Falkland Island Fisheries Department

Fishery Report

Loligo gahi, Second Season 2008

Fishery Statistics, Biological Trends, Stock Assessment and Risk Analysis

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- May 2009 -

INDEX

Page

I. SUMMARY

Loligo catch during the second season (July/15-September/30, 2008) was 26,996 tonnes, which was 12% greater than in second season 2007. The fishing effort increased (25%) but the catch rates decreased (11%). In a historical perspective second season 2008 catch was of a medium-high level. Although CPUE was lower than in 2007, since the lowest historical CPUE recorded in 1997, the CPUE has showed a highly variable but increasing trend. Since 2002 the fishing effort has been relatively stable in comparison with the high levels recorded in 1993-1996. During second season 2008, 68% of the squid were caught in the northern area, 27% in the southern area and 5% in the central area. The catch rates (20.1-23.4 tonnes/h) were similar in all the areas, although the highest rates were achieved in the northern area and the lowest ones in the central area.

The fleet started fishing in Beauchene area, with low CPUE (20 tonnes/vessel-day) during the first week. The second week started with high CPUE (40 tonnes/vessel-day) but quickly decreased to low CPUE (14 tonnes/vessel-day). Then the fleet moved to explore the central and northern areas, and remained mainly in the northern area for the rest of the season. Average CPUE during August and September were similar (23-24 tonnes/vessel-day), however during the first and the third week of September two groups of squid arrived that increased the CPUE (40-30 tonnes/vessel-day) during few days.

Biological trends in proportion of mature individuals and proportion of females were similar to previous second seasons. The average mantle length was 13.31 cm, which was 1.3 cm shorter than in 2007, similar to in 2006 and 2.1 cm shorter than in 2005. Three squid groups arrived sequentially to the Beauchene area and three groups to the central-northern area. In-season stock assessment based on the first month of the

season projected an escapement biomass lower than the limit, therefore an early fishery closure warning was sent to the fishing industry. Later the arrivals of new squid groups increased the biomass and allowed the normal ending of the season. The whole biomass, the one that was present at the start of the season plus the ones that arrived during the season, was estimated at 40,228 tonnes. The escapement spawning biomass was estimated at 9,798 tonnes, with a coefficient of variation of 63%. The probability (risk) of surpassing the conservation limit (10,000 tonnes) was estimated at 0.4.

II. INTRODUCTION

Just before the beginning of the second season, *Loligo* biomass was estimated at 14,453 tonnes using a swept area survey (Payá 2008). This biomass was 73% and 63% of the biomasses estimated in 2007 and 2006 July surveys. However the oceanographic information showed that *Loligo* had not fully entered to the *Loligo* box because it was restricted to the extension of the upper part of Transient Zone waters.

The second season of 2008 started on the 15th of July and lasted until the 30th of September. The fleet started fishing in the same place where the survey had found the best *Loligo* concentrations and had similar CPUE than the *Loligo* survey. After two weeks of fishing for *Loligo*, the Beauchene area started to be depleted and the fleet moved to northern area. The rest of the season the fleet remained fishing in the northern area with some sporadic excursions to the central area and in less extent to the southern area. The catches were supported by three squid groups in the central-northern area, three in the southern area.

Daily fishery statistics and biological data covered the whole fishing season, except for a two-day interruption of biological sampling. During this first 2008 season a new area was opened to the fishery, this was restricted to the depth range of the natural northward continuity of trawling tracks that come from the central area. For the analysis this area was added to the central area and therefore the boundary between the central and northern area was moved northward (Fig. 1).

The stock assessment was made using the last FIFD's implementation of the stock depletion model which includes several sequential depletion events by area (Payá 2007). In order to warn the fishing industry with two weeks in advance of any chance of early fishery closure the catch during these two weeks and the spawning biomass were projected and the risk of leaving less than 10,000 tonnes was calculated.

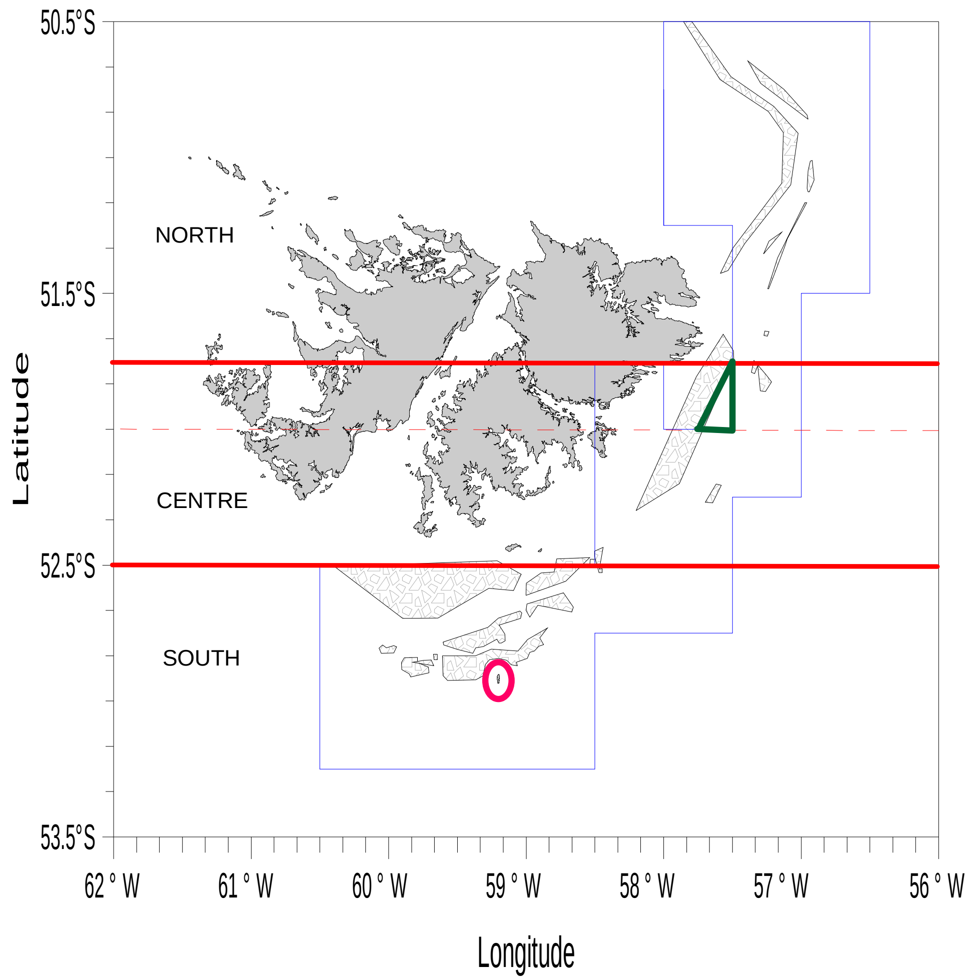


Fig. 1.- Fishing grounds and rocky bottoms around the Falkland Islands. In blue, the *Loligo* box, in green, the new fishing area opened in 2008, and in magenta, the three-nm exclusion area around Beauchene Island. The border between the northern and central area was moved northward according to the new opened area, the previous border is shown by a broken red line

III. FISHERY STATISTICS

1. Total Catch and Total Effort in Historical Perspective

The whole catch in the second season was 26,996 tonnes, which was 12% greater than second season 2007. The catch increased because the fishing effort increased (25%), conversely the CPUE decreased (11%). In a historical perspective second season 2008 catch was of a medium-high level. Although CPUE was lower than in 2007, since the lowest historical CPUE recorded in 1997, CPUE has showed a highly variable but increasing trend. Since 2002 the fishing effort has been relatively stable in comparison to the high levels recorded in 1993-1996 (**Table 1 and Fig. 2**)

Table 1.- Fishery statistics and initial biomass for the known history of the *Loligo gahi* fishery of the Falkland Islands. 'Failure' indicates that stock depletion model could not produce a reasonable estimate of initial biomass. From 1970 to 1985 the source is Csirke (1986), from 1987 to the present the source is either RRAG (for initial biomass up to 2003) or FIFD (catch and effort and initial biomass from 2004). Since 2007 the initial biomass is the sum of the biomass at the beginning of the season and the biomasses of squid groups that arrived during the season.

Year	First Fishing Season			Second Fishing Season			Annual
	Catch (tonnes)	Effort (h)	Initial Biomass (tonnes)	Catch (tonnes)	Effort (h)	Initial Biomass (tonnes)	Catch (tonnes)
1970							200
1971							100
1972							100
1973							250
1974							200
1975							140
1976							129
1977							354
1978							911
1979							925
1980							1111
1981							631
1982							18452
1983							38256
1984							36450
1985							36430
1986							
1987	64063		101000	18484		202000	82547
1988	48664		115000	5267		39000	53931
1989	106186	33159	165000	11671	16881	46000	117857
1990	69366	24177	206000	13624	15713	104000	82990
1991	37353	13808	53000	16462	16610	146000	53815
1992	48157	15406	97000	35227	19291	264000	83384
1993	23567	16065	47000	28711	32950	90000	52278
1994	35502	19891	55000	30254	29687	116000	65756
1995	60293	10913	195000	37486	22365	141000	97779
1996	38679	16438	31000	22694	28420	130000	61373
1997	15962	16766	40000	10159	18486	82000	26121
1998	33379	16835	60000	18178	22762		51557
1999	22863	19642	44826	12008	18266	53737	34871
2000	38713	21034	63683	25781	18869		64494
2001	27624	20955	26000	25935	19841	162234	53559
2002	14198	20824	21000	9513	11570		23711
2003	18973	8494	40350	28447	16166	Failure	47420
2004	8609	8740	Failure	18229	17024	62732	26838
2005	28747	7292	114878	30047	17658	47201	58794
2006	19056	8521	39218	23238	13150	26500	42294
2007	17229	8780	37517	24171	14740	48500	41400
2008	24752	8657	96753	26996	18489	40228	51748

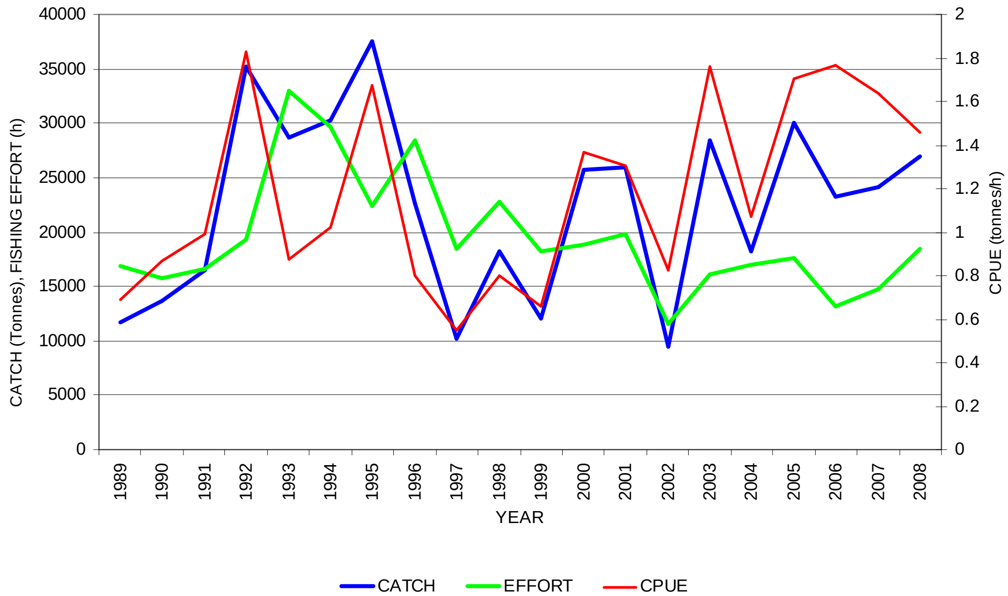


Fig. 2.- Historical catches, fishing effort and CPUE of the second season.

