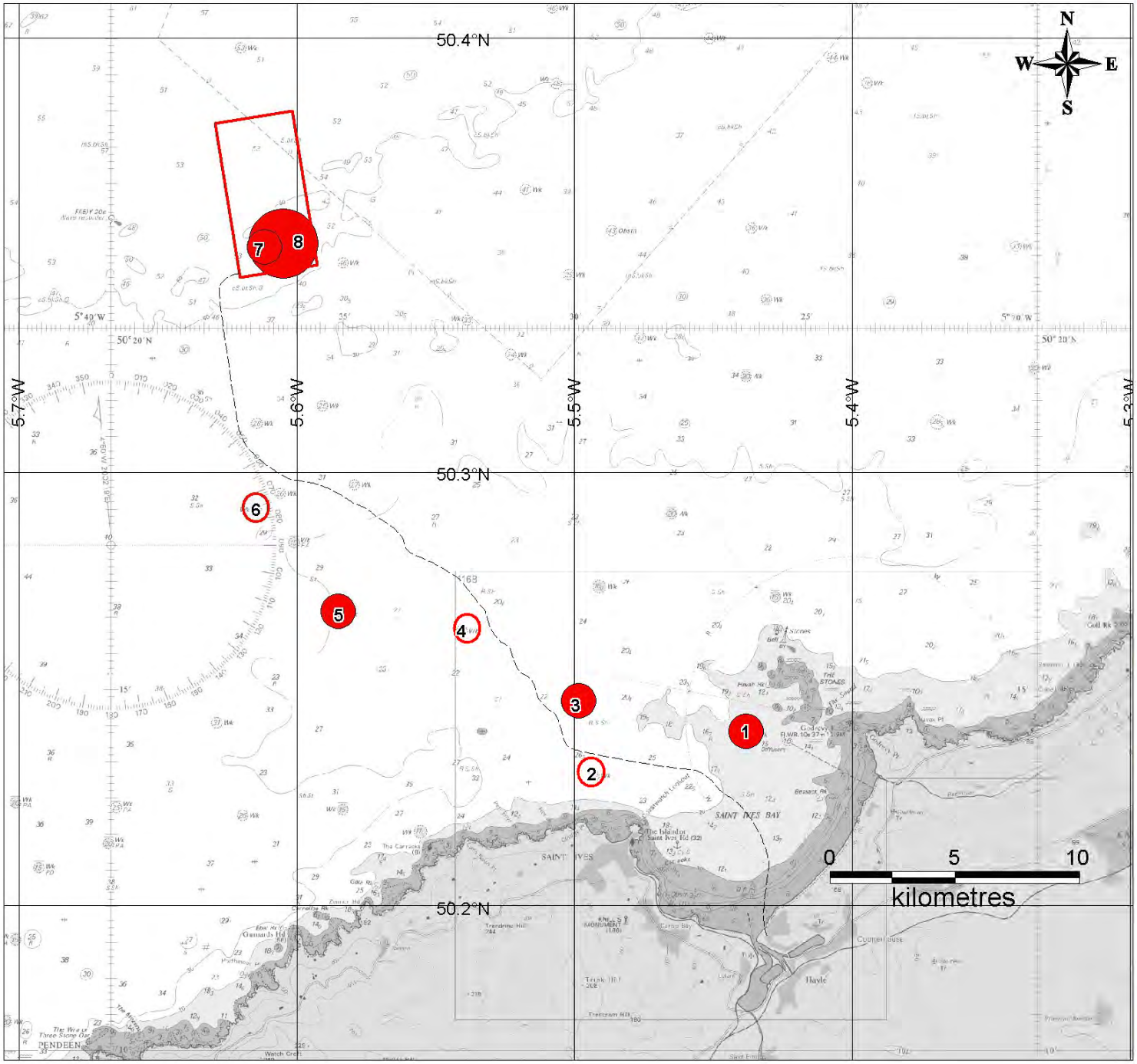
Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Total Abundance of Individuals per Station (Otter Trawling)

Job No.	Date Issued	Figure 6		
J/1/06/0782	2/5/06			
Sheet Size	**Scale**	**Drawn by**	**Checked by**	**Revision No.**
A4	1: 4100 km	RLC	JXL	



Legend

Number of Individuals

1-3

4-7

8-10

Proposed Site to Shore Cable Route

Proposed Wave Hub Site (New Area Deployment)

4 Station Number

April Survey 2006

Notes

Coordinate System:

WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

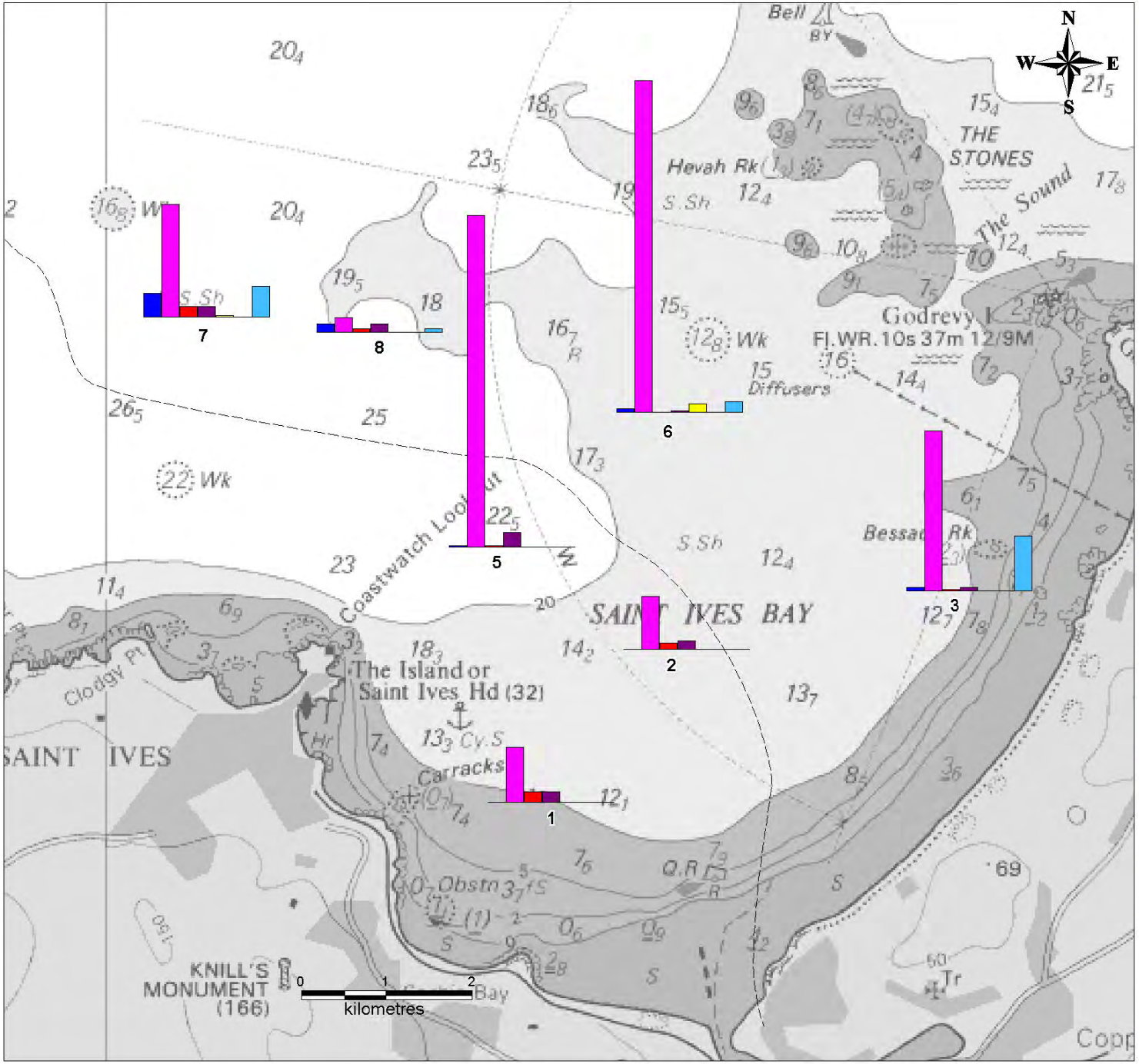
Project Title

EIA Baseline Fisheries Surveys

Drawing Title

Totoal Numbers of Pollack Caught per Station During Hand-lining Survey

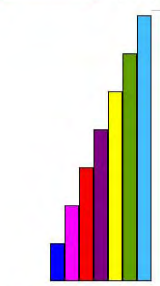
Job No.	Date Issued	Figure 7		
J/1/06/0782	2/5/06			
Sheet Size	**Scale**	**Drawn by**	**Checked by**	**Revision No.**
A4	1: 1.4 km	RLC	JXL	



