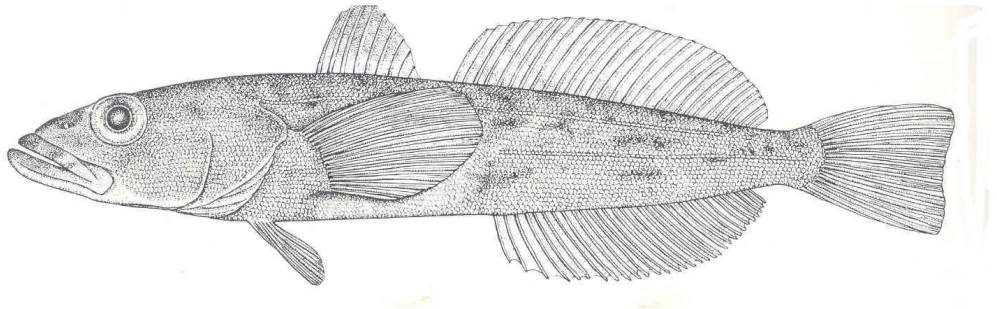
# Scientific Report

# Fisheries Research Cruise ZDLH1-07-2005



## Fisheries Department
## Falkland Islands Government

# Scientific Report

# Fisheries Research Cruise

# ZDLH1-07-2005


***FPRV Dorada***

***12th July to 26th July 2005***

Fisheries Department
Falkland Islands Government
Stanley
Falkland Islands

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# 1. Introduction

In July 2005, a research cruise was undertaken in the southern part of the FICZ (FOCZ) including the Burdwood Bank using the Falkland Islands Government Research and Patrol Vessel *Dorada* (Figure 1). The primary objective of the cruise was to carry out a semi-pelagic deep-water survey of the southern part of the Falkland Islands and the Burdwood Bank in order to study the spawning grounds of the Patagonian toothfish (*Dissostichus eleginoides*).

## *1.2 Cruise objectives*

The five objectives of the cruise were to:

1. Conduct a semi-pelagic deep-water survey of the spawning grounds of *D. eleginoides*.
2. Conduct a survey of the cephalopod and ichthyofauna of the southern part of the Falklands slope and the slope of the Burdwood Bank.
3. To study the oceanographic conditions of the survey area.
4. To collect *ad hoc* acoustic data along the track of the survey.
5. To collect toothfish boodstock for potential aquaculture operations.

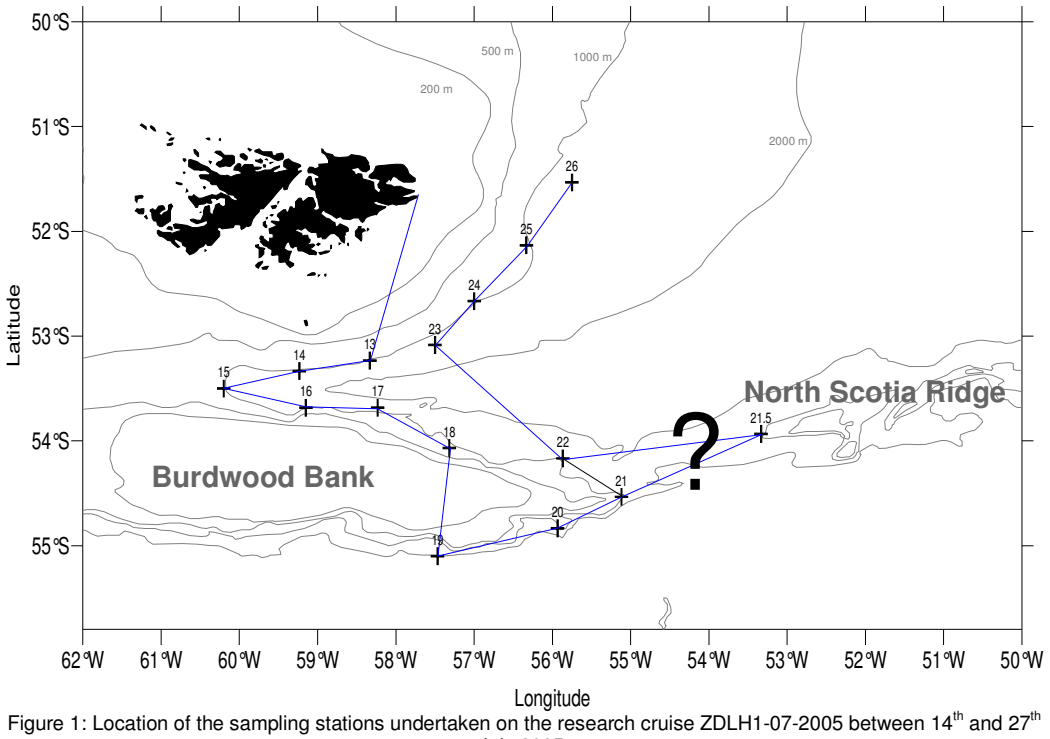



Figure 1: Location of the sampling stations undertaken on the research cruise ZDLH1-07-2005 between 14th and 27th July 2005.

## *1.3 Cruise plan and key dates*

After departing Stanley on the 13th July the vessel proceeded to the first deep-water station to the southeast of Beauchêne Island with the intention of carrying out trawl stations along the 1000 m isobath. Then the intention was to proceed to the southern part of the Falkland Islands' slope and the Burdwood Bank. During the first tow an unexpected problem with one of the crewmembers revealed itself, which forced the vessel to be returned to Stanley the next day. The survey resumed on the 18th July on the southern slope of the Falkland Islands. Each day two to three deepwater trawls were conducted with durations of approximately two hours at horizon near the bottom. Several trawls were conducted in the water column at a horizon of 900-1000 m over a bottom depth of 1500-2000 m.

In order to get some live toothfish for further aquaculture experiments ashore (in case of difficulties getting them from the trawls), one to two days were provisionally planned to work with a Falkland registered longliner. The longliner used the pots to catch toothfish, which were then transferred to the

Dorada at the end of the cruise. On the 24th July one of the trawl winches malfunctioned. After approximately two days of unfruitful attempts to repair it at sea it was decided to terminate the cruise prematurely and return to Stanley. The cruise finished on 27th July.

## 1.4 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 |

## 1.5 Personnel and responsibilities

The following personnel participated in the cruise:

| | |
|---|---|
| Dr. Alexander Arkhipkin | Chief Scientist |
| Dr. Vladimir Laptikhovsky | Oceanographer |
| Dr. Lianos Triantafillos | Fisheries Biologist/Acoustic Survey |
| Dr. Paul Brickle | Fisheries Biologist |
| Joost Pompert | Fisheries Biologist |
| Justine Jury | Fisheries Biologist |
| Jonathan Moir | Fisheries Biologist/Aquaculture specialist. |

## 1.6 Equipment used

*1.6.1 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. Unfortunately the triggering time was not synchronised with the Furuno Current Doppler Profiler and this resulted in quite a large amount of interference. 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.

*1.6.2 Trawling*

An ENGEL semi-pelagic trawl with "Super-V" doors was used at all trawl stations. It had a 40.2 m headline and a 38.7 m footrope equipped with rockhoppers. Simrad ITI net monitor sensors has been attached to the upper panel of the trawl. The vertical opening was between 6.9 and 17 m (mean = 11.50 m) and the codend mesh size was 95 mm.

*1.6.3 Oceanographic*

The oceanographic equipment used on ZDLH1-07-2005 was the same as was used on previous surveys and included:

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

# 2. Sampling

## 2.1 Acoustic surveying

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

## 2.2 Trawl stations and biological sampling

During the ZDLH1-07-2005 research cruise the station numbers ranged from 2119 to 2152 (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. Dates, locations, modal depths and duration of oceanographic (C) and trawl (S) stations carried out during research cruise ZDLH1-07-2005 between 13th to 27th July 2005.