2. Catch and Effort per Fishing Ground and Cumulative Catch

68% of the squid were caught in the northern area, 27% in the southern area and 5% in the central area (**Table 2**). The highest catch rates were achieved in the northern area and the lowest in the central area. The distribution (percentages) of fishing effort by area was similar to the catch distribution by area.

Table 2.- Effort and catch statistics of *Loligo* second season 2008 by area.

Fishing Ground	Catch tonnes	Effort Vessel-Days	Effort Hours	CPUE tonnes/V-D	CPUE tonnes/h
South	7168	339	5554	21.1	1.29
Centre	1475	73	1357	20.2	1.09
North	18353	784	13003	23.4	1.41
Total	26996	1196	19914	22.6	1.36

The daily cumulative catch was at medium-high level compared with the highest and lowest historical figures (**Fig. 3**). The fleet achieved a sustained increase in its cumulated catches by changing fishing areas.

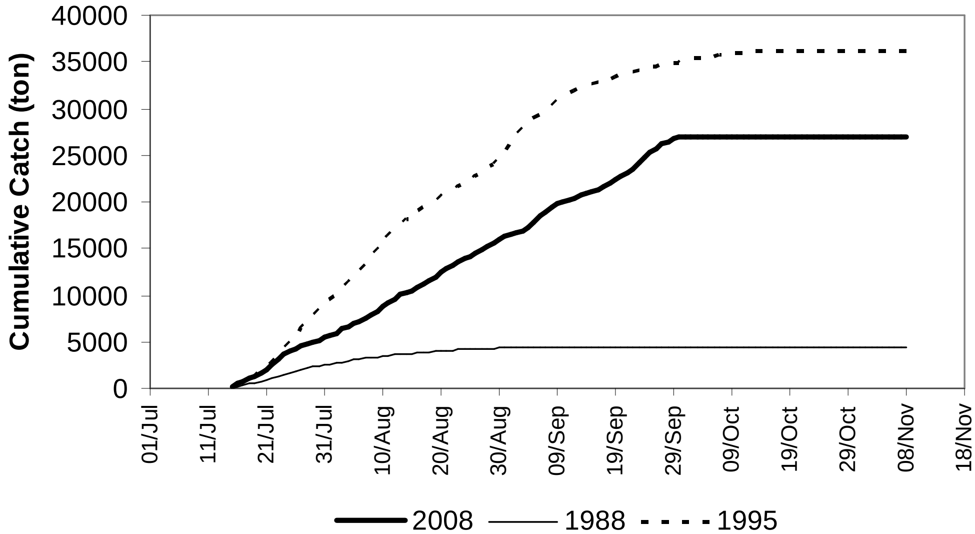


Fig. 3.- Cumulative catch versus date in the second season of 2008 compared to the cumulative catch of the first seasons that yielded the highest (year 1995) and lowest (year 1998) historical catches on exactly the same date range.

3. Fleet Movement Dynamics, Catch and Catch Rate

The fleet mainly fished in the southern area during the first two weeks, then it gradually moved to the north and after a month it was fishing mainly in the northern area (**Fig. 4a**). Three main peaks of catches were observed, the first in the southern area during the second week; the second peak in the northern area during the first week of September and the last peak also in this area at the beginning of the fourth week of September (**Fig. 4b)**. The CPUE had the same three peaks observed in the catches, with an additional peak during august in the southern area (**Fig. 4c**).

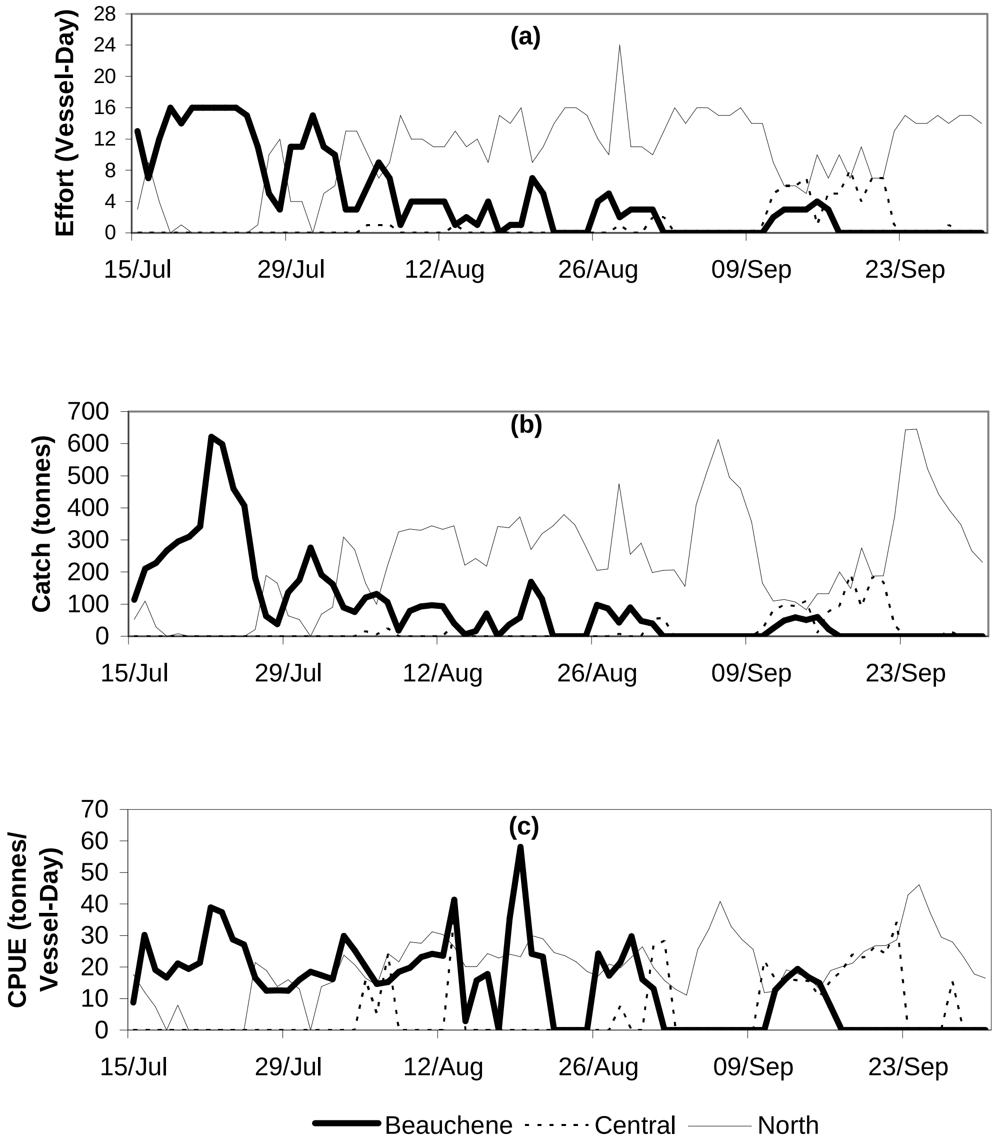


Fig. 4.- Daily evolution of effort (a), catch (b), and average catch per unit of effort (c) in the *Loligo* fishery during the second season of 2008.

The analysis of the fleet movement based on e-logbooks, showed the sequential arrivals of three *Loligo* groups in the southern area and others three groups in the northern area. During the first two days the fleet was divided fishing one part in the southern and the other part in the north (**Fig. 5**). The three squid groups arrived to the southern area; the first one on 22nd July (**Fig. 6**), the second one on 3rd August (**Fig. 7**) and third one on 13th August (**Fig. 8**). The squid groups arrived to the northern area; the first one on 9th August (**Fig. 9**), the second one on 4th of September (**Fig. 10**) and the third one on 23rd September (**Fig. 11**). During the last day of the season the CPUE were low and the fleet fished along the northern area (**Fig. 12**).

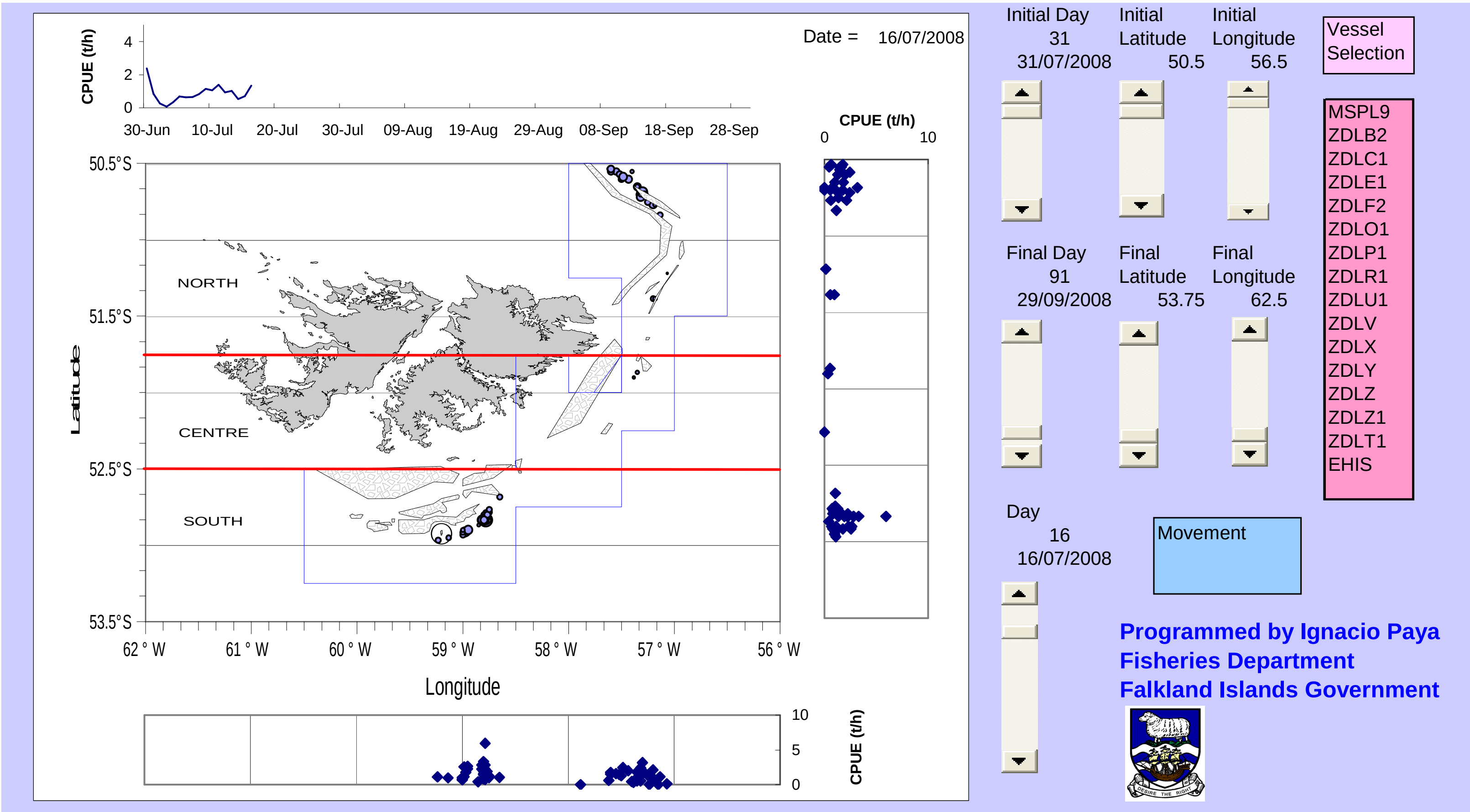


Fig. 5. During the first two days (15-16/7) one part of the fleet was fishing in the south and the other in north. The graphical interface displays the fleet movement and CPUE (tonnes/h) and has been described in previous reports.

