

**Final Report**

***Programme 2: Western Anglerfish***

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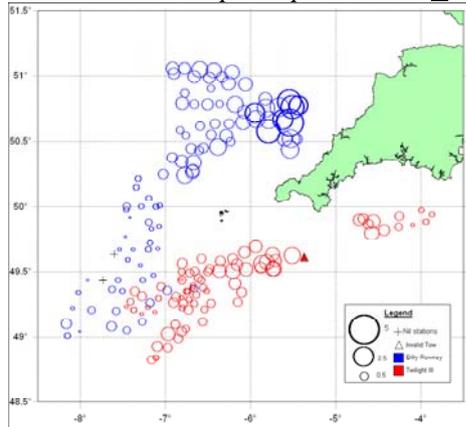


**November 2006**

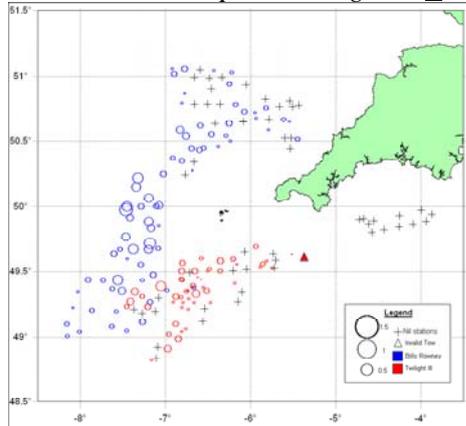
## Summary

A Fisheries Science Partnership survey of anglerfish (monkfish) was carried out in September 2006 off the SW coast of England. Beam trawlers *Billy Rowney* and *Twilight III* were chartered to repeat surveys carried out in autumn of 2003–2005. The most abundant of eight important species caught was megrim (48% by number), followed by anglerfish (*L. piscatorius*) (20%), lemon sole (15%) and sole (7%). Anglerfish (*L. budegassa*) made up 3%, while hake and cod each accounted for only 2% of the total catch by number for these 8 commercially important species.

### Distribution of *Lophius piscatorius* $\geq 25$ cm



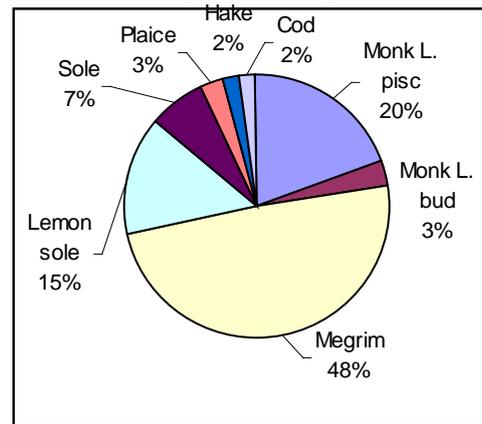
### Distribution of *Lophius budegassa* $\geq 25$ cm



Length distributions for anglerfish (*L. piscatorius*) show a decline in abundance of larger fish during 2004 and 2005. A strong year class first apparent in 2004 around 20 cm was confirmed in 2005 at a modal length around 30 cm and is still present in 2006 at around 45 cm modal length. The incoming year class in 2005 is present in the 2006 survey, but does not appear to be strong.

Length distributions for anglerfish (*L. budegassa*) suggest a decline in abundance of large fish in 2005 and 2006. A good year class at around 25 cm in 2005 still appears relatively abundant in 2006 at 36 cm and an incoming year class at around 22 cm also seems reasonably strong.

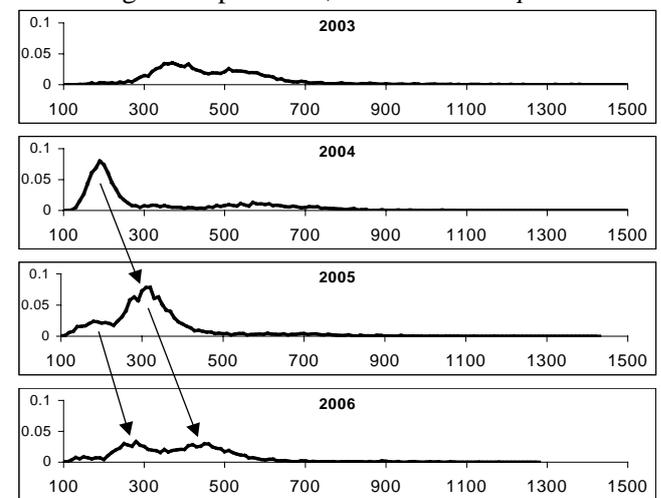
### Commercial species composition



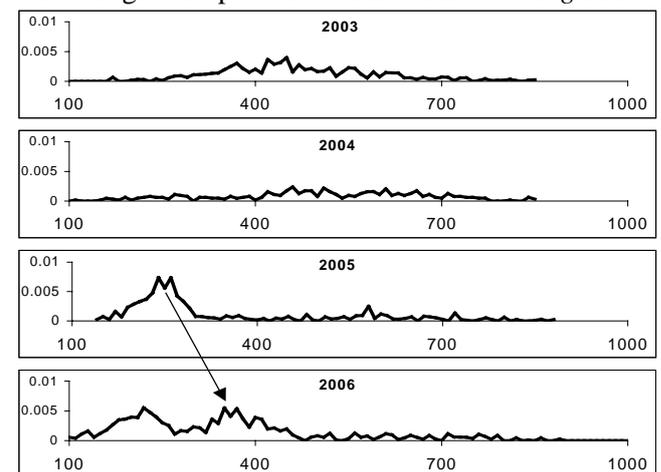
Anglerfish (*L. piscatorius*) were widely distributed throughout the surveyed area. Catch rates were higher in the northeast and lower in the southeast and southwest of the surveyed area.

Anglerfish (*L. budegassa*) were much less abundant. They were quite widely distributed in the west of the surveyed area, but scarce in the east. Catch rates were highest in the west of the surveyed area.

### Mean length compositions, 2003–2006 *L. piscatorius*



### Mean length compositions 2003–2005 *L. budegassa*



## Introduction

The Fisheries Science Partnership (FSP) was established in 2003 to build relationships between fishermen and scientists, and to involve fishermen in the co-commissioning of science. The FSP is funded by the UK's Department for Environment, Food and Rural Affairs (Defra). Ten projects per year have been carried out since 2003/04, comprising a mixture of time-series surveys, fishing gear selectivity studies and examination of spatial patterns of catch compositions. Reports for FSP projects already completed are available on the FSP page of the Cefas website ([www.cefas.co.uk](http://www.cefas.co.uk)).

Industry proposals for FSP projects have typically been developed at a port/regional level, refined and agreed with Cefas and approved by the FSP Steering Group. Charter vessels are selected through an open tendering procedure, and are given dispensations from the relevant quota and effort controls and to fish in non-UK waters where appropriate.

This report presents the results of FSP 2006/07 Programme 2, carried out on the anglerfish fishing grounds off the SW coast of England during September 2006. The project used the commercial beam trawler *Twilight III* (skipper M. Patterson) to survey the southern part of the survey area from 4 to 6, 8 to 12 and 14 to 17 September. The beam trawler *Billy Rowney* (skipper S. Moseley) surveyed the northern region from 7 to 12 and 23 to 28 September.

The vessels fished in the same areas, using the same gear and towing practices, as in the equivalent FSP trips in 2003, 2004 and 2005, and the survey therefore forms the fourth in the time-series and provides useful information on changes in abundance and size composition of anglerfish off SW England.

Two species of anglerfish are caught on these grounds. The most common species (scientific name *Lophius piscatorius*) is referred to as anglerfish or monk(fish) (*L. piscatorius*) in this report. The less common species (scientific name *Lophius budegassa*), is referred to as anglerfish or monk(fish) (*L. budegassa*), to avoid the use of common names such as "black anglerfish" or "white anglerfish" which can be used for the same species in different areas. The two species of anglerfish belong to populations that extend over a large area of the continental shelf to the west and southwest of the British Isles. The populations extend from coastal waters out to the shelf slope, and are fished by several nations using beam trawls, otter trawls and fixed nets. The area covered by the FSP survey is therefore only a small part of the overall range of the populations.

Results are presented separately for the two species.

## Objectives

The objectives as outlined in the detailed plans (Appendix 1) were:

- 1) To repeat the surveys of anglerfish in the western Channel.
- 2) To provide data on the distribution and catch rates of anglerfish and other commercial species using commercial gear.
- 3) To determine length compositions of anglerfish and other commercial species in the catches.
- 4) To add to the time-series started in 2003.

The reports of the 2003, 2004 and 2005 western anglerfish surveys (Cotter *et al.*, 2004; Walmsley *et al.*, 2005, Smith *et al.*, 2006) are available on the Cefas FSP website ([www.cefas.co.uk](http://www.cefas.co.uk)).

The detailed operational plans were discussed at meetings between Cefas and the vessel owners on 4<sup>th</sup> August 2006 (Appendix 1).

Cruise narratives prepared by Cefas seagoing staff are reproduced in Appendix 2.

## Methods

### *Vessels and gear*

FV *Twilight III* (PZ137) is a steel beam trawler of 27 m reg. length, with a 783 kW engine, built in 1969. FV *Billy Rowney* (PZ538) is a steel beam trawler of 27 m reg. length, 783 kW engine, built in 1973.

*Twilight III* fished with two 9-m beam trawls fitted with chain mats and 3-bar flip-up ropes. Codends were constructed from 80 mm mesh. *Billy Rowney* fished with two 10-m beam trawls, similarly equipped with chain-mats, flip-up ropes and 80 mm mesh codends. Tow duration was generally between 1.0 and 1.25 h with exceptions at night and during poor weather when duration was extended to a maximum of 3.25 h. Towing speeds were kept at around 4-5 knots where possible. Table 1 summarizes the fishing activities of the two vessels.

### *Survey design*

As last year, in order to produce a relatively wide coverage, the survey areas were divided into 15' × 15' boxes (Appendix 1). Boxes were classified as those unsuitable for trawling, which were excluded from the survey, and boxes where anglerfish abundance was expected to be high or lower. More tows per box were carried out in the main anglerfish areas, but where possible all boxes covering suitable habitat for anglerfish were sampled. In 2006 slightly fewer tows were made on the southern

survey and more on the northern survey than in 2005. The overall number of tows was 176, 9 fewer than in 2005.

**Table 1.** FSP 2006 Programme 2: Western Anglerfish. Details of valid fishing activities

Vessel	Dates in 2006	Stations (valid)	Number of valid hauls	Fishing gear	Codend mesh	Tow duration (min) Average (range)
<i>Twilight III</i>	Sep 4-6, 8-12, 14-17	1-18 1-36 1-25	79	2 × 9 m beam trawls	80 mm	99.2 (75-195)
<i>Billy Rowney</i>	Sep 7-12, 23-28	1-53 1-43	96	2 × 10 m beam trawls	80 mm	103.5 (75-195)

### *Sorting and processing the catch*

Standard methods employed by Cefas staff for sorting and recording catches on commercial fishing vessels were employed (see FSP reports for 2004/05 for details). Catches were quantified and classified as 'discarded' or 'retained' according to advice from the fishing crew. Length measurements were carried out on each component. Where catches were sampled rather than fully sorted, an appropriate raising factor was determined to allow the total catch to be estimated. In line with the detailed plan (Appendix 1), discard sampling was carried out for both species of anglerfish and for hake, cod, plaice and sole at all stations.

## **Results**

### *Fishing stations*

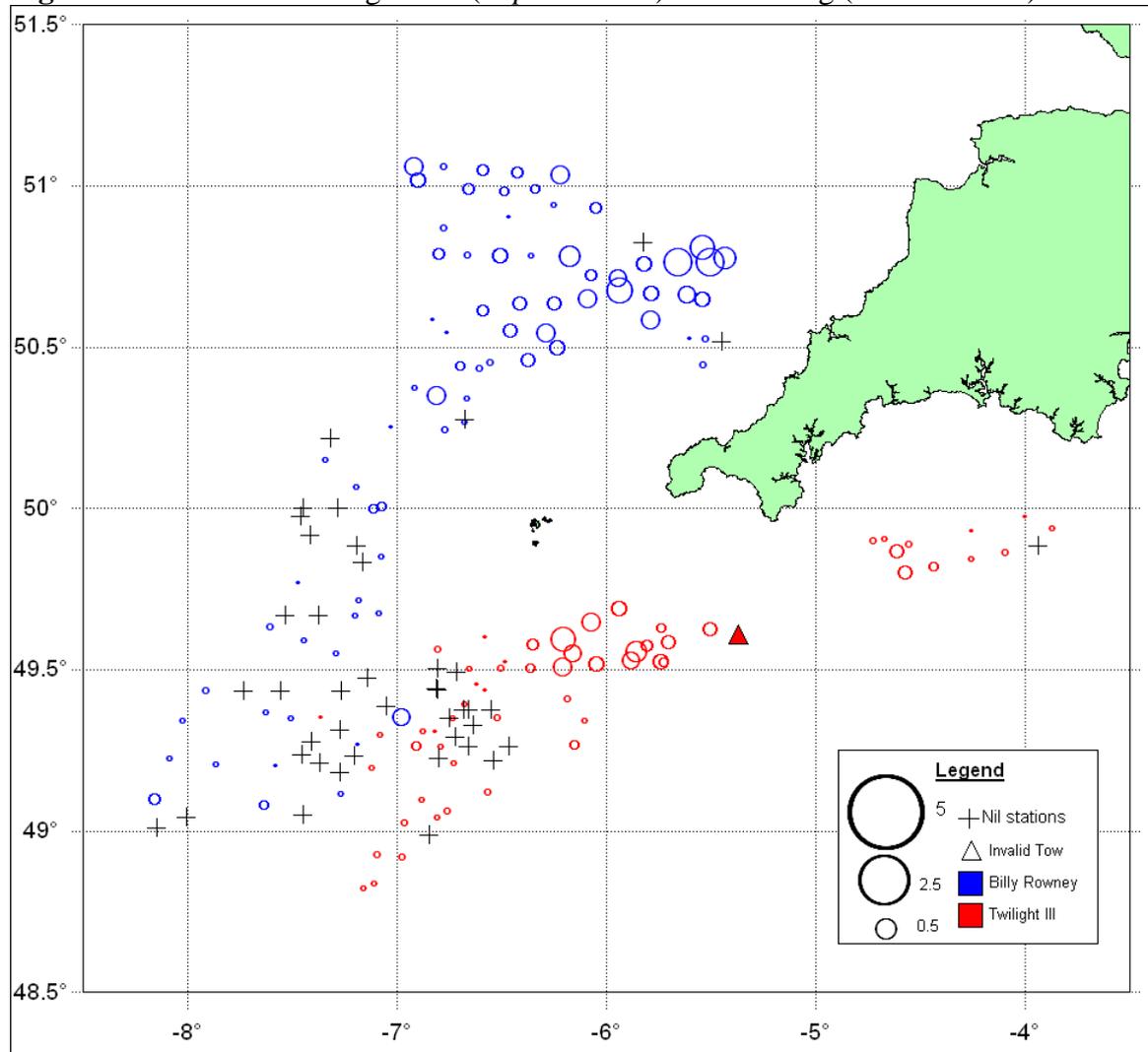
Details of tow position, date and time, together with raised catches for eight commercial species (anglerfish [*L. piscatorius* and *L. budegassa*], megrim, sole, lemon sole, hake, cod and plaice) are given in Appendix 3. Details of all species sampled are held on a Cefas database. One haul (*Twilight III* 1/06, Station 19) was invalid for scientific purposes because it was curtailed due to mechanical problems. Tow positions were in general accord with the survey design (Appendix 1).