| *Station* | Activity | *Date* | *Start Time* | *Start Latitude* | | *Start Longitude* | | *Finish Latitude* | | *Finish Longitude* | | *Modal Depth (m)* | *Duration* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2119 | C | 14/07/2005 | 06:06 | 53 | 13.9 | 58 | 19.9 | 53 | 13.7 | 58 | 18.4 | 1023 | 38 |
| 2120 | S | 14/07/2005 | 07:58 | 53 | 09.8 | 58 | 04.4 | 53 | 15.0 | 58 | 11.0 | 1073 | 180 |
| 2121 | C | 18/07/2005 | 09:44 | 53 | 19.0 | 59 | 13.0 | 53 | 19.0 | 59 | 11.0 | 979 | 35 |
| 2122 | S | 18/07/2005 | 10:30 | 53 | 19.0 | 59 | 12.0 | 53 | 18.2 | 59 | 25.6 | 992 | 220 |
| 2123 | S | 18/07/2005 | 17:01 | 53 | 20.4 | 59 | 31.9 | 53 | 17.0 | 59 | 50.0 | 987 | 254 |
| 2124 | C | 18/07/2005 | 21:43 | 53 | 19.0 | 59 | 51.0 | 53 | 18.0 | 59 | 50.0 | 963 | 36 |
| 2125 | C | 19/07/2005 | 06:31 | 53 | 23.0 | 60 | 10.0 | 53 | 22.5 | 60 | 10.5 | 994 | 41 |
| 2126 | S | 19/07/2005 | 07:34 | 53 | 22.7 | 60 | 11.5 | 53 | 33.1 | 60 | 17.2 | 968 | 208 |
| 2127 | S | 19/07/2005 | 11:34 | 53 | 34.3 | 60 | 11.5 | 53 | 38.6 | 59 | 55.0 | 933 | 213 |
| 2128 | S | 19/07/2005 | 15:35 | 53 | 38.9 | 59 | 49.8 | 53 | 44.6 | 59 | 34.7 | 1097 | 223 |
| 2129 | C | 19/07/2005 | 20:59 | 53 | 45.0 | 59 | 36.0 | 53 | 45.6 | 59 | 37.3 | 944 | 33 |
| 2130 | C | 20/07/2005 | 06:31 | 53 | 41.0 | 59 | 09.0 | 53 | 41.7 | 59 | 09.1 | 1638 | 43 |
| 2131 | S | 20/07/2005 | 07:50 | 53 | 44.5 | 59 | 06.4 | 53 | 45.1 | 58 | 50.2 | 996 | 206 |
| 2132 | S | 20/07/2005 | 11:51 | 53 | 44.1 | 58 | 46.8 | 53 | 47.2 | 58 | 33.6 | 957 | 244 |
| 2133 | P | 20/07/2005 | 16:38 | 53 | 45.5 | 58 | 28.6 | 53 | 45.1 | 58 | 12.2 | 1083 | 218 |
| 2134 | C | 20/07/2005 | 21:03 | 53 | 43.3 | 58 | 09.6 | 53 | 44.2 | 58 | 09.5 | 1658 | 38 |
| 2135 | S | 21/07/2005 | 07:28 | 53 | 48.0 | 58 | 33.0 | 53 | 50.2 | 58 | 16.4 | 629 | 189 |
| 2136 | S | 21/07/2005 | 11:20 | 53 | 50.1 | 58 | 11.9 | 53 | 55.6 | 57 | 56.6 | 711 | 187 |
| 2137 | S | 21/07/2005 | 15:00 | 53 | 53.4 | 57 | 56.1 | 53 | 45.8 | 58 | 07.5 | 855 | 191 |
| 2138 | C | 21/07/2005 | 19:15 | 53 | 46.0 | 57 | 55.2 | 53 | 46.5 | 57 | 54.5 | 863 | 31 |
| 2139 | S | 22/07/2005 | 09:54 | 54 | 04.1 | 57 | 15.1 | 54 | 08.8 | 56 | 58.8 | 1011 | 216 |
| 2140 | S | 22/07/2005 | 14:20 | 54 | 09.8 | 56 | 59.1 | 54 | 07.3 | 57 | 13.0 | 834 | 199 |
| 2141 | C | 22/07/2005 | 18:17 | 54 | 05.8 | 57 | 09.9 | 54 | 06.1 | 57 | 08.7 | 1008 | 38 |
| 2142 | C | 23/07/2005 | 06:40 | 55 | 03.6 | 57 | 13.5 | 55 | 03.8 | 57 | 12.1 | 971 | 36 |
| 2143 | S | 23/07/2005 | 14:35 | 54 | 45.4 | 56 | 00.7 | 54 | 49.8 | 56 | 11.5 | 901 | 235 |
| 2144 | C | 23/07/2005 | 18:59 | 54 | 49.0 | 56 | 13.3 | 54 | 48.8 | 56 | 11.7 | 1184 | 39 |
| 2145 | S | 24/07/2005 | 07:33 | 54 | 41.7 | 55 | 33.2 | 54 | 39.0 | 55 | 15.0 | 690 | 192 |
| 2146 | C | 24/07/2005 | 16:40 | 54 | 31.9 | 55 | 06.3 | 54 | 30.9 | 55 | 04.5 | 1069 | 43 |
| 2147 | C | 25/07/2005 | 08:08 | 54 | 09.8 | 55 | 52.0 | 54 | 08.6 | 55 | 52.2 | 1537 | 43 |
| 2148 | C | 26/07/2005 | 14:04 | 53 | 50.9 | 56 | 08.2 | 53 | 50.1 | 56 | 08.8 | 2050 | 37 |
| 2149 | C | 26/07/2005 | 16:31 | 53 | 32.2 | 56 | 21.0 | 53 | 31.6 | 56 | 21.4 | 2926 | 35 |
| 2150 | C | 26/07/2005 | 19:00 | 53 | 13.5 | 56 | 35.0 | 53 | 12.9 | 56 | 35.2 | 2055 | 38 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2151 | C | 26/07/2005 | 21:36 | 52 | 54.5 | 56 | 48.0 | 52 | 54.0 | 56 | 48.2 | 1514 | 35 |
| 2152 | C | 26/07/2005 | 23:30 | 52 | 40.7 | 56 | 57.6 | 52 | 40.3 | 56 | 57.7 | 971 | 36 |

# 3. Oceanography

## *3.1 Oceanographic sampling*

Oceanographic data were collected at 18 oceanographic stations. Every day, these stations were made mostly before the first and after the last trawl, and a transect across the most of the Falkland Current (Section 4) was also carried out (Figure 2).

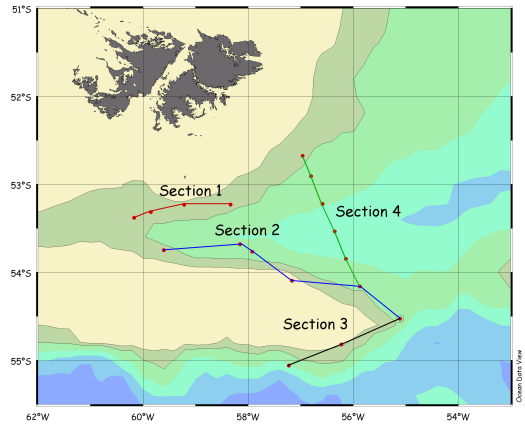



Figure 2. Locations of oceanographic stations conducted on the ZDLH1-07-2005 research cruise.

## *3.2 Results*

The survey's aim was to assess the oceanographic conditions over spawning grounds the Patagonian toothfish and adjacent waters.

The stations that were situated around the Burdwood Bank were above depths of 840-2,930 m. Temperatures ranged from 3.0º to 5.7ºC, salinity from 33.91 to 34.34 , and density from 25.74 to 27.34 kg/m$^3$. Analysis of T-S curves demonstrated a presence of five water masses and their modifications around the Burdwood Bank, and two more at the centre of the Section 4 (Figure 3).

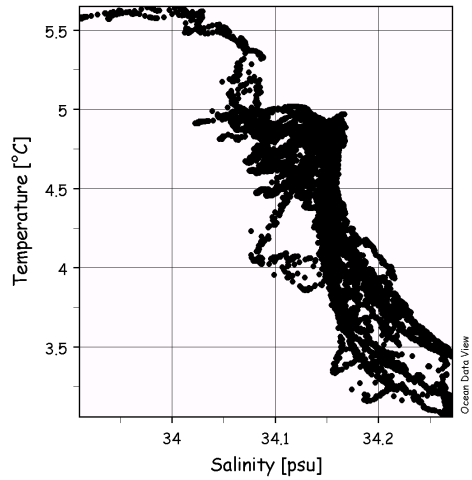
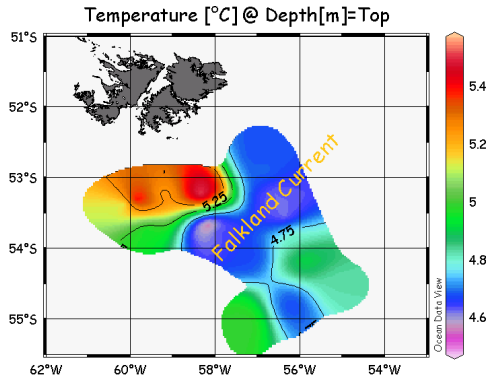
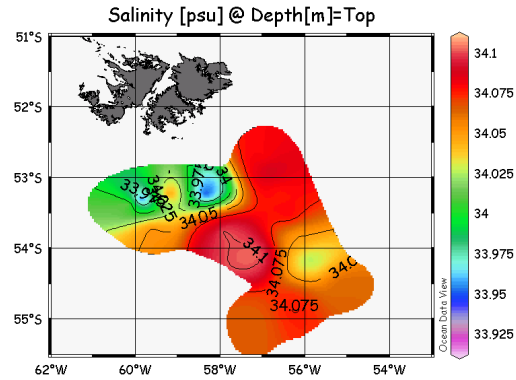


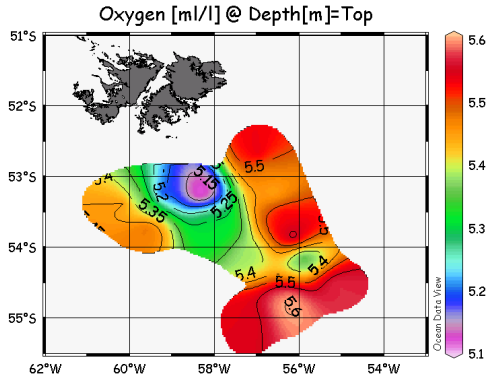

Figure 3. Temperature – Salinity profiles of water masses encountered on and around the Burdwood Bank.

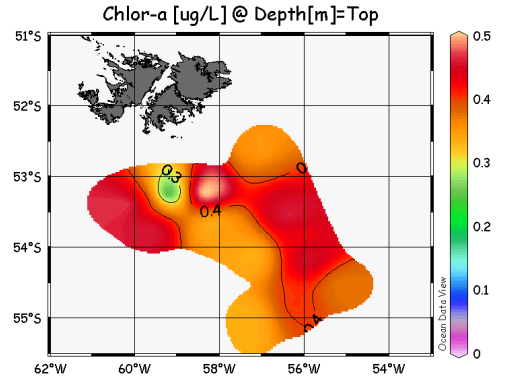
The distribution of the main oceanographic features at the surface and at a horizon of 800 m are presented in Figure 4. The predominant oceanographic body was the Falkland Current, which crossed the area from southwest to northeast. Colder and more saline waters in the surface layers indicated the position of the Falkland Current. Low salinity and relatively warm shelf waters occupied the inshore

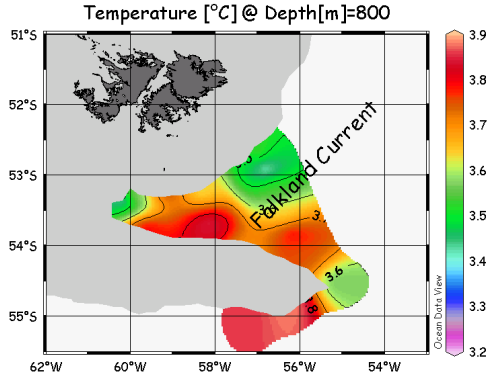
part of the area, including an eddy with a centre at approximately 53º15'S, 58º15'W. The border between the Falkland Current and shelf waters on the west of the Burdwood Bank was situated at the level of Falkland Trough intrusion into the Patagonian shelf. Oceanic waters with both moderate salinity and temperature were found at the eastern edge of the Burdwood Bank.

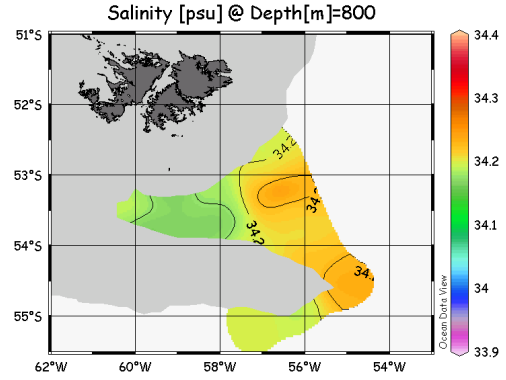


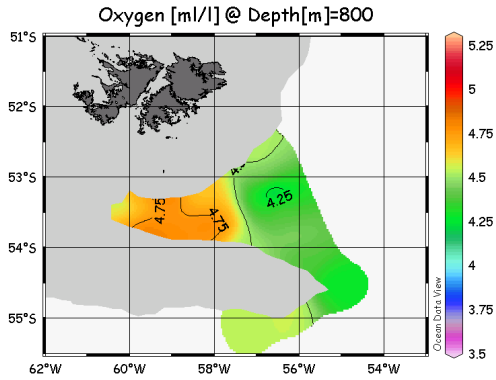



Figure 4. The distribution of temperature, salinity, oxygen, and chlorophyll A around the Burdwood Bank on the surface and at a depth of 800 m (ZDLH1-05-2005).