Legend

Proposed Site to Shore Cable Route

Proposed Wave Hub Sit (New Deployment Area)



- Brown crabs sized
- Brown crabs undersized
- Spider crabs sized
- Spider crabs undersized
- Lobsters sized
- Lobsters undersized
- VSC

April Survey 2006

Notes

Coordinate System: WGS 84

Client

Halcrow

Halcrow Group Ltd
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Consultant

EMU

EMU Ltd
1 Mill Court, The Sawmills
Durley, Southampton.
SO32 2EJ.
United Kingdom
Tel: +44 (0)1489 860050
Fax: +44(0)1489 860051

Project Title

EIA Baseline Fisheries Surveys

Drawing Title

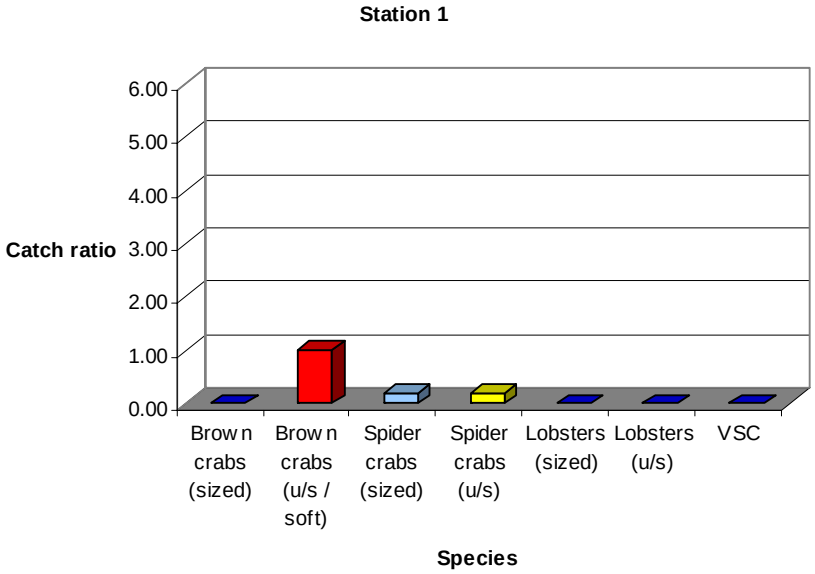
Inshore Potting Catch Ratio for Main Species ***(Chloe Estelle)***

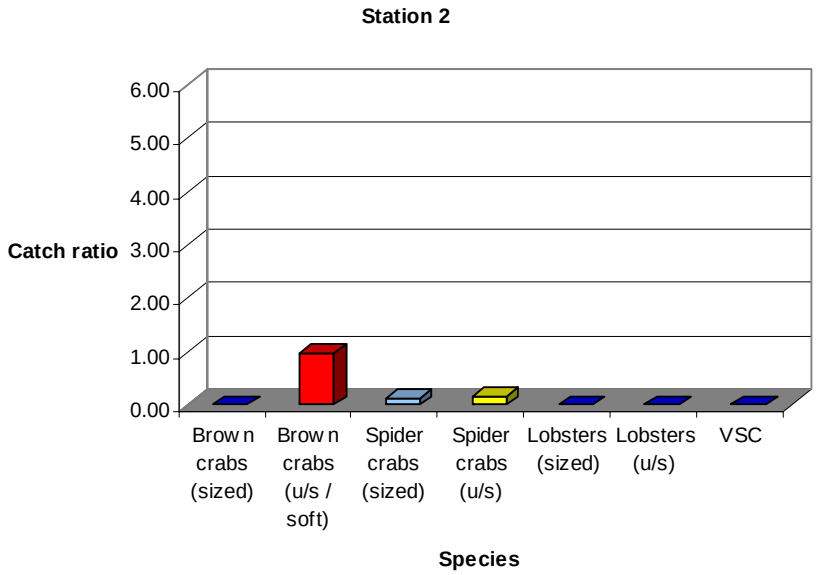
Job No.	Date Issued	Figure 4		
J/1/06/0782	2/5/06			
Sheet Size	**Scale**	**Drawn by**	**Checked by**	**Revision No.**
A4	1: 0.410 km	RLC	JXL	