### *Spatial distribution of anglerfish*

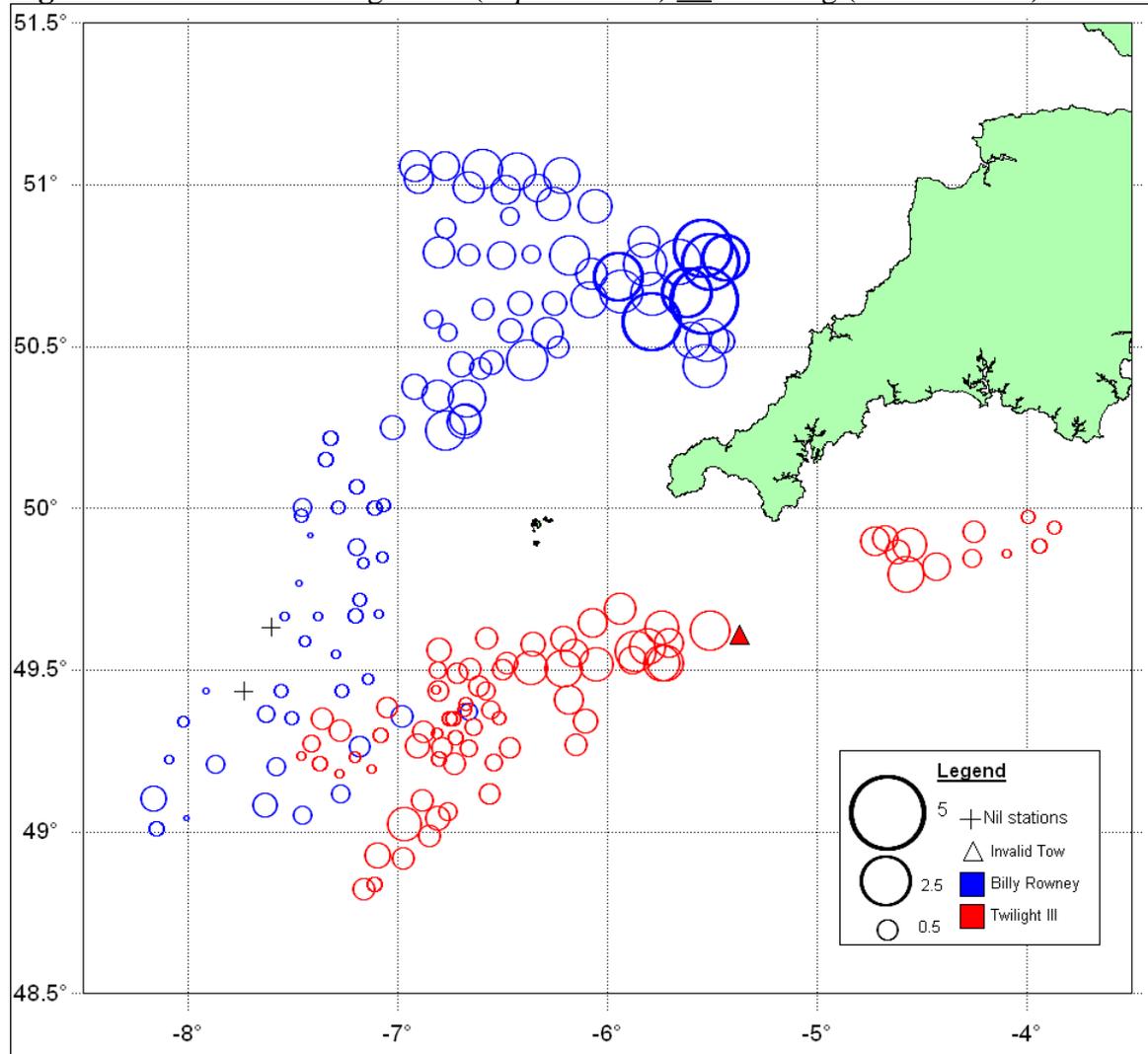
The spatial distributions of both large ( $\geq 25$  cm) and small ( $< 25$  cm) anglerfish (*L. piscatorius*) were very similar to those described last year. Both size categories were widely distributed throughout the area covered by the surveys, but smaller anglerfish (*L. piscatorius*) were noticeably less abundant or absent in the southwestern part of the survey coverage. The greatest abundance of both large and small anglerfish (*L. piscatorius*) was northeast of the survey area (northwest of Trevoise Head), and catch rates were also high in the area southeast of the Scilly Isles. Catch rates in the 2006

surveys were generally lower for both large and small anglerfish (*L. piscatorius*) than in the 2005 surveys. This reflects a weaker incoming year class than last year and a reduction in the abundance of the strong 2004 year class.

**Figure 1a.** Catch rate of anglerfish (*L. piscatorius*) <25 cm long (no./m beam/h)



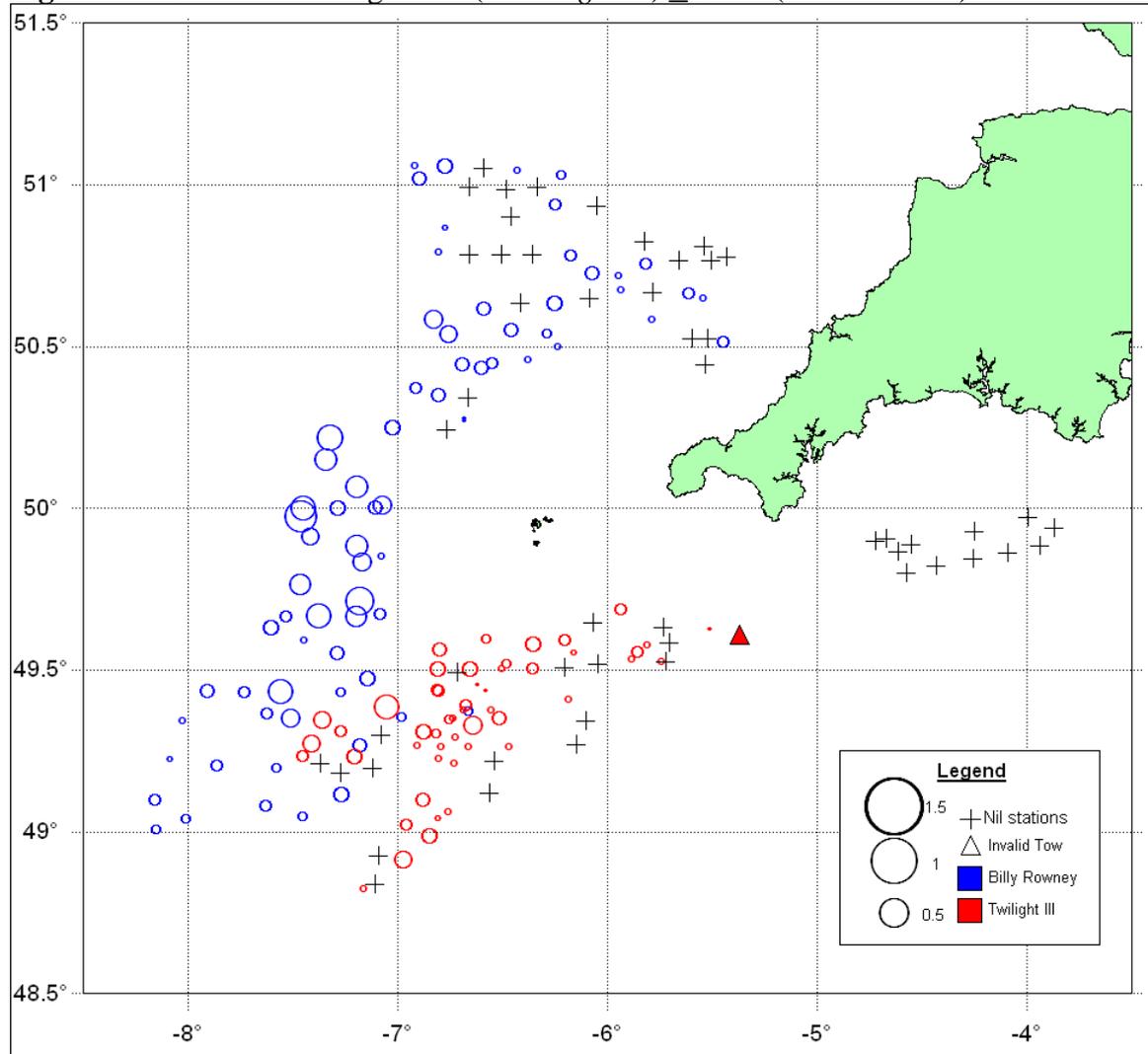
**Figure 1b.** Catch rate of anglerfish (*L. piscatorius*)  $\geq 25$  cm long (no./m beam/h)



Throughout the surveyed area the abundance of anglerfish (*L. budegassa*) was much less than that of anglerfish (*L. piscatorius*). As last year both large and small anglerfish (*L. budegassa*) were scarce east of 6°W, but were more widely distributed farther west. However, the distribution was slightly different from that described in last year's surveys. Greatest abundances of small anglerfish (*L. budegassa*) were southwest of the Scilly Isles and in the far southwest of the grid, rather than as last year in the northwest. A similar change in distribution was noted for larger anglerfish (*L. budegassa*), which were most abundant to the west and southwest of the Scilly Isles in 2006 rather than in the northwest of the grid as in 2005. Catch rates of larger anglerfish (*L. budegassa*) were higher in 2006 than in 2005.



**Figure 2b.** Catch rate of anglerfish (*L. budegassa*)  $\geq 25$  cm (no./m beam/h)

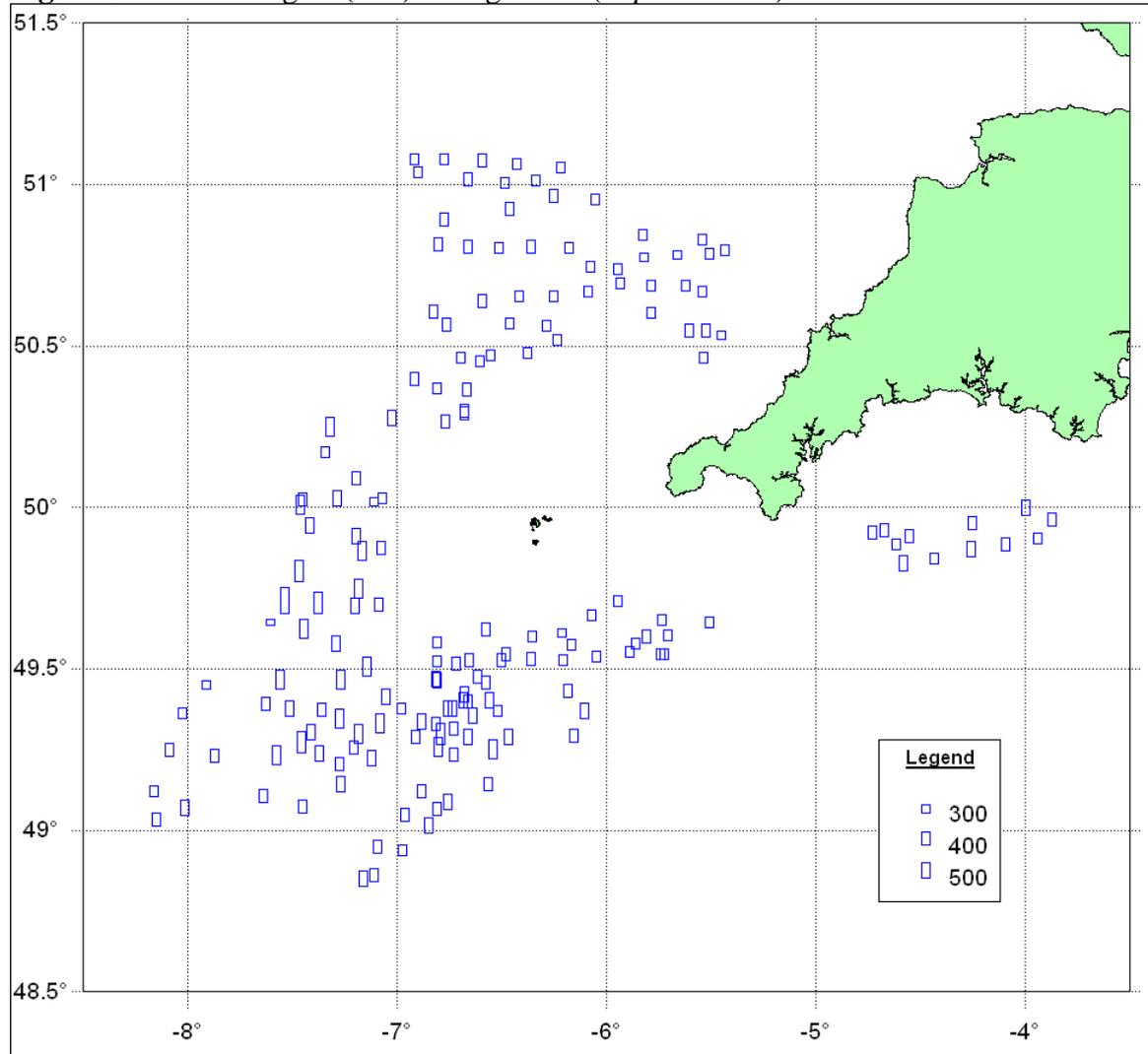


*Anglerfish lengths and length distributions*

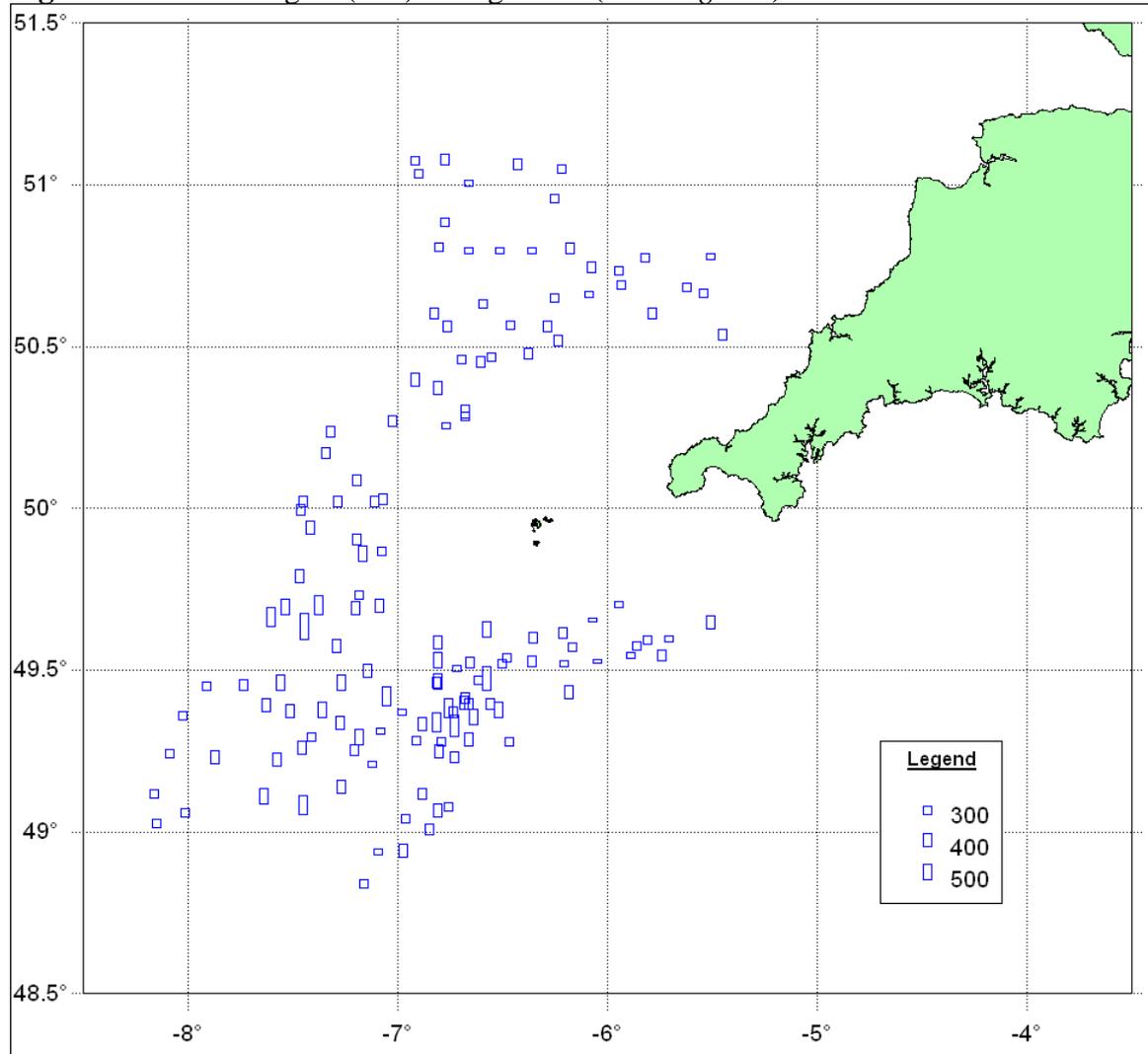
Mean lengths of anglerfish (*L. piscatorius*) were greatest in the southwest of the surveyed area (Figure 3a), similar to last year, but the larger mean size of anglerfish south of Devon last year was not apparent this year.

