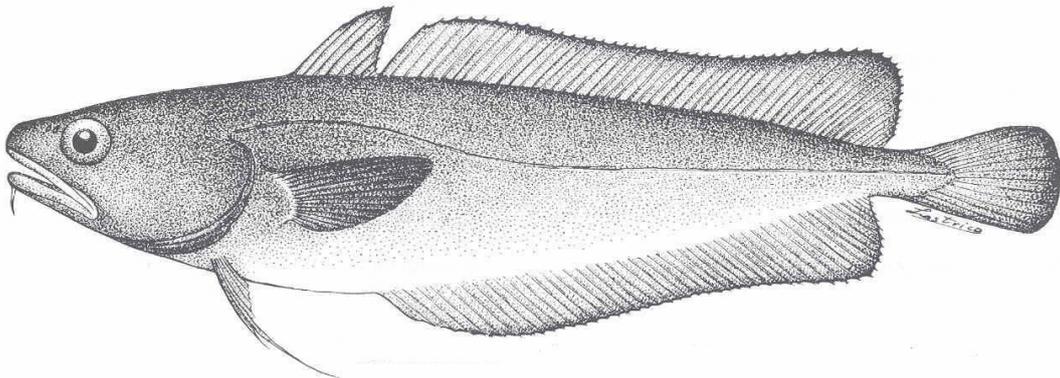


Scientific Report

Fisheries Research Cruise ZDLH1-10-2006



**Fisheries Department
Falkland Islands Government**

Scientific Report
Fisheries Research Cruise
ZDLH1-10-2006



FPRV Dorada

30th September – 13th October 2006

Fisheries Department
Falkland Islands Government
Stanley
Falkland Islands

<i>Participating Scientific Staff</i>	<i>Principle author of Section</i>
Dr. Alexander Arkhipkin	<i>1.1 and 3.2</i>
Dr. Paul Brickle	<i>Editor and 1.0 – 3.7</i>
Dr. Vladimir Laptikhovski	<i>2.0</i>
Wetjens Dimmlich	<i>3.7.1</i>
Daniel Fowler	
Bahadır Önsoy	
St. John Payne	

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Summary

ZDLH1-10-2006 was undertaken on the shelf to the south and west of the Falkland Islands. The main tasks of the cruise were to identify the spawning grounds of red cod and southern blue whiting in order to delineate them for future stock assessment surveys; to tag skates for migration and age validation studies and to continue oceanographic studies of the Falkland shelf.

After departure on the evening of 30 September, the vessel proceeded to the south of the Falkland Island and spent two days trawling on the standard transects P6 and P7. The rest of the cruise was spent working in the 'skate' box (XUAH) targeting skates and tagging them, and in several 'redcod' boxes to the south of Cape Meredith (West Falkland) to investigate the spawning behaviour of redcod and southern blue whiting. Two days were devoted to diel stations, where the trawls were conducted at different times of the day. Only one working day was lost because of bad weather. The *Dorada* returned to FIPASS on the morning of 13 September.

During the cruise a total of 39 bottom trawls and 36 oceanographic stations were conducted. This cruise yielded 74,221 kg of over 60 species. The most important species in terms of weight caught during this cruise were *Salilota australis* (redcod), *Micromesistius australis australis* (southern blue whiting) and *Patagonotothen ramsayi* (Patagonian rockcod). Over this period the redcod spawning grounds were identified. During the subsequent diel trawl stations, their time of spawning was revealed. A peak in spawning occurred from late afternoon to early evening. Spawning aggregations were found at depths between 180 and 200 m. Spawning seemed to occur on ridges perpendicular to the current and were associated with a frontal system comprising shelf water and waters of the western branch of the Falkland Current. Participating scientists also managed to fertilize, incubate and hatch eggs of both southern blue whiting and redcod during the cruise. These successful experiments will be useful for future egg and larval studies of the area.

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1.0 Introduction

In October 2006, a research cruise was undertaken in the south-western region of the Falkland Islands Shelf using the Falkland Islands Research and Patrol Vessel *Dorada*. Figure 1 illustrates the sampling locations undertaken during the cruise. The primary objective of the cruise was to identify the spawning grounds of redcod and other finfish in order to delineate them for future stock assessment surveys.

1.1 Cruise objectives

The cruise objectives were to:

1. To identify the spawning grounds of redcod and other finfish species in order to delineate them for future stock assessment surveys.
2. To tag skates for migration and age validation studies.
3. To continue oceanographic studies of the Falkland shelf.

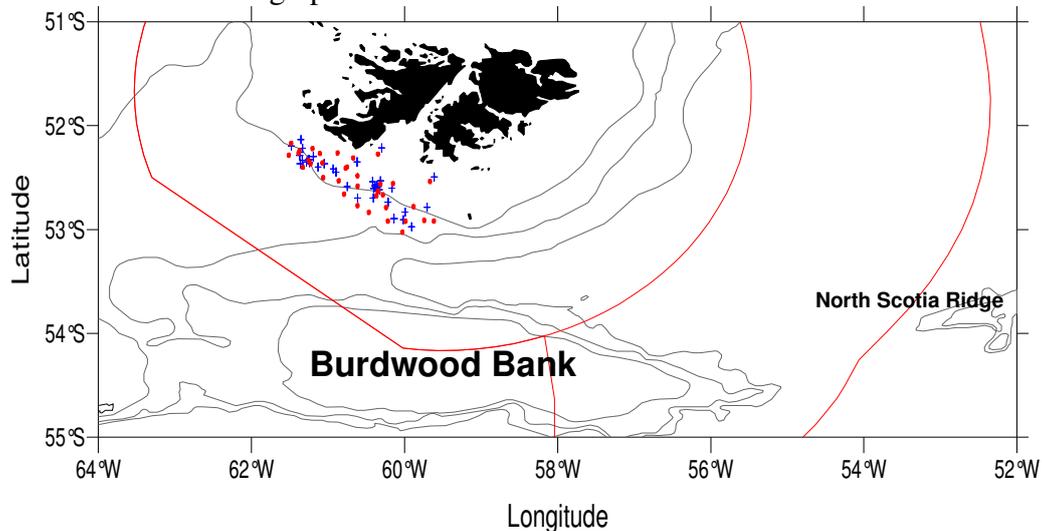


Figure 1: Location of sampling stations undertaken on research cruise ZDLH1-10-2006 between the 30th of September and the 13th of October 2006 (Trawl stations = blue crosses; and CTDs = red circles)

1.2 Cruise Plan and key dates

After departure in the evening of 30 September, the vessel proceeded to the south of the Falkland Island and spent two days of trawling at standard transects P6 and P7. The rest of the cruise was spent working in the 'skate' box (XUAH) targeting skates and tagging them, and in several 'red cod' boxes to the south of Cape Meredith (West Falkland) to investigate the spawning behavior of red cod and southern blue whiting. Two days were devoted to the diel station, where the trawls were made at one station at different times of the day. Only one working day was lost because of bad weather. The *Dorada* arrived to Stanley in the morning of 13 October.

1.3 Vessel Characteristics

The cruise was conducted on the RVFP *Dorada*, which is registered in the Falkland Islands. The *Dorada*'s characteristics are shown in table 1.

Table 1: Vessel characteristics

Callsign	ZDLH1
Length	76 m
GRT	2360 mt
NRT	708 mt
Crew	16 people

1.4 Personnel and responsibilities

The following personnel participated in the cruise:

Dr. Alexander Arkhipkin	Chief Scientist
Dr. Paul Brickle	Trawl survey
Dr. Vladimir Laptikovskiy	Oceanographic survey
Wetchens Dimlich	Trawl survey
Dan Fowler	Trawl survey/Data entry
Bahadir Önsoy	Trawl survey/Data entry
St. John Payne	Trawl survey (Fish ID and sampling)

1.5 Equipment used

1.5.1 Acoustics

The acoustic equipment was similar to that used on previous research cruises and included:

1. Simrad EK500 scientific echo-sounder with hull mounted split transducers at 38 kHz and 120 kHz; and
2. SonarData Echolog_EK v1.50 (data acquisition and Echo View (post processing) software.

The EK500 had a ping interval of approximately 2 seconds. The calibration of the EK500 was not carried out during this research cruise. All data were logged with an expanded bottom echogram of approximately 15 m range, starting at 10 m above the substrate. The range of the echogram was automatically adjusted to cover the entire water column.

1.5.2 Trawling

At all trawl stations, a standard bottom trawl equipped with polyvalent trawl doors, tickler chain and a 40-mm codend liner were used. The trawl was equipped with SIMRAD ITI sensors. The typical vertical opening of the trawl was between 6 and 10 m.

1.5.3 Oceanographic

The oceanographic equipment used on ZDLH1-10-2006 was the same as was used on previous surveys and included.

1. CTD SBE-25 with Sea Tech fluorometer and an oxygen sensor; and
2. Thermosalinometer SBE45.

1.6 Acoustic surveying

During the survey acoustic data were logged over the entire trip. The data were archived in SonarData EK5 format on a PC in the dry lab running the SonarData Echolog 500.

1.7 Trawl stations and biological sampling

During the ZDLH1-10-2006 research cruise the station numbers ranged from 2553 to 2627 (Table 2). The catches at all stations were weighed using an electronic marine adjusted balance (POLS, min 10 g, and max 80 kg).

Finfish and rajids were measured (total, pre-anal and disc width) to the nearest centimetre below and sex and stage of maturity were recorded for all specimens sampled. Individual weights were measured to the nearest gram using a POLS balance or, for larger specimens, to the nearest 20 grams using the Scanvaegt balances.

Cephalopods were analysed for length, sex, maturity and weight, with statoliths extracted from sub samples.

