FALKLAND ISLANDS FISHERIES DEPARTMENT

Loligo Stock Assessment Survey, 1st Season 2013

Vessel	Robin M Lee (ZDLZ1), Falkland Islands
Dates	09/02/2013 - 24/02/2013
Survey Report	Andreas Winter
Survey Crew	Lars Jürgens, Alberto Monllor

Summary

1) A stock assessment survey for *Loligo* squid was conducted in the 'Loligo Box' from 9th to 24th February 2013. Sixty scientific trawls were taken during the survey, catching 51.6 tonnes of *Loligo*.
2) A geostatistical estimate of 5333 tonnes *Loligo* (95% confidence interval: 4143 to 6660 t) was calculated for the fishing zone. This represents the lowest 1st-season survey estimate since 2007. Of the total, 2016 t were estimated north of 52 ºS, and 3317 t were estimated south of 52 ºS.
3) Male and female *Loligo* had modal mantle lengths of 11 cm north of 52 ºS, and 10-11 cm south of 52 ºS. Most *Loligo* were at maturity 2, and among samples north of 52 ºS a minor mode of individuals at maturity 1 was evident. Males had much higher proportions of individuals at maturity ≥ 3 than females.
4) Seventy taxa were identified in the catches, of which *Loligo* made up <20% by weight and only the third largest species group. Specimens of icefish, porbeagle, toothfish, and sardines were collected in addition to *Loligo*. CTD data were recorded from 38 trawls.

Introduction

A stock assessment survey for *Loligo* (*Doryteuthis gahi* - Patagonian squid) was carried out by FIFD personnel onboard the fishing vessel *Robin M Lee* from the 9th to 24th February 2013. This survey continues the series of surveys that have, since February 2006, been conducted immediately prior to *Loligo* season openings to estimate the *Loligo* stock available to commercial fishing at the start of the season, and to initiate the in-season management model based on depletion of the stock.

The survey was designed to cover the 'Loligo Box' fishing zone (Arkhipkin et al., 2008) that extends across the southern and eastern part of the Falkland Islands Interim Conservation Zone (Figure 1). The current delineation of the Loligo Box represents an area of approximately 31,118 km^2.

Objectives of the survey were to:

1) Estimate the biomass and spatial distribution of *Loligo* on the fishing grounds at the onset of the 1st fishing season, 2013.
2) Collect biomass and spatial distribution data for continued monitoring of the rock cod (*Patagonotothen ramsayi*) stock.
3) Collect biological information on *Loligo*, rock cod, and opportunistically other commercially important fish and squid taken in the trawls.

The F/V *Robin M Lee* is a Stanley, Falkland Islands - registered stern trawler of 70.04 m length, 2015 t gross registered tonnage, and 3000 main engine bhp. Crew and equipment specifications are listed in Källqvist (2010). Like all vessels employed for these pre-season surveys, *Robin M Lee* operates regularly in the commercial *Loligo* fishery and used its commercial trawl gear for the survey catches. The following personnel from FIFD participated in the survey:

Lars Jürgens	fisheries observer, lead survey scientist
Alberto Monllor	fisheries observer

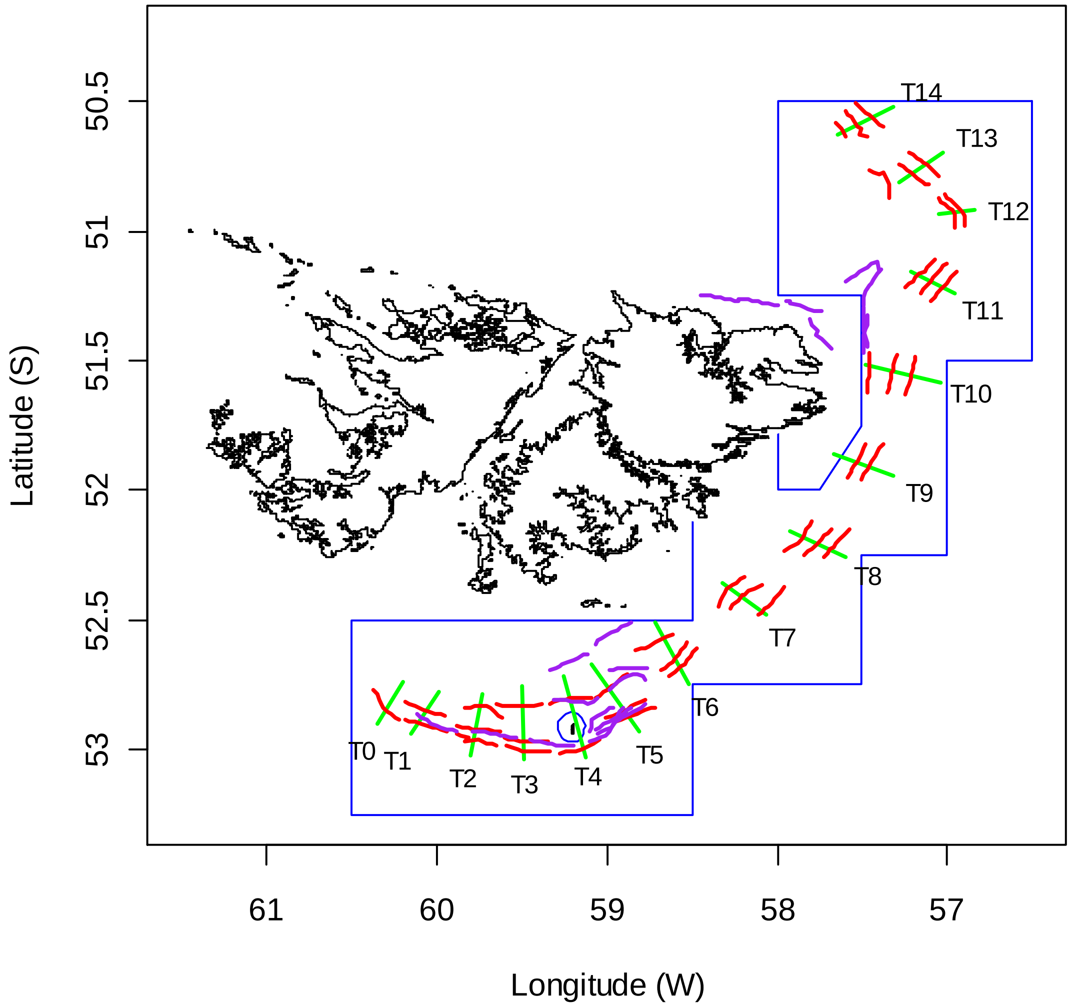


Figure 1. Transects (green lines), fixed-station trawls (red lines), and adaptive-station trawls (purple lines) sampled during the pre-season 1 2013 survey. Boundaries of the 'Loligo Box' fishing zone and the Beauchêne Island exclusion zone are shown in blue.