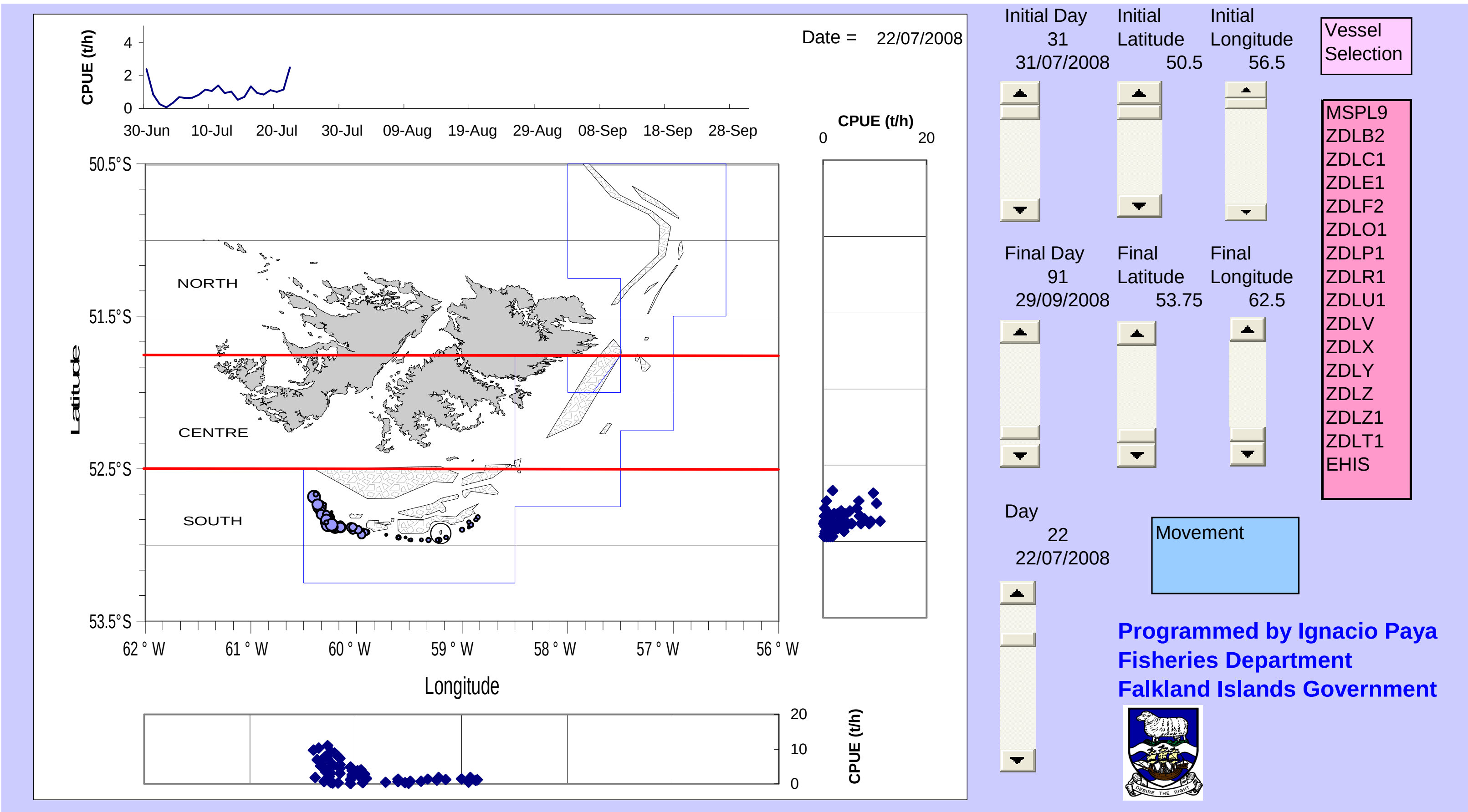


Fig. 6. On 22nd of July, the first group of squid arrived through the west side of the southern area.

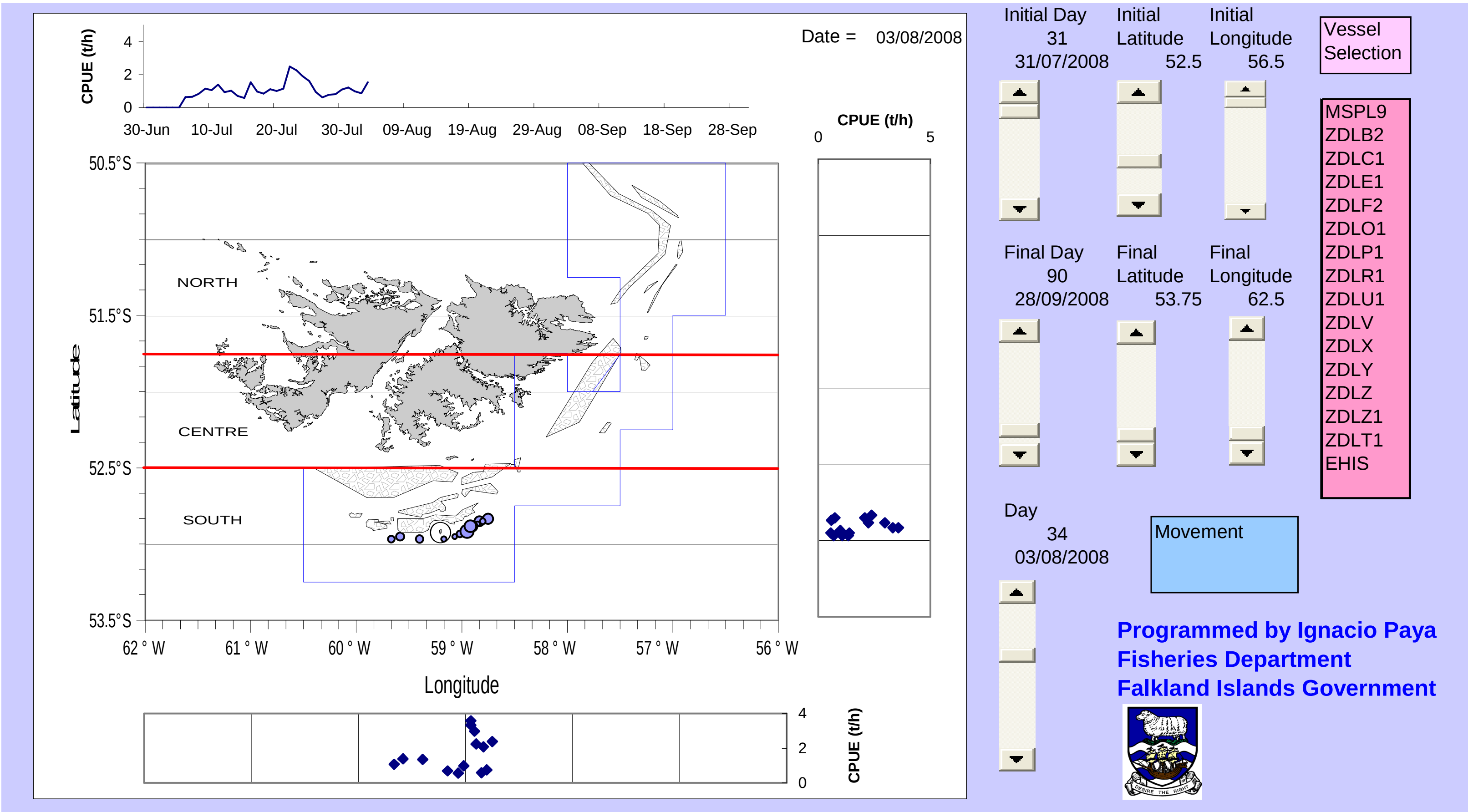


Fig. 7. On 3rd of August, the second squid group arrived to the southern area (only southern area is shown in the figure).

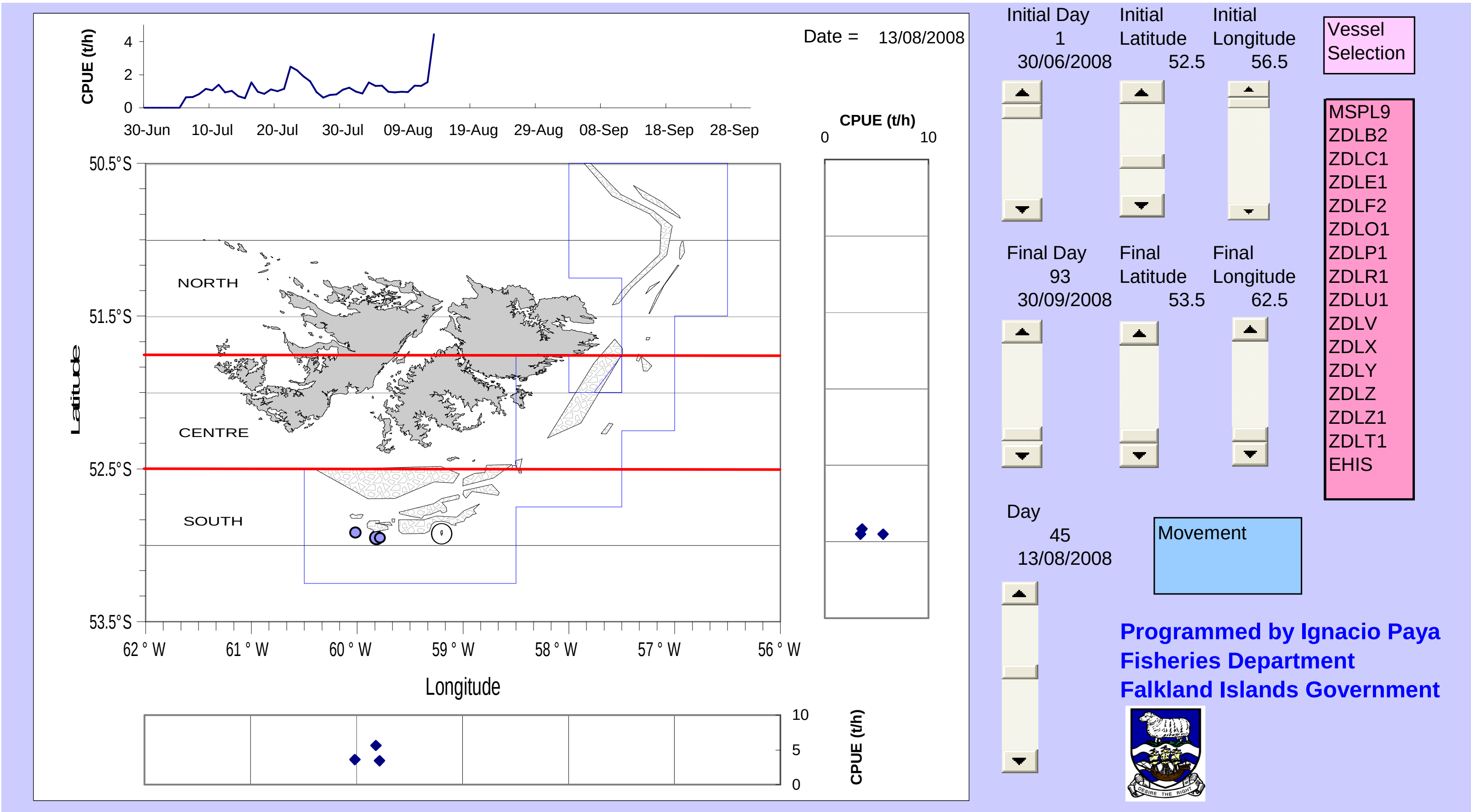


Fig. 8. On the 13th of August, the third squid group entered into the southern area (only southern area is shown in the figure).