Table 2: Trawl and Oceanographic stations conducted during ZDLH1-10-2006 (B = bottom trawl; C = CTD)

Station	Activity	Time	Start		Start	Depth	Duration	
			Latitude		Longitude	(m)		
2553	B	07.30	52	29.6	59	36.7	100	45
2554	C	09.07	52	32.3	59	40.1	105	6
2555	B	13.17	52	47.2	59	42.3	158	113
2556	C	15.31	52	46.8	59	53.01	167	
2557	B	16.50	52	58.4	59	54.5	279	107
2558	C	19.00	52	54.7	59	44.6	280	20
2559	B	07.30	52	41.9	60	36.8	328	112
2560	C	09.38	52	39.6	60	47.5	330	
2561	B	10.30	52	35.2	60	45	300	119
2562	C	12.14	52	31.9	60	51.6	233	10
2563	B	13.06	52	26.8	60	53.8	182	98
2564	C	14.58	52	24	60	45.1	165	7
2565	B	16.46	52	21	60	37.2	142	75
2566	C	18.45	52	24.5	60	46.2	170	10
2567	C	20.15	52	18.7	60	40.3	111	7
2568	B	07.30	52	12.8	60	18	82	60
2569	C	08.45	52	16.5	60	20.8	98	5
2570	B	10.37	52	31.8	60	18.8	145	88
2571	C	12.26	52	33.5	60	9.1	147	6
2572	B	13.03	52	36.16	60	9.8	149	97
2573	C	14.53	52	33.7	60	18.9	157	7
2574	B	16.05	52	32.4	60	25.1	166	175
2575	C	19.40	52	40	60	17	193	12
2576	B	08.00	52	41.9	60	24.5	247	92
2577	C	10.00	52	47.3	60	14.5	218	8
2578	B	10.50	52	44.3	60	12.9	197	92
2579	C	12.39	52	40.5	60	22.1	218	10
2580	B	13.44	52	35.5	60	20.8	161	46
2581	C	14.44	52	37.8	60	20.9	111	10
2582	B	19.00	52	36.7	60	21.5	157	30
2583	C	19.56	52	37.9	60	20.5	194	8
2584	B	05.34	52	34.85	60	23.4	166	91
2585	B	09.50	52	35.7	60	22.9	171	60
2586	C	13.04	52	46.2	60	36.9	401	17
2587	C	14.51	52	35	60	36.8	230	10
2588	C	15.46	52	29	60	36.9	182	9
2589	B	22.02	52	34.5	60	21.6	161	83
2590	B	01.00	52	36.2	60	24.3	186	74
2591	B	12.45	52	37	60	19.7	184	108
2592	B	17.50	52	25	60	55.9	182	89
2593	B	08.00	52	22	61	3	182	80
2594	C	09.45	52	16.09	61	6.4	157	

Station	Activity	Time	Start		Start		Depth	Duration
			Latitude		Longitude		(m)	
2595	B	10.47	52	21.29	61	14.6	217	103
2596	C	12.44	52	21.5	61	4.4	180	8
2597	B	13.26	52	24	61	7.8	246	104
2598	C	15.34	52	22	61	13.7	204	7
2599	B	16.20	52	19.6	61	15	205	90
2600	C	18.16	52	14.5	61	22.4	195	
2601	B	07.30	52	13	61	19.9	173	95
2602	C	09.24	52	10.2	61	28.9	204	10
2603	B	09.43	52	11.8	61	28.8	210	90
2604	C	11.29	52	15.9	61	23.1	209	
2605	B	13.15	52	8.1	61	21.3	158	96
2606	C	15.08	52	13.2	61	12.2	148	7
2607	C	16.15	52	15.8	60	52.5	107	6
2608	B	10.55	52	15.5	61	21.8	197	102
2609	C	12.53	52	20	61	15.3	205	9
2610	B	13.08	52	19.8	61	15.7	206	106
2611	B	15.01	52	17.2	61	22.2	213	
2612	B	16.55	52	17.8	61	11.5	173	73
2613	B	08.05	52	19.9	61	14.9	200	95
2614	B	10.25	52	22	61	21.8	242	86
2615	B	12.59	52	20.1	61	20.1	211	75
2616	C	15.46	52	17.1	61	30.8	274	11
2617	C	16.43	52	24	61	19.8	254	11
2618	B	17.45	52	20.9	61	16.8	213	59
2619	C	20.00	52	30	61	3.8	277	16
2620	B	7.55	52	50	59	59.6	175	60
2621	C	09.10	52	55.2	59	59.4	205	14
2622	B	09.50	52	54.4	60	1	198	75
2623	C	12.21	52	50.1	60	28	308	13
2624	C	13.33	52	55.1	60	13.1	324	15
2625	B	14.19	52	53.7	60	8.2	221	101
2626	C	16.38	53	1.5	60	1.8	390	19
2627	C	18.32	52	55.1	59	37.1	150	

2.0 Oceanography

2.1 Methods

A logging CTDO (SBE-25, Sea-Bird Electronics Inc., Bellevue, USA) was deployed from the surface to 1-20 m above the bottom to obtain profiles of temperature ($^{\circ}\text{C}$), salinity (PSU), and dissolved oxygen (ml l^{-1}). The CTD was deployed for the first one minute at about 8-10 m depth to allow the polarisation of the oxygen sensor. It was then retrieved to 1 m depth and deployed again either to depth of about 1000 m or to approximately 10 m from the bottom. The speed of deployment was c. 1m/s and was monitored by the use of a wire counter. Temperature was measured directly whereas the other variables were calculated using Seasoft v.4.326 software (Sea-Bird Electronics Inc.) from the following measured parameters: pressure (db), conductivity (S/m), oxygen current (μA) and temperature ($^{\circ}\text{C}$). The CTDO sensors are calibrated annually by Sea-Bird Electronics Inc. For each station, vertical profiles of temperature, salinity and density were constructed using the Seasoft software. Profiles for each transect and iso-surfaces were constructed using the VG gridding method included in the Ocean Data View package v. 3.0-2005 (Schlitzer 2005).

2.2 Results

Oceanographic data were collected at 36 stations. These stations were made either before or after each trawl. The stations were situated on the southern Falkland shelf between 98 and 400 m (Figure 2).

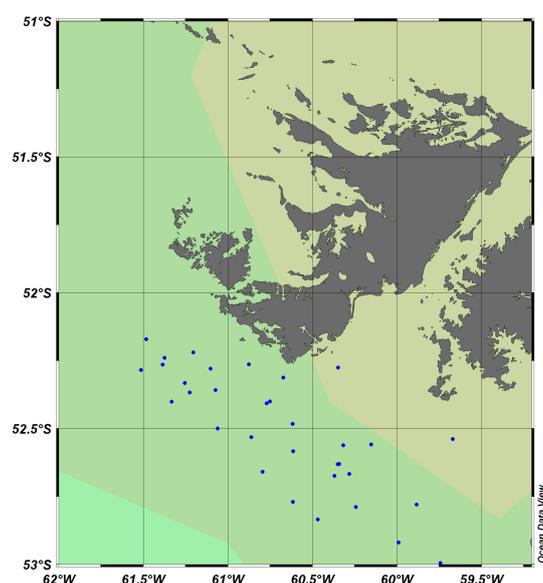


Figure 2: Locations of oceanographic stations conducted on ZDLH1-10-2006

The survey was aimed at assessing the oceanographic conditions on the redcod, *Salilota australis*, spawning grounds and to gather environmental data influencing their spawning aggregations and larval survival. Temperatures ranged from 4.88° to 6.15°C , salinity from 33.60 to 34.12 psu, and densities from 26.42 to 26.99 kg/m^3 . T-S curves are shown in Figure 3.

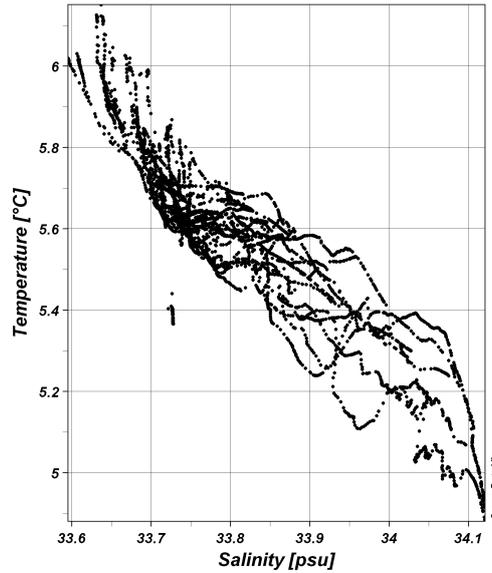
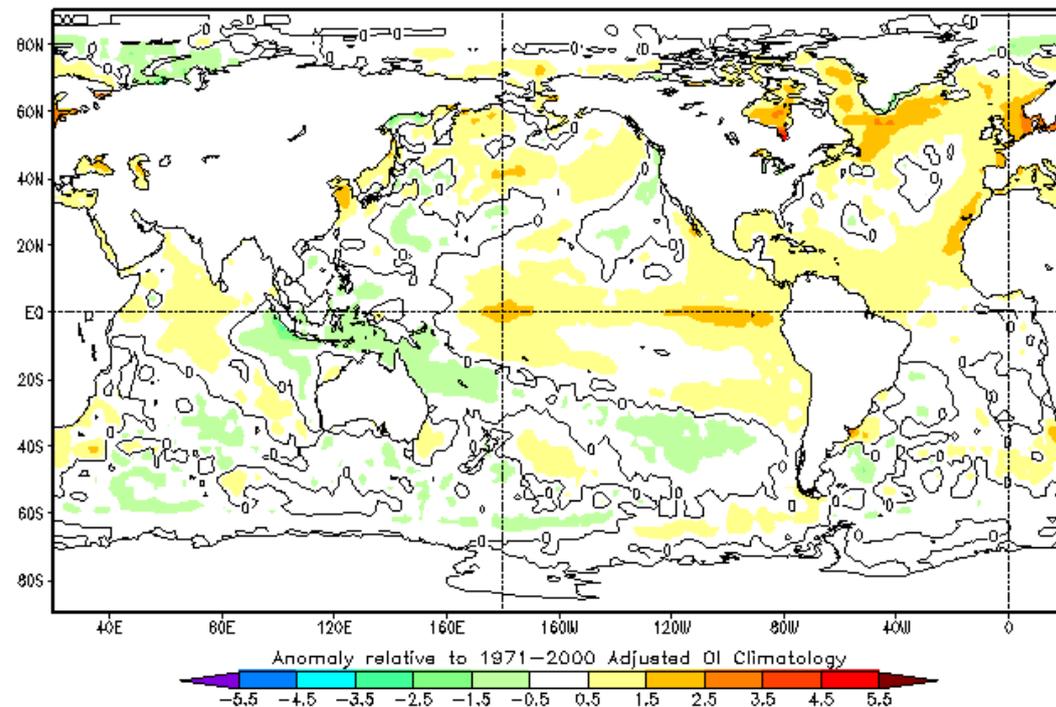