Methods

Sampling procedures

The survey plan included 39 fixed-station trawls located on a series of 15 transects perpendicular to the shelf break around the Loligo Box (Figure 1), followed by up to 21 adaptive-station trawls selected to increase the precision of *Loligo* biomass estimates in high-density or high-variability locations. The fixed-station survey plan was modified this season by placing one station further inshore on transects 6, 7, 8, 10, 11, 13 and 14, and removing the station furthest offshore on transects 8, 9, 10, 11, 12, 13 and 14. This modification was undertaken because previous surveys showed practically no *Loligo* present on the deep stations offshore before 1st season (Arkhipkin et al., 2010; Winter et al., 2011; 2012), and it is thus more informative to survey-trawl further inshore. In addition, while the survey was in progress, the decision was made by the FIFD senior scientist to extend the survey by one day to cover a nearshore area northeast, outside the Loligo Box, that is a likely important spawning ground.

Trawls were designed for an expected duration of 2 hours each, ranging in distance from 14.9 to 20.0 km (mean 16.8 km). All trawls were bottom trawls. During the progress of each trawl, GPS latitude, GPS longitude, bottom depth, bottom temperature, net height, trawl door spread, and trawling speed were recorded on the ship's bridge in 15-minute intervals, and a visual assessment was made of the quantity and quality of acoustic marks observed on the net-sounder. Following the procedure described in Roa-Ureta and Arkhipkin (2007), the acoustic marks were used to apportion the *Loligo* catch of each trawl to the 15-minute intervals and increase spatial resolution of the catches. For small catches acoustic apportioning cannot be assessed with accuracy, and any *Loligo* amounts <100 kg were iteratively aggregated by adjacent intervals (if the total *Loligo* catch in a trawl was <100 kg it was assigned to one interval; the middle one).

Catch estimation

Catch of every trawl was processed separately by the factory crew and retained catch weight of *Loligo*, by size category, was estimated from the number of standard-weight blocks of frozen *Loligo* recorded by the factory supervisor. Catch weights of commercially valued fish species, including rock cod, were recorded in the same way, although without size categorization. Discards of damaged, undersized, or commercially unvalued fish and squid were estimated by FIFD survey personnel either visually (for small quantities) or by noting the ratio of discards to commercially retained fish and squid in sub-portions of the catch (for larger quantities). Discards were added to the product weights (as applicable) to give total catch weights of all fish and squid.

Biomass calculations

Biomass density estimates of *Loligo* per trawl were calculated as catch weight divided by swept-area; which is the product of trawl distance × trawl width. Trawl distance was defined as the sum of distance measurements from the start GPS position to the end GPS position of each 15-minute interval. Trawl width was derived from the distance between trawl doors (determined per interval, from the net sensor) according to the equation:

trawl width = (door dist. × footrope length) / (footrope + sweep + bridle lengths)

(www.seafish.org/media/Publications/FS40_01_10_BridleAngleandWingEndSpread.pdf)

Measurements of *Robin M Lee*'s trawl were: footrope = 100 m, sweep = 100 m and bridle = 77 m.

Biomass density estimates were extrapolated to the fishing grounds area using geostatistical methods described in Roa-Ureta and Niklitschek (2007). The methods are based on the approach of separately modelling positive (non-zero) catch densities, and the probability of occurrence (presence/absence) of the positive catch densities (Pennington, 1983), then multiplying the two together. Positive catch densities were modelled for spatial correlation using a fitted variogram (Cressie, 1993) and Box-Cox transformation to normalize the data (MacLennan and MacKenzie, 1988). Presence/absence was modelled for spatial correlation using Monte Carlo Markov Chain simulation (Christensen, 2004; Roa-Ureta and Niklitschek, 2007). However this model did not show significant correlation. Therefore linear interpolation was used instead for points within the convex hull of survey stations, and cubic-spine interpolation (Akima, 1996) for points outside.

Compared to previous surveys, the delineated fishing area (Figure 2) was slightly expanded inshore east of East Falkland to encompass the further-inshore trawl stations that had been added to the survey plan this season. It was not expanded to encompass the extra day's trawls on the northern spawning ground, because these were outside the Loligo Box. The new delineated area is 16,924 km^2, and partitioned for analysis as 682 area units of 5×5 km.

Uncertainty of total biomass on the fishing grounds was estimated by a hierarchical bootstrap re-sampling (Efron, 1981) of biomass densities in each of the 682 area units. Biomass densities per area unit were draws from the random normal distribution with mean equal to the empirical biomass density of each unit and standard deviation equal to the empirical biomass density multiplied by the average coefficient of variation of the positive catch density variogram (the interpolation used for presence/absence is deterministic and does not have any associated variation). The bootstrap was iterated 10000×. This uncertainty is nevertheless an approximation because it does not include evaluation of model error of the variogram itself.