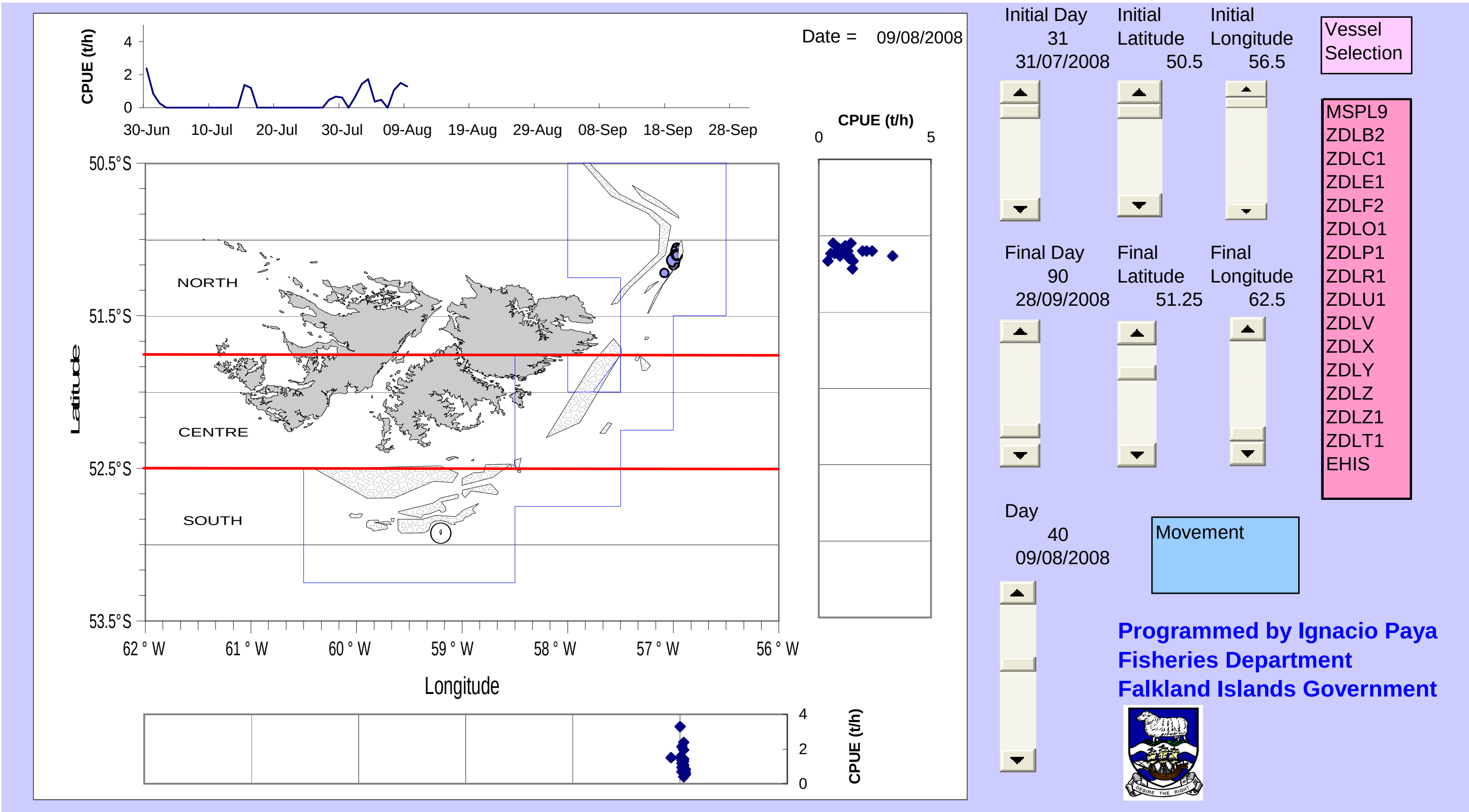


Fig. 9.- On the 9th of August, the first squid group of the northern area was found.

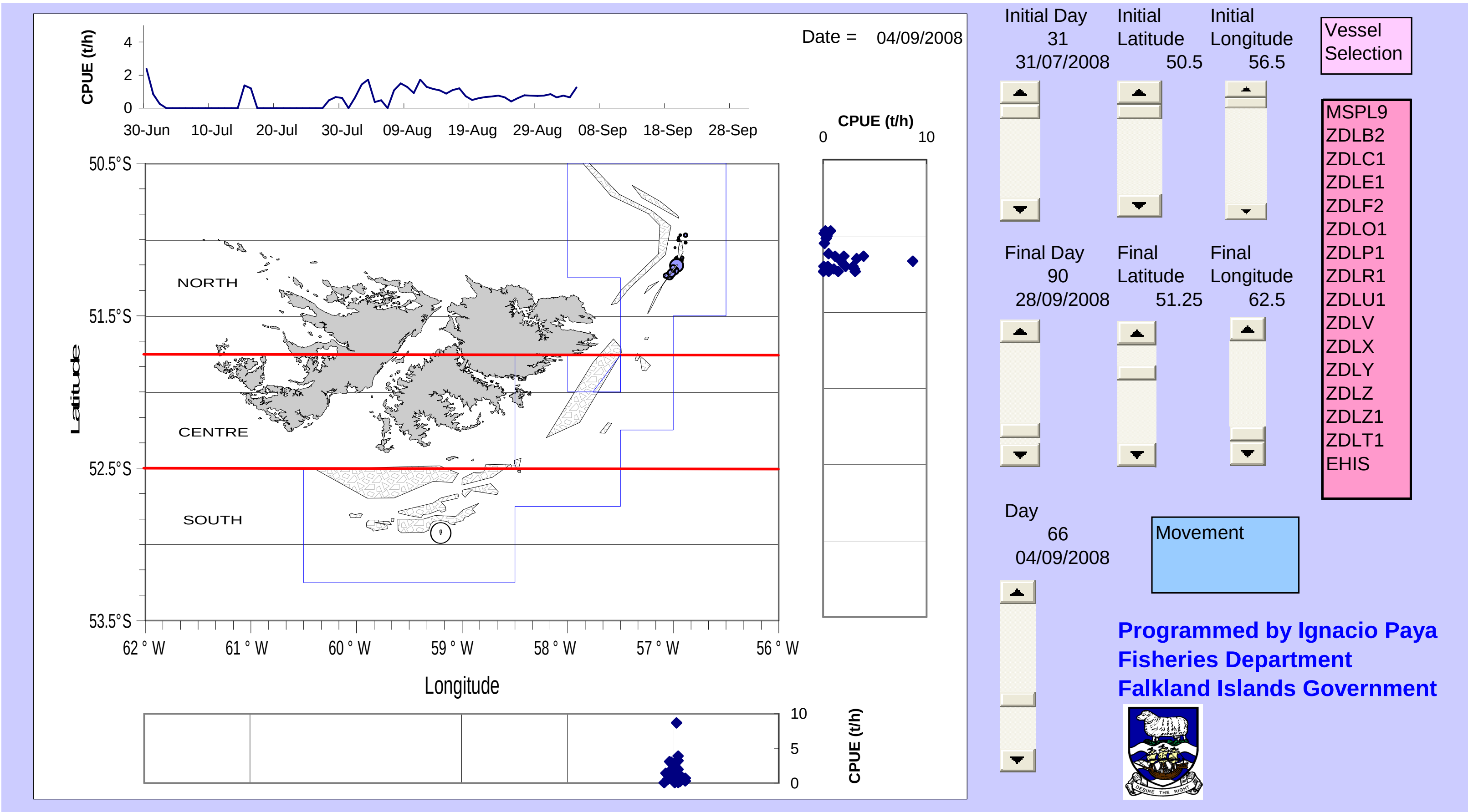


Fig. 10.- On the 4th of September, a second squid group arrived in the northern area.

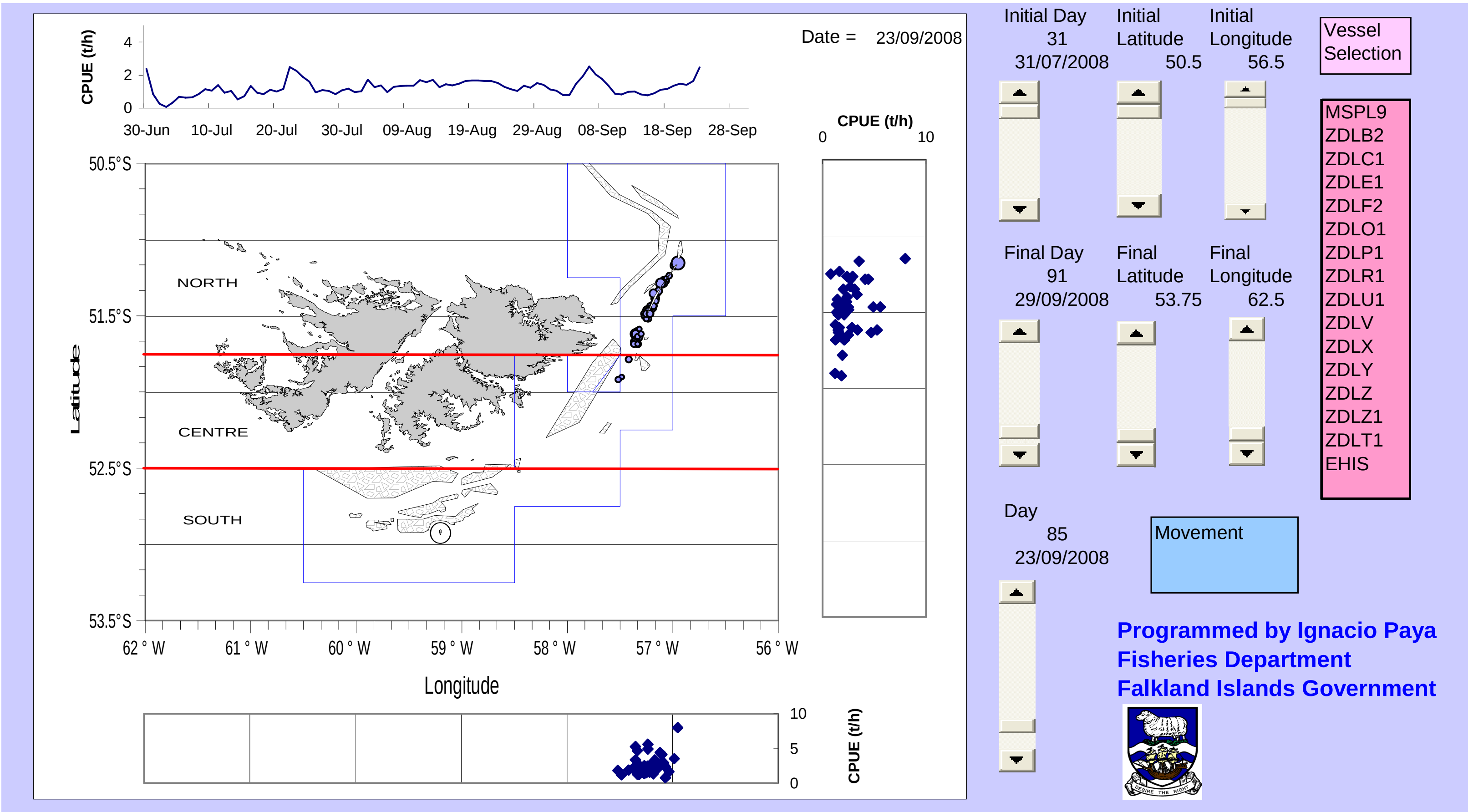


Fig. 11.- On the 23rd of September, a third squid group arrived to the northern area.

