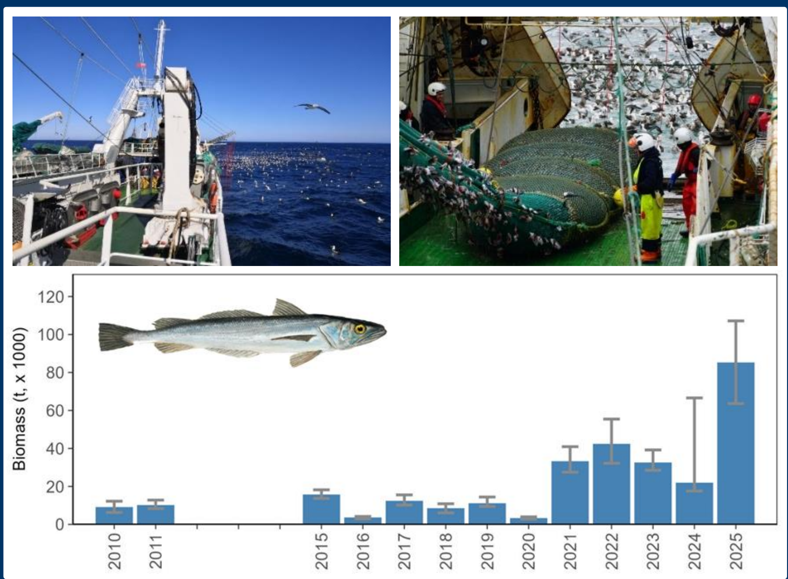
February bottom trawl survey biomasses of fishery species in Falkland Islands waters, 2010–2025



SA-2025-05

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Stanley, Falkland Islands

May 2025

For citation purposes this publication should be referenced as follows:

Ramos JE (2025) February bottom trawl survey biomasses of fishery species in Falkland Islands waters, 2010–2025. SA-2025-05. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 85 p.

Acknowledgements

We thank the captains and crews of the commercial fishing vessels, and the scientific observers of the Falkland Islands Fisheries Department (FIFD) that facilitated and assisted in catch and biological data collection. Comments provided by Frane Skeljo and Andreas Winter. Cover photo credits: J.E. Ramos, FIFD (top left), Toni Trevizan, FIFD (top right).

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Reviewed and approved on 21 May 2025 by:

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February bottom trawl survey biomasses of fishery species in Falkland Islands waters, 2010–2025

1. Summary

Survey biomass assessments of 11 commercial stocks (Argentine shortfin squid, banded whiptail grenadier, common hake, hoki, kingclip, Patagonian squid, red cod, rock cod, southern blue whiting, southern hake, and Patagonian toothfish) were carried out covering the area of the north and west of the Falkland Islands Interim Conservation and Management Zone (FICZ), the north in the Falkland Islands Outer Conservation Zone (FOCZ), and the 'Loligo Box'. The assessments were based on catch data of 1,818 bottom trawls conducted during the February parallel groundfish and calamari pre-season surveys in 2010, 2011, and 2015 to 2025.

Hoki, red cod, rock cod, and southern hake had statistically significant declining trends in biomass from 2010 to 2025. The estimated biomass of hoki in 2025 (6,842 t) was 2% of its estimated biomass in 2010 (278,980 t). Rock cod biomass in 2025 (124,187 t) was 15% of its biomass in 2010 (817,086 t). Red cod biomass in 2025 (16,521 t) was 17% of its biomass in 2010 (95,050 t), and southern hake biomass in 2025 (2,168 t) was 43% of its biomass in 2010 (5,097 t).

Kingclip biomass in 2025 (10,081 t) was the lowest in the time series, and was 47% of its biomass in 2010 (21,274 t); however, there was no significant decline in biomass from 2010 to 2025 due to considerable interannual biomass variability. Argentine shortfin squid, banded whiptail grenadier, Patagonian squid, Patagonian toothfish, and southern blue whiting also did not have statistically significant trends from 2010 to 2025.

Common hake had a statistically significant increase in biomass from 2010 to 2025, with its biomass in 2010 (9,124 t) being 11% of its biomass in 2025 (85,299 t).

In February 2025, the highest densities of the Argentine shortfin squid were to the west near the limit of the FICZ. High densities of common hake and rock cod were observed to the north-west. Banded whiptail grenadier, hoki, kingclip, Patagonian toothfish, red cod, and southern hake were mainly aggregated to the south-west, whereas southern blue whiting were mostly found to the north-east, and to the south-west and south-east in relatively lower concentrations.

Most stocks assessed in Falkland Islands waters are targeted across several nations' Exclusive Economic Zones, and for some stocks the Falkland Islands contribute a small proportion of the reported total shared catch in the Southwest Atlantic and Southeast Pacific. Declines in biomass of some of these stocks may also be in part due to fishing pressure outside Falkland Islands waters. However, Falkland Islands fisheries contribute a major proportion of the reported total shared catch for some stocks (i.e., rock cod and red cod), and the spawning grounds of some of these stocks are located in the Falklands shelf (i.e., hoki, rock cod, red cod, and southern blue whiting). Therefore, pertinent management decisions made at the Falkland Islands Fisheries Department (FIFD) are relevant for the sustainability of those stocks.

2. Introduction

The Falkland Islands shelf is located within the Patagonian large marine ecosystem, one of the most productive fishing areas in the world (Arkhipkin et al. 2012). The Patagonian large marine ecosystem is comprised of a southern temperate ecosystem in the north and a sub-Antarctic ecosystem in the south (Boltovskoy 1999). The temperate ecosystem lies within waters of subtropical origin, transported onto the shelf by the Brazil Current and mixed with temperate shelf waters. Several productive zones are revealed in this ecosystem, mainly due to the existence of tidal mixing oceanographic fronts, as well as seasonal fronts originating from cold fresh water inflows into the Strait of Magellan. The sub-Antarctic ecosystem lies within waters of sub-Antarctic origin transported onto the shelf by the Falkland Current (Peterson & Whitworth 1989). The Falkland Current diverges from the main stream of the Antarctic Circumpolar Current in the Drake Passage and turns northwards. The Falkland Current splits at the continental slope south of the Falkland Islands into a weak branch and a stronger branch that flow around the west and east of the Islands, respectively (Bianchi et al. 1982). These oceanographic features affect the distribution and abundance of marine species; for instance, Argentine shortfin squid (*Illex argentinus*) and hoki (*Macruronus magellanicus*) migrate to frontal zones for feeding and back to non-frontal zones for spawning (Agnew 2002). In contrast, migrations of deep-water fish such as Patagonian toothfish (*Dissostichus eleginoides*) into the shelf are favoured by intrusions of sub-Antarctic waters (Laptikhovsky et al. 2008; Arkhipkin & Laptikhovsky 2010).

Squid and fish species around the Falkland Islands have been targeted by international fishing fleets over decades. However, catch data by species only started to be recorded systematically from the year 1987 (Falkland Islands Government 1989). Total catches reached a maximum of 462,487 t in 2015, in part due to the unusual large intrusion of *I. argentinus* in Falkland Islands waters from April to May 2015 (Winter 2015) that resulted in record catches (332,862 t) for this species that year (Falkland Islands Government 1989, 2025).

Finfish license allocations in the Falkland Islands used to be set by Total Allowable Effort (TAE) calculated as a function of the catchability of an index species that represents the main target of the fishery. This approach worked under the assumption of consistent relationships among catch, effort, and biomass. The first index species for finfish TAE was southern blue whiting (*Micromesistius australis*). However, catches of southern blue whiting declined in the 1990s and the stock collapsed by 2009, whilst catches of rock cod (*Patagonotothen ramsayi*) peaked in 2010 (Laptikhovsky et al. 2013; Ramos & Winter 2023a). Hence, the index species was re-examined (Payá et al. 2010) and switched in 2011 from southern blue whiting to rock cod in order to set effort allocation. Catches of rock cod decreased since 2010 (Falkland Islands Government 2025; Ramos & Winter 2023a) whereas catches of common hake (*Merluccius hubbsi*) increased, and reached a maximum catch in 2022 (62,624 t; Falkland Islands Government 2025). The use of an index species to manage all Falkland Islands commercial species was thus considered unreliable, and the Falkland Islands Government mandated assessing each individual commercial stock. An important step to achieve this goal is to estimate the abundance and distribution of each commercial stock in the Falkland Islands Conservation Zones (FICZ and FOCZ) based on commercial and scientific surveys.

Fisheries-independent data are information about fish species and the environment (physical, chemical, and biological oceanographic data) collected through scientific surveys, which benefit from a standardised sampling plan and constant catchability, and are not directly influenced by commercial fishing activities (Hilborn & Walters 1992; Alglave et al. 2022; Gallo et al. 2022). The Falkland Islands Fisheries Department (FIFD) has carried out parallel groundfish and calamari (*Doryteuthis gahi*) pre-season surveys every February since 2010, except for 2012, 2013, and 2014. The groundfish surveys are conducted along the north, west and south-west in Falkland Islands waters. The calamari pre-season surveys are conducted along the 'Loligo Box' to the east of the Falkland Islands. The original objective of these February parallel demersal surveys was to provide a synchronous biomass estimate of rock cod on the entire Falklands fishing grounds (Winter et al. 2010), which has since been expanded to provide information on other commercial stocks. It is noted, however, that Falkland Islands waters represent only part of the range for most stocks examined, and for some migratory stocks February is not a time of peak abundance, i.e., common hake (Arkhipkin et al. 2015), kingclip (*Genypterus blacodes*; Arkhipkin et al. 2012), and southern blue whiting (Barabanov 1982). Stations to the south-west in the FICZ have also not been sampled equally in all years, which may influence biomass estimates for stocks that occur in that area during February, such as banded whiptail grenadier (*Coelorinchus fasciatus*), hoki, southern blue whiting, and Patagonian toothfish.

This report summarizes catch data jointly from the groundfish survey and the calamari pre-season survey, to estimate the biomass of key stocks in Falkland Islands waters since

2010. Previous index species (southern blue whiting and rock cod), and main commercial species are included in this report.

3. Methods

3.1. Trawl stations and biological sampling

Concurrent groundfish and calamari pre-season research surveys were carried out during February 2010–2011 and 2015–2025 onboard chartered fishing trawlers to cover the Falkland Islands fishing zone (Fig. 1). All trawls were bottom trawls; GPS latitude and longitude, net vertical opening, net horizontal opening, trawl door spread, and trawl speed were recorded on the ship's bridge when the net achieved the required configuration at the seafloor (based on net sensor readings, confirmed by the bridge officer), and every 15 minutes during the progress of each trawl (calamari pre-season survey).

All species from the catch of each trawl station were sorted by FIFD scientific staff and the vessel's factory crew. FIFD scientific staff recorded the total catch of each species assessed by a combination of weighing on an electronic balance to the nearest 0.01 kg and factory production records. Random samples of up to 100 individuals of each species were measured to the lowest 1 cm for finfish and to the lowest 0.5 cm for squid species. Dorsal mantle length was measured for Argentine shortfin squid and Patagonian squid (Calamari *D. gahi*). Total length was measured for common hake, kingclip, red cod (*Salilota australis*), rock cod, southern blue whiting, southern hake (*Merluccius australis*), and Patagonian toothfish. Pre-anal length was measured for banded whiptail grenadier and hoki. In this report, catches and length frequencies were assessed for eleven species that represent important commercial targets in the Falkland Islands and other nations' fishing zones (Table I; Appendix I).

The duration of each trawl was approximately 60 min on the bottom during groundfish surveys, and 120 min on the bottom during calamari pre-season surveys. Characteristics of the trawl nets, trawl performance, and biological sampling during groundfish (Brickle & Laptikhovsky 2010; Arkhipkin et al. 2011, 2019; Gras et al. 2015, 2016, 2017, 2018; Randhawa et al. 2020; Trevizan et al. 2021, 2022, 2023; Ramos et al. 2024, 2025) and calamari pre-season (Arkhipkin et al. 2010; Winter et al. 2011, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023; Chemshirova et al. 2024, *in prep.*) surveys can be consulted in detail in their respective survey reports. These surveys were designed to be consistent in the number and position of stations across years. However, there were variations in the number of stations mainly to the south-west of the FICZ for specific purposes of the February 2018 and 2020 groundfish surveys (Gras et al. 2018; Randhawa et al. 2020). In February 2022, a total of 42 stations were conducted instead of the usual number of stations (n ≈ 84) due to the survey being shortened because of COVID-19 quarantine requirements of the vessel's crew (Trevizan et al. 2022).

Table I. Main commercial species assessed in groundfish and calamari pre-season surveys in Falkland Islands waters during February 2010–2011 and 2015–2025. Geographic distributions taken from http://www.fao.org/fishery/species/search/en

Common name	Scientific name	Distribution
Argentine shortfin squid	*Illex argentinus*	Southwest Atlantic: Brazil, Uruguay, Argentina, Falkland Islands.
Banded whiptail grenadier	*Coelorinchus fasciatus*	Southwest Atlantic: Brazil, Uruguay, Argentina, Falkland Islands. Southern Pacific: Chile, Australia, New Zealand. Southern Indian: Africa, Australia.
Common hake	*Merluccius hubbsi*	Southwest Atlantic: Brazil, Uruguay, Argentina, Falkland Islands.
Hoki	*Macruronus magellanicus*	Southwest Atlantic: Argentina, Falkland Islands. Southeast Pacific: Chile.
Kingclip	*Genypterus blacodes*	Southwest Atlantic: Brazil, Uruguay, Argentina, Falkland Islands. Southern Pacific: Chile, Australia, New Zealand.
Patagonian squid	*Doryteuthis gahi*	Southwest Atlantic: Argentina, Falkland Islands. Southern Pacific: Peru, Chile.
Red cod	*Salilota australis*	Southwest Atlantic: Argentina, Falkland Islands. Southeast Pacific: Chile.
Rock cod	*Patagonotothen ramsayi*	Southwest Atlantic: Argentina, Falkland Islands.
Southern blue whiting	*Micromesistius australis*	Southwest Atlantic: Argentina, Falkland Islands. Southeast Pacific: Chile. Southern Ocean: South Georgia, South Shetland, South Orkney Islands.
Southern hake	*Merluccius australis*	Southwest Atlantic: Argentina, Falkland Islands. Southern Pacific: Chile, New Zealand.
Patagonian toothfish	*Dissostichus eleginoides*	Southwest Atlantic: Argentina, Falkland Islands. Southeast Pacific: Chile. Southwest Pacific: Macquarie Island. Southern Ocean: South Georgia.

3.2. Abundance calculations

Station and catch data were recorded during the surveys, checked and uploaded to the FIFD database, from which the data were available for analyses. Trawls were excluded if not quantifiable for the following reasons: 1) the trawl doors did not open properly, 2) the net broke during the trawl, or 3) if the net was quickly filled with medusae, which resulted in the trawl being interrupted (Appendix I).

Densities (kg/km^2) per species at each trawl station were calculated as the species catch weight divided by the trawl station area (distance covered × net horizontal opening). For calamari pre-season surveys, net horizontal opening was derived from the distance between trawl doors (Seafish 2010). For groundfish surveys, the triangulation method that derives net horizontal opening from the distance between trawl doors is unsuitable because the geometry of the net is different. Since 2016, groundfish survey net horizontal opening has instead been measured directly from Marport sensors fitted to the extremities of the survey vessel's trawl net wings. If net horizontal opening was not recorded due to failure of the Marport sensors, it was calculated from door spread, net vertical opening and/or trawl speed using a generalized additive model.

Yearly trawl biomass densities were extrapolated to the survey area combining the finfish zone (122,493.7 km^2) and 'Loligo Box' (31,296.9 km^2), partitioned into grids of 5×5 km^2. Position coordinates of trawls were converted to WGS 84 projection in UTM sector 21, and extrapolation was calculated using inverse distance weighting. The basic inverse distance weighting algorithm assigns a value *u* to any grid location *x* that is the weighted average of a known scattered set of points x_i according to the inverse of the *i* points' distances from the grid location *x*:

$$u(\mathrm{x}) = \begin{cases} \dfrac{\sum_{i=1}^{N} w_i(\mathrm{x}) u_i}{\sum_{i=1}^{N} w_i(\mathrm{x})}, & \text{if } d(\mathrm{x}, \mathrm{x_i}) \neq 0 \\ u_i, & \text{if } d(\mathrm{x}, \mathrm{x_i}) = 0 \end{cases}$$

where

$$w_i(\mathrm{x}) = \frac{1}{d(\mathrm{x}, \mathrm{x_i})^p}$$

The power parameter *p* (a positive real number) adjusts the weight of points x_i as a function of distance (x, x_i); higher values of *p* put higher influence on the points x_i closest to a given interpolated point *x*. For this survey analysis, an empirical approach to selecting *p* was used running the inverse distance weighting algorithm with *p* values from 1 to 25 by 0.25, and for each *p* calculating the aggregate of log proportional differences between the empirical values of density at every trawl and the interpolation at every trawl from all other trawls. The lowest aggregate of log proportional differences corresponded to the best *p* value. Because some points may be more clustered than others, an isolation parameter was assigned attributing more weight to points x_i in proportion to being further away from any other point x_j. Isolation parameters (*s*) per yearly survey were calculated as the standardized mean of distances between each point x_i and all other points x_j:

$$s(\mathrm{x_i}) = \overline{d(\mathrm{x_i}, \mathrm{x_j})}$$

An additional weighting factor was included to adjust for trawl differences in area coverage. Survey trawls are generally standardized (60 min duration in groundfish surveys and 120 min in calamari pre-season surveys), but may be shortened on immediate notice for reasons that include unmanageably large concentrations of fish accumulating in the net. Such instances will result in the trawl being stopped just when its biomass density is maximized, rather than being stopped independently of the biomass density, and thereby create a potential bias of the density estimate at that location. For shoaling fish in sparse, highly aggregated distributions, the effect can be substantial (i.e., hoki; Appendix II in Ramos & Winter 2022a). However, the trawl itself is not an error record that should be invalidated and removed from the data set. To mitigate the potential bias effect, swept area of each trawl was taken as a proportional weighting parameter so that a shortened trawl covering, for example, only half as much ground would have only half as much weight. Like the isolation parameters $s(\mathrm{x_i})$, the area parameters $a(\mathrm{x_i})$ were standardized (divided by their mean among all trawls), then $s(\mathrm{x_i})$ and $a(\mathrm{x_i})$ were added together and divided again by their sum to give a factor centred on 1. The revised inverse distance weighting factor is:

$$w_i(\mathrm{x}) = \left(\frac{\left(\frac{s(\mathrm{x_i}) + a(\mathrm{x_i})}{\overline{\left(s(\mathrm{x_i}) + a(\mathrm{x_i})\right)}} \right)}{d(\mathrm{x}, \mathrm{x_i})} \right)^p$$

Distance $d(x, x_i)$ is inherently calculated as Euclidean (straight-line) distance. However, the survey area surrounds the Falkland Islands and between two remote points a fish or ship would have to travel a real distance longer than straight-line; circumnavigating the landmass. Therefore, an axial loop was drawn through the survey area (Fig. 1), and $d(x, x_i)$ was defined as the longer of either the Euclidean distance between x and x_i, or the distance on the axial loop between its two points respectively closest to x and x_i (Winter 2019).

As an extrapolation algorithm, calculated biomass over a given area will depend on the spatial distribution of surveyed densities, not just their total or average value. Accordingly, the biomass is considered an estimate.

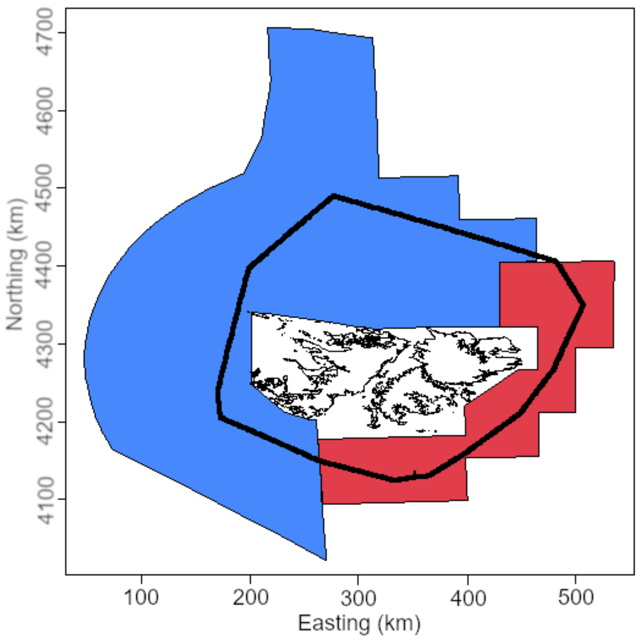


Fig. 1. Groundfish (blue) and calamari pre-season (red) survey areas, with axial loop (black line) used to define relative distances for the inverse distance weighting algorithm.

Uncertainty of the biomass estimate was calculated by a hierarchical bootstrap algorithm. Survey trawls and their catches were first randomly re-sampled with replacement for 10,000 iterations, whereby each year's groundfish survey and parallel calamari pre-season survey were re-sampled separately so that both 'halves' of the survey area retained about the same relative coverage. Second, each re-sampled trawl was given a random uniform re-assignment of its coordinate position between start latitude and longitude and end latitude and longitude. Third, the isolation parameters were re-calculated for the randomized set of trawl data, and the inverse distance weighted algorithm re-applied. One iteration might thus re-sample any trawl twice or more, but each would have a slightly different position. The 95% confidence intervals of the 10,000 bootstrap iterations were used to infer uncertainty.

LOESS (span = 1.0, C.I. = 0.95) was implemented to examine changes in biomass through time from the yearly estimates.

4. Results

4.1. Trawls

A total of 1,818 bottom trawls were carried out during the February groundfish and calamari pre-season surveys from 2010–2011 and 2015–2025; a range of 42 to 97 trawls were carried out during groundfish surveys per year, and 52 to 64 trawls were carried out during calamari pre-season surveys per year. In 2025, a total of 84 trawls were carried out during the groundfish survey, and 60 trawls were carried out during the calamari pre-season survey (Appendix I).

4.2. Abundance, distribution and size structure

Biomass estimates and catches of each commercial stock assessed during the February parallel demersal surveys 2010–2025 are summarized in Table II and in Appendix II, respectively. Biomass histograms from 10,000 bootstrap iterations of each commercial stock are in Appendix III. Biomass trends of each commercial stock assessed over the same period of time are shown in Appendix IV. The spatial distribution of densities of each stock during the February 2025 parallel demersal surveys are in Appendix V.

Table II. Biomass calculations (t) of main commercial species during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters. The 95% confidence intervals are indicated in parentheses.

Year	Argentine shortfin squid	Banded whiptail grenadier	Common hake	Hoki
2010	8633.92 (3510.35–13384.35)	66622.68 (40514.45–98311.11)	9124.06 (6280.46–12219.25)	278980.21 (188264.88–457666.96)
2011	9294.45 (6777.82–12564.25)	43482.30 (20547.39–73607.37)	10180.24 (8330.32–12809.67)	221132.74 (172507.38–281186.26)
2015	210513.16 (129839.58–365643.99)	60434.68 (35864.88–77202.47)	15758.48 (13700.90–18213.42)	134733.17 (44674.67–179592.78)
2016	201.73 (146.47–263.11)	34897.77 (8500.93–55042.45)	3661.91 (2974.25–4175.68)	158388.16 (79371.74–222823.65)
2017	11830.16 (7412.76–18225.10)	36736.93 (19596.89–43533.35)	12419.11 (10191.95–15538.58)	28882.54 (16801.50–38817.08)
2018	45086.43 (30158.94–64394.07)	34256.01 (27633.27–43657.43)	8534.38 (6048.05–10877.41)	141953.50 (92768.34–204228.49)
2019	60076.25 (40113.04–93531.22)	21976.99 (9186.12–36085.96)	11151.32 (9483.58–14419.93)	41864.81 (5779.47–166317.90)
2020	148081.91 (89302.24–196203.10)	25225.42 (8358.90–43250.89)	3340.09 (2846.51–3971.84)	75402.28 (20203.23–143531.23)
2021	42780.70 (20466.20–68912.67)	68844.80 (32834.53–85342.42)	33281.79 (27502.33–40938.52)	245890.30 (92470.50–431476.19)
2022	5823.75 (2397.40–30856.33)	49558.54 (25192.54–102067.28)	42420.98 (32223.84–55471.45)	144782.83 (12362.55–248962.54)
2023	10483.67 (7614.37–15619.55)	34369.51 (22666.50–46028.90)	32616.58 (28532.20–39221.03)	131715.33 (37696.82– 212465.82)
2024	61986.65 (52241.58–81690.59)	36692.12 (20129.73–49562.23)	21981.6 (17585.78–66611.91)	46549.50 (22017.84–77799.87)
2025	51153.37 (32561.35–74764.10)	27692.81 (19309.04–36038.47)	85299.39 (63653.77–107187.97)	6842.43 (1973.31–12060.90)

Table II. *continued*

Year	Kingclip	Patagonian squid	Patagonian toothfish	Red cod
2010	21274.04 (13705.30–28607.34)	184615.48 (160421.18–239516.37)	9492.17 (7096.05–11727.84)	95050.09 (18335.99–158897.80)
2011	41485.02 (28424.85–63121.38)	47236.55 (39537.83–62533.45)	10588.19 (7859.83–13377.29)	166617.50 (39230.31–258711.16)
2015	76722.26 (30150.81–124958.88)	112296.69 (82994.09–164421.27)	3730.91 (1359.57–4477.02)	106244.23 (45278.81–160780.36)
2016	24782.64 (13955.05–39613.42)	41292.65 (34357.75–53300.16)	7472.12 (5373.64–10194.34)	102789.02 (28384.22–149860.74)
2017	18831.90 (11873.32–28544.00)	182113.39 (145101.61–234454.73)	9316.94 (5662.92–11183.99)	59568.95 (22863.35–86532.41)
2018	14788.92 (11069.78–21527.00)	63154.37 (44073.52–96689.36)	8633.46 (6276.48–10886.50)	57422.88 (19277.51–117355.42)
2019	20869.45 (14764.62–28127.04)	214492.39 (188175.67–259467.94)	6173.70 (3162.82–7794.58)	83005.12 (35235.62–119480.37)
2020	14531.98 (10052.06–26304.43)	91415.65 (80832.08–126778.53)	2499.29 (1621.34–3392.18)	21889.98 (10993.21–32014.04)
2021	21216.07 (12901.88–35823.59)	119433.40 (98119.16–165138.90)	4395.03 (2825.50–4845.25)	35217.39 (22852.74–51663.11)
2022	43437.30 (14738.11–80447.75)	167439.23 (131702.50–235968.93)	3877.36 (2080.95–5151.07)	81176.73 (34162.13–129660.26)
2023	35880.61 (18884.19–58232.85)	190506.92 (156060.20–262829.20)	3350.25 (1991.62–4590.57)	38861.12 (20178.92–56206.64)
2024	16597.44 (11950.68–27609.68)	206976.96 (181079.58–288983.91)	4284.69 (3078.91–5092.08)	47937.57 (20903.51–70057.72)
2025	10080.51 (4415.44–21118.61)	109302.57 (93488.70–141403.72)	6393.09 (4806.11–7627.01)	16520.89 (6578.36–30412.18)

Table II. *continued*

Year	Rock cod	Southern blue whiting	Southern hake
2010	817086.43 (519306.26–1306091.27)	68447.18 (25380.63–91314.04)	5096.76 (3910.63–6443.37)
2011	884741.55 (716079.56–1064218.58)	154691.35 (42459.43–357267.81)	5223.77 (3445.99–8095.63)
2015	350913.41 (269667.68–432687.92)	35307.57 (12197.06–80184.05)	2961.07 (1750.69–4350.03)
2016	232429.14 (177911.14–306135.45)	113986.55 (25096.46–204263.77)	1971.72 (1204.90–2963.73)
2017	141469.65 (113896.56–176351.05)	54456.87 (1375.47–65699.77)	1829.09 (1021.33–2478.36)
2018	90679.85 (63308.48–122537.23)	57963.36 (17839.34–69597.20)	1453.02 (978.54–1947.08)
2019	45669.16 (29040.32–66668.90)	5856.24 (205.30–34084.93)	425.70 (88.45–577.12)
2020	19079.02 (11656.70–27065.20)	4989.54 (26.73–15435.54)	593.71 (230.37–868.25)
2021	59670.41 (45689.57–66885.68)	13567.47 (3616.43–25713.15)	1943.34 (919.34–2941.07)
2022	93177.17 (58753.11–131454.56)	19200.92 (877.49–48977.89)	920.22 (574.62–1471.85)
2023	64729.11 (51235.90–78204.69)	39575.05 (9904.22–67656.97)	1247.99 (629.48–2028.57)
2024	122995.42 (87911.52–164719.01)	67202.42 (21635.73–134012.68)	2281.6 (1734.88–5932.60)
2025	124187.41 (68446.37–173470.28)	68215.25 (33451.15–112700.16)	2168.10 (1259.63–2924.16)

4.2.1. Argentine shortfin squid (*Illex argentinus*)

On average, 91% of the total Argentine shortfin squid catches were from groundfish surveys in any year. The highest catch was reported in 2015 (32 t) and the lowest catch in 2016 (0.1 t), with the catch of 2025 (13 t) being above the average (9 t) from 2010 to 2024 (Fig. 2; Appendix II). The maximum biomass was estimated in 2015 (210,513 t) whereas the lowest biomass was estimated for 2016 (202 t). The biomass calculated for 2025 (51,153 t) was lower than the biomass calculated for 2024, and it was near the average (51,233 t) from 2010 to 2024 (Fig. 2; Table II). Argentine shortfin squid biomass in 2010 (8,634 t) was 17% of its biomass in 2025 but did not have a significant inter-annual trend for the period 2010 to 2025 (Appendix IV).