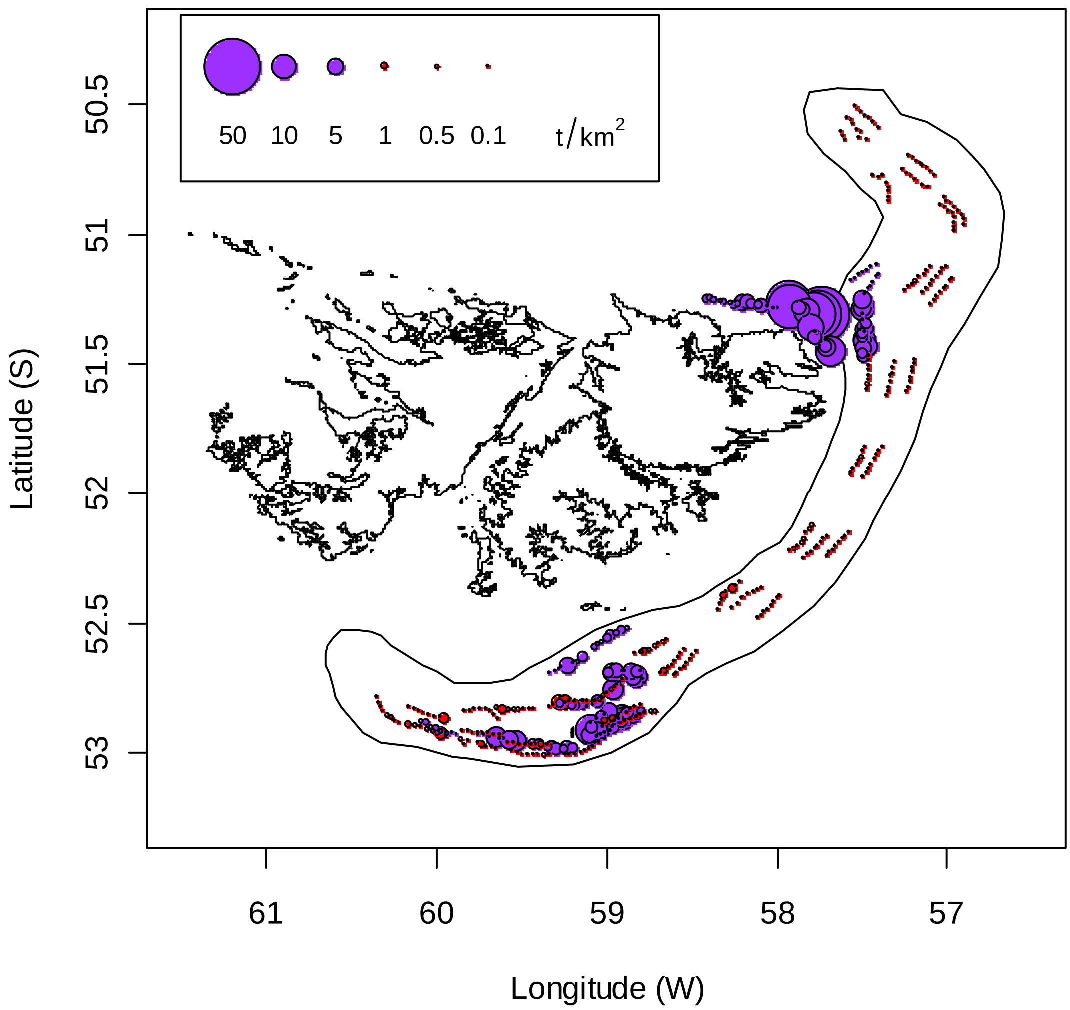


Figure 2. *Loligo* CPUE (t km^{-2}) of fixed-station trawls (red) and adaptive trawls (purple), per 15-minute trawl interval. The boundary of the fishing area is outlined.

Sea temperature and salinity measurements

Sea temperature and salinity measurements were recorded using a mini-CTD instrument (Valeport Ltd., UK) attached to the headrope of the trawl. The instrument recorded conductivity (mS/cm), temperature (ºC) and pressure (dBar) continuously at a frequency setting of 1 Hz. Pressure was converted to depth as:

Depth (m) = dBar / 1.01325 (one atmosphere)

Conductivity was converted to salinity units according to the practical salinity scale PSS-78 (UNESCO, 1983).

Surface temperature, surface salinity, bottom temperature and bottom salinity were extracted for archiving. Surface temperature and salinity were defined as the average of measurements between 1 m and 3 m tare depth[1] after deployment and before retrieval; thus two data each per trawl. Surface positions were linear-extrapolated from the start and end trawl positions, as the vessel moves in a straight line when setting or retrieving a trawl. Bottom temperature and salinity were defined as all measurements sequentially recorded while the trawl was on the sea bottom, determined by cross-referencing the bridge log trawl start and end times with the CTD time stamp. To reduce the volume of data, measurements were sub-sampled from 1 per second (1 Hz) to 1 per minute. Bottom positions were assigned by interpolating the bridge log start and end trawl positions. Surface and bottom temperature and salinity, and depth, were then mapped across the fishing area by linear interpolation within the convex hull of measured data and cubic-spine extrapolation outside the convex hull.

Biological analyses

Random samples of approximately 150 *Loligo* were collected from the factory at all trawl stations (as far as available). Biological analysis at sea included measurements of the dorsal mantle length (ML) rounded down to the nearest half-centimetre, sex, and maturity stage. Additional samples of *Loligo* were taken according to area stratification (north, central, south) and depth (shallow, medium, deep), and frozen for statolith extraction and age analysis (Arkhipkin, 2005). Specimens of icefish (*Champsocephalus esox*), porbeagle (*Lamna nasus*), toothfish (*Dissostichus eleginoides*), sardines (*Sprattus fuegensis*), and various invertebrates were collected and frozen for otolith sampling, parasitology, and other biological analyses.

Results

Catch rates and distribution

The survey started with fixed-station trawls in the north of the Loligo Box and proceeded southward. A schedule of 4 scientific trawls per day was maintained except for February 11th, when only 3 trawls were taken because of a broken winch and February 19th, when only one trawl was taken because of rough weather (Appendix Table A1). One trawl (third on February 9th) was shortened because it ran across bad ground. In total 60 scientific trawls were recorded during the survey: 39 fixed station trawls catching 4.98 t *Loligo* and 21 adaptive trawls catching 46.63 t *Loligo*. Thirteen optional trawls (made after survey hrs) yielded an additional 27.67 t *Loligo*, bringing

[1] Shallower than 1 m is considered too turbulent for reliable measurement.

the total catch for the survey to 79.29 t. The scientific catch of 51.61 is one of the lowest on record (Table 1).

Table 1. *Loligo* pre-season survey scientific catches and biomass estimates (in metric tonnes). Before 2006, surveys were not conducted immediately prior to season opening.