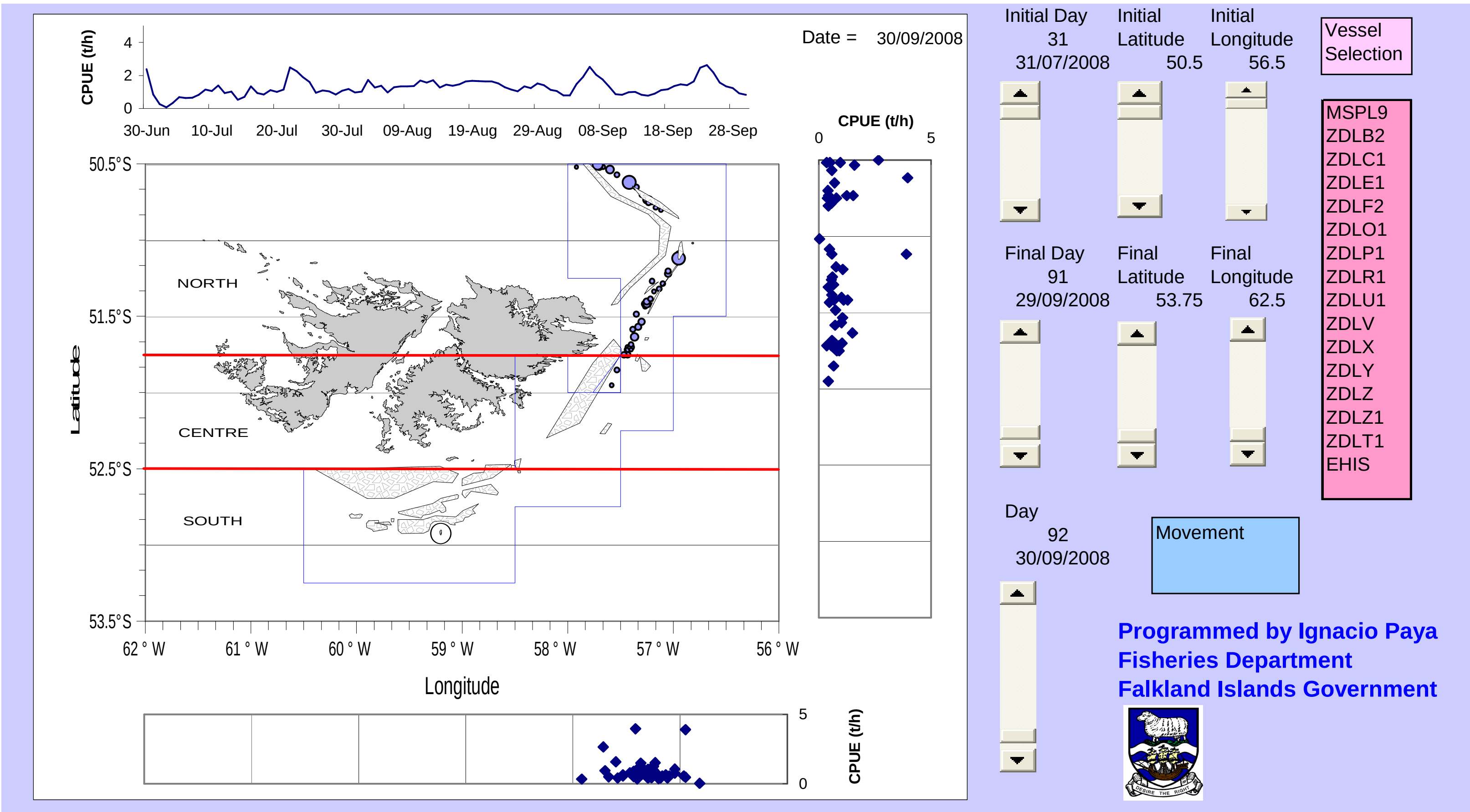


Fig. 12. In the last day the fleet was fishing in the northern and had low CPUE.

IV. BIOLOGICAL TRENDS

Biological trends of the stock were based on sampling taken by one scientific observer onboard of one commercial vessel, except for 18 days when two observers overlapped onboard of two different vessels. The observers took a sample of approximately 400 animals per day. There were only two days without biological samples.

1. Comparison of Daily Mean Biological Characteristics with Recent Years

In the case of females, the proportion of sexually immature squid in the catch followed the trends observed in previous second seasons (**Fig. 13**). In the case of the males, the proportion on immature squids was higher than in previous second seasons and started to decrease later in the season. The female proportion in the catches fluctuated from 0.3 to 0.7; the lowest proportions were observed between the 24th of August and the 15th of September (**Fig. 14**).

The average dorsal mantle length for the whole season was 12.9 cm (12.5 cm for females and 13.44 cm for males), which was 1.3 cm shorter than in 2007, similar to in 2006 and 2.1 cm shorter than in 2005 (**Fig. 15)**. The variation of length by day was similar between sexes and the length distributions were uni-modals (**Fig. 16**).

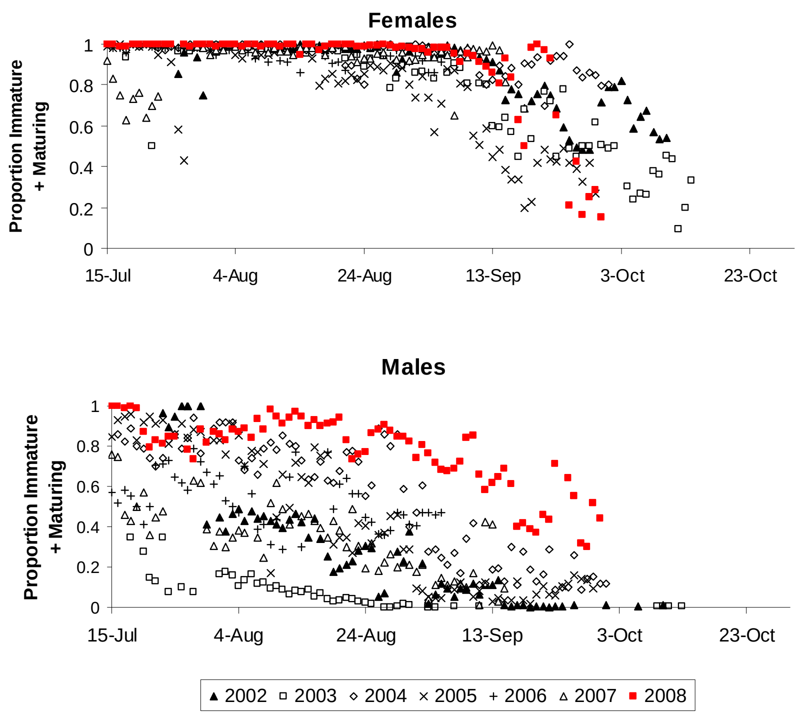


Fig. 13.- Current year trends in the proportion of sexually immature squids in the catch, compared with six previous years.

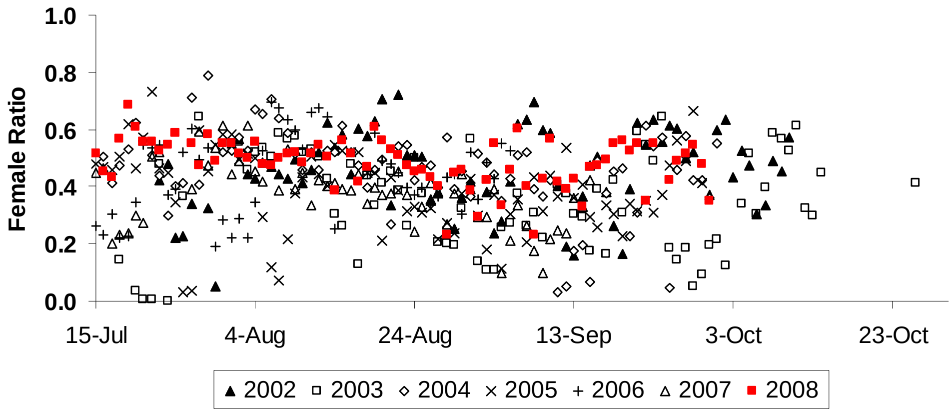


Fig. 14.- Current year trends in the daily evolution of the proportion of female squids in the catch, compared with six previous years.

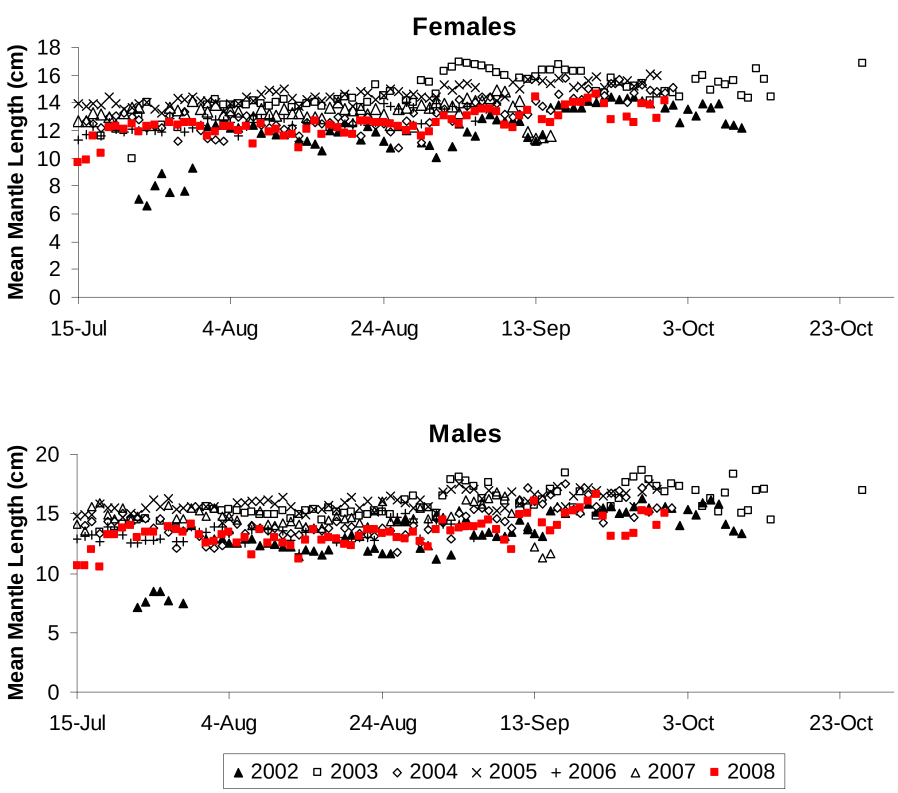


Fig. 15.- Current year trends in the mantle size by sexes, compared with six previous years.

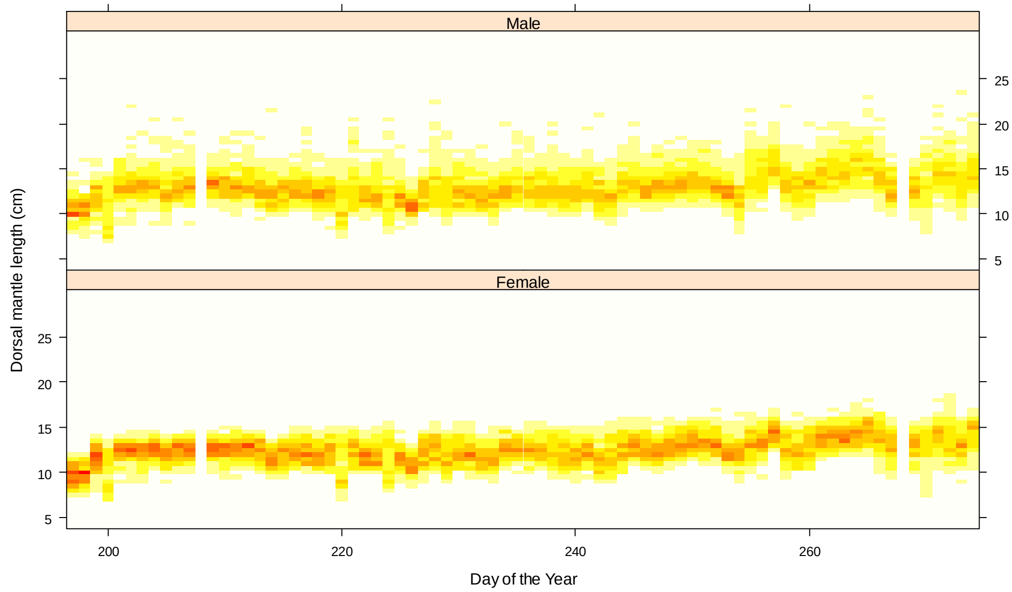
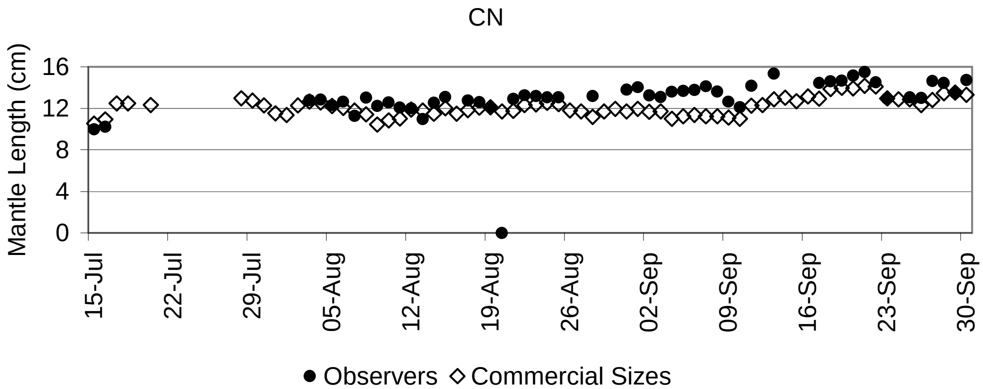


Fig. 16.- Time series of proportions (increases from yellow to red) of dorsal mantle length of squid in the catch during the second season, 2008.