The distribution of temperature, salinity, oxygen and chlorophyll A on Sections 1-4 is shown in Figures 5 and 6.

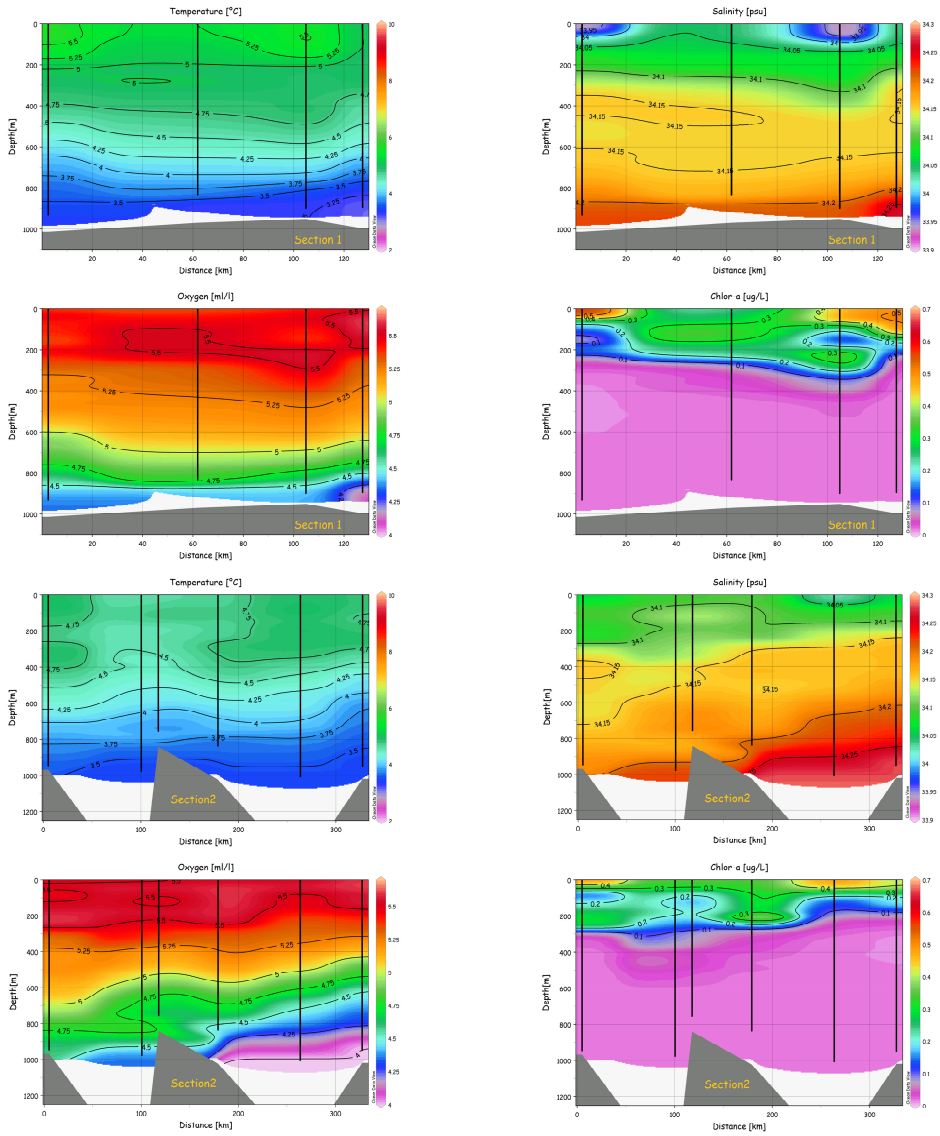



Figure 5. Contoured vertical sections for Section 1 and Section2

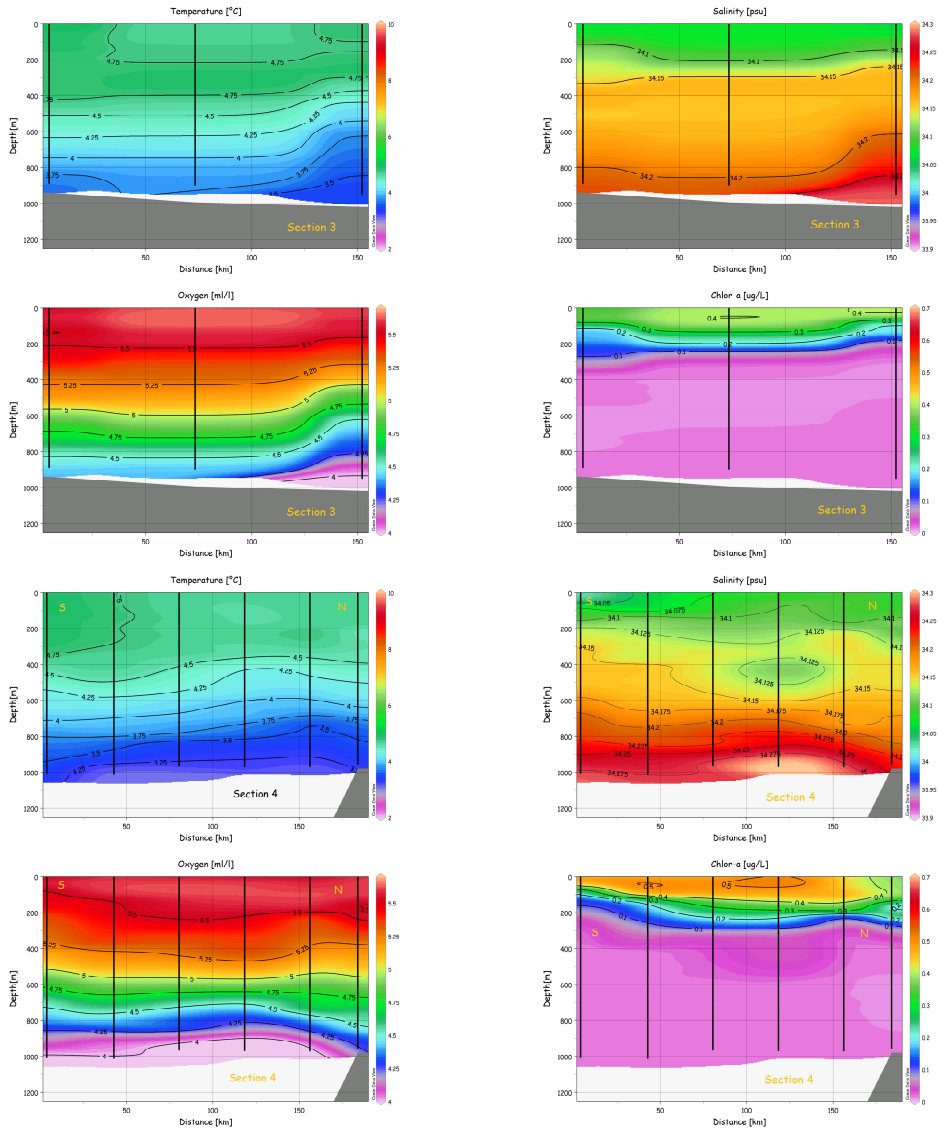



Figure 6. Contoured vertical sections for Section 3 and Section 4.

# 4. Biological Sampling

## 4.1 Catch and by-catch

Trawling was conducted at 16 stations on the southern Falkland slope and on the slope of the Burdwood Bank comprising 15 semi-pelagic and 1 pelagic station (Figure 1). Trawling time at horizon varied between 20 and 122 minutes, with an average time at the horizon of 106 minutes.

A total of 13,361 kg, consisting of over 80 species, was caught during the cruise. In terms of weight, the greatest catch during the cruise was the grenadier *Macrourus carinatus* followed by blue antimora *Antimora rostrata*, and the Patagonian toothfish *Dissostichus eleginoides*. These three species accounted for over 90% of the total catch. Significant catches of lantern fish (myctophids), blue whiting (*Micromesistius australis australis*), southern driftfish (*Icichthys australis*) and the greater hooked squid (*Moroteuthis ingens*) were also taken.

Table 3. Total catch of trawl stations during research cruise ZDLH1-07-2005.

| ***Species Code*** | ***Species name*** | ***Total Catch (kg)*** | ***Total Sampled (kg)*** | ***Total Discarded (kg)*** | ***Proportion (%)*** |
|---|---|---|---|---|---|
| GRC | *Macrourus carinatus* | 11,899.900 | 1,359.660 | 11,899.900 | 89.06% |
| ANR | *Antimora rostrata* | 550.970 | 314.630 | 550.970 | 4.12% |
| TOO | *Dissostichus eleginoides* | 289.080 | 279.080 | 0.000 | 2.16% |
| GYN | *Gymnoscopelus nicholsi* | 126.820 | 8.300 | 126.820 | 0.95% |
| BLU | *Micromesistius australis* | 63.120 | 59.840 | 63.120 | 0.47% |
| ICA | *Icichthys australis* | 42.070 | 36.230 | 42.070 | 0.31% |
| ING | *Moroteuthis ingens* | 40.610 | 10.440 | 26.910 | 0.30% |
| MXX | Myctophidae | 38.220 | 0.000 | 38.220 | 0.29% |
| MED | Medusae | 34.050 | 0.000 | 34.050 | 0.25% |
| ALP | *Alepocephalus productus* | 31.560 | 29.730 | 31.560 | 0.24% |
| ECC | *Echiodon cryomargarites* | 31.550 | 0.000 | 31.550 | 0.24% |
| PAC | *Pasiphaea acutifrons* | 31.581 | 31.557 | 0.024 | 0.24% |
| GRH | *Macrourus holotrachys* | 29.000 | 9.220 | 29.000 | 0.22% |
| NED | *Neolithodes diomedeae* | 26.580 | 26.580 | 0.000 | 0.20% |
| HAJ | *Halargyreus johnsonii* | 17.430 | 3.740 | 17.420 | 0.13% |
| SPN | Sponges | 15.530 | 0.000 | 15.530 | 0.12% |
| NOC | *Notacanthus chemnitzi* | 14.030 | 11.230 | 14.030 | 0.11% |
| COS | *Coryphaenoides subserrulatus* | 13.230 | 11.970 | 11.910 | 0.10% |
| PAA | *Pandalopsis ampla* | 7.930 | 7.310 | 0.610 | 0.06% |
| BAA | *Bathyteuthis abyssicola* | 5.610 | 0.000 | 5.610 | 0.04% |
| ACP | *Acanthephyra pelagica* | 4.620 | 4.300 | 0.310 | 0.03% |
| PAT | *Merluccius australis* | 4.490 | 4.490 | 4.490 | 0.03% |
| RPA | *Bathyraja papilionifera* | 3.910 | 3.910 | 3.910 | 0.03% |
| PSM | *Pseudocyttus maculatus* | 3.440 | 0.000 | 3.440 | 0.03% |
| COK | *Coelorinchus kaiyomaru* | 3.360 | 1.270 | 3.360 | 0.03% |
| MAM | *Mancopsetta milfordi* | 2.800 | 1.130 | 1.670 | 0.02% |
| RGR | *Bathyraja griseocauda* | 2.650 | 2.650 | 2.650 | 0.02% |
| MUO | *Muraenolepis orangiensis* | 2.360 | 1.480 | 2.360 | 0.02% |
| CET | *Ceratias tentaculatus* | 2.150 | 2.000 | 1.990 | 0.02% |
| MGP | *Magnisudis prionosa* | 2.080 | 0.000 | 2.080 | 0.02% |
| LEE | *Lepidion ensiferus* | 2.060 | 0.530 | 2.040 | 0.02% |
| RDO | *Raja doellojuradoi* | 1.890 | 1.890 | 1.840 | 0.01% |
| TRM | *Trigonolampa miriceps* | 1.710 | 0.000 | 1.710 | 0.01% |
| MEY | Melanomidae | 1.230 | 1.230 | 0.000 | 0.01% |
| PGR | *Paradiplospinus gracilis* | 1.110 | 0.000 | 1.110 | 0.01% |