Figure 3: T – S curves of water masses on the southwest Falkland Shelf

The area was characterized by a normal temperature background with neither positive nor negative SST anomalies in the Falkland waters (Figure 4). There was a big inflow of cold and saline waters of the Falkland Current on the southwest Falklands' shelf. A strip of these waters moved northward between 60°30 W and 61°W reaching 52°30 S (Figure 5). A strong frontal zone appeared at its periphery. This cold flow met shelf waters that were moving generally from the Patagonian shelf in an eastward direction making a loop around the northern tip of this flow (Figure 5 and 6).

Olv2 Sea Surface Temperature Anomaly (°C)
October 2006



GRADS: OQLA/IGES

Climate Modeling Branch/EMC/NCEP

Figure 4: SST anomalies distribution (negative – green) in October 2006 (NOAA data)

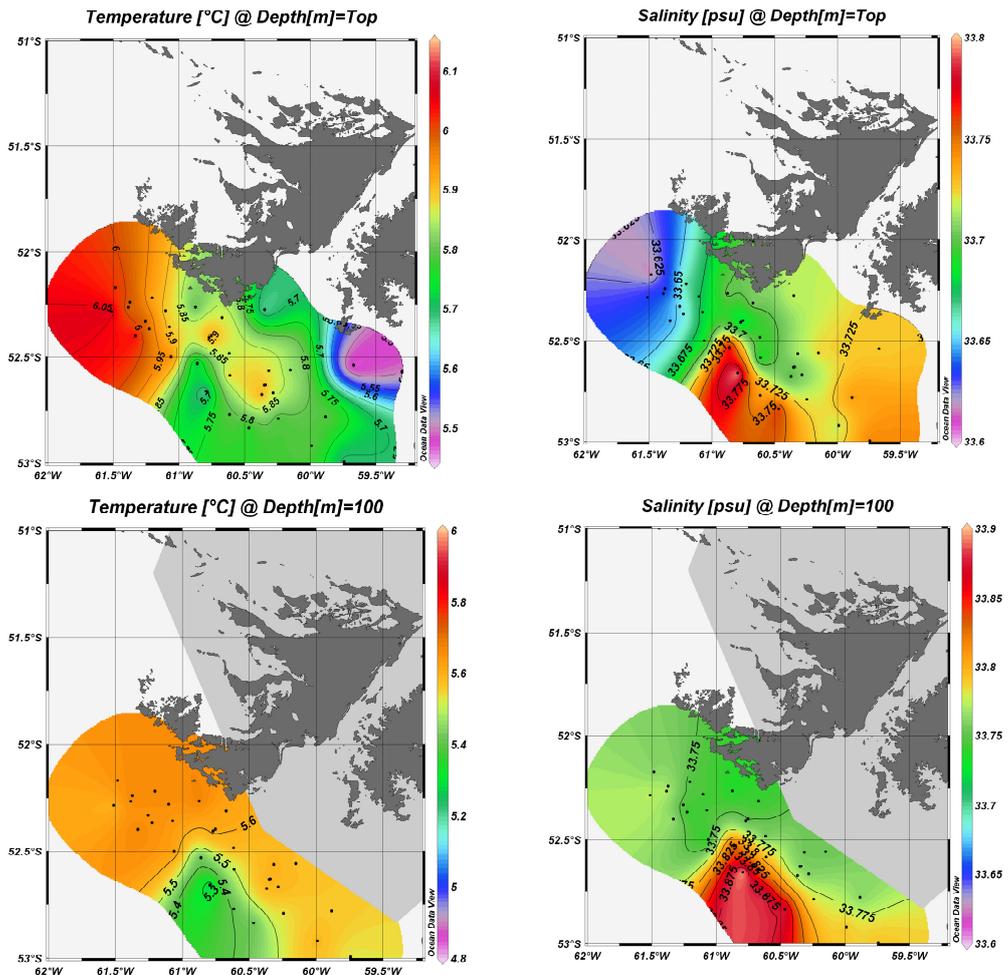


Figure 5: Distribution of temperature and salinity of the southern Falklands' shelf in October 2006

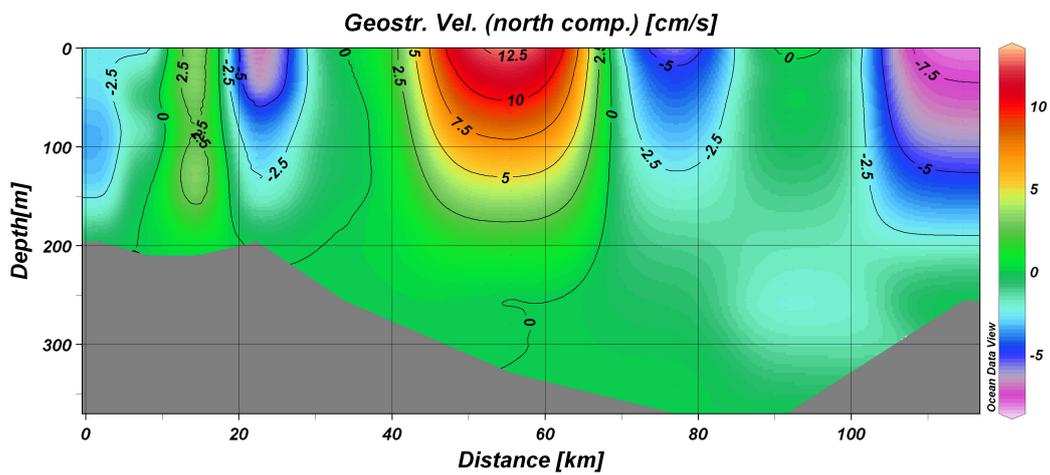


Figure 6: Northern component of geostrophic velocities (cm/s) across the transect south of the West Falkland

3.0 Biological Sampling

3.1 Catch and by-catch

Trawling was conducted on 39 stations in the southern part of the Falkland Islands' shelf. Trawling time on horizon varied between 7 and 85 minutes, with an average time at horizon of 51 minutes.

A total of 74,221 kg, consisting of over 60 species, was caught during the cruise (Table 3). In terms of weight, the greatest catches during the cruise were redcod (*Salilota australis*), southern blue whiting (*Mircomesistius australis*) and the Patagonian rockcod (*Patagonotothen ramsayi*). These three species accounted for over 90% of the total catch.

Table 3: Total catch of trawl stations during research cruise ZDLH1-10-2006

Species Code	Species Name	Total Catch (kg)	Total Sampled (kg)	Total Discarded (kg)	Proportion (%)
BAC	SALILOTA AUSTRALIS	34985.27	2531.28	34985.27	47.14
BLU	MICROMESISTIUS AUSTRALIS	29108.36	1009.50	29108.36	39.22
PAR	PATAGONOTOTHEN RAMSAYI	4301.37	21.01	4301.29	5.80
RBR	BATHYRAJA BRACHYUOPS	887.64	886.81	887.64	1.20
RFL	DIPTURUS CHILENSIS	809.44	809.44	809.44	1.09
CGO	COTTOPERCA GOBIO	726.72	0.00	726.72	0.98
DGH	SCHROEDERICHTHYS BIVIUS	613.14	54.00	581.14	0.83
WHI	MACRURONUS MAGELLANICUS	452.81	122.51	450.23	0.61
RGR	BATHYRAJA GRISEOCAUDA	282.98	282.98	272.98	0.38
MUG	MUNIDA GREGARIA	238.03	1.49	238.03	0.32
LOL	LOLIGO GAHI	215.66	155.82	196.74	0.29
KIN	GENYPTERUS BLACODES	190.82	189.09	78.36	0.26
UCH	SEA URCHIN	173.89	0.00	173.89	0.23
RAL	BATHYRAJA ALBOMACULATA	156.54	156.54	156.54	0.21
SPN	SPONGES	152.13	0.00	152.13	0.20
RMU	BATHYRAJA MULTISPINIS	116.82	116.82	116.82	0.16
RBZ	BATHYRAJA COUSSEAUAE	107.60	104.60	107.60	0.14
SHT	MIXED INVERTEBRATES	96.16	0.00	96.16	0.13
AST	ASTEROIDEA	84.97	0.00	74.17	0.11
GRC	MACRURUS CARINATUS	73.21	50.85	73.21	0.10
RSC	BATHYRAJA SCAPHIOPS	57.75	54.91	57.75	0.08
PYM	PHYSICULUS MARGINATUS	56.17	0.00	56.17	0.08
HAK	MERLUCCIUS HUBBSI	46.59	37.90	31.46	0.06
GRF	COELORHYNCHUS FASCIATUS	33.60	0.00	33.60	0.05
RMC	BATHYRAJA MACLOVIANA	29.04	27.24	29.04	0.04
TOO	DISSOSTICHUS ELEGINOIDES	27.09	27.09	27.09	0.04
ANM	ANEMONE	22.85	0.00	22.85	0.03
WLK	WHELKS	22.66	0.00	22.66	0.03
NEM	NEOPHYRNICHTHYS MARMORATUS	21.92	18.26	21.92	0.03
GOC	GORGONOCEPHALAS CHILENSIS	19.60	0.00	19.60	0.03
CHE	CHAMPSOCEPHALUS ESOX	14.34	6.59	6.37	0.02
OCM	OCTOPUS MEGALOCYATHUS	13.31	10.23	4.97	0.02
OPH	OPHIUROIDEA	13.01	0.00	13.01	0.02
MUL	ELEGINOPS MACLOVINUS	12.30	12.30	8.94	0.02

