2025 1st Pre-Season Assessment Survey

Falkland calamari
(Doryteuthis gahi)

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Natural Resources - Fisheries
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Summary

1) A stock assessment survey for *Doryteuthis gahi* (Falkland calamari) was conducted in the Loligo Box from 5th to 20th February 2025. A total of 60 scientific trawls were performed during the survey: 39 fixed-station trawls, 17 adaptive-station trawls, and 4 extra trawls in the region north of the Loligo Box, in grid squares XKAM and XKAN. The scientific catch of the survey was 344.17 tonnes *D. gahi*.

2) An estimate of 31, 048.62 tonnes *D. gahi* (95% confidence interval: 27, 431.33 to 42, 174.42 tonnes) was calculated for the fishing zone by inverse distance weighting. The biomass estimate was the lowest for a 1st pre-season since 2020. Of the total, 2, 679.17 tonnes were estimated north of 52 ºS, and 28, 369.45 tonnes were estimated south of 52 ºS. The proportion north (8.62%) was the lowest for a 1st pre-season survey estimate since 2019.

3) There was no significant difference in average mantle length of *D. gahi* between north of 52˚S and south of 52ºS. A significant difference in female maturity was identified between the two areas. Males north: mean mantle length 9.72 cm; mean maturity stage 1.96, south: mantle length 9.74 cm; maturity 1.99. Females north: mantle length 9.52 cm; maturity 1.92, south: mantle length 9.58 cm; maturity 1.96. Mantle length distributions suggested that some immigration continued throughout the survey.

4) A total of 98 taxa were identified in the catches. *D. gahi* was the largest species group at 80.4% of total catch by weight, followed by southern blue whiting (11.8%) and rock cod (5.7%), which were the only other taxa comprising ≥0.5% of total survey catch. Biological measurements and samples were taken from *D. gahi*, rock cod, toothfish, hoki, southern blue whiting, common hake, southern hake, and several non-commercial species.

Introduction

A stock assessment survey for *Doryteuthis gahi* (Falkland calamari – Patagonian longfin squid – colloquially *Loligo*) was carried out by the FIFD on-board the fishing vessel *Golden Chicha* from the 5th to 20th February 2025; experimental license FK0044E25. This survey continues the series of surveys that have, since February 2006, been conducted immediately prior to season openings to estimate *D. gahi* stock available to commercial fishing at the start of the season, and to initiate the in-season management model based on depletion time series of the stock.

Objectives of the survey were to:

1) Estimate the biomass and spatial distribution of *D. gahi* on the fishing grounds at the onset of the 1st fishing season, 2025.
2) Estimate the biomass and distribution of common rock cod (*Patagonotothen ramsayi*) and other commercial species in the 'Loligo Box', for continued monitoring of these stocks in parallel to the finfish research survey.
3) Estimate the bycatch of toothfish (*Dissostichus eleginoides*) in *D. gahi* trawls.
4) Collect biological information on *D. gahi*, rock cod, toothfish and opportunistically sample other fish and invertebrates taken in the trawls.

The survey was designed to cover the 'Loligo Box' fishing zone (Arkhipkin et al. 2008, 2013) that extends along the shelf break across the southern and eastern part of the Falkland Islands Interim Conservation Zone, plus two grids directly to the north. The delineation of the

Loligo Box (Figure 1) represents an area of approximately 31,517.9 km^2, subtracting the 3-nautical mile exclusion zone around Beauchêne Island.

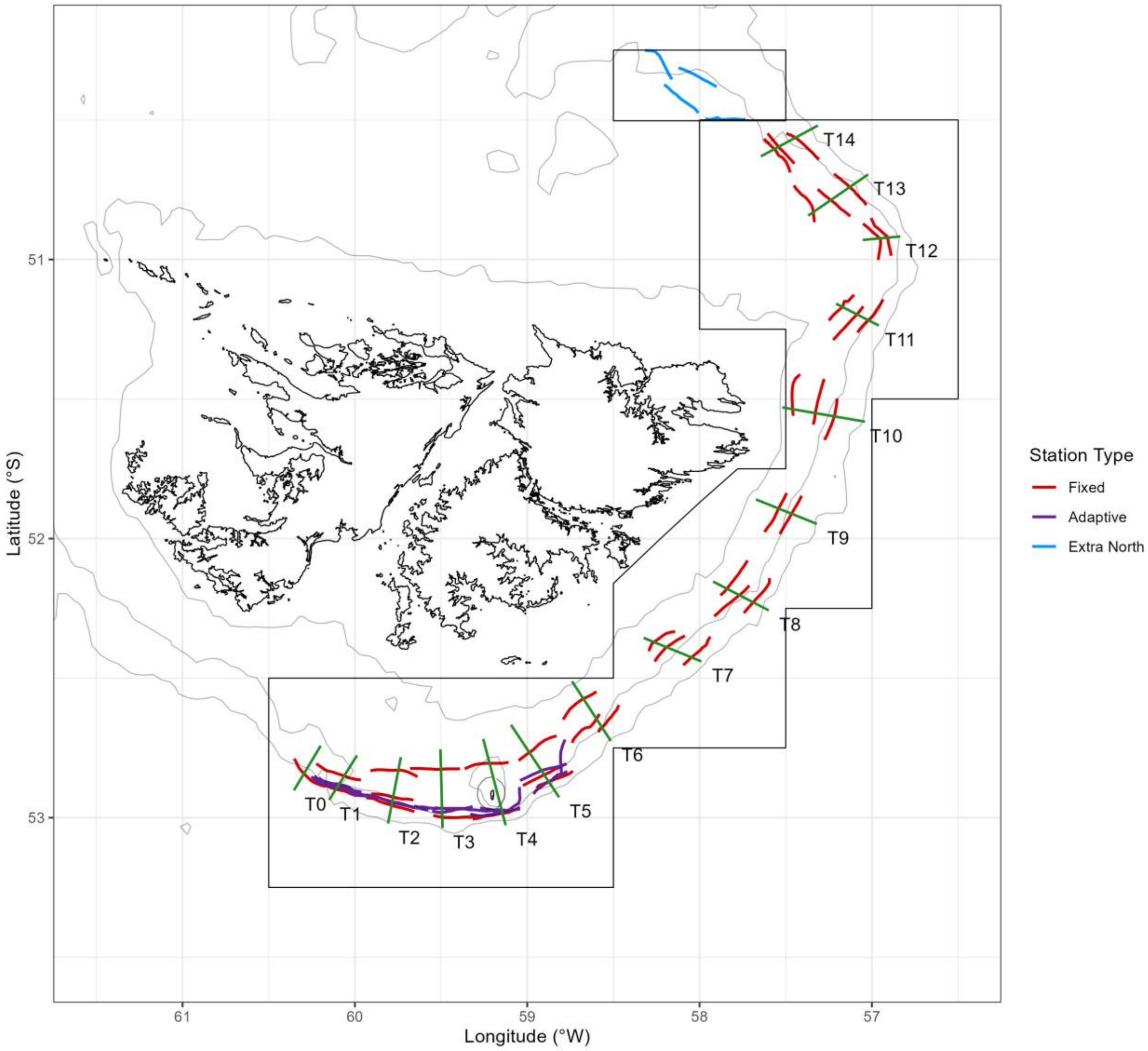

Figure 1. Survey transects (green lines), fixed-station trawls (red), adaptive-station trawls (purple), and extra north station trawls (blue) sampled during the 1st pre-season 2025 survey. Boundaries of the 'Loligo Box', Beauchêne Island exclusion zone, and extra grids north XKAM and XKAN, are outlined in black.