In 2025, this species was distributed to the west, with the highest densities near the limit of the FICZ (10,074 kg/km^2; Fig. 3). This may be an indication of patches of higher abundance beyond the west limit of the FICZ at the time of the surveys, just before this species starts migrating into Falkland Islands waters. Across years, the Argentine shortfin squid was mainly distributed through the north and west in the FICZ, with the highest density in the time series reported to the north of East Falkland during 2015 (74,434 kg/km^2; Appendix VI).

Length frequency histograms show a range of sizes of *I. argentinus* from 5 cm to 36.5 cm across years. At least two length-groups were detected every year. The modal dorsal mantle length of the smaller group was nearly 9.0 cm, and the modal dorsal mantle length of the larger group ranged from 22 cm to 23 cm. In 2025, the main length-group was detected at about 23 cm dorsal mantle length, with females being larger than males. No juveniles were collected during the surveys (Fig. 4).

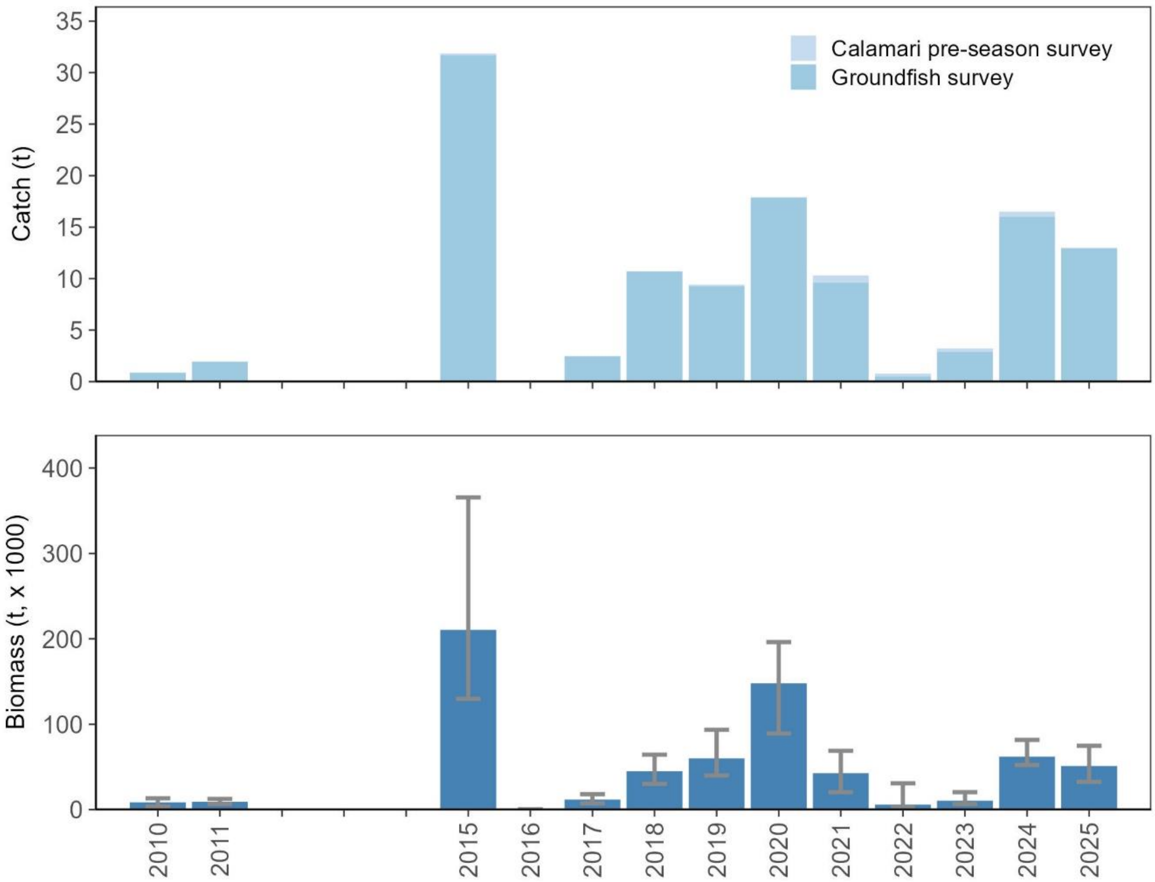


Fig. 2. Catch (t), and mean biomass (t) ± 95% confidence intervals of the Argentine shortfin squid (*Illex argentinus*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

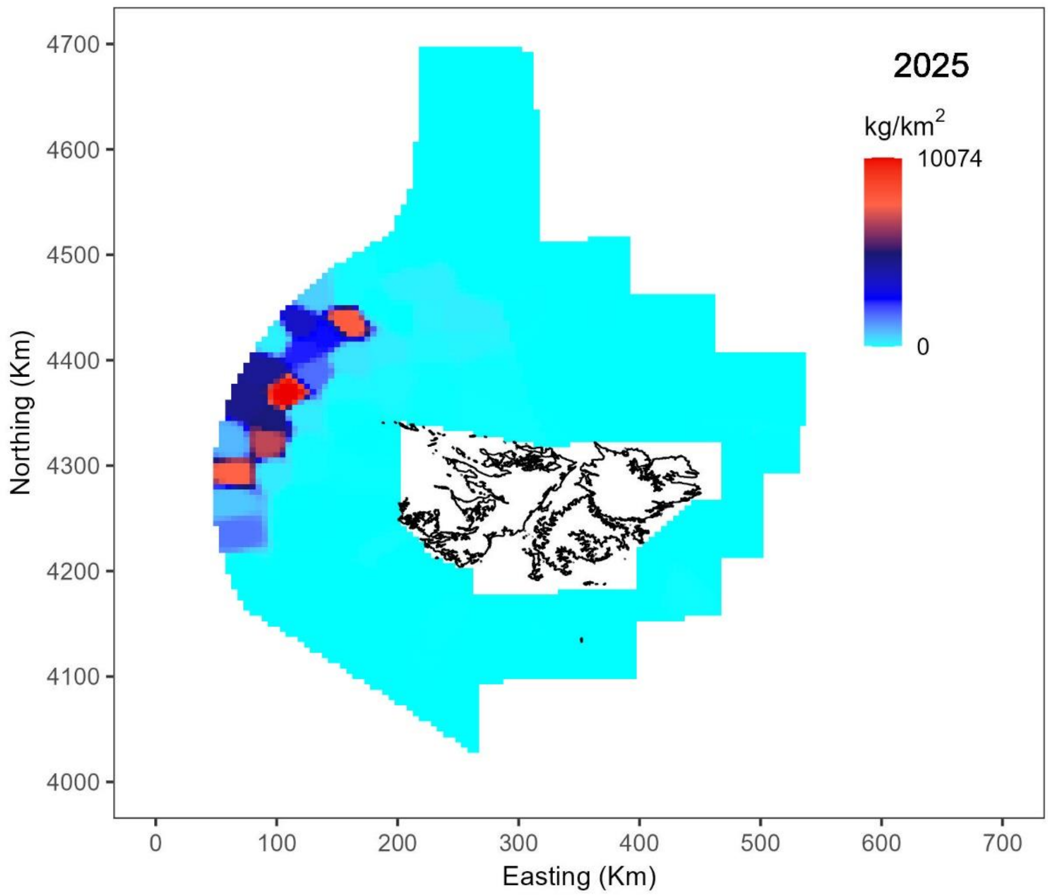


Fig. 3. Distribution and abundance of the Argentine shortfin squid (*Illex argentinus*) calculated from the February 2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

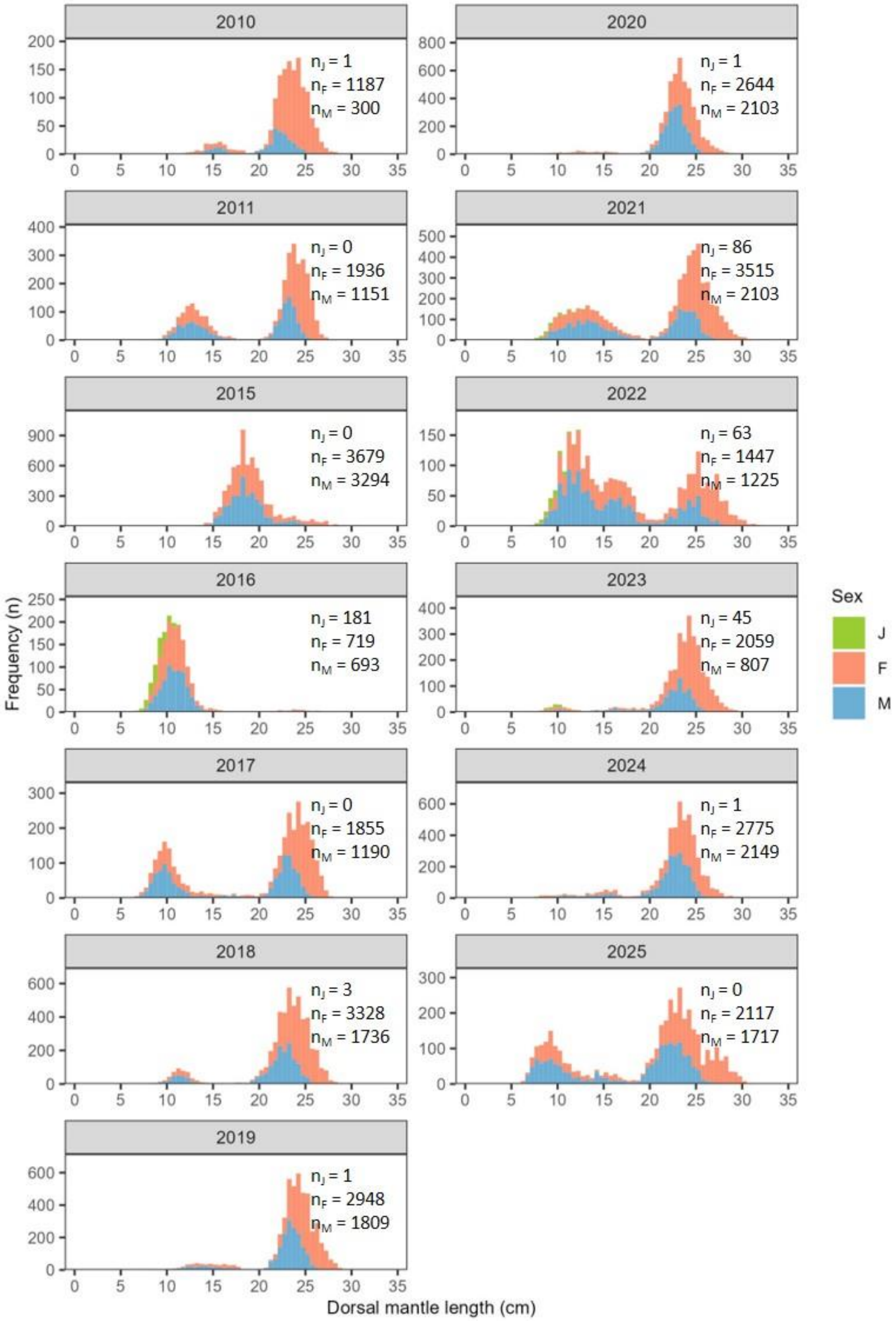


Fig. 4. Length-frequency distribution of Argentine shortfin squid (*Illex argentinus*) during the February groundfish and calamari pre-season surveys in Falkland Islands waters. Bars are superimposed.

4.2.2. Banded whiptail grenadier (*Coelorinchus fasciatus*)

Patterns of catch and biomass across years were variable, likely due to the small catches and patchy distributions of this species, which also reflects in wide biomass confidence intervals (Table II). On average, 90% of the total banded whiptail grenadier catches were from groundfish surveys. Total catches of banded whiptail grenadier ranged between 2.5 t and 8 t, with the catch in 2025 (4.7 t) being below the average (5 t) from 2010 to 2024 (Fig. 5; Appendix II). The biomass of banded whiptail grenadier ranged from 21,977 t in 2019 to 68,845 t in 2021, with no evident trend through time. The biomass in February 2025 was calculated at 27,693 t, which is below the average (42,758 t) from 2010 to 2024, and is 42% of its biomass in 2010 (66,623 t) (Fig. 5; Table II; Appendix IV).

Banded whiptail grenadier was distributed to the south-west of West Falkland during 2025, with the maximum density calculated at 2,323 kg/km^2 (Fig. 6). Across years, there was a consistent pattern of distribution to the south-west of West Falkland with the highest density calculated for 2011 (9,126 kg/km^2; Appendix VII).

Length frequency histograms of banded whiptail grenadier show a range of sizes from 2 cm to 20 cm pre-anal length. One mode was evident every year and remained constant through time, i.e., 9–10 cm pre-anal length for females and for males, with females often being larger than males (Fig. 7).

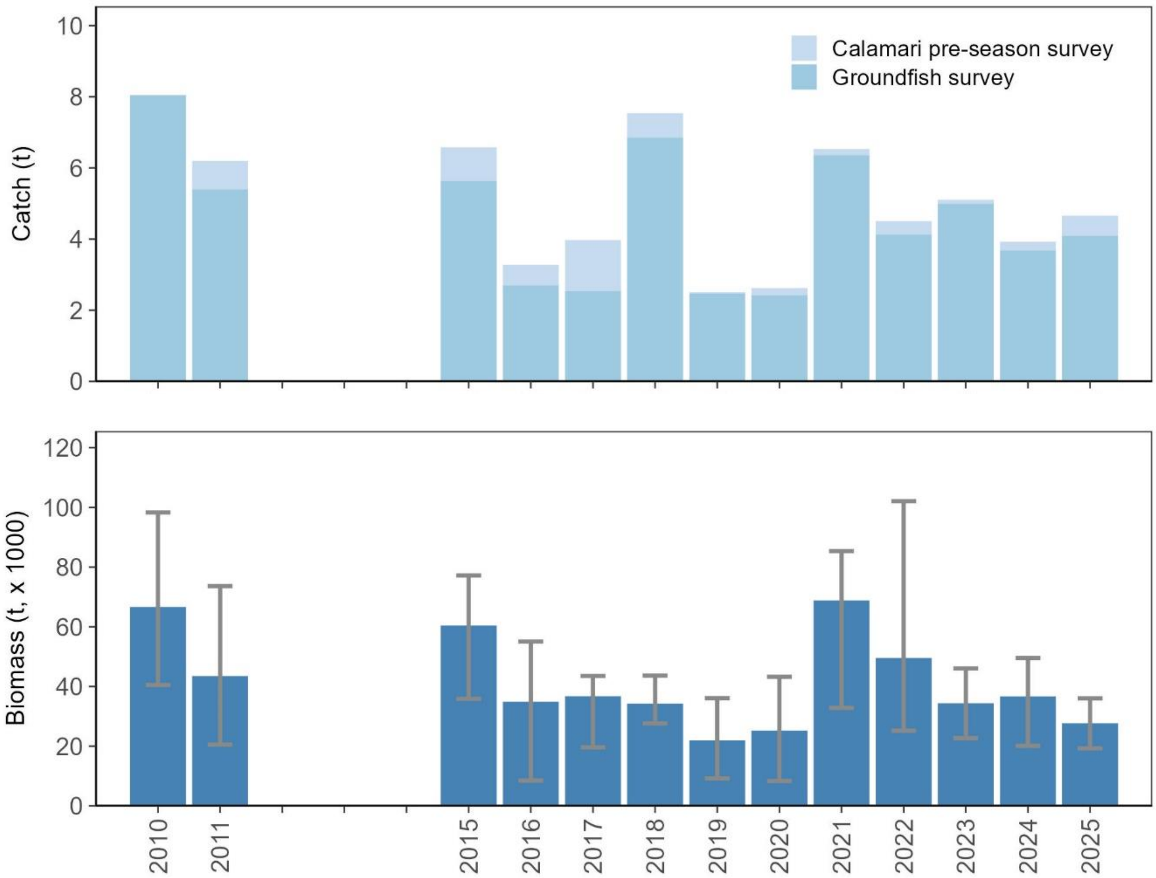


Fig. 5. Catch (t), and mean biomass (t) ± 95% confidence intervals of banded whiptail grenadier (*Coelorinchus fasciatus*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

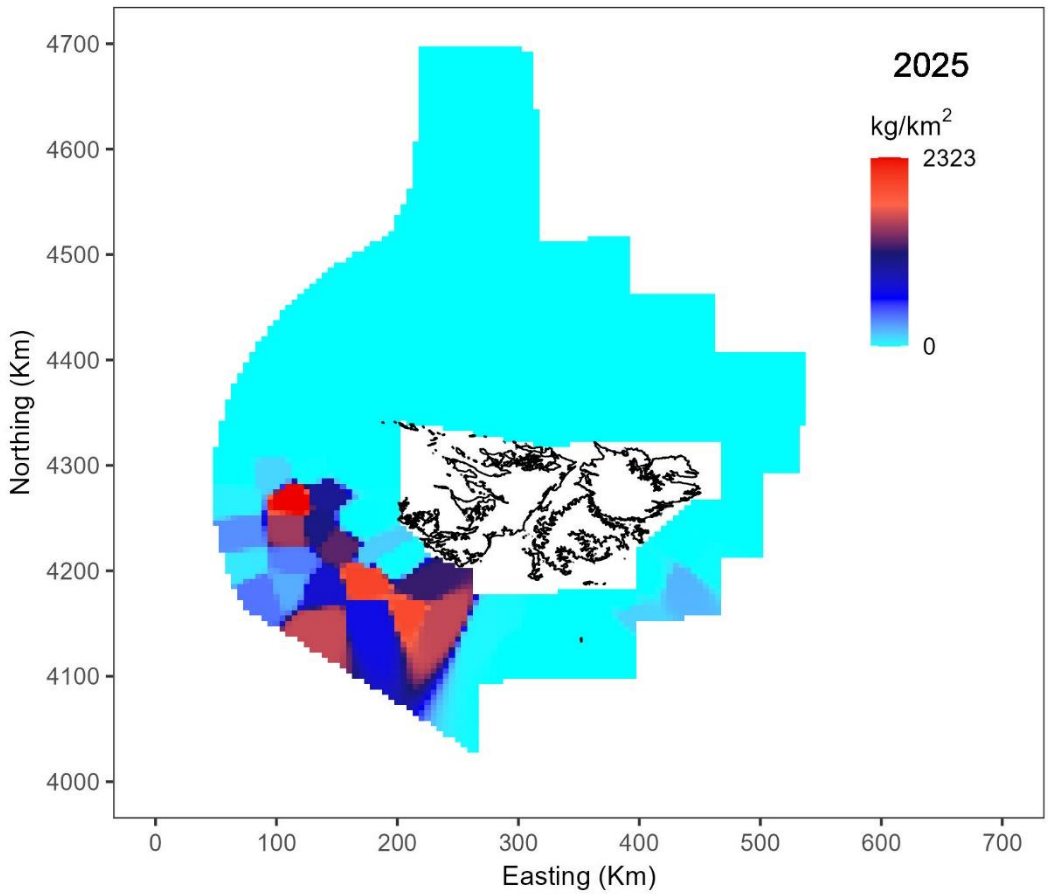


Fig. 6. Distribution and abundance of banded whiptail grenadier (*Coelorinchus fasciatus*) calculated from the February 2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

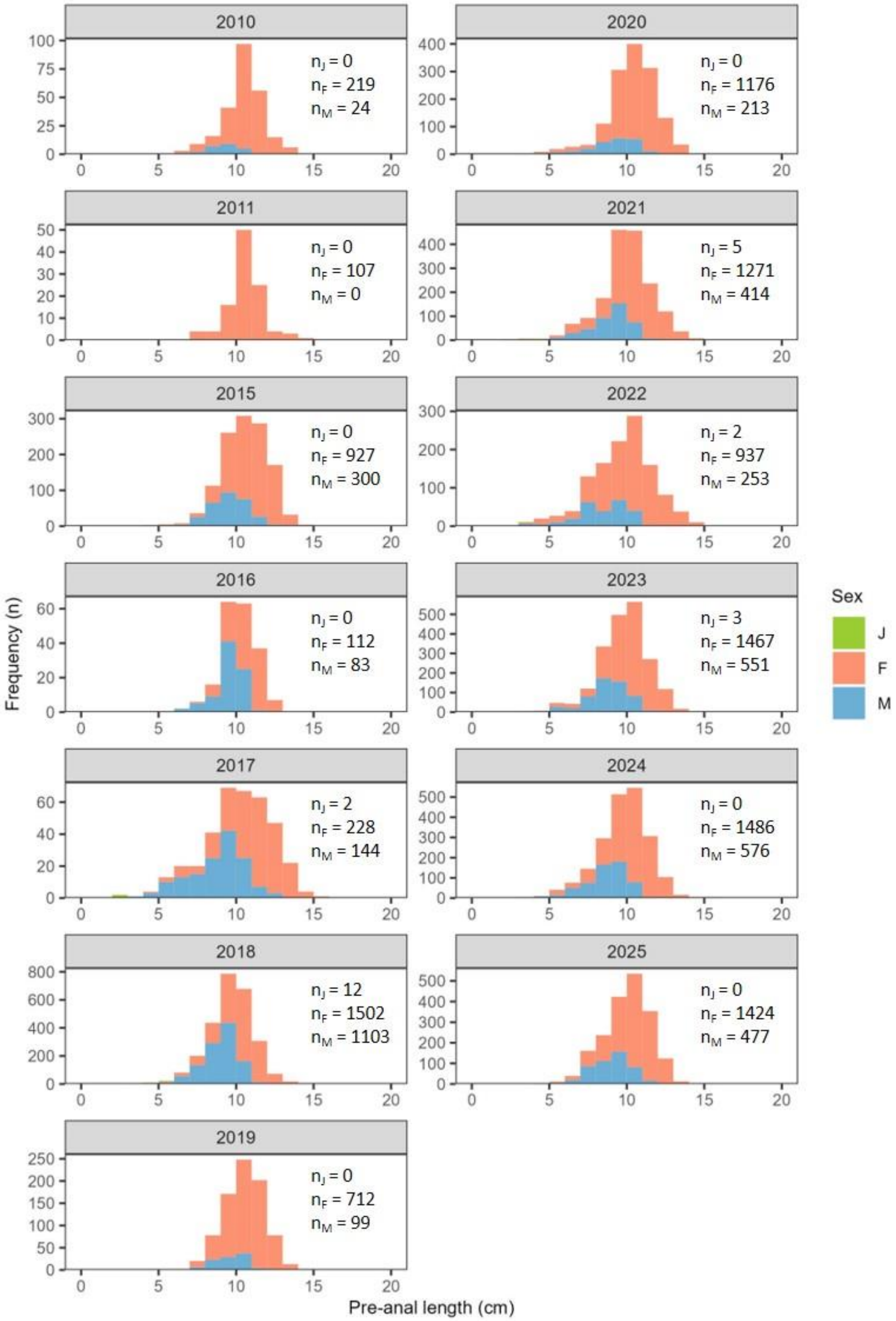


Fig. 7. Length frequency of banded whiptail grenadier (*Coelorinchus fasciatus*) during the February groundfish and calamari pre-season surveys in Falkland Islands waters. Bars are superimposed.

4.2.3. Common hake (*Merluccius hubbsi*)

Common hake were mainly caught in groundfish surveys through the time series, averaging 99% of the surveys' total common hake catch. The average catch of common hake from 2010 to 2024 was 3.6 t; the total catch of common hake reached a maximum in 2025 with 17 t (Fig. 8; Appendix II). The biomass of common hake was calculated at 9,124 t in 2010 and reached its highest value in 2025 (85,299 t) (Fig. 8; Table II), resulting in a statistically significant increase in biomass from 2010 to 2025 (Appendix IV).

In 2025, common hake was mainly distributed to the north-west of West Falkland with the highest density estimated at 8,294 kg/km^2 (Fig. 9). Migration of common hake into Falkland Islands waters is likely driven by specific oceanographic conditions, and takes place in February when the surveys are being conducted. Hence, changes in oceanographic conditions may result in year-to-year abundance variability for this species during February in Falkland Islands waters that may not be proportional to overall population abundance. Across years, high densities were detected to the north-west offshore or near the north-west limit of the FICZ, with the highest density calculated for 2025 (8,294 kg/km^2; Appendix VIII).

Length frequency histograms show a wide range of common hake sizes, from 13 cm to 95 cm total length, across the time series. Common hake >60 cm total length have been rare since 2015. In 2025, one length-group was detected, with modal lengths at 38 cm and at 36 cm total length for females and for males, respectively, and with smaller modal lengths compared with 2024 (Fig. 10).

