



Falkland Islands Fisheries Department

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## Preliminary Report:

### *Loligo gahi* Stock Assessment Survey, Second Season 2009

<b>Vessel</b>	<b>Baffin Bay (MSLP9)</b>
<b>Flag</b>	Falkland Islands
<b>Dates</b>	30/06/2009-14/07/2009
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<b>Scientific Crew</b>	Ignacio Payá and Alex Blake

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## SUMMARY

This report is delivered to inform about the preliminary *Loligo* biomass estimation and the biological and oceanographic data that were collected. The biomass was preliminary estimated using the same method as in the previous surveys, but it is not standardised by fishing power. The oceanographic data collected are presented but are not analysed yet.

A research survey was conducted in the *Loligo* box on the Falkland Islands shelf on board the F/V Baffin Bay between the 30<sup>th</sup> of June and 14<sup>th</sup> of July 2009. 51 daytime trawls were made at selected localities with a total *Loligo* catch of 113 tonnes. *Loligo* was concentrated in the northern area, with scarce presence in the southern area. The biomass was estimated at 20,956 tonnes, which was 1.5, 1.1, and 0.9 times greater than the biomasses estimated in the second season of 2008, 2007 and 2006. *Loligo* mantle length average was 10.5 cm for females and 11.8 cm for males. Females were 1 cm shorter than in July 2008, but males were similar. The average female proportion was 0.53 in the whole area, and the greater female proportions were found in the central-northern area. Preliminary analysis of the oceanography data suggested that the fishing grounds with the highest *Loligo* concentrations had the coldest bottom temperatures and medium-range salinities. The scarce abundance of *Loligo* in the southern area during the start of the second season is unusual, and probably is related to significant delay in immigration time into this area.

## INTRODUCTION

The present survey is the 10<sup>th</sup> made since May 2004, when the first scientific survey using commercial vessel was carried out (Roa-Ureta 2004, 2005a, 2005b; Payá and Roa-Ureta 2006; Payá 2006, 2007a, 2007b, 2008a, 2008b and 2009a). The first three surveys were made long before the next fishing season and therefore the biomass at the beginning of the next fishing season had to be estimated using projection models. To avoid the uncertainty of these projections and possibility that the resource had not fully recruited to the fishing area, since February 2006 the surveys have been conducted just before the beginning of the fishing season. Since July 2008 the sampling and analysis of oceanographic data was introduced.

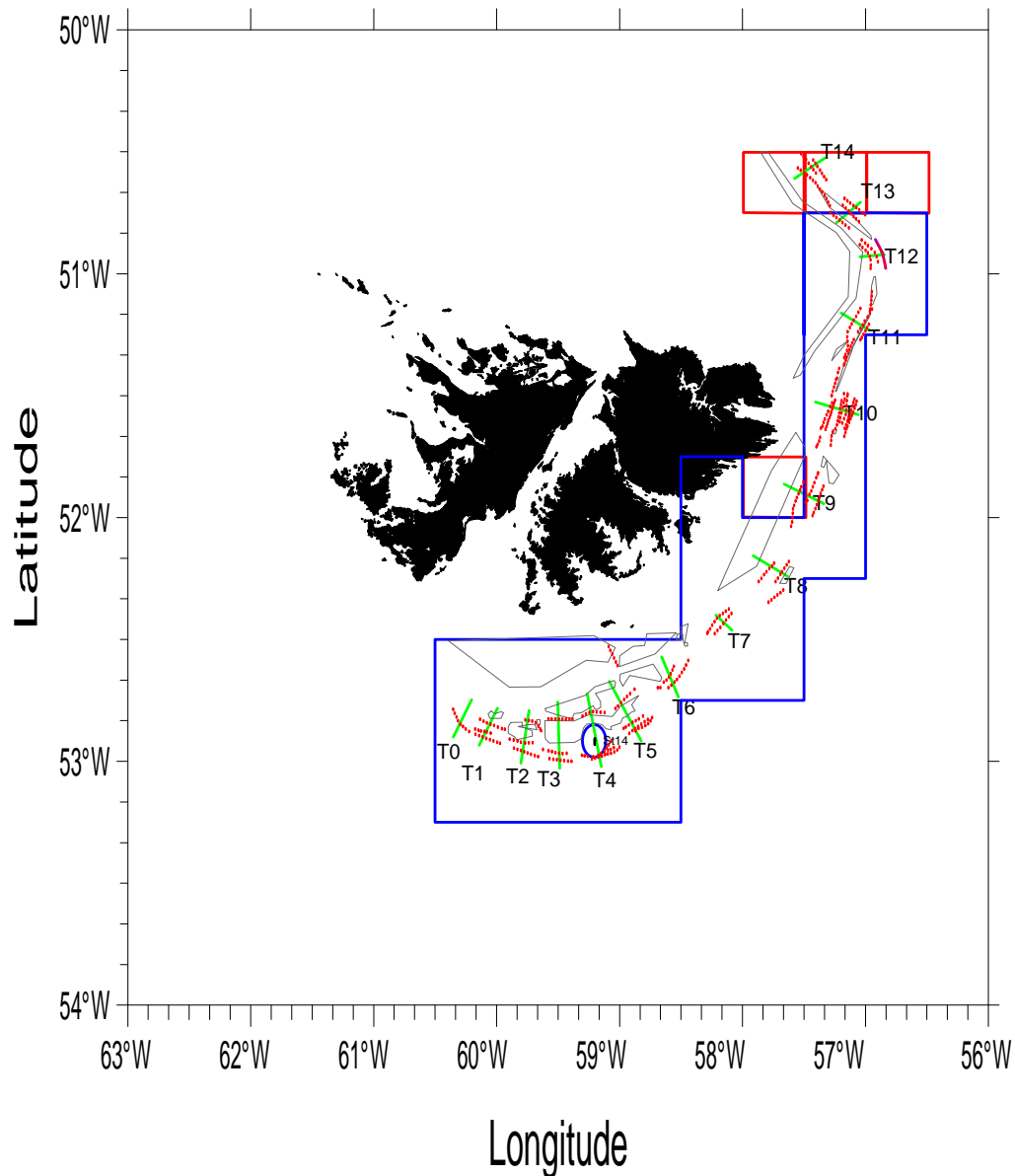
## METHODOLOGY

All fishing activities were performed on F/V Baffin Bay. A total of 51 hauls were conducted at locations selected by the Chief Scientist yielding a total catch of 113 tonnes. The survey covered the whole shelf area of the *Loligo* box (depths ranging between 100 and 320 m). The survey consisted of 15 transects, with several trawls on each transect depending on the width of the shelf in the area (**Fig. 1**).