F/V *Golden Chicha* is a Falkland Islands-registered stern trawler of 69.8 m length, 1400 gt, and 3700 main engine bhp. Like all vessels employed for pre-season surveys, *Golden Chicha* operates regularly in the Falkland Islands calamari fisheries, and used its commercial trawl gear for the survey catches. *Golden Chicha* was previously employed for the 2nd pre-season surveys in 2010, 2013, and 2014 (Winter et al., 2010; 2013; 2014) and the 1st pre-season survey in 2008 (Payá, 2008). The following FIFD personnel participated in the 1st pre-season 2025 survey:

Role	Name
Survey lead scientist	Irina Chemshirova
Fishery scientist	Aina Amukwaya
Fishery scientist	Daniel Garcia

Methods
Sampling procedures

The regular 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 17 adaptive-station trawls selected to increase the precision of *D. gahi* biomass estimates in high-density or high-variability locations, one day of fishing was missed due to bad weather resulting in fewer than the 21 trawls planned. This dual approach ensures that the scientific requirements of randomization and repeatability are met (via fixed stations) and the spatio-temporal variability of the *D. gahi* population is captured (via adaptive stations) (Gawarkiewicz and Malek Mercer 2018). For the 2025 1st pre-season survey, one day was added by agreement with the Loligo Producers Group to trawl four tracks in grids XKAM and XKAN and evaluate potential fishable biomass just north of the Loligo Box (>50.5 ºS) (Figure 1). Unlike the fixed-station trawls, these four tracks were not prescribed as no precedent information was available about the most suitable locations. The additional day north of the Loligo Box with 4 trawls was used by the vessel on the third day of the survey, at the captain's request. All trawl tracks were designed for an expected duration of two hours each. All trawls were bottom (demersal) trawls. During the progress of each trawl, GPS latitude, GPS longitude, bottom depth, bottom temperature, net height, cable length, trawl door spread, and trawl speed were recorded on the ship's bridge in 15-minute intervals, and the quantity and quality of acoustic marks observed on the net-sounder were scored visually on a scale from 0 to 10. Following the procedure described in Roa-Ureta and Arkhipkin (2007), the acoustic marks were used to apportion the *D. gahi* catch of each trawl to the 15-minute intervals and thereby increase spatial resolution of the catches. For small catches acoustic apportioning cannot be assessed with accuracy, and any *D. gahi* amounts <100 kg were iteratively aggregated by adjacent intervals. For example, if the total *D. gahi* catch in a trawl was <100 kg it was assigned to one interval; the middle one.

Catch estimation

The catch of every trawl was processed by the factory crew and retained catch weight of *D. gahi*, by size category, was calculated from the number of standard-weight blocks of frozen squid recorded by the factory supervisor. Catch weights of commercially valued fish species were also recorded from the number of blocks of frozen product, but without size categorization. Processed product weights were scaled to whole weights using standard conversion factors (FIG 2016). Total catch composition per trawl, including commercially unvalued species, damaged fish, and undersized fish, was estimated using a combination of visual assessment and basket sample data. Baskets (30 – 35 kg capacity) were hand-sorted by FIFD survey personnel, and species weighed separately. The aggregate quantities of bycatch species in baskets were proportioned to the *D. gahi* catch of the whole trawl. Scarce bycatch species, and all toothfish, were collected and weighed entirely from each trawl. Non-commercial bycatch weights were then added to the factory production weights (as applicable) to give total catch weights of all fish and squid.

Biomass calculation

Biomass density estimates of *D. gahi* per trawl were calculated as catch weight divided by swept area. The calculation of biomass density thus assumes a catchability coefficient = 1, as commonly used in fishery surveys (Somerton et al. 1999)[a]. Swept area equals the product of trawl distance × trawl width, and 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[b]. Trawl width was derived from the distance between trawl doors (determined per interval) according to the equation (Seafish 2010):

trawl width = (door distance × footrope length) / (footrope length + bridle + sweep)

Measurements of *Golden Chicha'*s trawl, provided by the vessel master, were as follows: footrope = 184 m, sweep = 140 m, bridle = 24 m.

Biomass density estimates were extrapolated to the fish stock area[c] using an inverse distance weighting algorithm (Ramos and Winter 2022). As previously, the fish stock area was delineated to 20,062.8 km^{2}[d], partitioned for analysis into 800 area units of 5×5 km. Forty area units with average depth either <90 m or >400 m, where calamari trawlers do not work, were assumed for this analysis to comprise zero *D. gahi*. Biomass densities from all 800 area units were averaged and multiplied by the total fish stock area for total biomass, as well as separately north and south of 52 ºS; the standard sub-area demarcation (Winter and Arkhipkin 2015).

Uncertainty of the biomass density extrapolation was estimated by hierarchical bootstrapping. For 30,000 iterations a number of survey trawls equivalent to the total number were randomly selected with replacement, and within each selected survey trawl its 15-minute intervals were randomly selected with replacement. The trawl's catch was re-proportioned according to the selected intervals' acoustic scores, thus varying the spatial distribution of the catch over that trawl track. When applicable, the aggregation of *D. gahi* amounts <100 kg (see Sampling procedures) was summed to an interval of the trawl also chosen randomly; not necessarily the middle interval. At each of the 30,000 iterations, the inverse distance weighting algorithm was re-calculated over the 5 × 5 km area units.

Comparison with the extra north

Biomass density estimates of survey trawls were compared between the south (<52 ºS), north (>52 & <50.5 ºS) and extra north (>50.5 ºS) for *D. gahi* and commercially important species shortfin squid *Illex argentinus,* blue whiting *Micromesistius australis,* rock cod, common hake *Merluccius hubbsi,* and toothfish. Comparisons were calculated with Kruskal-Wallis tests: non-parametric one-way analysis of variance, followed by Dunn's test for identifying significant differences for multiple comparisons (Kruskal and Wallis 1952, Dunn 1964).

Biological analyses

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[a] Albeit more likely to underestimate than overestimate true density (Harley and Myers 2001); thus conservative.
[b] At the end of any trawl the net may continue to 'fish' for some distance as it is being hauled. Swept-area bias caused by this factor cannot be quantified but is unlikely to be substantial.
[c] The (approximate) area occupied by the fishable stock of *D. gahi*. This is largely overlapping, but not exactly equal, to the Loligo Box, which is the area that is legally open to *D. gahi* trawling.
[d] For this survey the fish stock area was not adjusted from previous surveys because of the addition of trawls just north of the Loligo Box.

Random samples of *D. gahi* (target n = 150, as far as available) were collected from the factory at all trawl stations. Biological analysis at sea included measurements of the dorsal mantle length rounded down to the nearest half-centimetre, sex, and maturity stage scored by inspection of the gonads. Statistical significance of sex ratio departures from 50/50, in total and by station, was evaluated with randomized re-sampling. Statistical significance of differences in mantle length and maturity stage distributions were evaluated with Kruskal-Wallis tests, non-parametric one-way analysis of variance (Kruskal and Wallis 1952).

Additional specimens of *D. gahi* were collected opportunistically according to area stratification (north, central, south) and depth (shallow, medium, deep), and frozen for statolith extraction and age analysis (Arkhipkin 2005), as well as calculation of the length-weight relationship $W = \alpha \cdot L^{\beta}$ (Froese 2006). A sample of 100 rock cod was taken at every trawl station, as far as available. All catches of toothfish were collected from all trawl stations to maximize the time series catch and biological information base for juvenile toothfish. Otoliths were taken from toothfish that corresponded to required size categories, and other fish species as available; usually the predominant fish bycatch in any trawl.

Results

Catch rates and distribution

The survey started with fixed-station trawls in the north part of the Loligo box and proceeded southward throughout the Loligo Box in the usual pattern. A schedule of 4 scientific trawls per day was maintained every day, except 11th February, when no fishing took place due to bad weather (Table A1), resulting in 60 scientific trawls total recorded during the survey: 39 fixed station trawls catching 118.847 tonnes *D. gahi*, 17 adaptive-station trawls catching 224.902 tonnes *D. gahi*, and 4 extra north station trawls catching 0.408 tonnes *D. gahi*. A total of 14 optional trawls (directed by the vessel master, after survey hours) yielded an additional 175.538 tonnes *D. gahi*, bringing the total catch for the survey to 519.695 tonnes. The scientific survey catch of 344.157 tonnes *D. gahi* was below the median for the last five years (Table 1).