| Species Code | *Species name* | *Total Catch (kg)* | *Total Sampled (kg)* | *Total Discarded (kg)* | *Proportion (%)* |
|---|---|---|---|---|---|
| UCH | Sea urchin | 0.930 | 0.000 | 0.930 | 0.01% |
| SQX | Unidentied squid | 0.920 | 0.920 | 0.000 | 0.01% |
| ANT | Anthozoa | 0.910 | 0.000 | 0.910 | 0.01% |
| COT | *Cottunculus granulosus* | 0.660 | 0.660 | 0.000 | <0.00% |
| EPR | *Epigonus robustus* | 0.640 | 0.210 | 0.450 | <0.00% |
| PYM | *Physiculus marginatus* | 0.630 | 0.100 | 0.580 | <0.00% |
| ETL | *Etmopterus lucifer* | 0.610 | 0.000 | 0.610 | <0.00% |
| BAT | *Bathylagus antarcticus* | 0.580 | 0.000 | 0.580 | <0.00% |
| OPX | *Opistoteuthis spp.* | 0.550 | 0.550 | 0.000 | <0.00% |
| SCH | *Scopelosaurus hamiltoni* | 0.510 | 0.280 | 0.230 | <0.00% |
| HIE | *Histioteuthis eltarinae* | 0.490 | 0.410 | 0.070 | <0.00% |
| OCT | *Unidentified octopus* | 0.460 | 0.460 | 0.000 | <0.00% |
| ANP | *Anotopterus pharao* | 0.440 | 0.000 | 0.440 | <0.00% |
| THB | *Thymops birsteini* | 0.400 | 0.150 | 0.250 | <0.00% |
| GRV | *Macrourus spp.* | 0.400 | 0.400 | 0.000 | <0.00% |
| CAY | *Careproctus spp.* | 0.360 | 0.360 | 0.000 | <0.00% |
| MAR | *Martialia hyadesi* | 0.350 | 0.000 | 0.350 | <0.00% |
| STB | *Stomias boa* | 0.230 | 0.000 | 0.230 | <0.00% |
| BAS | *Batoteuthis scolips* | 0.210 | 0.210 | 0.000 | <0.00% |
| GUG | *Guttigadus globosus* | 0.200 | 0.200 | 0.000 | <0.00% |
| GON | *Gonatus antarcticus* | 0.200 | 0.180 | 0.060 | <0.00% |
| LMK | *Laemonema kongi* | 0.190 | 0.190 | 0.000 | <0.00% |
| BRL | *Brachioteuthis linkovskyi* | 0.180 | 0.180 | 0.010 | <0.00% |
| BOA | *Borostomias antarcticus* | 0.170 | 0.000 | 0.170 | <0.00% |
| AVI | *Avocettina infans* | 0.160 | 0.000 | 0.160 | <0.00% |
| PAP | *Paralomis spinosissima* | 0.160 | 0.140 | 0.010 | <0.00% |
| GRF | *Coelorhynchus fasciatus* | 0.130 | 0.000 | 0.130 | <0.00% |
| POC | *Poromitra crassiceps* | 0.130 | 0.000 | 0.130 | <0.00% |
| NEC | *Neorossia caroli* | 0.120 | 0.120 | 0.000 | <0.00% |
| STG | *Stomias gracilis* | 0.120 | 0.000 | 0.120 | <0.00% |
| MAS | *Mastigoteuthis psychrophila* | 0.100 | 0.100 | 0.000 | <0.00% |
| CAM | *Cataetyx messieri* | 0.090 | 0.000 | 0.090 | <0.00% |
| HIX | *Histioteuthis spp.* | 0.050 | 0.050 | 0.000 | <0.00% |
| NOY | *Notostomus spp.* | 0.030 | 0.000 | 0.030 | <0.00% |
| CAS | *Campylonotus semistriatus* | 0.030 | 0.000 | 0.030 | <0.00% |
| BEN | *Belonella spp.* | 0.020 | 0.020 | 0.000 | <0.00% |
| MEX | *Melanostomias spp.* | 0.020 | 0.000 | 0.020 | <0.00% |
| PAR | *Patagonotothen ramsayi* | 0.020 | 0.000 | 0.020 | <0.00% |
| MKN | *Moroteuthis knipovichi* | 0.020 | 0.000 | 0.020 | <0.00% |
| BRX | *Brachioteuthis sp.* | 0.010 | 0.010 | 0.000 | <0.00% |
| HOL | Holothuroidea | 0.010 | 0.000 | 0.010 | <0.00% |
| LIY | *Liparid spp.* | 0.010 | 0.010 | 0.000 | <0.00% |
| DPX | *Diplophos sp.* | 0.010 | 0.000 | 0.010 | <0.00% |
| XXX | Unidentified animal | 0.010 | 0.010 | 0.000 | <0.00% |
| AST | Asteroidea | 0.009 | 0.000 | 0.009 | <0.00% |
| ZOX | Zoarcid | 0.005 | 0.005 | 0.000 | <0.00% |
| SER | *Serolis spp.* | 0.003 | 0.000 | 0.003 | <0.00% |
| **Grand Total** | | **13,361.207** | **2,230.305** | **12,978.922** | |

## 4.2 The Nototheniidae

### *4.2.1 Dissostichus eleginoides*

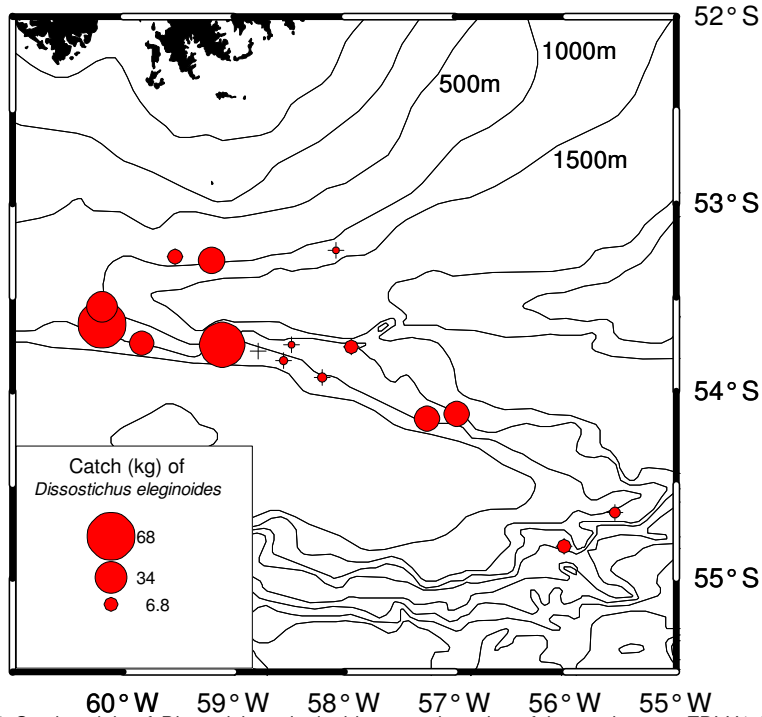



Figure 7: Catch weight of *Dissostichus eleginoides* at each station of the trawl survey ZDLH1-07/2005.

*Dissostichus eleginoides* were caught at all stations with the exception of station 2132. Toothfish were caught between 587 and 1119 m during the survey. The abundance of toothfish was highest on the northern slope of the Burdwood Bank (Figure 7).

A total of 93 toothfish ranging in size from 35 to 110 cm $L_T$ (mean = 64.62 cm $L_T$ ± 15.34) were sampled on this research cruse (Figure 8). To our surprise, toothfish as small as 35 cm $L_T$ were encountered at depths of greater than 900 m. Animals of this size are usually found on the shelf at 150-300 m depth. Toothfish maturities ranged from 1 to 4. Interestingly, no animals at stage 3 were encountered. The overall sex ratio on and around the Burdwood Bank was with a slight female bias (55%). The most common maturity was stage one for both sexes (Figure 9). Unfortunately, no spawning animals were found.

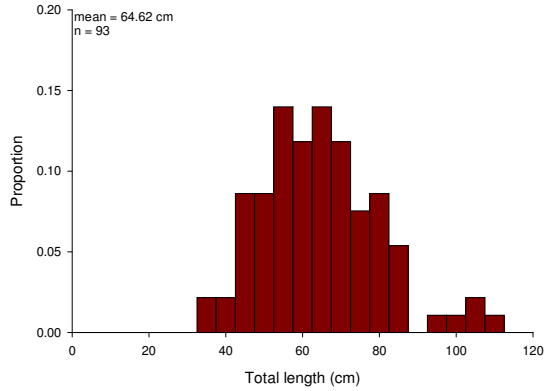



Figure 8. Combined length frequency distribution of *Dissostichus eleginoides*

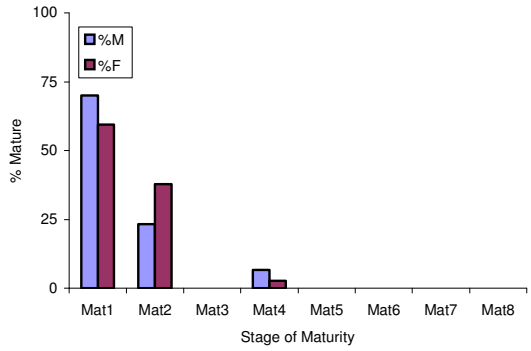



Figure 9. Maturity stages for male and female *Dissostichus eleginoides* sampled on ZDLH1-07-2005.