Between two and four trawls were conducted each day when the weather allowed. The trawl was a standard Spanish bottom trawl with small mesh liner in the codend. The door opening varied from 92 to 145 m with the mean of 122 m, and the horizontal trawl opening ranged from 33 to 50 m with the mean of 42 m depending on the course and trawl speed. The average duration of each trawl was two hours. Every fifteen minutes during each tow the bridge officers and chief scientist noted the position, trawl speed, door opening and quantity and quality of marks observed on the echosounder.

The net was hauled on board and lifted into place to allow the catch to flow into one of two fish bins at stern of the trawl deck. The fish bins fed a conveyor system in the factory. A random sample of 150 squid was taken from every trawl and as soon as they were separated by sex and maturity they were measured for length frequency analysis. Additionally, all by-catch species were collected from each trawl by crew members working at the conveyor belt. After the contents of the trawl had been processed, the bycatch was weighed and some species like *Illex argentinus*, rockcod, icefish and skates were examined in greater detail.

The biomass was estimated using geo-statistical methods. The biomass was product of the probability of presence, mean density and total area. The probability of presence was estimated by Binomial logit-normal models, using geoRglm R package (Christensen and Ribeiro Jr, 2005). The mean density was estimated using the likelihood-based methods of Diggle *et al.* (1998 and 2003) and the geoR R package (Ribeiro Jr and Diggle, 2001). More mathematical and statistical details have been described previously (Roa-Ureta 2005).



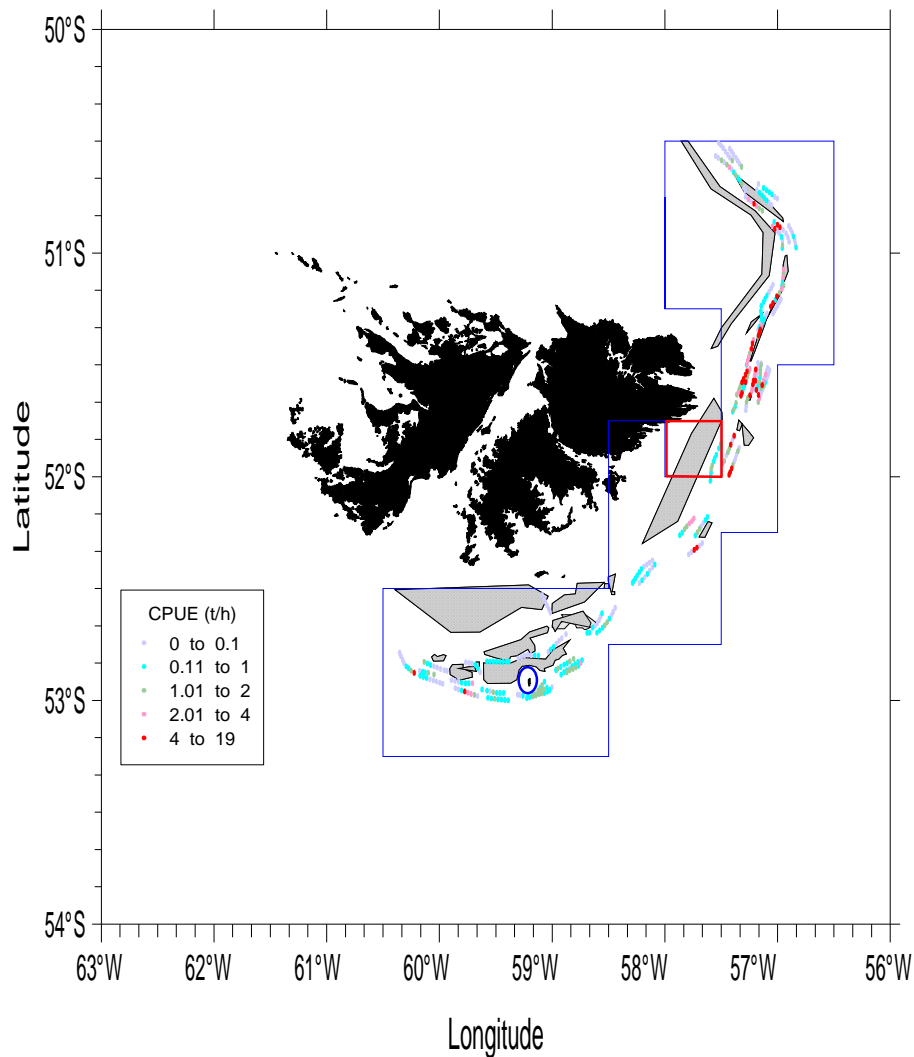
**Fig. 1. Adaptive sampling design of 51 daytime trawls (red dotted lines) on the 15 transects (green lines) of the *Loligo* survey in July 2009.**

In order to collect oceanographic information a Data Storage Tag (DST) CTD (Star-Oddi, <http://www.microdaq.com/star-oddi/index.php>), was attached to the upper rope of the net mouth. DST CTD is a compact microprocessor-controlled conductivity, temperature and depth recorder with electronics housed in a waterproof housing. In every haul the recorders were removed from the net and put in the communication box to retrieve the data and to program the recorders for the next haul.

With good precision but limited accuracy the DST-CTD had to be post-calibrated using a proper CTD. The DST-CTD and the proper CTD were simultaneously deployed in different localities that covered a wide range of salinities and temperatures: Mullet River, Moody Brook, West Stanley Harbour (Beaver Hangar), FIPASS, East Stanley Harbour (Boxer Bridge) and Surf Bay coast.