APPENDICES

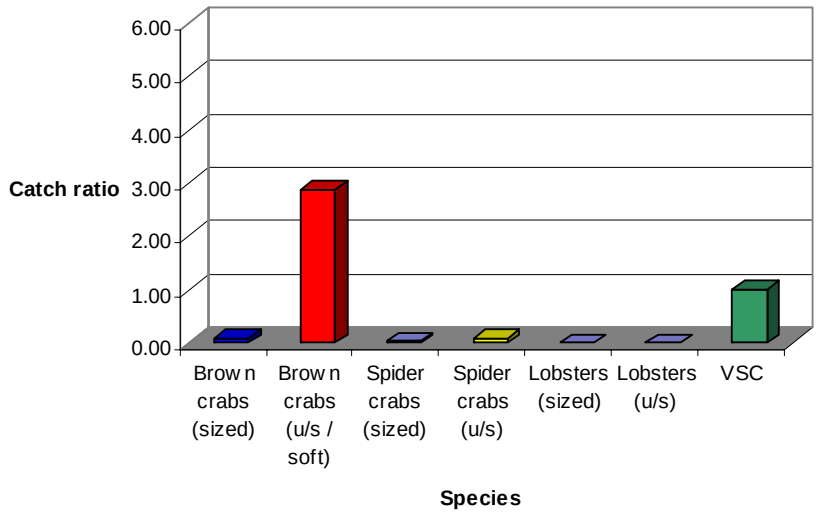
APPENDIX I – Survey Data

CATCH RATIO OF KEY SPECIES RECORDED DURING APRIL 2006 INSHORE POTTING SURVEY (*Chloe Estelle*)





Station 3



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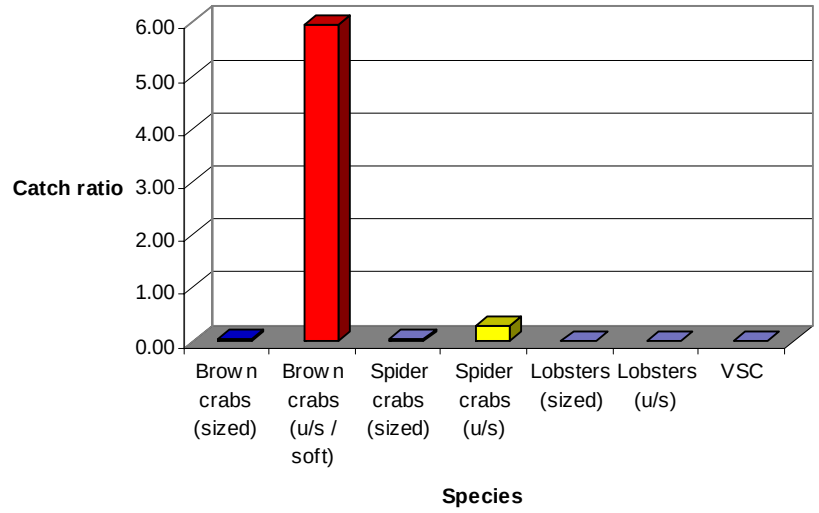
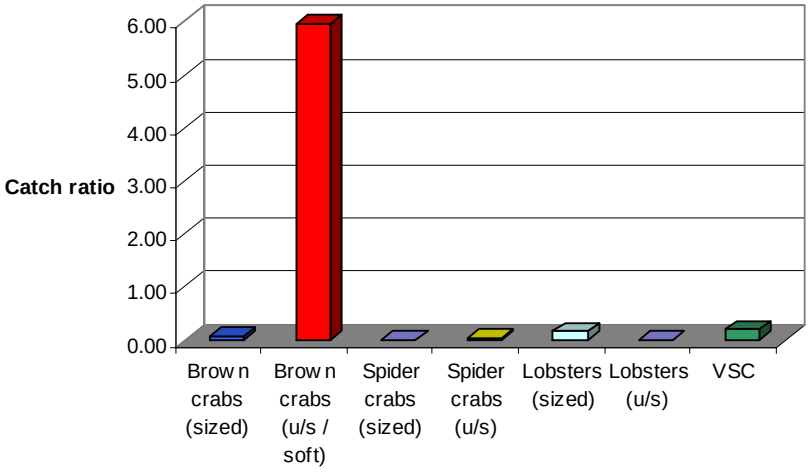
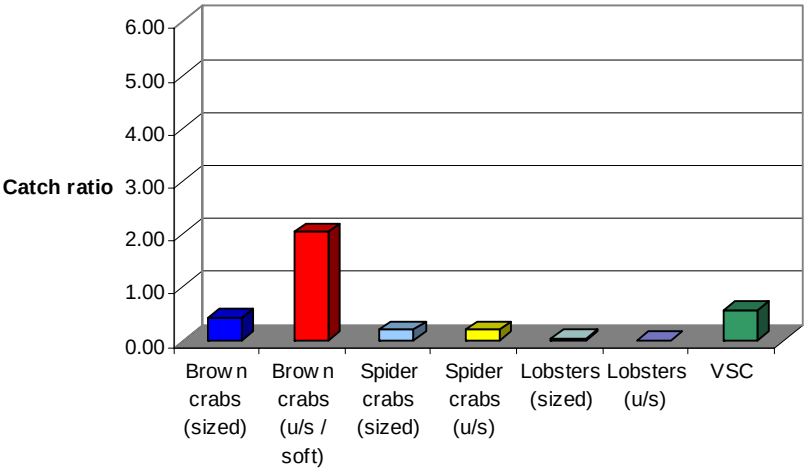
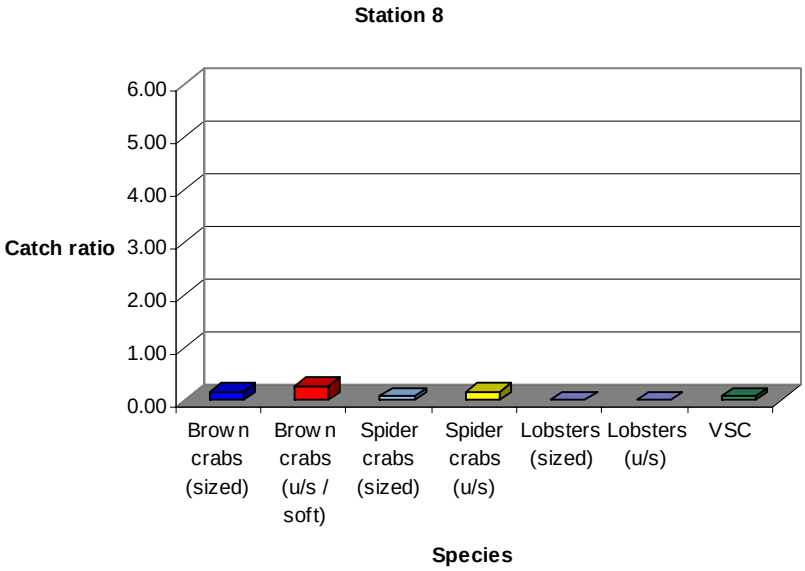