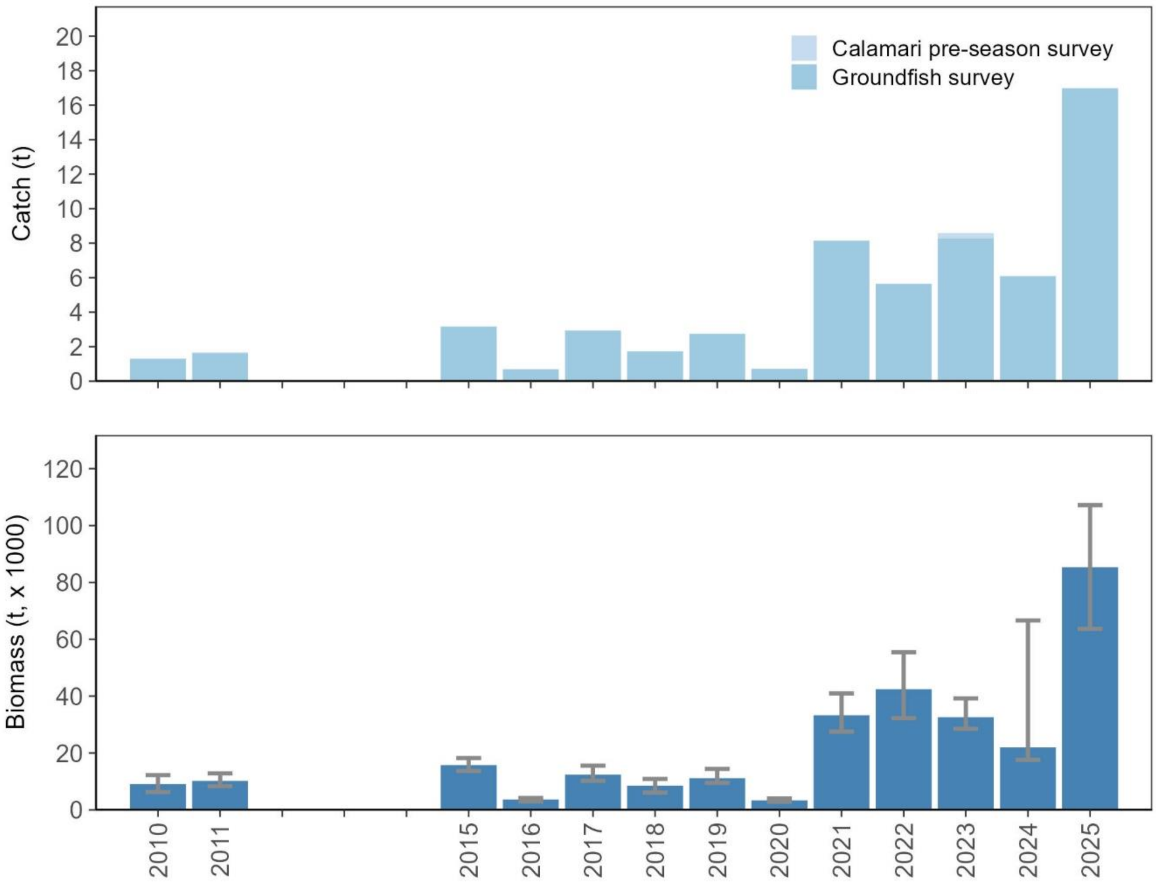


Fig. 8. Catch (t), and mean biomass (t) ± 95% confidence intervals of common hake (*Merluccius hubbsi*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

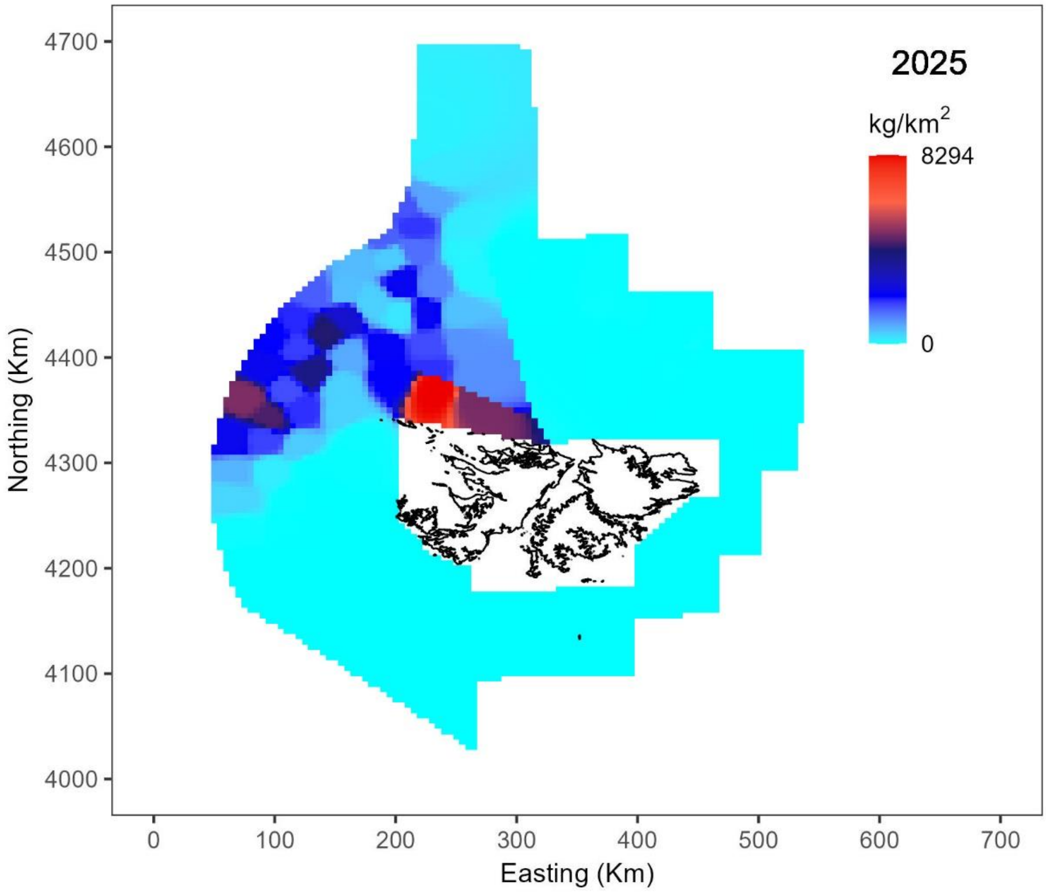


Fig. 9. Distribution and abundance of common hake (*Merluccius hubbsi*) calculated from the February 2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

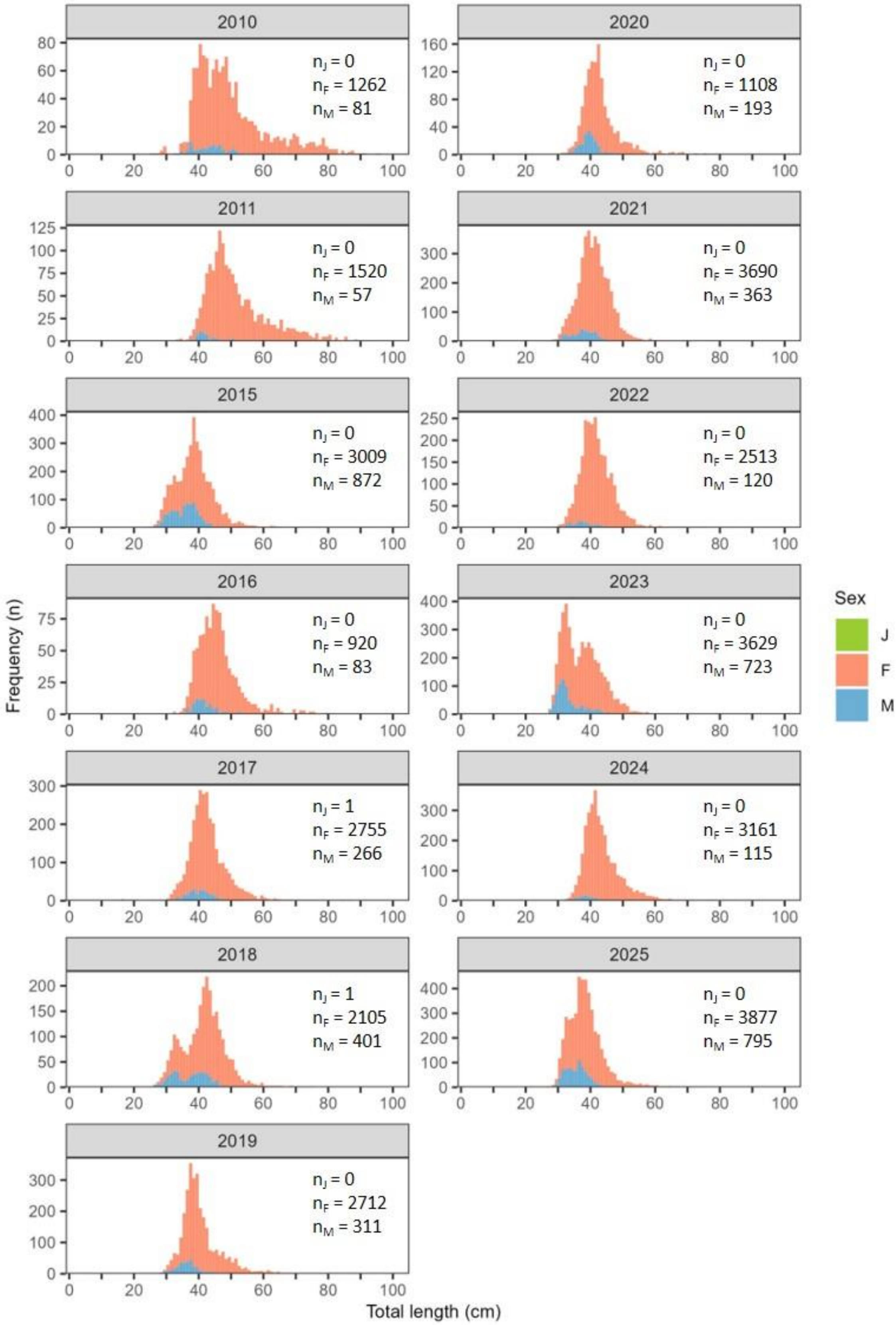


Fig. 10. Length frequency of common hake (*Merluccius hubbsi*) during the February groundfish and calamari pre-season surveys in Falkland Islands waters. Bars are superimposed.

4.2.4. Hoki (*Macruronus magellanicus*)

Hoki catches were nearly evenly split between groundfish and calamari pre-season surveys in 2010, 2011, and 2015, 2016. However, hoki catches were taken predominantly in groundfish surveys from 2017 to 2023 at an average of 97% of the combined surveys' total hoki catch. In 2024, hoki catches were higher in the calamari pre-season survey, at 73% of the total hoki catch. The opposite was observed in 2025, with the groundfish survey having 76% of the total hoki catch (Fig. 11). The highest catch was reported in 2010 (80 t) and the lowest catch was reported in 2025 (1.1 t); the average hoki catch from 2010 to 2024 was 28 t (Appendix II). The highest biomass in the time series was calculated for 2010 (278,980 t) and the lowest was calculated for 2025 (6,842 t); the average biomass from 2010 to 2024 was 137,523 t. Hoki biomass in 2025 was 2% of its biomass in 2010 (Fig. 11; Table II), with a statistically significant decrease in biomass from 2010 to 2025 (Appendix IV).

In 2025, hoki was found close to the south-west edge of the FICZ with the highest density calculated at 1,792 kg/km^2 (Fig. 12). The distribution of hoki has been patchy and variable from year to year. From 2010 to 2015, hoki occurred over the entire FICZ and FOCZ. However, its distribution was localized mainly to the south-west of West Falkland from 2016 to 2025 (Appendix IX); the highest density in the time series occurred close to the south-west limit of the FICZ in 2021 (146,194 kg/m^2).

Length frequency histograms show a range of sizes from 11 cm to 47 cm pre-anal length across the time series. The largest animals (≥ 35 cm pre-anal length) have been less frequent since 2018. In 2025, length frequency histograms allowed detecting two length-groups with modal lengths at 22 cm and at 28 cm pre-anal length for both females and males (Fig. 13).

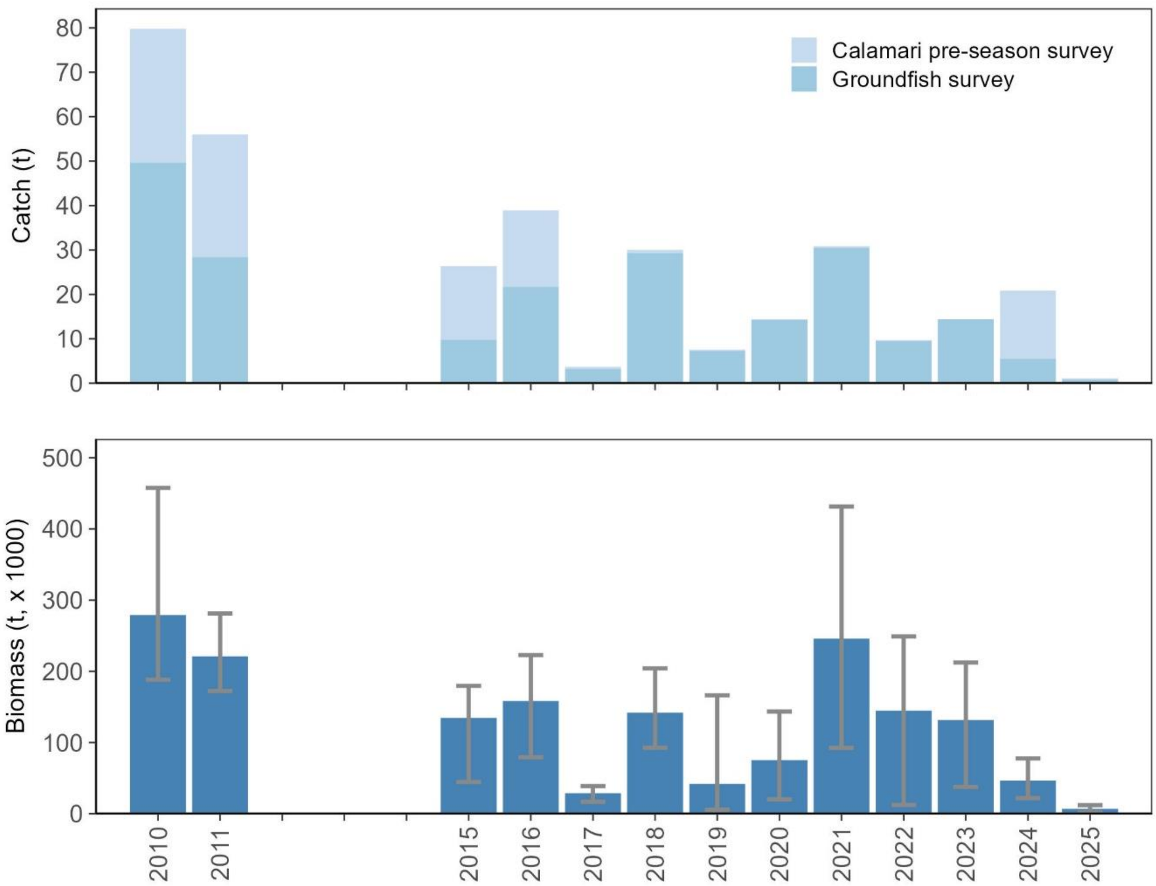


Fig. 11. Catch (t), and mean biomass (t) ± 95% confidence intervals of hoki (*Macruronus magellanicus*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

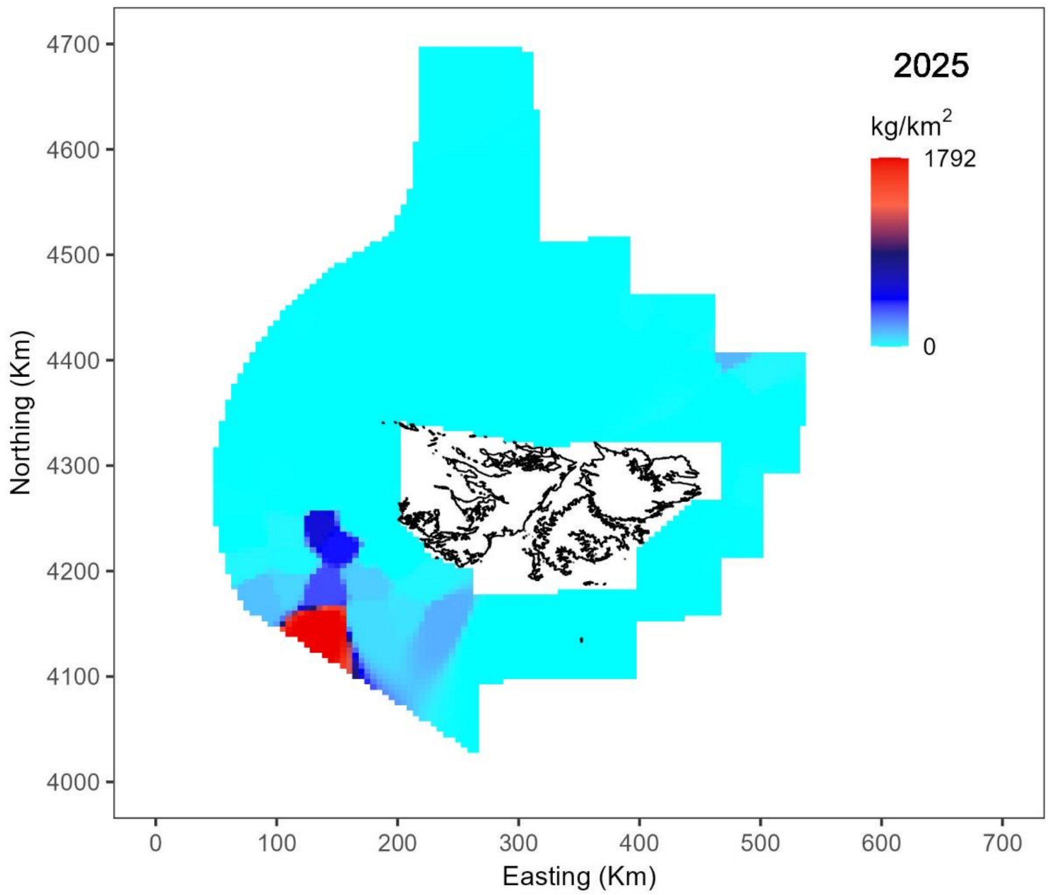


Fig. 12. Distribution and abundance of hoki (*Macruronus magellanicus*) calculated from the February 2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

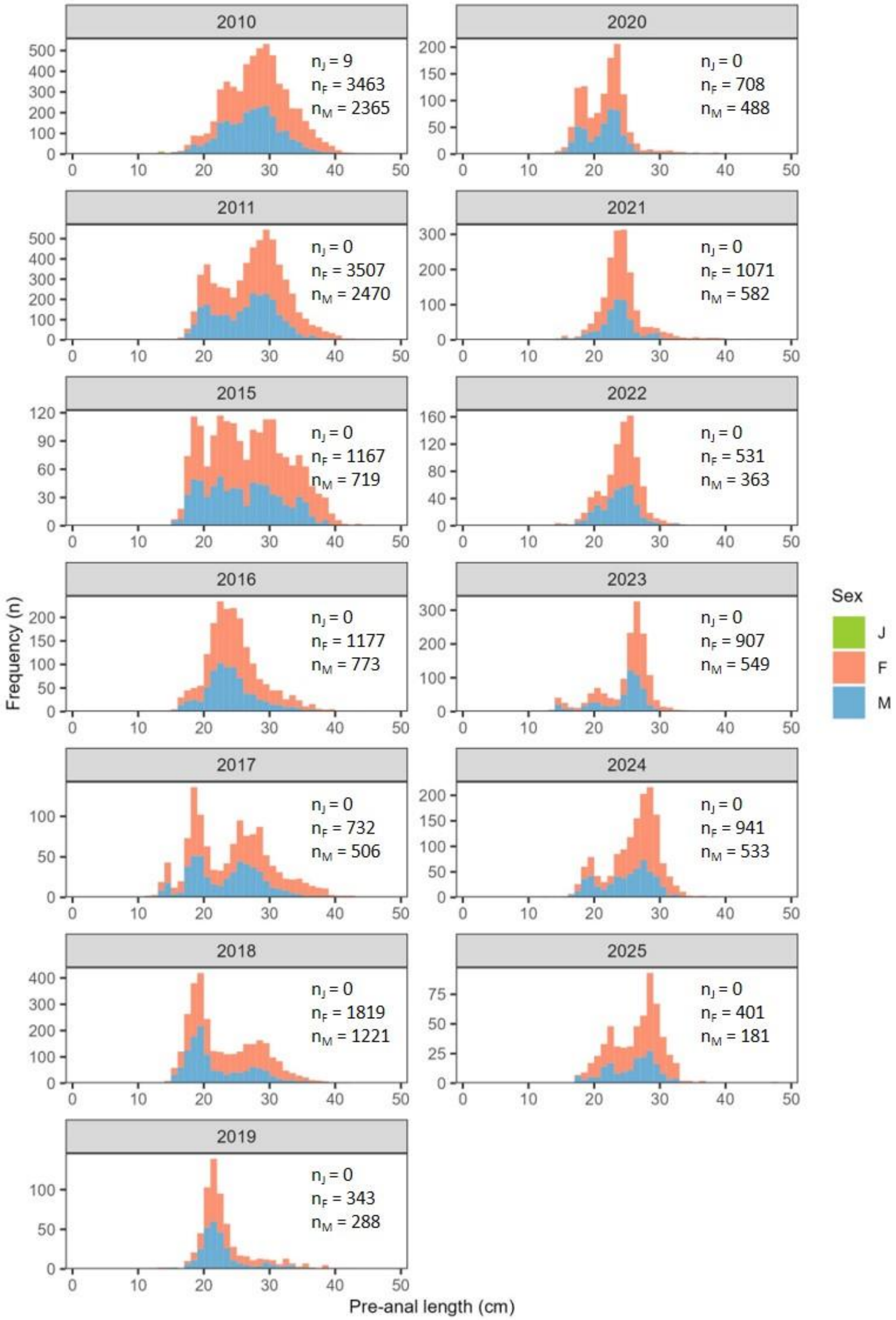


Fig. 13. Length frequency of hoki (*Macruronus magellanicus*) during the February groundfish and calamari pre-season surveys in Falkland Islands waters. Bars are superimposed.

4.2.5. Kingclip (*Genypterus blacodes*)

Most kingclip were caught in groundfish surveys (an average of 94% of the total kingclip catch across years) compared with calamari pre-season surveys. The highest catch of kingclip occurred in 2015 (14.7 t), whereas the lowest catch in the time series occurred in 2025 (2.4 t), which was below the average (6 t) from 2010 to 2024 (Fig. 14; Appendix II). Kingclip biomass in 2015 was the highest (76,722 t) in the time series, and the lowest biomass was calculated for 2025 (10,081 t). The average biomass from 2010 to 2024 was 29,201 t. Kingclip biomass in 2025 was 47% of its biomass in 2010 (21,274 t) (Fig. 14; Table II). However, there was no statistically significant trend in biomass from 2010 to 2025 (Appendix IV).

In 2025, the highest density (4,835 kg/km^2) of kingclip occurred to the south-west near West Falkland, with patches of relatively high density along the west (Fig. 15). Throughout the time series, kingclip was dispersed around the FICZ and FOCZ, except for the south-east. The highest density in the time series was 32,774 kg/km^2 to the north-west in 2015 (Appendix X).

Length frequency histograms show a wide range of kingclip sizes across the time series, from 23 cm to 136 cm total length. In 2025, overlap in sizes did not allow detecting distinct length-groups. Females were on average larger than males, with a modal length detected for females at 80–87 cm total length, and a modal length detected for males at 69–73 cm total length (Fig. 16).

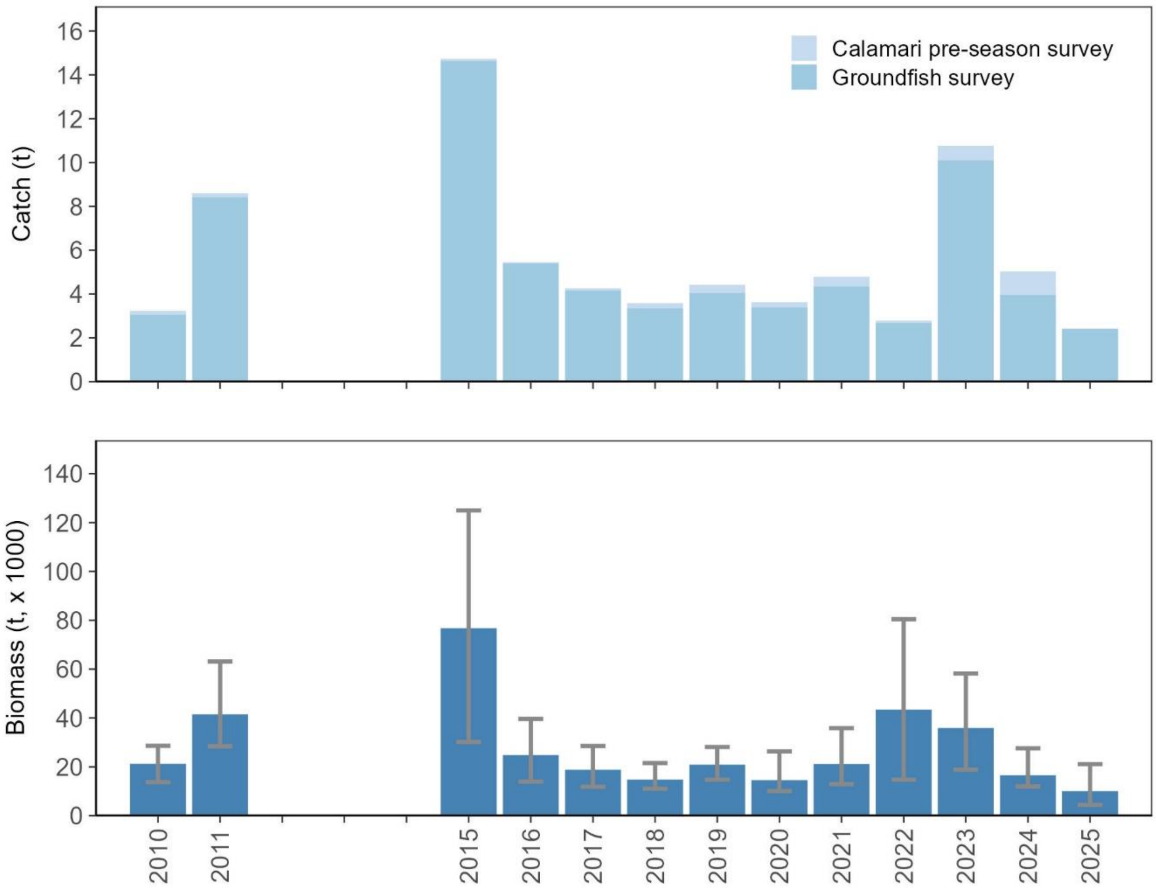


Fig. 14. Catch (t), and mean biomass (t) ± 95% confidence intervals of kingclip (*Genypterus blacodes*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

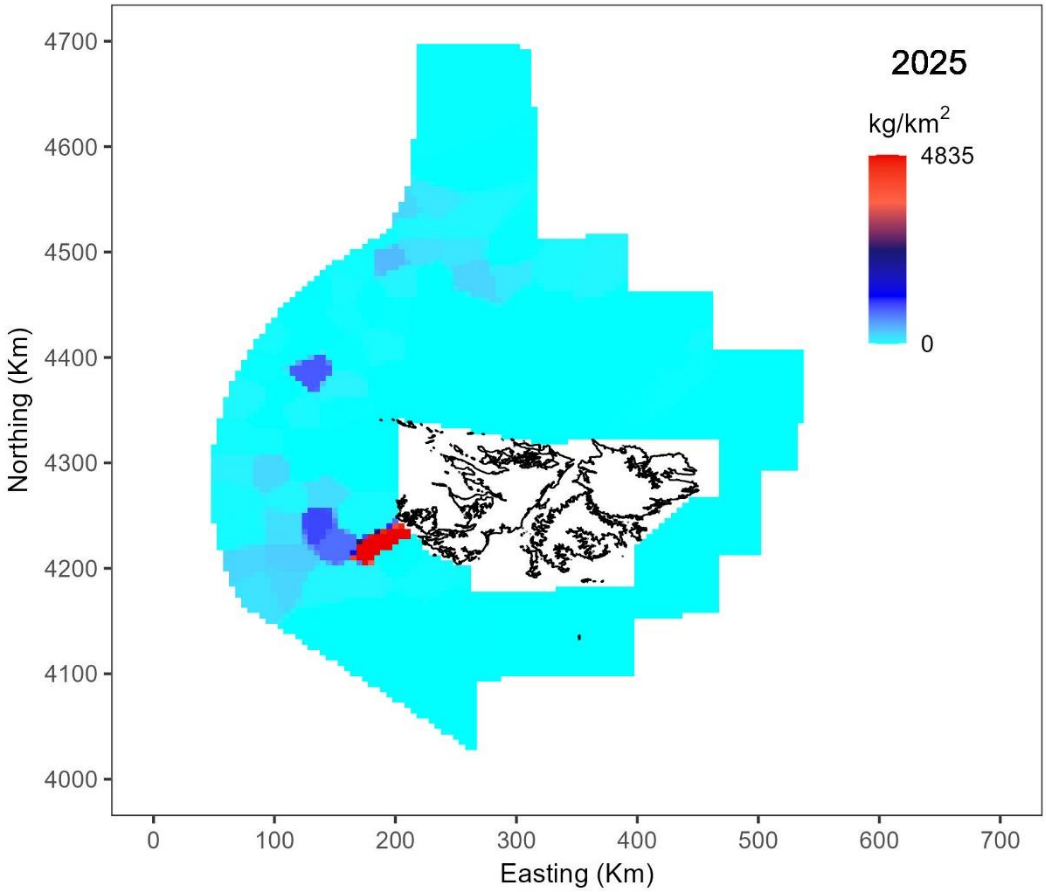


Fig. 15. Distribution and abundance of kingclip (*Genypterus blacodes*) calculated from the February 2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

