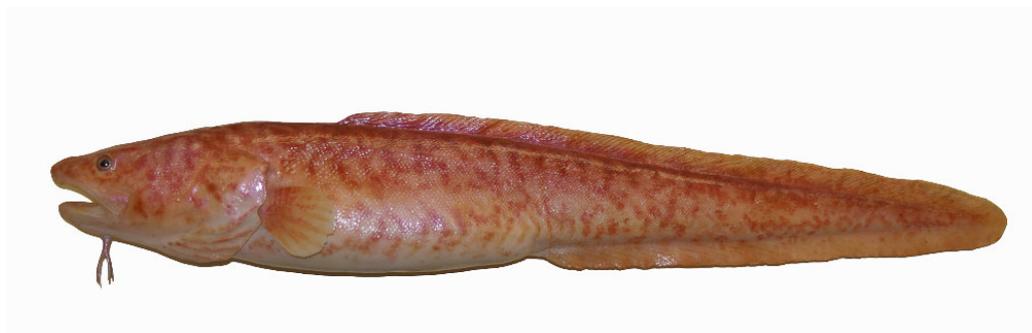


Scientific Report

Fisheries Research Cruise ZDLH1-02-2006



**Fisheries Department
Falkland Islands Government**

Scientific Report
Fisheries Research Cruise
ZDLH1-02-2006



FPRV Dorada
4th to 15th February 2006

Fisheries Department
Falkland Islands Government
Stanley
Falkland Islands

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Summary

In February 2006 (4th to 15th) a FIFD research cruise, ZDLH1-02-2006, was conducted on the Falkland Islands Government's *RV Dorada*. The primary objectives of the cruise were to carry out a bottom trawl survey of *Loligo gahi* and to continue oceanographic studies of the Falkland Islands Shelf. Secondary objectives included a skate survey, a tag and release program for rajids in order to examine their movement and to validate age. Finally an *ad hoc* plankton survey was carried out to collect samples for Dr. Pertra Quillfeldt and fish larvae for the FIFD's reference collection. The cruise took place in the southern and western parts of the Falkland Islands Shelf.

During the cruise oceanographic data were collected from 43 stations on the shelf and offshore waters. During the cruise a total of 29 bottom trawl stations were conducted with over 80 species caught. The most important species were *Macruronus magellanicus*, *Patagonotothen ramsayi*, *Coelorhynchus faciatus* and *Genypterus blacodes*, in order of decreasing abundance.

Loligo gahi were most abundant in the south of the survey area between 100 and 220 m depth. The highest catch was encountered to the south of Cape Meredith in 140 m of water. *Loligo gahi* caught during the survey were considered to be the first cohort including the very small squid (modal length = 4 cm) caught in waters of less than 100 m depth.

The most abundant finfish were analysed for their distribution, length frequency dynamics and maturities. During the cruise, a total of 272 skates were tagged with orange T bar tags and injected with oxytetracycline as part of a tag and release programme and for age validation. Over 17 species of plankton were caught during the plankton survey.

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1.0 Introduction

In February 2006, a research cruise was undertaken in the southern and western parts of the Falkland Islands Shelf using the Falkland Islands Government Research and Patrol Vessel *Dorada*. The primary objectives of this cruise were to carry out a bottom survey of *Loligo gahi* and to continue the oceanographic studies on the Falklands shelf. The following report summaries the research activities carried out on the R/V *Dorada* in February 2006. All of the data were checked prior to being uploaded onto the FIFD SQL server where it will be used in the analysis of various biological parameters that allow the FIFD to examine age, growth, reproductive biology, population dynamics and ultimately stock assessment of a number of species.

1.1 Region

The southern and western parts of the Falkland Islands shelf (Figure 1).

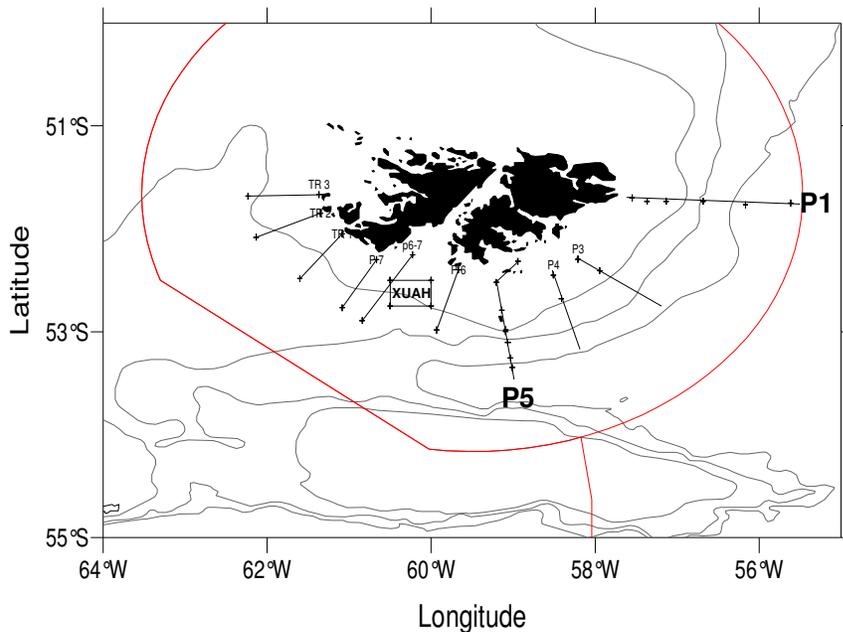


Figure 1: Planned regions for ZDLH1-02-2006

1.2 Cruise objectives

- To carry out a *Loligo gahi* survey on the southern part of Falkland's Shelf.
- To carry out a skate survey of the region and in particular stations within XUAH.
- To tag skates for migration and age validation studies.
- To continue oceanographic studies of the Falkland Islands shelf.
- To conduct an *ad hoc* zooplankton survey.

1.3 Cruise Plan and key dates

The vessel departed Stanley at 0900 local time on the 4th February and navigated to the first station oceanographic station on P1 and spent the remainder of the day proceeding through the transect. On the 5th and the 6th of February the vessel conducted three trawls on P3 and P4 respectively and then proceeded to P5 to conduct 2 trawls and eight oceanographic stations. The *Dorada* spent a day on each of the remaining transects. During the cruise six plankton trawls were carried out in order to catch larval fish ourselves and to collect samples for Dr. Petra Quillfeldt who is studying the trophic ecology of seabirds using fatty acid signatures and stable isotopes in prey items.

1.4 Vessel characteristics

The cruise was conducted on board the Fishery Patrol/Research Vessel *Dorada* registered in the Falkland Islands.

Table 1: Vessel characteristics

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

1.5 Personnel and responsibilities

The following personnel participated in the cruise:

Dr. Paul Brickle	Chief Scientist
Wetjens Dimmlich	Oceanographic survey
Joost Pompert	Trawl survey
Daniel Fowler	Trawl survey
Ester Sancho	Trawl survey
Sam Clarke	Trawl survey

1.6 Equipment used

Acoustics

The acoustic instrumentation was similar to that used in previous surveys:

1. Scientific echosounder SIMRAD EK500 38/120 KHz
2. SonarData Echolog (data acquisition) and Echoview (post-processing) software

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.

Oceanographic

The oceanographic equipment was similar to that used in previous surveys:

1. CTD SBE 25 with oxygen sensor and SeaTech fluorometer
2. Thermosalinometer SBE45

Plankton trawls

As with previous surveys an Issacs-Kidd-Midwater trawl was used to conduct the plankton survey.

1.7 Sampling

1.7.1 Acoustic survey

During the survey acoustic data were logged along the entire track. The data were archived in SonarData EK5 format on a PC in the dry lab running the SonarData Echolog500.

1.7.2 Trawl stations and biological sampling

During the ZDLH1-02-2006 research cruise the station numbers ranged from 2312 to 2389 (Table 2). The catches at all stations were weighed using an electric marine adjusted balance (POLS, min 10 g, and max 80 kg).

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

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

Table 2: Dates, locations, modal depths and duration of oceanographic (C), trawl (B), and plankton (I) stations carried out during research cruise ZDLH1-02-2006.

Station	Date	Start		Modal depth (m)	Activity	Duration Mins		
		Latitude	Longitude					
2312	04/02/2006	51	39.70	57	45.40	18	C	4
2313	04/02/2006	51	41.80	57	33.30	96	C	12
2314	04/02/2006	51	44.00	57	21.80	194	C	4
2315	04/02/2006	51	44.00	57	7.80	296	C	13
2316	04/02/2006	51	44.00	56	40.80	515	C	20
2317	04/02/2006	51	46.00	56	9.90	990	C	37
2318	04/02/2006	51	44.90	55	36.90	1110	C	41
2319	05/02/2006	52	16.10	57	58.90	138	C	6
2320	05/02/2006	52	16.20	57	59.00	138	B	99
2321	05/02/2006	52	20.80	57	58.30	223	C	11
2322	05/02/2006	52	20.90	57	58.50	220	B	113
2323	05/02/2006	52	19.50	57	44.90	301	C	11
2324	05/02/2006	52	19.70	57	45.40	308	B	116
2325	06/02/2006	52	41.60	58	13.10	425	C	14
2326	06/02/2006	52	39.70	58	22.10	299	B	80
2327	06/02/2006	52	35.40	58	12.90	311	C	12
2328	06/02/2006	52	31.30	58	16.20	219	C	12
2329	06/02/2006	52	31.70	58	16.40	229	B	109
2330	06/02/2006	52	33.30	58	44.70	108	B	89
2331	06/02/2006	52	32.30	58	35.80	131	C	6
2332	06/02/2006	52	16.00	58	47.20	62	I	35
2333	07/02/2006	52	18.90	58	56.50	63	C	3
2334	07/02/2006	52	31.30	59	12.20	64	C	3
2335	07/02/2006	52	47.40	59	8.20	104	C	6
2336	07/02/2006	52	47.30	59	7.90	105	B	92
2337	07/02/2006	52	59.10	59	10.20	233	B	113
2338	07/02/2006	52	58.90	59	5.20	224	C	8
2339	07/02/2006	53	0.00	59	4.90	335	C	13
2340	07/02/2006	53	6.30	59	3.80	509	C	22
2341	07/02/2006	53	15.40	59	1.90	692	C	27
2342	07/02/2006	53	20.90	59	0.60	1184	C	37
2343	08/02/2006	52	57.80	59	44.50	228	C	8
2344	08/02/2006	52	58.40	59	44.90	240	B	95
2345	08/02/2006	52	47.00	59	45.20	158	C	9
2346	08/02/2006	52	47.10	59	54.30	166	B	91
2347	08/02/2006	52	32.90	59	52.40	121	B	96
2348	08/02/2006	52	30.30	60	0.90	124	C	4
2349	08/02/2006	52	39.90	60	29.50	257	I	22
2350	09/02/2006	52	44.10	60	13.20	195	C	7