Table 1. *D. gahi* 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	54	164	36283
2014	60	124	34673	58	207	40090
2015	57	184	36424	53	137	25422
2016	57	65	21729	58	225	43580
2017	59	180	48785	63[A]	314	56807
2018	59[A]	115	32194	53	510	183593
2019	55	382	49618	51	298	50880
2020	59	268	27991	55	575	92194
2021	55	280	31770	59	534	77526
2022	60	421	47058	59	441	63348
2023	61[B]	549	44015	56	294	19859
2024	64[B]	675	70334	47	49	13554
2025	64[B]	344	31048			

[A] Includes four juvenile toothfish transect trawls.
[B] Includes four extra trawls north of the Loligo Box.

Average *D. gahi* catch density (Figure 2) among fixed-station trawls north of 52º S was 0.27 t km^{-2}: the lowest for 1st pre-seasons since 2015. Average *D. gahi* catch density among fixed-station trawls south of 52º S was 3.32 t km^{-2}, approximately half the density recorded in 2024 and 2022, but consistent with the median recorded for previous surveys dating back to 2012. Average *D. gahi* catch density among adaptive-station trawls south of 52º S was 9.40 t km^{-2}, which was the fourth highest mean density recorded for adaptive stations in this area since 2012. Average *D. gahi* catch density of the extra north station trawls was 0.07 t km^{-2}, lower than fixed and adaptive stations for this pre-season survey, and lowest recorded in the extra north since 2023 (which was the first year this area was surveyed).

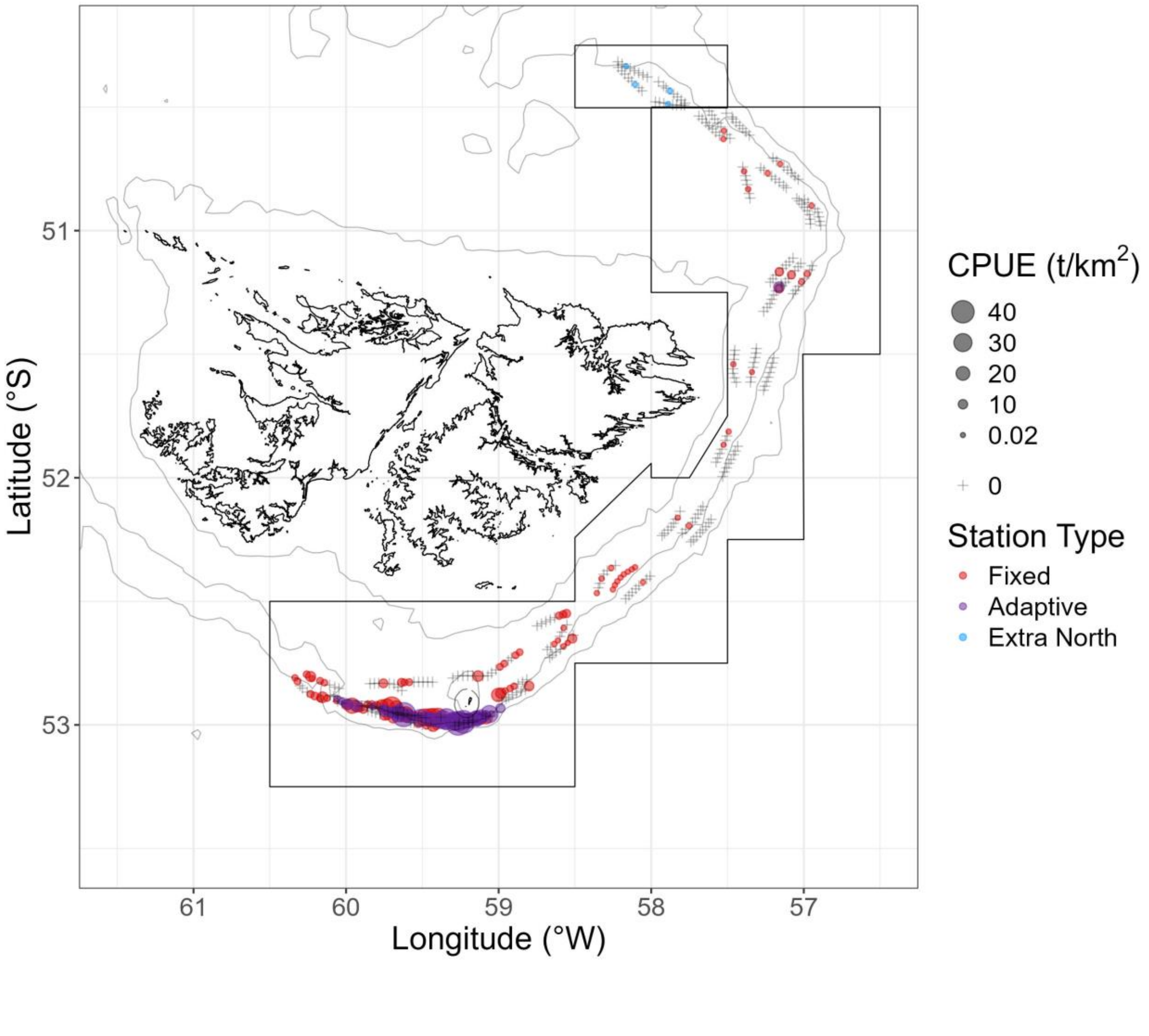

Figure 2. *D. gahi* CPUE (t km^{-2}) of fixed-station (red), adaptive-station (purple) and extra north station (blue) trawls per 15-minute trawl interval. Boundaries of the 'Loligo Box' fishing zone and the Beauchêne Island exclusion zone are traced in black.

Biomass estimation

Total *D. gahi* biomass in the fish stock area was estimated at 31, 048.62[e] tonnes, with a 95% confidence interval of [27, 431.33 to 42, 174.42 tonnes]. The total biomass estimate was the lowest for a 1st pre-season since 2020 (Table 1). Partition of the estimated biomass was 2, 679.17 tonnes north [1, 331.30 to 4, 850.16 tonnes] vs. 28, 369.45 tonnes south [24, 658.05 to 38, 952.79 tonnes]. The biomass proportion north (8.62%) was the lowest for a 1st pre-season since 2017. Within the north sub-area 50% of *D. gahi* density was aggregated in 34 of 368 5×5 km area units, and 95% of density was aggregated in 158 of the 368 5×5 km area units (Figure 3). Within the south sub-area 50% of *D. gahi* density was aggregated in 73 of 392 5×5 km area units, and 95% of density was aggregated in 228 of the 392 5×5 km area units (Figure 3).