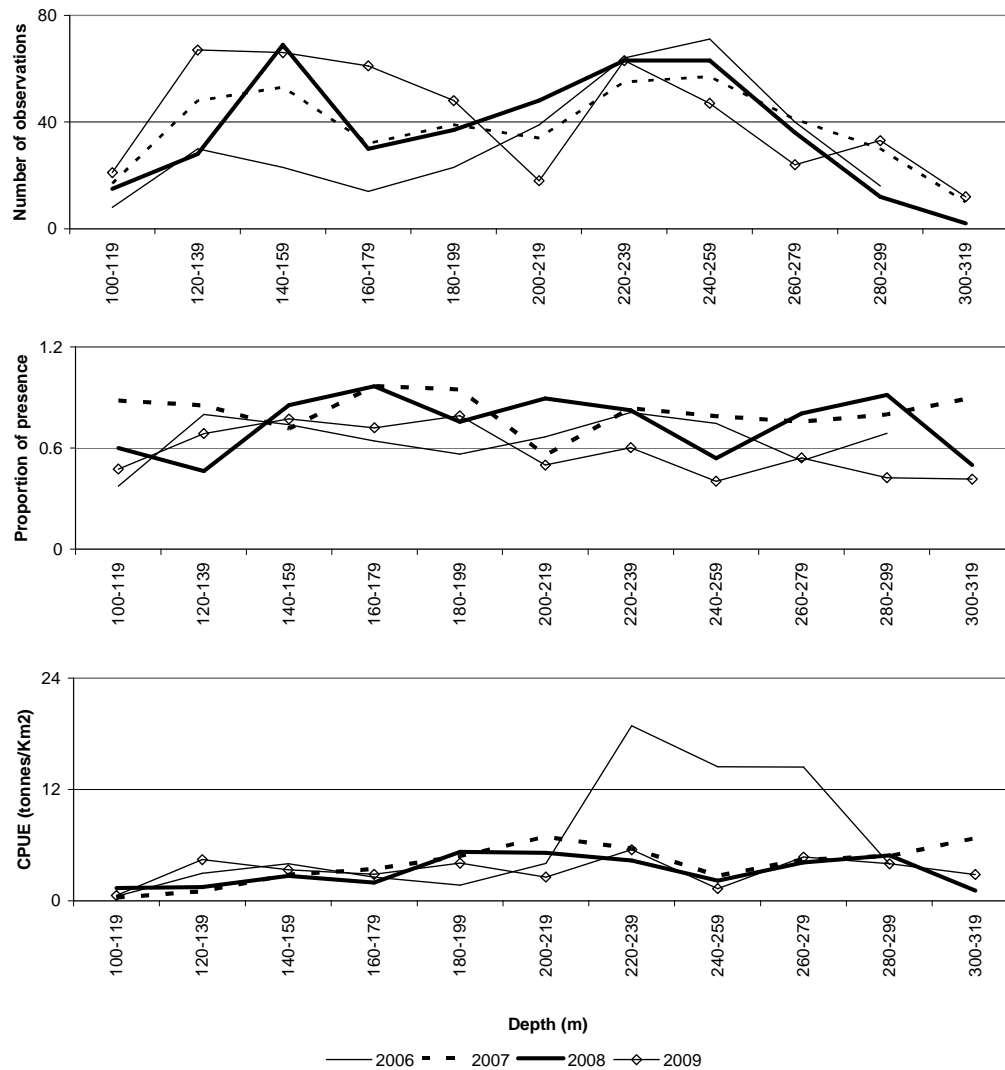
## RESULTS AND DISCUSSION

*Loligo* were mostly concentrated in the northern area; while were very scarce in the central and southern areas (**Fig. 2**).



**Fig.2. CPUE (tonnes/h) of *L. gahi* observed during July 2009 *Loligo* Survey.**

The observations made every 15 minutes on the SCANMAR sensor covered from 100 to 320 m of depth, *Loligo* were present along the whole range of depths, but were most abundant at 180-239 and 260-319 m depths (**Fig. 3**). The number of observations and proportion of presence by depth were similar to those found during the July 2007 and July 2008 surveys, but much lower than in July 2006 at 220-279 m depth.



**Fig. 3. Number of 15-minute observations (upper plot), proportion of observations with *Loligo* (middle plot) and mean density of positive observations (down plot) by depth and years for second season surveys.**

Rockcod (*marujito*, *Patagonotothen ramsayi*) were abundant and were located mainly to the north of 52°50'S (Fig. 4).