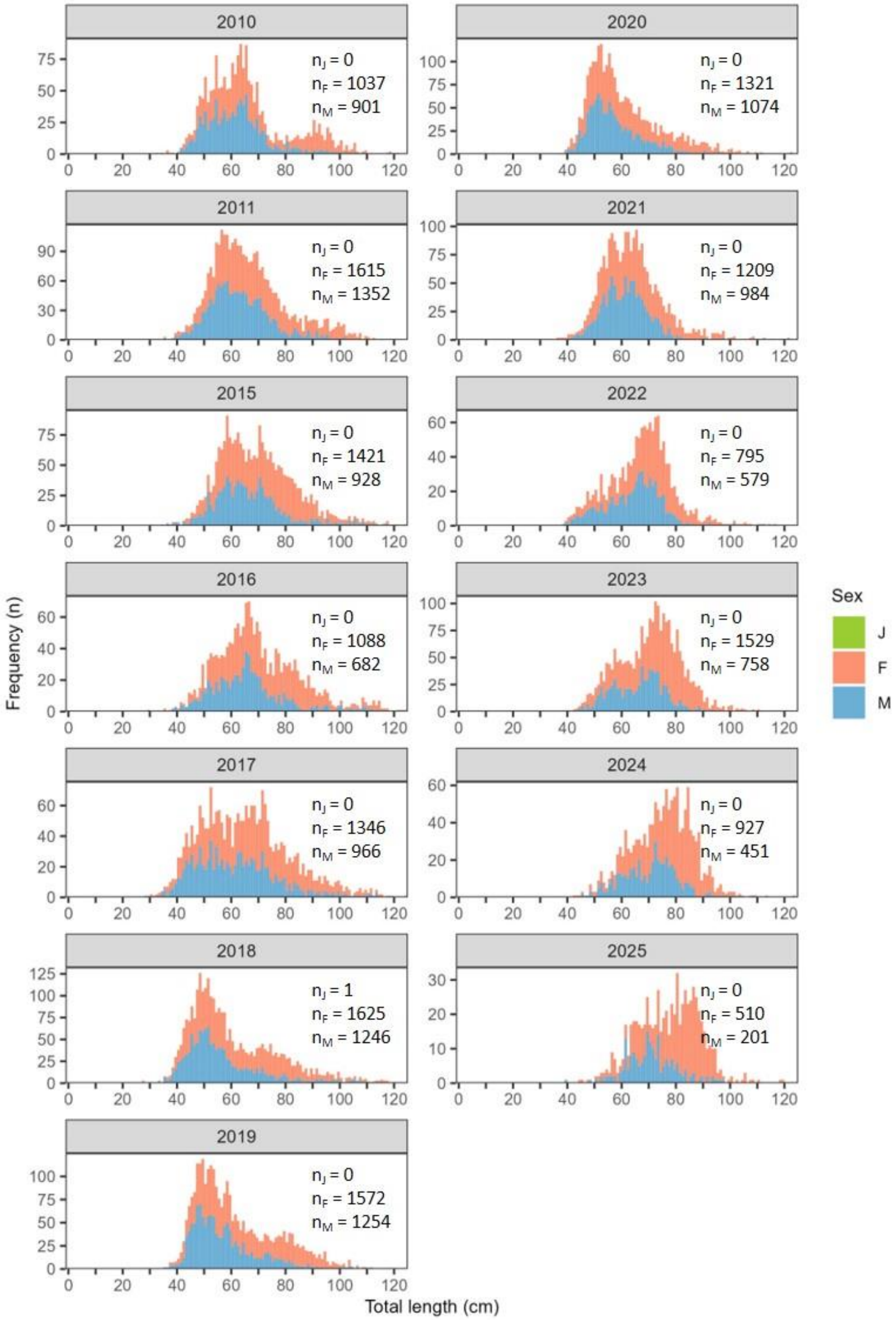


Fig. 16. Length frequency of kingclip (*Genypterus blacodes*) during the February groundfish and calamari pre-season surveys in Falkland Islands waters. Bars are superimposed.

4.2.6. Patagonian squid (*Doryteuthis gahi*)

On average, 98% of the total Patagonian squid catches were from calamari pre-season surveys. The highest total catch of Patagonian squid in the time series occurred in 2024 (683 t), due to high catches during the calamari pre-season survey (Fig. 17; Appendix II). The highest biomass in the time series was estimated in 2019 with 214,492 t, and the lowest was calculated for 2016 (41,292 t). The biomass in February 2025 (109,303 t) was below the average (135,081 t) from 2010 to 2024, decreasing for the first time since 2020 (Fig. 17; Table II). However, there was no statistically significant trend in biomass from 2010 to 2025 (Appendix IV).

Patagonian squid were mainly found to the south of East Falkland. In 2025, the maximum density was 16,619 kg/km^2 to the south of East Falkland (Fig. 18), and the highest density throughout the time series was reported in 2023 (40,205 kg/km^2) (Appendix XI).

Length-frequency histograms show a wide range of Patagonian squid sizes, from 2.5 cm to 36 cm, across the time series. Two length-groups were evident only in some years. In 2025, the modal length was at 8.5–9.5 cm mantle length for females and for males (Fig. 19).

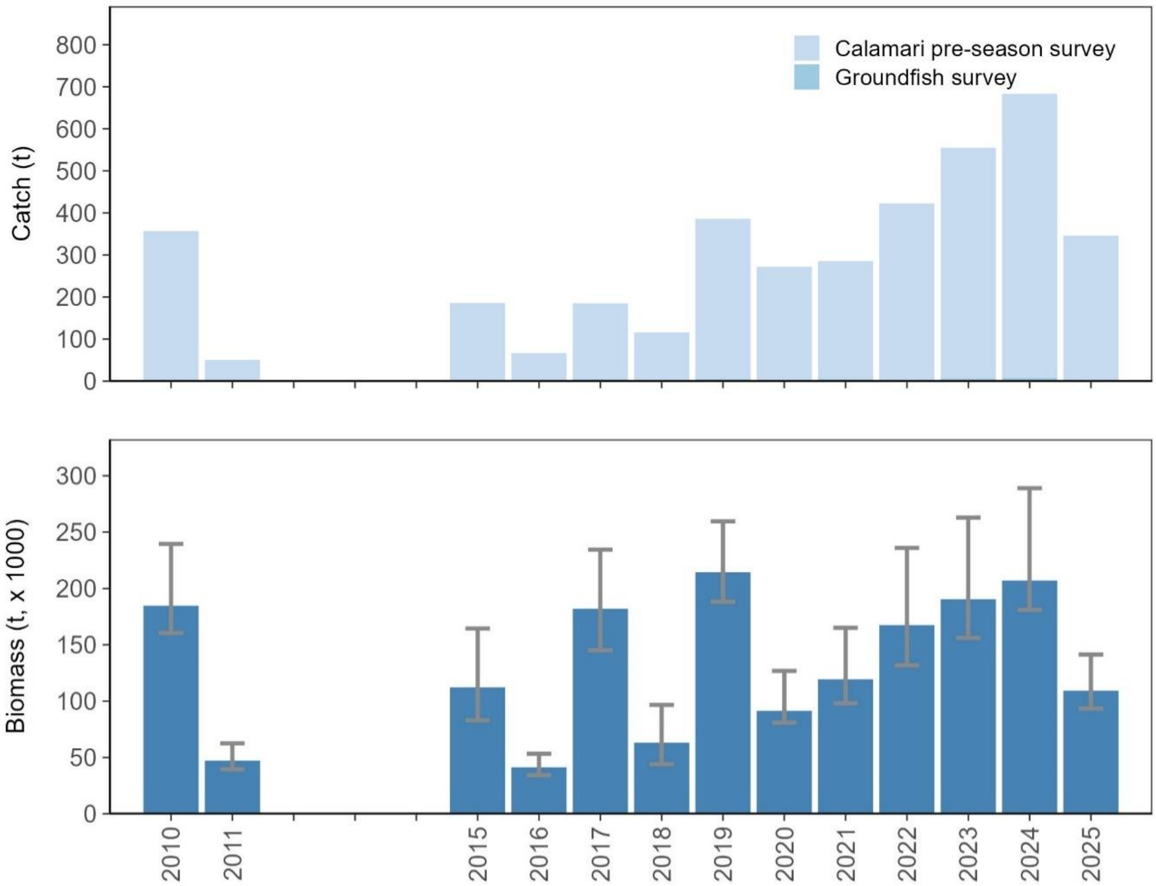


Fig. 17. Catch (t), and mean biomass (t) ± 95% confidence intervals of the Patagonian squid (*Doryteuthis gahi*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

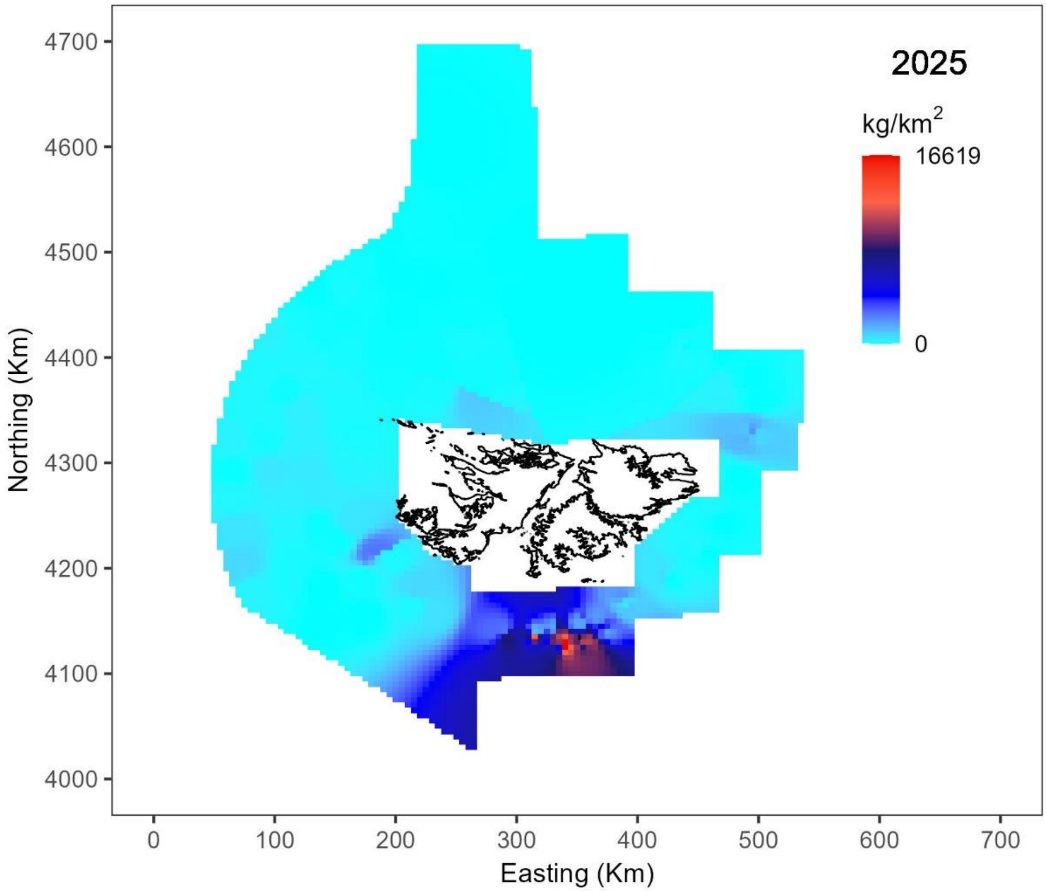


Fig. 18. Distribution and abundance of the Patagonian squid (*Doryteuthis gahi*) calculated from the February 2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

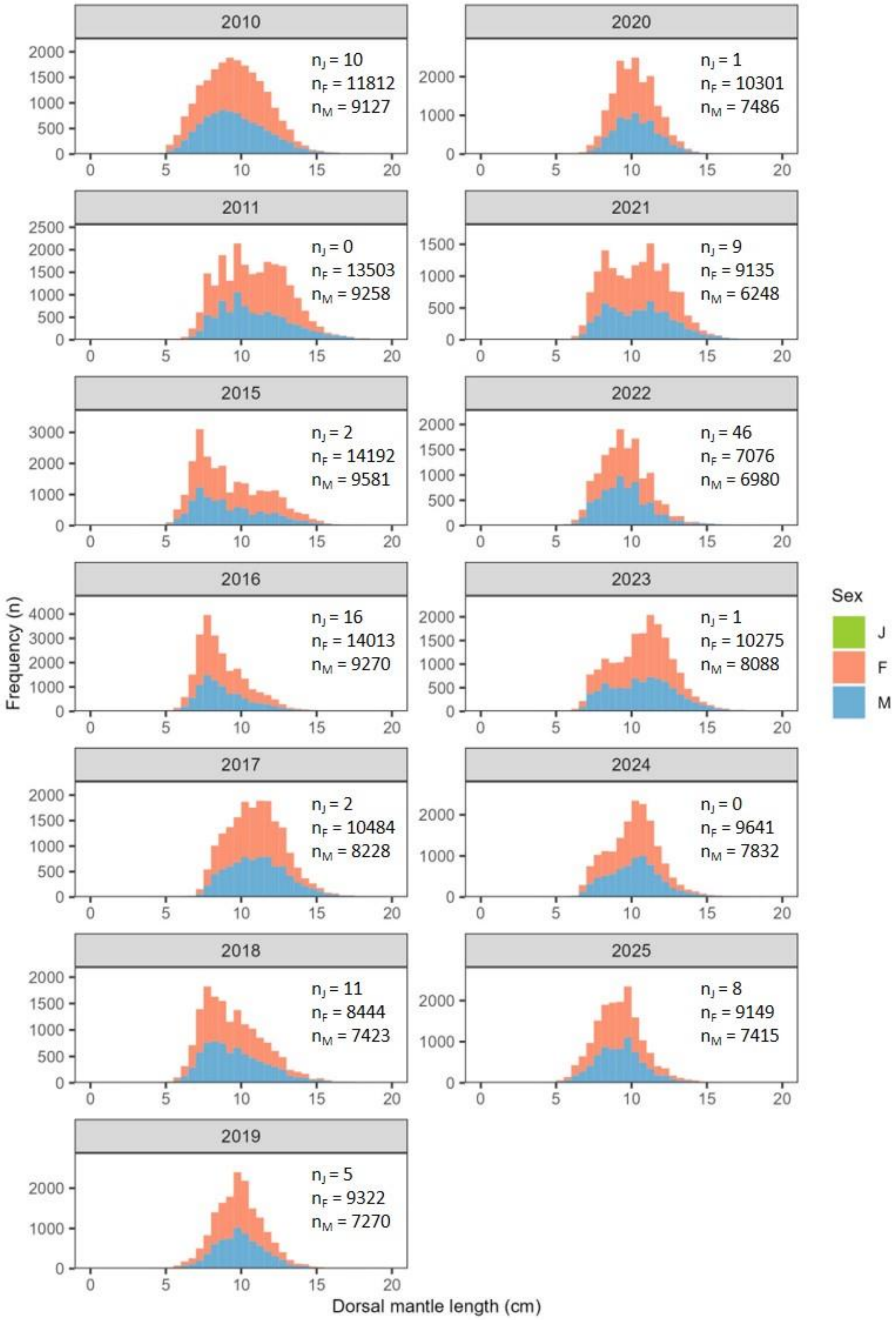


Fig. 19. Length frequency of the Patagonian squid (*Doryteuthis gahi*) during the February groundfish and calamari pre-season surveys in Falkland Islands waters. Bars are superimposed.

4.2.7. Patagonian toothfish (*Dissostichus eleginoides*)

Adult Patagonian toothfish are caught mainly using longline; therefore, the information provided in this report is not representative of the adult portion of the Patagonian toothfish population.

The proportion of Patagonian toothfish catches between groundfish and calamari pre-season surveys was variable across years but on average was 53% from calamari pre-season surveys and 47% from groundfish surveys. The maximum total catch was reported in 2017 (2.5 t); the third highest catch was reported in 2025 with 2.1 t, which was above the average (1.3 t) from 2010 to 2024 (Fig. 20; Appendix II). The highest biomass of Patagonian toothfish was calculated for 2011 (10,588 t), and the lowest biomass was calculated for 2020 (2,499 t). In 2025, the biomass of Patagonian toothfish was calculated at 6,393 t, above the average (6,151 t) from 2010 to 2024, and it was 67% of its biomass in 2010 (9,492 t) (Fig. 20; Table II). However, there was no statistically significant trend in biomass from 2010 to 2025 (Appendix IV).

In 2025, the highest densities of Patagonian toothfish were detected at scattered locations across the FICZ, with the largest aggregation to the south-west of West Falkland (439 kg/km^2; Fig. 21). Patagonian toothfish have had a patchy distribution around the Falkland Islands through the time series, with the highest density reported in 2018 to the west and south-west of West Falkland (902 kg/km^2; Appendix XII).

Length frequency histograms show that Patagonian toothfish have had a range of sizes from 5 cm to 115 cm throughout the time series, probably with several length-groups present. A small group had modal length at 30–36 cm total length in several years. However, this group was not present in 2025, and the small numbers of small individuals suggest that recruitment has been low in recent years. In 2025, the main modal length was detected at 43–45 cm total length (Fig. 22).

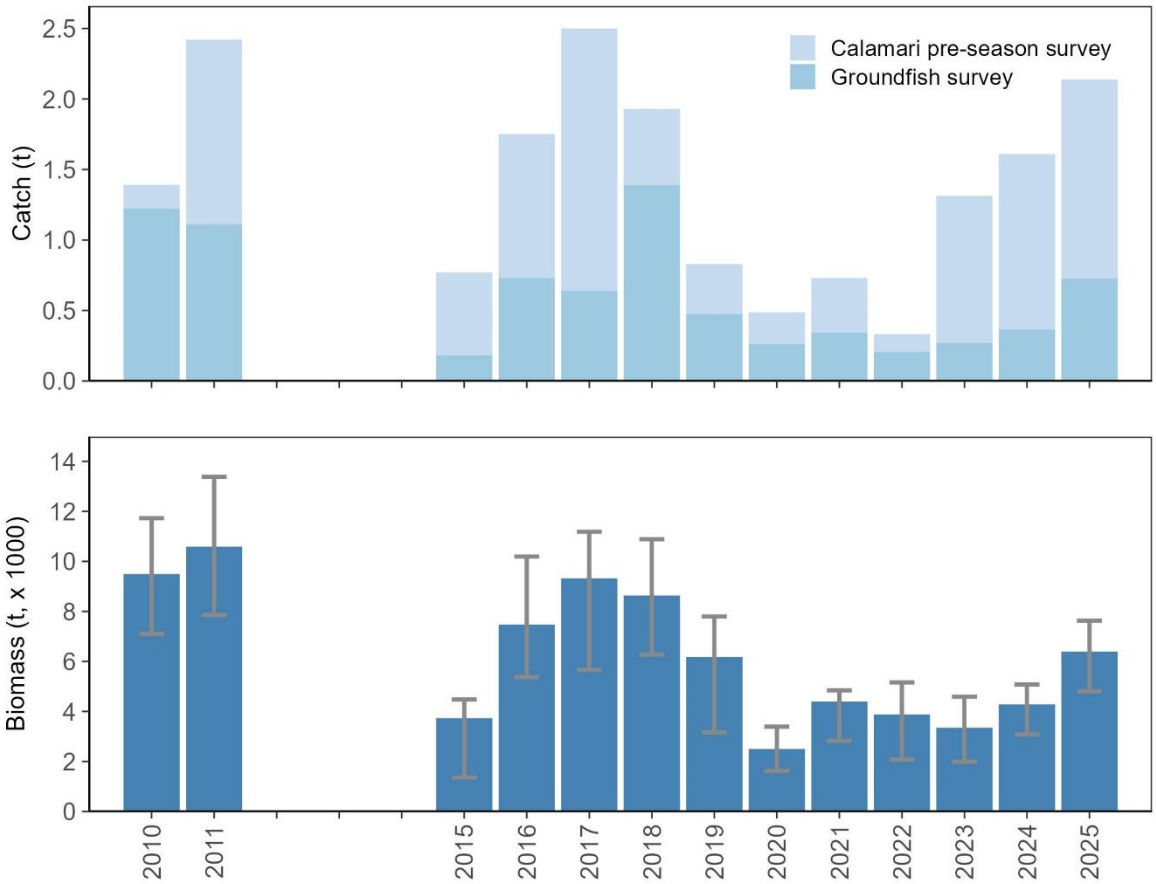


Fig. 20. Catch (t), and mean biomass (t) ± 95% confidence intervals of Patagonian toothfish (*Dissostichus eleginoides*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

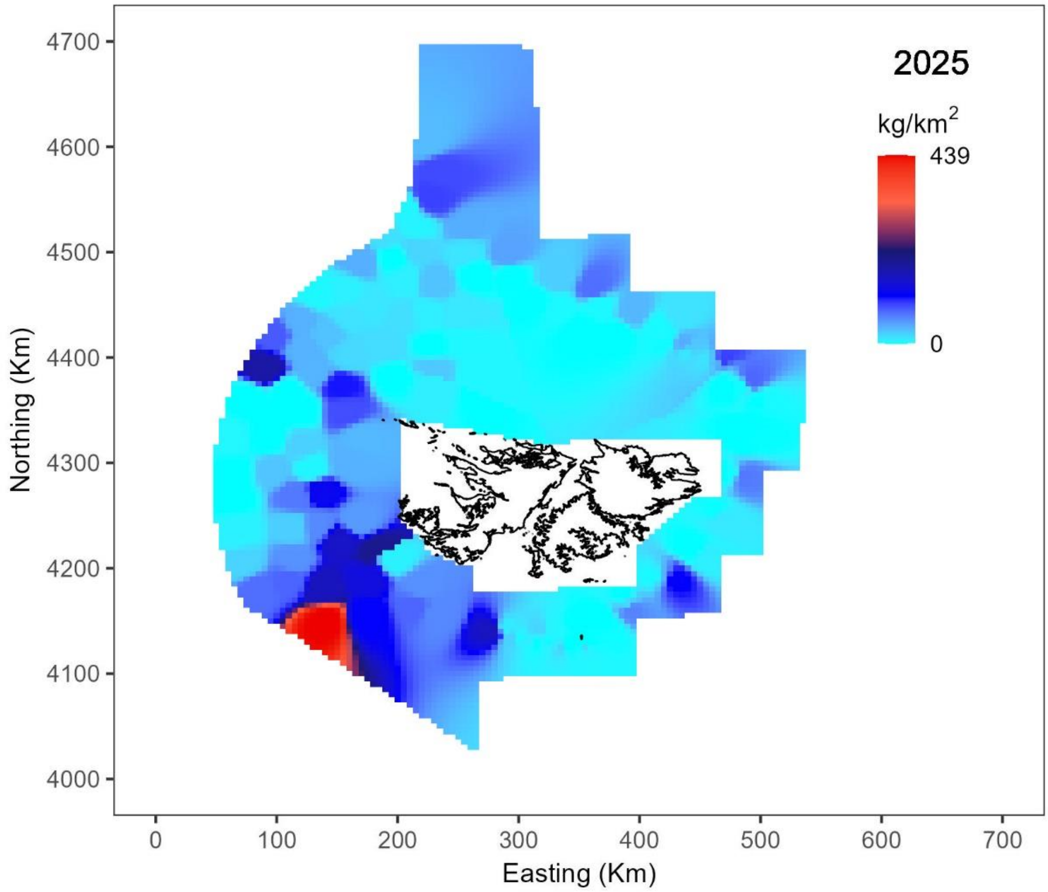


Fig. 21. Distribution and abundance of Patagonian toothfish (*Dissostichus eleginoides*) calculated from the February 2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

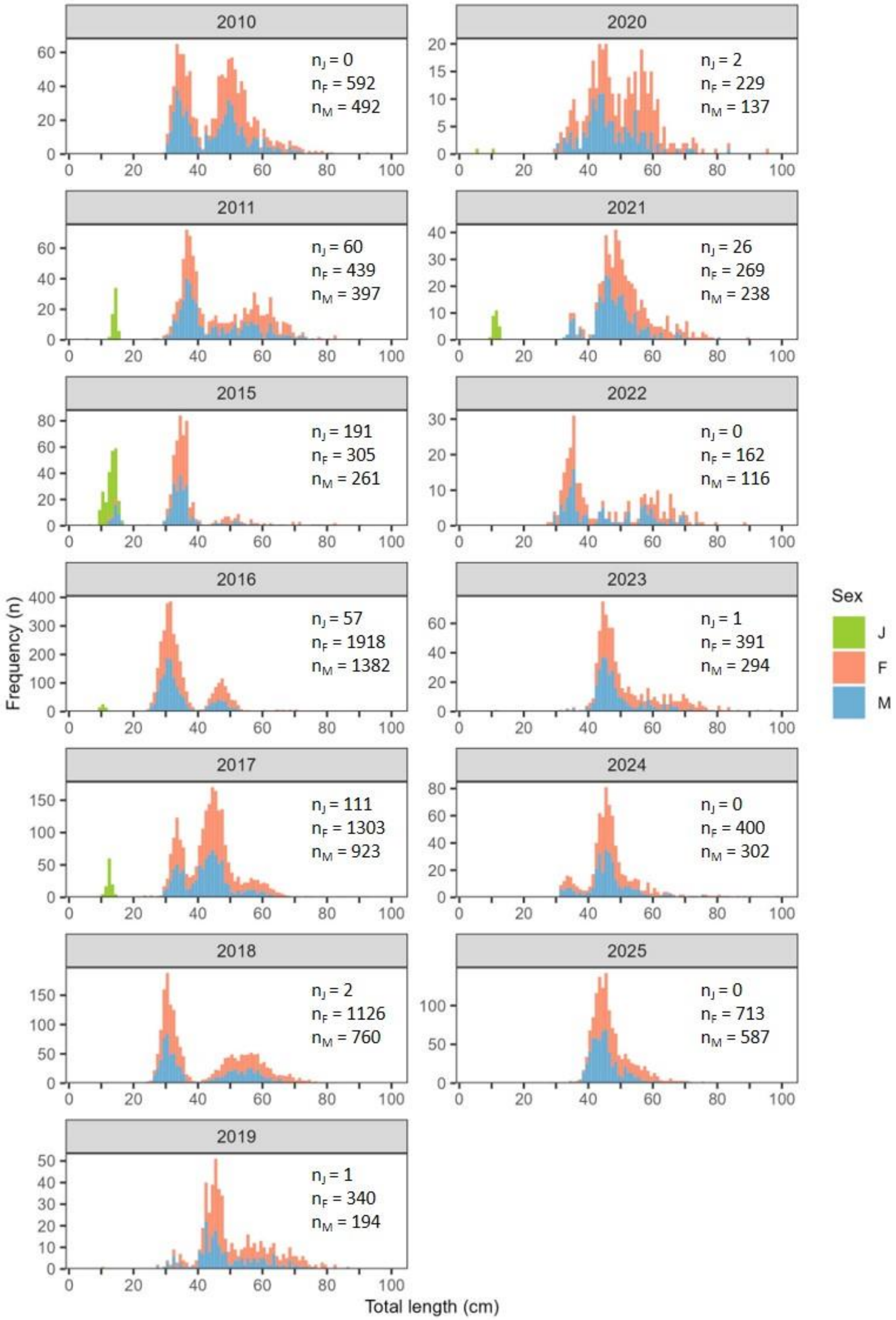


Fig. 22. Length frequency of Patagonian toothfish (*Dissostichus eleginoides*) during the February groundfish and calamari pre-season surveys in Falkland Islands waters. Bars are superimposed.