<i>Species</i>	<i>Species Name</i>	<i>Total</i>	<i>Total</i>	<i>Total</i>	<i>Proportion</i>
<i>Code</i>		<i>Catch (kg)</i>	<i>Sampled (kg)</i>	<i>Discarded (kg)</i>	<i>(%)</i>
RPX	PSAMMOBATUS SPP.	11.95	11.95	4.92	0.02
WRM	WORM CASES	9.55	0.00	9.55	0.01
RMG	BATHYRAJA MAGELLANICA	5.16	5.16	4.16	<0.01
ANT	ANTHOZOA	5.03	0.00	5.03	<0.01
PAT	MERLUCCIIUS AUSTRALIS	4.55	4.55	2.33	<0.01
BEJ	BENTHOCTOPUS SP.CF.JANUARI	3.75	3.75	1.80	<0.01
PTE	PATAGONOTOTHEN TESSELLATA	2.98	0.00	2.98	<0.01
EEL	ILUOCOETES FIMBRIATUS	2.06	1.98	2.06	<0.01
BDU	BRAMA DUSSUMIERI	1.95	1.95	0.00	<0.01
STE	STERECHINUS SP.	1.76	0.00	1.76	<0.01
SQT	ASCIDIACEA	1.60	0.00	1.60	<0.01
ADA	ADELOMELON ANCILLA	1.12	0.00	1.12	<0.01
ZYP	ZYGOCHLAMYS PATAGONICA	1.08	0.00	1.08	<0.01
EUL	EURYPODIUS LATREILLEI	0.93	0.00	0.93	<0.01
EGG	EGGMASS	0.82	0.36	0.46	<0.01
ING	MOROTEUTHIS INGENS	0.69	0.00	0.69	<0.01
SEP	SERIOLELLA POROSA	0.60	0.60	0.60	<0.01
RED	SEBASTES OCULATUS	0.46	0.46	0.46	<0.01
PES	PELTARION SPINOSULUM	0.39	0.00	0.39	<0.01
COG	PATAGONOTOTHEN GUNTHERI	0.20	0.20	0.11	<0.01
BRP	BRACHIOPOD SPP.	0.17	0.00	0.17	<0.01
AUC	AUSTROCIDARIS CANALICULATA	0.14	0.00	0.14	<0.01
MUN	MUNIDA SPP.	0.05	0.00	0.05	<0.01
EUP	EUPHAUSIDS	0.02	0.00	0.02	<0.01
MAU	MAUROLICUS MUELLERI	0.01	0.00	0.01	<0.01
SRP	SEMIROSSIA PATAGONICA	0.01	0.01	0.00	<0.01
Total		74220.82	6718.23	73984.58	

3.2 Patagonian longfin squid – *Loligo gahi*

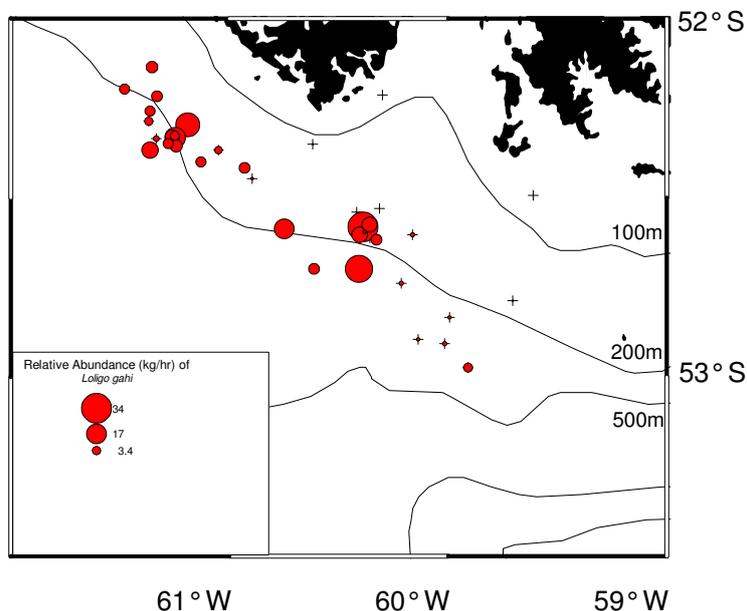


Figure 7: Relative abundance of *Loligo gahi* at each station on the trawl survey ZDLH1-10-2006

The Patagonian squid *Loligo gahi* was quite abundant during the survey mainly in two regions to the south of Falkland Sound, and to the south of Beaver Island (Figure 7). The largest catches were observed at depths of 243 m (29 kg per 1 hr trawl) and 166 m (25 kg per 1 hr trawl) to the south of Falkland Sound. Surprisingly, very little squid were caught to the west of Beauchêne Island. There were no *L. gahi* in shallow waters (Figure 7) during this period.

Almost all of the squid caught (>95%) belonged to the spring-spawning cohort (SSC). They were mainly in pre-spawning condition (females at maturity stages III-V, and males at stages IV-V). However, there were some small immature squid (5-7 cm) belonging to the autumn-spawning cohort in the deepwater parts of the Falkland Shelf.

Length-frequency distributions and maturities of males and females were analysed separately for depth ranges less than and more than 200 m, and for the following regions which were already established in October 2005, i.e. Eastern (to the east of 61°W), and South-western regions (to the west of 61°W) outside the *Loligo* box.

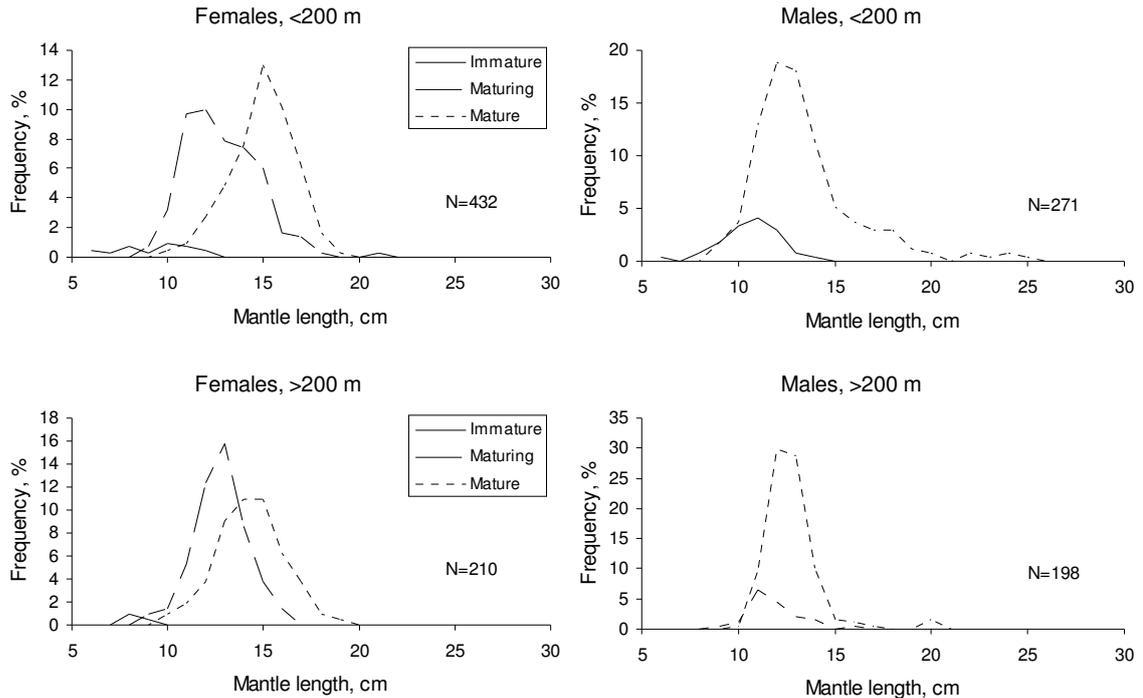


Figure 8: Length frequency distributions of females and males of *Loligo gahi* at different depths in the Eastern region

In the Eastern region, mature males and maturing and mature females of the SSC dominated the catches, with mature females being larger than the mature males. Females were also predominant in sex ratios at depths <200 m, whereas there was an equality of sexes in deeper waters (Figure 8).