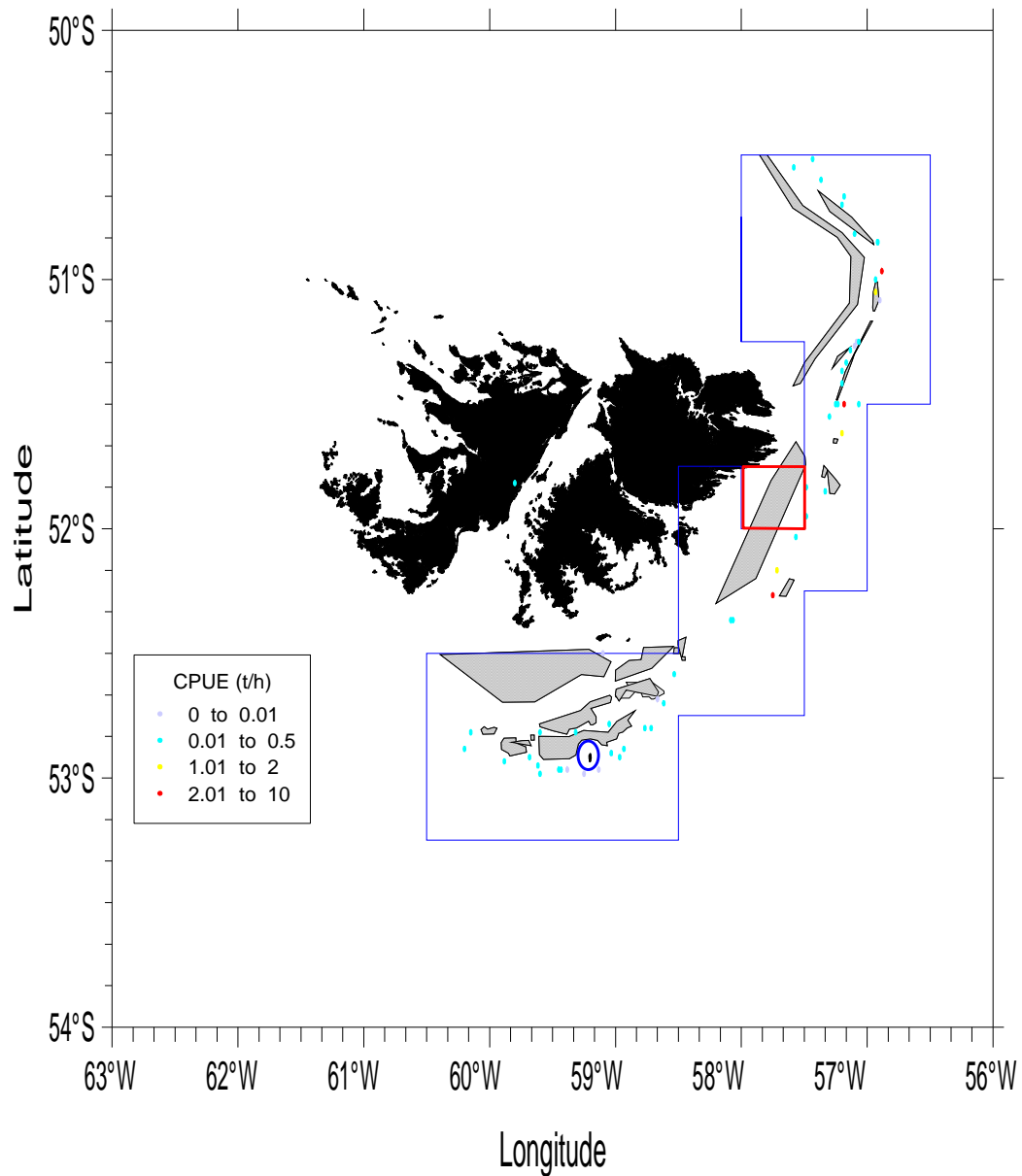
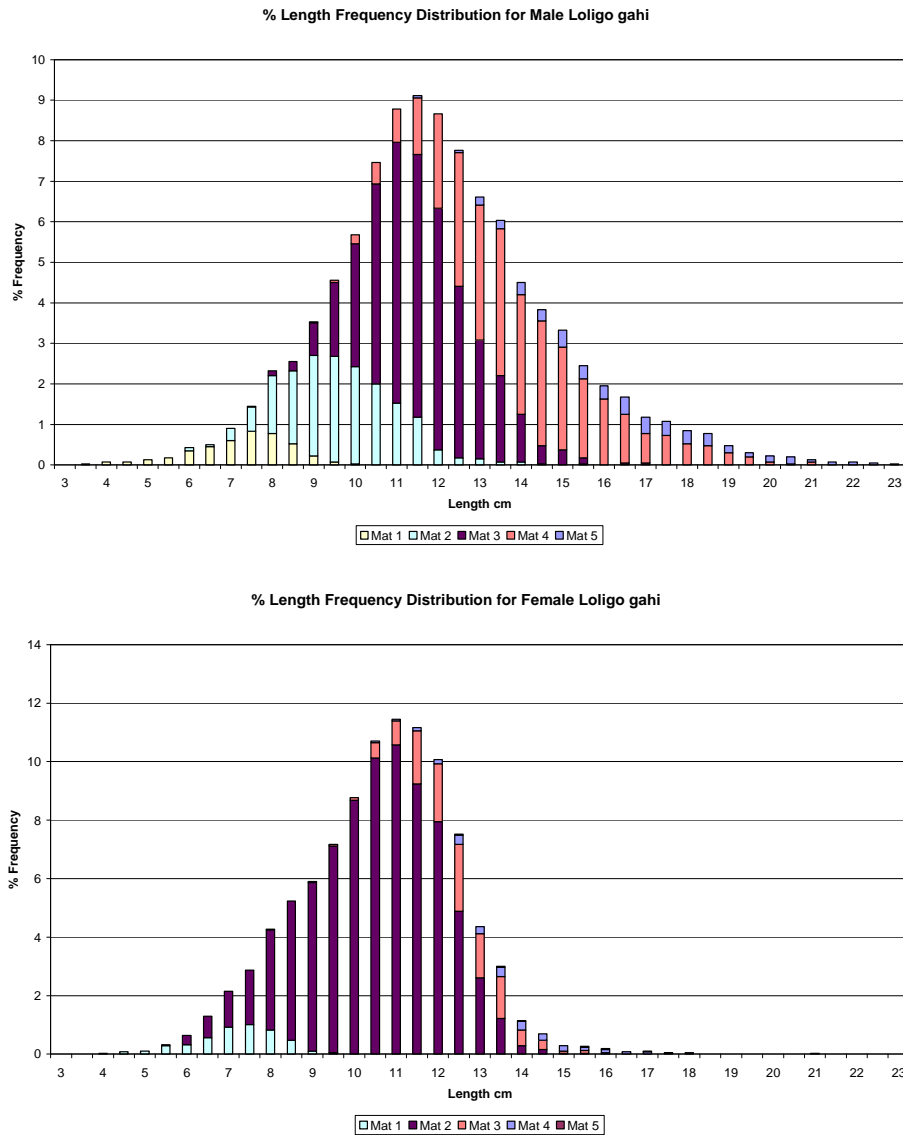


Fig. 4. Rockcod CPUE (t/h) at the initial positions of each trawl.

*Loligo* mantle length frequencies were unimodal with an average (weighed by CPUE) of 10.5 cm for females and 11.8 for males (Fig. 5). Females were 1 cm shorter than in July 2008, but males were similar. The spring-spawning cohort was found only. The maturity stages did not show any presence of the first cohort, most of individuals were

either at immature or maturing stages. The length distribution by sex and maturity stages suggested that the female arrivals were delayed in relation with male arrivals, especially of those females greater than 12 cm.