4.2.8. Red cod (*Salilota australis*)

Red cod was predominantly caught in groundfish surveys (average of 90% of the total red cod catch across years) compared with calamari pre-season surveys. Catches declined from 2011 and reached the lowest value in 2025 (3.3 t). Catches increased consecutively from 2020 to 2023 but declined again in 2024 (6.4 t) and in 2025. Red cod catch in 2025 was below the average (13 t) from 2010 to 2024 (Fig. 23; Appendix II). Red cod biomass was the highest in 2011 (166,618 t) and decreased during the following years to reach the lowest level (16,521 t) in 2025. The biomass of red cod in 2025 was 17% of its biomass in 2010 (95,050 t) (Fig. 23; Table II). There was a statistically significant decrease in biomass from 2010 to 2025 (Appendix IV).

In 2025, the highest densities occurred to the south-west in the FICZ (4,134 kg/km^2), although there were also patches of high densities through the north in the FICZ (Fig. 24). Through the time series, red cod was found mainly along the west of West Falkland, and the highest density in the time series was 38,175 kg/km^2 in 2016 (Appendix XIII).

Length frequency histograms show a wide range of red cod sizes across the time series (i.e., 4–85 cm total length) due to the presence of several length-groups. Poor recruitment occurred in 2010, 2018, and since 2020; individuals recruited to the fishery had modal lengths between 15 cm and 19 cm total length across years. In 2025, the main modal lengths were detected at about 45–46 cm total length (Fig. 25).

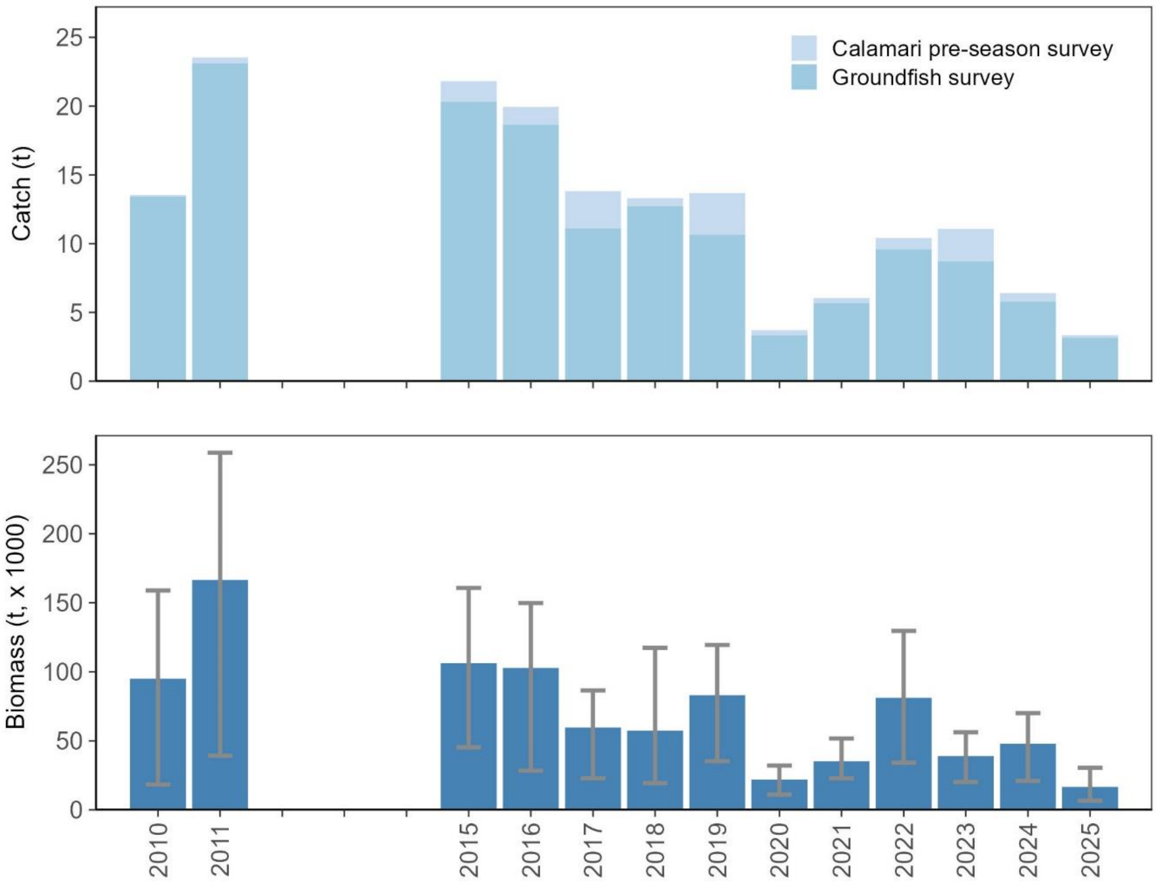


Fig. 23. Catch (t), and mean biomass (t) ± 95% confidence intervals of red cod (*Salilota australis*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

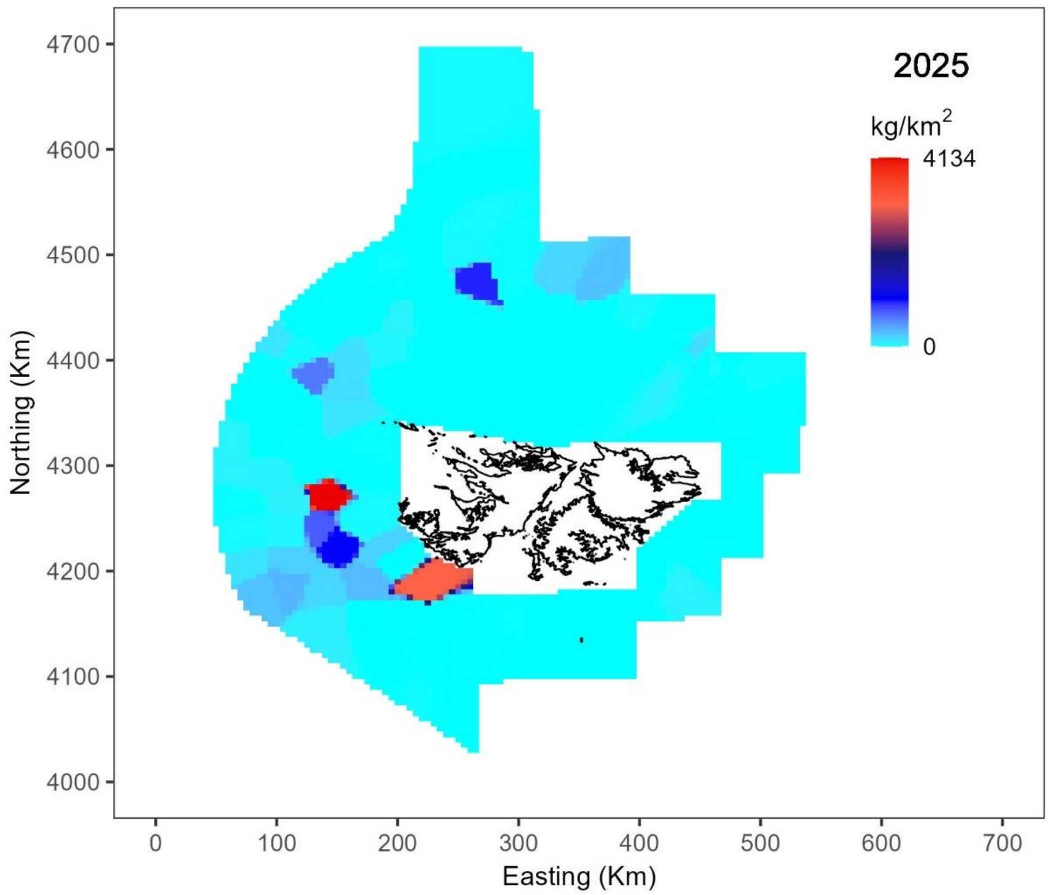


Fig. 24. Distribution and abundance of red cod (*Salilota australis*) calculated from the February 2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

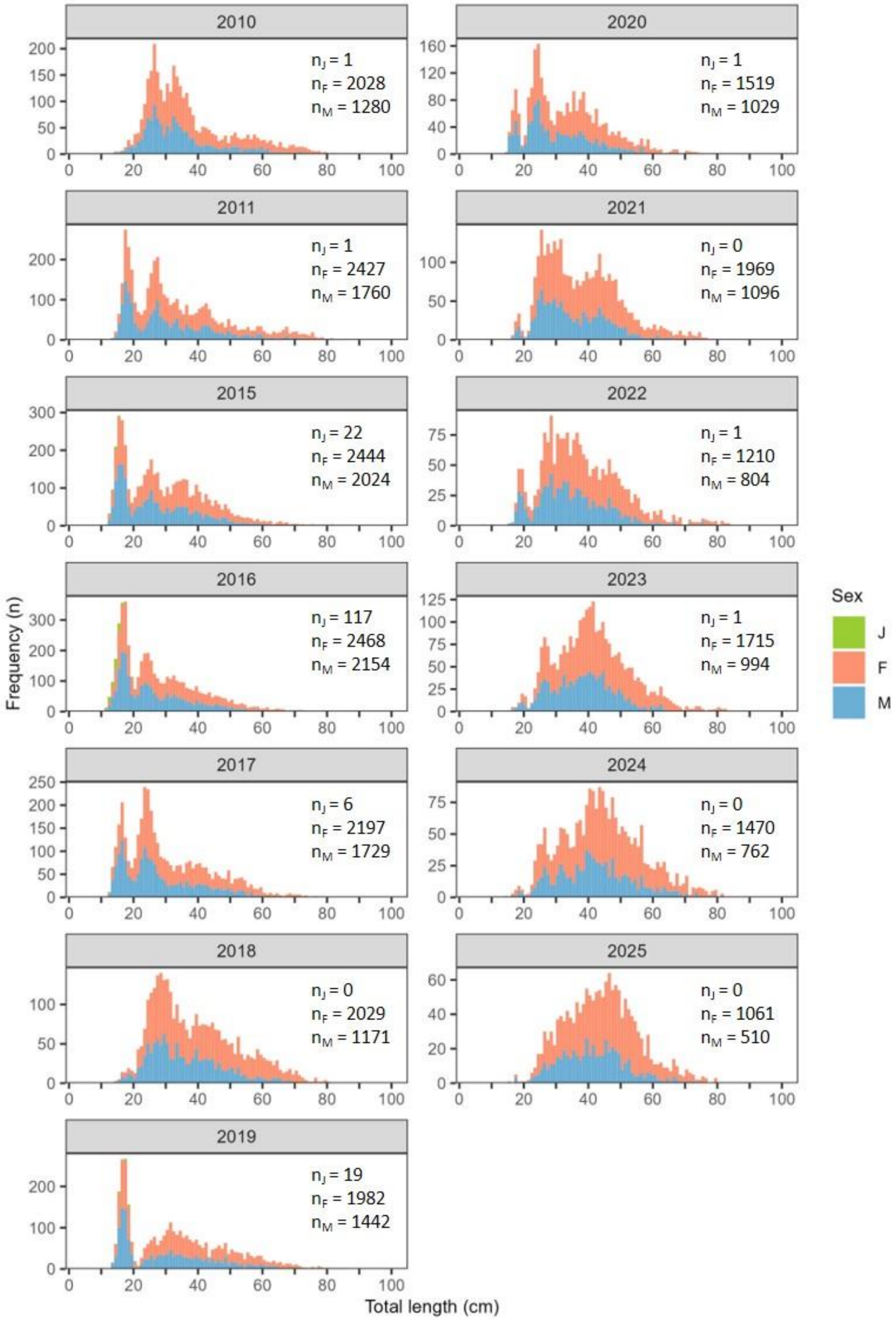


Fig. 25. Length frequency of red cod (*Salilota australis*) during the February groundfish and calamari pre-season surveys in Falkland Islands waters. Bars are superimposed.

4.2.9. Rock cod (*Patagonotothen ramsayi*)

Since 2011 the majority of rock cod have been reported from calamari pre-season surveys, with an average of 73%. The highest catch of rock cod was reported in 2011 (249 t) and the lowest catch in 2020 (11 t). A total of 48 t of rock cod were caught in 2025, which is below the average (94 t) from 2010 to 2024 (Fig. 26; Appendix II). The biomass of rock cod in 2025 (124,187 t) was below the average (243,553 t) from 2010 to 2024. Rock cod biomass had a statistically significant decline from 2010 (817,086 t) to 2025, with its biomass in 2025 being 15% of its biomass in 2010 (Fig. 26; Table II; Appendix IV).

In 2025, rock cod occurred in high densities (35,688 kg/km^2) to the north-west in the FICZ (Fig. 27). Rock cod had a patchy distribution around the Falkland Islands throughout the time series, and the highest density in the time series was calculated for 2011 to the north-east of East Falkland (602,180 kg/km^2; Appendix XIV).

Sizes of rock cod have ranged widely throughout the time series (i.e., 4–43 cm). In some years, at least two length-groups were detected. In 2025, modal length was 14 cm total length for a smaller length-group, 18 cm total length for a medium length-group, and 22 cm for a larger length-group (Fig. 28). In 2025, 21 juveniles were collected in a range of sizes between 4 cm and 5 cm total length.

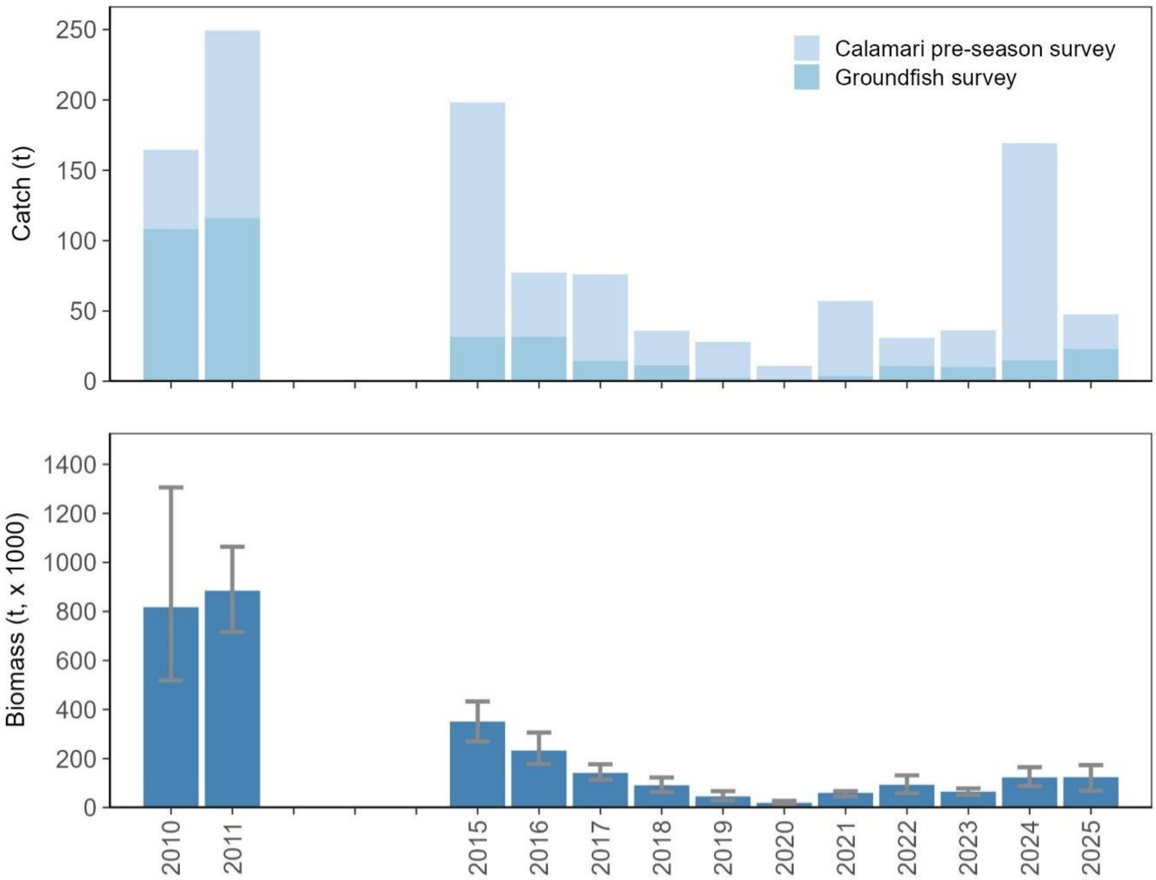


Fig. 26. Catch (t), and mean biomass (t) ± 95% confidence intervals of rock cod (*Patagonotothen ramsayi*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

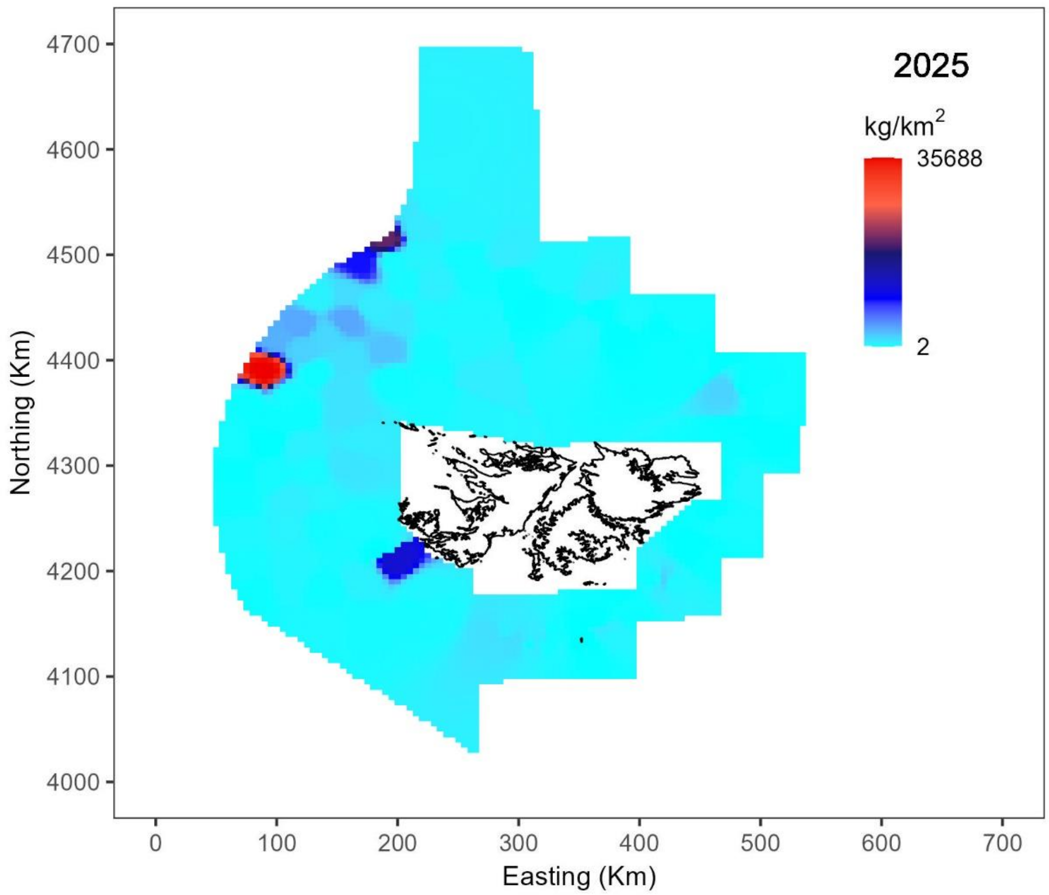


Fig. 27. Distribution and abundance of rock cod (*Patagonotothen ramsayi*) calculated from the February 2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

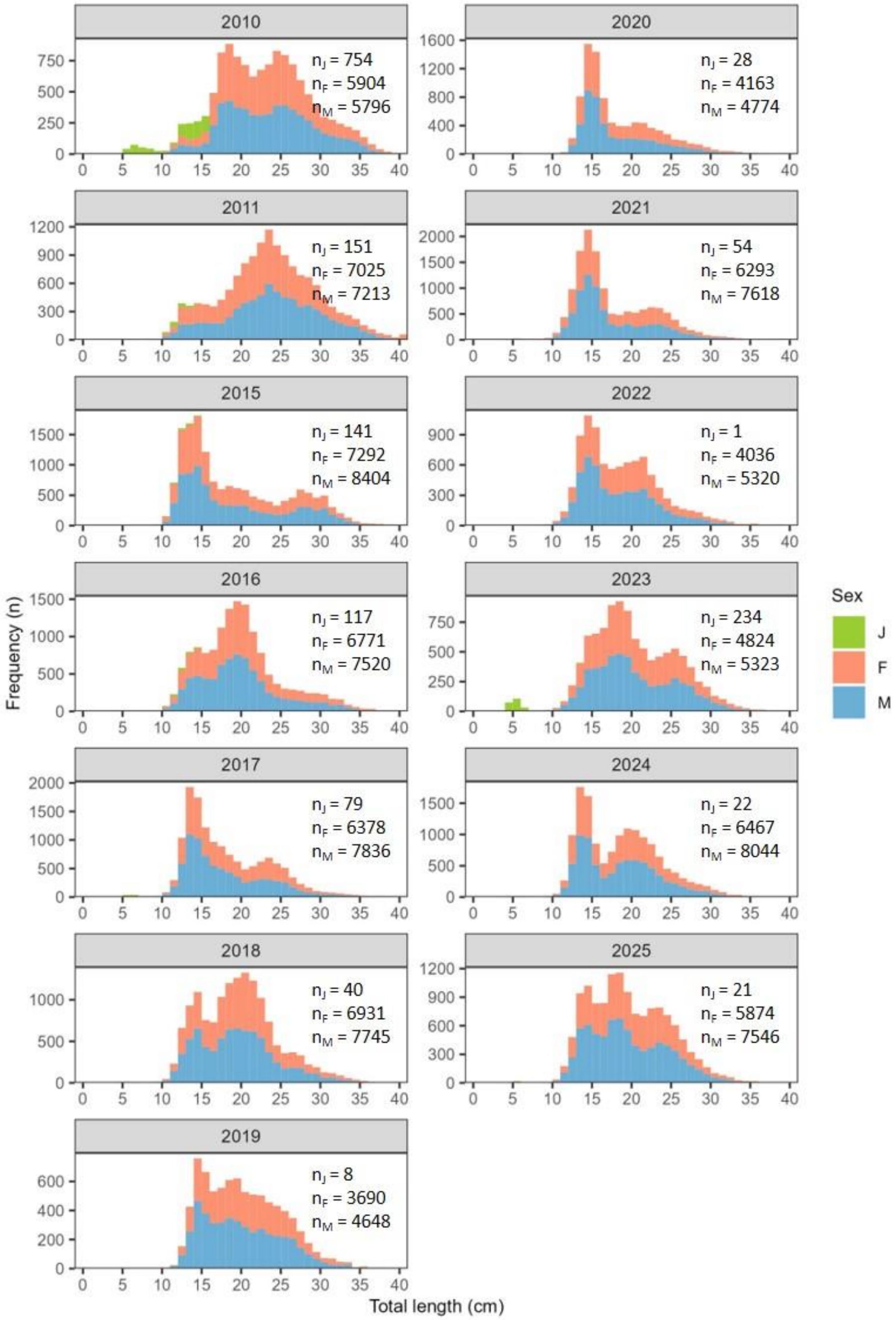


Fig. 28. Length frequency of rock cod (*Patagonotothen ramsayi*) during the February groundfish and calamari pre-season surveys in Falkland Islands waters. Bars are superimposed.

4.2.10. Southern blue whiting (*Micromesistius australis*)

Southern blue whiting were mainly caught in the calamari pre-season surveys compared with the groundfish surveys, at an average of 94% of the surveys' total southern blue whiting catch across years. The highest catch was reported in 2024 (120 t) and the lowest catch in 2022 (3 t). The catch of southern blue whiting in 2025 (59 t) was above the average (33 t) from 2010 to 2024 (Fig. 29; Appendix II). The highest biomass was estimated for 2011 (154,691 t), and the lowest biomass was estimated for 2020 (4,990 t). However, biomass increased since 2020, and was 68,215 t in 2025 (Fig. 29; Table II), which is above the average (52,937 t) from 2010 to 2024. Southern blue whiting biomass in 2025 was similar to its biomass in 2010 (68,447 t), and there was no significant trend in biomass between 2010 and 2025 (Appendix IV).

In 2025, southern blue whiting occurred to the south-west, south-east, and north-east in the FICZ, with the highest density (20,491 kg/km^2) occurring to the north-east (Fig. 30). Throughout the time series, southern blue whiting occurred mainly to the south of the FICZ and to the north-east of East Falkland, with the highest density calculated for 2016 to the south of East Falkland (203,954 kg/km^2; Appendix XV).

Southern blue whiting have been caught in small numbers through the time series. Total length ranged from 6 cm to 72 cm; a small length-group with total length at 23–25 cm was present across years, and in smaller numbers in 2025. In 2025, a total of 1,532 individuals were sampled, and allowed detecting three length-groups. The small group with modal length at 22-23 cm total length, the medium group with modal length at 30-31 cm total length, and the large length-group with modal length at 52 cm total length (Fig. 31).