2351	09/02/2006	52	43.90	60	12.70	195	B	102
2352	09/02/2006	52	42.40	60	11.60	185	C	11
2353	09/02/2006	52	42.60	60	11.40	174	B	111
2354	09/02/2006	52	38.20	60	25.80	230	C	10
2355	09/02/2006	52	39.10	60	24.90	218	B	107
2356	09/02/2006	52	34.40	60	26.60	180	C	6
2357	09/02/2006	52	34.70	60	26.20	191	B	114
2358	10/02/2006	52	11.20	60	18.30	72	C	4
2359	10/02/2006	52	17.80	60	20.80	95	B	60
2360	10/02/2006	52	21.00	60	37.10	137	C	6
2361	10/02/2006	52	20.90	60	37.50	150	B	94
2362	10/02/2006	52	35.10	60	34.20	230	C	8
2363	10/02/2006	52	35.10	60	34.30	221	B	117
2364	10/02/2006	52	32.30	60	35.40	198	I	43
2365	11/02/2006	52	40.20	60	42.30	321	C	11
2366	11/02/2006	52	40.40	60	41.00	315	B	110
2367	11/02/2006	52	34.20	60	58.20	306	C	11
2368	11/02/2006	52	35.00	60	56.70	311	B	102
2369	11/02/2006	52	30.90	60	41.30	220	C	8
2370	11/02/2006	52	31.20	60	40.70	226	B	111
2371	12/02/2006	52	6.20	61	5.90	111	C	5
2372	12/02/2006	52	6.70	61	5.00	112	B	84
2373	12/02/2006	52	18.90	61	23.50	219	C	12
2374	12/02/2006	52	18.00	61	23.10	220	B	102
2375	12/02/2006	52	21.90	61	28.70	295	C	11
2376	12/02/2006	52	21.70	61	28.20	307	B	113
2377	12/02/2006	51	54.62	61	20.95	101	I	42
2378	13/02/2006	51	51.50	61	24.40	105	C	5
2379	13/02/2006	51	50.80	61	23.70	102	B	64
2380	13/02/2006	52	0.50	61	40.20	163	C	9
2381	13/02/2006	52	1.05	61	41.40	173	B	96
2382	13/02/2006	52	4.70	61	47.30	253	C	11
2383	13/02/2006	52	4.80	61	46.80	240	B	109
2384	13/02/2006	51	43.68	61	45.95	158	I	40
2385	13/02/2006	51	41.80	61	43.66	157	I	30
2386	14/02/2006	51	40.10	62	12.40	215	C	8
2387	14/02/2006	51	39.60	62	12.40	236	B	109
2388	14/02/2006	51	32.80	61	42.80	148	C	7
2389	14/02/2006	51	32.90	61	42.90	151	B	106

2.0 Oceanography

Oceanographic data were collected during a trawl survey at 43 stations located in the southern shelf and offshore waters of the Falkland Islands (Figure 2).

Sampling was conducted either before or after each trawl, and also along the FIFD standard transects P1 and P5 (Figure 2). A logging CTDO (SBE-25, Sea-Bird Electronics Inc., Bellevue, USA) was deployed from the surface to 10-20 m above the bottom to obtain profiles of temperature ($^{\circ}\text{C}$), salinity (PSU), fluorescence (ml/L) and dissolved oxygen (ml/L). The CTDO was initially deployed for one minute at approximately 10 m depth to allow polarising of the oxygen sensor. It was then retrieved to 1 m depth prior to deploying to a depth about 10-20 m above the bottom (shelf and continental slope) or down to 1000 m in the open sea. The speed of deployment was approximately 1 ms^{-1} and was monitored by use of wire counter.

Temperature was measured directly whereas the other variables were calculated using Seasoft v5.37 software (Sea-Bird Electronics Inc.) from the following measured parameters: pressure (db), conductivity (S/m), oxygen current (μA) and oxygen temperature ($^{\circ}\text{C}$). The CTDO sensors were calibrated annually by Sea-Bird Electronics Inc.

Iso-surface maps of temperature (Figure 3), salinity (Figure 4), chlorophyll-a (Figure 5) and dissolved oxygen (Figure 6) at 0 m and 50 m depths were constructed using the kriging interpolation algorithm provided by Surfer v8.05 (Golden Software Inc. Colorado, USA). Surface temperatures ranged from 8.95° to 12.13°C , salinity from 32.12 to 32.80, chlorophyll- α from 0.01 to 3.23 ml/L and dissolved oxygen from 4.39 to 5.06 ml/L.

Vertical profiles for the transects P1 and P5 (Figure 2; Figures 7-8) were constructed using the VG gridding method provided by the Ocean Data View package v3.0.1 (Schlitzer 2005). Up to 130km offshore along transect P1 temperatures fell to approximately 6°C by 200m before falling again to $< 5^{\circ}\text{C}$ below 700m. Further offshore, this cooler water extended to within 200m of the surface. The cooler waters were not present along transect P2 with a well mixed water column of approximately 6°C occurring below a thermocline at approximately 200m depth.

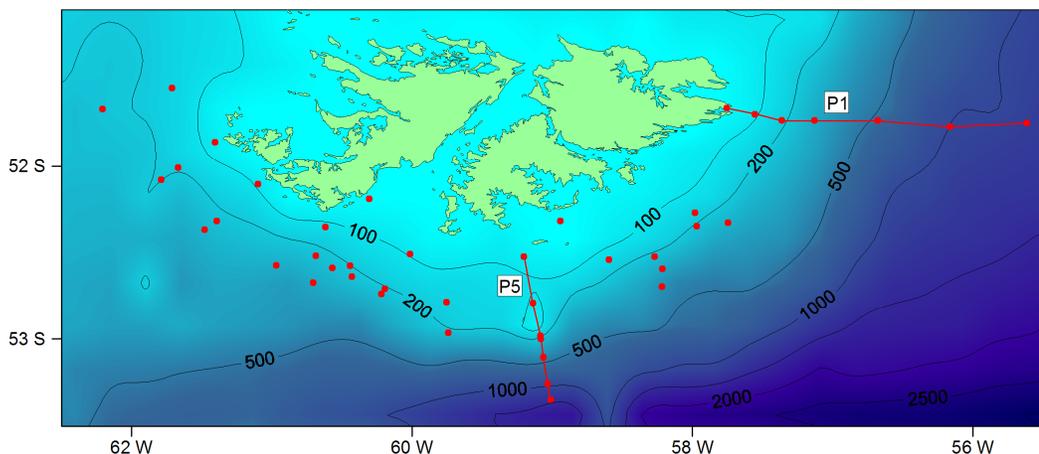


Figure 2. Locations of oceanographic stations in February 2006.

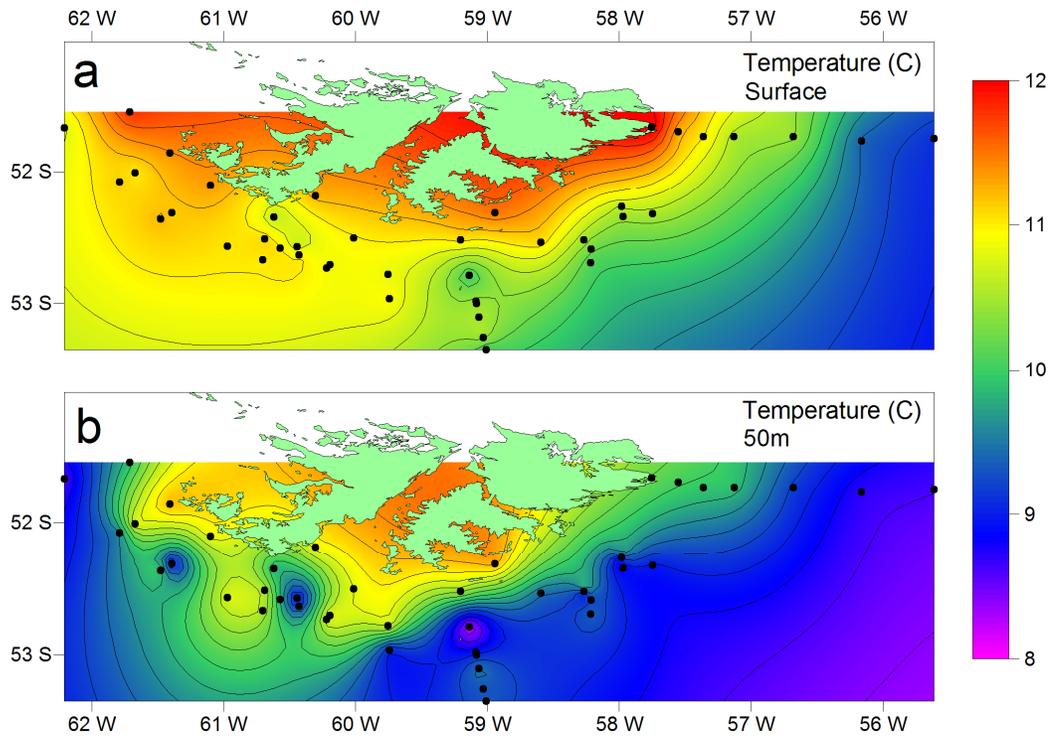


Figure 3. Iso-surface of temperature (C) at the surface (a) and at 50m (b)