One of the secondary aims of this research cruise was to try and collect toothfish brood stock for a potential aquaculture venture between Consolidated Fisheries Ltd and Fortuna Ltd. The port side fish pound was sealed, water-proofed and flooded with water in order to keep fish alive for their transport back to Stanley. An extra tank (~ $4m^3$ ) was also positioned on the starboard side of the trawl deck in case large numbers of viable toothfish were caught. About 30 toothfish remained alive for approximately one week but then died when the *Dorada* came alongside the FIPASS. The remainder seemed to die approximately 1~2 days post capture. Generally the fish came on board damaged with split fins and missing scales. This was almost certainly caused by grenadiers which were also caught in the net as they had very sharp and tough scales. Other factors causing high mortality of toothfish were decompression and baro-trauma. The corneas of toothfish became opaque possibly because of the gas bubbles building up within the tissues. A series of protocols was then set up that included recommendations to decompress toothfish caught on the longlines and/or pots by stopping at several critical depths. It was also agreed that further collections would go ahead using the two CFL longliners equipped with fish tanks for transporting them back to Stanley.

## 4.3 The Macrouridae

### *4.3.1 Macrourus carinatus*

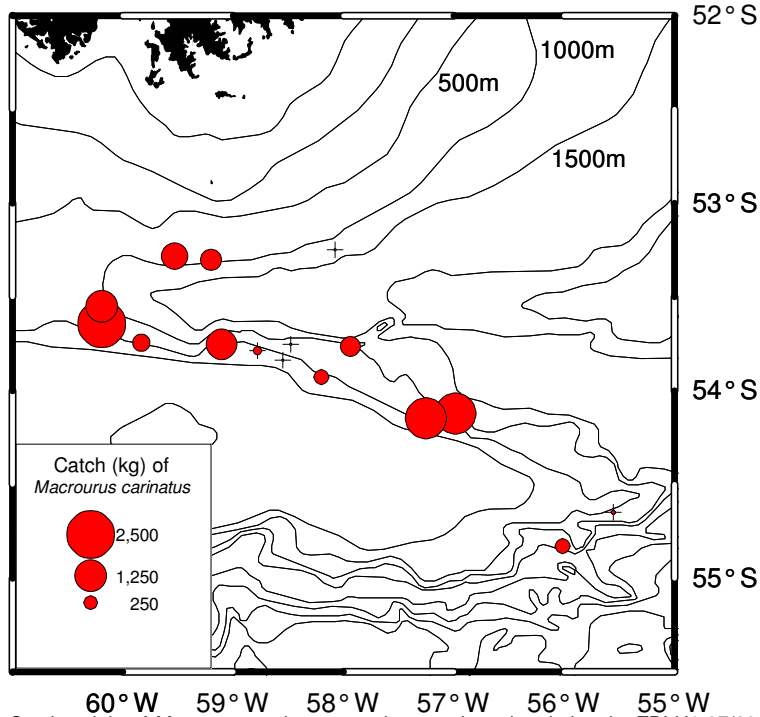



Figure 10. Catch weight of *Macrourus carinatus* caught at each station during the ZDLH1-07/2005 survey.

*Macrourus carinatus* is common from the Subantarctic to temperate waters on both sides of South America, Falkland Islands, Discovery Tablemount and Meteor Seamount, South Africa, off Crozet and Prince Edward Islands, and off New Zealand and Macquarie Island (Cohen et al. 1990). It is abundant at depths between 300 to about 1000 m and is potentially commercial.

*Macrourus carinatus* were caught at every trawl station throughout the survey and their catches ranged from 13 to 2,480 kg (mean = 743.74 kg) (Figure 10). Their largest catches were taken between 800 to 1000 m on the Burdwood Bank.

A total of 1270 individual *M. carinatus* were sampled during the cruise. The animals ranged from 3 to 34 cm $L_{pa}$ (mean = 20.67 cm ± 4.39) (Figure 11). The sex ratio on the Bank illustrated a high prevalence of males (60%). Males ranged from 5 to 27 cm $P_{PA}$ (mean = 19.89 cm ± 3.57), however, females were larger and ranged from 6 to 34 cm $L_{PA}$ (mean = 22.32 cm ± 4.32). Most of the fish sampled were resting or maturing with some post-spawning and fewer in a ripe condition (Figure 12).

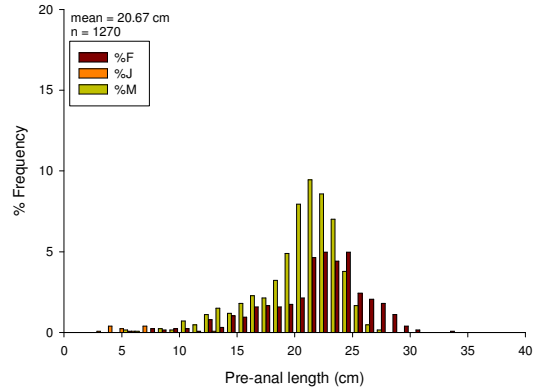



Figure 11. Length frequency distribution of male, female and juvenile *Macrourus carinatus* sampled on ZDLH1-07-2005

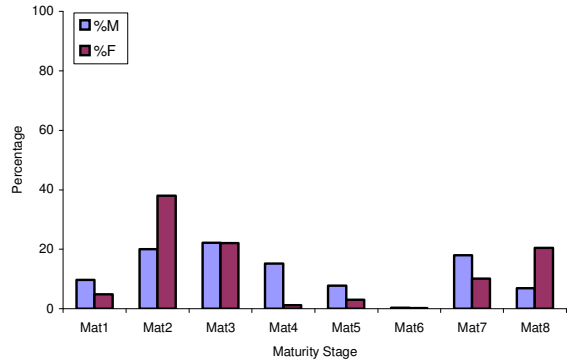



Figure 12. Maturity stages for male and female *Macrourus carinatus* sampled on ZDLH1-07-2005.

### *4.3.2 Macrourus holotrachys*

*Macrourus holotrachys* is also a relatively large grenadier occurring on the Patagonian Shelf and Slope from the Rio de la Plata to the Falkland Islands. It is very similar, morphologically to *M. cariniatus* and may be easily confused with this species. It was also found around Shag Rocks and South Georgia. The fish is bentho-pelagic inhabiting depths from 300 to more than 1500 m. In the Falkland Islands it is most common in depths of greater than 900 m. *Macrourus carinatus* and *M. holotraychus* are separated by depth possibly to avoid competition and Figure 13 illustrates the depth distribution the two species.

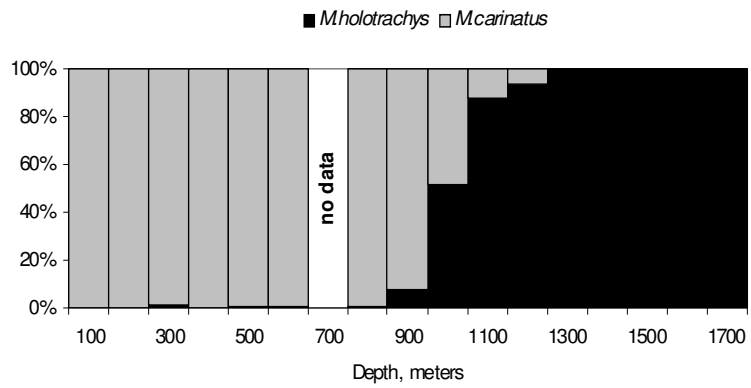



Figure 13. Bathymetric distribution of *Macrourus holotrachys* and *Macrourus carinatus* in the Falkland Islands

*Macrourus holotrachys* was caught in smaller quantities than *M. carinatus* due to the depths sampled during the survey. This species was taken at 11 out of the 16 stations (Figure 14). The catches ranged from 0.07 to 10.06 kg (mean = 2.64 kg).

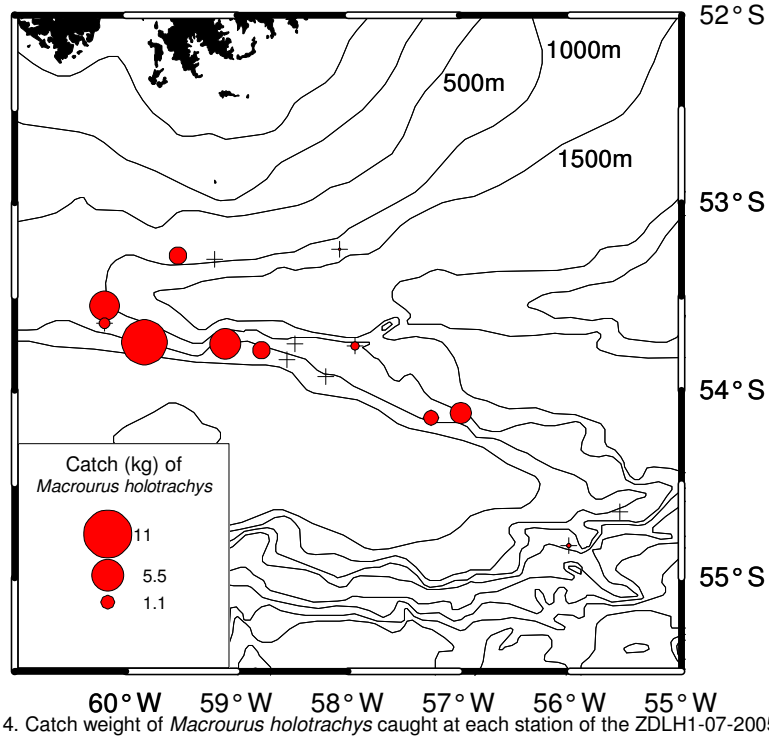



Figure 14. Catch weight of *Macrourus holotrachys* caught at each station of the ZDLH1-07-2005 survey

The majority of individuals sampled were juvenile (56%). The animals ranged between 2 and 26 cm $L_{pa}$ with males having a slightly larger mean length than females (Figure 15). The majority of the animals sampled were at maturity stage 2 and 3 (Figure 16).