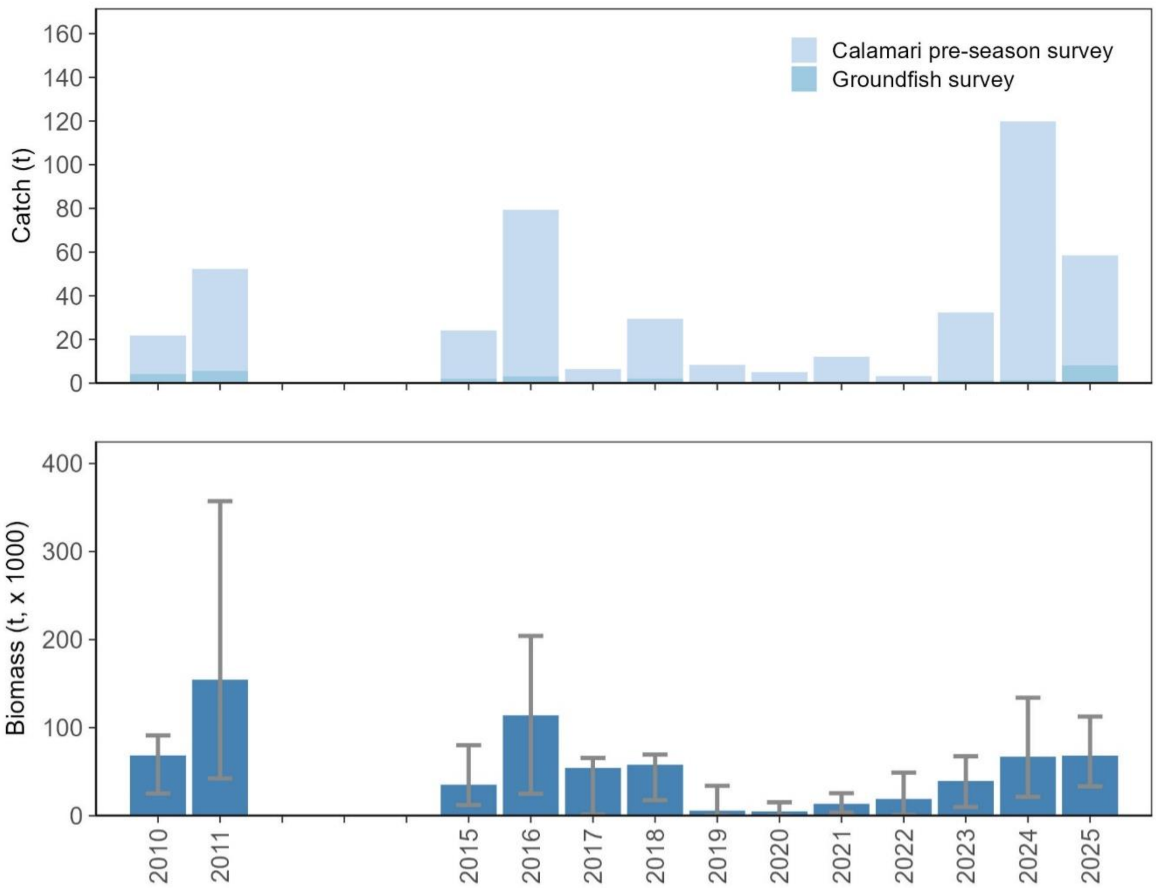


Fig. 29. Catch (t), and mean biomass (t) ± 95% confidence intervals of southern blue whiting (*Micromesistius australis*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

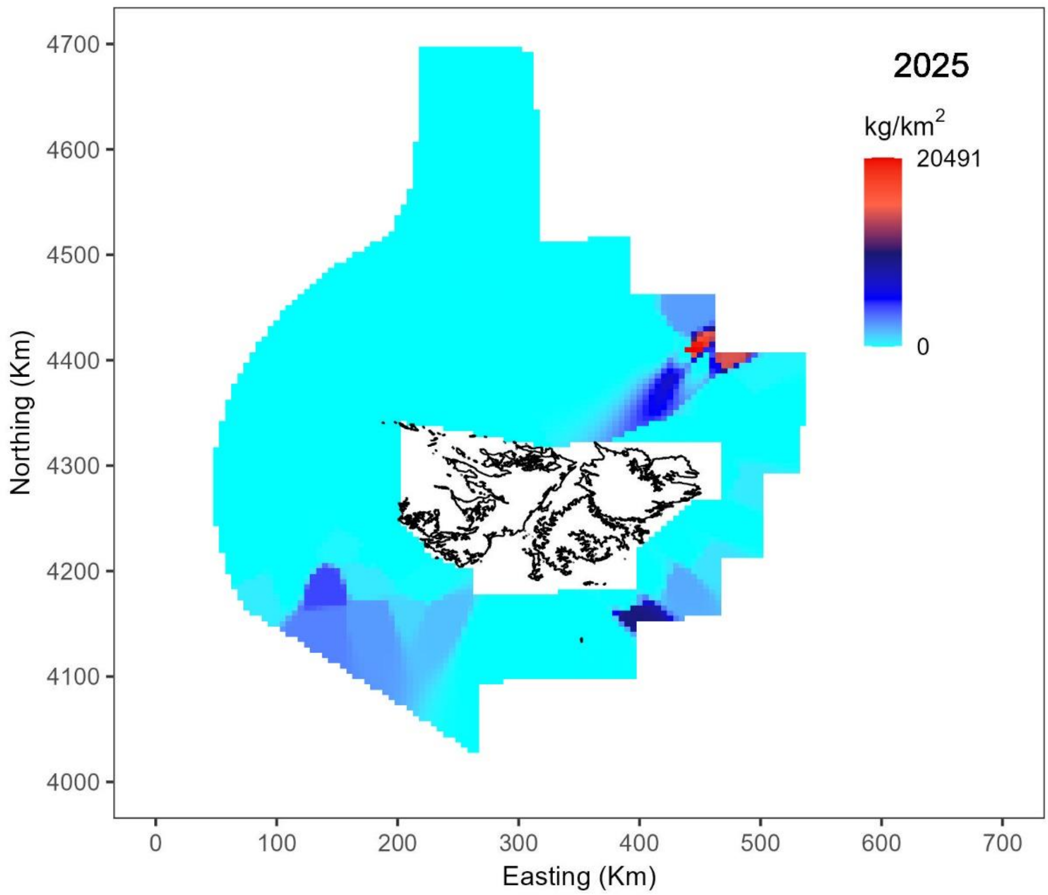


Fig. 30. Distribution and abundance of southern blue whiting (*Micromesistius australis*) calculated from the February 2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

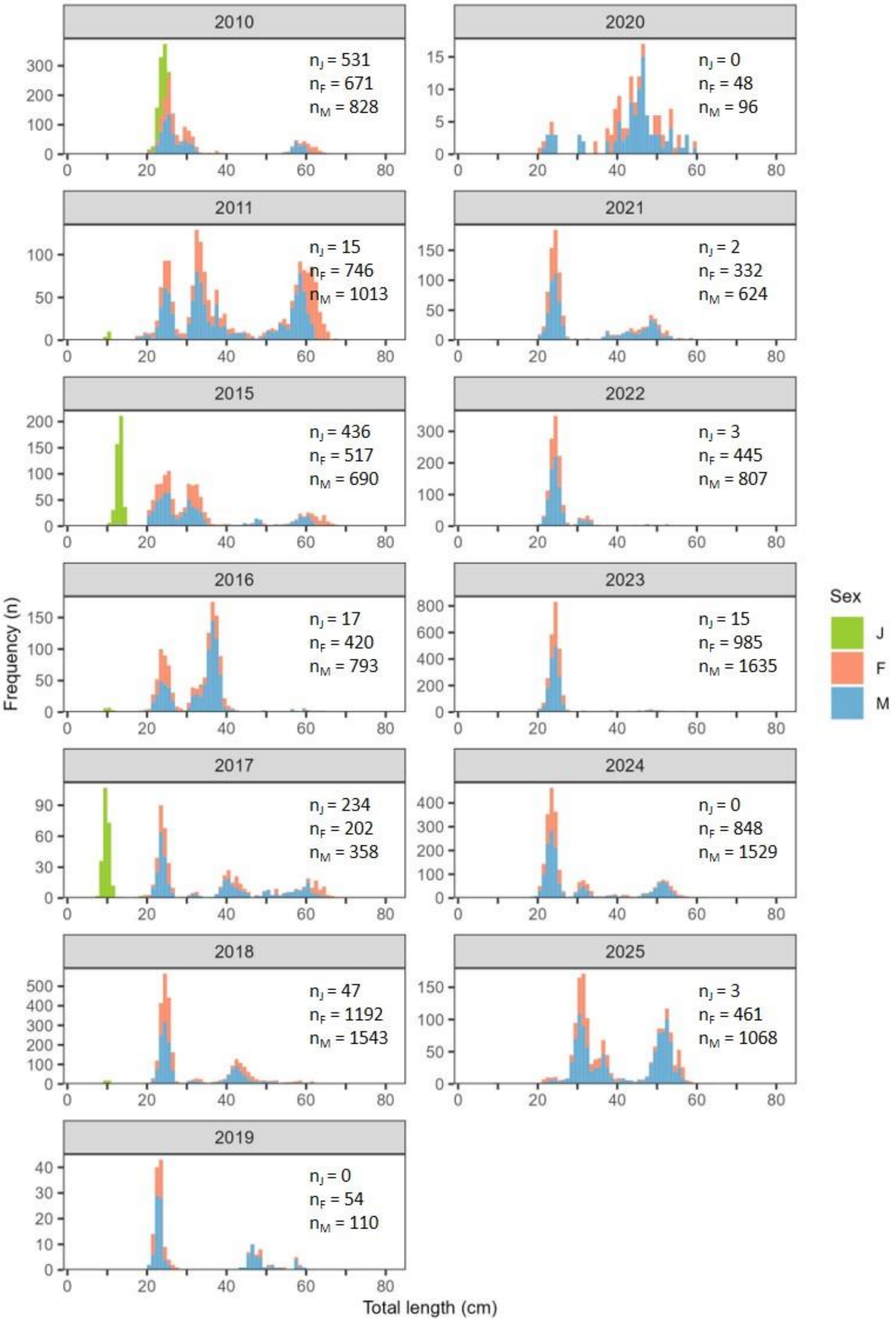


Fig. 31. Length frequency of southern blue whiting (*Micromesistius australis*) during the February groundfish and calamari pre-season surveys in Falkland Islands waters. Bars are superimposed.

4.2.11. Southern hake (*Merluccius australis*)

On average, 91% of the surveys' total southern hake catch was from the groundfish survey across the years. The highest catch in the time series was reported in 2010 (822 kg) and the lowest catch was reported in 2019 (51 kg). A total of 336 kg of southern hake were caught in 2025, which is similar to the average (316 kg) from 2010 to 2024 (Fig. 32; Appendix II). The highest biomass was calculated for 2011 (5,224 t) and the lowest biomass was calculated for 2019 (426 t). The biomass of southern hake in February 2025 was calculated at 2,168 t, which is similar to the average (2,162 t) from 2010 to 2024; southern hake biomass in 2025 was 43% of its biomass in 2010 (5,097 t) (Fig. 32; Table II). Biomass of southern hake decreased significantly from 2010 to 2025 (Appendix IV).

In 2025, the highest densities of southern hake were detected to the south-west of West Falkland (362 kg/km^2; Fig. 33), a consistent spatial distribution pattern through the time series. The highest density of southern hake was reported in 2011 (923 kg/km^2; Appendix XVI).

Southern hake is caught in small numbers in Falkland Islands waters; hence the small number of samples. Length frequency histograms show range of sizes from 29 cm to 106 cm throughout the time series, with a modal length at approximately 62 cm total length for females (Fig. 34).

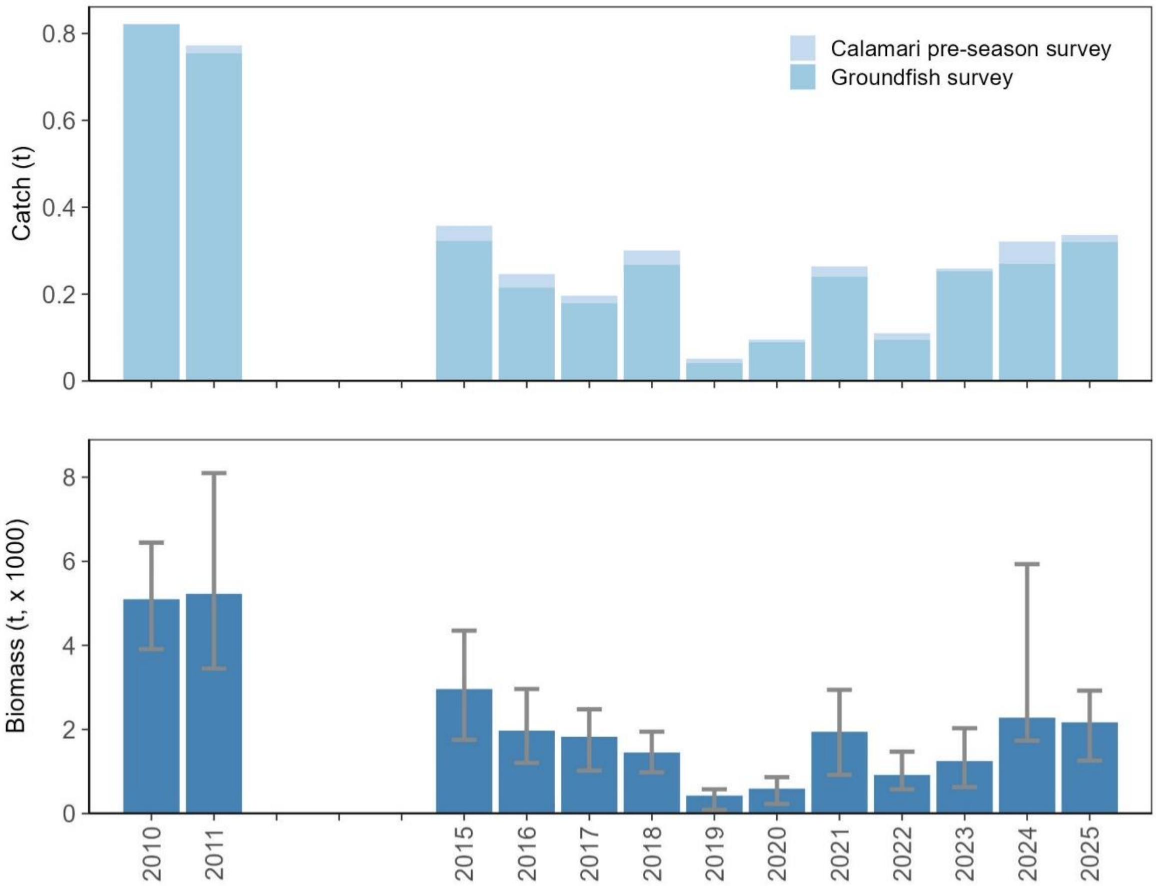


Fig. 32. Catch (t), and mean biomass (t) ± 95% confidence intervals of southern hake (*Merluccius australis*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

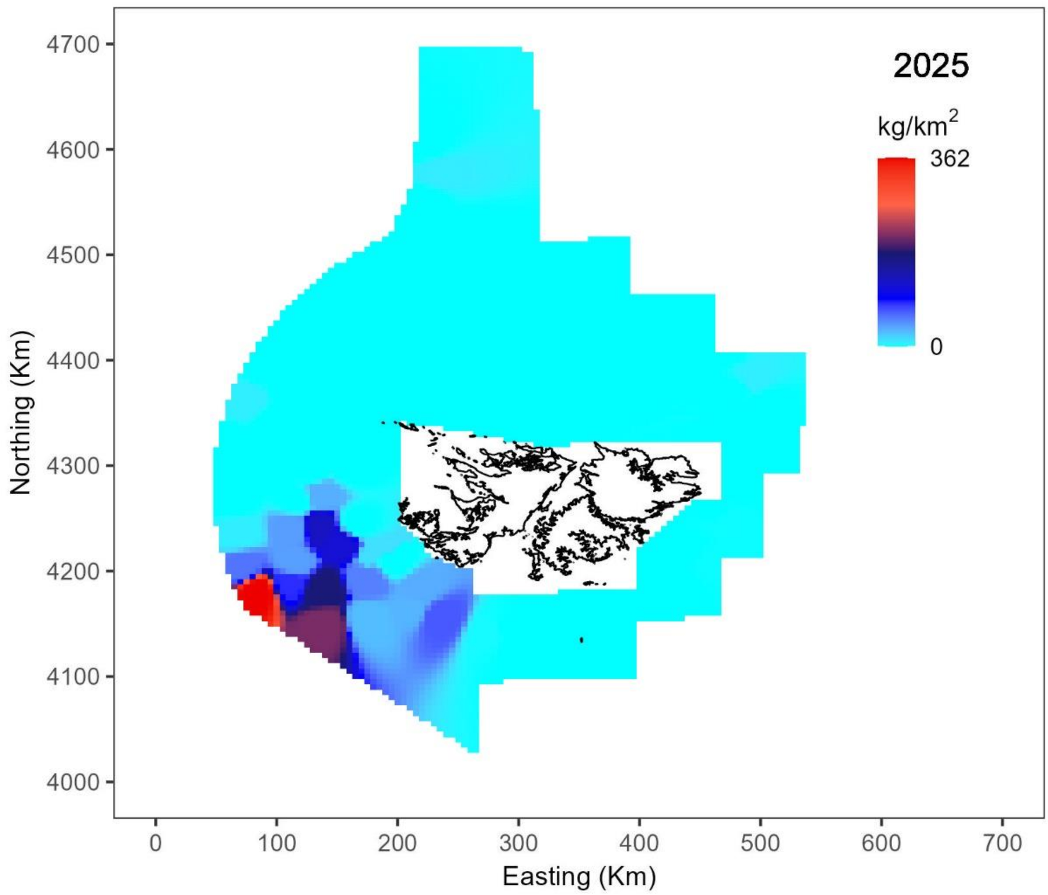


Fig. 33. Distribution and abundance of southern hake (*Merluccius australis*) calculated from the February 2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

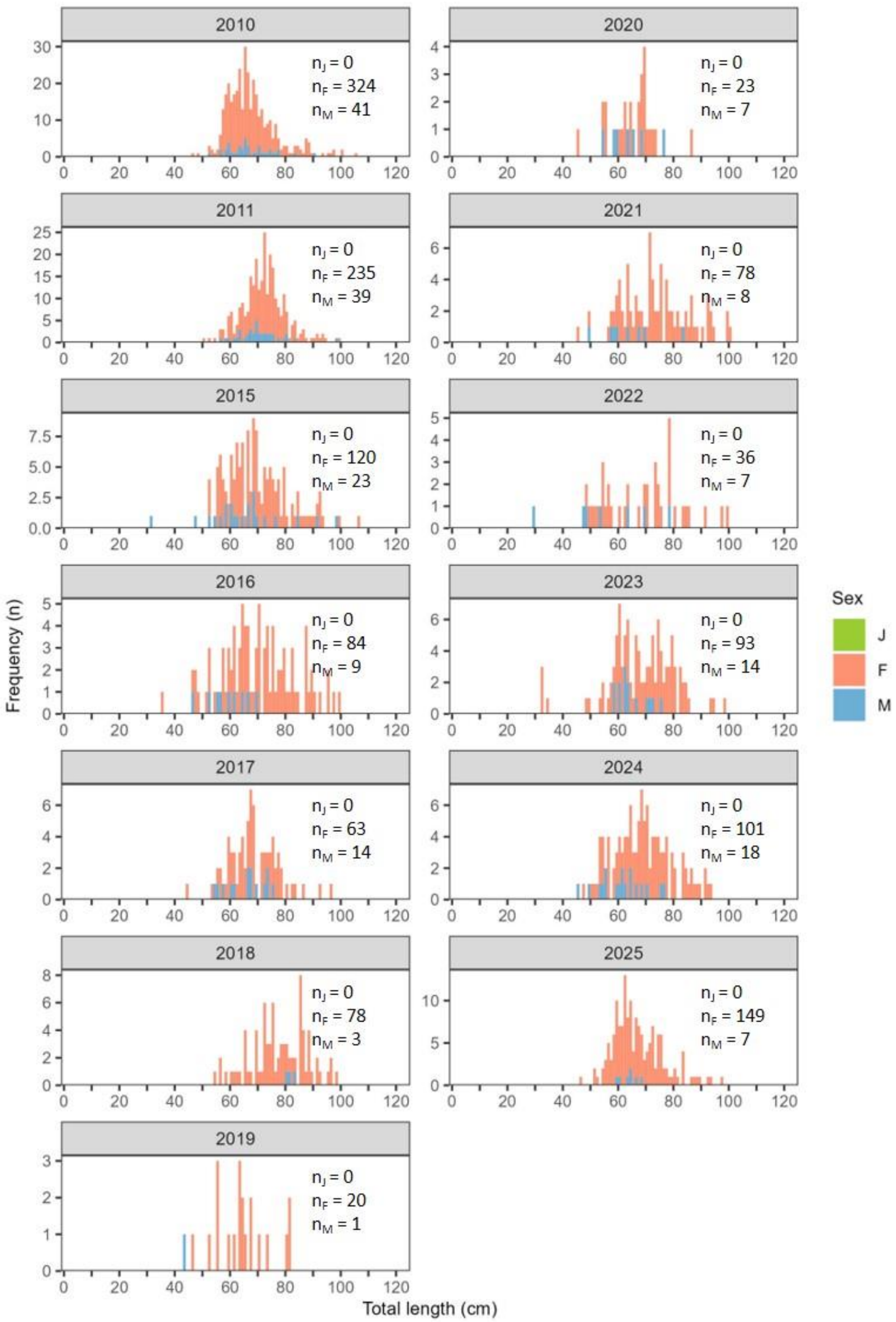


Fig. 34. Length frequency of southern hake (*Merluccius australis*) during the February groundfish and calamari pre-season surveys in Falkland Islands waters. Bars are superimposed.

5. Discussion

The biomasses of four commercial stocks calculated from the February parallel demersal surveys were statistically significantly lower in 2025 than in 2010: hoki, red cod, rock cod, and southern hake. Kingclip biomass in 2025 reached the lowest level since 2010 but its trend was not significant from 2010 to 2025 due to considerable interannual biomass variability. Other species with no significant trend in biomass from 2010 to 2025 were the Argentine shortfin squid, banded whiptail grenadier, Patagonian squid, Patagonian toothfish, and southern blue whiting. Common hake was the only species with statistically significant increase in biomass from 2010 to 2025.

The declining biomass trend of hoki observed from this fisheries-independent dataset is consistent with stock assessment using commercial fisheries data and data-poor methods such as LBB and OCOM. Stock assessment showed a declining biomass trend from 1987 to 2018, with the biomass in 2018 being 13% of the biomass in 1987 (Ramos & Winter 2019). Biomass has not been calculated from commercial fisheries data since 2019 (e.g., Ramos & Winter 2019, 2022b), limiting our understanding of the state of this stock in recent years, and our capacity to compare biomass patterns from commercial fisheries and from fisheries-independent data in recent years.

The biomass of southern blue whiting increased for fifth consecutive year since 2020, and is at a similar level compared with the biomass calculated for 2010. However, it must be noted that this stock was already at low levels in 2010 due to heavy exploitation that caused its decline in the Southwest Atlantic since the early 1990's and its collapse in 2009 (Navarro et al. 2014; Falkland Islands Government 2025). A no-fishing area was established to the south and south-west of the Falkland Islands from 1st of July to 15th of October in 2007, mandated for S-licensed vessels targeting both southern blue whiting and hoki stocks (Falkland Islands Government 2025). Both stocks may have benefited from reduced fishing pressure because of the S-licence not being used since 2017. Nevertheless, both stocks are targeted across several nations' Exclusive Economic Zones and the Falkland Islands contribute only a small proportion of the total shared catch in the Southwest Atlantic and Southeast Pacific. For instance, Falkland Islands fisheries have contributed nearly 3% and 10% of the average catch of southern blue whiting and hoki respectively, shared with Argentina and Chile, since 2017 (Ramos & Winter 2022b, 2023b; Falkland Islands Government 2025; Government of

Argentina[1]; Government of Chile[2]). The low biomass of these stocks may be in part due to high fishing pressure outside Falkland Islands waters. However, conservation measures must be implemented in the FICZ for both stocks. The spawning ground of southern blue whiting located to the south of the Falkland Islands (Shubnikov et al. 1969; Pájaro & Macchi 2001; Macchi et al. 2005) should continue to be protected, also taking into account that it varies in size and location depending on the intensity of the Falkland Current (Arkhipkin et al. 2009, 2012).

The declining biomass trend of rock cod in February parallel demersal surveys is consistent with the declining biomass trend from 2005 to 2019 based on commercial fisheries data (Winter 2020), and with the declining trend of CPUE since 2011, which has stabilized at low levels since 2020 (Ramos & Winter 2023a). An apparent change in its geographic distribution inferred from increasing out-of-zone catches may also have contributed to the decrease in abundance of this stock in Falkland Islands waters from 2016 to 2018 (Table A1 in Winter 2021).

Falkland Islands fisheries contribute a major proportion of the reported total catch of rock cod shared with Argentina in the Southwest Atlantic, i.e., 84% of the 10-year average catch of rock cod (Ramos & Winter 2023a), and pertinent management decisions made at FIFD are relevant for the sustainability of this stock. Commercial rock cod catches in Falkland Islands waters have decreased significantly since 2010 (Ramos & Winter 2023a), and the proportion of rock cod discarded has increased from an annual average of 13% over the period 2010–2015 to 72% from 2016 to 2024, with up to 94% discards reported in 2021 (Falkland Islands Government *unpublished data*). Rock cod are discarded in the commercial fishery because of their small size and most of these small individuals have not reproduced during their lifetime. Survival rates of discards are low, and the future growth and biomass of these individuals is therefore wasted. Discarding may also result in less certain stock assessments because discarded catch is often not reported accurately (Guillen et al. 2018). Currently, rock cod is a permitted catch in finfish vessels (A–, G–, and W–licences) and apart from a TAC there are no other conservation measures in any Falkland Islands fisheries (Falkland Islands Government 2025), including the Patagonian squid fishery that has

[1] https://www.magyp.gob.ar/sitio/areas/pesca_maritima/desembarques/
[2] https://www.sernapesca.cl/informacion-utilidad/anuarios-estadisticos-de-pesca-y-acuicultura/

contributed most rock cod catches and discards in Falkland Islands waters since 2016 (Ramos & Winter 2023a). Lack of conservation measures against the incidental catch and discard of juvenile individuals can affect the state of a fishery stock, and recruitment to the fishery (Gilman et al. 2020).

Red cod declining biomass observed from February parallel demersal surveys is consistent with the declining trend of CPUE from finfish licensed vessel in the FICZ; this stock has shown large fluctuations of CPUE in the commercial fishery, with peaks in 1996 and 2011, and the most recent decline from 2013 to 2024 (Ramos & Winter 2022c; Falkland Islands Government *unpublished data*). Red cod spawning grounds are located to the south and southwest of West Falkland, and have been closed for fishing since 2010 (Ramos & Winter 2022c). Nevertheless, a survey conducted in late September 2022 found low biomass of spawning red cod, and also concluded that this stock has decreased in the Falkland Islands fishing area (Arkhipkin et al. 2022). On average, Falkland Islands fisheries have contributed 58% of the Falkland Islands and Argentine combined annual catch since 1987 (Ramos & Winter 2022c; Falkland Islands Government *unpublished data*). This highlights the need of conservation measures for this stock in Falkland Islands waters, including the continued protection of the spawning grounds.

Falkland Islands fisheries contribute a minor proportion (≤ 12%) of the southern hake catch that is shared with Argentina (Ramos & Winter 2022d), likely resulting in a smaller impact on the southern hake stock. Information of this species collected from the commercial fisheries in the FICZ is limited, which restricts our capacity to assess this stock.

Kingclip biomass in 2025 was the lowest amongst February parallel demersal surveys, consistent with the decrease of CPUE in the Falkland Islands finfish fishery since 2013 (Ramos & Winter 2022e; García 2024). Kingclip are being caught at small sizes by the Falkland Islands commercial fisheries, and the stock level is below the limit reference point. According to García (*in prep.*), if the fish were caught at larger sizes (~ 80 cm total length), fishing mortality could be improved, resulting in better yield per recruit and help to recover the stock.