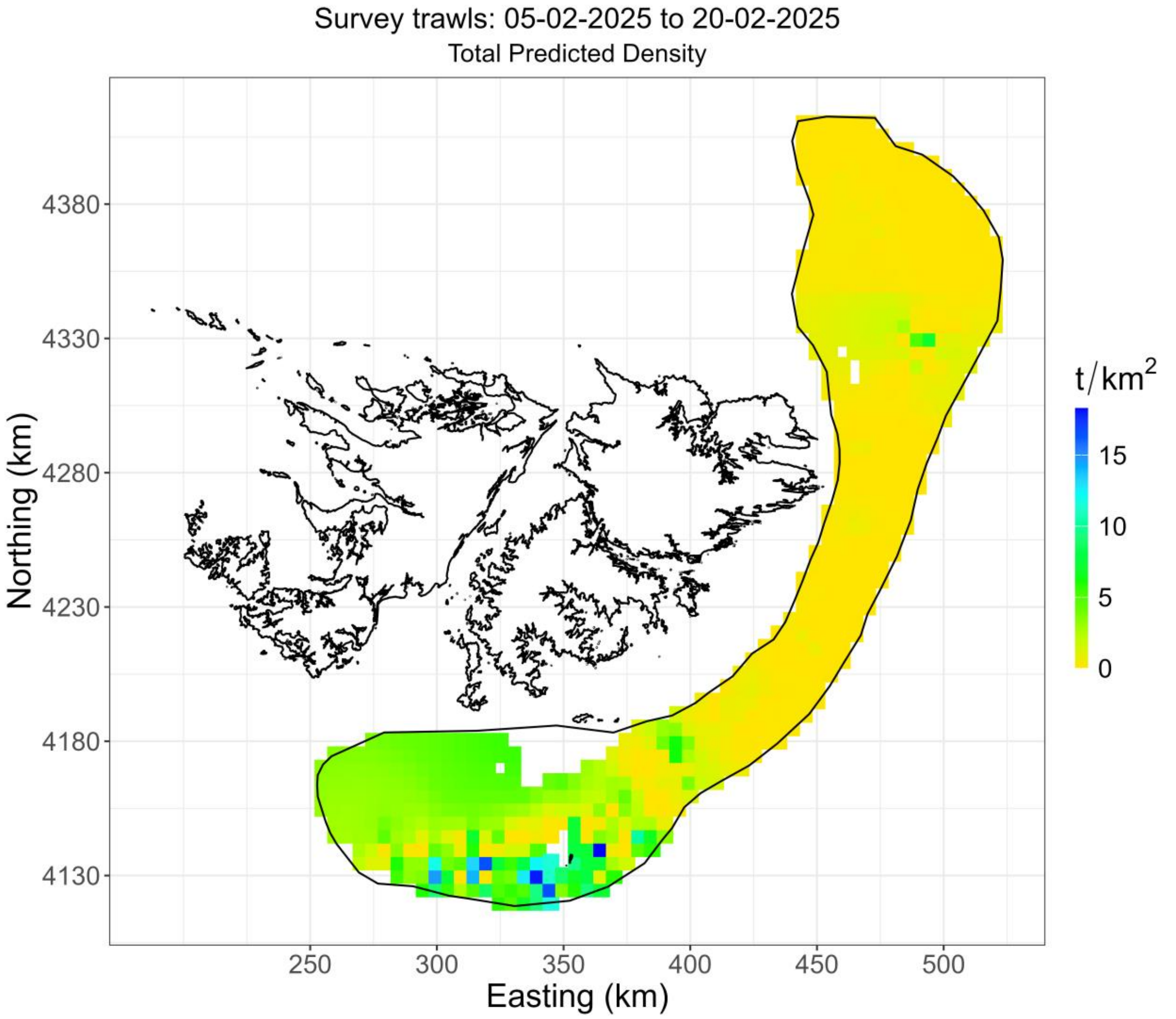

Figure 3. *D. gahi* predicted density estimates per 5 km^2 area units. Blank area units within the perimeter are either <90 or >400 m average depth.

[e] The estimate and associated confidence intervals are different to the initial estimate provided immediately after the survey (31, 034 tonnes), as it was noted that in Station 1047, the vessel did not report any *D. gahi* catch, whereas the scientific staff weighed the entire catch and found that there were 14.8 kg caught at this station.

Comparison with the extra north

Average biomass density of *D. gahi* in the four trawls north of the Loligo Box was low: significantly lower than in the south and non-significantly lower than in the north, while the difference between south and north was statistically significant (Table 2; Figure 4)[f]. Among other commercially important species, trawls north of the Loligo Box (extra north) had the lowest average biomass density of common hake and *I. argentinus*. There was significant difference in the common hake catch density between the extra north stations and both areas of the Loligo Box. Whereas, for *I. argentinus* there was a significant difference between the southern part of the Loligo Box and the trawls in the extra north. The highest average biomass density of common hake was found in the trawls north of the Loligo Box. The average density of common hake was significantly higher in the north compared with the south (Table 2, Figure 4). However, abundance of common hake is seasonally low overall in Falkland Islands waters during the time of 1st pre-season surveys (Arkhipkin et al. 2012b).

Table 2. Average biomass densities of important commercial species from survey trawls in the south, north, and extra north of the Loligo Box during the 1st pre-season 2025 survey. Numbers of trawl stations in parentheses.

Species	Survey catch density (tonnes km^{-2})		
	South (39)	North (17)	Extra North (4)
D. gahi	5.583	0.340	0.071
I. argentinus	0.0008	0.001	0.0007
Blue whiting	0.320	1.196	0.005
Rock cod	0.333	0.169	0.061
Common hake	0.00006	0.0002	0.0007
Toothfish	0.014	0.018	0.014

[f] Note that with uneven sample sizes (39, 17, 4), this analysis has relatively limited statistical power (Oldfield and Haig 2016).

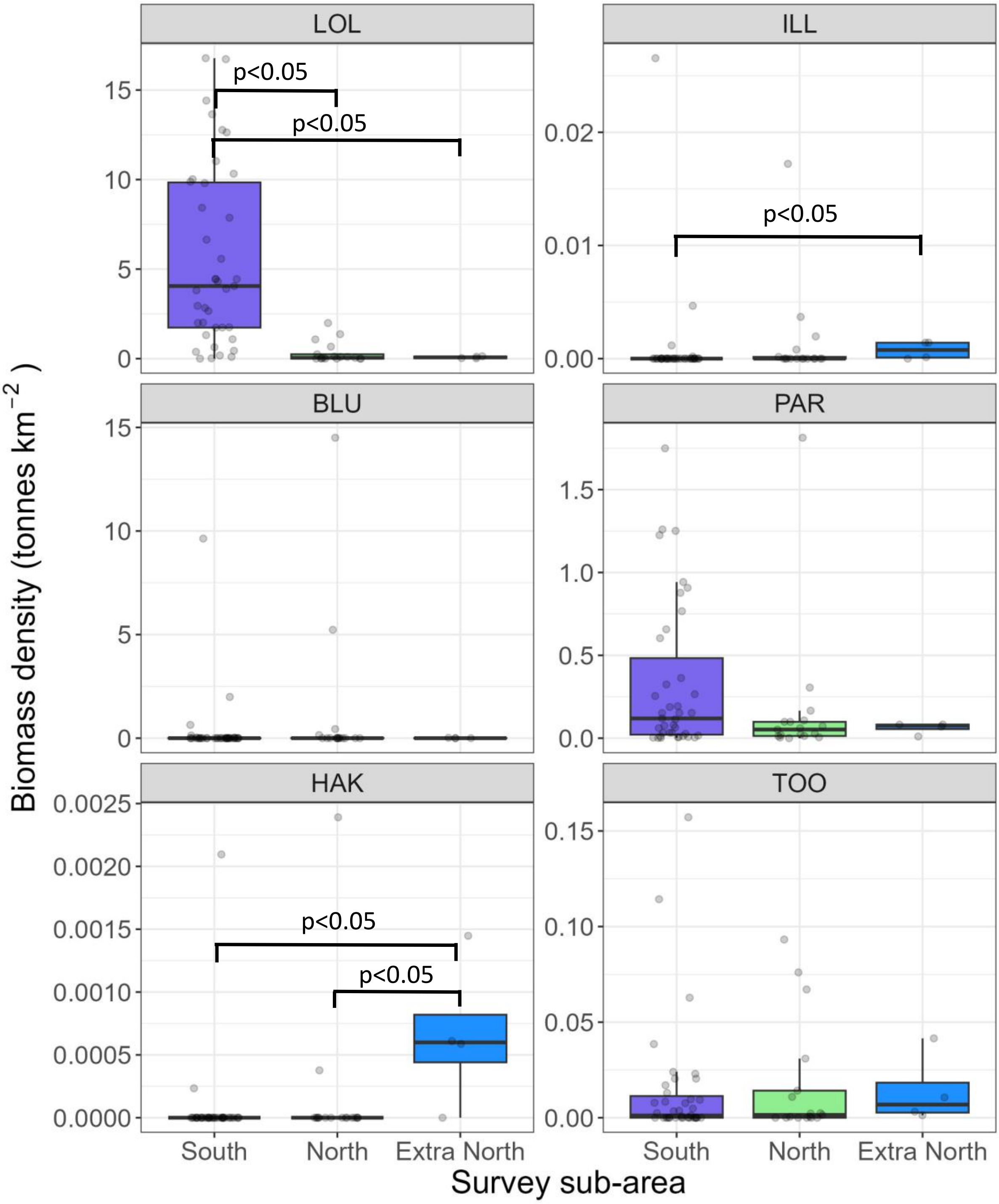

Figure 4. Boxplots of survey biomass densities of important commercial species south (n = 44 survey trawls), north (n = 16) and extra north (n = 4) from the 1st pre-season 2025 survey. Significant differences between areas are indicated by brackets.