Mean lengths of anglerfish (*L. budegassa*) were highest southwest of the Scilly Isles, but became smaller again in the extreme southwest of the surveyed area (Figure 3b).

**Figure 3a.** Mean lengths (mm) of anglerfish (*L. piscatorius*) in the catch

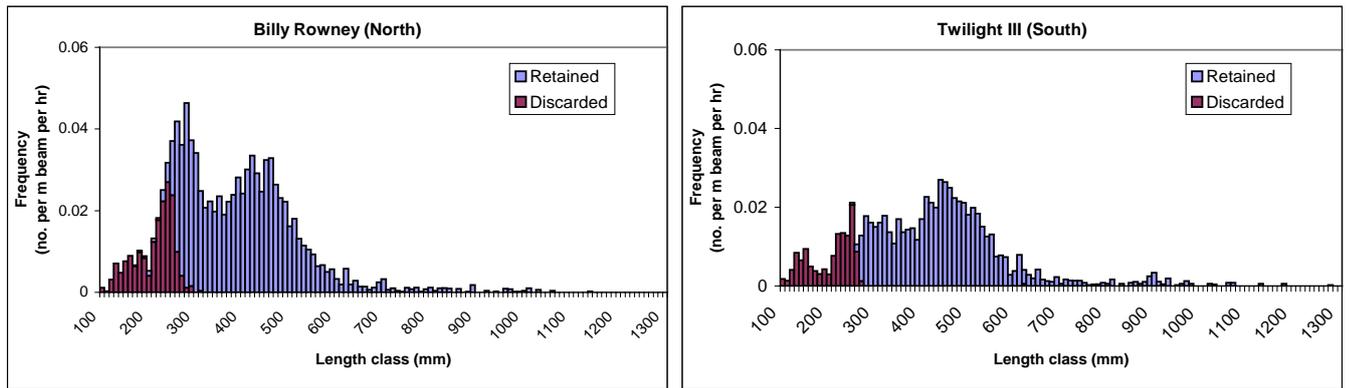


**Figure 3b.** Mean lengths (mm) of anglerfish (*L. budegassa*) in the catch



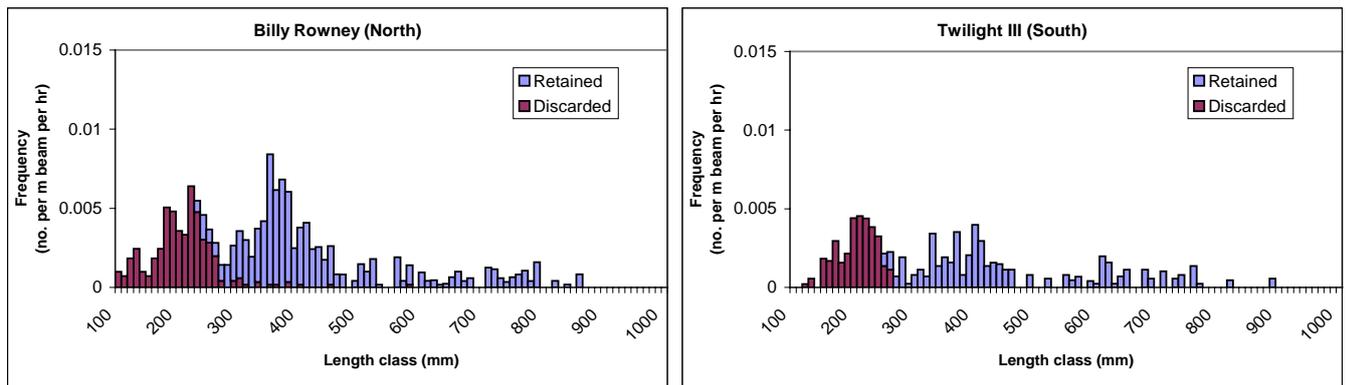
Length compositions as numbers per metre beam length per hour for anglerfish (*L. piscatorius*) in 2006 (Figure 4a) show that catch rates were generally higher in the northern area than in the southern. In the northern area there was a major peak at around 26-28 cm with smaller peak apparent around 42-46 cm. In the southern area peaks were at broadly similar sizes (25 and 45 cm), but the larger size class appears to be more abundant than the smaller one. The length distribution for the southern area is supported by data from the third in a series of Cefas scallop surveys (Cend 18/06) carried out off the south Cornish coast, during which it was noted that anglerfish (*L. piscatorius*) abundance was higher than in the previous surveys and although a relatively small sample, the major mode in the length distribution was in the range 40–46 cm and a secondary mode was present at 31–35 cm.

**Figure 4a.** Stacked histograms of anglerfish (*L. piscatorius*) length distributions by vessel (area) in 2006



The corresponding length compositions for anglerfish (*L. budegassa*) (Figure 4b) show that *L. budegassa* were considerably less abundant than *L. piscatorius*. Frequencies were highest for a year class at around 35-37 cm long in the northern area, with smaller modes around 18 and 22 cm. In the southern area the main peak was at around 22 cm .

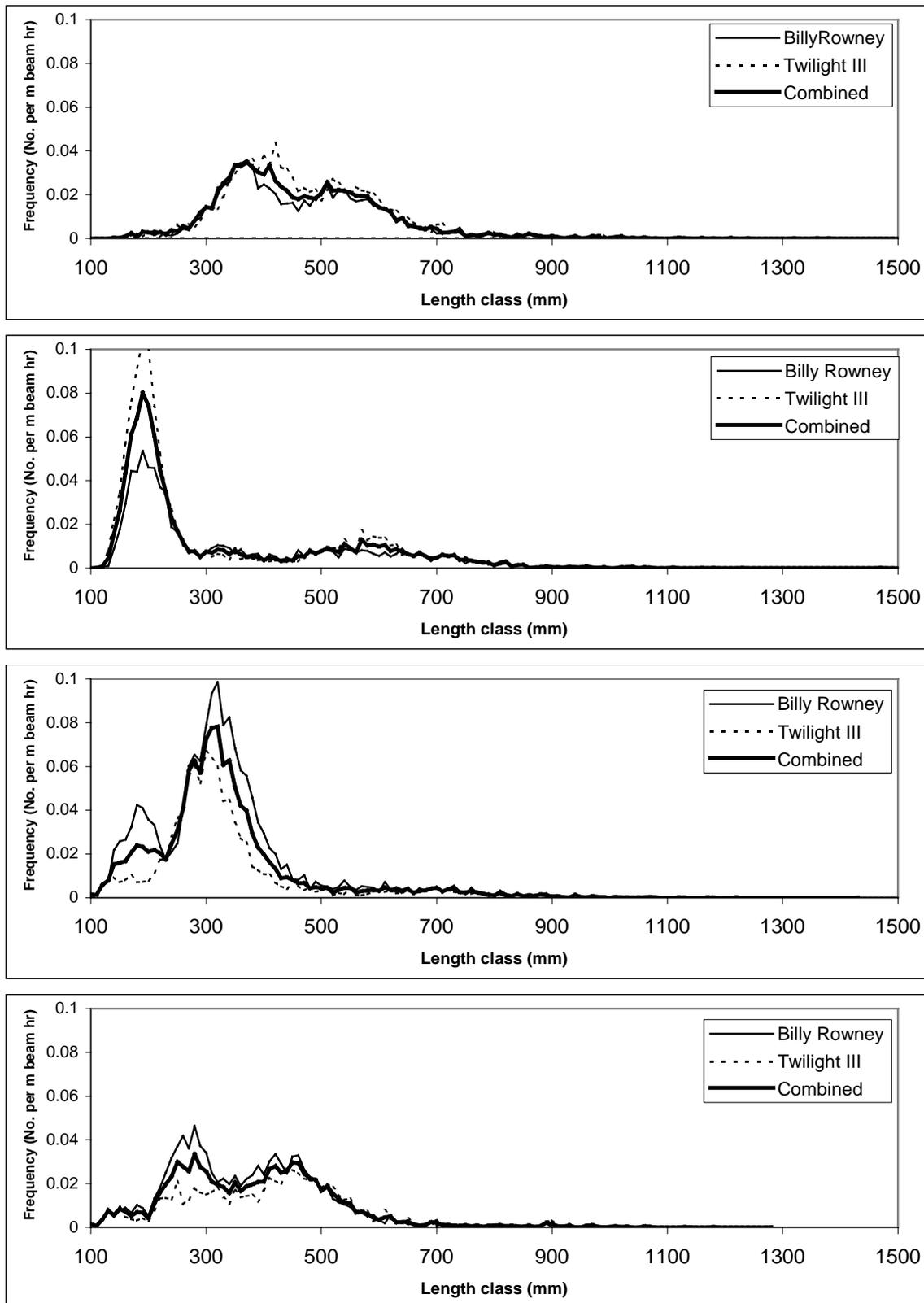
**Figure 4b.** Stacked histograms of anglerfish (*L. budegassa*) length distributions by vessel (area) in 2006



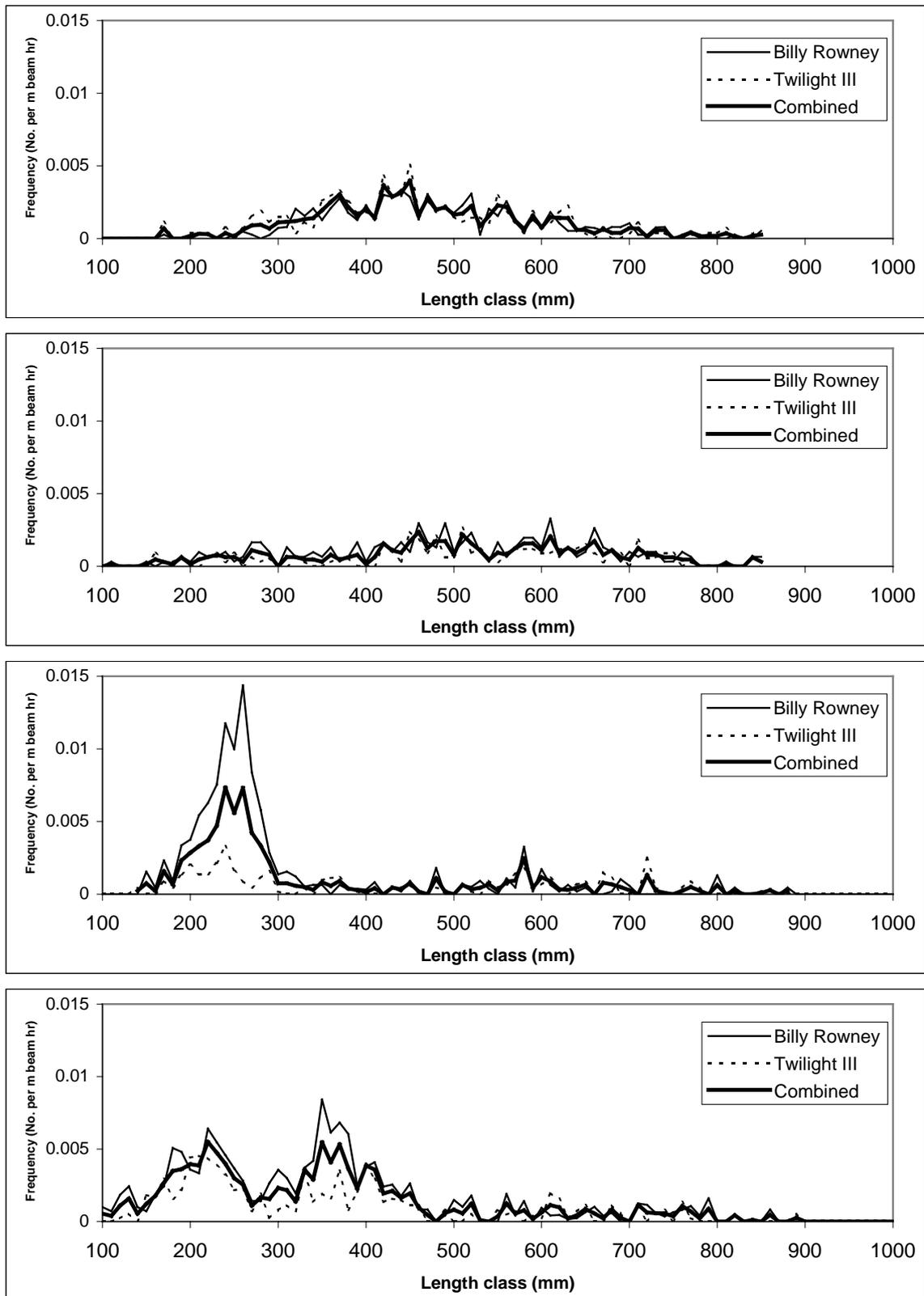
Between 2003 and 2005, the abundance of larger (>50 cm) anglerfish (*L. piscatorius*) declined considerably. A strong incoming year class was apparent during the 2004 survey, especially in the northern area, and this was confirmed in the 2005 survey, with high abundances of anglerfish in the 28–35 cm size range in both southern and northern areas. This year class can still be followed in 2006, now in the length range around 42-46 cm. The incoming year class around 20 cm long in 2005 is at around 28 cm and does not appear to be particularly abundant.

Catch rates of *L. budegassa* were as usual considerably less than those of *L. piscatorius*. However, a relatively strong incoming year class of (*L. budegassa*) at around 25–27 cm in 2005 was confirmed in 2006 now with a size range of 35–37 cm (Figure 5b). The incoming year class in the 2006 survey at a length of 20-25 cm, although not as strong as that of last year, appears to be reasonably well represented in both the northern and southern surveys and is high in comparison with the 2003 and 2004 surveys.