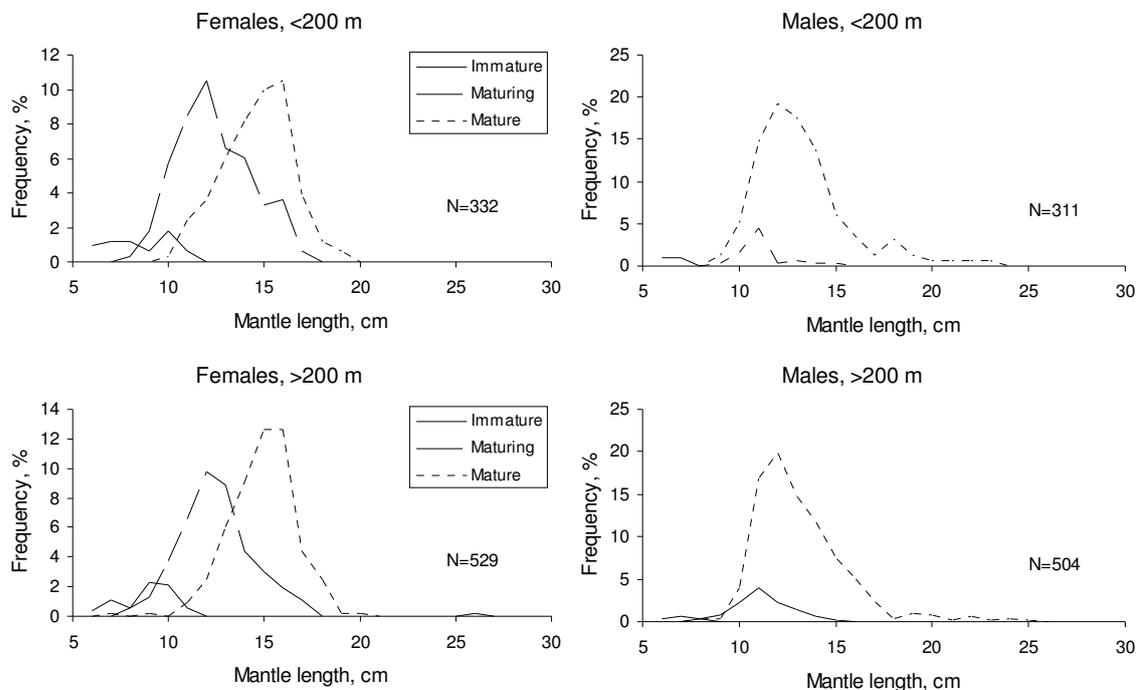


Figure 9. Length frequency distributions of females and males of *Loligo gahi* at different depths in the South-western region.

A similar situation was observed in the South-western region (Figure 9). Females were generally larger than males, with about half of them still being immature. Large males were caught mainly at depths of less than 200 m. Sex ratios were equal in both depth ranges.

In general, maturation rates of females were slower than of those observed in October 2005, when the majority of females were already mature. A negative anomaly in water temperatures in winter 2006 probably slowed down their maturation rates. During the survey, large males had already emigrated from their deepwater feeding grounds to their shallow-water spawning grounds. The size composition of both sexes was quite similar to that of the previous year, only a large-size group of females was present both in the eastern and South-western regions.

3.3 Redcod – *Salilota australis*

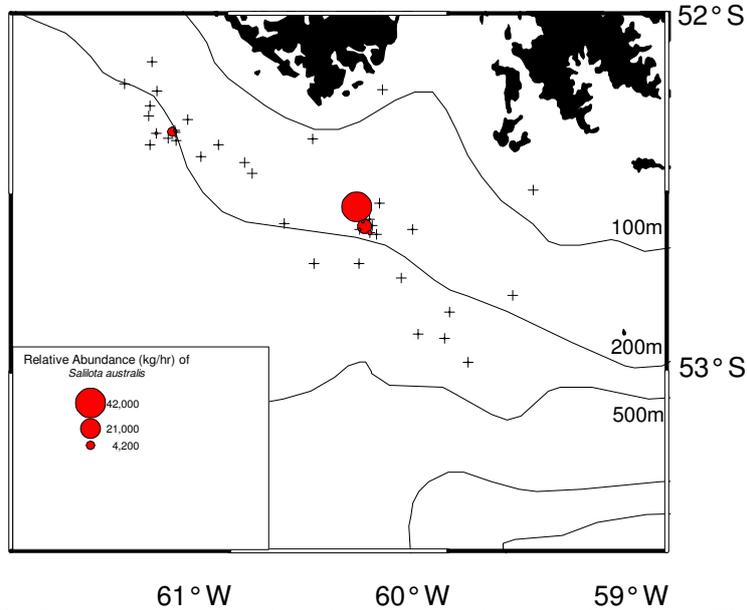


Figure 10: Relative abundance of *Salilota australis* at each station on the trawl survey ZDLH1-10-2006

Salilota australis were caught on 31 of the 39 trawl stations between 142 and 328 m during the survey. The greatest catches were caught to the south and south west of Cape Meredith in water depths of between 180 and 200 m (Figure 10). CPUEs ranged between 0.57 and 42000 kg/hr (mean = 2023 ± 7728) during the cruise.

A total of 1407 redcod ranging from 12 to 88 cm L_T (mean = 52.69 ± 16.63) were sampled on this research cruise (Figure 11).

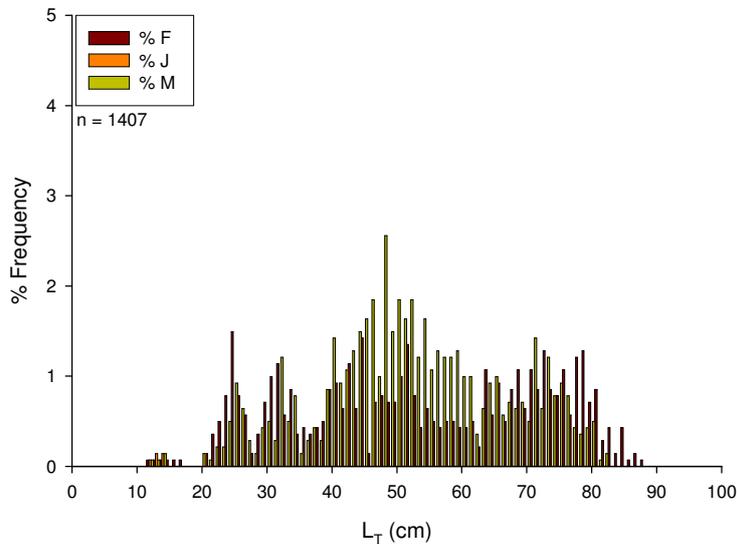


Figure 11: Length frequency distribution of *Salilota australis* sampled during ZDLH1-10-2006

This was the spawning period and as one would expect many of the animals were at maturity stages V, VI and VII-V (Figure 12). The latter stage was included during the cruise to represent those females that had spawned a batch of eggs and were in the process of producing another batch for the following day.

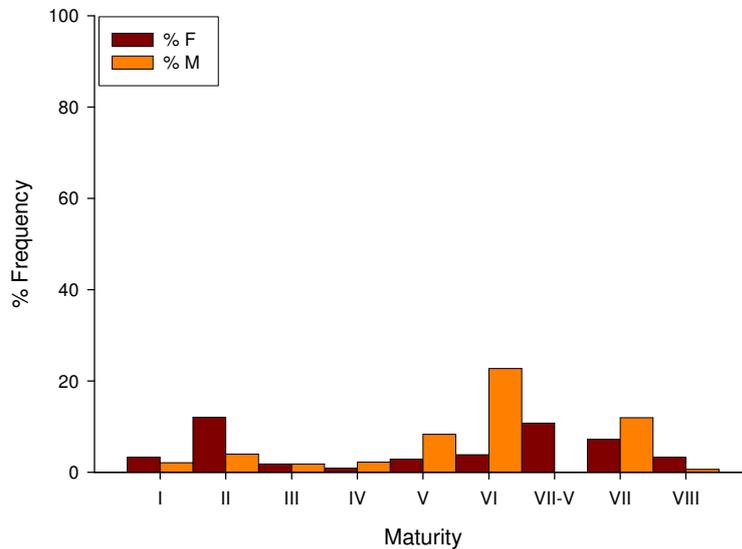


Figure 12: Maturity stages for male and female *Salilota australis* sampled on ZDLH1-10-2006

3.3.1 Spawning grounds and spawning behaviour

Spawning Grounds

During the cruise we identified the spawning grounds of *Salilota australis*. Spawning aggregations were found at depths between 180 and 200 m. Spawning seemed to occur on ridges perpendicular to the current and was associated with a frontal system comprising of shelf water and upwelling waters of the western branch of the Falkland Current. Figure 13 illustrates the abundance of spawning fish (maturities V, VI and VII-V) to the south and south west of Cape Meredith in association with the salinity and temperature of the waters at the horizon of 100 m. Oceanographic data were interpolated with the inverse distance to a power gridding method with a smoothing interpolator.