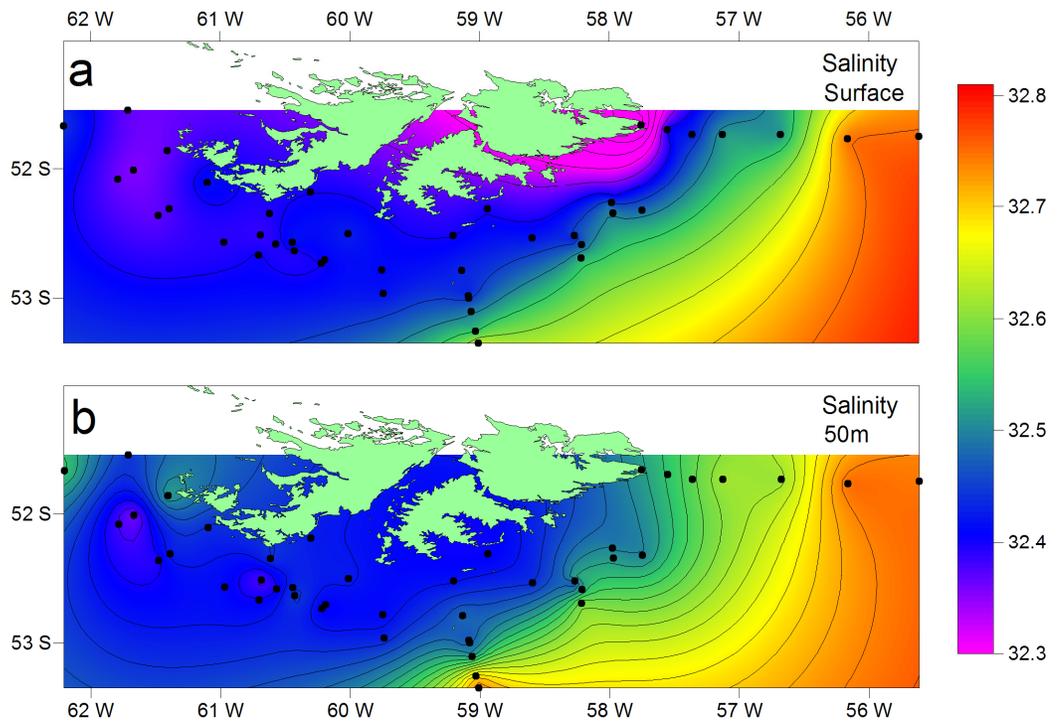


Figure 4. Iso-surface of salinity at the surface (a) and at 50m (b)

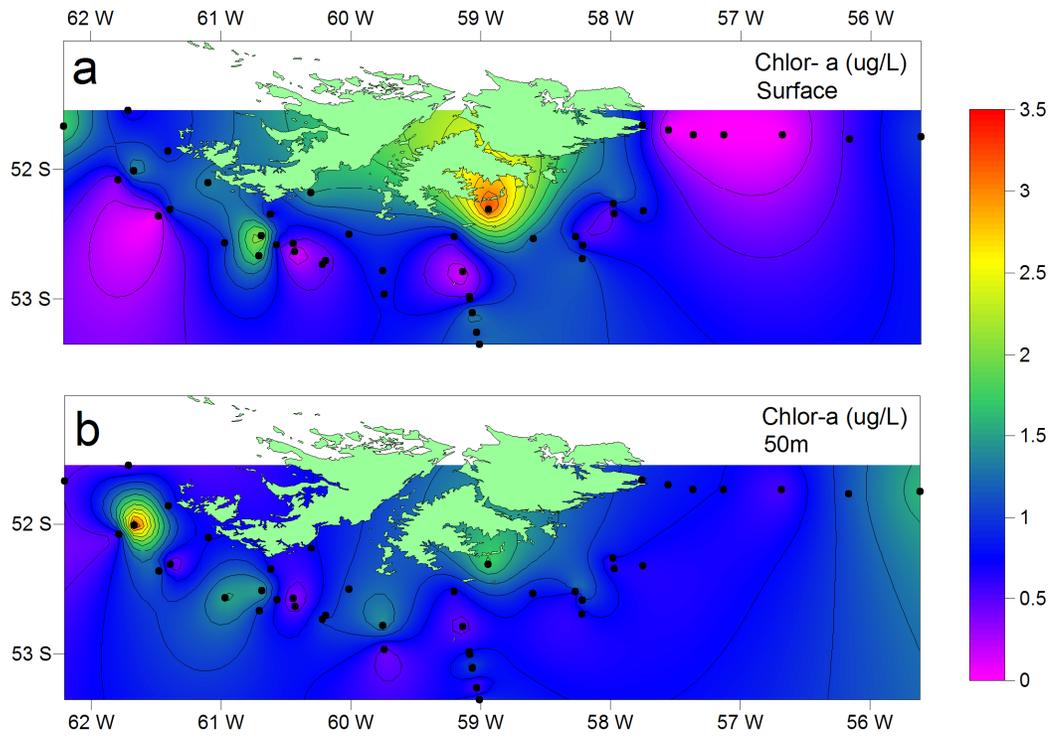


Figure 5. Iso-surface of chlorophyll –a at the surface (a) and at 50m (b)

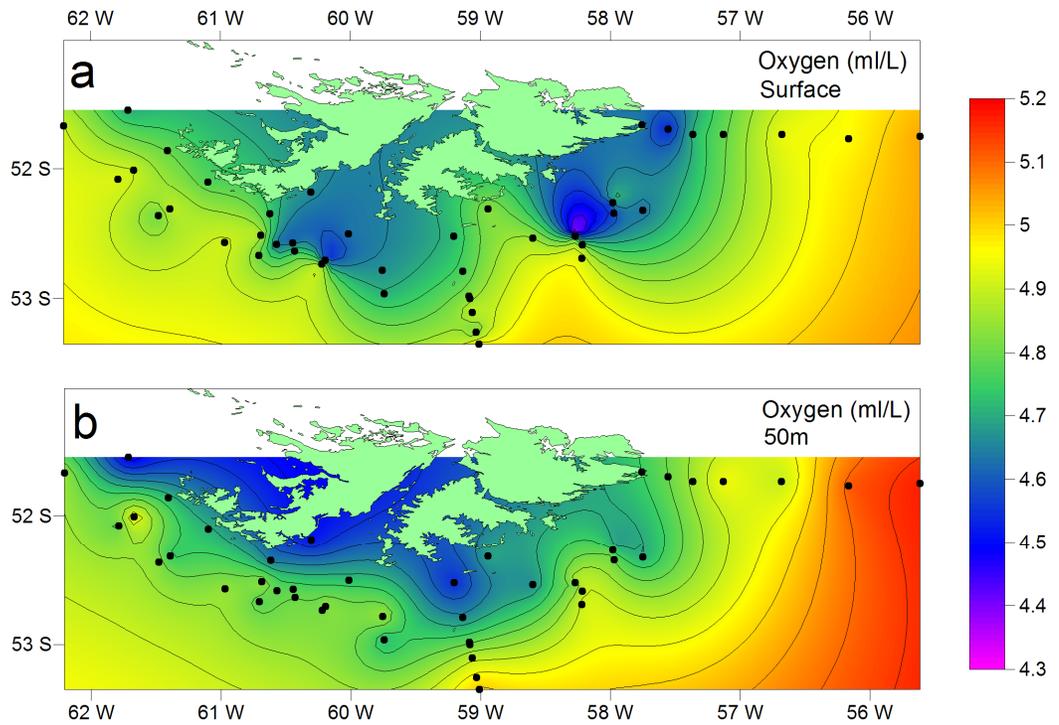
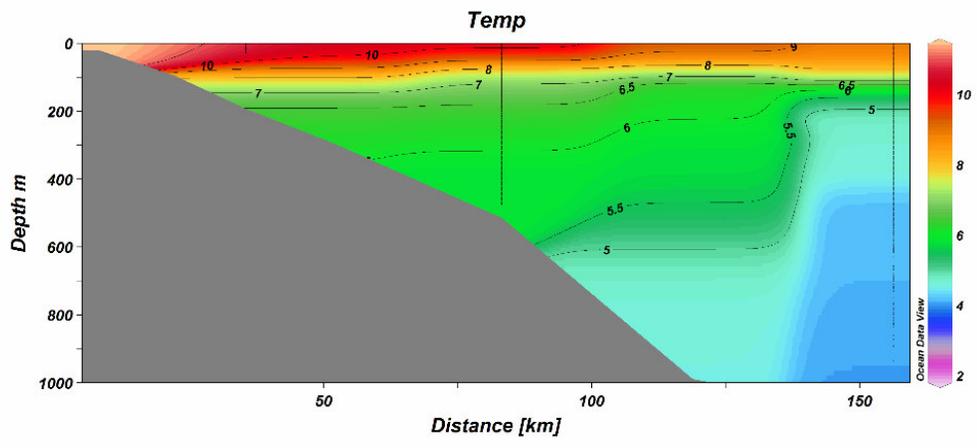
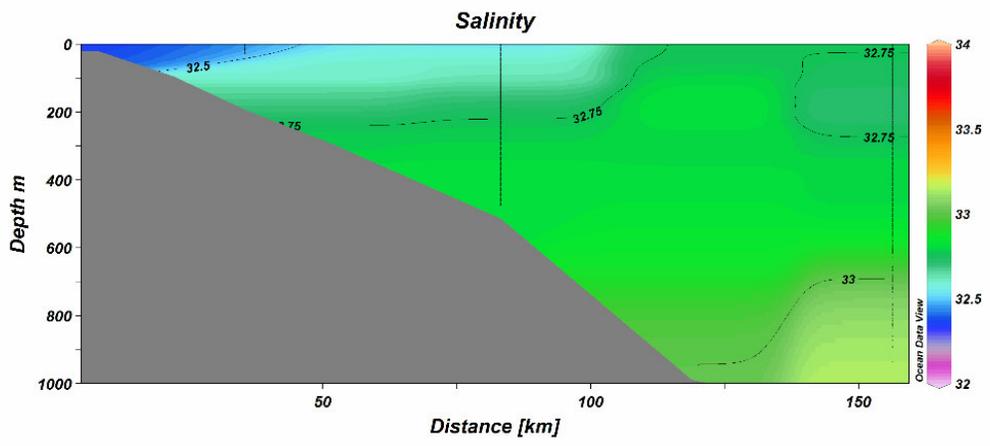


Figure 6. Iso-surface of dissolved oxygen (ml/L) at the surface (a) and at 50m (b)