Adult Patagonian toothfish are caught mainly using longline; therefore, the information provided in this report is not representative of the adult portion of the Patagonian toothfish population. The FIFD has made efforts to search for juvenile Patagonian toothfish during austral spring or summer, by conducting juvenile Patagonian toothfish surveys (e.g., Pompert et al. 2015; Arkhipkin et al. 2017; Lee et al. 2018), by including four inshore stations in February groundfish surveys (e.g., see Arkhipkin et al. 2019; Randhawa et al. 2020; Trevizan et al. 2021), or by opportunistic search of juvenile Patagonian toothfish during most groundfish surveys. In the February groundfish surveys, Patagonian toothfish smaller than 20 cm total length (ages ≤ 1) have been scarce through the time series (n_{2010} = 0; n_{2011} = 60; n_{2015} = 237; n_{2016} = 57; n_{2017} = 109; n_{2018} = 0; n_{2019} = 1; n_{2020} = 2; n_{2021} = 26; $n_{2022\text{-onwards}}$ = 0). Higher numbers of juveniles found in the February 2015 and 2017 surveys are consistent with higher recruitment in 2015 and 2017, with persistent recruitment hotspots for newly-settled Patagonian toothfish found to the north-west in the FICZ, along with opportunistic areas to the north-east (2015), north (2016), and south (2017), coinciding with the main areas of upwelling and high productivity (Lee et al. 2021). The apparent increase of Patagonian toothfish biomass in recent years may be due to an increase in the catch of 30–40 cm total length fish, which could be an indication of recruitment between 2022 and 2023 (F. Skeljo, FIFD Senior Stock Assessment Scientist, *pers. comm.*). The state of Patagonian toothfish recruitment has remained low apart from 2015 and 2017, and the suspected pulse of recruitment in 2022–2023. During years of low recruitment, juvenile Patagonian toothfish are largely constrained to sheltered inshore regions to the north-west of the Falkland Islands (Lee et al. 2021). Environmental factors seem to largely influence Patagonian toothfish recruitment. Sporadic pulses of juvenile recruitment supporting the longline fishery emphasizes the need to protect high-recruitment cohorts through appropriate spatial management (Falkland Islands Government 2025). Juveniles of other species are recorded and measured opportunistically, but are not currently the objective of a systematic study.

6. Conclusions

1. The biomasses of four commercial stocks calculated from the February parallel demersal surveys were statistically significantly lower in 2025 than in 2010: hoki, red cod, rock cod, and southern hake.
2. Hoki, kingclip, and red cod reached the lowest biomass levels since 2010.
3. Hoki had the greatest decrease in biomass from 2010 to 2025 given that its estimated biomass in 2025 (6,842 t) was only 2% of its estimated biomass in 2010 (278,980 t). Rock

cod biomass in 2025 (124,187 t) was 15% of its biomass in 2010 (817,086 t). Red cod biomass in 2025 (16,521 t) was 17% of its biomass in 2010 (95,050 t), and southern hake biomass in 2025 (2,168 t) was 43% of its biomass in 2010 (5,097 t). Kingclip biomass in 2025 (10,081 t) was 47% of its biomass in 2010 (21,274 t); however, there was no significant decline in kingclip biomass from 2010 to 2025 due to considerable interannual variability it its biomass.

4. Argentine shortfin squid, banded whiptail grenadier, Patagonian squid, Patagonian toothfish, and southern blue whiting also did not have statistically significant trends from 2010 to 2025.
5. Common hake had a statistically significant increase in biomass from 2010 to 2025, with its biomass in 2010 (9,124 t) being 11% of its biomass in 2025 (85,299 t).

7. Recommendations

1. The poor state of several finfish stocks (i.e., hoki, kingclip, red cod, rock cod, and southern blue whiting) in Falkland Islands waters highlights the need for conservation action. The following management options should be examined:
   1.1. The inclusion of some of these species in the calculation of the daily by-catch limit for the finfish licences (A–, G–, and W–licences), which triggers a move on rule and no fishing during a number of days in the grid square where the by-catch limit was reached. The 10% proportion of the by-catch limit and the 10-days duration of the move-on and no fishing rule could be re-assessed to include these species, reducing fishing pressure on those stocks.
   1.2. Closure of specific grid squares where high proportions of the catch of each stock take place, to decrease fishing pressure on those stocks.
   1.3. Protection of the spawning grounds of hoki, red cod, rock cod, and southern blue whiting, taking into account that they may vary in size and location depending on oceanographic conditions.
2. Inclusion of biomass calculations in stock assessments should be re-considered if commercial fisheries catch, fishing effort, and biological data are available and appropriate for the different stocks. Biomass has not been calculated from

commercial data for several stocks since 2019, limiting our understanding of the state of some stocks in recent years.

8. References

Agnew DJ (2002) Critical aspects of the Falkland Islands pelagic ecosystem: distribution, spawning and migration of pelagic animals in relation to oil exploration. Aquatic Conservation 12: 39–50.

Alglave, B, Rivot E, Etienne MP, Woillez M, Thorson JT, Vermard Y (2022) Combining scientific survey and commercial catch data to map fish distribution. ICES Journal of Marine Science 79: 1133–1149. https://doi.org/10.1093/icesjms/fsac032

Arkhipkin AI, Schuchert PC, Danyushevsky L (2009) Otolith chemistry reveals fine population structure and close affinity to the Pacific and Atlantic oceanic spawning grounds in the migratory southern blue whiting (*Micromesistius australis australis*). Fisheries Research 96: 188–194. doi: 10.1016/j.fishres.2008.11.002

Arkhipkin AI, Laptikhovsky VV (2010) Convergence in life-history traits in migratory deep-water squid and fish. ICES Journal of Marine Science 67: 1444–1451.

Arkhipkin A, Winter A, May T (2010) *Loligo gahi* Stock Assessment Survey, First Season 2010. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 13 p.

Arkhipkin A, Bakanev S, Laptikhovsky V (2011) Rock cod Biomass Survey – 2011. Report number ZDLT1-02-2011. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 37 p.

Arkhipkin A, Brickle P, Laptikhovsky V, Winter A (2012) Dining hall at sea: feeding migrations of nektonic predators to the eastern Patagonian Shelf. Journal of Fish Biology 81: 882–902. https://doi.org/10.1111/j.1095-8649.2012.03359.x

Arkhipkin AI, Laptikhovsky VV, Barton AJ (2015) Biology and fishery of common hake (*Merluccius hubbsi*) and southern hake (*Merluccius australis*) around the Falkland/Malvinas Islands on the Patagonian shelf of the Southwest Atlantic Ocean. In H. Arancibia (Ed.), Hakes, Biology and Exploitation (pp. 154–184). Oxford: Wiley.

Arkhipkin A, Herrera D, Lee B, Boag T, Bradley K, Cockcroft K (2017) Scientific Report, Fisheries Cruise ZDLT1-01-2017. Stanley, Fisheries Department, Directorate of Natural Resources, Falkland Islands Government. 34 p.

Arkhipkin A, Lee B, Goyot L, Ramos JE, Chemshirova I, Roberts G, Costa M, Blake A (2019) Demersal biomass survey. Report number ZDLM3-02-2019. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 44 p.

Arkhipkin A, Evans D, Raczynski M, Winter A (2022) Southern blue whiting and red cod spawning survey. Cruise Report ZDLV-09-2022. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 28 p.

Barabanov AV (1982) Influence of hydrometeorological conditions of the Southwest Atlantic on migrations of southern blue whiting in Scotia Sea. *In:* Arkhipkin AI, Schuchert PC, Danyushevsky L (2009) Otolith chemistry reveals fine population structure and close affinity to the Pacific and Atlantic oceanic spawning grounds in the migratory southern blue whiting (*Micromesistius australis australis*). Fisheries Research 96 : 188–194. https://doi.org/10.1016/j.fishres.2008.11.002

Bianchi A, Massonneau M, Olevera RM (1982) Análisis estadístico de las características T–S del sector austral de la Plataforma Continental Argentina. Acta Oceanológica Argentina 3: 93–118. *In:* Arkhipkin A, Brickle P, Laptikhovsky V, Winter A (2012) Dining hall at sea: feeding migrations of nektonic predators to the eastern Patagonian Shelf. Journal of Fish Biology 81: 882–902. https://doi.org/10.1111/j.1095-8649.2012.03359.x

Boltovskoy D (Ed.) (1999) South Atlantic Zooplankton. *In:* Arkhipkin A, Brickle P, Laptikhovsky V, Winter A (2012) Dining hall at sea: feeding migrations of nektonic predators to the eastern Patagonian Shelf. Journal of Fish Biology 81: 882–902. https://doi.org/10.1111/j.1095-8649.2012.03359.x

Brickle P, Laptikhovsky V (2010) Rock cod Biomass Survey. Report number ZDLT1-02-2010. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 31 p.

Chemshirova I, Raczynski M, Ongoro F, Winter A (2024) 2024 1st Pre-season Assessment Survey Falkland calamari (*Doryteuthis gahi*). ZDLF2-S1-2024. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 18 p.

Chemshirova I, Amukwaya A, Garcia D (*in prep.*) 2025 1st Pre-season Assessment Survey Falkland calamari (*Doryteuthis gahi*). ZDLC1-S1-2025. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands.

Falkland Islands Government (1989) Fisheries Report, FIG Stanley, Fisheries Department. 45 p.

Falkland Islands Government (2025) Fisheries Department Fisheries Statistics, Vol. 29, FIG Stanley, Fisheries Department.

Gallo ND, Bowlin NM, Thompson AR, Satterthwaite EV, Brady B, Semmens BX (2022) Fisheries surveys are essential ocean observing programs in a time of global change: A synthesis of oceanographic and ecological data from U.S. west coast fisheries surveys. Frontiers in Marine Science 9: 1–18. https://doi.org/10.3389/fmars.2022.757124

García D (2024) Stock assessment of kingclip (*Genypterus blacodes*) in the Falkland Islands using JABBA. SA–2024–KIN. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government. Stanley, Falkland Islands. 69 p.

García D (*in prep.*) Stock Assessment of kingclip (*Genypterus blacodes*) in the Falkland Islands using length-based methods and yield per recruit approach. SA–2025–KIN. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government. Stanley, Falkland Islands.

Gilman E, Perez-Roda A, Huntington T, Kennelly SJ, Suuronen P, Chaloupka M, Medley PAH (2020) Benchmarking global fisheries discards. Scientific Reports 10: 14017. https://doi.org/10.1038/s41598-020-71021-x

Guillen J, Holmes SJ, Carvalho N, Casey J, Dorner H, Gibin M, Mannini A, Vasilakopoulos P, Zanzi A (2018) A Review of the European Union Landing Obligation Focusing on Its Implications for Fisheries and the Environment. Sustainability 10: 900. https://doi.org/10.3390/su10040900

Gras M, Blake A, Pompert J, Jürgens L, Visauta E, Busbridge T, Rushton H, Zawadowski T (2015) Rock cod Biomass Survey. Report number ZDLT1-02-2015. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 45 p.

Gras M, Pompert J, Blake A, Boag T, Grimmer A, Iriarte V, Sánchez B (2016) Finfish and Rock cod Biomass Survey. Report number ZDLT1-02-2016. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 72 p.

Gras M, Pompert J, Blake A, Busbridge T, Derbyshire C, Keningale B, Thomas O (2017) Groundfish survey. Report number ZDLT1-02-2017. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 83 p.

Gras M, Randhawa H, Blake A, Busbridge T, Chemshirova I, Guest A (2018) Groundfish survey. Report number ZDLM3-02-2018. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 81 p.

Hilborn R, Walters CJ (1992) Quantitative fisheries stock assessment: Choice, dynamics and uncertainty. New York, USA: Chapman & Hall.

Laptikhovsky VV, Arkhipkin AI, Brickle P (2008) Life history, fishery and stock conservation of the Patagonian toothfish around the Falkland Islands. American Fisheries Society

Symposium 49: 1357–1363. *In:* Arkhipkin A, Brickle P, Laptikhovsky V, Winter A (2012) Dining hall at sea: feeding migrations of nektonic predators to the eastern Patagonian Shelf. Journal of Fish Biology 81: 882–902. https://doi.org/10.1111/j.1095-8649.2012.03359.x

Laptikhovsky V, Arkhipkin A, Brickle P (2013) From small bycatch to main commercial species: Explosion of stocks of rock cod *Patagonotothen ramsayi* (Regan) in the Southwest Atlantic. Fisheries Research 147: 399–403. http://dx.doi.org/10.1016/j.fishres.2013.05.006

Lee B, Goyot L, Ramos-Castillejos JE, Hall J, Zawadowski T (2018) Research cruise ZDLT1-12-2018. Patagonian toothfish – juvenile survey. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government. Stanley, Falkland Islands. 28 p.

Lee B, Arkhipkin A, Randhawa HS (2021) Environmental drivers of Patagonian toothfish (*Dissostichus eleginoides*) spatial-temporal patterns during an ontogenetic migration on the Patagonian Shelf. Estuarine, Coastal and Shelf Science 259: 107473. https://doi.org/10.1016/j.ecss.2021.107473

Macchi GJ, Pájaro M, Wöhler OC, Acevedo MJ, Centurión RL, Urteaga DG (2005) Batch fecundity and spawning frequency of southern blue whiting (*Micromesistius australis*) in the southwest Atlantic Ocean. New Zealand Journal of Marine and Freshwater Research 39: 993–1000. https://doi.org/10.1080/00288330.2005.9517370

Navarro G, Rozycki V, Monsalvo M (2014) Estadísticas de la pesca marina en la Argentina. Evolución de los desembarques 2008-2013. Ministerio de Agricultura, Ganaderia y Pesca de la Nación. Buenos Aires, 144 p.

Pájaro M, Macchi GJ (2001) Spawning pattern, length at maturity, and fecundity of the southern blue whiting (*Micromesistius australis*) in the south-west Atlantic Ocean. New Zealand Journal of Marine and Freshwater Research 35: 375–385. https://doi.org/10.1080/00288330.2001.9517008

Payá I, Brickle P, Laptikhovsky V, Winter A (2010) Vessel Units, Allowable Effort, and Allowable Catch 2011. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 53 p.

Peterson RG, Whitworth III T (1989) The Subantarctic and Polar fronts in relation to deep water masses through the Southwestern Atlantic. Journal of Geophysical Research 94: 10817–10838. *In:* Arkhipkin A, Brickle P, Laptikhovsky V, Winter A (2012) Dining hall at sea: feeding migrations of nektonic predators to the eastern Patagonian Shelf. Journal of Fish Biology 81: 882–902. https://doi.org/10.1111/j.1095-8649.2012.03359.x

Pompert J, Blake A, Lee B, Jones J, Zawadowski T (2015) Scientific Report, Fisheries Cruise ZDLT1-11-2015. Stanley, Fisheries Department, Directorate of Natural Resources, Falkland Islands Government. 39 p.

Ramos JE, Winter A (2019) Stock assessment of hoki (*Macruronus magellanicus*) in the Falkland Islands. SA–2019–WHI. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government. Stanley, Falkland Islands. 47 p.

Ramos JE, Winter A (2022a) February bottom trawl survey biomasses of fishery species in Falkland Islands waters, 2010–2022. SA–2022–05. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 86 p.

Ramos JE, Winter A (2022b) Stock assessment of hoki (*Macruronus magellanicus*) in the Falkland Islands. SA–2022–WHI. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 39 p.

Ramos JE, Winter A (2022c) Stock assessment of red cod (*Salilota australis*) in the Falkland Islands. SA–2022–BAC. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 39 p.

Ramos JE, Winter A (2022d) Stock assessment of Southern hake (*Merluccius australis*) in the Falkland Islands. SA–2022–PAT. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 37 p.

Ramos JE, Winter A (2022e) Stock assessment of kingclip (*Genypterus blacodes*) in the Falkland Islands. SA–2022–KIN. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 41 p.

Ramos JE, Winter A (2023a) Stock assessment of rock cod (*Patagonotothen ramsayi*) in the Falkland Islands. SA–2023–PAR. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 49 p.

Ramos JE, Winter A (2023b) Stock assessment of southern blue whiting (*Micromesistius australis*) in the Falkland Islands. SA–2022–BLU. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 36 p.

Ramos JE, Soeth M, Hoyer P, Amukwaya A, Peruzzo M, Villarroel M, Vukasin V, Blake A (2024) Cruise Report 2024-02-ZDLT1. Groundfish survey. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government. Stanley, Falkland Islands. 45 p.

Ramos JE, Soeth M, Desmet L, Minichino R, Orlandi N, Peruzzo M, Villarroel M, Blake A (2025) Cruise Report 2025-02-ZDLU1. Groundfish survey. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government. Stanley, Falkland Islands. 50 p.

Randhawa HS, Goyot L, Blake A, Ramos JE, Roberts G, Brewin J, Evans D (2020) Cruise Report ZDLT1-02-2020: 2020 Demersal Biomass Survey. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 97 p.

Seafish (2010) Bridle angle and wing end spread calculations. Research and development catching sector fact sheet. Available at: www.seafish.org

Shubnikov DA, Permitin YE, Voznyak SP (1969) Biology of the pelagic gadoid fish *Micromesistius australis* Norman. Trudy VNIRO 66: 299–306. In: Arkhipkin AI, Schuchert PC, Danyushevsky L (2009) Otolith chemistry reveals fine population structure and close affinity to the Pacific and Atlantic oceanic spawning grounds in the migratory southern blue whiting (*Micromesistius australis australis*). Fisheries Research 96: 188–194. https://doi.org/10.1016/j.fishres.2008.11.002

Trevizan T, Ramos JE, Blake A, Brewin J, Büring T, Claes J, Evans D (2021) Cruise Report ZDLT1-2021-02. Demersal survey. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government. Stanley, Falkland Islands. 50 p.

Trevizan T, Evans D, Büring T, Ramos JE, Santana-Hernandez N, Sadd D, Copping EA, Piontek R, Blake A (2022) Cruise Report ZDLT1-2022-02. Demersal survey. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government. Stanley, Falkland Islands. 34 p.

Trevizan T, Shcherbich Z, Büring T, Ramos JE, Nicholls R, Hoyer P, Amukwaya A, Fournier-Carnoy L, Piontek R (2023) Cruise Report ZDLT1-2023-02. Demersal survey. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government. Stanley, Falkland Islands. 39 p.

Winter A, Laptikhovsky V, Brickle P, Arkhipkin A (2010) Rock cod (*Patagonotothen ramsayi* (Regan, 1913)) stock assessment in the Falkland Islands. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 12 p.

Winter A, Davidson D, Watson M (2011) *Loligo gahi* Stock Assessment Survey, 1st Season 2011. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 18 p.

Winter A (2015) Loligo Stock Assessment, First Season 2015. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 28 p.

Winter A, Jones J, Shcherbich Z (2015) *Loligo* Stock Assessment Survey, 1st Season 2015. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 16 p.

Winter A, Zawadowski T, Shcherbich Z, Bradley K, Kuepfer A (2016) Falkland calamari Stock Assessment Survey, 1st Season 2016. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 19 p.

Winter A, Jones J, Shcherbich Z, Iriarte V (2017) Falkland calamari Stock Assessment Survey, 1st Season 2017. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 17 p.

Winter A, Iriarte V, Zawadowski T (2018) *Doryteuthis gahi* Stock Assessment Survey, 1st Season 2018. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 20 p.

Winter A (2019) Rock cod stock assessment (*Patagonotothen ramsayi*). Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 23 p.

Winter A, Zawadowski T, Tutjavi V (2019) *Doryteuthis gahi* Stock Assessment Survey, 1st Season 2019. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 18 p.

Winter A (2020) Rock cod stock assessment (*Patagonotothen ramsayi*). Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 33 p.

Winter A, Lee B, Arkhipkin A, Tutjavi V, Büring T (2020) 2020 1st Season Assessment Survey Falkland calamari (*Doryteuthis gahi*). ZDLY-S1-2020. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 16 p.

Winter A (2021) Rock cod (*Patagonotothen ramsayi*) stock assessment. SA–2021–PAR. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 29 p.

Winter A, Shcherbich Z, Matošević N (2021) 2021 1st Season Assessment Survey Falkland calamari (*Doryteuthis gahi*). ZDLY-S1-2021. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 18 p.

Winter A, Lee B, Shcherbich Z, Nicholls R (2022) 2022 1st Pre-season Assessment Survey Falkland calamari (*Doryteuthis gahi*). ZDLS3-S1-2022. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 15 p.

Winter A, Raczynski M, Peruzzo M (2023) 2023 1st Pre-season Assessment Survey Falkland calamari (*Doryteuthis gahi*). ZDLE1-S1-2023. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Stanley, Falkland Islands. 17 p.

Appendix I. February surveys summary

February groundfish (gf) and calamari pre-season (pr) surveys information. Catches per survey and combined total include Argentine shortfin squid, banded whiptail grenadier, common hake, hoki, kingclip, Patagonian squid, Patagonian toothfish, red cod, rock cod, and southern blue whiting.

Year	Vessel		No. of trawls			Stations excluded		Catch (t)		
	gf	pr	gf	pr	total	gf	pr	gf	pr	total
2010	Castelo (ZDLT1)	Beagle F.I. (ZDLZ)	87	55	142	478, 501	NA	194.24	457.99	652.2
2011	Castelo (ZDLT1)	Venturer (ZDLP1)	88	58	146	NA	NA	196.05	257.28	453.3
2015	Castelo (ZDLT1)	Baffin Bay (MSPL9)	89	57	146	NA	NA	121.35	392.82	514.2
2016	Castelo (ZDLT1)	Sil (ZDLR1)	90	56	146	NA	638	87.32	206.62	293.9
2017	Castelo (ZDLT1)	Argos Vigo (ZDLU1)	90	58	148	2328	1002	47.35	254.29	301.6
2018	Monteferro (ZDLM3)	Castelo (ZDLT1)	97	59	156	143,144,156,164,183	NA	80.91	169.47	250.4
2019	Monteferro (ZDLM3)	Argos Cíes (ZDLS3)	79	52	135	240,242,244,246	25,29,37	45.09	418.44	463.5
2020	Castelo (ZDLT1)	Argos Cíes (ZDLS3)	80	59	139	NA	NA	47.89	283.83	331.7
2021	Castelo (ZDLT1)	Capricorn (ZDLY)	80	55	135	3388,3391,3392,3393	NA	74.67	347.85	422.5
2022	Castelo (ZDLT1)	Argos Cíes (ZDLS3)	42	60	102	NA	NA	45.61	445.51	491.1
2023	Castelo (ZDLT1)	Igueldo (ZDLE1)	84	61	145	NA	1174	67.63	610.63	678.3
2024	Castelo (ZDLT1)	New Polar (ZDLF2)	84	64	148	NA	NA	66.26	966.15	1032.4
2025	Argos Vigo (ZDLU1)	Golden Chica (ZDLC1)	84	60	144	NA	NA	75.31	420.98	496.3

Appendix II. February surveys catches

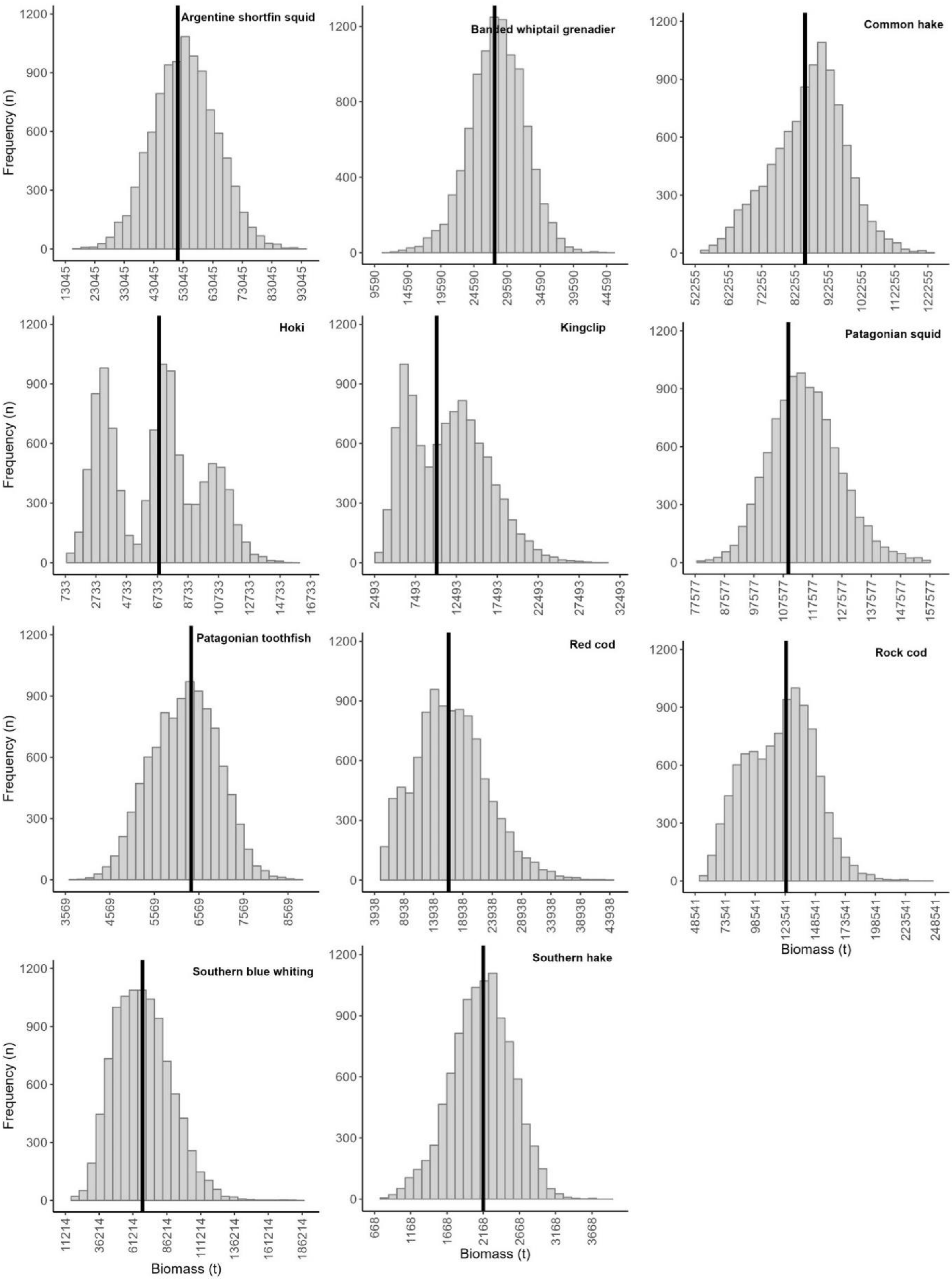
Catches (t) of main commercial species during the February 2010–2011, and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.