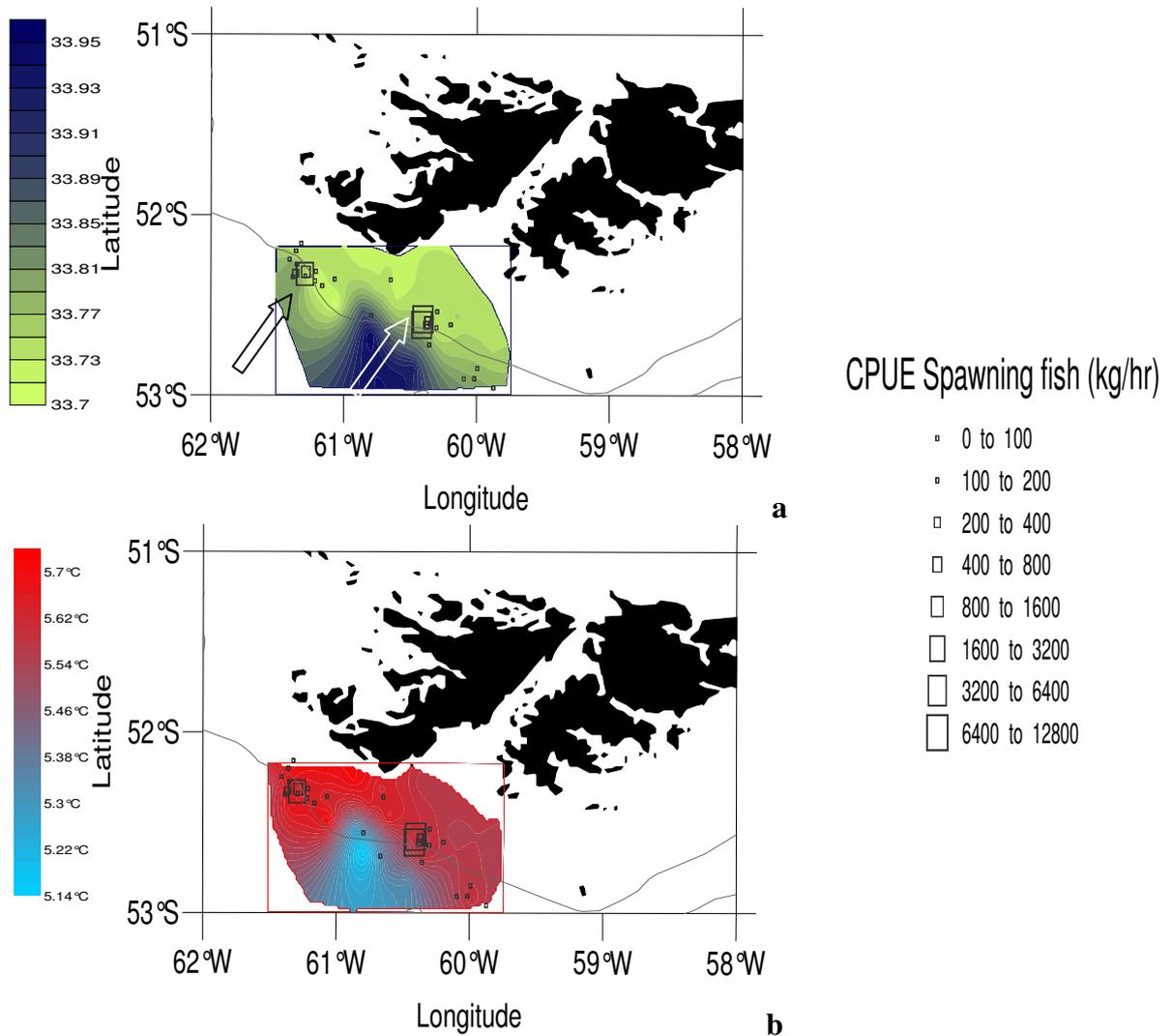


Figure 13: Abundance of spawning *Salilota australis* in association with salinity (a) and temperature (b) at a horizon of 100m.

The highest CPUEs occurred on the edges of the main upwelling systems in the area (see arrows on Figure 13a).

The *RV Dorada* was tasked with trawling over a 24-hr period in order to identify the peak time of spawning. The examination of the frequency distribution of maturity stages in 4 hourly periods through the daily cycle illustrated that there was a peak in spawning during the late afternoon and early evening (1600~2000 hrs) (Figure 14).

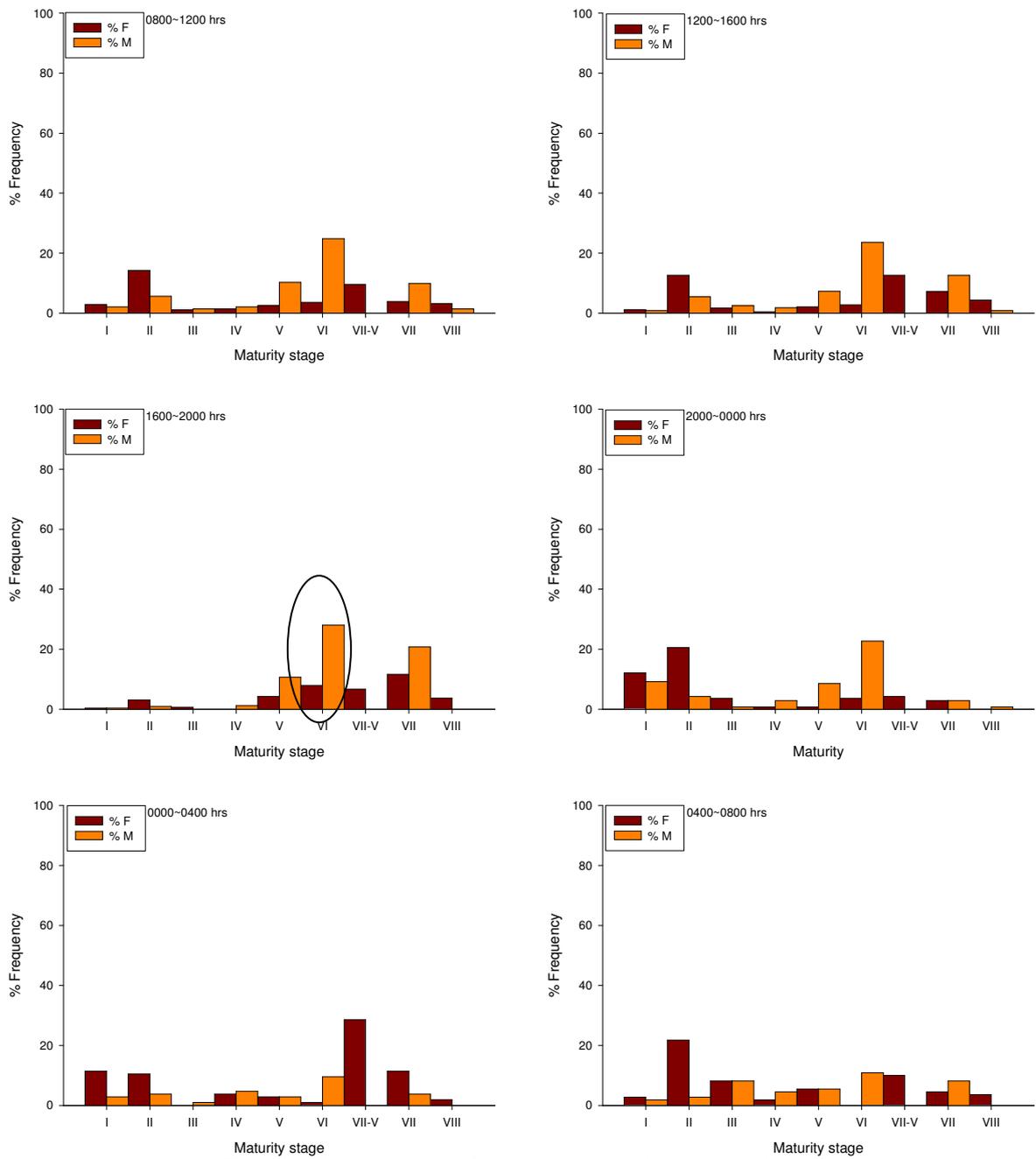


Figure 14: Maturity stages of *Salilota australis* at different times of the day.

Scientists on the cruise also managed to fertilize a number of batches of redbcod eggs and raise them to hatchlings (Figure 15).



Figure 15: *Salilota australis* hatchling ~ 14 days post fertilization, note the large oil droplet in the yolk sac

3.4 Southern blue whiting – *Micromesistius australis*

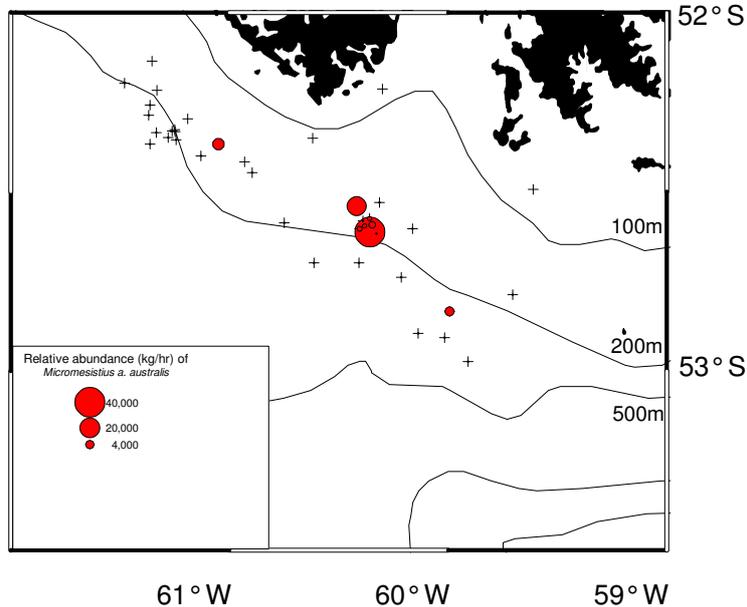


Figure 16: Relative abundance of *Micromesistius australis* at caught at each station on research cruise ZDLH1-10-2006

Micromesistius australis were caught on 31 of the 39 bottom trawls. During the cruise southern blue whiting were caught between 145 and 328 m. The largest catches were encountered to the south of Cape Meredith (Figure 16). CPUEs ranged from 0.30 to 39600 kg/hr (mean = 2488 ± 7726).

During the survey 1335 southern blue whiting were sampled for length frequency analyses and otoliths were removed from sub samples of these. Southern blue whiting ranged in size from 19 to 68 cm L_T (mean = 48.86 ± 7.95) and presented a trimodal frequency distribution (Figure 17).