**Figure 5a.** Time-series of anglerfish (*L. piscatorius*) length frequencies (numbers per m beam per h per 10 mm length class) (2003 top to 2006 bottom)



**Figure 5b.** Time-series of anglerfish (*L. budegassa*) length frequencies (numbers per m beam per h per 10 mm length class) (2003 top to 2006 bottom)



### Catch composition

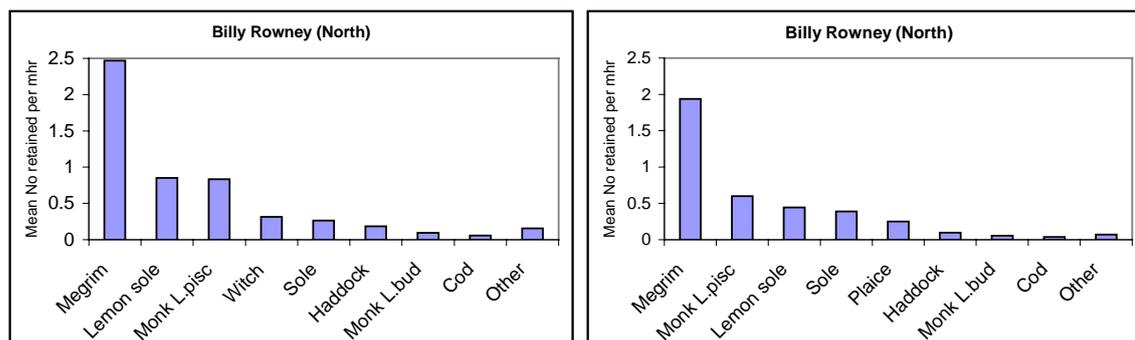
These surveys were ‘off quota’, and discarding practice may not therefore be representative of normal commercial operations. Discard rates are not therefore considered in detail.

As in last years survey, of eight commercially important species (Table 3), megrim were the most abundant by number, followed by monkfish (*L. piscatorius*), lemon sole and sole. Megrim were the most abundant commercial species in both northern and southern areas, but the rank of catch rates for the other 3 species varied between areas (Figure 6).

**Table 3.** Absolute catch numbers, relative catch (within these species) and approximate average catch per h for 8 commercially important species

	Monk L. pisc	Monk L. bud	Megrim	Lemon sole	Sole	Plaice	Hake	Cod
Total catch number	4797	649	11700	3496	1637	802	534	452
Percentage	20	3	49	15	7	3	2	2
Approximate catch no. per h	17	2.2	43.5	13.4	6.1	2.6	2.1	1.8
2005 total catch number	6492	427	12388	2497	2429	906	402	450
2004 total catch number	6620	380	13376	1377	2420	388	146	180

**Figure. 6.** Catch rates as numbers of retained fish per m beam hour of trawling averaged over all valid hauls by vessel (area)



A comparison of retained catch rates for a wider range of 16 commercially important species (Table 4) again highlighted the relative importance of these four species (megrim, anglerfish (*L. piscatorius*), lemon sole and sole). Anglerfish (*L. piscatorius*) were the most frequently encountered commercial species, occurring in 99% of tows, followed by sole and megrim (85%), and lemon sole (75%). These percentages are almost identical to those of last year’s survey. However, although surveys previous to 2005 also found anglerfish (*L. piscatorius*) to be the most ubiquitous commercial species, occurring in almost all hauls, they did not encounter other species with such

high frequency, sole again being the second most common species in 2004 but occurring in just 66% of tows (Walmsley *et al.*, 2004).

Total numbers for megrim and cod were similar (within 10%) to those in the 2005 surveys. For anglerfish (*L. piscatorius*), sole and plaice, total numbers were lower in 2006 and for anglerfish (*L. budegassa*), lemon sole and hake, they were higher. However, the average catch rates of anglerfish (*L. budegassa*), plaice, cod and hake were considerably lower than those of the main target species (Table 3).

**Table 4.** Percentage of stations where a species was caught and retained, mean catch rate of retained fish over all stations (numbers per m beam per h) and retained catch rate as a proportion of 16 commercially important species.

	Megrim	Monk L.pisc	Lemon sole	Sole	Witch	Haddock	Plaice	Monk L.bud
% occurrence	85	99	75	85	26	60	53	71
Mean catch rate	2.228	0.728	0.667	0.320	0.175	0.145	0.139	0.075
Catch rate (proportion)	0.498	0.163	0.149	0.071	0.039	0.032	0.031	0.017

	Cod	Ling	Hake	Whiting	John Dory	Brill	Turbot	Red mullet
% occurrence	55	30	24	25		14	14	7
Mean catch rate	0.048	0.018	0.018	0.017	0.015	0.009	0.006	0.005
Catch rate (proportion)	0.011	0.004	0.004	0.004	0.003	0.002	0.001	0.001

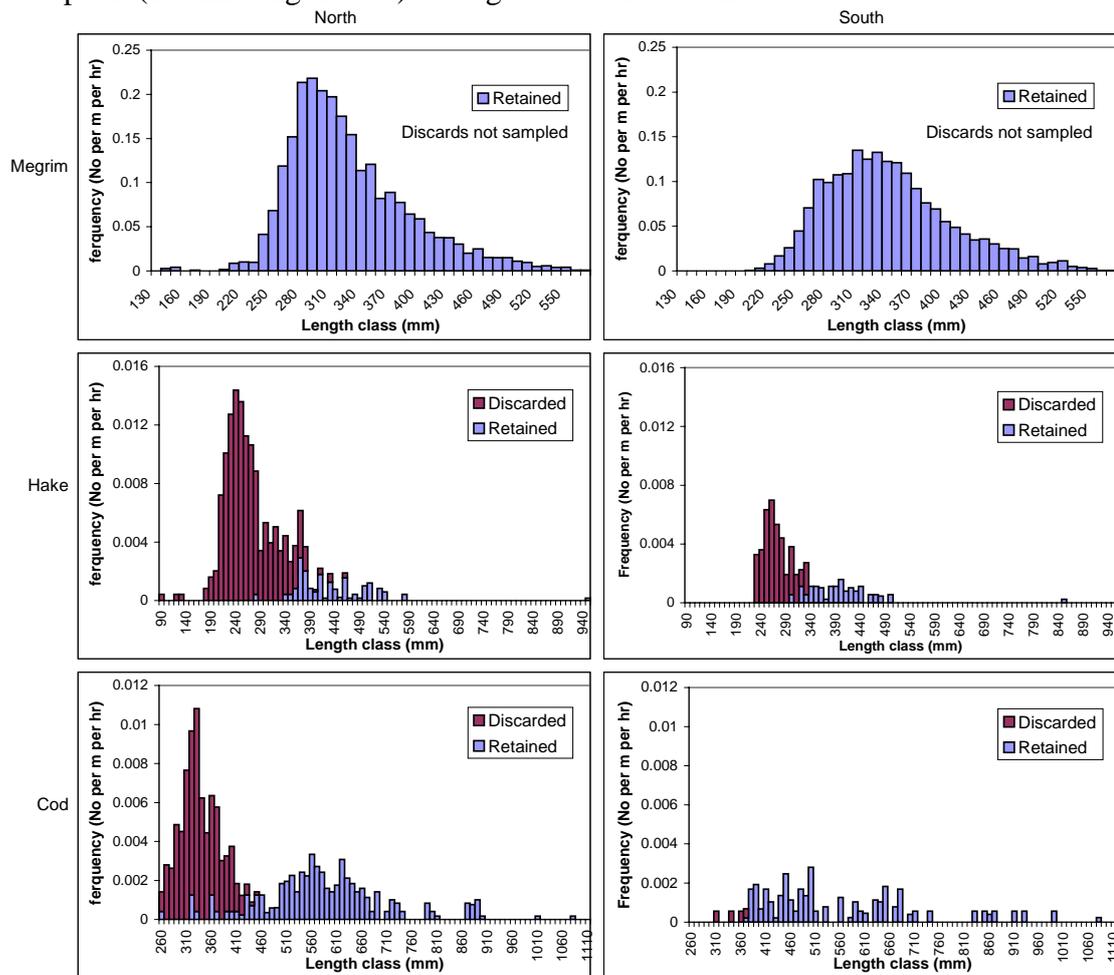
#### *Length compositions of commercial by-catch species*

Numbers caught in each 1 cm length class per m beam length per h of trawling, averaged over all valid hauls for megrim, hake and cod (Figure 7a), show that catch rates for megrim were very similar to those of last year in the northern area, but slightly lower than last year in the southern area. The size distribution in the south also suggests a slightly larger modal size than last year.

Despite generally low catch rates for cod during these surveys, catch rates for cod were similar to those obtained in 2005 and displayed the same spatial pattern, being more abundant in the northern area. In the northern area, the incoming year class of cod was largely discarded this year, whereas around half the fish in this size group (30–45 cm) were retained during last year's survey.

In last year's survey, hake catch rates were higher in the south, but in 2006 this pattern was reversed. In both northern and southern areas most hake were discarded.

**Figure. 7a** Length frequencies of megrim, hake and cod as numbers per m beam per h (10 mm length class) averaged over all valid hauls

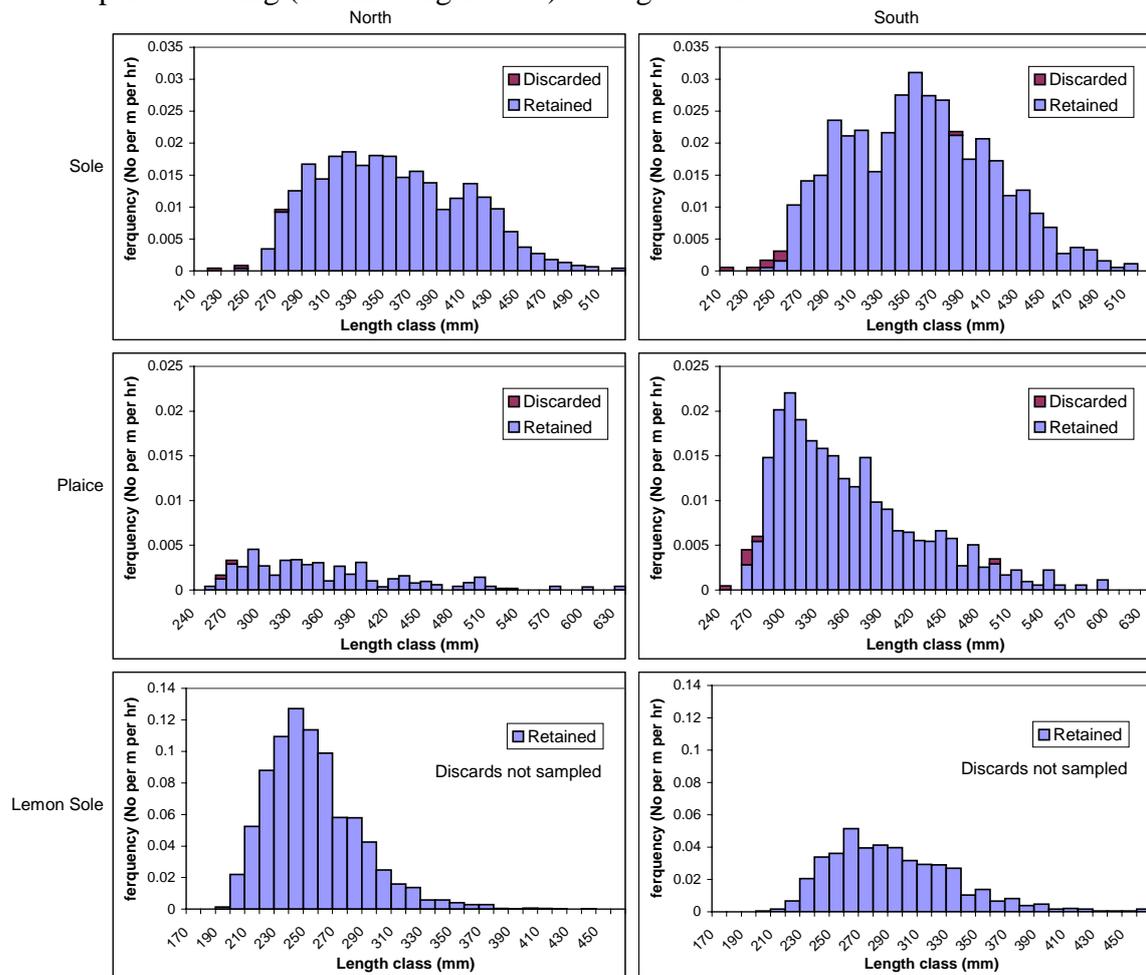


The corresponding length compositions for sole, plaice and lemon sole (Figure 7b) show that catch rates of sole were reduced this year relative to last year, especially in the northern area. As in last year's survey, the northern area had lower catch rates of sole in general than the southern area, and catch rates of smaller sole in particular were much lower than in last year's survey.

As in last year's survey, catch rates of plaice were very low in the northern area and higher in the southern area, although they were lower than in last year's survey.

As last year, catch rates for lemon sole were higher in the northern area than the southern area, and were slightly higher this year than in last year's survey. The relative distribution by length class was similar to that last year in both northern and southern areas.

**Figure. 7b.** Length frequencies of sole, plaice and lemon sole as numbers per m beam per h trawling (10 mm length class) averaged over all valid hauls



## Discussion

FSP Programme 2 in 2006 continued successfully to build on previous FSP western anglerfish surveys using the same two beam trawl vessels, gears and towing practices. The overall design of the survey and areas covered were similar over the years, although since 2005 the stations have been more evenly spread over the survey areas, to improve spatial coverage and resolution.

The surveys continue to confirm that the catches in this fishery consist predominantly of the target anglerfish species and megrim, with sole and lemon sole as important by-catch species in terms of numbers. Anglerfish (*L. piscatorius*) made up around 20% of the commercial catch by number, with a mean catch rate of around 17 per h. The other anglerfish species (*L. budegassa*) was far less abundant throughout the surveyed area, constituting around 3% of the catch by number, with a mean catch rate of some 2.2 fish per h.

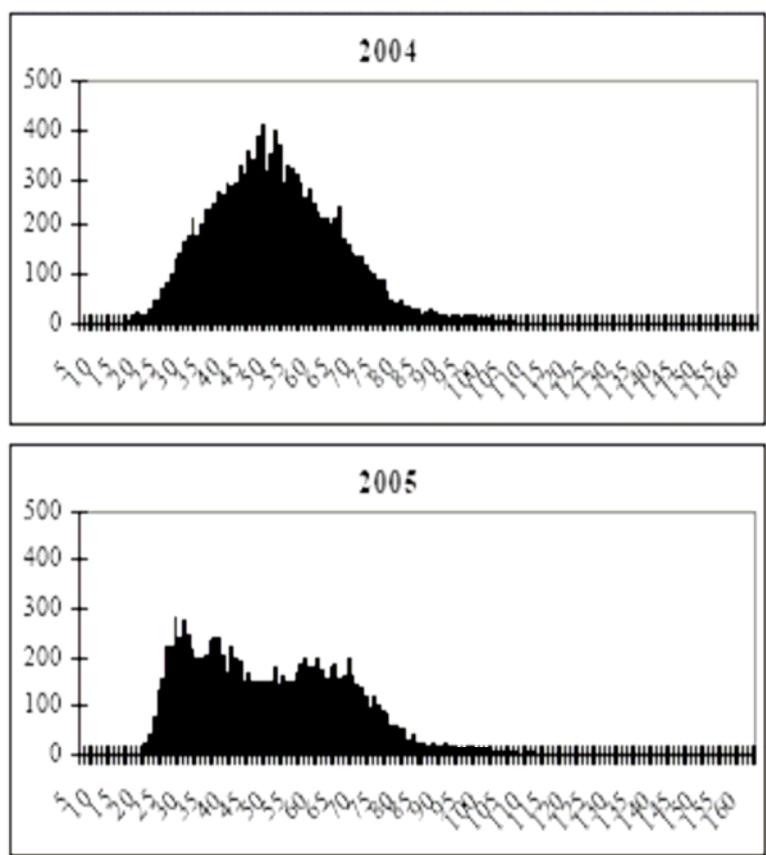
Catches of cod and hake were higher than during the previous two surveys, but were still low in comparison with the other commercial species, averaging around 2 fish of each species per hour.