2. Mean Mantle Length and Commercial Size Categories

During 2008, with only one scientific observer onboard, it was not possible to take samples from all the areas where the fleet fished. Therefore the mantle size was also estimated based on the e-logbook records of production by ***C***ommercial ***S***ize ***C***ategory (***CSC***) by haul and vessel. The procedure for estimation was the one described in the 2006 second season fishery and stock assessment report (Payá 2006). The mantle size estimated using the CSC were similar to size sampled by the observers, except when the vessel with the observer was not fishing in the same fishing grounds that most of the fleet fished (**Fig. 17**).



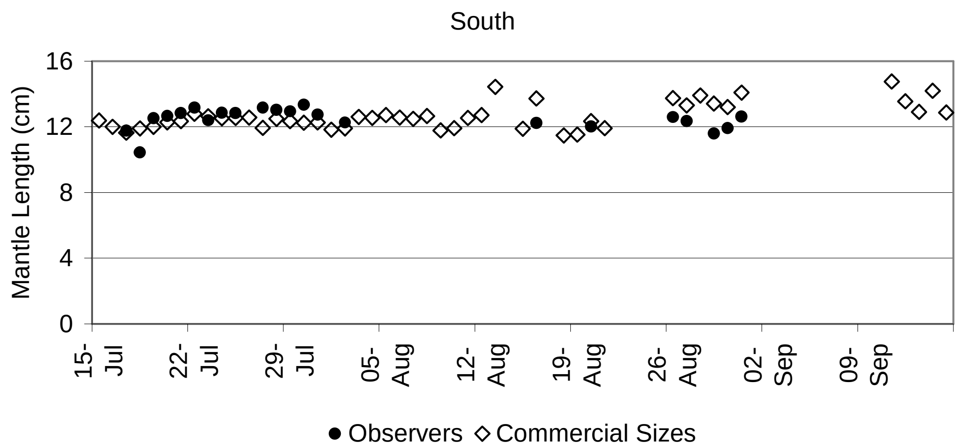
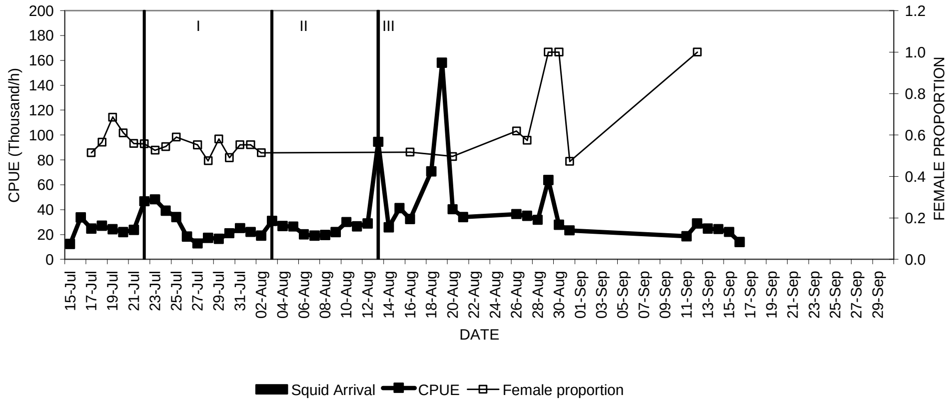


Fig. 17.- Average mantle length by area. Data from scientific observers onboard and estimations based on the commercial size categories (CSC).

3. Arrivals of squid waves by area.

The arrivals of the different squid waves, identified using the spatial distribution of CPUE, were also evident when CPUE trends were compared with female proportion and average weights. In the southern area the identification of first and second group was based mostly on the CPUE because the female proportion and mean weight did not change so much, as they did change in the third group (**Fig. 18**). In the northern area, the three groups were clearer identified than in the southern area, because most of the time the fleet fished in this area and so more biological data were available (**Fig. 19**).



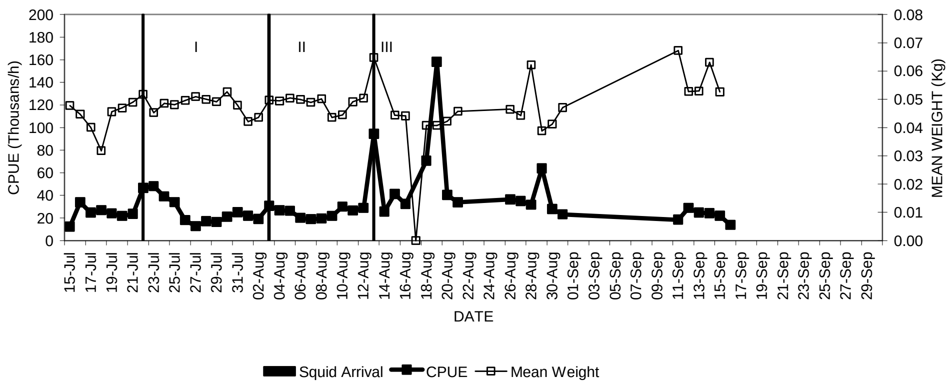


Fig. 18.- The arrivals of three different groups of squid to the southern area was identified based on the behaviour of the CPUE (Thousands/h), the female proportion (upper plot) and the mean weight (down plot). The arrival date is represented by the vertical bars.

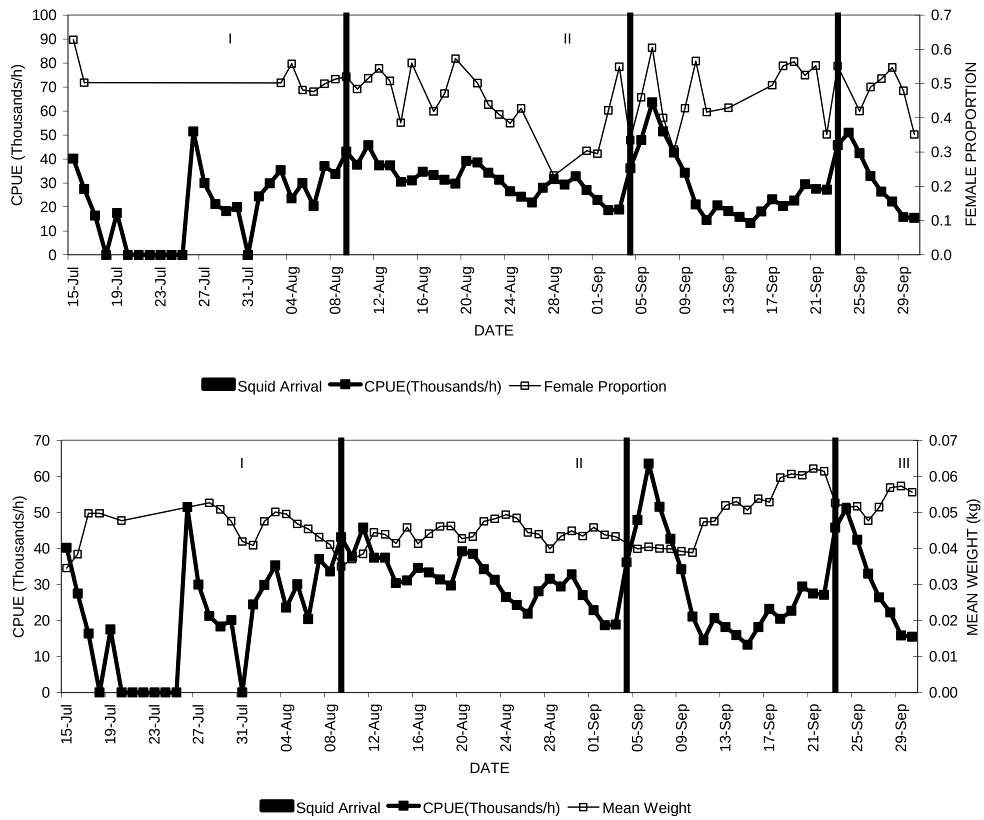


Fig. 19.- The arrivals of three groups of squid to the central-northern area was identified based on the behaviour of the CPUE (Thousands/h), the female proportion (upper plot) and the mean weight (down plot).

V. STOCK ASSESSMENT AND RISK ANALYSIS

1. In-Season Stock Assessment and Risk Analysis

In-season stock assessment was used to apply the decision rule to close the fishery if the projected spawning biomass is below 10,000 tonnes, under the restriction to warn the industry with two weeks in advance of the expected closing date. A flowchart of the *Loligo* management procedure is presented in **Figure 20**.

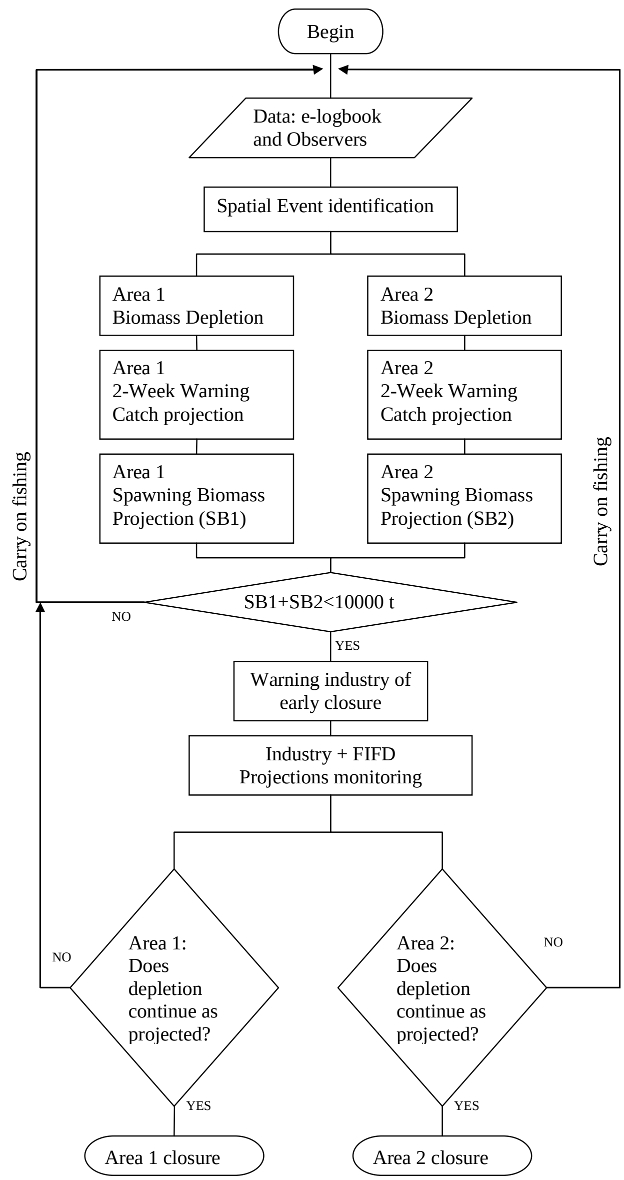


Fig. 20.- Flowchart of spatial management procedure for the early fishery closure decision. For simplicity only two depletion events are shown.