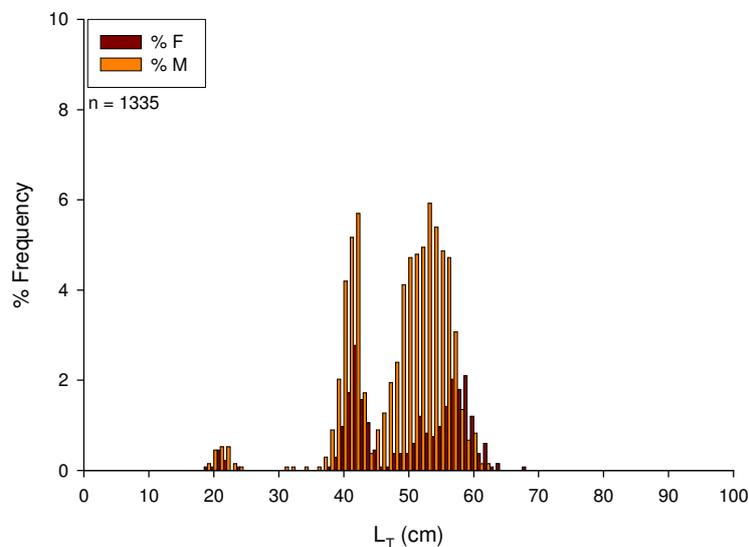


Figure 17: Length frequency distribution of female and male *Micromesistius australis* sampled on ZDLH1-10-2006

This survey encountered southern blue whiting mainly at their post spawning stages (VII and VIII) with fewer numbers in spawning condition (V and VI) (Figure 18). As some animals were still in spawning condition the scientists on board managed to fertilize and hatch larval southern blue whiting (Figure 19).

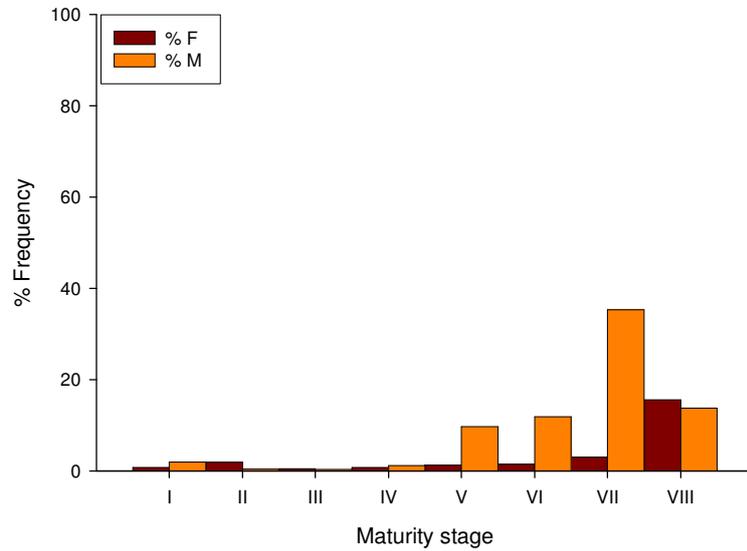


Figure 18: Maturity stages for male and female *Micromesistius australis* sampled on ZDLH1-10-2006



Figure 19: *Micromesistius australis* hatchling ~ 14 days post fertilization, note lack of an oil droplet in the yolk sac

3.5 Hoki – *Macruronus magellanicus*

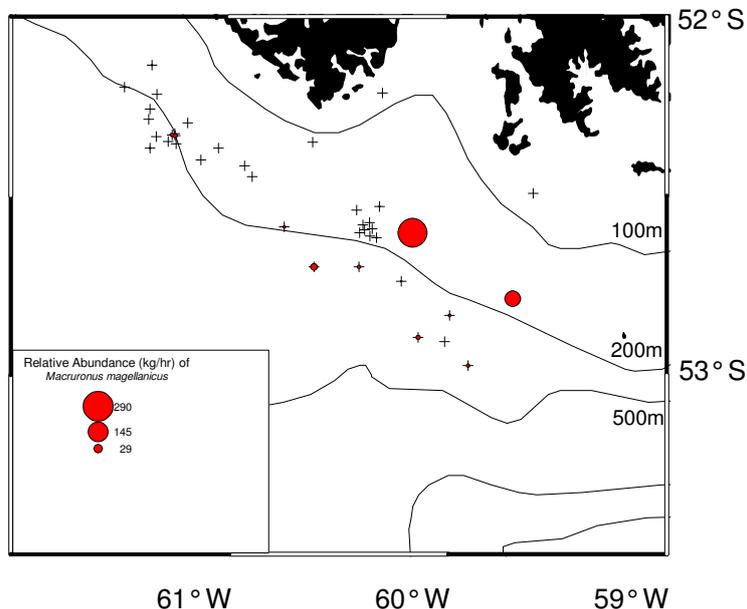


Figure 20: Relative abundance of *Macruronus magellanicus* at each station on the trawl survey ZDLH1-10-2006

Hoki was the 8th most abundant species caught on the cruise. Its largest catches were encountered to the south the Falkland Sound in less than 200 m of water. CPUEs ranged from 0.23 to 282.26 kg/hr (mean = 28.26 ± 71.54) (Figure 20).

A total of 272 hoki were sampled for length frequency analyses and for otoliths. Hoki ranged from 6 to 41 cm L_{PA} (mean = 19.15 ± 4.45) (Figure 21).

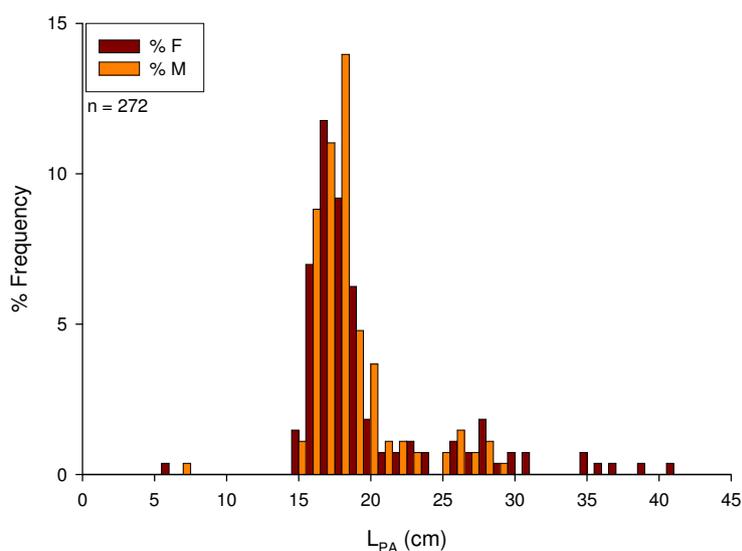


Figure 21: Length frequency distribution of male and female *Macruronus magellanicus* sampled on ZDLH1-10-2006

Most of the hoki sampled were at maturity stage II with fewer at stages I, III, V and VIII. Figure 22 illustrates the distribution of maturity stages encountered during the cruise.

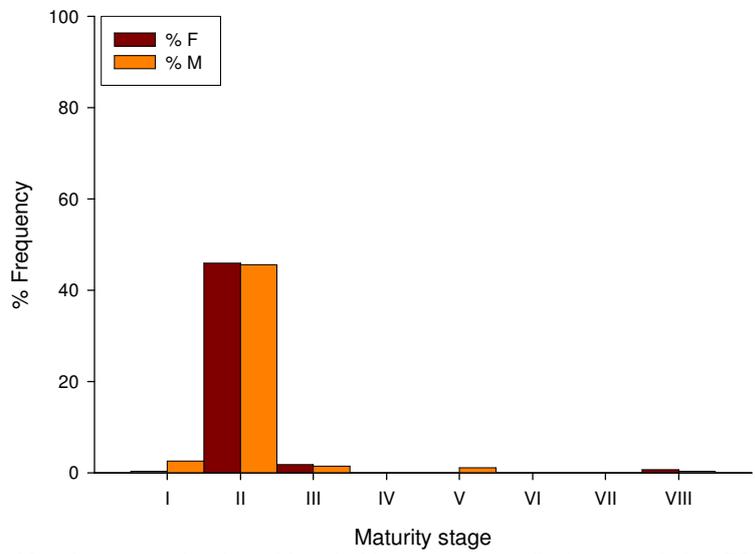


Figure 22: Maturity stages of male and female *Macrurus magellanicus* sampled on ZDLH1-10-2006

3.6 Kingclip – *Genypterus blacodes*

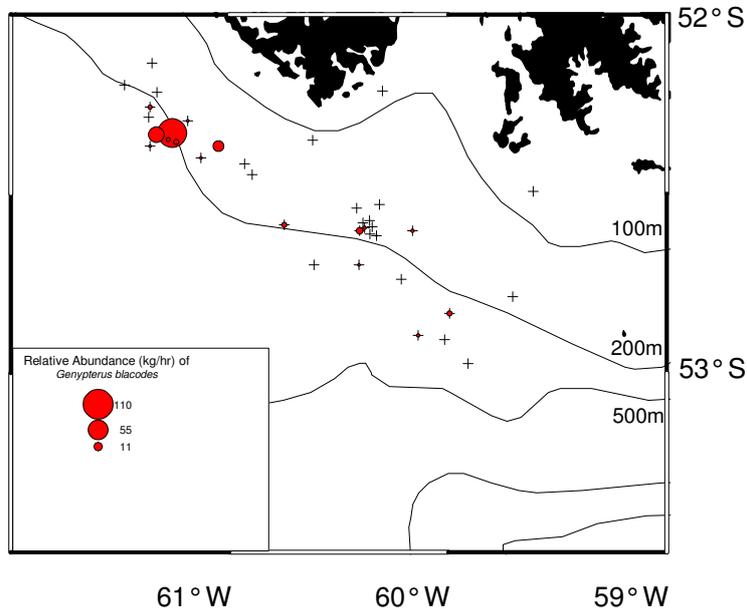


Figure 23: Relative abundance of *Genypterus blacodes* at each station on the trawl survey ZDLH1-10-2006

Genypterus blacodes represented the 12th most important species in terms of catch. The largest catches were encountered to the southwest of Cape Meredith in approximately 200 m (Figure 23). Depths of capture ranged between 149 and 300 m. During the cruise CPUEs ranged between 0.97 and 102.92 kg/hr (mean = 11.80 ± 25.04).