**Fig. 5. *Loligo* mantle length frequency by sex and maturity stages found during the July 2009 survey.**

The largest *Loligo* were found in the northern and deepest stations along the whole *Loligo* box (**Fig. 6**). The average female proportion (weighed by CPUE) was 0.53 in the whole area, and spatially had the greater values in the centre-northern area (**Fig. 7**).

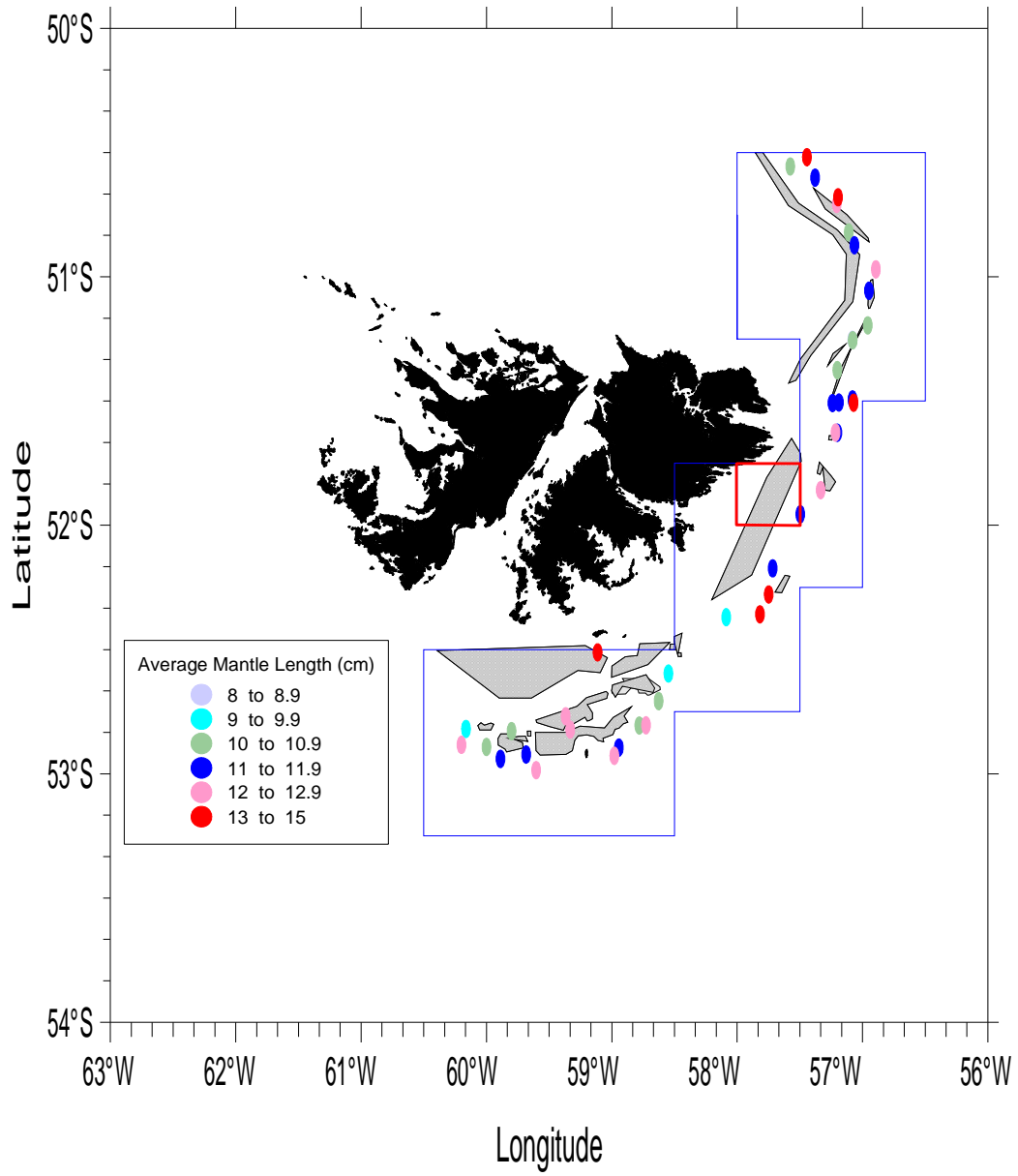
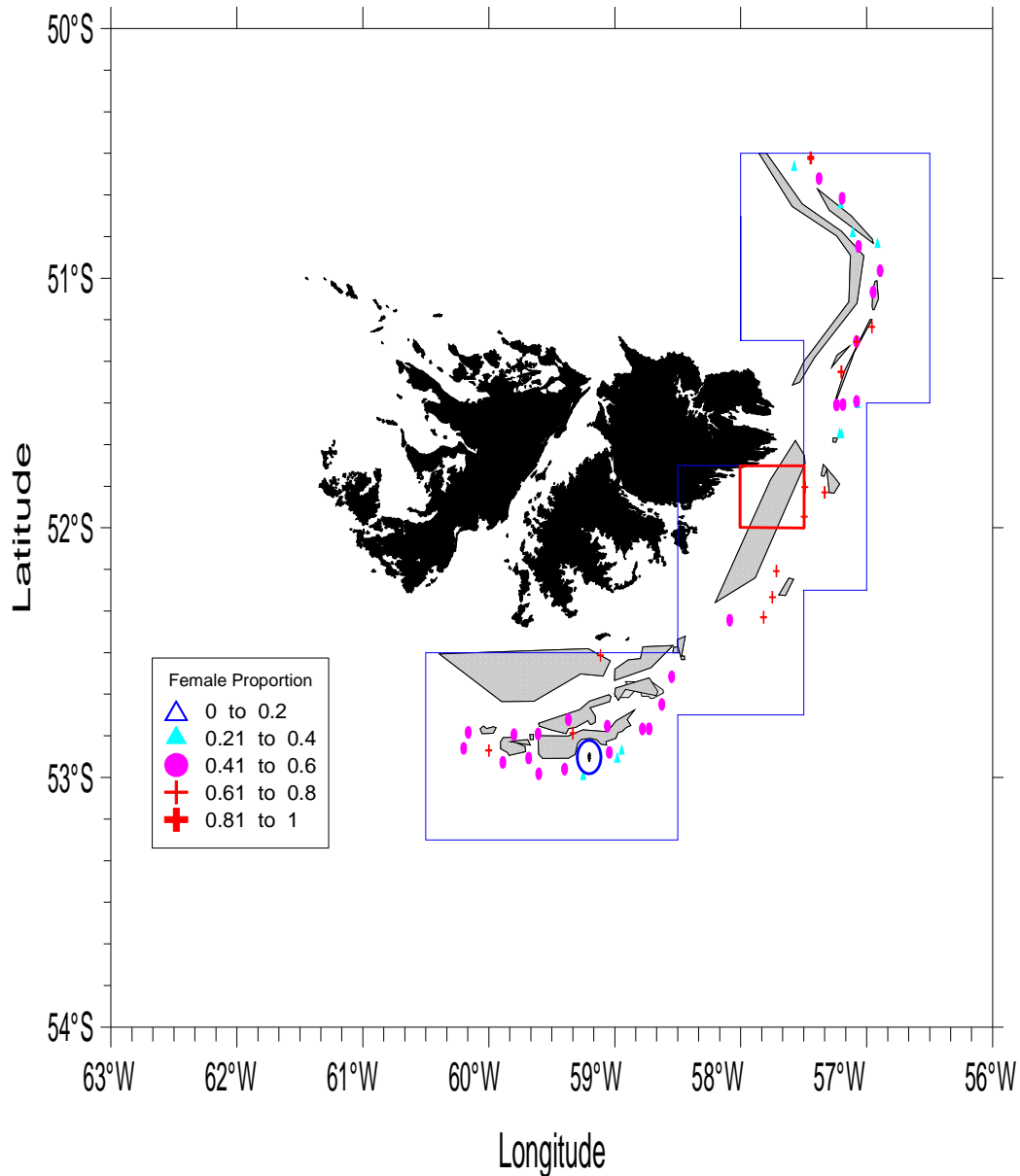