Year	First season			Second season		
	No. trawls	Catch	Biomass	No. trawls	Catch	Biomass
2006	70	376	10213	52	240	22632
2007	65	100	2684	52	131	19198
2008	60	130	8709	52	123	14453
2009	59	187	21636	51	113	22830
2010	55	361	60500	57	123	51754
2011	59	50	16095	59	276	51562
2012	56	128	30706	59	178	28998
2013	60	52	5333			

Average *Loligo* catch density among fixed-station trawls was 0.03 t km^{-2} north of 52° S and 0.23 t km^{-2} south of 52° S. Average *Loligo* catch density among adaptive-station trawls was 4.49 t km^{-2} north of 52° S and 1.90 t km^{-2} south of 52° S. Excluding the extra (last) day's trawls outside the Loligo Box, average *Loligo* catch density among adaptive-station trawls north of 52° S was 2.08 t km^{-2}. Notably, these average catch densities by sub-area and station type are confounded with the progression of the survey, which went north to the south on the fixed-station trawls, then back south to north on the adaptive-station trawls. Results therefore indicate that timing over the two-week survey may have been the most important factor in determining catch density, as the *Loligo* progressively out-migrated.

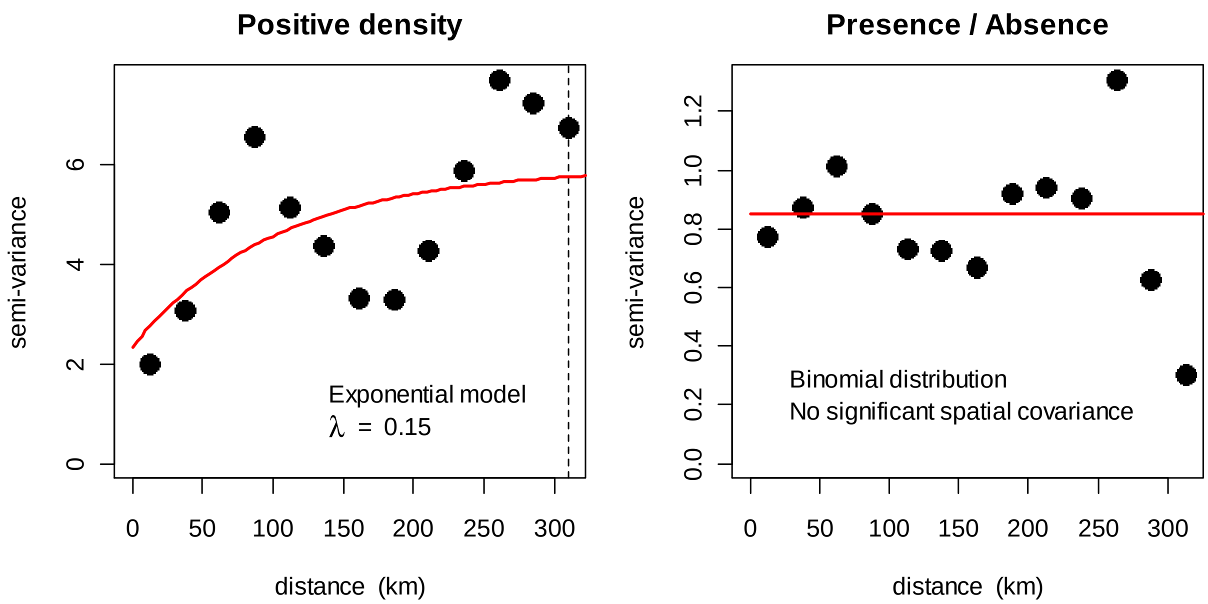


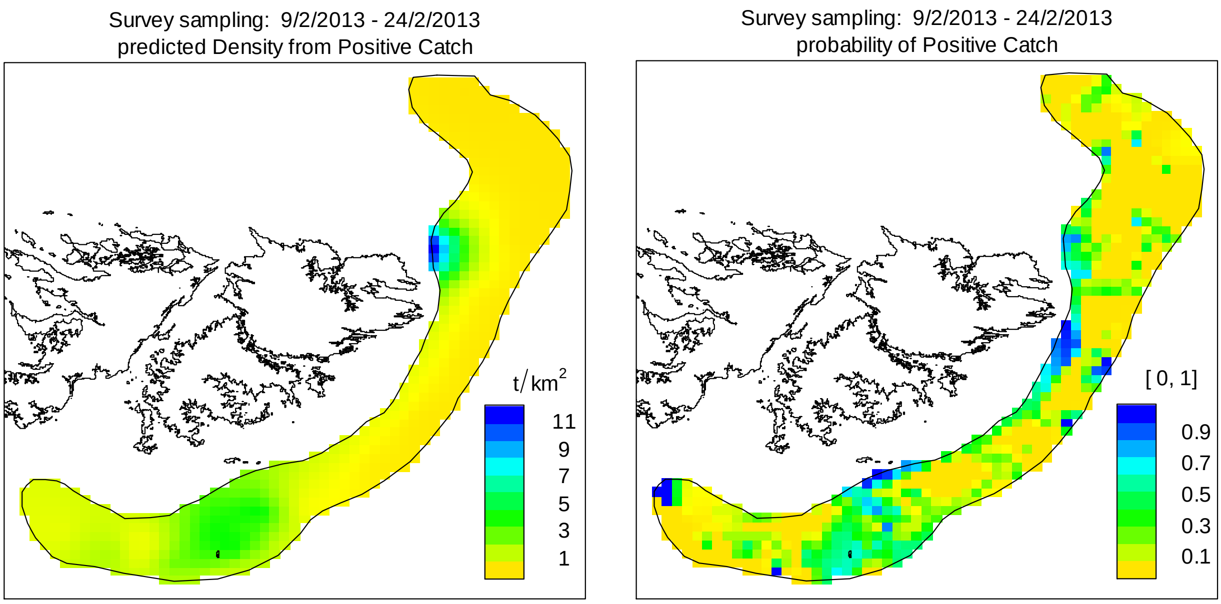
Figure 3. Empirical variogram (black points) and model variogram (red line) of *Loligo* positive catch density distributions (left) and presence / absence (right). The positive catch density distribution had a correlation range of 310 km, shown by a dotted vertical line.

Biomass estimation

Geostatistical modelling of the positive catch densities and presence / absence showed relatively weak spatial correlations. The best variogram fit for positive catch densities was obtained with an exponential model function and $\lambda = 0.15$ Box-Cox transformation of catch densities (Figure 3, left). This variogram fit converged with a range of 310 km, indicating that *Loligo*, where present, spatially correlated over an average maximum of 310 km separation distance. The variogram actually showed two distinct peaks at approx. 90 and 260 km, which are consistent with the *Loligo* catches having two poles of density separated by about 260 – 90 = 170 km (Figure 2). The presence/absence variogram also suggested the same two peaks, but spatial covariance of this variogram was not significant (Figure 3, right). Only 26% of 15-minute trawl intervals had assigned positive *Loligo* catch based on the acoustic marks. Non-correlative extrapolation was instead used to expand the probabilities of positive catch to the fishing grounds area.