The fishery data was collected by daily catch reports and e-logbook and biological data by scientific observers onboard. Depletion events were located spatially and temporally by means of the graphical interface. Current biomass in each area was estimated by depletion models, then the catches and biomass during the 2-week warning period were projected and finally the surviving spawning biomass was estimated. If the projected spawning biomass is lower than 10,000 tonnes then a warning of an early fishery closure is sent to the industry. During the warning period the FIFD daily updates the stock assessment and biomass projections, which are shown to the fishery entrepreneurs for discussion. Real time fleet movements and possible new areas of good catches are also discussed. If the biomass depletion follows the projection and no other new squid appear then the area will be closed.

The stock assessment was done using the depletion model with several recruitment pulses and vessel catchability coefficients estimations by area. The equations for the stock assessment and risk analysis have been previously described in the 2007 second fishery report (Payá 2007), and therefore are not presented here.

On the 21st of August a warning of a possible early closure of the fishery was sent to the *Loligo* fishing companies group. The stock assessment with data up to 18th of August estimated the probability (risk) that the escapement biomass be less than 10,000 tonnes at 0.46 (**Fig. 21**). The probability of no more groups arrive to the Southern area was estimated at 0.53 (**Fig. 22**) and the combined risk was estimated at 0.34 (**Fig. 23**). In a meeting between FIFD and the fishing companies it was agreed to close the southern area on the 25th of August unless there was evidence in the intervening period that a fresh stock pulse has entered the fishery. As new squid groups eventually arrived to both areas, the biomass estimations increased (**Figs. 24 and 25**), and the fishery went on and had a normal end.

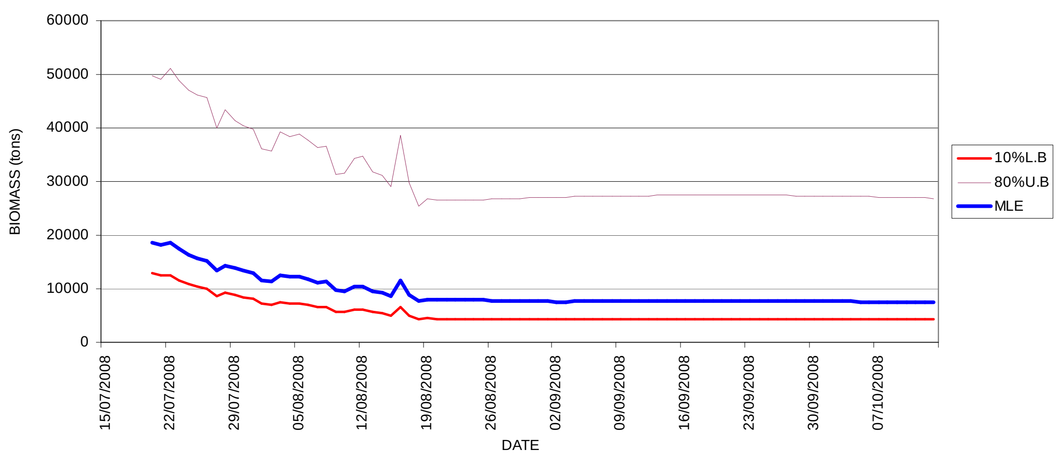


Fig. 21.- In-season stock assessment with data up to 18th of August. Biomass estimated and projected (Maximum Likelihood Estimation and percentiles of 10% and 80%).

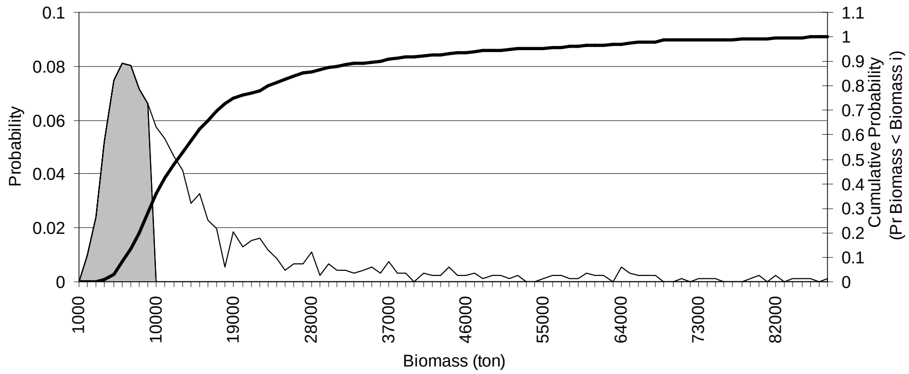


Fig. 22.- In-season stock assessment with data up to the 18th of August. Probability distribution of escapement biomass (B) and its cumulative probability. The risk of Biomass <10,000 tonnes was 0.46 (proportion of grey area in the total area under the curve).

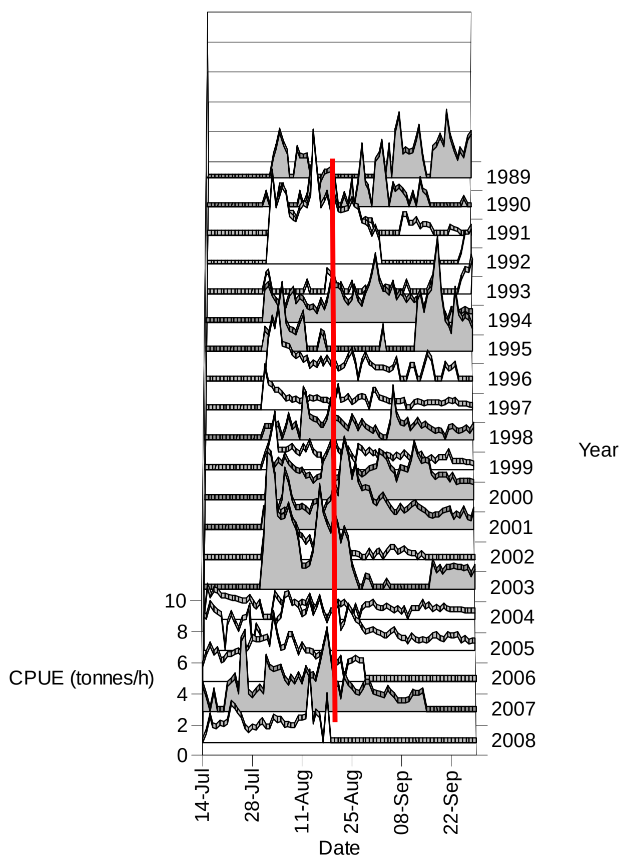


Fig. 23.- Historical first season CPUE trends in the southern area. The red line shows the 18th of August; the grey colour years had not any increase in CPUE between this date and the end of fishing season. There was a 0.53 probability that no more squid groups arrive to this area.

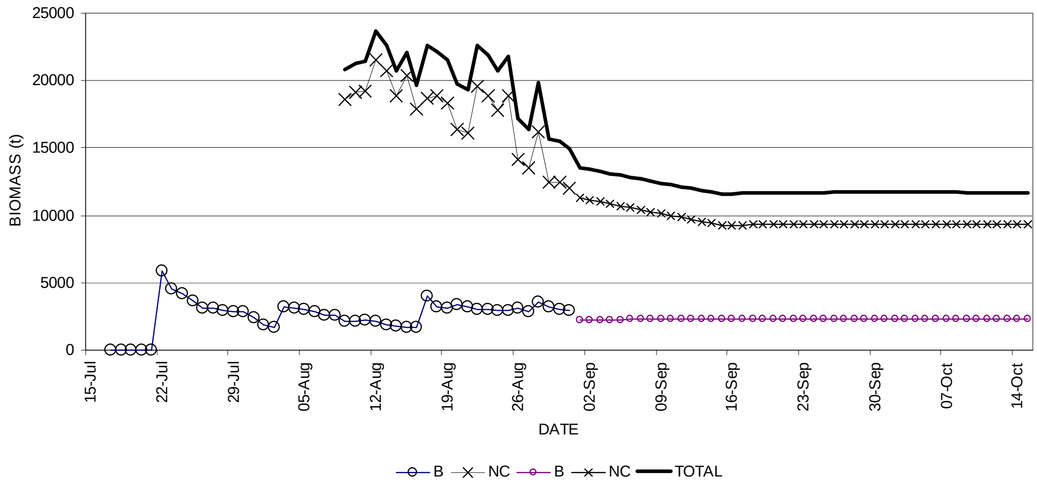


Fig. 24.- In-season stock assessment with data up to 31st of August. Biomass estimated (-o-) and projected (-x-) by area (B: Southern Area; NC: Central-North Area) and whole area (TOTAL).

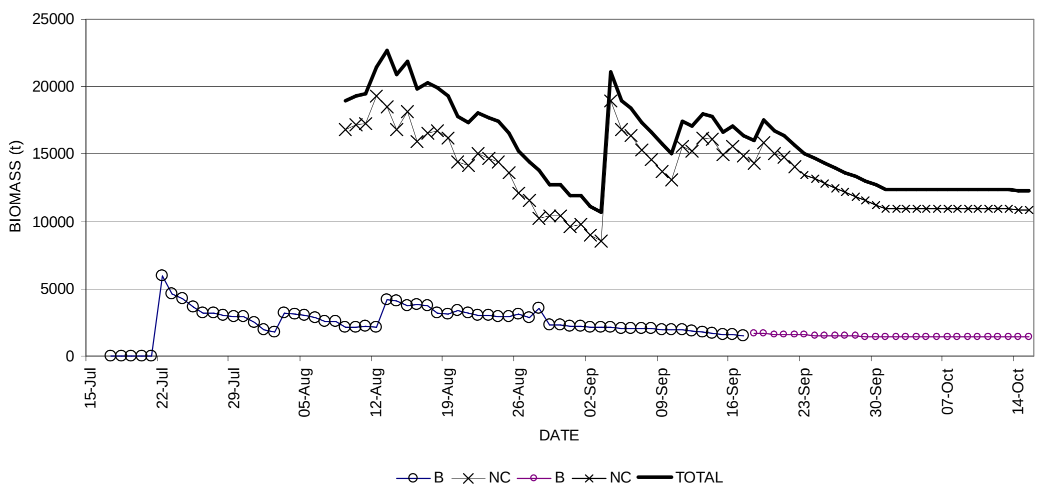


Fig. 25.- In-season stock assessment with data up to the 22nd of September. Biomass estimated (-o-) and projected (-x-) by area (B: Southern Area; NC: Central-North Area) and whole area (TOTAL).

2. After-Season Stock Assessment and Risk Analysis

The models fitted well to the data in both areas (**Figs. 26 and 27**).

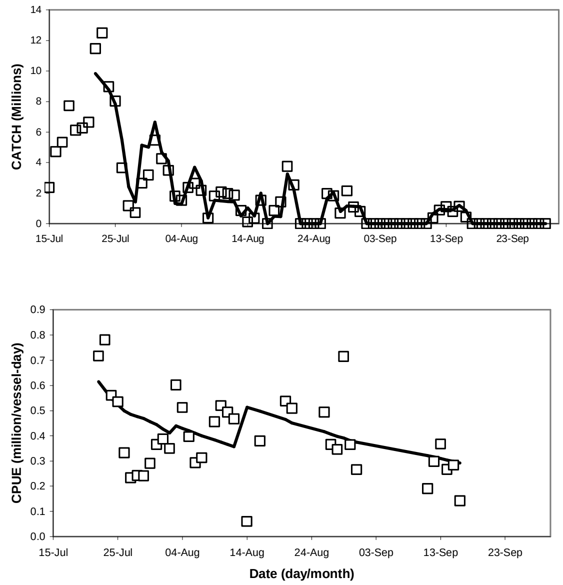


Fig. 26.- Model (line) fitted to southern area data (squares). Catch in the upper plot and CPUE in the down plot.