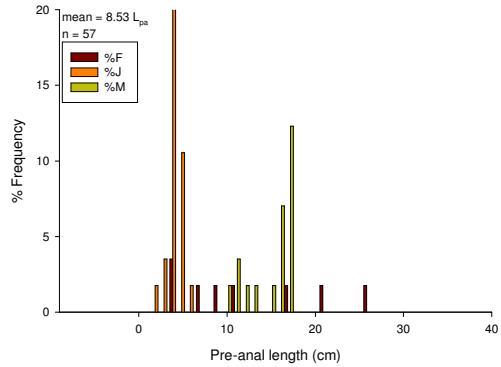



Figure 15. Length frequency distribution of male, female and juvenile *Macrourus holotrachys* sampled on ZDLH1-07-2005

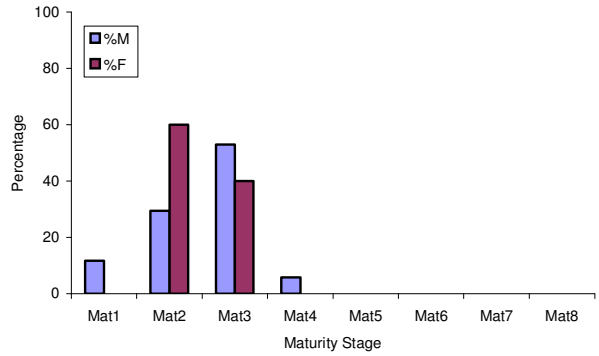



Figure 16. Maturity stages for male and female *Macrourus holotrachys* sampled on ZDLH1-07-2005.

### *4.3.3 Coryphaenoides subserrulatus*

This species occurs off New Zealand, south of Tasmania, off Campbell Island, of Chatham Island, South Africa, Southwest Atlantic off the Falkland Islands and Argentina. A search of our data would suggest that this was a first record for the FIFD on the Burdwood Bank. This is a small bentho-pelaic species with a maximum size of 37 cm $L_T$.

During the survey *C. subserrulatus* was not abundant. The catches ranged between 0.06 and 9.12 kg (mean = 1.47) with the largest catch on the southwestern side of the Burdwood Bank (Figure 17).

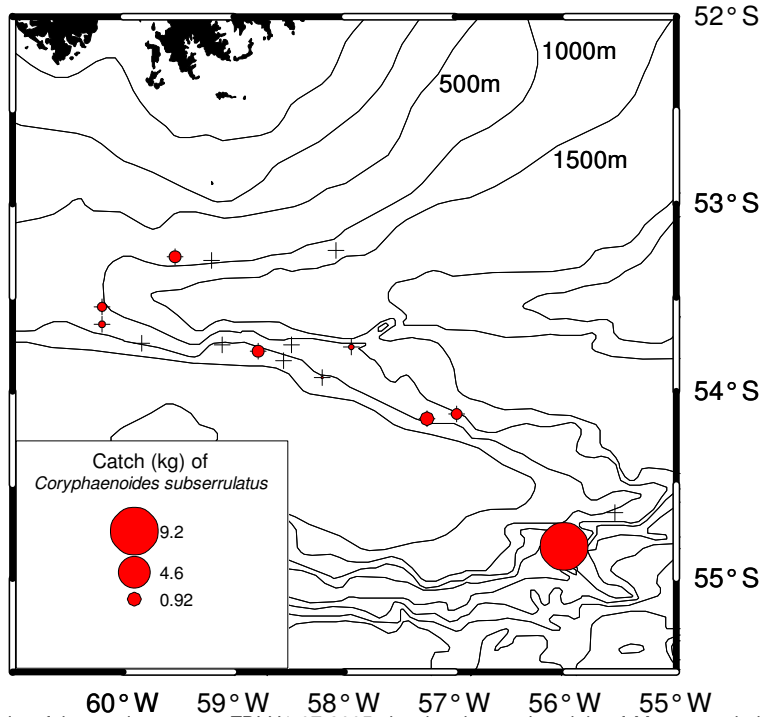



Figure 17. Results of the trawl survey on ZDLH1-07-2005 showing the catch weight of *Macrourus holotrachys* caught at each station.

*Coryphaenoides subserrulatus* is a small grenadier and it ranged in size from 3 to 10 cm $L_{PA}$ (mean = 7.62 cm ± 1.22) (Figure 18). Their length frequency distribution was bimodal with a small mode at 4 cm and stronger second mode at approximately 7 cm. Females were slightly larger than males, 8.01 as opposed to 7.22 cm $L_{PA}$. Most fish were at maturity stage 2 and 3 although a small proportion of females were found at stage 4. Among males, some mature animals were found (Figure 19).

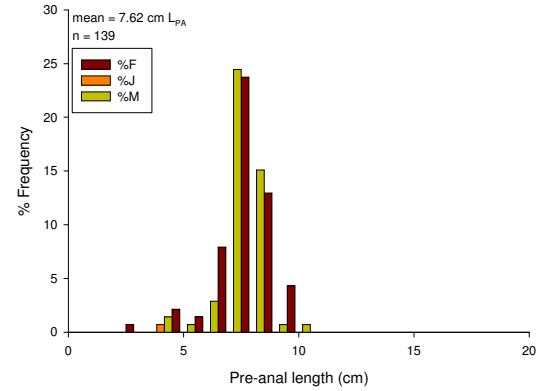



Figure 18. Length frequency distribution of male, female and juvenile *Coryphaenoides subserruatus* sampled on ZDLH1-07-2005

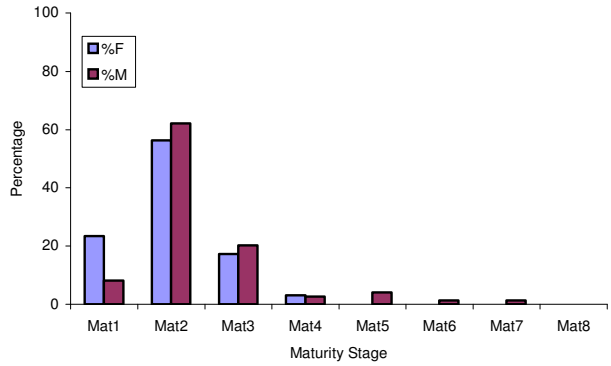



Figure 19. Maturity stages for male and female *Coryphaenoides subserrulatus* sampled on ZDLH1-07-2005.

### *4.3.4 Coelorhinchus kaiyomaru*

This is a small grenadier and is characterised by its long, sharply pointed snout and a dark band encircling its trunk. *Coelorhinchus kaiyomaru* is found off New Zealand, Tasmania, Falkland Islands and in the south-eastern Atlantic around Gough and the Discovery Tablemounts. It is bentho-pelagic fish inhabiting depths ranging from 340 to 1360 m in the Atlantic and 850 to 1050m in the Pacific.

*Coelorhinchus kaiyomaru* were rare in catches with weights of 0.07 to 0.96 kg. They were present in 9 of the 16 hauls and occurred between 700 and 1200m (Figure 20). A total of 13 individuals were sampled ranging in size from 7 to 10 cm $L_{PA}$ (mean = 9 cm $L_{PA}$ ± 0.91) were. Sex ratios were approximately equal, however, the majority of males were at maturity stage II and most females were at stage 3 (Figure 21).

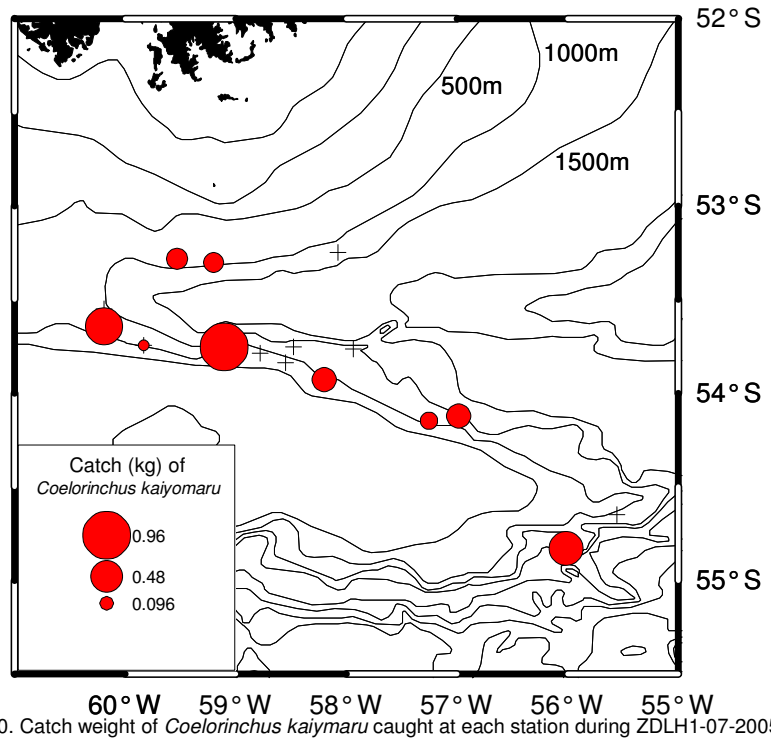



Figure 20. Catch weight of *Coelorinchus kaiymaru* caught at each station during ZDLH1-07-2005 survey

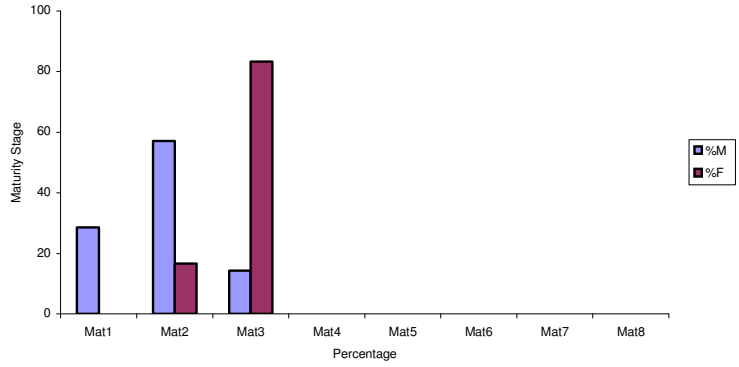



Figure 21. Maturity stages for male and female *Coelorinchus kaiyomaru* sampled on ZDLH1-07-2005

## *4.4 The Moridae*

### *4.4.1 Antimora rostrata*

Blue antimora occurs in all oceans with the exception of the north Pacific. It is bento-pelagic fish found between 350 to 3000 m. There are some indications that as they get older they may move to deeper waters, and that males and females are segregated by depth.

*Antimora rostrata* was found on 14 of the 16 stations (Figure 22). Catches ranged from 0.03 to 176.17 kg (mean = 39.39 kg ± 47.78) with the smallest catch occurring at the shallowest depth (656 m).