Loligo biomass in the fishing area was estimated by the combined geostatistical and interpolation model at 5333 t, with a 95% confidence interval of [4143 to 6660 t]. Of this estimated total, 2016 t [1119 to 3205 t] were north of 52 ºS, and 3317 t [2579 to 4014 t] were south of 52 ºS. The total of 5333 t was the lowest 2nd-season estimate since 2007 (Table 1). The highest estimated biomass concentrations occurred in the small area north between 590-600 km E, 4300-4325 km N (30.3% of biomass density vs. 0.3% of the total fishing area), and more diffusively, in the area south between 480-510 km E, 4125-4180 km N (42.9% of biomass density vs. 10.9% of the total fishing area) (Figure 4).

Similar distributions of biomass density were observed in the 1st pre-season surveys of 2011 (Winter et al., 2011) and 2012 (Winter et al., 2012). The distribution is not predictive of commercial catch success, as 2011 had a below-average 1st *Loligo* season (Winter, 2011), and 2012 had a record-high 1st *Loligo* season (Winter, 2012).



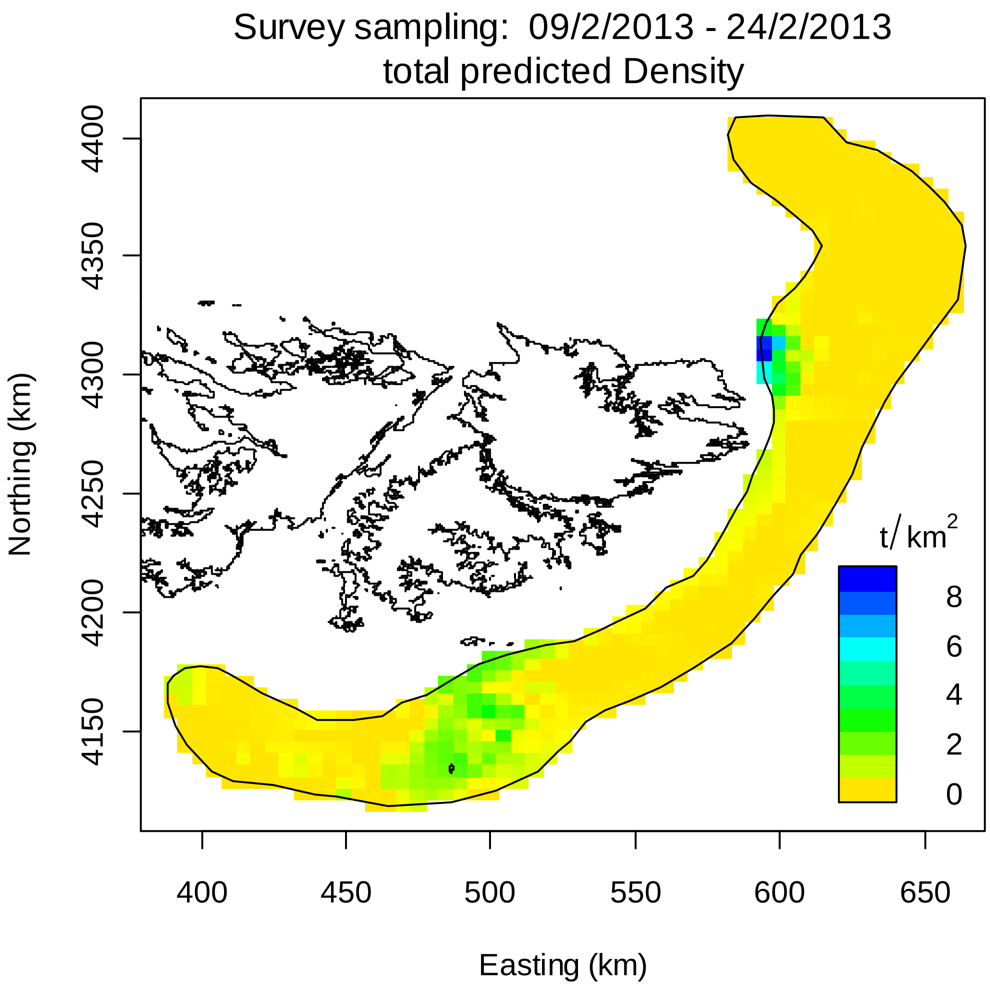


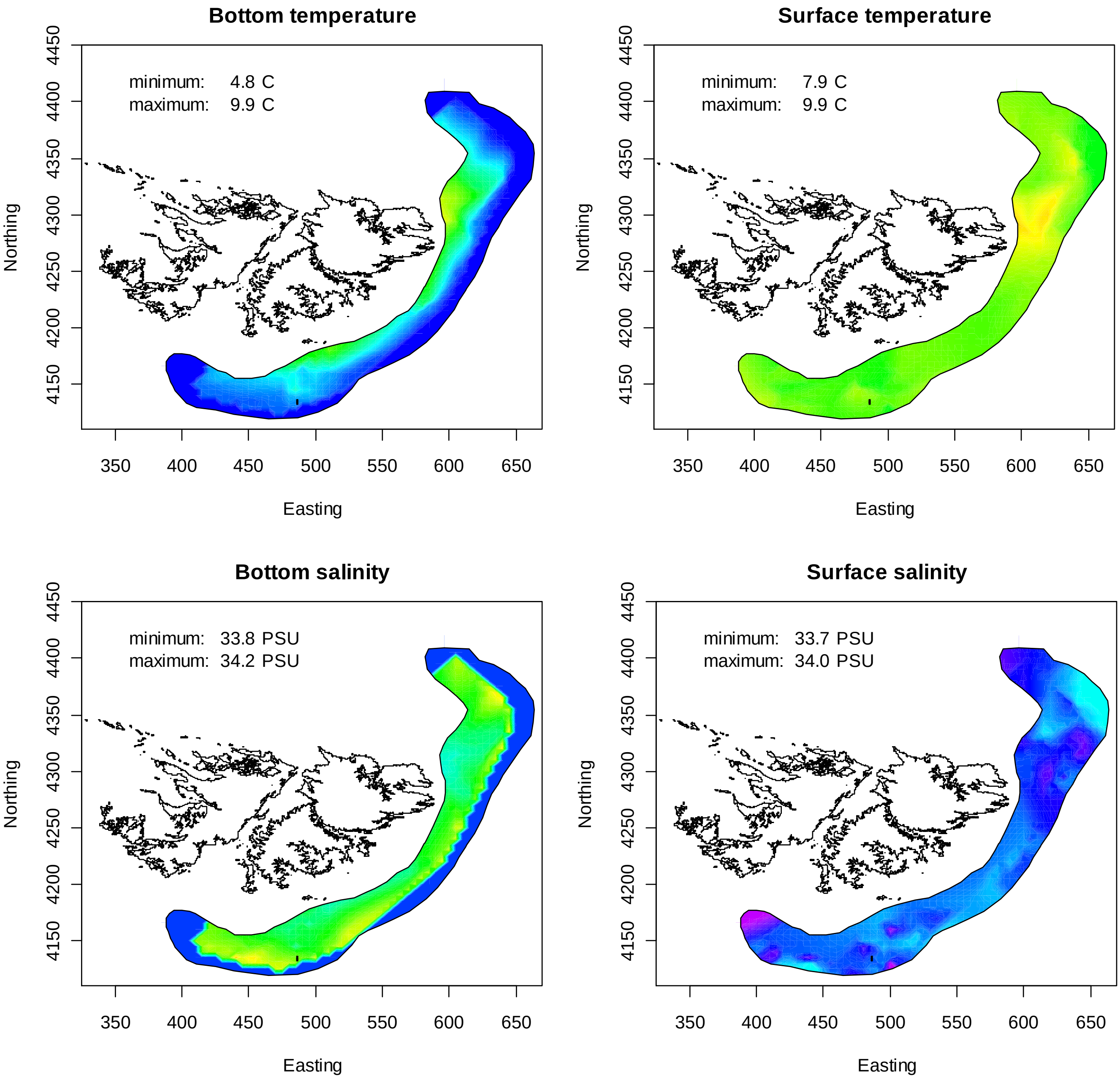
Figure 4. *Loligo* density estimates per 5 × 5 km area units. Top left (A): catch density distribution from variogram model of positive catches. Top right (B): probability of positive catch modelled from linear extrapolation of presence/absence. Main plot (C): predicted density = A × B. For calculating geostatistical estimates, coordinates were converted to WGS 84 projection (GeoConv software, www.kolumbus.fi/eino.uikkanen/geoconvgb/index.htm).

Sea temperature and salinity