### *Trends in anglerfish abundance and size composition*

The mean length frequency of anglerfish (*L. piscatorius*) in the FSP survey in 2004 showed a strong mode at around 20 cm, suggesting a relatively strong year class entering the fishery. This was observed in both the FSP western anglerfish survey and in the FSP Western Channel sole survey in 2004. The FSP surveys in 2005 confirmed this through the presence of a strong mode at around 30 cm, again observed in both the western anglerfish and Western Channel sole FSP surveys. This year class, now with lengths around 42–46 cm, is still well represented, with catch rates similar to the succeeding year class and well above the incoming year class in 2006, which looks to be relatively weak by recent year standards. Catch rates of very large (>60 cm) anglerfish (*L. piscatorius*) have declined over the 4 years of the FSP surveys.

The international catch-at-length compositions for anglerfish (*L. piscatorius*) used by the ICES Working Group on the assessment of southern shelf stocks of Hake, Monk and Megrin (WGHMM, ICES 2006) (Figure 8) do not feature the strong year class indicated in the FSP surveys at length 20 cm in 2004, but this cohort is apparent in the international catches in 2005 with a mode around 30 cm. This suggests that the FSP surveys may be useful in providing an early indication of strong year classes.

**Figure 8.** International catch at length compositions for anglerfish (*L. piscatorius*) used by WGHMM

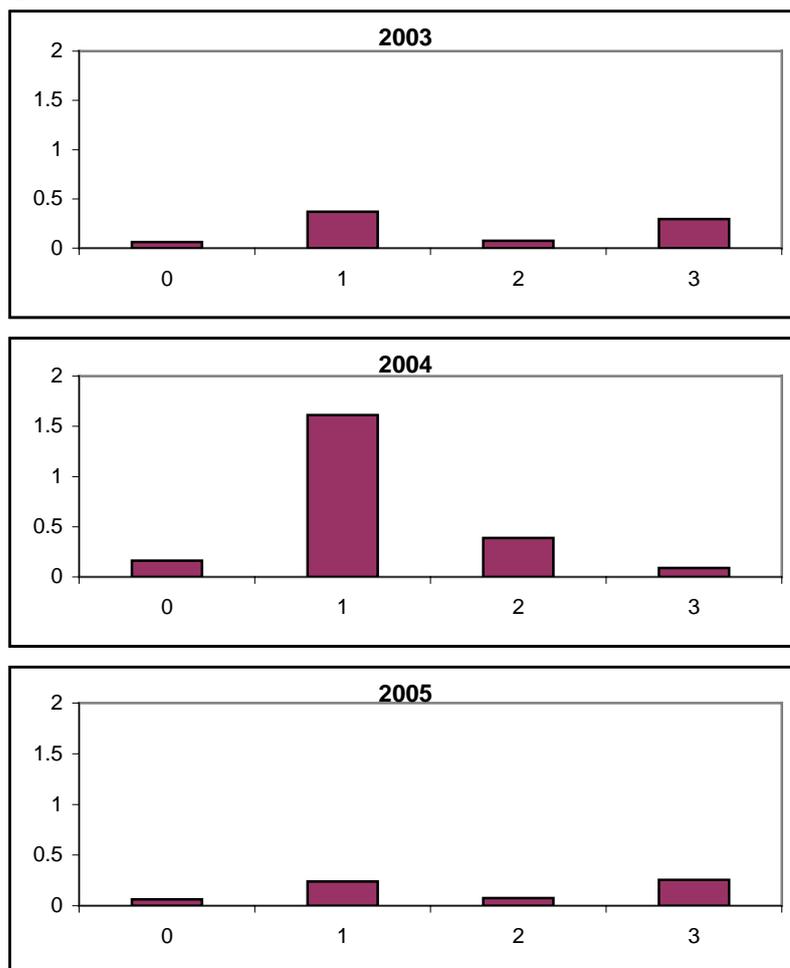


The ICES Hake, Monk and Megrin working group also utilizes a survey, called Evhoe, carried out by the Institut français de Recherche pour l'Exploitation de la Mer,

IFREMER, as an abundance index for anglerfish. The Evhoe survey index covers a wide area of the continental shelf, out to the shelf edge, of the western Celtic Sea and Bay of Biscay. The Evhoe survey used in the anglerfish (*L. piscatorius*) assessment (Figure 9) suggests that 1-year-olds were relatively abundant in autumn 2004, but did not confirm the strength of this cohort in 2005, although in 2005, anglerfish of age 3 were estimated to be relatively abundant.

Last year's FSP report raised the issue of uncertainties regarding the ageing of anglerfish by counting rings on thin sections taken from the illicium (the fish's "fishing rod"), or by counting rings on otoliths (earbones). The report pointed out that the report of the Anglerfish Illicia/Otoliths Ageing Workshop (ICES, 2004) lists a number of studies that have validated growth as being faster than that obtained from interpretation of illicia, including Wright *et al.* (2002), who suggested subtracting 1 year from ages obtained from illicia reading. The fact that a strong year class can be followed consistently in sequential annual length frequency histograms from the FSP time-series further suggests that there may well be problems with this ageing technique.

**Figure 9.** Evhoe (October) survey abundance index for anglerfish (*L. piscatorius*), ages 0–3, 2003–2004.



Despite catch rates of anglerfish (*L. budegassa*) in the survey being relatively low, the evidence for a reasonably strong incoming year class in the northern area last year was supported by this year's surveys.

### *Acknowledgements*

This work was carried out in cooperation with the skippers and crew of the FV *Billy Rowney* (skipper Steve Mosely) and FV *Twilight III* (skipper Morgan Patterson). Cefas offers sincere thanks to them for their valued contributions towards this ongoing survey programme. Cefas staff who contributed to the programme of sampling and analyses are also thanked for their help. The project was funded by Defra.

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## Appendix 1: Detailed operation plan

### ***Fisheries Science Partnership 2006/07***

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#### **Western Channel Angler (North): September 2006**

##### ***Detailed Operation Plan (as proposed 4 August 2006)***

#### **VESSEL**

FV Billy Rowney

#### **OBSERVERS**

1. Rob Forster

#### **OBJECTIVES**

1. To repeat the survey of Anglerfish in the western Channel (North) region carried out by Billy Rowney during 2004 and 2005, using chain mat gear.
  - Provide data on the distribution and catch rates of anglerfish and other commercial species using commercial gear, based on the agreed survey design;
  - Determine length compositions of anglerfish and other commercial species in the catches
  - Add to the time-series started in 2003

#### **FISHING GEAR**

The fishing gear to be fitted and used is two 10 (ten) metre beams with chain mat and flip up ropes to be fished at about 4 knots at all of the depths within the defined area.

#### **AREA OF OPERATION and TOW POSITIONS**

Fishing will be undertaken within British Fishery limits and within the area bounded by straight lines joining: Hartland Point, 51°06'N and 7° W, 49°N and 8° 15' W, 49° and 7° W and Lands End. Fishing will be conducted in a way which samples across the entire specified area if grounds permit.

Annex 1a shows the survey area divided into 15' x 15' boxes. Boxes where trawling cannot take place, or which lie well beyond the typical distribution of anglerfish, are to be indicated at the meeting. The remaining boxes will be divided into those where the main concentrations of anglerfish of any size are expected, and those where anglerfish are expected to be at lower abundance, based on previous FSP results and

fishermen's knowledge. More tows per box will be carried out in the main anglerfish areas, but all boxes covering suitable habitat for anglerfish should be sampled where possible in order to map the extent of the distribution. Details of sample tow positions (2004) are given in Annex 1b.

## **PERIOD OF SURVEY**

The vessel will depart on dates agreed between the skipper and observer within the period September to November 2006. The duration of the trip will be two periods of six continuous days. There will be a maximum of three days, between the two six day periods, in port to land fish and refuel.

## **FISHING ACTIVITIES**

Fishing will be required potentially over a 24- hour period with an uninterrupted period of 6 hours rest for the observer. Individual tows should cover the same distance as in the last two year's surveys, at approximately 4 knots over the ground, resulting in a typical tow duration of approx. 1 hour. In the event of very large catches requiring longer than normal processing, the time between hauling and shooting should be adjusted in consultation with the observer.

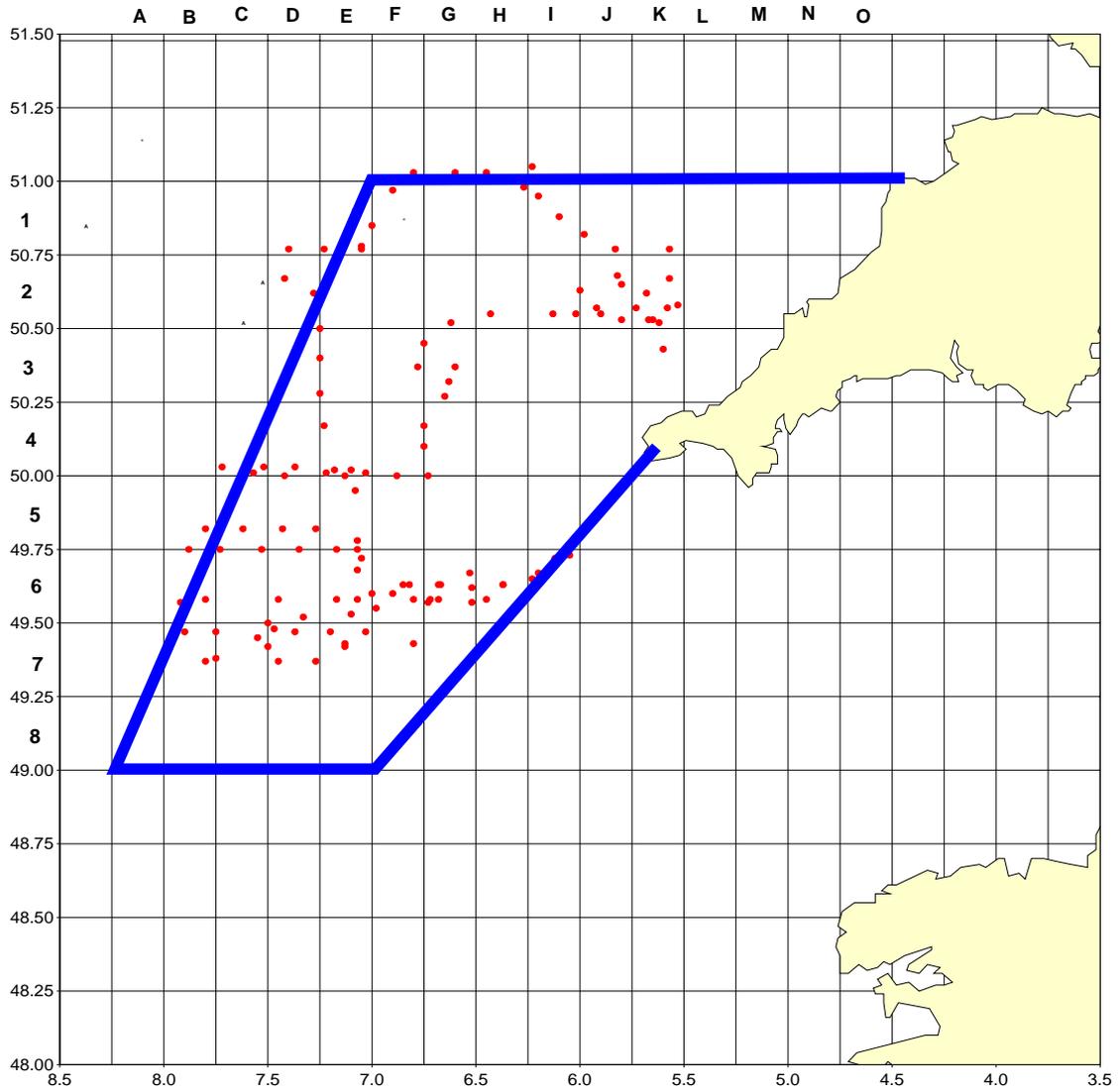
## **SORTING AND RECORDING THE CATCH**

It is important that the catches of anglerfish, sole, plaice, megrim, cod and other commercial species are quantified as accurately as possible. The crew will be required to assist in sorting the catch as required by the observer and preparing any fish for sale. Standard CEFAS methods for sorting and measuring commercial fish catches at sea will be carried out. The entire catch should be available to the observer for sampling, and none discarded without being recorded. Generally the catch will be sorted into three general categories:

1. Large and high value fish e.g. cod, turbot, John Dory and hake which may be landed or discarded but which can all be counted and measured (i.e. raising factor of 1.0).
2. The retained catch of other individuals of commercial species. The observer must be able to record the total number of boxes or baskets of retained fish of each species from each tow, and will carry out a length measure on either the whole catch (raising factor = 1.0) or a known sample of the catch (raising factor > 1.0).
3. Discarded anglerfish, cod, hake and sole. All off these species to be discarded will be retained for counting and measuring (raising factor up to 1.0 depending on numbers). An estimate of the total bulk of discards of other species (in addition to those in (1)) should be made from each tow. Where time permits, an estimate of the species composition of this discarded catch should be made.



Annex 1a: Map of the area within which sampling will be required. Tow positions from previous FSP trips are indicated.



**Western Channel Angler (South): September 2006**

***Detailed Operation Plan (as proposed 4 August 2006)***

**VESSEL**

FV Twilight III

**OBSERVERS**

2. Steve Warnes

**OBJECTIVES**

2. To repeat the survey of Anglerfish in the western Channel (South) region carried out by Twilight III during 2004 and 2005, using chain mat gear.
  - Provide data on the distribution and catch rates of anglerfish and other commercial species using commercial gear, based on the agreed survey design;
  - Determine length compositions of anglerfish and other commercial species in the catches
  - Add to the time-series started in 2003

**FISHING GEAR**

The fishing gear to be fitted and used is two 9 (nine) metre beams with chain mat and flip up ropes to be fished at about 4 knots at all of the depths within the defined area.

**AREA OF OPERATION and TOW POSITIONS**

Fishing will be undertaken within British Fishery limits and within the area bounded by straight lines joining: Salcombe, 49°30'N and 3° 50'W, 48°N and 7° 30' W, 50° and 7° 30' W and Lands End. Fishing will be conducted in a way which samples across the entire specified area if grounds permit.

Annex 1a shows the survey area divided into 15' x 15' boxes. Boxes where trawling cannot take place, or which lie well beyond the typical distribution of anglerfish, are to be indicated at the meeting. The remaining boxes will be divided into those where the main concentrations of anglerfish of any size are expected, and those where anglerfish are expected to be at lower abundance, based on previous FSP results and fishermen's knowledge. More tows per box will be carried out in the main anglerfish areas, but all boxes covering suitable habitat for anglerfish should be

sampled where possible in order to map the extent of the distribution. Details of sample tow positions (2004) are given in Annex 1b.

## **PERIOD OF SURVEY**

The vessel will depart take place on dates agreed between the skipper and observer within the period September to November 2006. The duration of the trip will be two periods of six continuous days. There will be a maximum of three days, between the two six day periods, in port to land fish and refuel.