Biological data

A total of 98 taxa were identified in the survey catches (Appendix Table A2). *D. gahi* was the predominant catch with 80.4% of the total (Table A2); consistent with 1st pre-season catches after 2019. A notable exception was observed in 2024, when the survey catch was more mixed, with *D. gahi* comprising only 69.16% of the total catch. Second-highest catch species was blue whiting with 11.8% of the total. This can be largely attributed to three trawls (Stations

1035, 1036, and 1071; Figure 4), where 89.44% of the blue whiting was caught, two were on northernmost Transect 14 in the Loligo Box, the final station was on Transect 6, south of 52˚S. Third-highest catch species was rock cod with 5.7%, the fourth-lowest percentage in a 1st pre-season survey since 2022 (4.4%). No other species group accounted for ≥0.5%.

Toothfish, a highly restricted bycatch, had the highest total catch percentage for a 1st pre-season since 2017 (0.7%) at 0.33%. Overall, 56.61% total toothfish survey catch was taken in five stations, where toothfish catch was >100 kg (St 1036; 1037; 1046; 1054; 1059). The two stations with the highest catch were St 1054 (172.23kg) and 1059 (254.64 kg), both were located south of 52ºS on Transects 7 and 0 respectively (Figure 1; Table A2). Additionally, upon investigation of the length-frequency of sampled individuals the range sampled was between 28 and 70 cm in total length, indicating that the high catch weight can be attributed to large individuals (Figure 5).

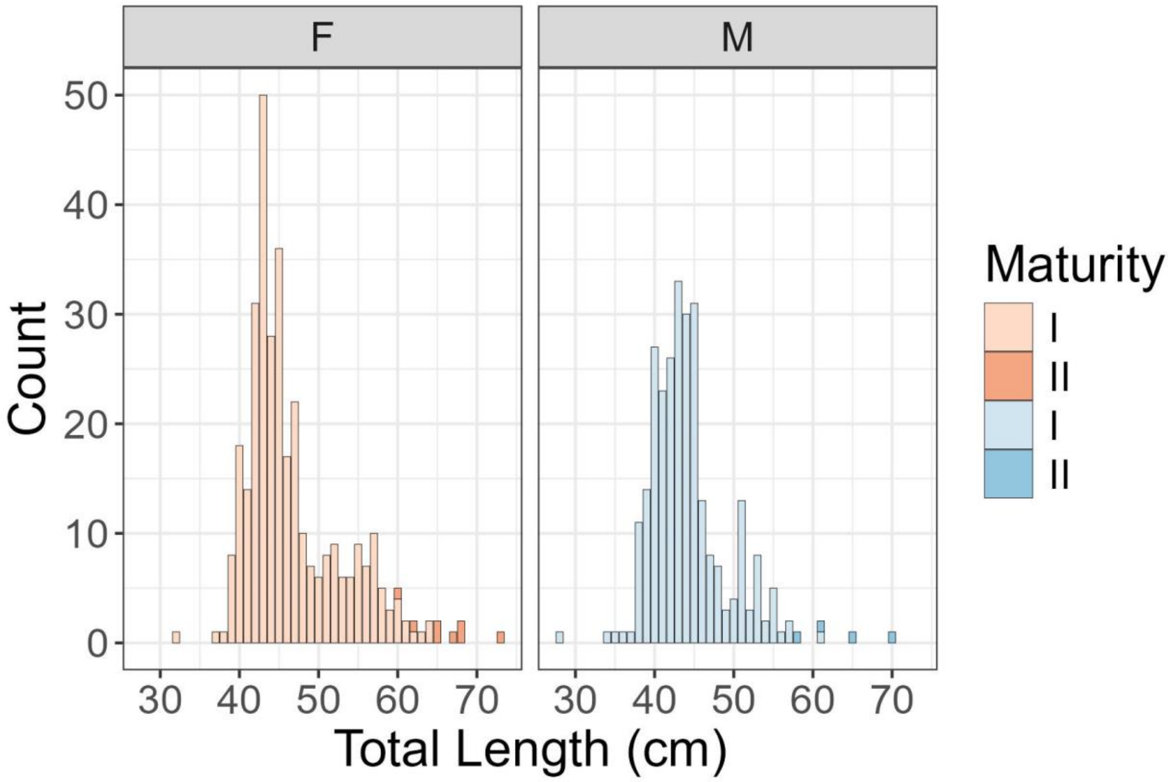

Figure 5. Length-frequency distributions by maturity stage of female (red) and male (blue) toothfish from survey trawls.

During the survey 9301 *D. gahi* were measured for length and maturity (4027 males, 5274 females, from 55 trawl stations). *D. gahi* mantle length and maturity distributions north and south of 52° S are presented in Figure 6. For males north: mean mantle length 9.72 cm; mean maturity stage 1.96 (on a scale of 1 to 6, Lipinski 1979), males south: mean mantle length 9.74 cm; mean maturity stage 1.99. Females north: mean mantle length 9.52 cm; mean maturity stage 1.92, females south: 9.58 cm; stage 1.96. Mean mantle lengths of males and females were smaller than the mean for both areas compared with the 1st pre-season last year. No significant difference was found in the mantle length of both sexes between north and south areas (Females $p = 0.63$; $\chi^2=0.24$; Males: $p = 0.36$; $\chi^2=0.82$). A marginally significant difference was found in the maturity of males between north and south ($p<0.1$; $\chi^2=5.33$), whereas a significant difference was found between the two areas for the maturities of females ($p<0.001$; $\chi^2=18.26$).