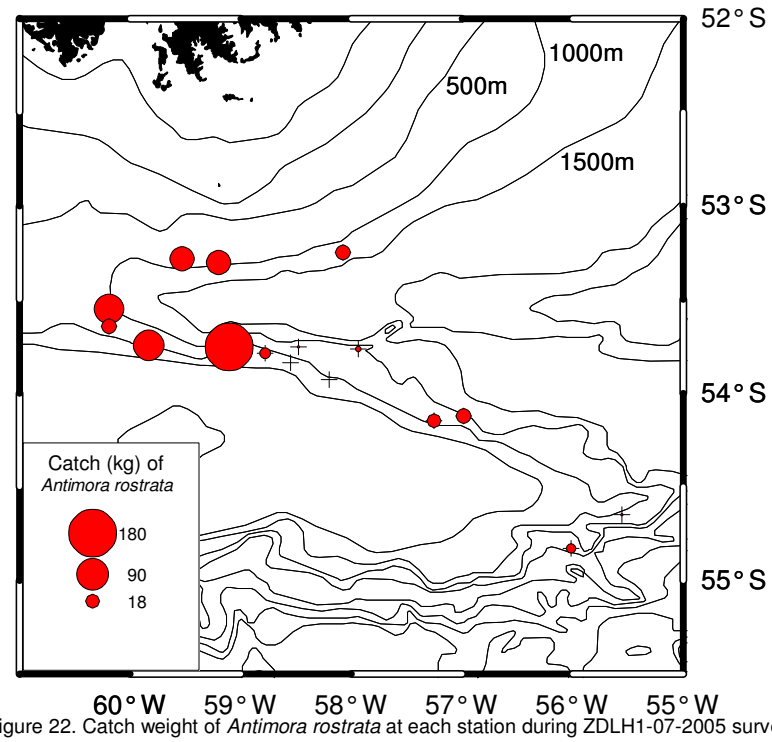


Figure 22. Catch weight of *Antimora rostrata* at each station during ZDLH1-07-2005 survey

During the cruise *A. rostrata* ranged in size from 14 to 70 cm $L_T$ (mean = 36.53 cm ± 9.24) with females being larger in size (Figure 23). Fish were predominantly at maturity stage 2 (Figure 24).

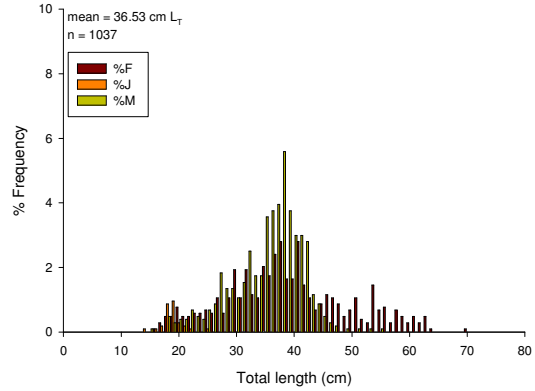


Figure 23. Length frequency distribution of male, female and juvenile *Antimora rostrata* sampled on ZDLH1-07-2005

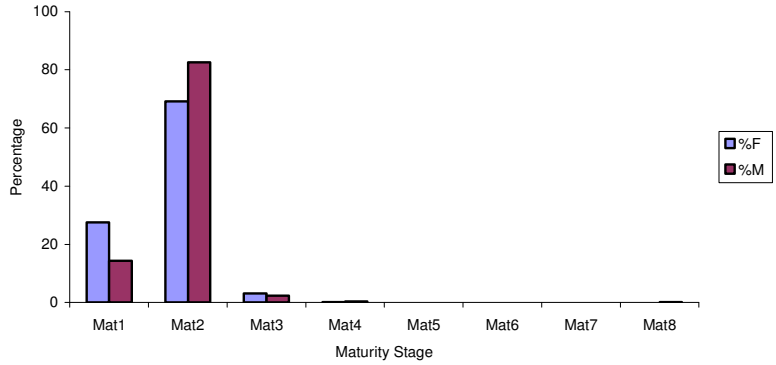


Figure 24. Maturity stages for male and female *Antimora rostrata* sampled on ZDLH1-07-2005

### *4.4.2 Halargyreus johnsonii*

This is a medium size morid cod attaining a maximum length of about 60 cm $L_T$. It is bentho-pelagic to pelagic over 700 to 1400 m depth, occurring in the Atlantic and Pacific Oceans but has not been caught in the northeast Pacific.

During the survey, this species was caught on 6 of the 16 stations (Figure 25) on the northern slope of the Burdwood Bank and the southern slope of the Falkland Shelf. Catches ranged from 0.01 to 12.24 kg (mean = 2.91 kg). Two animals were sampled, both were females at stage 2 (31 and 36 cm $L_T$).

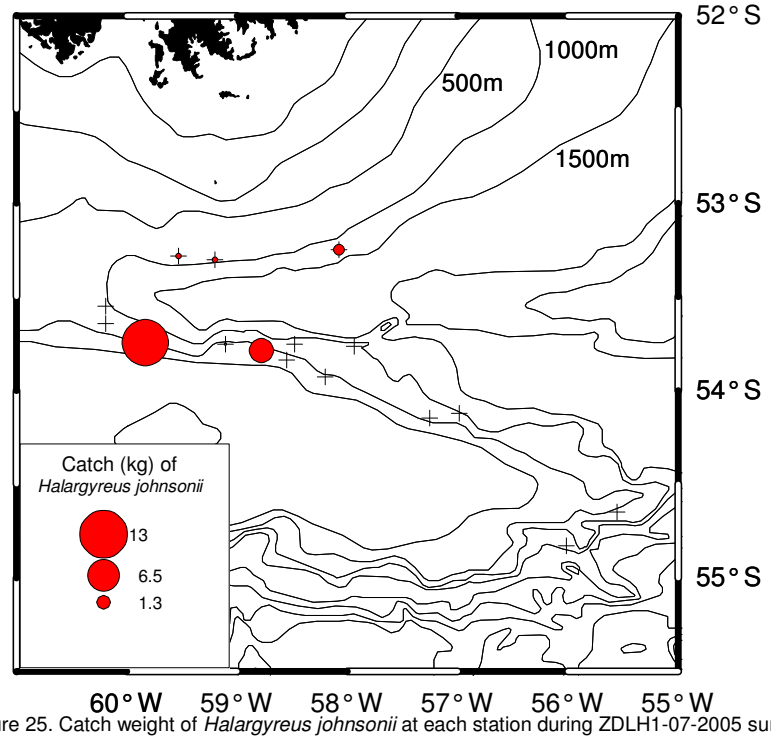


Figure 25. Catch weight of *Halargyreus johnsonii* at each station during ZDLH1-07-2005 survey

### *4.4.3 Lepidion ensiferus*

Also known as the Patagonian codling, *L. ensiferus* has only been found on the Patagonian Shelf between 39°S and 55°S. It is bentho-pelagic fish inhabiting the upper slope and reaching a maximum length of 40 cm $L_T$.

During the cruise this species was encountered at 8 of the 16 stations (Figure 26). Otoliths were also collected from this species so we can compare the age and growth of deep water morids at a later date. Only 9 individuals were sampled and they ranged from 10 – 35 cm $L_T$. All fishes were immature.

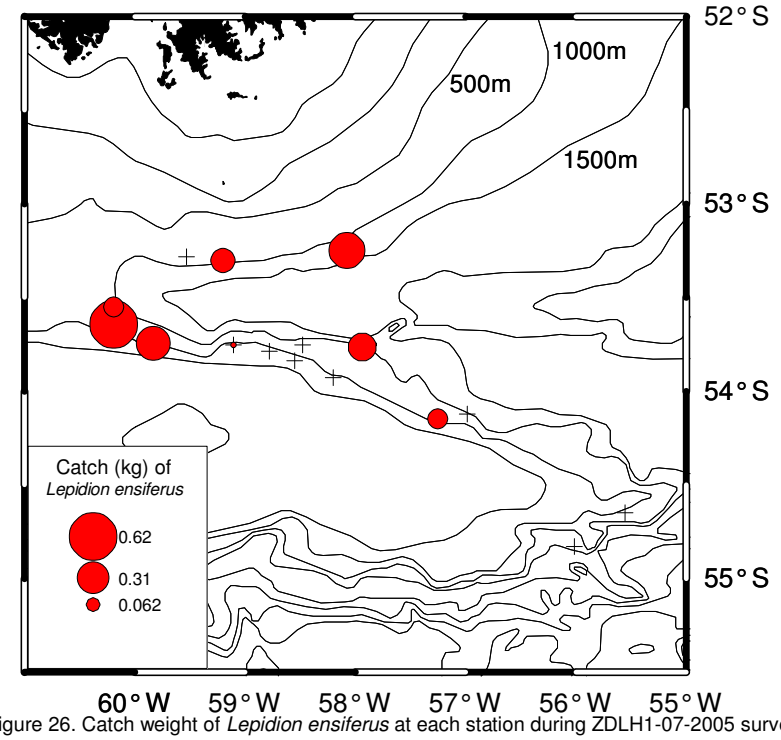


Figure 26. Catch weight of *Lepidion ensiferus* at each station during ZDLH1-07-2005 survey

## 4.5 Other fish species

### *4.5.1 Icichthys australis*

*Icichthys australis* (southern driftfish) is one of the three species of the family Centrolophidae that are a common by-catch in the Falkland Zones. *Icichthys australis* has a wide circumpolar distribution, reported from Tasmania in the Eastern Indian Ocean; New Zealand and Chile in the Pacific; Argentina and the Falkland Islands in the South Atlantic; South Georgia, South Orkney Islands, and the Kerguelen Islands in the Southern Ocean. Its maximum TL is reported (Fishbase) as 81cm.

During the July cruise, a total amount of 42kg of this species were caught, with the catch ranging from 0.44kg at station 2136 to 24.31kg at station 2126. At this latter station, 22 specimens were caught (Figure 27). The lengths of the specimens ranged from 31 to 75cm TL for females, and from 33 to 51cm for the males, with mean lengths 45.19cm and 40.29cm for females and males respectively. The most dominant size class for females was 40 cm (40-44cm grouped), and for males 35 cm (35-39cm grouped) (Figure 28). All of the male specimens were found to be in pre-spawning, spawning, and post spawning stages, with 7 of the 14 specimens sampled in a running condition (stage 6). Although females were found across the range of maturity stages, a proportion of the specimens were clearly in spawning condition (two at stage 4, two at stage 5, two at stage 6, two at stage 7, and one at stage 8), The occurrence of mature females may suggest that the spawning takes place in winter (Figure 29).