The Valeport mini-CTD returned useable temperature and salinity data from 38 of the 60 scientific trawls. Spatial distributions are shown in Figures 5 and 6. Surface temperatures were colder than during the preseason-1 survey of 2012 (Winter et al., 2012).

Figure 5 [next page]. Bottom and surface sea temperatures interpolated from measurements of the mini-CTD attached to the trawl. Both plots to same scale; temperature increasing purple → yellow.

Figure 6 [next page]. Bottom and surface salinities interpolated from measurements of the mini-CTD attached to the trawl. Both plots to same scale; salinity increasing purple → yellow.



Biological data

Seventy taxa were identified in the catches (Appendix Table A2), of which *Loligo* made up <20% by weight – a notably low proportion compared, for example, to last year (Winter et al., 2012). Most of the blue whiting *Micromesistius australis* came from a single large trawl, on February 11th. 8466 *Loligo* were measured for length and maturity, but length-weight samples were not taken.

Loligo size and maturity distributions north and south of 52° S are plotted in Figure 7. North of 52° S, both male and female *Loligo* had modal lengths of 11 cm, with a distinct minor mode of maturity 1 individuals. South of 52° S, modal lengths were again equivalent for males and females but slightly lower at 10-11 cm, and no minor mode of maturity 1 individuals was evident. Most *Loligo* were at maturity 2 but males had higher proportional maturity with 32% of males at maturity ≥ 3 north of 52° S and 16% of males at maturity ≥ 3 south of 52° S, versus 5% of females at maturity ≥ 3 north of 52° S and 2% of females at maturity ≥ 3 south of 52° S.