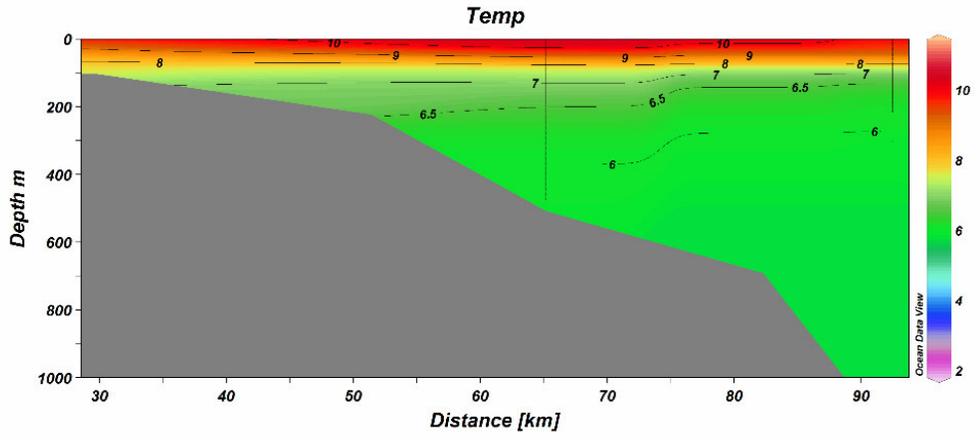


a

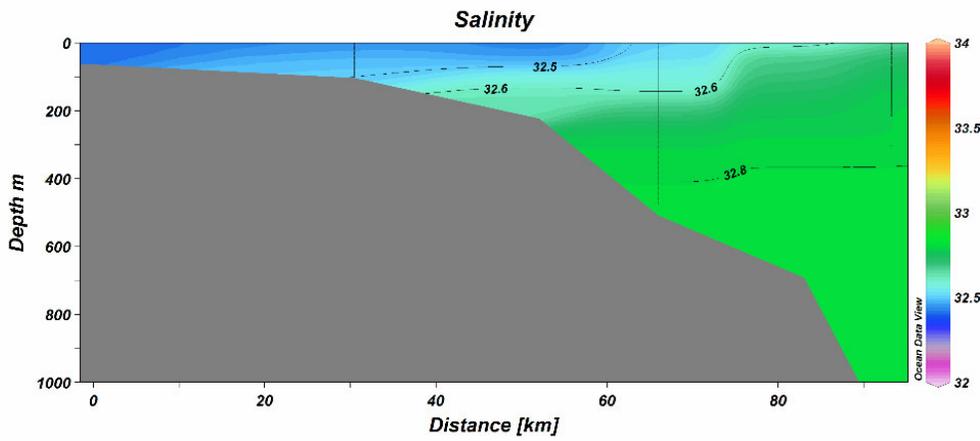


b

Figure 7. a) Temperature (C) and b) salinity profiles for transect P1.



a



b

Figure 8. a) Temperature (C) and b) salinity profiles for transect P5.

3.0 Biological sampling

3.1 Catch and by-catch

A total of 29 bottom trawl stations were conducted on the southern and western Falkland Islands Shelf. A total of 20,311 kg were caught consisting of over 80 species. The most abundant species in terms of weight was *Macruronus magellanicus* followed by *Patagonotothen ramsayi*, *Coelorhynchus fasciatus* and *Genypterus blacodes* (Table 3).

Table 3: Total catch of trawl stations conducted during the research cruise ZDLH1-02-2006

<i>Species Code</i>	<i>Species name</i>	<i>Total Catch (kg)</i>	<i>Total Sampled (kg)</i>	<i>Total Discarded (kg)</i>	<i>Proportion (%)</i>
WHI	<i>Macruronus magellanicus</i>	8,052.370	1,489.284	7,933.370	39.65%
PAR	<i>Patagonotothen ramsayi</i>	5,163.530	158.762	5,146.730	25.42%
GRF	<i>Coelorhynchus fasciatus</i>	1,268.331	31.178	1,268.331	6.24%
KIN	<i>Genypterus blacodes</i>	1,196.743	455.126	161.783	5.89%
BLU	<i>Micromesistius australis</i>	938.218	332.838	938.218	4.62%
SHT	Mixed invertebrates	870.700	0.000	870.700	4.29%
RGR	<i>Bathyraja griseocauda</i>	365.814	365.814	365.814	1.80%
CGO	<i>Cottoperca gobio</i>	288.840	232.508	288.840	1.42%
SPN	Sponges	270.487	0.000	270.487	1.33%
BAC	<i>Salilota australis</i>	236.131	236.131	236.131	1.16%
RBR	<i>Bathyraja brachyurops</i>	174.883	174.883	174.883	0.86%
GRC	<i>Macrourus carinatus</i>	145.456	70.306	145.456	0.72%
TOO	<i>Dissostichus eleginoides</i>	132.694	132.694	16.830	0.65%
RAL	<i>Bathyraja albomaculata</i>	112.340	112.340	112.340	0.55%
RSC	<i>Bathyraja scaphiops</i>	111.750	111.750	111.750	0.55%
ING	<i>Moroteuthis ingens</i>	110.339	107.102	110.339	0.54%
LOL	<i>Loligo gahi</i>	102.837	75.397	81.215	0.51%
PYM	<i>Physiculus marginatus</i>	87.103	17.474	87.103	0.43%
RBZ	<i>Bathyraja cousseauae</i>	72.719	72.719	72.719	0.36%
STE	<i>Sterechinus sp.</i>	68.375	0.000	68.375	0.34%
GOC	<i>Gorgonocephalus chilensis</i>	64.878	0.000	64.878	0.32%
AST	Asteroidea	55.690	0.000	55.690	0.27%
ANT	Anthozoa	50.654	0.000	50.654	0.25%
UCH	Sea urchin	33.433	0.000	33.433	0.16%
NEM	<i>Neophrynichthys marmoratus</i>	31.490	31.490	31.490	0.16%
DGH	<i>Schroederichthys bivius</i>	30.250	0.000	30.250	0.15%
MED	Medusae	29.676	0.000	29.676	0.15%
ZYP	<i>Zygochlamys patagonica</i>	29.000	1.025	29.000	0.14%
PAT	<i>Merluccius australis</i>	24.812	24.812	2.891	0.12%
RMU	<i>Bathyraja multispinis</i>	19.262	19.262	19.262	0.09%
RMC	<i>Bathyraja macloviana</i>	17.205	17.205	17.205	0.08%
ANM	Anemone	15.358	0.000	15.358	0.08%
GYM	<i>Gymnoscopelus spp.</i>	15.170	0.000	15.170	0.07%
OPH	Ophiuroidea	14.536	0.000	14.536	0.07%
OCM	<i>Octopus megalocyathus</i>	13.665	11.756	1.909	0.07%
RED	<i>Sebastes oculatus</i>	12.962	12.962	12.962	0.06%
RFL	<i>Raja flavirostris</i>	10.998	10.998	10.998	0.05%
WLK	Whelks	10.376	0.000	10.376	0.05%
EEL	<i>Ilucoetes fimbriatus</i>	9.951	9.951	9.951	0.05%
RPX	<i>Psammobatis spp.</i>	9.860	9.860	9.860	0.05%
HAK	<i>Merluccius hubbsi</i>	9.500	9.500	0.000	0.05%
BEE	<i>Benthoctopus eureka</i>	5.320	2.796	2.524	0.03%
COG	<i>Patagonotothen guntheri</i>	5.159	0.670	4.039	0.03%

Species Code	Species name	Total Catch (kg)	Total Sampled (kg)	Total Discarded (kg)	Proportion (%)
MUG	<i>Munida gregaria</i>	4.347	0.000	4.347	0.02%
CHE	<i>Champsoccephalus esox</i>	4.167	4.151	1.384	0.02%
ADA	<i>Adelomelon ancilla</i>	3.321	0.000	3.321	0.02%
HOL	Holothuroidea	1.722	0.000	1.722	0.01%
AUC	<i>Austrocidaris canaliculata</i>	1.355	0.000	1.355	0.01%
COT	<i>Cottunculus granulatus</i>	1.140	1.140	1.140	0.01%
BEJ	<i>Benthoctopus sp. cf. januarii</i>	1.090	0.000	1.090	0.01%
PES	<i>Peltarion spinosulum</i>	0.946	0.000	0.946	<0.01%
WRM	Worm cases	0.761	0.000	0.761	<0.01%
UHH	<i>Heart urchin</i>	0.564	0.000	0.564	<0.01%
ILL	<i>Illex argentinus</i>	0.455	0.455	0.000	<0.01%
MAM	<i>Mancopsetta milfordi</i>	0.420	0.420	0.000	<0.01%
BRP	<i>Brachiopod spp.</i>	0.412	0.000	0.412	<0.01%
PTE	<i>Patagonotothen tessellata</i>	0.403	0.002	0.401	<0.01%
MUO	<i>Muraenolepis orangiensis</i>	0.397	0.397	0.397	<0.01%
EUL	<i>Eurypodius latreillei</i>	0.181	0.000	0.181	<0.01%
NOW	<i>Paranotothenia magellanica</i>	0.150	0.150	0.150	<0.01%
ARD	<i>Arbacia dufresni</i>	0.136	0.136	0.000	<0.01%
NUD	Nudibranchia	0.061	0.000	0.061	<0.01%
GAY	Gastropods.	0.032	0.000	0.032	<0.01%
SRP	<i>Semirossia patagonica</i>	0.020	0.020	0.000	<0.01%
PYX	Pycnogonida	0.019	0.000	0.019	<0.01%
CAS	<i>Campylonotus semistriatus</i>	0.013	0.000	0.013	<0.01%
AGO	<i>Agonopsis chiloensis</i>	0.012	0.012	0.000	<0.01%
RDO	<i>Raja doellojuradoi</i>	0.012	0.012	0.012	<0.01%
THB	<i>Thymops birsteini</i>	0.012	0.000	0.012	<0.01%
		20,311.013	4,345.488	18,951.756	

3.2 *Loligo gahi*

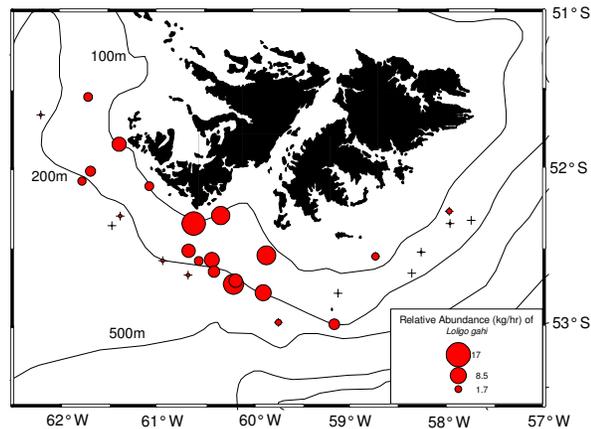


Figure 9: CPUE of *Loligo gahi* caught at each station on the research cruise ZDLH1-02-2006

Loligo gahi were caught in all areas of the survey and were present at every station. *Loligo gahi* was most abundant in the South of the survey area (Figure 9) between 100 and 220 m depth. CPUEs ranged from 0.03 to 16.53 kg/hr (mean = 16.53 ± 4.34) and the highest catch was south of Cape Meredith in 140 m of water.

Loligo gahi varied in size and maturity with depth. Squid at all depths are considered to be the first cohort including the very small squid caught in less than 100 m of water (modal length = 4 cm) (Figure 10). The group of squid is likely to represent a later pulse of recruitment to the fishery. The squid in these areas comprised juveniles, immature and consisted of a very small proportion of maturing individuals.