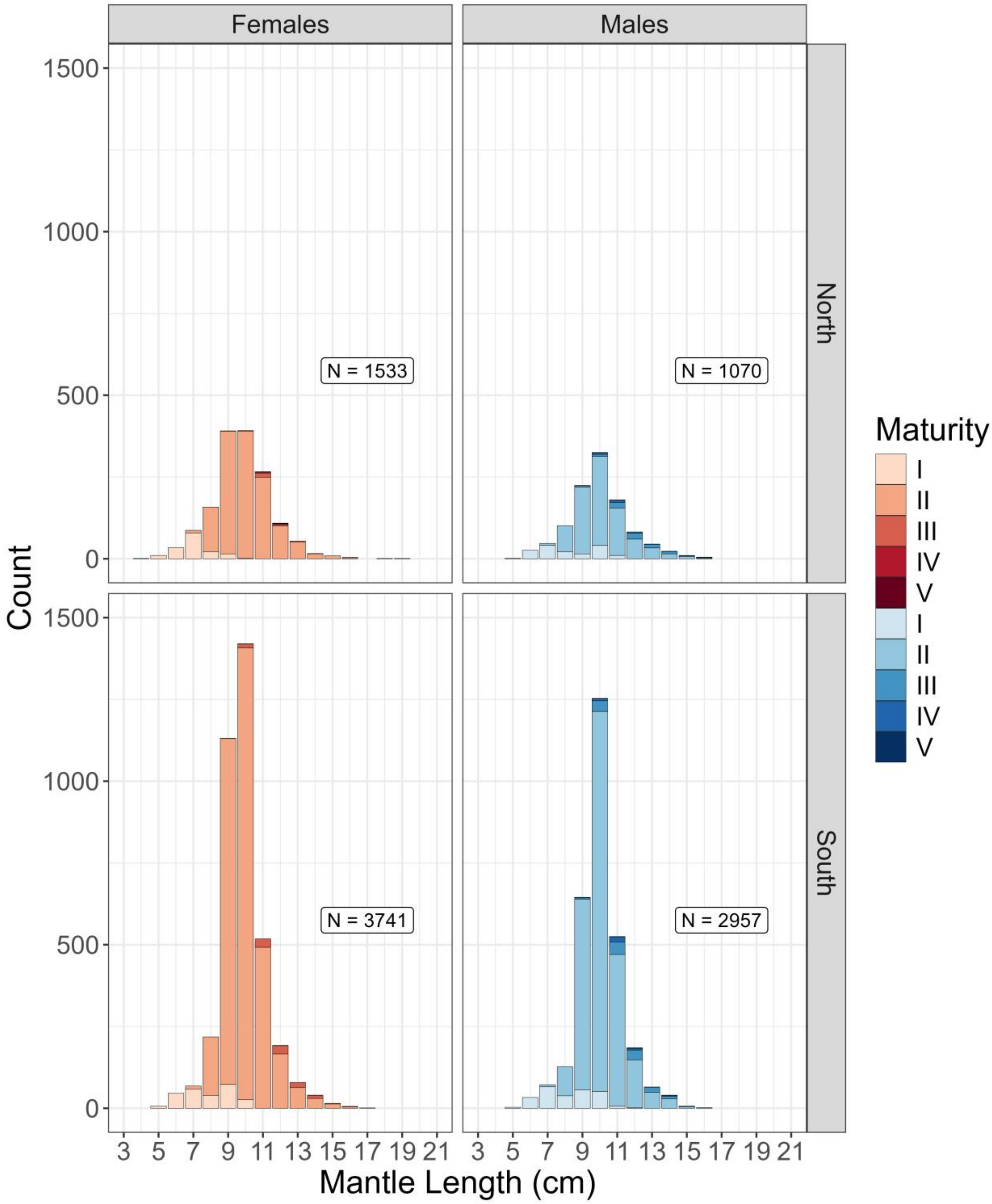

Figure 6. Length-frequency distributions by maturity stage of female (red) and male (blue) *D. gahi* from trawls north (top) and south (bottom) of latitude 52 ºS.

A general additive model (GAM) was used to investigate the relationship between mantle length and sampling day (survey progression), sex, latitude and longitude, and mean depth. The following was identified as the optimal model using Akaike Information Criterion:

$$(Mantle\ Length_i) \sim \alpha\ + f(Latitude, Longitude_i) +$$
$$f(Sampling\ Day_i): Sex + f(Mean\ Depth_i): Sex + Sex_i + \varepsilon_i$$
$$\varepsilon_i \sim N(0, \sigma^2)$$

where α is the intercept, $f(\,)$ denotes smooth term applied with penalized thin plate regression spline for Latitude and Longitude and was varied by *Sex* for *Sampling Day* and *Mean Depth*.

The results from the GAM are presented in Table 3. Overall, mantle length significantly differed between sexes. The sampling day smoother revealed a similar overall pattern for both females and males (Fig. 7A), although males were smaller than females at the beginning of the survey. It is possible that a migration occurred during this survey, due to the decreasing trend in mantle length over time.

The mean depth smoother also revealed a negligible increase in mantle length with greater depth for females, whereas an overall decrease in mantle length was evident for males (Fig. 7B). As *D. gahi* typically segregates by depth during the feeding phase, the presence of larger females in deeper waters is expected. In contrast, male mantle length remains consistent across depths, as males generally aggregate in shallower waters early in the season (Rodhouse et al., 2013).

Table 3. Estimated parameters of generalised additive model for mantle length presented above. edf, expected degrees of freedom; DE deviance explained.

Response variable	Explanatory variable	edf	F-value	p-value	DE (%)
Mantle Length	Sex	-	125.6	<0.0001***	25.6
	Latitude, Longitude	26.84	51.68	<0.0001***	
	Sampling Day: Females	7.40	25.49	<0.0001***	
	Sampling Day: Males	7.08	13.99	<0.0001***	
	Mean Depth: Females	2.16	2.86	0.133	
	Mean Depth: Males	6.50	3.04	<0.01**	

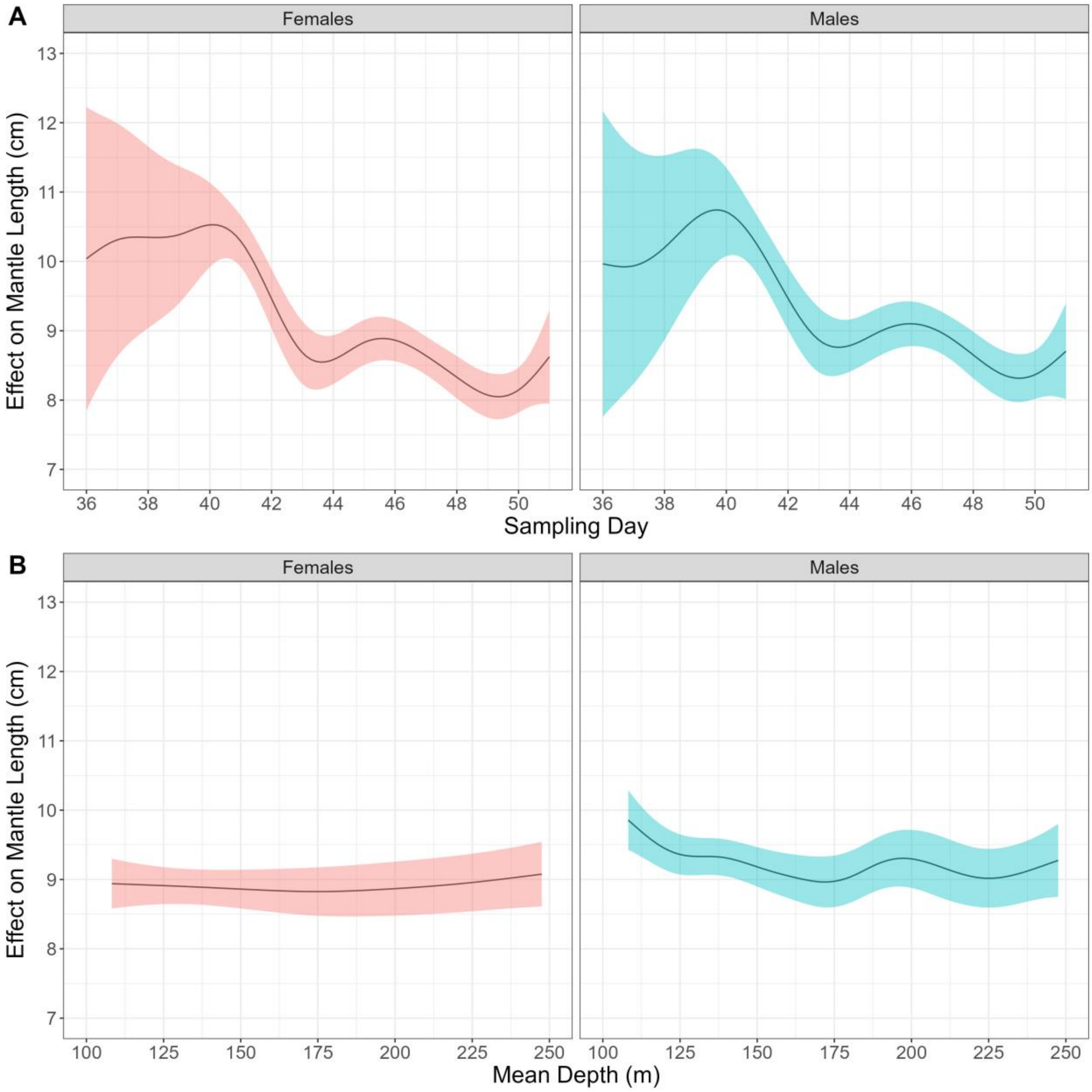

Figure 7. Generalised additive model of mantle length as a function of (A) Sampling Day and (B) Mean depth, smoothing curves were fitted per sex, with 95% confidence intervals shaded.