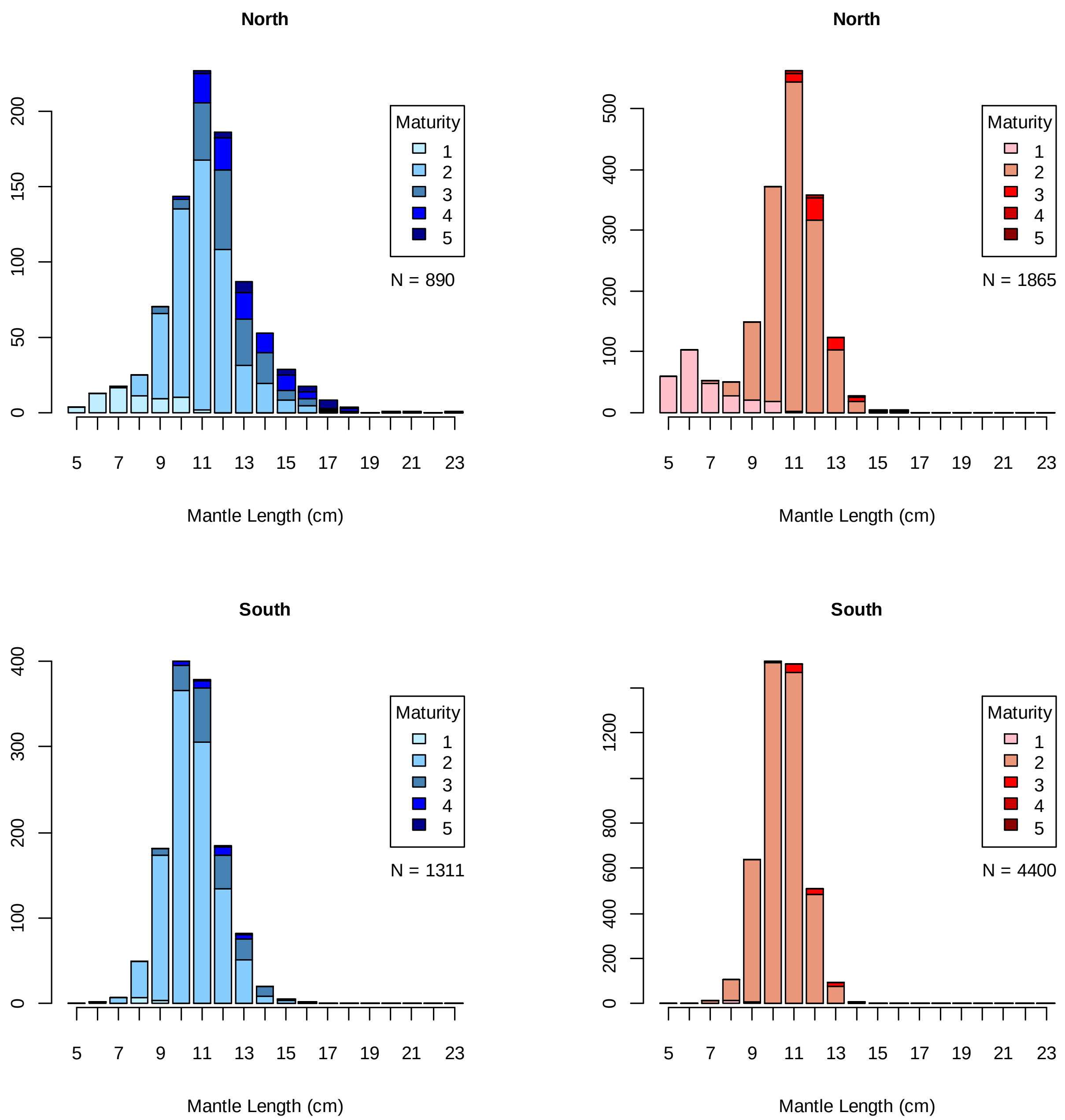


Figure 7. Length-frequency distributions by maturity stage of male (blue) and female (red) *Loligo* from trawls north (top) and south (bottom) of latitude 52 ºS.

References

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Appendix

Table A1. Survey stations with total *Loligo* catch. Time: local (Stanley, F.I.), latitude: °S, longitude: °W.

Station	Date	Start			End			Depth	*Loligo*
		Time	Lat	Lon	Time	Lat	Lon	Avg. (m)	Catch (kg)
516	09/02/2013	06:25	50.54	57.59	08:10	50.64	57.47	144	2
517	09/02/2013	09:10	50.60	57.37	11:10	50.51	57.54	254	0
518	09/02/2013	12:10	50.58	57.66	12:55	50.64	57.59	136	0
519	09/02/2013	17:02	50.76	57.45	19:02	50.87	57.34	131	11
520	10/02/2013	06:30	50.98	56.89	08:30	50.86	57.02	121	2
521	10/02/2013	09:30	50.79	57.05	11:30	50.70	57.22	253	4
522	10/02/2013	13:15	50.74	57.29	15:15	50.82	57.10	131	2
523	10/02/2013	15:50	50.87	57.05	17:50	50.99	56.96	116	0
524	11/02/2013	06:00	51.15	56.95	08:00	51.27	57.09	159	10
525	11/02/2013	14:45	51.24	57.16	16:45	51.12	57.01	128	7
526	11/02/2013	17:20	51.11	57.08	19:20	51.22	57.25	114	69
527	12/02/2013	06:00	51.96	57.50	08:00	51.82	57.38	223	9
528	12/02/2013	09:20	51.63	57.24	11:20	51.48	57.18	229	2
529	12/02/2013	13:05	51.48	57.30	15:05	51.62	57.35	147	32
530	12/02/2013	15:55	51.62	57.47	17:55	51.47	57.46	128	126
531	13/02/2013	07:03	52.26	57.73	09:03	52.15	57.58	266	9
532	13/02/2013	09:55	52.15	57.68	11:55	52.25	57.84	202	9
533	13/02/2013	12:47	52.23	57.96	14:47	52.12	57.80	136	300
534	13/02/2013	16:00	51.95	57.59	18:00	51.82	57.48	163	115
535	14/02/2013	06:58	52.38	57.96	08:58	52.48	58.11	498	15
536	14/02/2013	09:56	52.46	58.27	11:56	52.36	58.09	186	28
537	14/02/2013	12:38	52.33	58.19	14:38	52.45	58.35	144	292
538	14/02/2013	15:50	52.55	58.61	17:50	52.62	58.83	132	278
539	15/02/2013	05:55	52.80	58.77	07:55	52.88	59.01	148	352
540	15/02/2013	08:35	52.89	58.96	10:35	52.83	58.72	207	180
541	15/02/2013	11:40	52.72	58.64	13:40	52.61	58.47	227	15
542	15/02/2013	14:25	52.59	58.53	16:25	52.69	58.68	166	110
543	16/02/2013	06:00	52.71	58.88	08:00	52.80	59.07	123	220
544	16/02/2013	08:28	52.80	59.09	10:28	52.82	59.34	110	642
545	16/02/2013	11:00	52.83	59.39	13:00	52.83	59.65	149	441
546	16/02/2013	13:48	52.88	59.62	15:48	52.84	59.84	160	89
547	17/02/2013	06:07	52.91	59.89	08:07	52.93	59.63	253	49
548	17/02/2013	08:52	52.95	59.61	10:52	52.97	59.35	231	115
549	17/02/2013	11:30	52.77	60.37	13:30	52.89	60.22	170	115
550	17/02/2013	14:10	52.88	60.19	16:10	52.93	59.95	180	756
551	18/02/2013	06:12	52.81	60.19	08:12	52.87	59.96	197	203
552	18/02/2013	08:57	52.94	59.89	10:57	52.98	59.65	240	247
553	18/02/2013	11:35	52.99	59.59	13:35	53.01	59.34	243	115
554	18/02/2013	14:15	53.01	59.27	16:15	52.96	59.05	274	10
555	19/02/2013	06:12	52.68	58.77	08:12	52.69	58.98	128	1669
556	20/02/2013	06:11	52.83	58.78	08:11	52.90	58.96	150	2756
557	20/02/2013	09:07	52.83	58.96	11:07	52.93	59.10	139	2798
558	20/02/2013	11:40	52.92	59.07	13:40	52.84	58.86	148	2085
559	20/02/2013	14:16	52.84	58.91	16:16	52.94	59.06	151	1308
560	21/02/2013	06:12	52.51	58.85	08:12	52.59	59.07	93	827
561	21/02/2013	08:41	52.63	59.12	10:41	52.70	59.33	125	677
562	21/02/2013	11:40	52.81	59.31	13:40	52.80	59.06	103	1076
563	21/02/2013	14:14	52.77	58.98	16:14	52.73	58.77	132	2189
564	22/02/2013	06:10	52.86	60.11	08:10	52.93	59.88	199	546
565	22/02/2013	08:45	52.93	59.79	10:45	52.96	59.53	175	2525
566	22/02/2013	11:20	52.96	59.46	13:20	52.98	59.20	175	2043
567	22/02/2013	13:55	52.97	59.10	15:55	52.87	58.91	157	131
568	23/02/2013	06:08	51.19	57.59	08:08	51.16	57.39	111	6
569	23/02/2013	08:40	51.15	57.39	10:40	51.29	57.49	92	1622
570	23/02/2013	11:15	51.32	57.47	13:15	51.47	57.49	106	2042