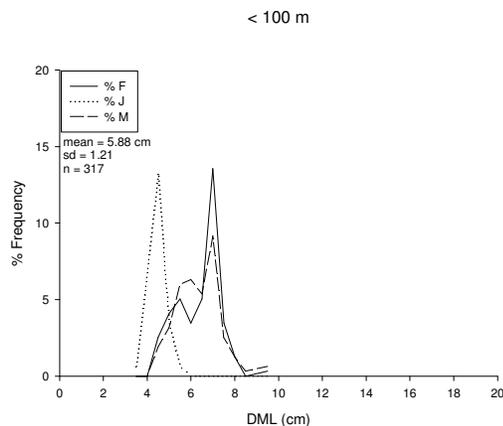


Figure 10: Length frequency distributions of female, male and juvenile *Loligo gahi* caught in < 100 m on ZDLH1-02-2006

Loligo gahi caught in waters between 100 and 200 m were larger on average ($8.09 \text{ cm} \pm 1.72$) and consisted of two modes at approximately 6.5 and 10.5 cm (Figure 11). Again most of the animals sampled were immature with a very small proportion in stages III and IV (maturing).

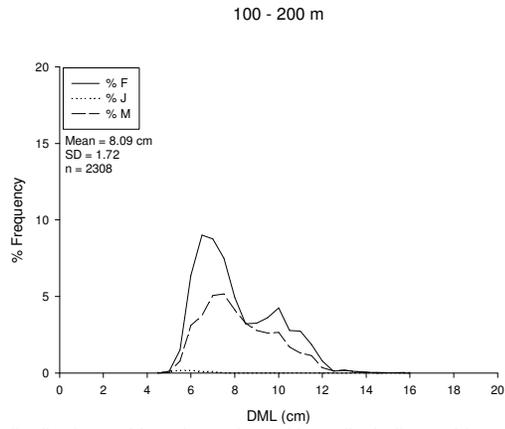


Figure 11: Length frequency distributions of female, male and juvenile *Loligo gahi* caught between 100 and 200 m on ZDLH1-02-2006

Loligo gahi caught in waters greater than 200 m were again larger on average ($8.97 \text{ cm} \pm 2.09$) but contained the same two modes as the length frequency for animals caught between 100 and 200 m (Figure 12). As with the previous depth range most of the animals sampled were immature (I) or resting (II) with a small proportion in the maturing stages (III and IV).

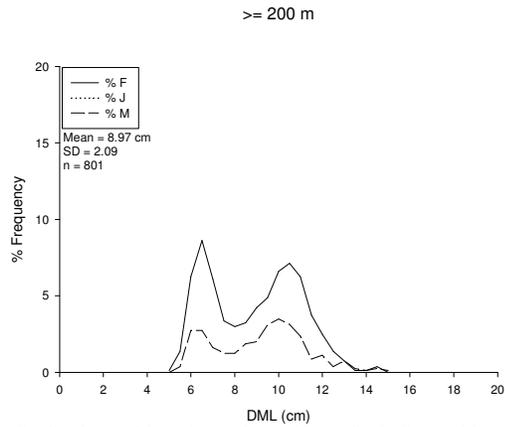


Figure 12: Length frequency distributions of female, male and juvenile *Loligo gahi* caught between at greater 200 m on ZDLH1-02-2006

3.3 *Macruronus magellanicus*

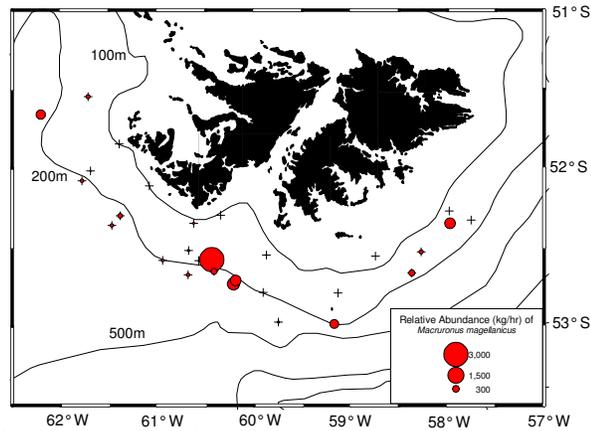


Figure 13: CPUE of *Macruronus magellanicus* caught at each station on the research cruise ZDLH1-02-2006

Hoki were caught on 23 of the 29 bottom trawl stations conducted. Positive catches were found throughout the area in waters greater than 100m depth (Figure 13). CPUEs ranged from 1.52 to 3011.90 kg/hr (mean = 346.58 kg \pm 642.14). The largest catches were encountered to the south of Cape Meredith in approximately 200 m of water.

The hoki sampled during the cruise ranged in pre-anal length between 13 and 49 cm (mean = 29.20 cm \pm 4.25) (Figure 14). Most individuals were in their resting stage at maturity stage II, however, there were a very small proportion of immature fish and small proportion in the early maturing stage (III). Only one male and 17 females were found to be in the recovering stage VIII (Figure 15).

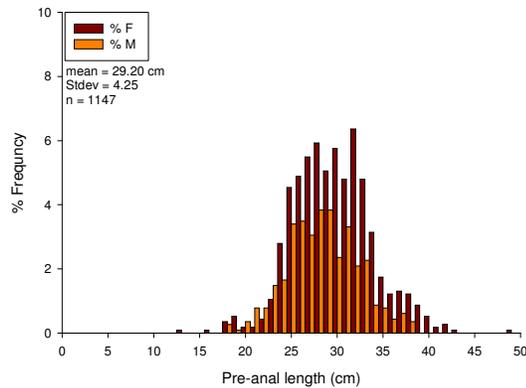


Figure 14: Length frequency distributions of male and female *Macruronus magellanicus* sampled on ZDLH1-02-2006

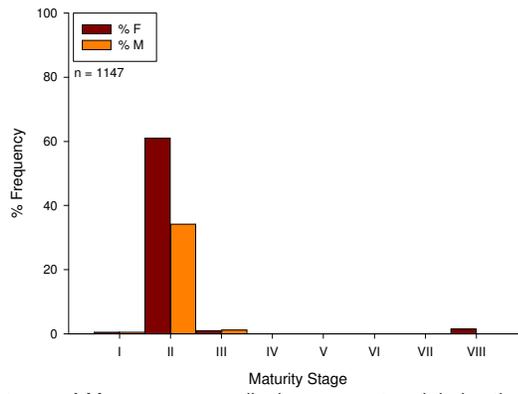


Figure 15: Maturity stages of *Macrurus magellanicus* encountered during the ZDLH1-02-2006 survey

3.4 Patagonotothen spp.

Three species of *Patagonotothen* were caught during the cruise with *Patagonotothen ramsayi* as the most abundant. *Patagonotothen guntheri* and *P. tessellata* were less abundant with total catches of 5.159 kg and 0.403 kg respectively.

3.4.1 *Patagonotothen ramsayi*

A total of 5,163.53 kg of *P. ramsayi* were caught on 27 of the 29 bottom trawl stations conducted. The CPUEs over the period ranged from 1.22 to 1957.94 kg/hr (mean = 196.41 kg/hr \pm 368.07). The largest catch was to the southwest of Beaver Island in just under 200 m of water (Figure 16).

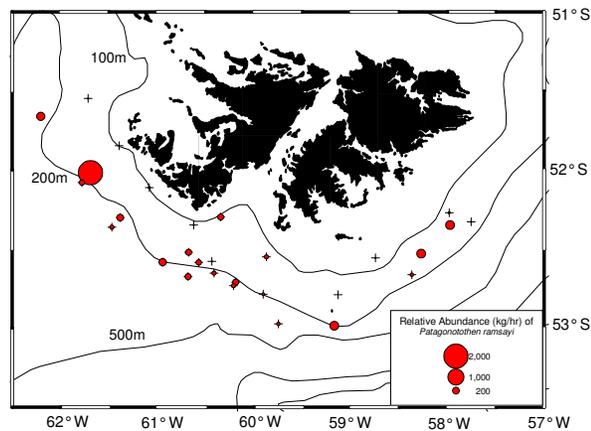


Figure 16: CPUE of *Patagonotothen ramsayi* caught at each station on the research cruise ZDLH1-02-2006

The total lengths of *P. ramsayi* ranged from 10 to 39 cm L_T (mean = 23.01 cm \pm 5.91) during the cruise and present a tri-modal length frequency distribution (Figure 17). With modes at 13, 22 and 27 cm L_T . Most of the individuals sampled were at stage II maturity (resting) with a smaller proportion of immature (I) and maturing (III) individuals (Figure 18).

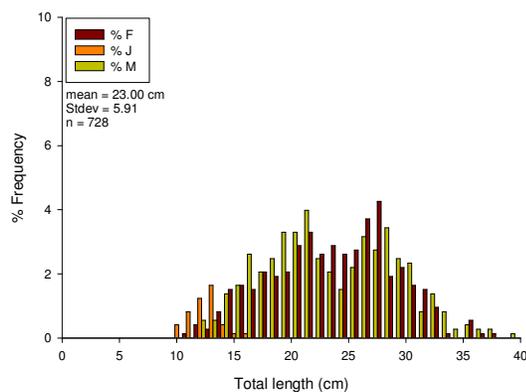


Figure 17: Length frequency distributions of male, female and juvenile *Patagonotothen ramsayi* sampled on ZDLH1-02-2006

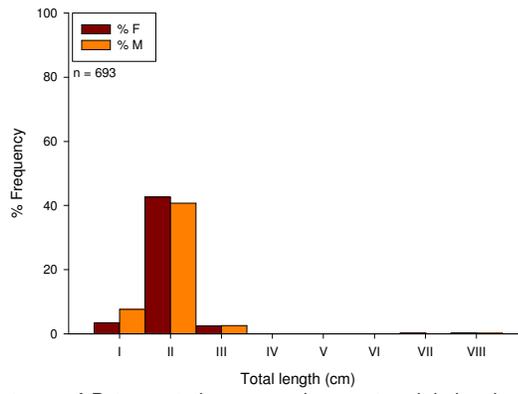


Figure 18: Maturity stages of *Patagonotothen ramsayi* encountered during the ZDLH1-02-2006 survey

3.5 *Genypterus blacodes*

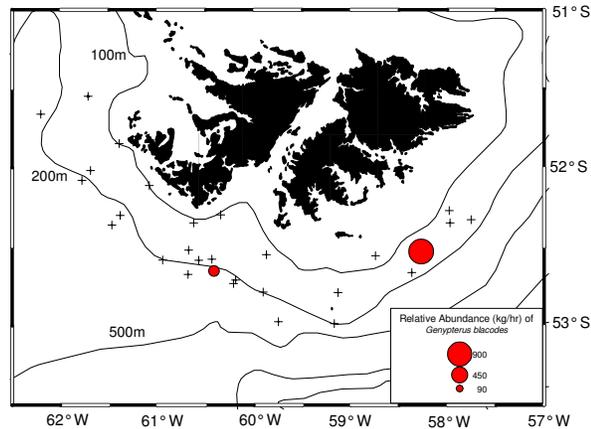


Figure 19: CPUE of *Genypterus blacodes* caught at each station on the research cruise ZDLH1-02-2006

Genypterus blacodes were caught on 18 of the 29 bottom trawl stations and were the fourth most common finfish species encountered in terms of weight. CPUEs ranged from 0.59 kg/hr to 923.22 kg/hr (mean = 66.90 ± 219.65). The greatest catch was encountered to the south east of the islands (Figure 19) in 228 m of water. Another significant catch was encountered in 219 m of water to the south of Cape Meredith (211.74 kg). All of the rest of the catches were less than 15 kg.