Fig. 6. *Loligo* average mantle length at the start positions of each trawl.



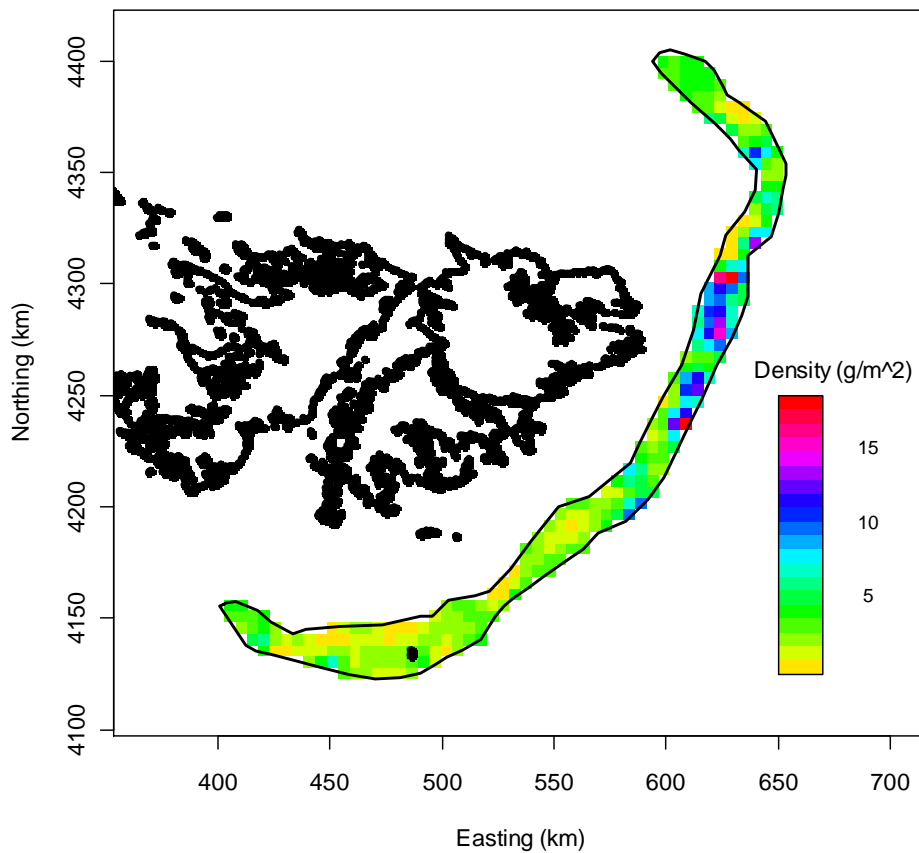
**Fig. 7. *Loligo* female proportion found at the start positions of each trawl.**

The biomass available to the survey in July was preliminary estimated at 20,956 tonnes with a coefficient of variation of 22 % (Tables 1). The biomass was 1.5, 1.1, and 0.9 times greater than the biomasses estimated in the second season of 2008, 2007 and 2006. All figures are preliminary estimations without any standardization of fishing powers. *Loligo* densities were higher in the northern area (Fig. 8), although the presence was higher in the southern area (Fig. 9). The scarce abundance of *Loligo* in

the southern area during the start of the second season is an unusual event, and is probably related with a significant delay in the immigration time into this area.