Station 6



Station 7

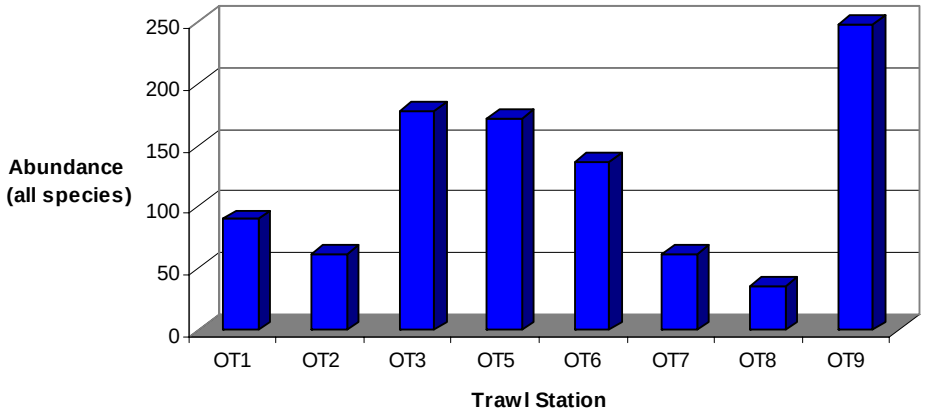



Station 8
Catch ratio
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Brown crabs (sized)
Brown crabs (u/s / soft)
Spider crabs (sized)
Spider crabs (u/s)
Lobsters (sized)
Lobsters (u/s)
VSC
Species