The total lengths of *G. blacodes* sampled on ZDLH1-02-2006 ranged from 52 and 152 cm L_T (mean = $76.09 \text{ cm} \pm 14.88$). Females were more abundant than males ($F\% = 63$) and were also marginally larger on average. Figure 20 illustrates the pooled length frequency distribution of *G. blacodes* sampled during the cruise.

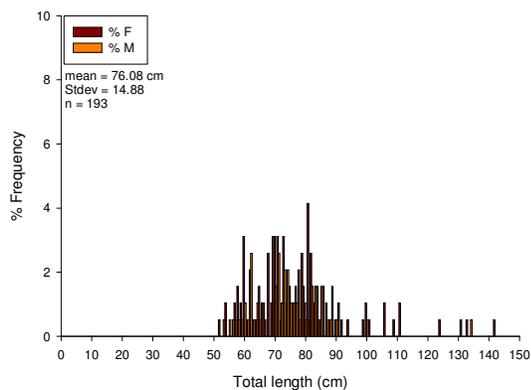


Figure 20: Length frequency distributions of male and female *Genypterus blacodes* sampled on ZDLH1-02-2006

For both males and females, most kingclip individuals were in their resting stage (maturity stage II). Fewer animals were in maturity stages I, II, III, IV, V and VI (Figure 21). Interestingly we encountered 3 females at stage V which is very rare for the Falkland Islands as no breeding animals have been encountered here before. Samples of their ovaries were fixed in 10% Buffered Formal Saline for further studies on fecundity.

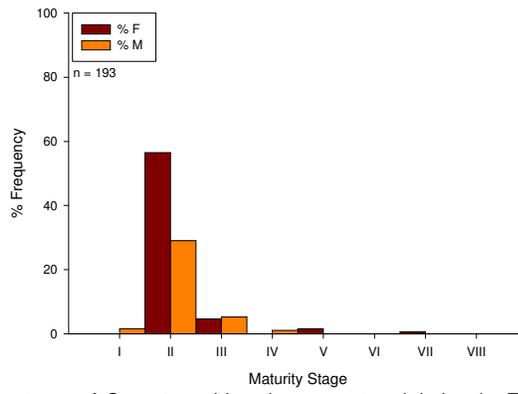


Figure 21: Maturity stages of *Genypterus blacodes* encountered during the ZDLH1-02-2006 survey

3.6 *Micromesistius australis australis*

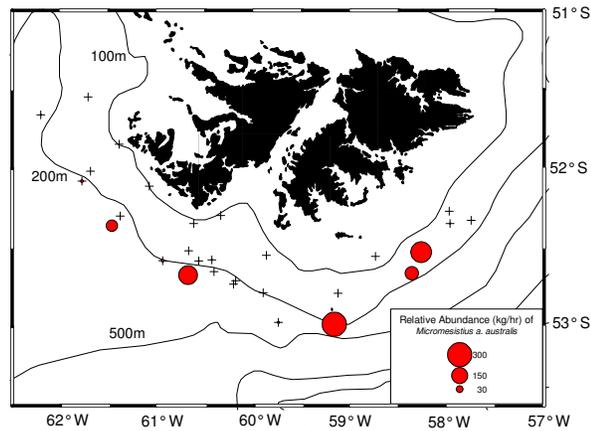


Figure 22: CPUE of *Micromesistius australis australis* caught at each station on the research cruise ZDLH1-02-2006

Southern blue whiting was the 5th most common species encountered on ZDLH1-02-2006 in terms of weight. Southern blue whiting were caught on 12 of the 29 bottom trawl stations on this cruise. Blue whiting were only caught in depths of greater than 180 m and were most common between 220 and 320 m during the cruise (Figure 22). CPUEs ranged between 0.12 and 299.52 kg/hr (mean = 78.59 ± 107.95) with the latter occurring in 235 m of water.

Total lengths ranged between 11 and 61 cm L_T ($43.29 \text{ cm} \pm 9.18$). The pooled length frequency distribution revealed 4 modes at 27, 38, 48 and 51 cm (Figure 23).

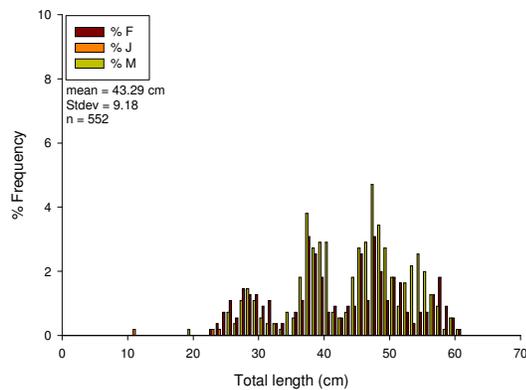


Figure 23: Length frequency distributions of male and female *Micromesistius australis australis* sampled on ZDLH1-02-2006

Most individuals of both sexes were in their resting stages (II) fewer individuals were in their recovering (VIII) and immature stages (I) (Figure 24). Southern blue whiting spawn in September and November so it was not a surprise to find spent - recovering animals on the cruise.

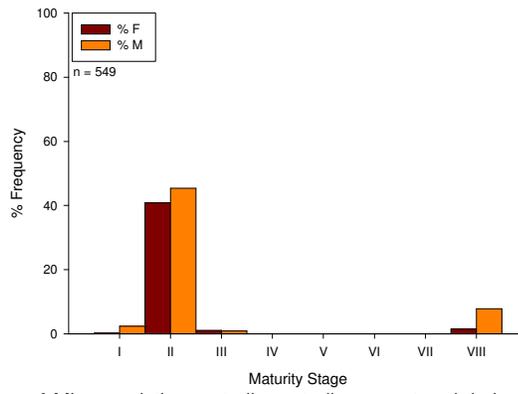


Figure 24: Maturity stages of *Micromesistius australis australis* encountered during the ZDLH1-02-2006 survey

3.7 *Salilota australis*

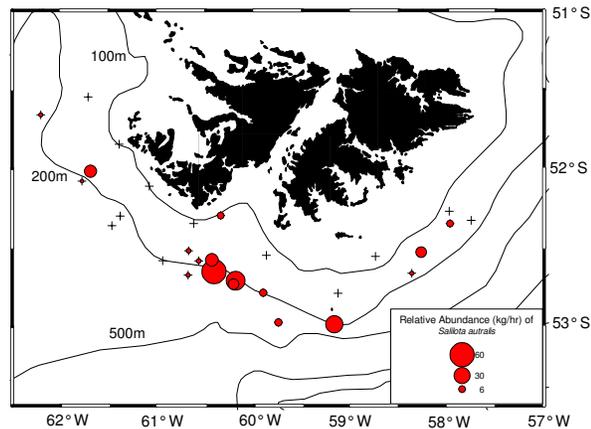


Figure 25: CPUE of *Salilota australis* caught at each station on the research cruise ZDLH1-02-2006

Salilota australis were caught on 20 of the 29 bottom trawls during the cruise and it was the 10th most abundant taxa in terms of weight. The greatest catches were in the south of the research area in approximately 200 m of water (Figure 25). CPUEs ranged from 0.21 to 60.28 kg/hr (mean = 12.07 ± 15.52).

Redcod ranged in length from 18 to 76 cm L_T (mean = 39.52 ± 11.09). The pooled length frequency distribution of *Salilota australis* is illustrated in Figure 26. Most individuals, of both sexes, sampled were in their resting stage (II) with smaller proportions in stage I, III and VIII (Figure 27). Otoliths and gonads were collected for ageing and histology respectively as part of the ongoing redbcod project.

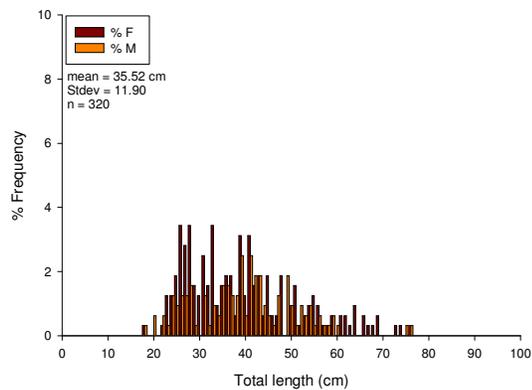


Figure 26: Length frequency distributions of male and female *Salilota australis* sampled on ZDLH1-02-2006

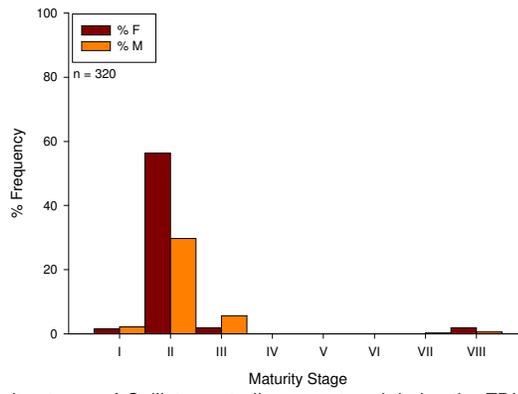


Figure 27: Maturity stages of *Salilota australis* encountered during the ZDLH1-02-2006 survey

3.8 *Champscephalus esox*

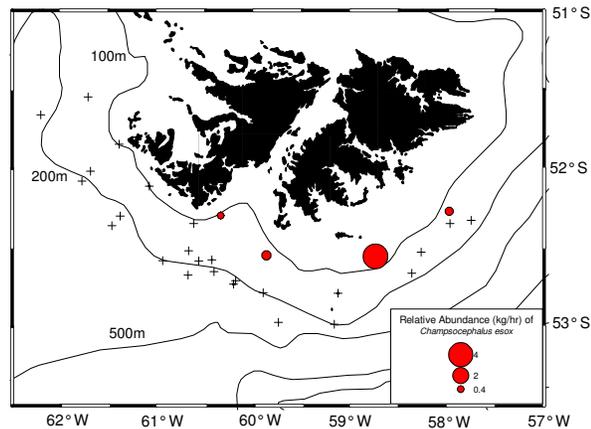


Figure 28: CPUE of *Champscephalus esox* caught at each station on the research cruise ZDLH1-02-2006

Champscephalus esox were caught on 8 of the 29 bottom trawl stations. Although this species was caught in small quantities their catch rates were higher than those encountered on previous research cruises. Icefish were most common to the south east and south of East Falkland at around 100 m (Figure 28). CPUEs ranged from 0.02 to 4.28 kg/hr (mean 0.78 kg/hr \pm 1.44).