## **FISHING ACTIVITIES**

Fishing will be required potentially over a 24- hour period with an uninterrupted period of 6 hours rest for the observer. Individual tows should cover the same distance as in the last two year's surveys, at approximately 4 knots over the ground, resulting in a typical tow duration of approx. 1 hour, weather conditions permitting. In the event of very large catches requiring longer than normal processing, the time between hauling and shooting should be adjusted in consultation with the observer.

## **SORTING AND RECORDING THE CATCH**

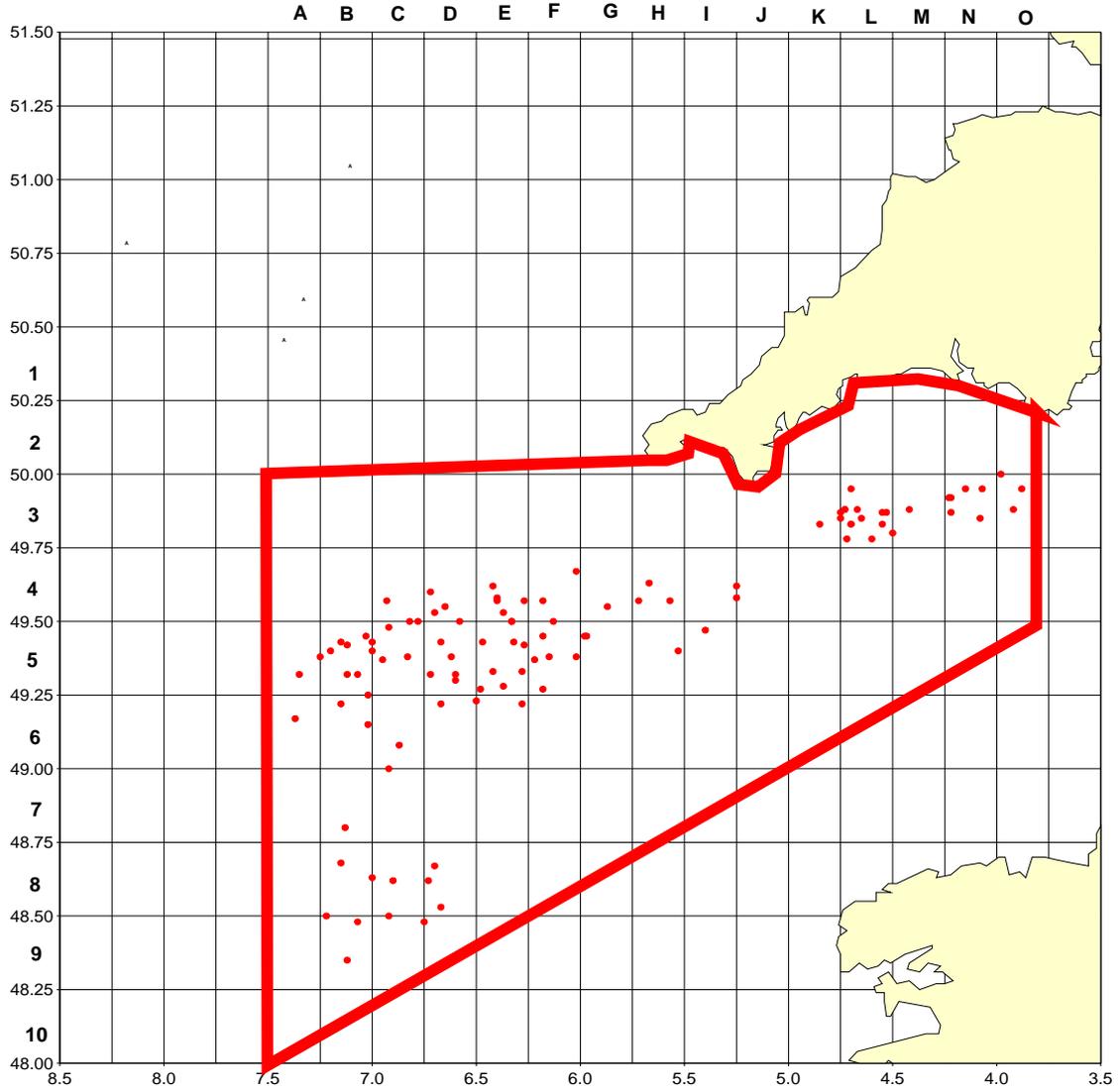
It is important that the catches of anglerfish, sole, plaice, megrim, cod and other commercial species are quantified as accurately as possible. The crew will be required to assist in sorting the catch as required by the observer and preparing any fish for sale. Standard CEFAS methods for sorting and measuring commercial fish catches at sea will be carried out. The entire catch should be available to the observer for sampling, and none discarded without being recorded. Generally the catch will be sorted into three general categories:

4. Large and high value fish e.g. cod, turbot, John Dory and hake which may be landed or discarded but which can all be counted and measured (i.e. raising factor of 1.0).
5. The retained catch of other individuals of commercial species. The observer must be able to record the total number of boxes or baskets of retained fish of each species from each tow, and will carry out a length measure on either the whole catch (raising factor = 1.0) or a known sample of the catch (raising factor > 1.0).
6. Discarded anglerfish, cod, hake and sole. All off these species to be discarded will be retained for counting and measuring (raising factor up to 1.0 depending on numbers). An estimate of the total bulk of discards of other species (in addition to those in (1)) should be made from each tow. Where time permits, an estimate of the species composition of this discarded catch should be made.

## **DATA TO BE RECORDED BY SKIPPER**



**Annex 1a:** Map of the area within which sampling will be required. Tow positions from previous FSP trips are indicated.



## **Appendix 2. Cruise reports**

**CENTRE FOR ENVIRONMENT, FISHERIES AND AQUACULTURE  
SCIENCE  
LOWESTOFT LABORATORY, LOWESTOFT, SUFFOLK NR33 OHT  
2006 FISHERIES SCIENCE PARTNERSHIP**

**MF008**

**A Study of Western Anglerfish**

**REPORT: FV BILLY ROWNEY (PZ 532) cruises 1 & 2.**

**SKIPPER: Steve Moseley**

**CEFAS STAFF: R Forster**

**DURATION:** Trip 1: 7<sup>th</sup> – 12<sup>th</sup> September 2006  
Trip 2: 23<sup>rd</sup> – 28<sup>th</sup> September 2006

**LOCATION:** ICES Sea areas VIIIf, g and h.

**AIMS:**

1. To repeat the survey of Anglerfish (*L. piscatorious* and *L. budegassa*) in the western Channel (North) region carried out by 'Billy Rowney' during 2004, using chain mat gear.
2. To provide data on the distribution and catch rates of anglerfish and other commercial species using commercial gear, based on the agreed survey design.
3. To determine length compositions of anglerfish and other commercial species in the catches).
4. To add to the time-series started in 2003.

**NARRATIVE:**

The area surveyed by FV 'Billy Rowney' is shown in Figure 1 of this report. Fishing was conducted using the vessel's normal gear (10m beam trawls fitted with chain mats and flip-up ropes), and was continuous in order to maximise geographical coverage. Towing speeds over the ground were kept at around 4.0 knots. Tow duration was generally 1.0 to 1.25 hours apart from two 2.75 h tows at night, and extension to 1.5 or 2.0 h during poor weather.

**Trip 1.**

FV 'Billy Rowney' sailed from Newlyn at 13:00hrs on 7<sup>th</sup> September 2006 to begin the fourth successive year of beam trawl surveys for monk in the Celtic Sea and W English Channel. Fishing began at 18:30 in ICES area VIIIf completing 1.0 to 1.25 h tows in each of the prescribed 15' x 15' areas as in the 2005 survey. Tows were generally carried out in an easterly or westerly direction, and a similar track across the

survey grid was followed as in the previous year. A total of 53 tows were successfully completed in statistical rectangles 29E4, 30E4, 30E3, and 29E3.

Weather conditions for the duration of the 6-day trip were excellent. There had been some concern about the strength of the tides affecting the survey plan or the validity of tows, but no problems were encountered in this respect.

'Stone holes' were left open for the duration of the trip to minimise damage to the catch. Gear damage during the course of the trip was very slight and tended to be limited to the loss of an occasional shackle in the chain mat. A small tear in the starboard belly occurred on tow 35 about 6-7 meshes behind the footrope but this did not appear to have any undue effect on the catch, and it was repaired immediately. The crew all helped with sorting and picking out the main species of interest enabling a smooth deck routine to be maintained throughout.

The gear was aboard by 14:00hrs on 12<sup>th</sup> September and 'Billy Rowney' arrived back in Newlyn at 18:00hrs.

## Trip 2.

'Billy Rowney' sailed from Newlyn at 14:00hrs on 23<sup>rd</sup> September and proceeded to north-west of the Isles of Scilly where the first leg of the survey had ended. Fishing began that evening at 21:30 with stone holes in the belly open. Sea conditions were good for the first four days allowing a zig-zag course to be made down the western half of the survey area. The passage of hurricane 'Helene' to the west on 27<sup>th</sup> September required tow direction to be altered to SW or NE, and tows to be extended to 2 hours duration.

The overall fishing pattern was maintained without interruption, and in spite of several quite sizable boulders being picked up on a number of tows there was no damage to the gear. There must have been slight differences in the way each beam trawl fished as catches of fish and benthos on the starboard side were consistently larger (by a factor of 1.5 –2), however, the by-catch of small hake (<30cm) tended to be greater on the port side. One explanation may have been a difference in the age and, therefore, weight of the chain mat of each beam trawl.

Catch rates of anglerfish by vessels fishing to the east of 'Billy Rowney' were reported to be slightly greater than those recorded during the second leg of the survey.

On 28<sup>th</sup> September the gear was aboard by 13:30 having completed 43 tows. FV 'Billy Rowney' arrived back in Newlyn with the evening tide at 20:30.

## Results

1. 96 tows were completed over the course of the two trips. All tows were valid for inclusion in the time series. The survey area was covered evenly as shown in Figure 1. The number of tows by ICES rectangle is summarised below:

ICES rectangle	Trip 1	Trip 2	Total
29E4	1		1
30E4	15		15
30E3	19		19
31E3	8		8
29E3	10	1	10
29E2		8	8
28E2		14	14
27E2		14	14
27E1		4	4
27E3		2	2
Grand total	53	43	96

2. Length distributions were obtained for both species of anglerfish by measuring the entire catch at each haul.
3. Length distributions were obtained for all commercial species retained at 86 stations.

Rob Forster 29<sup>th</sup> September 2006.



Appendix 2. Cruise reports continued

**CENTRE FOR ENVIRONMENT, FISHERIES AND AQUACULTURE  
SCIENCE  
LOWESTOFT LABORATORY, LOWESTOFT, SUFFOLK NR33 OHT  
2006 FISHERIES SCIENCE PARTNERSHIP**

**MF008**

**A Study of Western Anglerfish**

**REPORT: FV TWILIGHT III (PZ 137) cruises 1, 2 & 3.**

**SKIPPER: M Patterson**

**CEFAS STAFF: S Warnes**

**DURATION:** Trip 1: 4<sup>th</sup> - 6<sup>th</sup> September 2006  
Trip 2: 8<sup>th</sup> - 12<sup>th</sup> September 2006  
Trip 3: 14<sup>th</sup> - 17<sup>th</sup> September 2006

**LOCATION:** ICES Sea areas VIIe-h

**AIMS:**

5. To repeat the survey of Anglerfish (*L. piscatorious* and *L. budegassa*) in the western Channel (South) region carried out by Twilight III during 2004, using chain mat gear.
6. To provide data on the distribution and catch rates of anglerfish and other commercial species using commercial gear, based on the agreed survey design.
7. To determine length compositions of anglerfish and other commercial species in the catches).
8. To add to the time-series started in 2003.

**NARRATIVE:**

The terms of the dispensation restricted the area to be surveyed to UK waters outside the 12-mile limit. Because fishing on the 2003 and 2004 surveys showed no difference in Anglerfish catch rates between day and night, fishing was undertaken continuously rather than in daylight only, allowing a larger area to be surveyed. Where possible tow speed was kept at 4-5 knots.

Trip 1.

TWILIGHT III sailed from Newlyn 1630 on 4 September and proceeded to the West of the survey area to start fishing in VIIe. Fishing operations, using 9m beam-trawls with chain mats, commenced 18.15 on 4 September. Fishing in VIIe continued in good weather until 0545 6 September when TWILIGHT III was forced to head for Newlyn as the main engine turbo-charger had blown, docking at 1630 6 September.

### Trip 2.

TWILIGHT III sailed from Newlyn 1800 on 8 September and proceeded to head for VIIIh to continue to the South of the area worked on Trip 1. The weather remained fine and Twilight III worked the area with the strong spring tide. Fishing continued in VIIIh until 1245 12 September when TWILIGHT III headed to Newlyn docking at 1930 on the same day.

### Trip 3.

TWILIGHT III sailed from Newlyn 1315 on 14 September and headed to a position East of the Lizard fishing commenced at 1845 on the same day. Some areas covered on previous surveys were no longer fishable due to high concentrations of queen scallops on the (*Chlamys opercularis*) ground. Once the area available for sampling to the East of the Lizard had been covered TWILIGHT III steamed SW to VIIIh to fish areas already covered during the high spring tide of the previous week. Fishing ceased at 0945 17 September at which time TWILIGHT III headed for Newlyn docking at 1400 the same day.

## Results

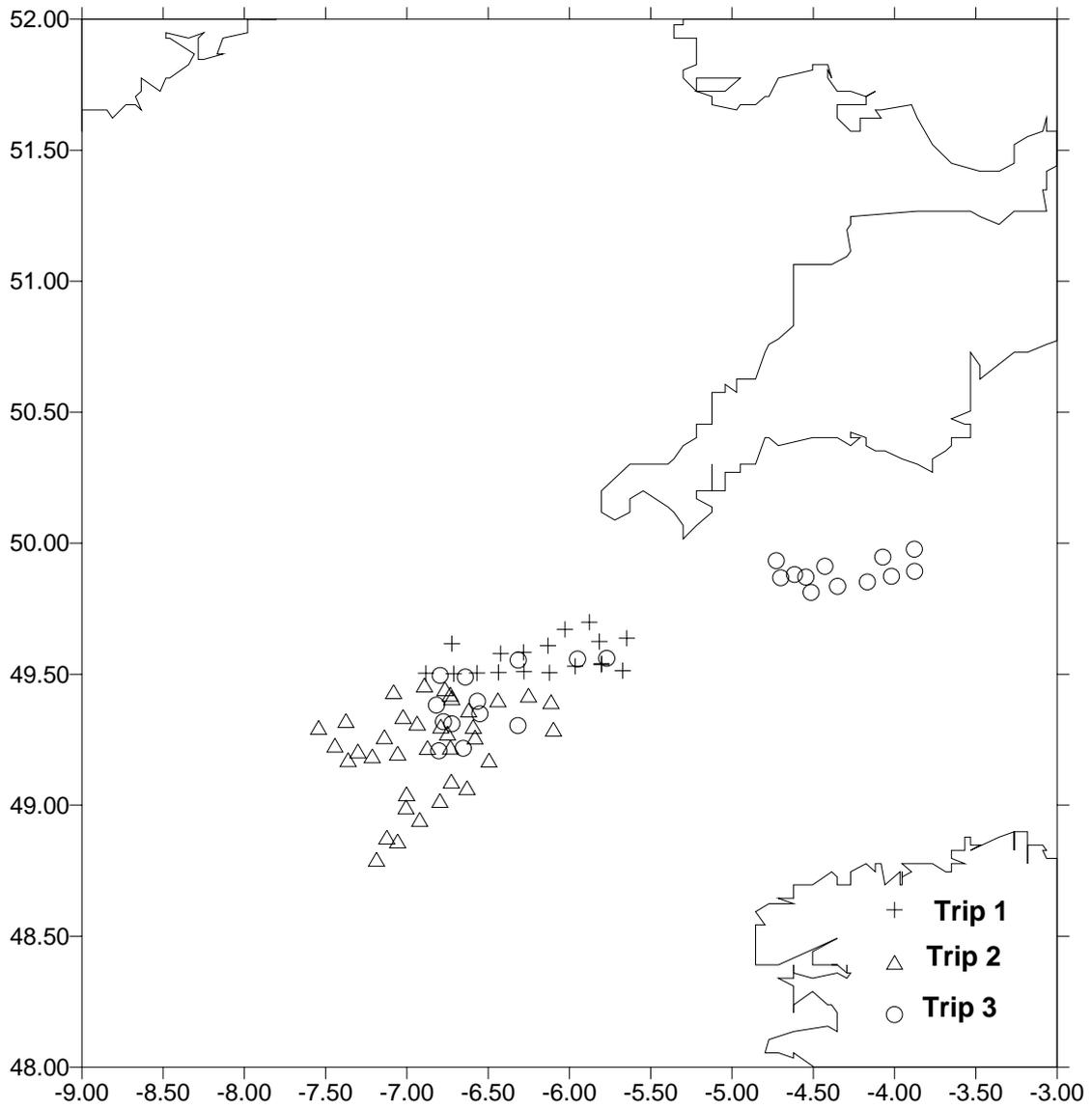
4. TWILIGHT III completed XX tows over the three survey trips. Figure 1 gives the position of the successful tows. The number of tows with catch data by ICES Rectangle is given below.