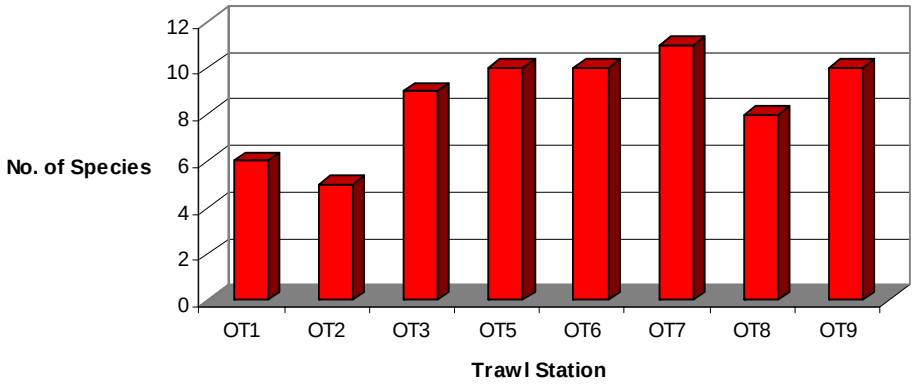
Otter Trawl Survey aboard *Girl Linda* – April 2006

Otter trawl 5th April 2006		South-West Wave Hub-station								
Species	**Latin Name**	**OT1**	**OT2**	**OT3**	**OT5**	**OT6**	**OT7**	**OT8**	**OT9**	**Total Recorded**
Squid	*Loligo* sp.						1		5	6
Scallop	*Pecten maximus*						1	2		3
Edible spider crab	*Maja squinado*	3	2	4	13	1	7	4	5	39
Swimming crab	*Liocarcinus holsatus*	70	45	151	108	87	4	2	183	650
Velvet swimming crab	*Macropipus puber*			1						1
Brown crab	*Cancer pagurus*	1			1		1	4	1	8
Masked crab	*Corystes casivelaunus*			2			4		1	7
Hermit crab	*Eupagurus bernhardus*			1	1			3		5
Spiny seastar	*Marthasterias glacialis*			1				2		3
Lesser spotted dogfish	*Scyliorhinus canicula*			2	5	2	37	13	1	60
Blonde ray	*Raja brachyura*		2							2
Spotted ray	*Raja montagui*				1					1
Small-eyed ray	*Raja microocellata*					7				7
Whiting	*Merlangius merlangus*						1			1
Cod	*Gadus morhua*					1				1
Grey gurnard	*Eutrigla gurnardus*	1			2	1	1		1	6
Red gurnard	*Aspitrigla cuculus*					1	1			2
Brill	*Scophthalmus rhombus*			1	6	3				10
Plaice	*Pleuronectes platessa*	14	11	15	33	31			49	153
Dab	*Limanda limanda*				2	3				5
Flounder	*Platichthys flesus*	1	2							3
Lemon Sole	*Microstomus kitt*						4	6		10
Dover Sole	*Solea solea*								1	1
Total all individuals		90	62	178	172	137	62	36	248	**123.12**
Total all species		6	5	9	10	10	11	8	10	**8.62**
Total fish individuals		16	15	18	49	49	44	19	52	**32.75**
Total fish species		3	3	3	6	8	5	2	4	**4.25**

Abundance at each otter trawl station (April 2006)



Number of Species at each otter trawl station (April 2006)



Hand-Lining aboard *Ellie Vee* – April 2006

	Position (WGS84)					
Station Number	**Latitude**	**Longitude**	**Number / Type of Hooks**	**Time Start**	**Time End**	**Site description**
HL1	50o14.413N	005o26.294W	6 rubber eels	14:33	14:53	Low lying wreck ~ 1.5m high
HL2	50o13.830N	005o29.625W	6 rubber eels	14:04	14:23	low lying wreck ~ 1.5m high
HL3	50o14.843N	005o29.902W	6 rubber eels	13:37	13:57	Low lying wreck ~ 0.5m high on hard seabed
HL4	50o15.820N	005o32.304W	6 rubber eels	13:13	13:32	Hard seabed rising from ~31m (BSL) to ~28m (BSL)
HL5	50o16.073N	005o35.116W	6 rubber eels	12:47	13:07	Small low lying wreck ~ 2m at highest point
HL6	50o17.500N	005o36.881W	6 rubber eels	12:18	12:38	Low lying wreck ~ 1.5m high on hard seabed
HL7	**50o21.112N**	**005o36.710W**	6 rubber eels	11:14	11:34	**NEW SITE WITHIN REVISED DEPLOYMENT AREA**
HL8	**50o21.619N**	**005o36.301W**	6 rubber eels	10:40	11:00	**NEW SITE WITHIN REVISED DEPLOYMENT AREA**