Total lengths of icefish sampled on the cruise ranged from 14 to 35 cm L_T (mean = 18.02 cm \pm 4.51). Their pooled length frequency distribution illustrates a prominent mode at approximately 16 cm with a smaller mode at 28 cm. It could be that during the cruise we only sampled part of the population (Figure 29). The icefish sampled had a large a range of maturities with stages IV and V bring most common for females and II and III the most common for the males (Figure 30).

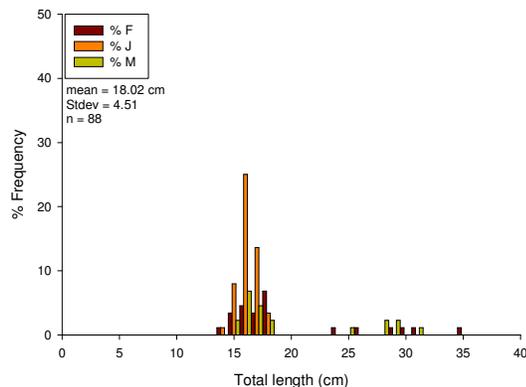


Figure 29: Length frequency distributions of juvenile, male and female *Champscephalus esox* sampled on ZDLH1-02-2006

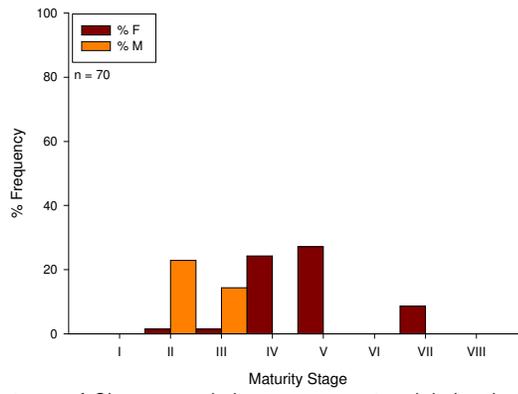


Figure 30: Maturity stages of *Champsocephalus esox* encountered during the ZDLH1-02-2006 survey

3.9 *Dissostichus eleginoides*

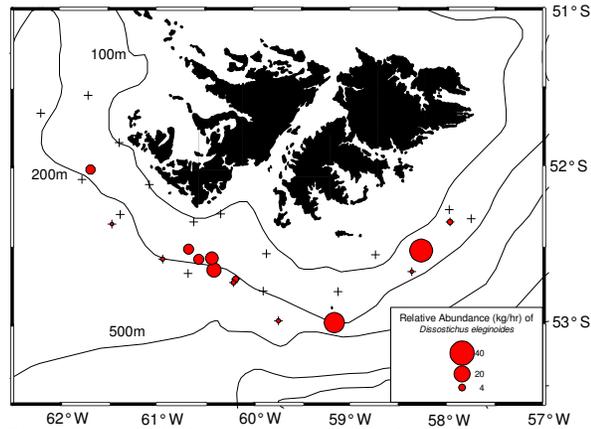


Figure 31: CPUE of *Dissostichus eleginoides* caught at each station on the research cruise ZDLH1-02-2006

Toothfish were caught throughout the survey area and were most common in depths of approximately 200 m (Figure 31). CPUEs ranged from 1.09 to 36.03 kg/hr (mean 9.52 kg/hr \pm 10.87). Although only encountered in small quantities they generally came up on board in good condition and because of this we attempted to keep them alive for potential brood stock. There were a number of catches successful in this respect, all to the southeast and south of the area (stations 2329-2370). Specimens between 66-85cm TL were placed in two (1-2 m³) fish holding tanks, tagged, and injected with a dose of oxytetracycline. Some smaller specimens were kept, but these may have been in poor condition (extensive scale loss for instance) initially, and did not survive long.

The first specimen was captured on 6/2/2006 at station 2329. This animal stayed alive until the day that *Dorada* returned to Stanley on 15/2/06. The second specimen was captured on 7/2 at station 2337 and died on 11-12/2, possibly due to oxygen starvation. The third specimen captured was “Len”. This animal was also caught at station 2337 (south of Beauchêne Island). It was the only survivor of a total number of 17 specimens that upon capture were deemed healthy enough to try and bring back for CFFL as brood-stock.

The first four specimens (from stations 2329 and 2337) were kept in isolation in the starboard fish tank for almost the entire period until return to Stanley. Each of these survived five days or more on board. The condition of these animals was initially very good, with no apparent damage, not even to their eyes. However over the course of their stay, eventually all started to show some signs of infection and eventually also abrasion to their eyeballs. This would most probably have been caused by a combination of factors such as the continuous movement in the tank, and probable overstocking.

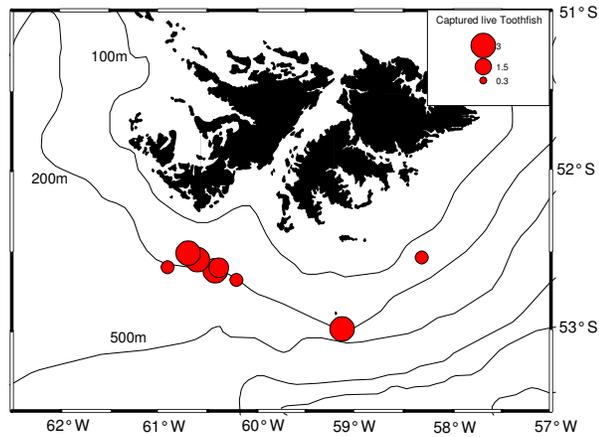


Fig 32: Captures of viable *Dissostichus eleginoides* for brood stock on the research cruise ZDLH1-02-2006

The latterly caught specimens were in similar condition as the original four, but as space in the tanks was running low, the levels of stress these animals were subjected to in trying to keep them alive may have been more than they would have been able to cope with. At one point, two healthy animals were in a tank together with a large quantity of skates (*B. brachyurops*). After having tagged and released the skates, the water was extremely clouded with mucous. This probably would have irritated and clogged the gills of the toothfish in the same tank, and within a day these two initially healthy looking animals were dead.

4.0 Rajidae

This family, of which a total of 10 species from 3 genera were caught, comprised just 3.99% of the total catch from 29 trawl stations. 25 of these stations yielded Rajidae catches. The most abundant species were *Bathyraja griseocauda*, *B. brachyurops*, *B. albomaculata*, and *B. scaphiops*, together 85.46% of the total Rajidae catch (see Table 4). Figure 33 shows the Rajidae catches by species and station.

Species Code	Species name	Total Catch (kg)	Total Sampled (kg)	Total Discarded (kg)	Proportion (%)
RGR	<i>Bathyraja griseocauda</i>	365.814	365.814	365.814	40.88%
RBR	<i>Bathyraja brachyurops</i>	174.883	174.883	174.883	19.54%
RAL	<i>Bathyraja albomaculata</i>	112.340	112.340	112.340	12.55%
RSC	<i>Bathyraja scaphiops</i>	111.750	111.750	111.750	12.49%
RBZ	<i>Bathyraja cousseauae</i>	72.719	72.719	72.719	8.13%
RMU	<i>Bathyraja multispinis</i>	19.262	19.262	19.262	2.15%
RMC	<i>Bathyraja macloviana</i>	17.205	17.205	17.205	1.92%
RFL	<i>Raja flavirostris</i>	10.998	10.998	10.998	1.23%
RPX	<i>Psammobatis spp.</i>	9.860	9.860	9.860	1.10%
RDO	<i>Raja doellojuradoi</i>	0.012	0.012	0.012	0.00%
Grand Total		894.843	894.843	894.843	

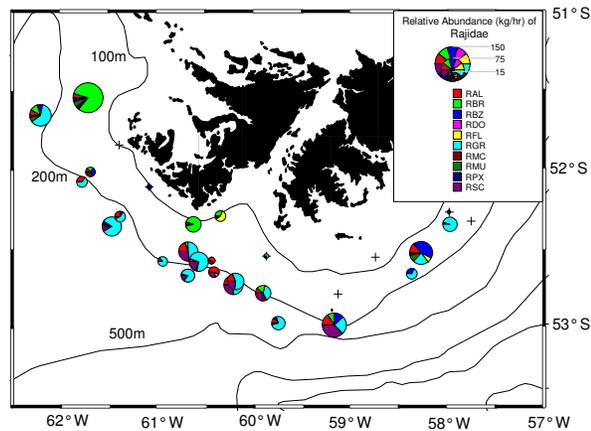


Figure 33: Rajidae catch by species and station

4.0.1 Tag & Release program

One of cruise objectives was to tag and release as many rays as possible, from all species, again except the genus *Psammobatis*. Recovering these animals will enable verification of the age/growth studies undertaken by scientists at FIFD, as well as help studies on migration patterns. The recovery should be affected through the commercial fleet. During this cruise, a total number of 272 specimens (compare with 659 in ZDLH1-10-2005 cruise) were tagged with an orange t-bar tag, and injected with the antibiotic Tetracycline (dosage of 20mg per 1kg of bodyweight, in 20mg/ml solution). Pictures depicting the tagging and injection procedures are shown in the ZDLH1-10-2005 cruise report. Figure 34 shows the number of specimens tagged at each station, as well as the exact release positions.