ICES Rectangle	Trip 1	Trip 2	Trip 3	Total
26E2		3		3
26E3		2		2
27E2		10		10
27E3		21	10	31
28E3	11		1	12
28E4	7		2	9
28E5			9	9
28E6			3	3
Grand Total	18	36	25	79

5. Length distributions of all Anglerfish, by species, were obtained at each haul for both retained and discarded fish.
6. At 74 stations length distributions were obtained for all commercial species retained.
7. Reasonable weather conditions enabled the survey area to be covered adequately for use in the time-series. However the high density of queen scallops East of the Lizard, in Falmouth Bay, reduced the coverage that was possible in this area.

S Warnes 17 September 2006.

**Figure 1. TWILIGHT III Tow position by trip**



**Appendix. 3. Tow details and numbers of fish caught for selected species (database of all sampled species is held at Cefas)**

Discard sampling was carried out at all stations for anglerfish, cod, hake, sole, and plaice, but not for megrim or lemon sole.

**Species codes:**

MON: anglerfish (*L. piscatorius*), WAF: anglerfish (*L. budegassa*), MEG: megrim, LEM: lemon sole, SOL: sole, PLE: plaice, COD: cod, HKE: hake

Cruise	Stn	Shot			Haul			Date	Time	TowMins	Rect	Valid	Species										
		LatDeg	LatMin	LonDeg	LonMin	LatDeg	LatMin						LonDeg	LonMin	MON	WAF	MEG	LEM	SOL	PLE	COD	HKE	
BILL 1/06	1	50	25	5	35	50	28	5	29	07/09/2006	18:35	75	29E4	V	49		17	73				15	2
BILL 1/06	2	50	29	5	28	50	33	5	26	07/09/2006	20:05	75	29E4	V	18	2	15	77	3			1	
BILL 1/06	3	50	32	5	28	50	31	5	35	07/09/2006	21:35	75	30E4	V	47		23	80	1	1		6	
BILL 1/06	4	50	31	5	38	50	32	5	34	07/09/2006	23:00	180	30E4	V	83								
BILL 1/06	5	50	32	5	56	50	38	5	38	08/09/2006	03:15	180	30E4	V	208	3	93	470	2			18	2
BILL 1/06	6	50	38	5	34	50	40	5	31	08/09/2006	07:45	75	30E4	V	107	1	22	142	8			3	
BILL 1/06	7	50	40	5	33	50	40	5	41	08/09/2006	09:15	75	30E4	V	71	2	45	154	10	1	11	11	2
BILL 1/06	8	50	40	5	43	50	40	5	51	08/09/2006	10:50	75	30E4	V	54		69	94	15	3	13	13	6
BILL 1/06	9	50	40	5	53	50	41	5	59	08/09/2006	12:25	85	30E4	V	77	3	110	76	3			2	
BILL 1/06	10	50	41	5	59	50	45	5	54	08/09/2006	14:00	75	30E4	V	67	2	33	33	15	7	9	9	3
BILL 1/06	11	50	45	5	53	50	46	5	45	08/09/2006	15:35	75	30E4	V	52	2	59	64	13	11	3	5	
BILL 1/06	12	50	46	5	44	50	46	5	35	08/09/2006	17:05	75	30E4	V	71		14	32	8	1	19	2	
BILL 1/06	13	50	47	5	34	50	45	5	27	08/09/2006	19:25	75	30E4	V	94	1	19	91	3			7	
BILL 1/06	14	50	45	5	26	50	48	5	26	08/09/2006	21:10	75	30E4	V	70		18	100	14	1	9		
BILL 1/06	15	50	48	5	28	50	49	5	37	08/09/2006	22:45	75	30E4	V	97		38	132	16	14	11	1	
BILL 1/06	16	50	49	5	40	50	50	5	59	09/09/2006	00:15	180	30E4	V	69								
BILL 1/06	17	50	50	6	0	51	2	6	6	09/09/2006	03:45	180	31E3	V	85		70	12	58	5	8	16	
BILL 1/06	18	51	2	6	8	51	2	6	18	09/09/2006	08:00	80	31E3	V	49	6	76	12	2			6	6
BILL 1/06	19	51	2	6	21	51	3	6	30	09/09/2006	09:45	75	31E3	V	41	1	70	24	1	2	2		
BILL 1/06	20	51	3	6	31	51	3	6	40	09/09/2006	11:20	75	31E3	V	43		72	12	5	5	4	14	
BILL 1/06	21	51	3	6	42	51	4	6	51	09/09/2006	13:10	75	31E3	V	26	8	140	14	2	8	6	20	
BILL 1/06	22	51	4	6	52	51	3	6	58	09/09/2006	14:40	75	31E3	V	38	3	74	17	4	5		25	

Cruise	Stn	Shot			Haul					Date	Time	TowMins	Rect	Valid	Species							
		LatDeg	LatMin	LonDeg	LonMin	LatDeg	LatMin	LonDeg	LonMin						MON	WAF	MEG	LEM	SOL	PLE	COD	HKE
BILL 1/06	23	51	2	6	57	51	0	6	51	09/09/2006	16:10	75	31E3	V	32	3	25	21	3	3	4	14
BILL 1/06	24	51	0	6	44	50	59	6	35	09/09/2006	18:20	75	30E3	V	31	1	74	18			5	4
BILL 1/06	25	50	59	6	33	50	59	6	25	09/09/2006	19:50	75	30E3	V	27		64	13	2		7	
BILL 1/06	26	50	59	6	24	51	0	6	16	09/09/2006	21:30	75	31E3	V	26		70	27			6	1
BILL 1/06	27	50	59	6	15	50	54	6	15	09/09/2006	23:10	75	30E3	V	30	3	66	4	1	1	6	
BILL 1/06	28	50	54	6	18	50	54	6	37	10/09/2006	00:45	180	30E3	V	29							
BILL 1/06	29	50	54	6	39	50	50	6	54	10/09/2006	04:15	180	30E3	V	37	3	277.5	46.5	1.5		17	5
BILL 1/06	30	50	48	6	52	50	47	6	44	10/09/2006	08:45	75	30E3	V	31	4	86	14	1	2	6	2
BILL 1/06	31	50	47	6	43	50	47	6	36	10/09/2006	10:20	75	30E3	V	16	3	64	12	1	3	2	1
BILL 1/06	32	50	47	6	35	50	47	6	26	10/09/2006	11:55	75	30E3	V	30	3	114	23	1	2	2	3
BILL 1/06	33	50	47	6	26	50	47	6	17	10/09/2006	13:25	75	30E3	V	11	1	71	8	1		2	3
BILL 1/06	34	50	47	6	15	50	47	6	6	10/09/2006	15:10	75	30E3	V	53	3	70	21	8	1	5	5
BILL 1/06	35	50	46	6	5	50	41	6	4	10/09/2006	16:45	75	30E3	V	31	5	57	34	10	3	7	5
BILL 1/06	36	50	41	6	3	50	37	6	7	10/09/2006	18:30	75	30E3	V	42	1	56	24	3		4	
BILL 1/06	37	50	38	6	11	50	38	6	19	10/09/2006	21:00	75	30E3	V	23	5	69	33	8	1	15	
BILL 1/06	38	50	38	6	21	50	38	6	29	10/09/2006	22:35	75	30E3	V	23		114	36	13		5	2
BILL 1/06	39	50	37	6	31	50	37	6	40	11/09/2006	00:05	75	30E3	V	18	6	64	20	14	1	4	3
BILL 1/06	40	50	37	6	42	50	33	6	57	11/09/2006	01:45	180	30E3	V	25	15						
BILL 1/06	41	50	32	6	56	50	33	6	35	11/09/2006	05:15	180	30E3	V	28	11	138	46	16		8	4
BILL 1/06	42	50	33	6	32	50	33	6	23	11/09/2006	09:15	75	30E3	V	24	4	68	22	8	1	10	2
BILL 1/06	43	50	33	6	22	50	32	6	12	11/09/2006	10:40	80	30E3	V	40	4	58.5	13.5	2	2	6	1
BILL 1/06	44	50	32	6	12	50	28	6	16	11/09/2006	11:30	195	29E3	V	58	3	48	28	3		2	5
BILL 1/06	45	50	28	6	18	50	27	6	27	11/09/2006	14:10	75	29E3	V	48	3	84	24	3	1	5	1
BILL 1/06	46	50	27	6	29	50	27	6	37	11/09/2006	15:45	75	29E3	V	18	4	48	24	4	2	6	2
BILL 1/06	47	50	27	6	38	50	26	6	45	11/09/2006	17:15	75	29E3	V	23	4	44	20	9		2	22
BILL 1/06	48	50	26	6	46	50	26	6	26	11/09/2006	19:00	80	29E3	V	17	3	45	15	9		1	21
BILL 1/06	49	50	24	6	56	50	21	6	54	11/09/2006	21:10	75	29E3	V	20	2	54	38	15		2	2
BILL 1/06	50	50	21	6	52	50	21	6	45	11/09/2006	22:45	75	29E3	V	39	3	122	50	5	1	5	
BILL 1/06	51	50	21	6	43	50	20	6	37	12/09/2006	00:15	75	29E3	V	37		72	24	9	7	2	1

Cruise	Stn	Shot				Haul				Date	Time	TowMins	Rect	Valid	Species								
		LatDeg	LatMin	LonDeg	LonMin	LatDeg	LatMin	LonDeg	LonMin						MON	WAF	MEG	LEM	SOL	PLE	COD	HKE	
BILL 1/06	52	50	20	6	37	50	13	6	44	12/09/2006	01:40	180	29E3	V	64	1							
BILL 1/06	53	50	13	6	44	50	19	6	37	12/09/2006	04:55	180	29E3	V	78	3	200	45	11	7	17	4	
BILL 2/06	1	50	14	6	42	50	15	6	50	23/09/2006	21:30	75	29E3	V	40	1	70	46	4	3	8	2	
BILL 2/06	2	50	15	6	52	50	15	7	11	23/09/2006	23:15	180	29E2	V	42	9							
BILL 2/06	3	50	15	7	12	50	11	7	26	24/09/2006	02:45	180	29E2	V	17	22	97.5	12	17			8	
BILL 2/06	4	50	10	7	24	50	8	7	17	24/09/2006	06:00	75	29E2	V	8	8	102	4	10			3	1
BILL 2/06	5	50	6	7	14	50	2	7	9	24/09/2006	08:15	75	29E2	V	8	8	87	7.5	10			1	1
BILL 2/06	6	50	1	7	8	50	0	7	0	24/09/2006	10:00	75	29E2	V	9	5	80	10	40			1	1
BILL 2/06	7	50	0	7	2	50	0	7	11	24/09/2006	11:45	75	29E2	V	11	3	62	14	18			3	8
BILL 2/06	8	50	0	7	13	50	0	7	21	24/09/2006	13:30	75	29E2	V	6	4	104	1	12			2	5
BILL 2/06	9	50	0	7	23	50	0	7	31	24/09/2006	15:15	75	29E2	V	10	9	52		17			1	8
BILL 2/06	10	50	0	7	32	49	57	7	23	24/09/2006	17:00	75	28E2	V	6	15	55		10			1	27
BILL 2/06	11	49	54	7	16	49	52	7	7	24/09/2006	20:00	75	28E2	V	9	9	86		19	1	4	19	
BILL 2/06	12	49	51	7	5	49	51	7	4	24/09/2006	21:45	75	28E2	V	5	2	74	1	12			1	6
BILL 2/06	13	49	50	7	5	49	50	7	15	24/09/2006	23:30	75	28E2	V	4	5	75		25			6	15
BILL 2/06	14	49	50	7	17	50	0	7	33	25/09/2006	01:15	180	28E2	V	4	11							
BILL 2/06	15	49	50	7	35	49	42	7	21	25/09/2006	04:45	180	28E2	V	6	17	38		11			1	24
BILL 2/06	16	49	44	7	15	49	42	7	7	25/09/2006	09:00	75	28E2	V	7	14	64.5		13				6
BILL 2/06	17	49	41	7	5	49	40	7	5	25/09/2006	10:45	90	28E2	V	6	5	70		25	1	3	3	
BILL 2/06	18	49	40	7	7	49	40	7	17	25/09/2006	13:00	75	28E2	V	8	8	66						1
BILL 2/06	19	49	40	7	18	49	40	7	27	25/09/2006	14:45	75	28E2	V	3	9	92		11				
BILL 2/06	20	49	40	7	28	49	40	7	36	25/09/2006	16:30	75	28E2	V	3	2	97		4				9
BILL 2/06	21	49	40	7	40	49	36	7	32	25/09/2006	19:00	75	28E2	V	2	4	77		1				8
BILL 2/06	22	49	36	7	30	49	35	7	23	25/09/2006	20:45	75	28E2	V	6	1	62		9				
BILL 2/06	23	49	34	7	21	49	32	7	14	25/09/2006	22:30	75	28E2	V	4	3	78		11			1	6
BILL 2/06	24	49	32	7	13	49	25	7	4	26/09/2006	00:15	180	27E2	V	11	8							
BILL 2/06	25	49	26	7	7	49	26	7	25	26/09/2006	04:00	180	27E2	V	13	5	133.5		17	1	3	2	
BILL 2/06	26	49	26	7	29	49	26	7	38	26/09/2006	08:15	75	27E2	V	6	8	95		11				