Otoliths taken during the survey are summarized in Table A3.

Pinniped and seabird monitoring

The 1st pre-season survey 2025 was conducted with seal exclusion devices (SED) in all trawls, to align with compulsory SED use in the following commercial C-licence fishery. Shooting and hauling of survey trawls was monitored from the bridge by the lead scientist. Pinnipeds were sighted near the stern of the vessel at the shoot and/or haul of the survey, but none were caught in fishing gear. In two hauls a black-browed albatross (*Thalassarche melanophris*) was retrieved on deck; one alive in the SED and one dead in net.

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Appendix

Table A1. Survey stations with total *Doryteuthis gahi* catch. Time: Stanley FI time. Latitude: °S; Longitude: °W. Transects labelled A were adaptive-station trawls. Transects labelled E were trawls in the Extra North.

			Start			End				
Transect - Station	Data Station	Date	Time	Lat	Lon	Time	Lat	Lon	Depth (m)	*D. gahi* (kg)
14-37	1034	05/02/2025	05:47	50.52	57.71	07:47	50.63	57.53	137	144
14-38	1035	05/02/2025	08:40	50.64	57.47	10:40	50.52	57.62	135	72
14-39	1036	05/02/2025	11:38	50.52	57.53	13:38	50.61	57.36	241	0
13-36	1037	05/02/2025	14:49	50.69	57.23	16:49	50.79	57.04	243	4
13-34	1038	06/02/2025	05:50	50.89	57.34	07:50	50.74	57.40	126	336
13-35	1039	06/02/2025	08:46	50.74	57.31	10:46	50.83	57.11	131	72
12-33	1040	06/02/2025	11:37	50.86	57.02	13:37	50.98	56.89	130	24
12-32	1041	06/02/2025	14:25	50.98	56.95	16:25	50.87	57.05	110	0
E15-40	1042	07/02/2025	05:53	50.49	57.75	07:53	50.48	57.97	140	168
E16-42	1043	07/02/2025	08:44	50.45	58.04	10:44	50.34	58.22	138	24
E16-43	1044	07/02/2025	11:42	50.31	58.24	13:42	50.38	58.03	139	48
E15-41	1045	07/02/2025	14:43	50.39	57.98	16:43	50.48	57.78	142	168
10-28	1046	08/02/2025	05:40	51.50	57.19	07:40	51.65	57.26	226	0
10-27	1047	08/02/2025	08:32	51.63	57.35	10:32	51.48	57.31	166	14.8
10-26	1048	08/02/2025	11:28	51.46	57.44	13:28	51.61	57.44	128	144
9-24	1049	08/02/2025	14:55	51.79	57.48	16:55	51.94	57.58	146	168
9-25	1050	09/02/2025	05:40	51.85	57.42	07:40	51.99	57.53	219	0
8-23	1051	09/02/2025	08:57	52.15	57.61	10:57	52.26	57.74	265	0
8-22	1052	09/02/2025	11:50	52.23	57.81	13:50	52.12	57.66	200	288
8-21	1053	09/02/2025	14:42	52.13	57.78	16:42	52.23	57.93	132	144
7-20	1054	10/02/2025	05:40	52.39	57.98	07:40	52.49	58.17	256	24
7-19	1055	10/02/2025	08:40	52.47	58.26	10:40	52.36	58.11	185	946
7-18	1056	10/02/2025	11:30	52.35	58.21	13:30	52.47	58.36	152	660
6-16	1057	10/02/2025	14:40	52.58	58.54	16:40	52.70	58.68	173	558
1-2	1058	12/02/2025	05:40	52.86	60.01	07:40	52.80	60.26	181	4,460
0-1	1059	12/02/2025	08:40	52.79	60.35	10:40	52.89	60.17	262	4,596
1-3	1060	12/02/2025	11:44	52.88	60.19	13:44	52.93	59.93	221	14,410
A1	1061	12/02/2025	14:45	52.93	59.89	16:45	52.88	60.10	220	9,764
2-4	1062	13/02/2025	05:50	52.88	59.61	07:50	52.83	59.84	152	2,004
2-5	1063	13/02/2025	08:50	52.91	59.89	10:50	52.93	59.65	182	20,952
2-6	1064	13/02/2025	12:00	52.97	59.66	14:00	52.94	59.89	233	5,824
A2	1065	13/02/2025	15:00	52.92	59.89	17:00	52.96	59.62	183	17,224
3-7	1066	14/02/2025	05:45	52.83	59.40	07:45	52.83	59.64	132	2,318
3-8	1067	14/02/2025	09:05	52.95	59.63	11:05	52.97	59.40	178	24,654
3-9	1068	14/02/2025	12:10	53.00	59.36	14:10	52.99	59.58	214	6,010
A3	1069	14/02/2025	15:05	52.97	59.54	17:05	52.99	59.26	190	28,008
6-15	1070	15/02/2025	05:40	52.61	58.78	07:40	52.55	58.56	131	2,866
6-17	1071	15/02/2025	08:40	52.62	58.50	10:40	52.73	58.67	237	1,686
5-14	1072	15/02/2025	11:50	52.84	58.76	13:50	52.90	58.98	210	2,578
A4	1073	15/02/2025	15:05	52.97	59.15	17:05	52.97	59.37	161	18,480
5-12	1074	16/02/2025	05:45	52.80	59.08	07:45	52.71	58.86	110	2,922
5-13	1075	16/02/2025	09:00	52.81	58.79	11:00	52.88	59.00	147	6,274
A5	1076	16/02/2025	12:08	52.96	59.14	14:08	52.97	59.38	160	11,680
A6	1077	16/02/2025	15:05	52.98	59.41	17:05	52.95	59.65	185	6,860
4-10	1078	17/02/2025	05:45	52.82	59.33	07:45	52.80	59.07	121	2,556
4-11	1079	17/02/2025	09:05	52.96	59.06	11:05	53.00	59.29	169	5,778
A7	1080	17/02/2025	12:00	52.99	59.25	14:00	52.93	58.99	173	18,984
A8	1081	17/02/2025	14:55	52.96	59.05	16:55	52.99	59.29	167	19,028
A9	1082	18/02/2025	05:55	52.92	59.93	07:55	52.95	59.67	192	6,716
A10	1083	18/02/2025	09:10	52.94	59.72	11:10	52.97	59.47	183	15,158
A11	1084	18/02/2025	12:05	52.97	59.50	14:05	52.94	59.75	190	6,972
A12	1085	18/02/2025	15:05	52.94	59.72	17:05	52.97	59.46	181	4,820
A13	1086	19/02/2025	05:57	52.95	59.08	07:57	52.97	59.30	154	7,532

Transect - Station	Data Station	Date	Start			End			Depth (m)	*D. gahi* (kg)
			Time	Lat	Lon	Time	Lat	Lon		
A14	1087	19/02/2025	09:00	52.97	59.32	11:00	52.96	59.06	177	20,490
A15	1088	19/02/2025	11:55	52.96	59.05	13:55	52.99	59.29	166	14,938
A16	1089	19/02/2025	14:55	52.99	59.33	16:55	52.97	59.06	182	16,268
11-31	1090	20/02/2025	07:10	51.27	57.09	09:10	51.14	56.95	140	1,018
11-30	1091	20/02/2025	09:55	51.12	57.00	11:55	51.23	57.16	128	2,888
11-29	1092	20/02/2025	12:50	51.22	57.23	14:50	51.11	57.07	113	1,454
A17	1093	20/02/2025	15:50	51.20	57.13	17:50	51.33	57.26	122	1,980

Table A2. Empirical estimates of survey total catches by species / taxon.