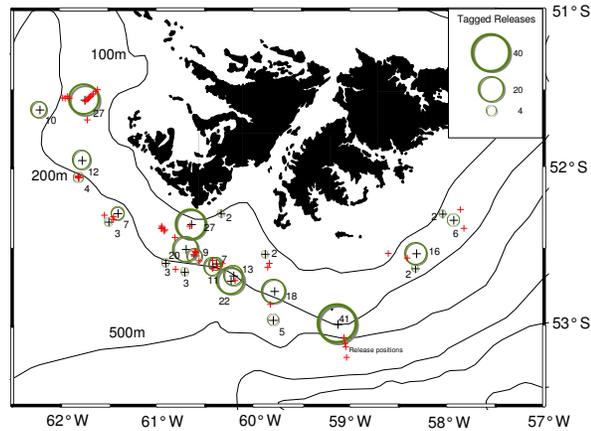


Figure 34: Numbers of tagged Rajidae, and release positions

4.1 Biology

4.1.1 *Raja flavirostris* (or *Dipturus chilensis*)

During this research cruise, of a total number of 375 skates caught only 2 specimens were *R. flavirostris*. One was caught in the Southeast of the survey area, the other one just at the South entrance of Falkland Sound, in relatively shallow waters, but both were sub-adults. The results of this cruise stand in stark contrast to the results obtained in October 2005. Only some of the then surveyed stations were surveyed again during this cruise, but *R. flavirostris* was very noticeably absent from all.

4.1.2 *Bathyraja albomaculata*

A total number of 89 specimens were caught in 20 stations, and was hence the most widely distributed species, even though by weight it came only third with a catch of 112kg. 48.3% of the specimens were female, with mean disk-widths of 33.9 and 36.7cm for females and males respectively. Figure 35 shows the size frequency for the species, with large females being largely absent from the population.

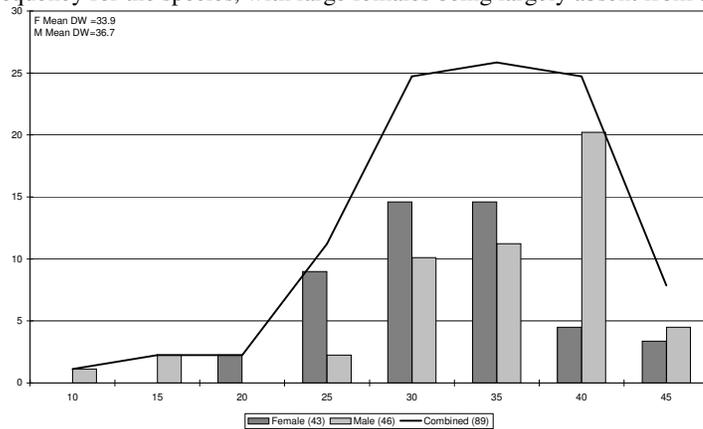


Figure 35: Size Frequency of *B. albomaculata*

4.1.3 *Bathyraja griseocauda*

A total number of 56 specimens were caught in 17 stations. It was the second most widely distributed species, but the first in respect of catch weight, with a total of 366kg (min 2kg, max 43kg, mean ~21.5kg, with numbers ranging from 1-9). The female proportion for all the grouped data was 30.4%, with the mean disk-width for females and males 61.76cm and 43.74cm respectively. The size frequency shows a distinct bi-modality with larger females being largely absent from the population.

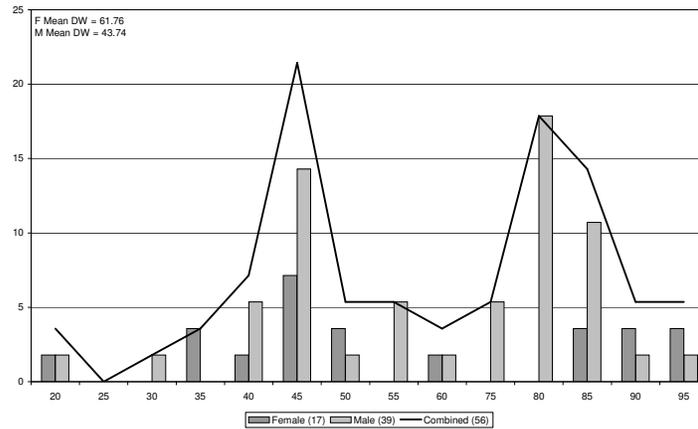


Figure 36: Size frequency of *B. griseocauda*

4.1.4 *Bathyraja brachyurops*

This species was the second most abundant ray species, with a total catch of 175kg (80 specimens) from 11 trawls. 77% (135kg) was caught in just two stations, with 99kg (39 specimens) caught in station 2389, and 36kg (25 specimens) in station 2361. All other stations yielded no more than 3 specimens each. Figure 5 shows the size frequency for all the specimens, with clearly the 40cm disk-width class being predominant. The mean disk-width for females was 40.4cm, with the mean for males 44.2cm. As noted with other species, large females were also largely absent from the population.

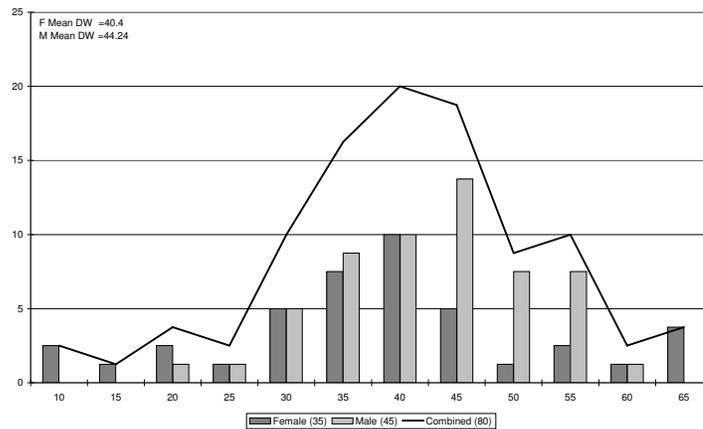


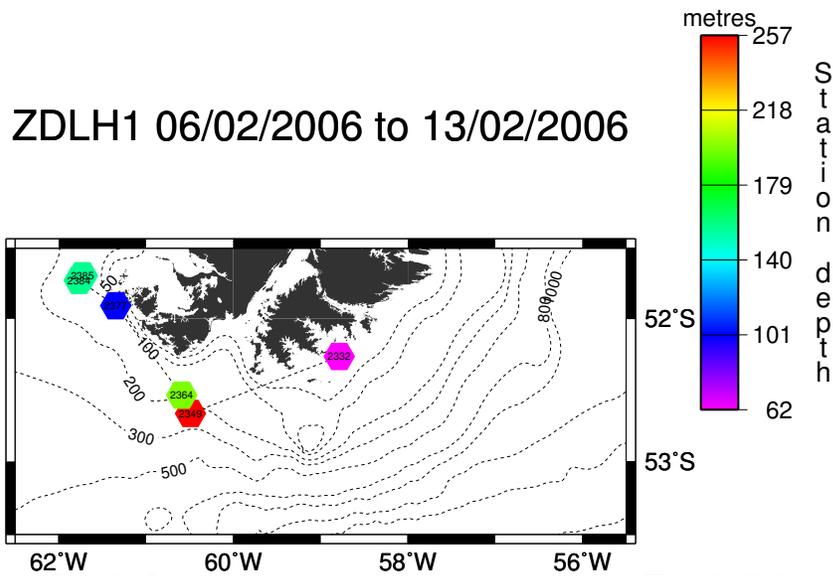
Figure 37: Size frequency of *Bathyraja brachyurops*

5.0 Plankton Studies

An *ad hoc* plankton survey (six stations) was undertaken to collect samples for Dr. Petra Quillfeldt who is studying the trophic ecology of seabirds using fatty acid signatures and stable isotopes in prey items. The survey also provided us with the opportunity to collect larval fish of the FIFD's reference collection.

5.1 Methods

Plankton trawls employed an Isaacs-Kidd midwater trawl (0.5 mm mesh) with a net monitor and a Valeport 105 self-recording current meter to measure the volume of the water through the net. The trawl was deployed for 15 minutes at a set horizon. Trawling horizons were chosen with the aid of acoustic indications of layering of biomass in the water column. At most sites a number of stations, with different trawling horizons, were carried out. Wet weight of the entire sample was measured. The sample was then put through a series of 5 sieves to separate the zooplankton by size. The abundance of each taxonomic group was estimated by eye as a proportion of total wet weight. Zooplankton were identified to the lowest possible taxon using a dissecting microscope. Figure 38 illustrates the positions of the plankton stations conducted on ZDLH1-02-2006.



5.2 Results

A total of 9.99 kg (wet weight) of zooplankton were caught over the six stations conducted during the cruise. Larval *Munida gregaria* and larval *Patagonotothen ramsayi* were the only two species caught on this inshore station 2332. Two stations were conducted in deeper (2349 and 2364) water above approximately 200 m depth at a horizon of approximately 30 m. The most dominant species in the latter stations were *Beroe* spp. followed by chaetognaths and euphausiids, fish larvae were less abundant. The last three stations were conducted to the southwest of Weddell and the west of Beaver Islands. These stations were dominated by *Beroe* spp. and yielded significant amounts of euphausiids, *Themisto gaudichaudi* and other pelagic amphipods. Table 5 illustrates the species caught at each of the plankton stations conducted.

Table 5: Species composition in plankton samples and the abundance of different taxonomic groups. D – dominant (30 – 80 %), A – abundant (5 – 20 %), C – common (1 – 5 %), O – occasional (<1%) and R – rare (1 to 2 individuals)

Name	2332	2349	2364	2377	2384	2385
Wet weight (g)	3984	767	4002	645	330	263
<i>BEROE SPP.</i>	-	D	D	O	D	D
PTEROPODA	-	-	-	-	O	-
CHAETOGNATHA	-	A	C	O	A	C
CARIDAE	-	-	-	-	-	R
DECAPODA	-	-	-	R	-	-
<i>MUNIDA GREGARIA</i>	D	R	A	R	-	-
<i>PRYMNO MACROPA</i>	-	-	-	-	R	-
<i>EUPHAUSIA LUCENS</i>	-	R	C	A	C	A
<i>EUPHAUSIA VALLENTINI</i>	-	O	-	-	-	-
<i>THYSANOESSA MACRURA</i>	-	O	O	C	C	O
<i>THEMISTO GAUDICHAUDI</i>	-	R	C	C	A	C
<i>VIBILIA SPP.</i>	-	R	-	-	-	-
<i>GONATUS ANTARCTICUS</i>	-	-	R	R	-	-
<i>GYMNOSCOPELUS SPP.</i>	-	-	O	R	-	-
<i>PATAGONOTO THEN TESSELLATA</i>	C	-	-	-	-	-
<i>MYCTOPHID SPP.</i>	-	-	C	-	R	R
UNIDENTIFIED FINFISH	-	O	-	R	-	-