**Table 1. Main results of July surveys by year. Preliminary figures that are not standardized by fishing power.**

	2006	2007	2008	2009
Biomass (tonnes)	22625	19198	13790	20956
Mean Density (g/cm <sup>2</sup> )	5.21	3.33	2.68	4.20
Area occupied by the stock	4341	5765	5145	4995
Fishing Grounds Area (km <sup>2</sup> )	7027	7027	7027	7027



**Fig. 8. *Loligo* density estimations for July 2009 survey.**

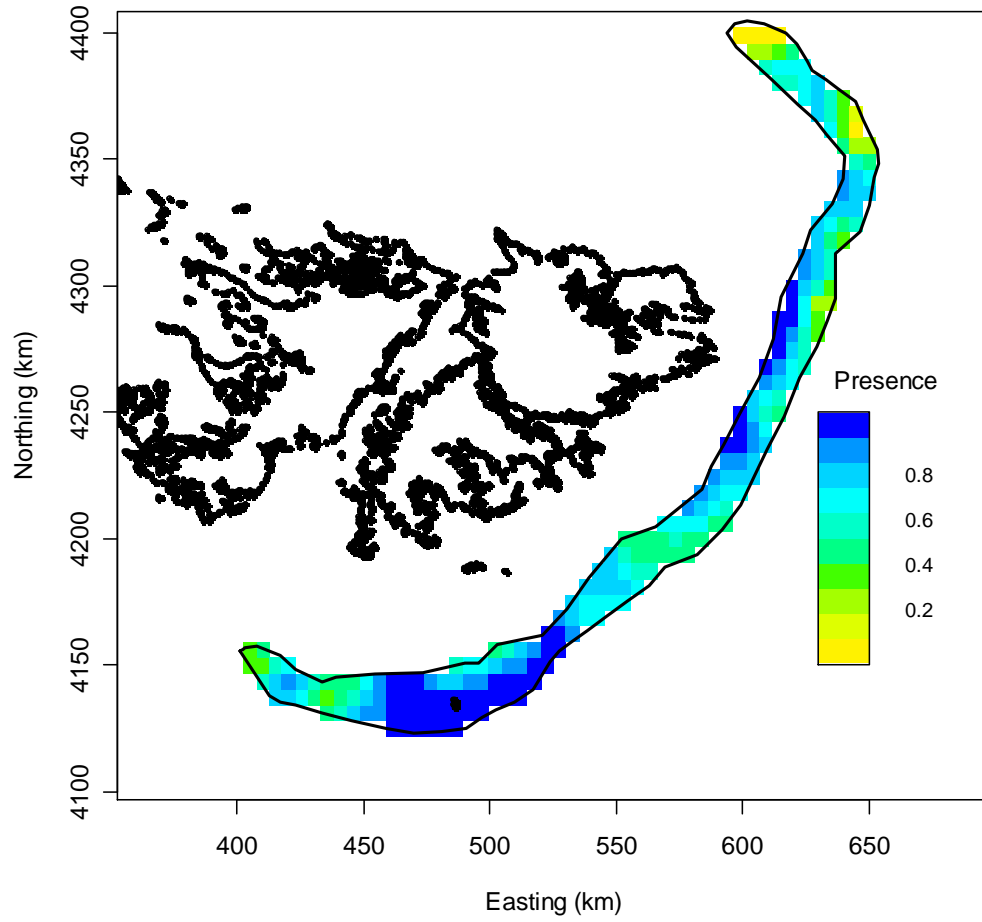
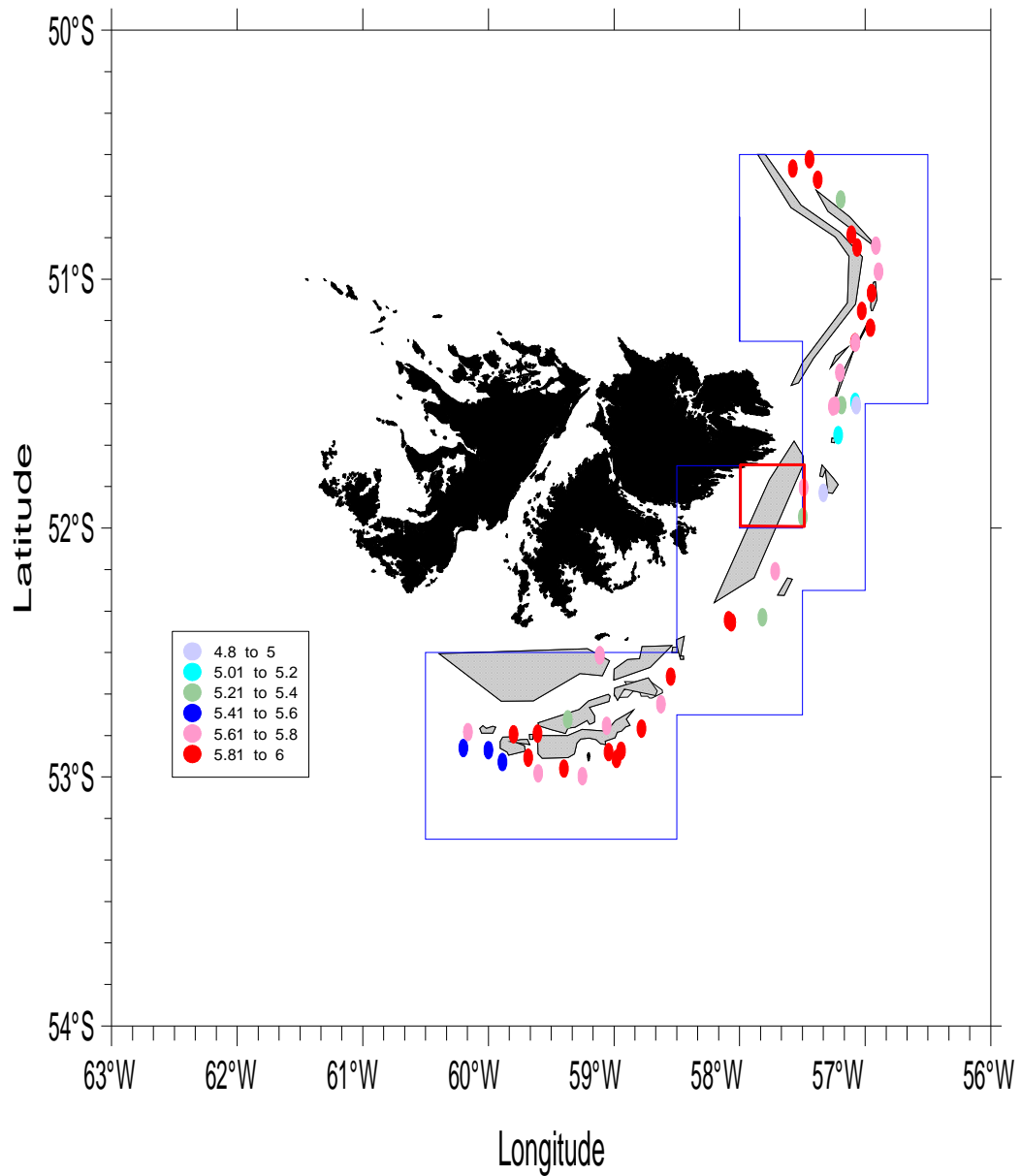