Species Code	Species/Taxon	Total catch (kg)	Total catch (%)	Sample (kg)	Discard (kg)
LOL	*Doryteuthis gahi*	344,156.8	80.4	260	313
BLU	*Micromesistius australis*	50,312	11.8	286	42,387
PAR	*Patagonotothen ramsayi*	24,600	5.7	284	24,355
TOO	*Dissostichus eleginoides*	1,411	0.3	555	1,411
ING	*Moroteuthopsis ingens*	784	0.2	0	784
GRF	*Coelorinchus fasciatus*	561	0.1	0	561
CGO	*Cottoperca gobio*	542	0.1	0	542
RFL	*Dipturus lamillai*	535	0.1	0	213
DGH	*Schroederichthys bivius*	446	0.1	0	446
PTE	*Patagonotothen tessellata*	399	0.1	7	399
LIS	*Lithodes santolla*	397	0.1	0	397
ZYP	*Zygochlamys patagonica*	342	0.1	0	342
RAY	Rajiformes	331	0.1	0	31
DGS	*Squalus acanthias*	277	0.1	0	277
WHI	*Macruronus magellanicus*	261	0.1	1	261
MED	Medusa sp	231	0.1	0	231
STA	*Sterechinus agassizii*	211	<0.1	0	211
RBR	*Bathyraja brachyurops*	208	<0.1	0	12
GRC	*Macrourus carinatus*	204	<0.1	0	204
SPN	Porifera	201	<0.1	0	201
BAC	*Salilota australis*	178	<0.1	0	99
SQT	Ascidiacea	144	<0.1	0	144
GOC	*Gorgonocephalus chilensis*	128	<0.1	0	128
SAL	Salpa sp.	122	<0.1	0	122
MXX	Myctophidae spp.	99	<0.1	0	99
ILL	*Illex argentinus*	88	<0.1	4	88
ANM	Anemonia	71	<0.1	0	71
ALG	Algae	59	<0.1	0	59
CAZ	Calyptraster sp.	49	<0.1	0	49
OPV	*Ophiosabine vivipara*	42	<0.1	0	42
RMG	*Bathyraja magellanica*	38	<0.1	0	38
AST	Asteroidea	34	<0.1	0	34
BUT	*Stromateus brasiliensis*	34	<0.1	0	34
CHE	*Champsocephalus esox*	31	<0.1	0	31
KIN	*Genypterus blacodes*	27	<0.1	11	27
OPL	*Ophiuroglypha lymani*	26	<0.1	0	26
SUN	*Labidiaster radiosus*	21	<0.1	0	21
TRP	*Tripylaster philippii*	21	<0.1	0	21
THO	Thouarella	20	<0.1	0	20
POA	*Glabraster antarctica*	19	<0.1	0	19
CTA	*Ctenodiscus australis*	18	<0.1	0	18
RAL	*Bathyraja albomaculata*	17	<0.1	0	16
NEM	*Psychrolutes marmoratus*	16	<0.1	0	16
PAT	*Merluccius australis*	16	<0.1	5	16
WRM	Worm casings	14	<0.1	0	14
FUM	*Fusitriton magellanicus*	12	<0.1	0	12
HAK	*Merluccius hubbsi*	12	<0.1	7	12
MYX	Myxine spp.	12	<0.1	0	12
RDO	*Amblyraja doellojuradoi*	12	<0.1	0	12
EUL	*Eurypodius latreillii*	11	<0.1	0	11
MEV	*Metelectrona ventralis*	10	<0.1	0	10
ILF	*Iluocoetes fimbriatus*	9	<0.1	0	9
RGR	*Bathyraja griseocauda*	9	<0.1	0	0

Species Code	Species/Taxon	Total catch (kg)	Total catch (%)	Sample (kg)	Discard (kg)
RPX	Psammobatis spp.	9	<0.1	0	9
DIA	Diaulula spp.	8	<0.1	0	8
ALF	*Allothunnus fallai*	7	<0.1	0	7
MIR	Mirostenella sp.	7	<0.1	0	7
PAU	*Patagolycus melastomus*	6	<0.1	0	6
PAY	Paralomis spp.	6	<0.1	0	6
RMC	*Bathyraja macloviana*	6	<0.1	0	6
CEX	Ceramaster sp.	5	<0.1	0	5
PES	*Peltarion spinulosum*	5	<0.1	0	5
PYX	Pycnogonida	5	<0.1	0	5
AUC	*Austrocidaris canaliculata*	4	<0.1	0	4
ODM	*Odontocymbiola magellanica*	4	<0.1	0	4
EGG	Egg mass	3	<0.1	0	3
NUD	Nudibranchia	3	<0.1	0	3
BRY	Bryozoa	2	<0.1	0	2
HOL	Holothuroidea	2	<0.1	0	2
ISO	Isopoda	2	<0.1	0	2
MAM	*Neoachiropsetta milfordi*	2	<0.1	0	2
MUN	*Grimothea gregaria*	2	<0.1	0	2
NEP	Nephtheidae	2	<0.1	0	2
RED	*Sebastes oculatus*	2	<0.1	1	2
ACS	*Acanthoserolis schythei*	1	<0.1	0	1
BOA	*Borostomias antarcticus*	1	<0.1	0	1
CRY	Crossaster sp.	1	<0.1	0	1
EEL	Iluocoetes/Patagolycus mix	1	<0.1	0	1
FLX	Flabellum spp.	1	<0.1	0	1
MAV	*Magellania venosa*	1	<0.1	0	1
MLA	*Muusoctopus longibrachus akambei*	1	<0.1	0	1
PSX	Psolidae	1	<0.1	0	1
RMU	*Bathyraja multispinis*	1	<0.1	0	1
SRP	*Semirossia patagonica*	1	<0.1	0	1
TED	*Terebratella dorsata*	1	<0.1	0	1
ZOA	Azoanthidae	1	<0.1	0	1
AGO	*Agonopsis chiloensis*	<1	<0.1	0	0
ANU	*Anteliaster australis*	<1	<0.1	0	0
ASA	*Astrotoma agassizii*	<1	<0.1	0	0
ASP	Porifera	<1	<0.1	0	0
BRM	*Brucerolis macdonnellae*	<1	<0.1	0	0
COG	*Patagonotothen guntheri*	<1	<0.1	0	0
DEG	*Dendrobathypathes cf. grandis*	<1	<0.1	0	0
EUO	*Eurypodius longirostris*	<1	<0.1	0	0
PEN	Pennatuloidea	<1	<0.1	0	0
PRX	Paragorgia sp.	<1	<0.1	0	0
SAR	*Sprattus fuegensis*	<1	<0.1	0	0
THN	*Thysanopsetta naresi*	<1	<0.1	0	0

Table A3. Summary of otolith sample numbers by species by sex taken during the survey.

Species			No. of otolith pairs		
			M	F	J
PAR	Common Rockcod	*Patagonotothen ramsayi*	112	96	0
TOO	Patagonian Toothfish	*Dissostichus eleginoides*	85	100	0
BLU	Southern Blue Whiting	*Micromesistius australis*	54	29	3
PTE	Black southern rockcod	*Patagonotothen tessellata*	42	28	0
HAK	Common Hake	*Merluccius hubbsi*	1	8	0
THN	Small Flounder	*Thysanopsetta naresi*	4	0	0
PAT	Patagonian Hake	*Merluccius australis*	1	2	0
WHI	Whiptail Hake, Hoki	*Macruronus magellanicus*	0	1	0
RED	Patagonian Redfish	*Sebastes oculatus*	1	0	0
COG	Yellowfin Rockcod	*Patagonotothen guntheri*	0	1	0
AGO	Crocodile Fish	*Agonopsis chiloensis*	0	1	0