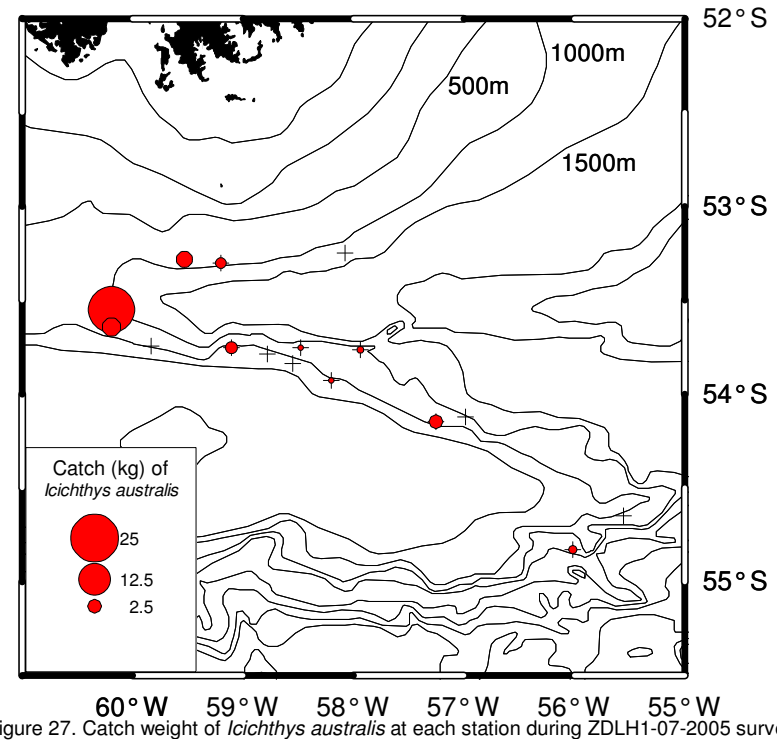



Figure 27. Catch weight of *Icichthys australis* at each station during ZDLH1-07-2005 survey

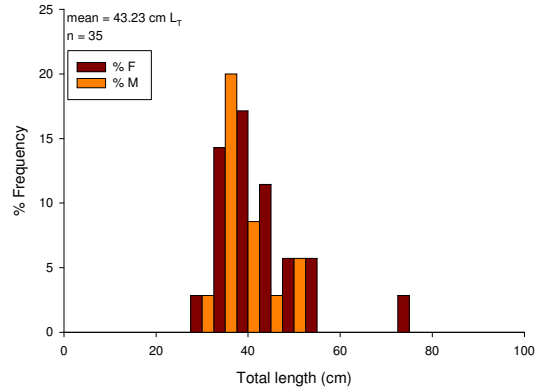



Figure 28. Length frequency distribution of male and female *Icichthys australis* sampled on ZDLH1-07-2005

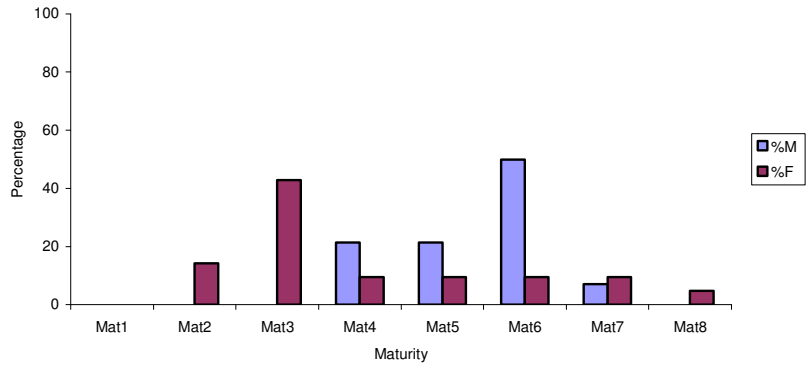



Figure 29. Maturity stages for male and female *Icichthys australis* sampled on ZDLH1-07-2005

## 4.6 Crustaceans

### 4.6.1 Crabs

Catches of the crab *Neolithodes diomedae* ranged from 1.43 to 11.35kg, with the highest catch at station 2126 (Figure 30). Another crab, *Paralomis spinosissima,* was recorded only twice at station 2127 and 2132, and catches were 0.145 and 0.017kg respectively (Figure 30). These species were not sampled for biological analysis. The regular occurrence of *N. diomedae* on the Northern slope of the Burdwood Bank both during research cruises as well as on the longline vessels may suggest a considerable population size. An experimental fishing trip for these species is suggested to assess whether an exploitable resource is present.

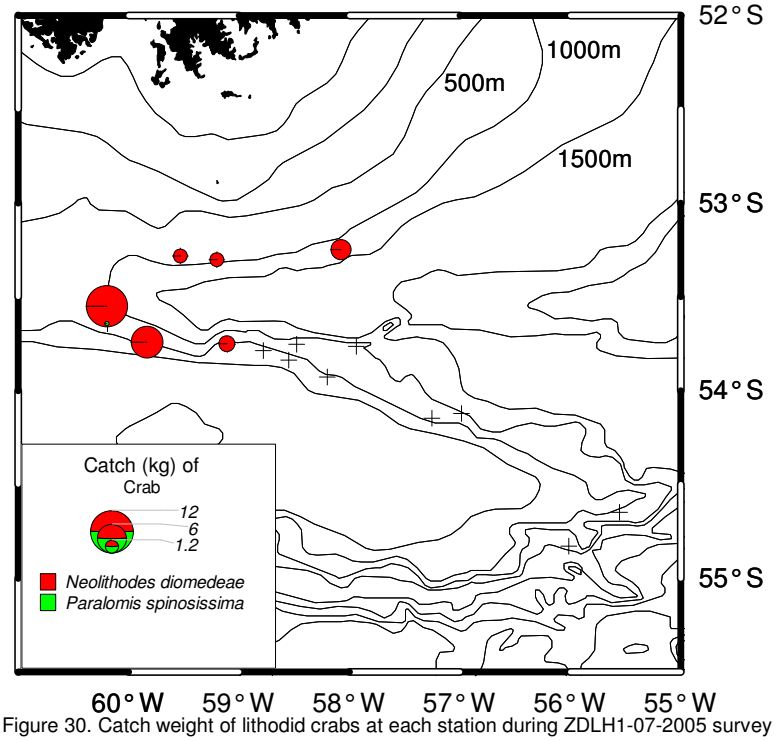



Figure 30. Catch weight of lithodid crabs at each station during ZDLH1-07-2005 survey

### 4.6.2 Prawns

Catches of prawns ranged from 0.024 to 11.01kg for *P. acutifrons,* 0.046 to 3.732kg for *P. ampla*, and 0.127 to 3.732kg for *A. pelagica* (Figure 31). Similar to crab catches, the stations on the Northern flank of the Burdwood Bank yielded the largest amounts of prawns. The largest catch of prawns ever encountered during a research trip however was 30.5kg of *P. acutifrons* in February 2004 at 1000 m on the slope to the south of Beauchêne Island. Trawls in a very similar position (st. 2122 and 2123) this time yielded only small amounts of the other two species.

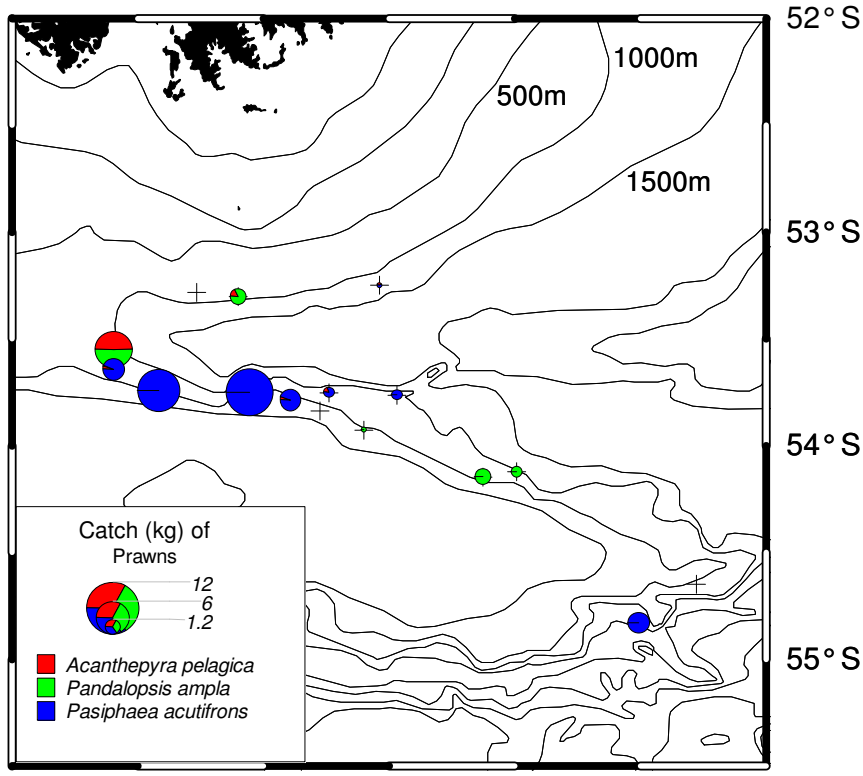


Figure 30. Catch weight of prawns at each station during the ZDLH1-07-2005 survey

## 4.7 Cephalopods

Unfortunately, this cruise did not yield great amounts of cephalopods, but there was a considerable variety. Of the total of 9.3kg, 5.61 kg (60%) consisted of *Bathyteuthis abyssicola*. One squid in a very good condition was not identified to the species level, and has been preserved for further analyses and identification ashore.

Table 4.Catch table for cephalopods caught during ZDLH1-07-2005.

| *Species Code* | *Species name* | *Total Catch (kg)* | *Total Sampled (kg)* | *Total Discarded (kg)* | *Proportion (%)* |
|---|---|---|---|---|---|
| BAA | *Bathyteuthis abyssicola* | 5.61 | 0 | 5.61 | 60.32% |
| SQX | Unidentified squid | 0.92 | 0.92 | 0 | 9.89% |
| HIE | *Histioteuthis eltaninae* | 0.49 | 0.41 | 0.07 | 5.27% |
| OCT | *Unidentified octopus* | 0.46 | 0.46 | 0 | 4.95% |
| MAR | *Martialia hyadesi* | 0.35 | 0 | 0.35 | 3.76% |
| BAS | *Batoteuthis scolops* | 0.21 | 0.21 | 0 | 2.26% |
| GON | *Gonatus antarcticus* | 0.2 | 0.18 | 0.06 | 2.15% |
| BRL | *Brachioteuthis linkovskyi* | 0.18 | 0.18 | 0.01 | 1.94% |
| NEC | *Neorossia caroli* | 0.12 | 0.12 | 0 | 1.29% |
| MAS | *Mastigoteuthis psychrophila* | 0.1 | 0.1 | 0 | 1.08% |
| HIX | *Histioteuthis spp.* | 0.05 | 0.05 | 0 | 0.54% |
| MKN | *Moroteuthis knipovichi* | 0.02 | 0 | 0.02 | 0.22% |
| BRX | *Brachioteuthis sp.* | 0.01 | 0.01 | 0 | 0.11% |
| **Total** | | **9.3** | **2.64** | **6.7** | |