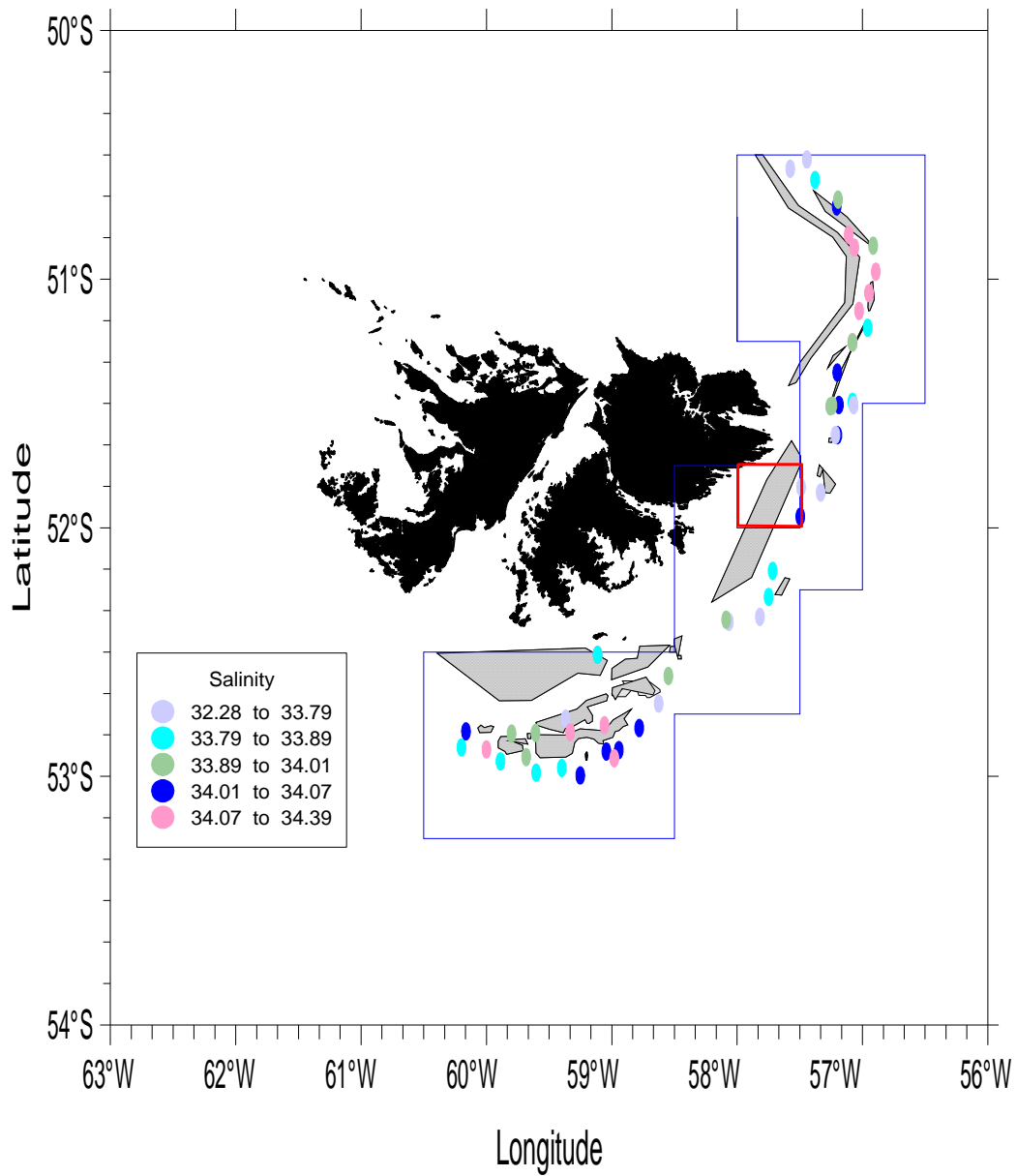
Fig. 9. *Loligo* presence during the July survey 2009.

The bottom temperatures were colder in the fishing grounds with the highest *Loligo* CPUE (**Fig. 10**).



**Fig. 10. Bottom temperature during July 2009.**

The bottom salinities in the fishing grounds with the best CPUE seem to be of middle-low range (**Fig. 11**).



**Fig. 11. Bottom salinities during July 2009.**

## CONCLUSIONS

1. *Loligo* biomass available to F/V Baffin Bay survey between 30<sup>th</sup> of June and 14<sup>th</sup> of July 2009 was preliminary estimated at 20,956 tonnes, which was 1.5, 1.1, and 0.9 times greater than the biomasses estimated in the second season of 2008, 2007 and 2006.
2. *Loligo* were concentrated in the northern area, and were very scarce in the southern area.
3. *Loligo* mantle length frequencies were uni-modal with an average of 10.5 cm for females and 11.8 cm for males. Females were 1 cm shorter than in July 2008, but males were similar.
4. The length distribution by sex and maturity stages suggested that female arrivals were delayed in relation with male arrivals, especially of those females greater than 12 cm.
5. The average female proportion was 0.53 in the whole area, and spatially the greater female proportions were found in the central-northern area.
6. Preliminary analysis of the oceanography data suggested that the fishing grounds with the highest *Loligo* concentrations had the coldest bottom temperatures and medium-range salinities.
7. The scarce abundance of *Loligo* in the southern area during the start of the second season is unusual, and probably is related to a significant delay in the immigration timing into this area.

## ACKNOWLEDGMENT

This study could not be done without the collaboration of the captain and crew of the F/V Baffin Bay. The captain and bridge officers actively participated in the identification and classification of *Loligo* acoustic marks. The crew helped attaching and removing the data storage tags from the net in every haul and facilitate the

biological sampling in the factory. The survey was conducted in a very friendly environment.

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