Cruise	Stn	Shot				Haul				Date	Time	TowMins	Rect	Valid	Species							
		LatDeg	LatMin	LonDeg	LonMin	LatDeg	LatMin	LonDeg	LonMin						MON	WAF	MEG	LEM	SOL	PLE	COD	HKE
BILL 2/06	27	49	26	7	40	49	26	7	48	26/09/2006	10:00	75	27E2	V		2	158		6	3	2	1
BILL 2/06	28	49	26	7	50	49	26	7	59	26/09/2006	11:45	75	27E2	V	4	4	69		9	2		5
BILL 2/06	29	49	23	8	0	49	18	8	3	26/09/2006	14:15	75	27E1	V	5	3	114		6	3		3
BILL 2/06	30	49	17	8	3	49	10	8	7	26/09/2006	16:00	105	27E1	V	7	4	262		2		1	
BILL 2/06	31	49	10	8	7	49	2	8	12	26/09/2006	18:30	105	27E1	V	35	11	69	3	1			
BILL 2/06	32	49	1	8	12	49	0	8	6	26/09/2006	20:45	105	27E1	V	11	8	153	9				1
BILL 2/06	33	49	0	8	4	49	5	7	57	26/09/2006	23:00	105	27E2	V	2	3	93	1	2	1		
BILL 2/06	34	49	6	7	56	49	19	7	48	27/09/2006	01:15	180	27E2	V	31	10						
BILL 2/06	35	49	20	7	46	49	24	7	29	27/09/2006	04:45	180	27E2	V	23	6	136	14	17	6		7
BILL 2/06	36	49	25	7	28	49	17	7	33	27/09/2006	09:00	135	27E2	V	12	12	228		21		1	4
BILL 2/06	37	49	16	7	32	49	8	7	37	27/09/2006	12:00	135	27E2	V	20	6	330	3	1		2	4
BILL 2/06	38	49	9	7	37	49	1	7	39	27/09/2006	15:45	135	27E2	V	34	6	258	3				4
BILL 2/06	39	49	3	7	34	49	3	7	20	27/09/2006	19:00	135	27E2	V	18	3	132	9	5			1
BILL 2/06	40	49	3	7	18	49	11	7	14	27/09/2006	21:45	135	27E2	V	23	7	136	6	7	1		
BILL 2/06	41	49	12	7	14	49	20	7	8	28/09/2006	00:30	165	27E2	V	28	8						
BILL 2/06	42	49	21	7	6	49	22	6	51	28/09/2006	03:45	165	27E3	V	52	24	178	5	25	11	1	21
BILL 2/06	43	49	21	6	48	49	24	6	31	28/09/2006	07:00	165	27E3	V	19	7	85	7	15	3	1	
TWIL 1/06	1	49	41.9	5	52.7	49	40.77	6	0.22	04/09/2006	18:15	75	28E4	V	32	3	26	24	1		1	2
TWIL 1/06	2	49	40.24	6	1.67	49	37.1	6	6.6	04/09/2006	19:45	75	28E3	V	32	2	41	21	9	1	1	1
TWIL 1/06	3	49	36.5	6	7.9	49	35	6	17	04/09/2006	21:15	75	28E3	V	32	5	36	35	13		3	
TWIL 1/06	4	49	35	6	17	49	34.7	6	25.4	04/09/2006	22:45	75	28E3	V	20	5	47	26	25	8		
TWIL 1/06	5	49	34.7	6	25.4	49	37	6	43.2	05/09/2006	00:15	180	28E3	V	33	4						
TWIL 1/06	6	49	37	6	43.4	49	30.3	6	53.1	05/09/2006	03:30	180	28E3	V	43	9	104	16	42	12		1
TWIL 1/06	7	49	30.2	6	53	49	30.09	6	43.86	05/09/2006	07:15	75	28E3	V	8	3	72	4	15	3		3
TWIL 1/06	8	49	30.09	6	42.7	49	30.13	6	35.47	05/09/2006	08:45	75	28E3	V	14	3	49	6	8	3		8
TWIL 1/06	9	49	30.24	6	34.11	49	30.4	6	26.2	05/09/2006	10:15	75	28E3	V	13	1	39	8	16	12		6
TWIL 1/06	10	49	30.4	6	26.2	49	30.6	6	16.8	05/09/2006	11:45	75	28E3	V	30	3	54	23	17	7	1	8
TWIL 1/06	11	49	30.6	6	16.8	49	30.4	6	7.6	05/09/2006	13:15	75	28E3	V	41	2	84	20	1	1		4
TWIL 1/06	12	49	30.3	6	7.4	49	31.8	5	57.9	05/09/2006	14:45	90	28E3	V	40	1	37	29	7		2	3

Cruise	Stn	Shot				Haul				Date	Time	TowMins	Rect	Valid	Species							
		LatDeg	LatMin	LonDeg	LonMin	LatDeg	LatMin	LonDeg	LonMin						MON	WAF	MEG	LEM	SOL	PLE	COD	HKE
TWIL 1/06	13	49	31.8	5	57.9	49	32.2	5	48.2	05/09/2006	16:30	75	28E4	V	27	3	21	41	2		1	
TWIL 1/06	14	49	32.2	5	48.2	49	30.8	5	40.3	05/09/2006	18:00	90	28E4	V	44	1	21	14	2			
TWIL 1/06	15	49	30.8	5	40.3	49	32.2	5	46.56	05/09/2006	19:45	75	28E4	V	34		13	12	1		1	
TWIL 1/06	16	49	32.43	5	48.1	49	36.56	5	48.9	05/09/2006	21:15	75	28E4	V	34	1	15	33		1		
TWIL 1/06	17	49	37.46	5	48.98	49	38.3	5	38.8	05/09/2006	23:00	180	28E4	V	75							
TWIL 1/06	18	49	38.2	5	38.8	49	36.6	5	22.2	06/09/2006	02:20	190	28E4	V	107	2	26	46	8	4	5	
TWIL 1/06	19	49	36.6	5	22.2	49	36.6	5	22.2	06/09/2006	05:45	0	28E4	I								
TWIL 2/06	1	49	16.5	6	45	49	25.51	6	45.39	09/09/2006	01:45	180	27E3	V	16	3						
TWIL 2/06	2	49	26.66	6	45.94	49	27.6	6	27.5	09/09/2006	05:00	180	27E3	V	27	2	140	16	42	20		6
TWIL 2/06	3	49	24.1	6	26.4	49	18	6	35.5	09/09/2006	09:15	90	27E3	V	9	3	67	3	7	4		2
TWIL 2/06	4	49	18	6	35.5	49	13.3	6	43.9	09/09/2006	11:00	75	27E3	V	8	1	58	2	9	4		2
TWIL 2/06	5	49	13.3	6	43.9	49	13.6	6	52.4	09/09/2006	12:30	75	27E3	V	6	2	65	8	13	6		2
TWIL 2/06	6	49	13.2	6	52.4	49	18.8	6	56.4	09/09/2006	14:15	75	27E3	V	18	2	90	4	11	6		3
TWIL 2/06	7	49	18.8	6	56.2	49	18.2	6	49.12	09/09/2006	15:45	75	27E3	V	14	3	60	2	11	7		2
TWIL 2/06	8	49	18.13	6	47.46	49	17	6	39.46	09/09/2006	17:15	75	27E3	V	7	1	60	2	10	3	3	2
TWIL 2/06	9	49	15.57	6	34.86	49	10.5	6	29.7	09/09/2006	20:00	75	27E3	V	8		48	3	9	1		
TWIL 2/06	10	49	10.3	6	29.7	49	4	6	37.7	09/09/2006	21:30	75	27E3	V	13		38	9	4		2	1
TWIL 2/06	11	49	4	6	37.8	49	1.3	6	59.2	09/09/2006	23:15	195	27E3	V	46	3						
TWIL 2/06	12	49	2.6	7	0.1	49	9.2	6	45.7	10/09/2006	03:15	180	27E3	V	37	9	212	4	16	4	1	7
TWIL 2/06	13	49	5.5	6	43.6	49	1.67	6	46.89	10/09/2006	08:00	75	27E3	V	11	5	62	4	4			
TWIL 2/06	14	49	1.08	6	47.82	48	57.56	6	53.76	10/09/2006	09:30	75	26E3	V	14	5	89	8	18			3
TWIL 2/06	15	48	56.72	6	55.27	48	53.4	7	1.4	10/09/2006	11:00	75	26E3	V	15	6	76	9	4		1	3
TWIL 2/06	16	48	51.8	7	3.4	48	48.6	7	9.6	10/09/2006	12:45	75	26E2	V	8		100	9	1			
TWIL 2/06	17	48	47.6	7	11.2	48	51.2	7	7.8	10/09/2006	14:30	75	26E2	V	14	2	89	9			1	1
TWIL 2/06	18	48	52.7	7	7.4	48	58.4	7	3.7	10/09/2006	16:15	75	26E2	V	20	2	87	8	4	2	1	
TWIL 2/06	19	48	59.6	7	0.3	49	3.2	6	54.7	10/09/2006	18:00	75	27E3	V	29	4	96	3	5		1	
TWIL 2/06	20	49	11.9	7	3.4	49	11.64	7	10.81	10/09/2006	21:30	75	27E2	V	4	3	80	1	6			
TWIL 2/06	21	49	11.28	7	12.8	49	10.51	7	19.71	10/09/2006	23:00	75	27E2	V	3		42	1	5		1	2
TWIL 2/06	22	49	10.4	7	21.7	49	17.8	7	32.8	11/09/2006	00:30	180	27E2	V	7	6						

Cruise	Stn	Shot				Haul				Date	Time	TowMins	Rect	Valid	Species								
		LatDeg	LatMin	LonDeg	LonMin	LatDeg	LatMin	LonDeg	LonMin						MON	WAF	MEG	LEM	SOL	PLE	COD	HKE	
TWIL 2/06	23	49	17.8	7	32.6	49	24.3	7	10.6	11/09/2006	04:00	180	27E2	V	33	11	208	2	16	4	7	3	
TWIL 2/06	24	49	26	7	4.9	49	20.4	7	1.4	11/09/2006	08:30	75	27E2	V	11	8	60		15	3	1	2	
TWIL 2/06	25	49	20.3	7	1.4	49	15.7	7	8.3	11/09/2006	10:15	75	27E2	V	8	1	80	4	4	5	3	4	
TWIL 2/06	26	49	15.7	7	8.3	49	12.46	7	16.38	11/09/2006	11:45	90	27E2	V	5	6	85		21	5	3		
TWIL 2/06	27	49	12.39	7	18.06	49	12.72	7	26.12	11/09/2006	13:30	75	27E2	V	6		75	1	10		2	3	
TWIL 2/06	28	49	13.72	7	26.57	49	19.3	7	22.7	11/09/2006	15:00	75	27E2	V	8	7	101		5	2			
TWIL 2/06	29	49	19.4	7	22.5	49	18.4	7	10.3	11/09/2006	16:45	75	27E2	V	13	4	79	1	6				
TWIL 2/06	30	49	27.5	6	53.5	49	25.4	6	44	11/09/2006	21:00	75	27E3	V	3	3	52	2	24	5		1	
TWIL 2/06	31	49	25.4	6	44	49	21.9	6	37.1	11/09/2006	22:45	75	27E3	V	6	2	74	4	11	2	1	1	
TWIL 2/06	32	49	21.8	6	37.2	49	23.31	6	44.4	12/09/2006	00:15	180	27E3	V	11	2							
TWIL 2/06	33	49	24.57	6	43.46	49	27.5	6	25.2	12/09/2006	04:30	180	27E3	V	23	1	134	28	66	32	1	3	
TWIL 2/06	34	49	25.2	6	15.1	49	23.8	6	6.8	12/09/2006	08:30	75	27E3	V	24	1	37	4	15	7		1	
TWIL 2/06	35	49	23.7	6	6.8	49	17.4	6	5.7	12/09/2006	10:00	75	27E3	V	17		29	20	6	1	2	1	
TWIL 2/06	36	49	17.4	6	5.9	49	14.9	6	12.2	12/09/2006	11:30	75	27E3	V	16		33	10			2	2	
TWIL 3/06	1	49	52.2	4	32.7	49	51.7	4	41.04	14/09/2006	18:45	75	28E5	V	20		1	26	5	1	5		
TWIL 3/06	2	49	52.08	4	42.02	49	55.66	4	45	14/09/2006	20:15	75	28E5	V	24			32	16			5	
TWIL 3/06	3	49	55.98	4	43.62	49	52.8	4	36.9	14/09/2006	21:45	75	28E5	V	19		3	31	10	2	3		
TWIL 3/06	4	49	52.8	4	36.9	49	53.6	4	29.2	14/09/2006	23:15	75	28E5	V	30			34	18	2	1		
TWIL 3/06	5	49	54.7	4	25.7	49	56.8	4	4.3	15/09/2006	01:15	180	28E5	V	33								
TWIL 3/06	6	49	56.8	4	4.3	49	59.6	3	55.3	15/09/2006	04:45	180	28E6	V	14			30	48	280			
TWIL 3/06	7	49	58.6	3	52.7	49	54.03	3	51.7	15/09/2006	09:30	75	28E6	V	6			10	14	77			
TWIL 3/06	8	49	53.54	3	52.55	49	52.61	4	0.27	15/09/2006	11:00	75	28E6	V	7			10	4	25	1		
TWIL 3/06	9	49	52.38	4	1.14	49	51.1	4	10	15/09/2006	12:30	75	28E5	V	5			6	9	15			
TWIL 3/06	10	49	51.1	4	10	49	50.1	4	20.9	15/09/2006	14:15	75	28E5	V	10			9	12	28	2		
TWIL 3/06	11	49	50.1	4	21	49	48.7	4	30.7	15/09/2006	16:00	75	28E5	V	23		1	25	6	5			
TWIL 3/06	12	49	48.7	4	30.8	49	47.4	4	38.5	15/09/2006	17:30	75	28E5	V	34			28	3	2	1		
TWIL 3/06	13	49	18.2	6	19	49	13.1	6	36.8	16/09/2006	03:30	180	27E3	V	27	4	78	10	22	4	1	2	
TWIL 3/06	14	49	13	6	39.2	49	12.4	6	48.2	16/09/2006	07:45	75	27E3	V	15	1	54		12	4	2	1	
TWIL 3/06	15	49	12.4	6	48.2	49	19.1	6	46.6	16/09/2006	09:30	75	27E3	V	12	3	71	6	6	2	2	3	

Cruise	Stn	Shot				Haul				Date	Time	TowMins	Rect	Valid	Species							
		LatDeg	LatMin	LonDeg	LonMin	LatDeg	LatMin	LonDeg	LonMin						MON	WAF	MEG	LEM	SOL	PLE	COD	HKE
TWIL 3/06	16	49	19.1	6	46.5	49	22.93	6	41.27	16/09/2006	11:15	75	27E3	V	7	1	83		10	4	1	3
TWIL 3/06	17	49	23.79	6	33.97	49	21.06	6	32.49	16/09/2006	13:00	75	27E3	V	9	2	72	4	19	4		1
TWIL 3/06	18	49	20.89	6	33.05	49	18.6	6	43.3	16/09/2006	14:45	75	27E3	V	8	5	87	5	21	6		3
TWIL 3/06	19	49	18.6	6	43.4	49	18.2	6	53.9	16/09/2006	16:30	105	27E3	V	6	2	66	2	23	4	2	
TWIL 3/06	20	49	22.9	6	49.1	49	29.7	6	47.8	16/09/2006	20:00	75	27E3	V	11	2	67	2	22	11		
TWIL 3/06	21	49	29.7	6	47.7	49	29.3	6	38.4	16/09/2006	21:30	75	27E3	V	12	3	62	7	22	5		3
TWIL 3/06	22	49	29.3	6	38.4	49	33.2	6	19	16/09/2006	23:15	180	27E3	V	32	6						
TWIL 3/06	23	49	33.2	6	18.9	49	33.43	6	0.55	17/09/2006	02:30	195	28E3	V	75	6	96	62	10	4	4	1
TWIL 3/06	24	49	33.46	5	56.97	49	33.5	5	46.3	17/09/2006	06:45	75	28E4	V	51	3	26	23	2		3	4
TWIL 3/06	25	49	33.6	5	46.2	49	36.6	5	38.1	17/09/2006	08:30	75	28E4	V	27	1	23	26	9	4		