571	23/02/2013	13:48	51.45	57.47	15:48	51.29	57.49	101	3179
572	24/02/2013	06:20	51.24	58.44	08:20	51.27	58.22	63	560
573	24/02/2013	08:50	51.26	58.23	10:50	51.29	58.00	65	1224
574	24/02/2013	11:15	51.27	57.95	13:15	51.31	57.74	69	14800
575	24/02/2013	13:56	51.34	57.81	15:56	51.45	57.68	54	2570

Table A2. Survey total catches by species / taxon.

Species Code	Species / Taxon	Total catch (kg)	Total catch (%)	Sample (kg)	Discard (kg)
BLU	*Micromesistius australis*	76751	28.3	261	43514
PAR	*Patagonotothen ramsayi*	57328	21.1	398	22524
LOL	*Doryteuthis gahi*	51634	19.0	302	68
WHI	*Macruronus magellanicus*	47115	17.4	600	354
MED	Medusae sp.	7964	2.9	0	4446
ING	*Moroteuthis ingens*	4688	1.7	9	768
DGH	*Schroederichthys bivius*	4466	1.6	0	94
PTE	*Patagonotothen tessellata*	3741	1.4	0	127
ALF	*Allothunnus fallai*	3252	1.2	66	0
RAL	*Bathyraja albomaculata*	3213	1.2	30	35
ANM	Anemone	3203	1.2	0	25
ZYP	*Zygochlamys patagonica*	1222	0.5	0	25
BAC	*Salilota australis*	1115	0.4	252	214
CHE	*Champsocephalus esox*	779	0.3	0	1
ALG	Algae	752	0.3	0	311
CGO	*Cottoperca gobio*	699	0.3	2	258
GRF	*Coelorhynchus fasciatus*	560	0.2	0	560
OPH	Ophiuroidea	442	0.2	0	1
FUM	*Fusitriton m. magellanicus*	442	0.2	0	1
CAZ	*Calyptraster* sp.	442	0.2	0	1
TOO	*Dissostichus eleginoides*	436	0.2	328	0
GRC	*Macrourus carinatus*	340	0.1	247	11
PAT	*Merluccius australis*	140	0.1	140	0
BUT	*Stromateus brasiliensis*	101	<0.1	0	101
POR	*Lamna nasus*	100	<0.1	100	0
KIN	*Genypterus blacodes*	96	<0.1	52	7
EEL	*Iluocoetes fimbriatus*	92	<0.1	3	92
RBZ	*Bathyraja cousseauae*	87	<0.1	70	77
RGR	*Bathyraja griseocauda*	81	<0.1	77	81
MUN	*Munida* sp.	55	<0.1	0	55
RFL	*Zearaja chilensis*	48	<0.1	48	43
RBR	*Bathyraja brachyurops*	48	<0.1	25	48
RSC	*Bathyraja scaphiops*	19	<0.1	19	19
GOC	*Gorgonocephalas chilensis*	12	<0.1	0	12
SPN	Porifera	10	<0.1	0	10
RMU	*Bathyraja multispinis*	9	<0.1	9	0
MYX	*Myxine* sp.	9	<0.1	0	9
MLA	*Muusoctopus longibrachus akambei*	9	<0.1	0	8
RMC	*Bathyraja macloviana*	7	<0.1	7	6
SAR	*Sprattus fuegensis*	5	<0.1	0	4
SHT	Mixed invertebrates	4	<0.1	0	4
RPX	*Psammobatis* sp.	4	<0.1	3	4
NEM	*Neophyrnichthys marmoratus*	4	<0.1	0	4

DGS	*Squalus acanthias*	4	<0.1	0	4
AST	*Asteroidea*	3	<0.1	0	3
STA	*Sterechinus agassizi*	2	<0.1	0	2
RMG	*Bathyraja magellanica*	2	<0.1	2	2
SEP	*Seriolella porosa*	1	<0.1	0	0
RDO	*Amblyraja doellojuradoi*	1	<0.1	1	1
POA	*Porania antarctica*	1	<0.1	0	1
OCM	*Octopus megalocyathus*	1	<0.1	0	1
OCC	Octocoralia	1	<0.1	0	1
MUL	*Eleginops maclovinus*	1	<0.1	1	0
HAK	*Merluccius hubbsi*	1	<0.1	1	0
BRY	Bryozoa	1	<0.1	0	1
BAL	*Bathydomus longisetosus*	1	<0.1	0	1
THO	Thouarellinae	<0.1	<0.1	0	0
THN	*Thysanopsetta naresi*	<0.1	<0.1	0	0
SUN	*Labidaster radiosus*	<0.1	<0.1	0	0
PYM	*Physiculus marginatus*	<0.1	<0.1	0	0
POL	Polychaeta	<0.1	<0.1	0	0
PES	*Peltarion spinosulum*	<0.1	<0.1	0	0
ODM	*Odontocymbiola magellanica*	<0.1	<0.1	0	0
NUD	Nudibranchia	<0.1	<0.1	0	0
MXX	Myctophid sp.	<0.1	<0.1	0	0
ISO	Isopoda	<0.1	<0.1	0	0
ICA	*Icichthys australis*	<0.1	<0.1	0	0
EUL	*Eurypodius latreillei*	<0.1	<0.1	0	0
AUC	*Austrocidaris canaliculata*	<0.1	<0.1	0	0
ACP	*Acanthephyra pelagica*	<0.1	<0.1	0	0
		271,542		3,054	73,938