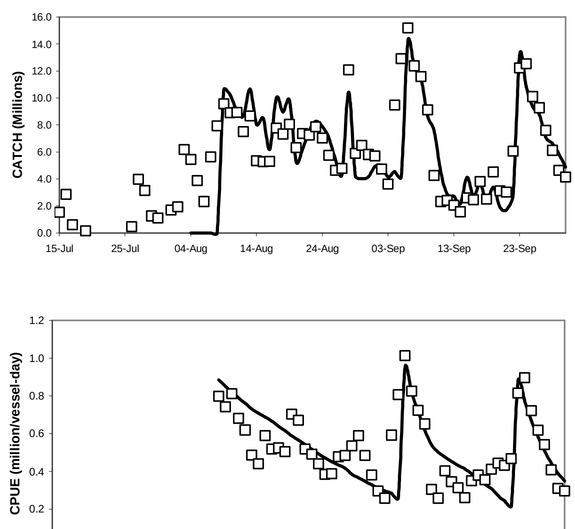


Fig. 27.- Model (line) fitted to central-northern area data (squares). Catch in the upper plot and CPUE in the down plot.

The whole escapement biomass at the 15th of October was estimated at 9,798 tonnes, and it was composed mainly (76%) by squids from the southern area (**Fig. 28 and Table 3**).

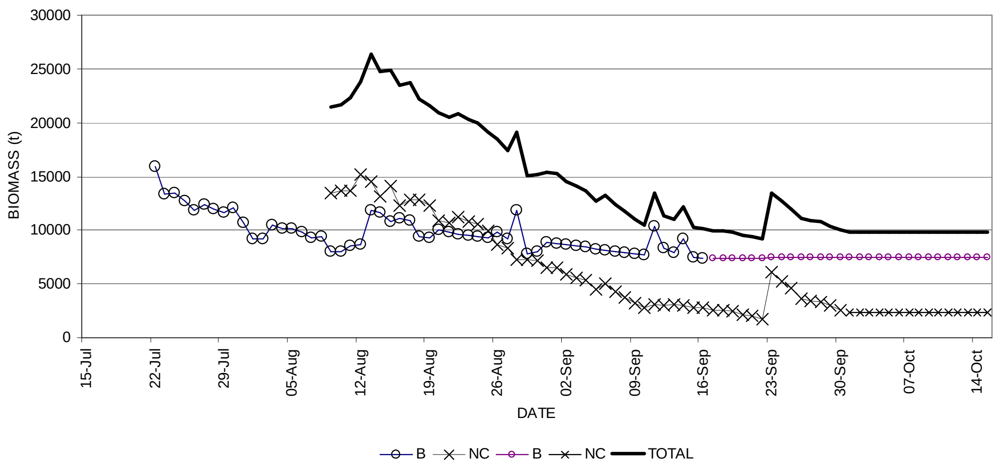


Fig. 28.- In-season stock assessment with data up to the 30th of September. Biomass estimated (-o-) and projected (-x-) by area (B: Southern Area; NC: Central-North Area) and whole area (TOTAL).

The uncertainty of the biomass estimations were calculated using bootstrapping techniques. The 80% confident intervals were asymmetric with the maximum likelihood estimations (MLE) closer to the 10% percentiles than the 90% percentiles (**Fig. 29**).

Fig. 29.- Biomass in the whole area. The 10% and 90% percentiles were estimated using bootstrapping technique. The red line is the escapement biomass limit.

Table 3.- Stock assessment of *Loligo gahi* in the Falkland Islands by a stock depletion model. Numbers in parentheses are the measures of statistical precision (coefficients of variation). (S = southern; C = Central; N = Northern; and CN = central-northern area). (*) It is the average of catchability by vessel. (**) This biomass is the sum of all squid group biomasses.

	2nd Season 2004			2nd Season 2005			2nd Season 2006		
Parameter	S	C	N	S	C	N	S	1rst CN	2nd CN
Starting Date	15/07	16/08	28/07	10/08	25/07	21/07	4/08	23/07	22/8
Final Date	30/09	30/09	30/09	30/09	30/09	30/09	29/08	21/08	5/9
N° of days	66	16	58	52	25	39	25	30	15
Catchability (1/vessel-day)	5.9x10-4 (5.4)	3.4x10-3 (9.9)	2.7x10-3 (14.9)	2.3x10-3 (1.2)	3.7x10-2 (703.5)	2.1x10-3 (25.6)	1.9x10-3 (12.5)	1.2x10-2 (12.4)	3.7x10-3 (18.3)
Catchability (1/h) *									
Initial numbers (billions)	8.5x10-1 (23.0)	1.4x10-1 (50.3)	2.7x10-1 (3.0)	3.2x10-1 (5.4)	1.6x10-2 (363.5)	4.1x10-1 (8.3)	5.2x10-1 (11.1)	5.8x10-3 (9.6)	1.7x10-1 (15.4)
Initial biomass (tonnes)	42239 (39.6)	6983 (61.2)	13510 (34.0)	20417 (30.2)	1070 (365.7)	25714 (32.0)	25500 (10.8)	2600 (10.0)	7900 (15.3)
Final Numbers NT (billions)	2.2x10-1 (31.1)	3.3x10-2 (100.9)	4.4x10-2 (21.0)	6.2x10-2 (13.9)	1.4x10-3 (2778.4)	5.6x10-2 (53.5)	0.21 (18.7)	0.02 (19.5)	0.08 (18.7)
Final Biomass (tonnes)	15191 (49.2)	2229 (107.8)	3009 (43.6)	5203 (39.8)	112 (2778.6)	4505 (56.4)	9500 (18.7)	1000 (19.5)	3500 (28.4)
Initial Biomass * * (tonnes)									
Final Biomass ** (tonnes)									

Table 3.- Continuing.

	2nd Season 2007				2nd Season 2008					
Parameter	1rst S	2nd S	3rd S	CN	1rst S	2nd S	3rd S	1rst CN	2nd CN	3rd CN
Starting Date	22/07	2/08	22/8	17/7	22/07	3/08	13/8	9/08	6/9	23/9
Final Date	1/08	13/08	15/9	15/09	2/8	12/08	16/9	5/09	22/9	30/9
N° of days	11	11	34	60	12	10	35	28	17	8
Catchability (1/vessel-day)					2.13x10-3 (10.0)	2.13x10-3 (10.0)	2.13x10-3 (10.0)	2.3x10-3 (5.0)	7.65x10-4 (28.5)	7.65x10-4 (28.5)
Catchability (1/h) *	1.54x10-4 (27.0)	1.54x10-4 (27.0)	1.54x10-4 (27.0)	1.46x10-4 (31.0)						
Initial numbers (billions)	1.9 x10-1 (8.3)	2 x10-1 (7.2)	1.3 x10-1 (7.5)	2.4 x10-1 (6.1)	2.9x10-1 (7.0)	0.1x10-1 (83.0)	0.8x10-1 (45.0)	0.4 x10-1 (8.2)	0.3 x10-2 (108)	0.9 x10-2 (25.0)
Initial biomass (tonnes)	12500 (8.3)	12000 (7.2)	7500 (7.5)	16500 (6.1)	15919 (7.0)	943 (83.0)	3948 (45.0)	13430 (8.2)	1075 (108)	4912 (25)
Final Numbers NT (billions)	1.4 x10-1 (10.2)	1.2 x10-1 (9.9)	4 x10-2 (8.0)	1.2 x10-1 (9.5)	1.9 x10-1 (7.0)	1.7 x10-1 (83.0)	1.14x10-1 (45.0)	0.9 x10-1 (19.0)	0.5 x10-2 (168)	0.4 x10-1 (41)
Final Biomass (tonnes)	8000 (10.2)	7000 (9.9)	2500 (28.4)	6500 (9.5)	9509 (7.0)	714 (83.0)	2446 (45.0)	3957 (19.0)	249 (168)	2500 (41)
Initial Biomass * * (tonnes)	12500 (7.4)	20500 (6.0)	19000 (4.6)		15919 (7.4)	10451 (15.0)	11865 (14.8)	13430 (8.2)	5032 (31.9)	6078 (31.8)
Final Biomass ** (tonnes)	8500 (8.8)	12000 (8.6)	5500 (10)		9144 (9.0)	8598 (15.8)	7349 (17)	4468 (16.8)	1753 (78.3)	2560 (58.5)

The escapement biomass projected to the 15th of October ranged from 6,000 to 29,000 tonnes with a maximum likelihood at 9,798 tonnes and a probability to surpass the 10,000 escapement limit of 0.40 (**Table 4 and Fig. 30**).

Table 4.- Biomass of squid projected from the end of the season with starting numbers as estimated from the stock depletion model. The numbers in parentheses are the measures of statistical precision (percentage coefficients of variation).

	Dates	Biomass (tonnes)
Second Season 2004	30/09 to 15/10	20,721 (24.3)
Second Season 2005	30/09 to 15/10	8,665 (38.0)
Second Season 2006	5/9 to 15/10	13,500 (15.9)
Second Season 2007	15/9 to 15/10	11,458 (9.4)
Second Season 2008	30/9 to 15/10	9,798 (62.7)

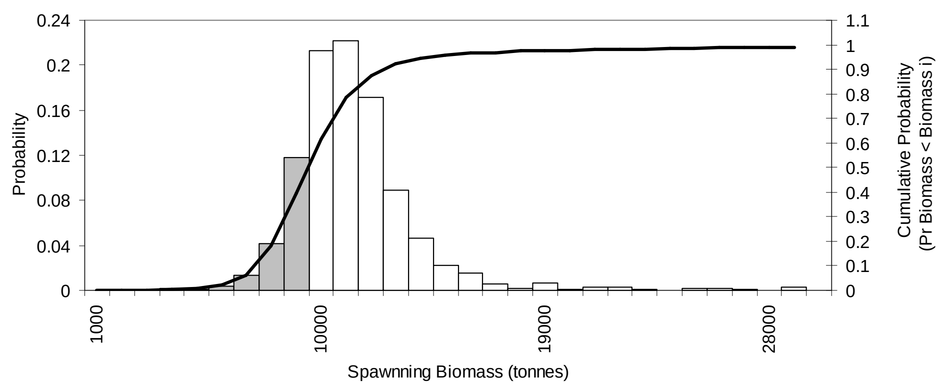


Fig. 30.- Escapement spawning biomass projected to the 15th of October. The probability distribution is shown in bars; the bars below the 10,000 limit are in grey colour. The cumulative probability is the risk curve.

VI. CONCLUSIONS

1) The whole *Loligo* catch was 26,996 tonnes, a medium-high level in historical perspective.
2) In comparison to second season 2007; catch increased 12%, fishing effort increased 25% and catch rate decreased 11%.
3) Most (68%) of the squid were caught in the northern area.
4) The average dorsal mantle length was 12.9 cm (12.5 cm for females and 13.44 cm for males), which was 1.3 cm shorter than in 2007.
5) Initial biomass on the 22nd of July was estimated at 15,919 tonnes.
6) Three squid groups arrived sequentially to the southern area and three groups to the central-northern area.
7) The whole biomass, the one that was present at the start of the season plus the ones that arrived during the season, was estimated at 40,228 tonnes.
8) The escapement spawning biomass was estimated at 9,798 tonnes, with a coefficient of variation of 63%.
9) The probability (risk) of surpassing the conservation limit (10,000 tonnes) was estimated at 0.4

VII. REFERENCES

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