A total of 100 individual kingclip were sampled for length frequency analysis and for otoliths. The sample population ranged between 59 and 101 cm L_T (mean = 73.89 ± 8.94). Figure 24 illustrates the length frequency distribution of kingclip sampled on this cruise.

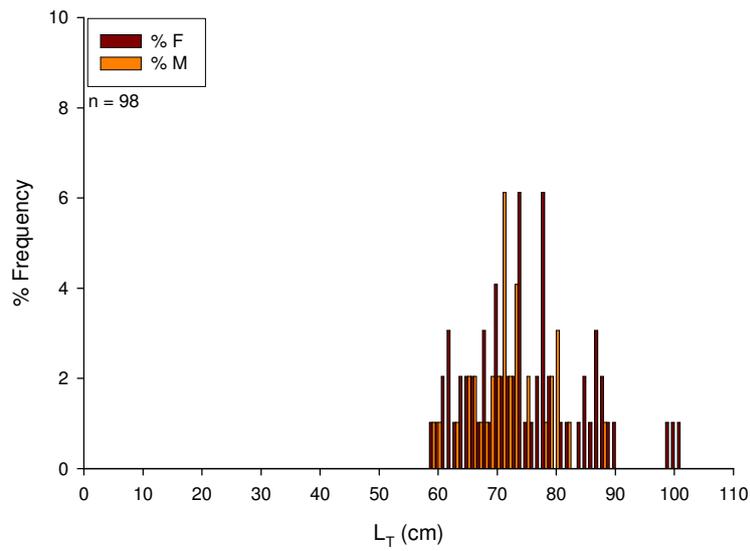


Figure 24: Length frequency distribution of male and female *Genypterus blacodes* sampled on ZDLH1-10-2006

Almost all of the kingclip sampled were at maturity stage II with fewer numbers being at stage VII an I (Figure 25).

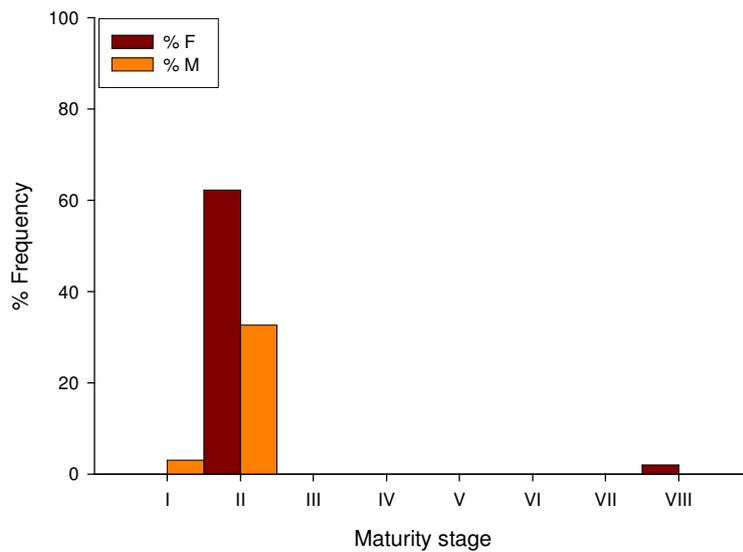
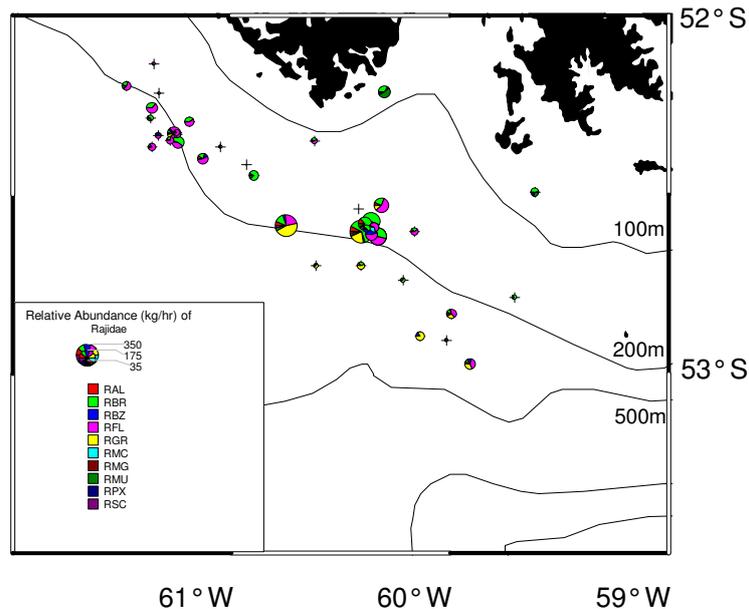


Figure 25: Maturity stages of male and female *Genypterus blacodes* sampled on ZDLH1-10-2006

3.7 Skates and rays – Rajidae

Ten taxa of skates and rays were caught during the survey (Table 2). The most important in terms of catch were *Bathyraja brachyruops* (887.64 kg), *Dipturus chilensis* (809.44 kg), *B. griseocauda* (282.98 kg), *B. albomaculata* (156.53 kg), *B. multispinis* (116.82 kg) and *B. cousseauae* (107.6 kg). Figure 26 illustrates the distribution of the different species encountered.



A number of species showed some interesting geographical and bathymetric distributions (Figure 23). *Bathyraja magellanica* was only found in shallow waters of less than 120 m. *Psammobatis* spp. were also found in shallow waters. *Dipturus chilensis* was more common to the south west of Cape Meredith in approximately 200 m of water and *B. griseocauda* was more common in deeper waters to the south the Cape.

3.7.1 Tagging programme

A total of 525 skates were tagged and released (Figure 24) during the October 2006 research cruise. Eight skate species were recorded. The most common were *Bathyraja brachyruops* (235 individuals), *Dipturus chilensis* (136) and *B. albomaculata* (98). A number of *B. scaphiops* (25) and *B. griseocauda* (20) were also captured. Low numbers of *B. cousseauae* (8), *B. macloviana* (2) and a single *B. magellanica* completed the catalogue of species processed. They were tagged to help with the examination of migrations and also for age validation as all of the specimens were injected with oxytetracycline.

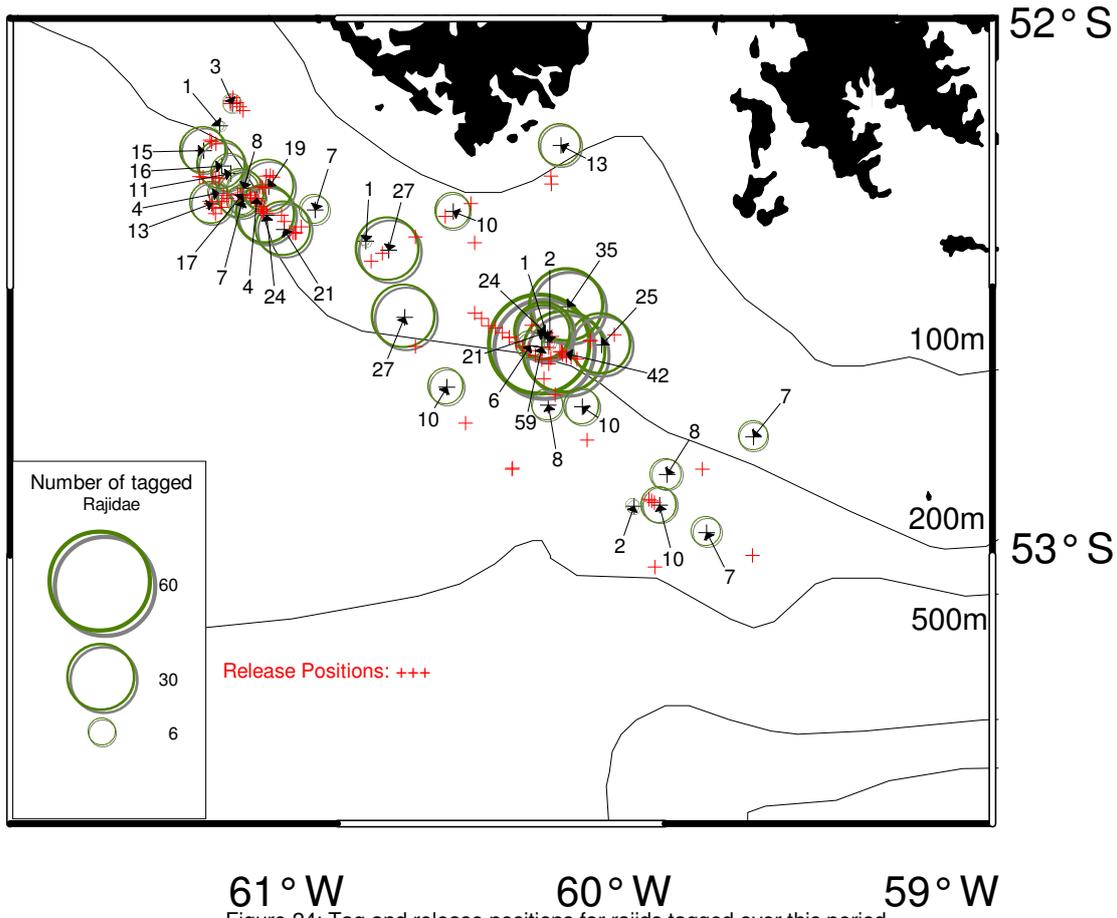


Figure 24: Tag and release positions for rajids tagged over this period.