Year	Argentine shortfin squid	Banded whiptail grenadier	Common hake	Hoki	Kingclip	Patagonian squid	Patagonian toothfish
2010	0.88	8.05	1.31	79.78	3.24	356.76	1.39
2011	1.95	6.20	1.67	56.00	8.59	50.51	2.42
2015	31.87	6.58	3.17	26.36	14.73	186.14	0.77
2016	0.10	3.28	0.69	38.92	5.45	66.90	1.75
2017	2.49	3.97	2.94	3.70	4.26	185.23	2.50
2018	10.70	7.54	1.73	30.02	3.59	115.84	1.93
2019	9.41	2.51	2.75	7.55	4.42	386.02	0.83
2020	17.92	2.62	0.73	14.38	3.63	272.08	0.49
2021	10.31	6.53	8.15	30.83	4.79	285.54	0.73
2022	0.78	4.50	5.65	9.71	2.79	422.74	0.33
2023	3.22	5.11	8.59	14.41	10.76	554.94	1.31
2024	16.51	3.93	6.11	20.84	5.03	682.71	1.61
2025	13.01	4.66	16.99	1.09	2.42	346.15	2.14
Total	119.12	65.47	60.48	333.58	73.68	3,912.15	18.2
Mean	9.16	5.04	4.65	25.66	5.67	300.93	1.4

Appendix II. *continued*

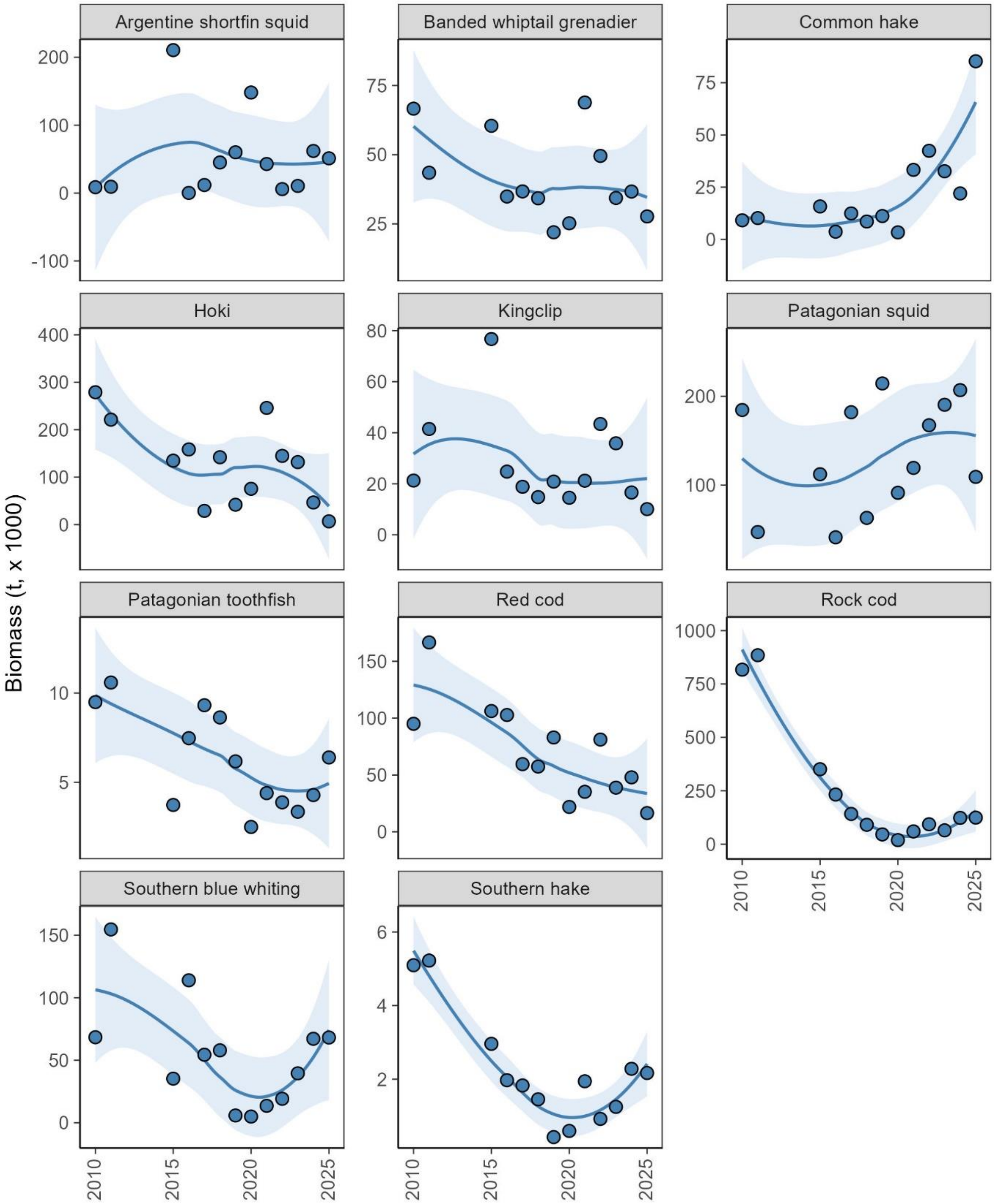
Year	Red cod	Rock cod	Southern blue whiting	Southern hake
2010	13.54	164.59	21.87	0.82
2011	23.54	249.38	52.29	0.77
2015	21.81	198.27	24.12	0.36
2016	19.95	77.31	79.36	0.25
2017	13.82	76.13	6.41	0.20
2018	13.30	35.92	29.51	0.30
2019	13.68	27.93	8.38	0.05
2020	3.71	10.98	5.10	0.10
2021	6.04	57.16	12.17	0.26
2022	10.41	30.82	3.27	0.11
2023	11.07	36.21	32.39	0.26
2024	6.41	169.71	119.80	0.32
2025	3.35	47.65	58.51	0.34
Total	160.63	1,181.52	453.16	4.13
Mean	12.36	90.89	34.86	0.32

Appendix III. February 2025 biomass bootstrap histograms
Deterministic biomass (indicated by the vertical black line) and 10,000 bootstrap iterations.



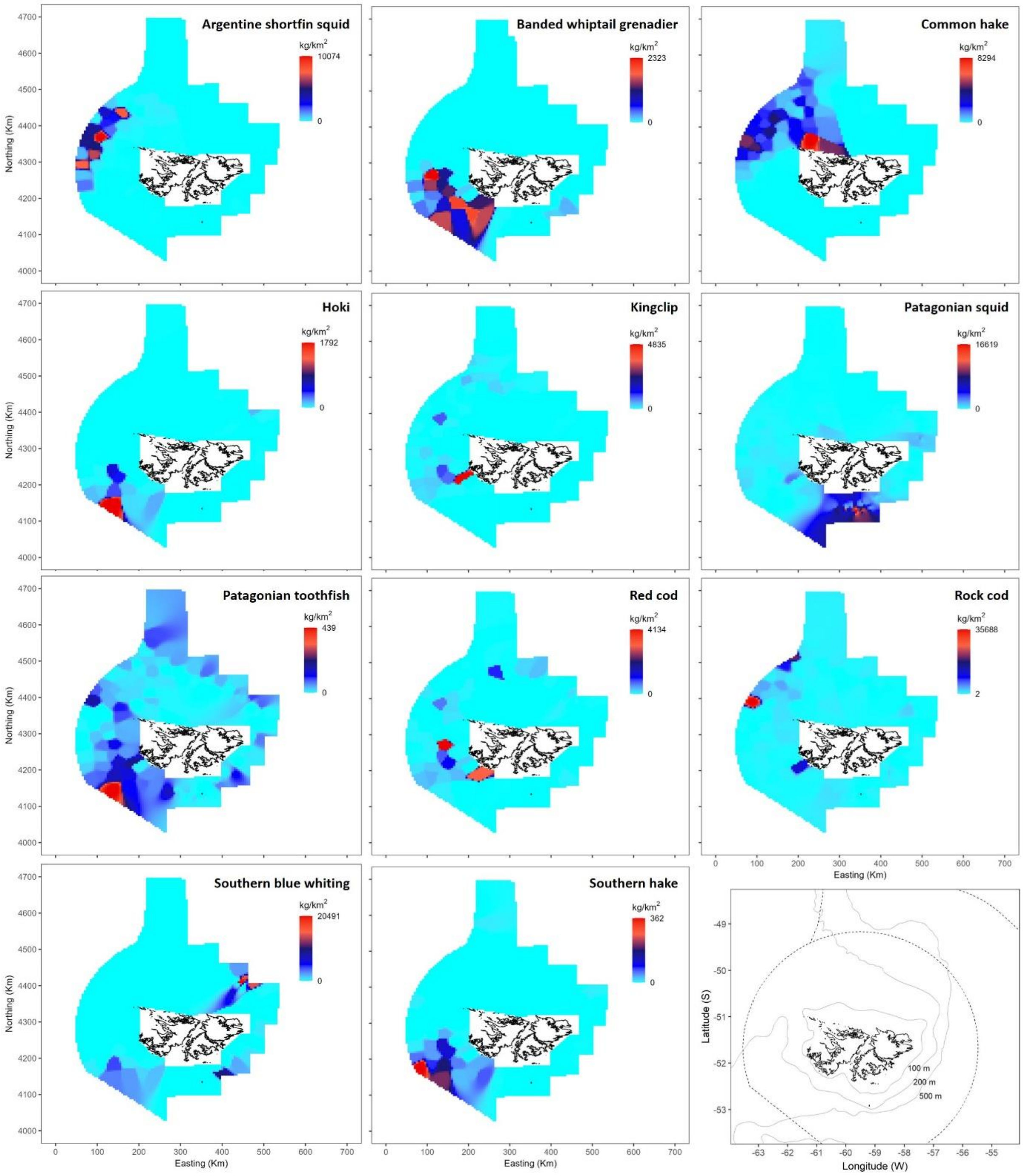
Appendix IV. February survey biomass trends

Biomass (t) of commercial species in February groundfish and calamari pre-season surveys during 2010-2011 and 2015-2025. The points indicate the calculated biomass per year. LOESS smooth ± 95% confidence intervals.



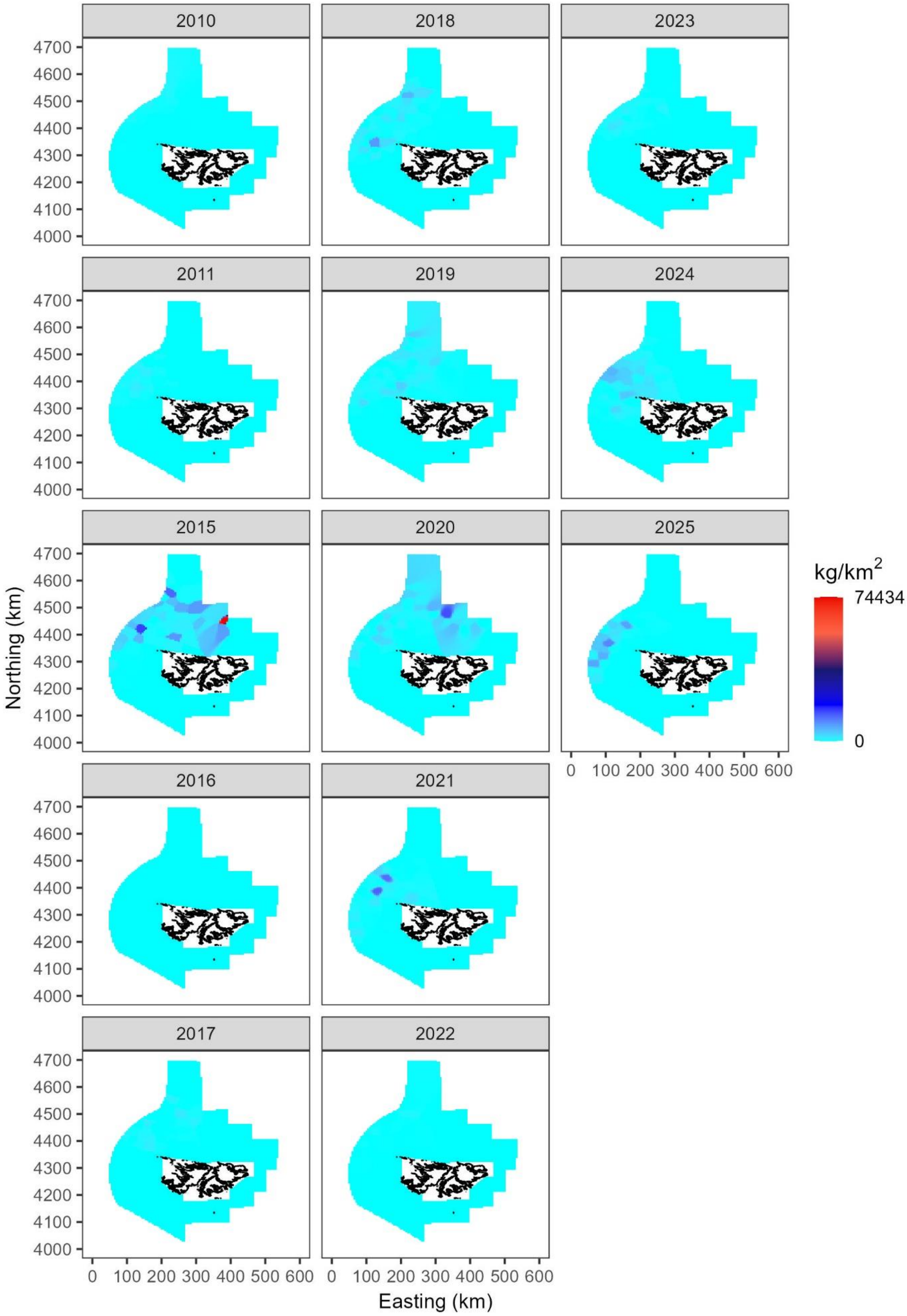
Appendix V. Species distribution during February 2025

Comparative density distribution of commercial species during the February 2025 groundfish and calamari pre-season surveys in Falkland Islands waters. Note the 100 m, 200 m, and 500 m isobaths in the bottom-right panel.



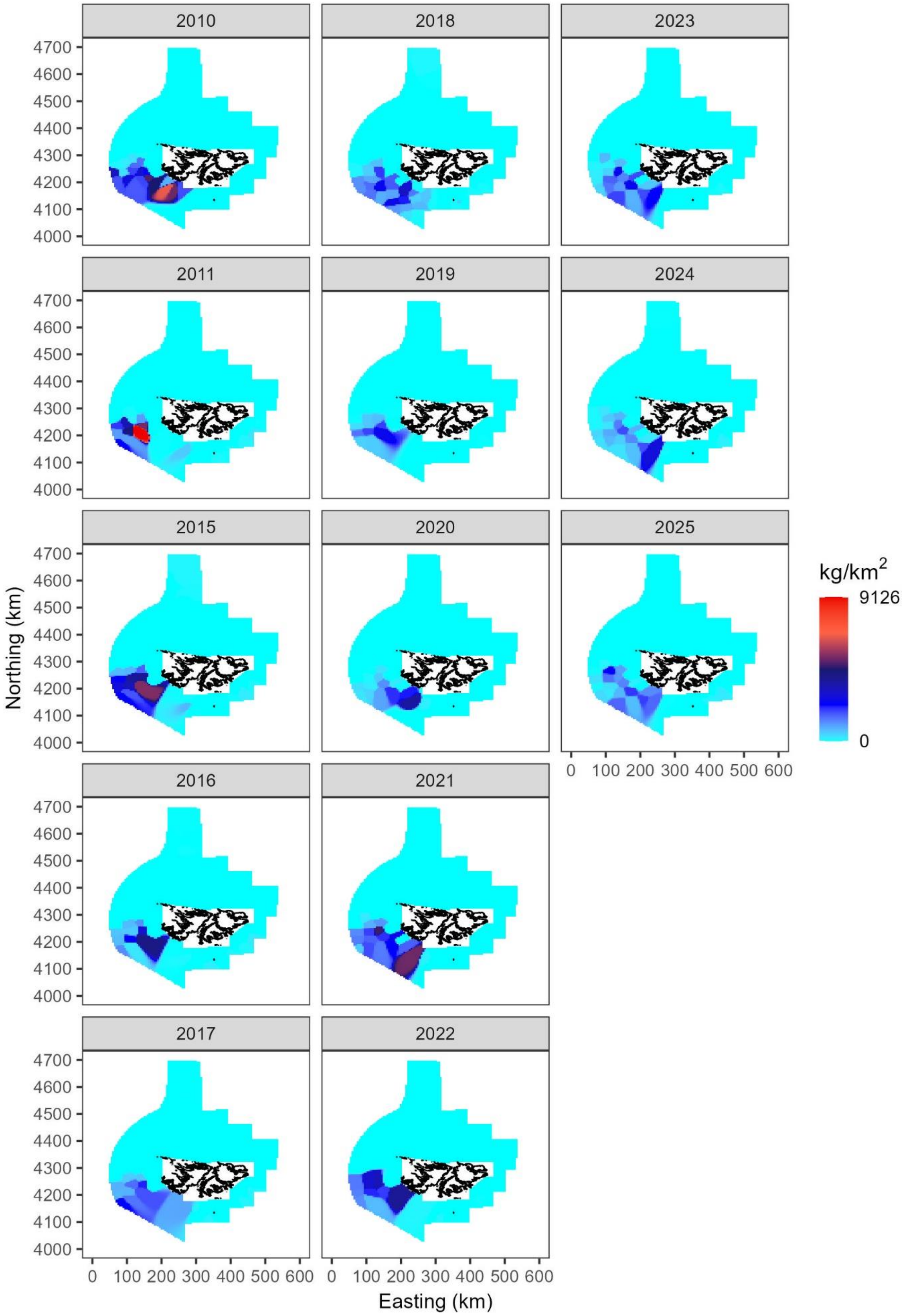
Appendix VI. Argentine shortfin squid inter-annual distribution

Comparative density distribution of the Argentine shortfin squid (*Illex argentinus*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.



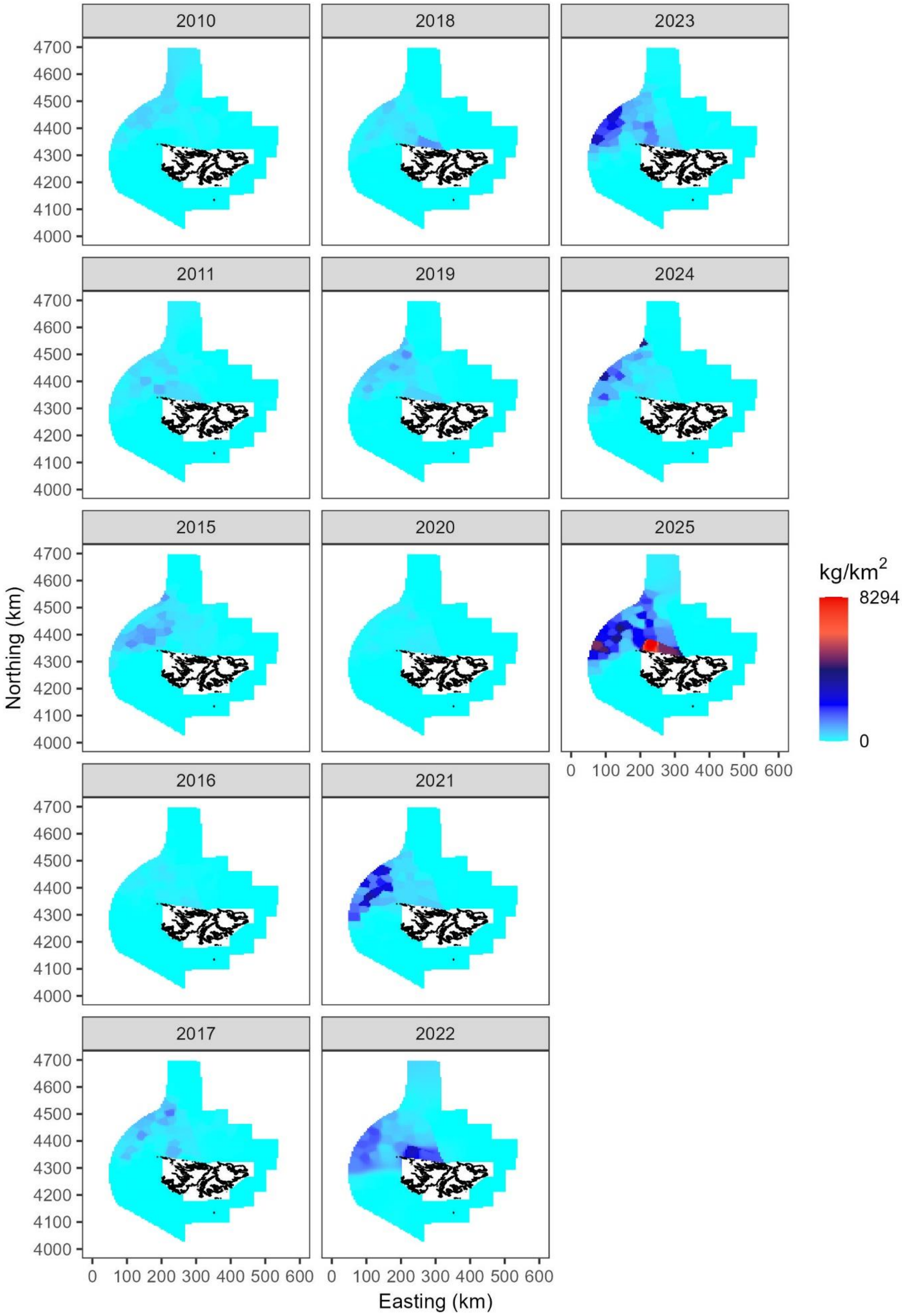
Appendix VII. Banded whiptail grenadier inter-annual distribution

Comparative density distribution of banded whiptail grenadier (*Coelorinchus fasciatus*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.



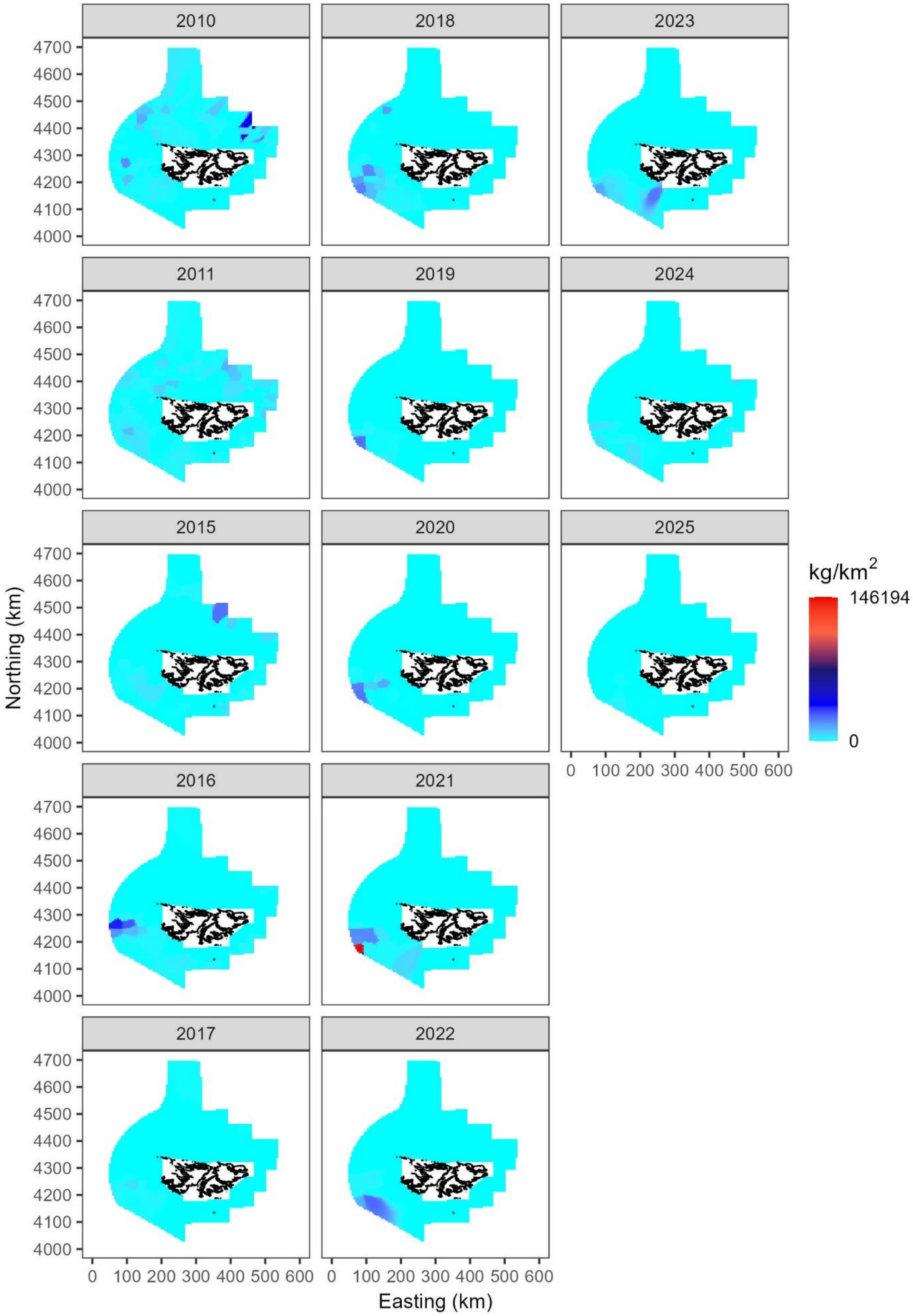
Appendix VIII. Common hake inter-annual distribution

Comparative density distribution of common hake (*Merluccius hubbsi*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.



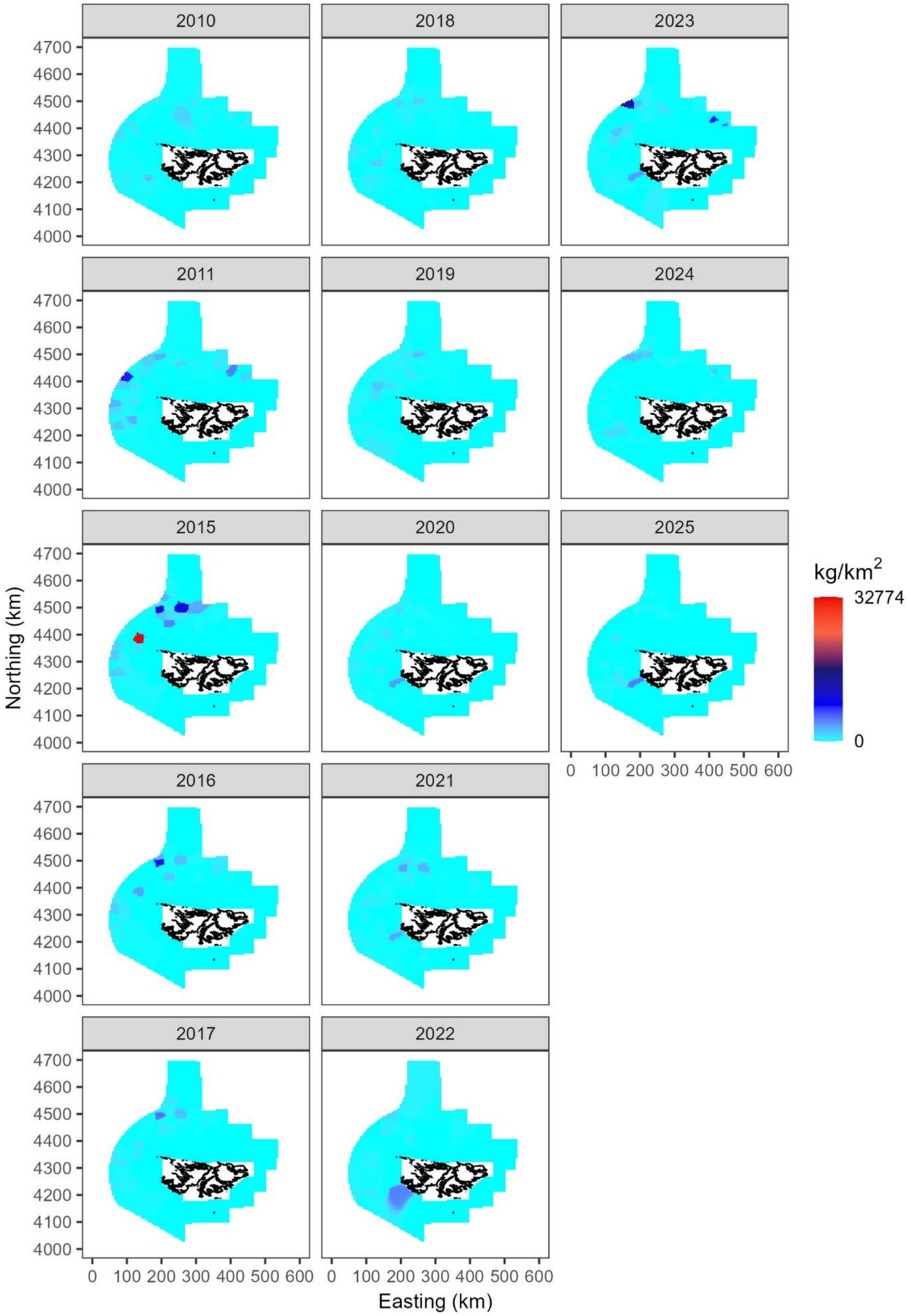
Appendix IX. Hoki inter-annual distribution

Comparative density distribution of hoki (*Macruronus magellanicus*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.



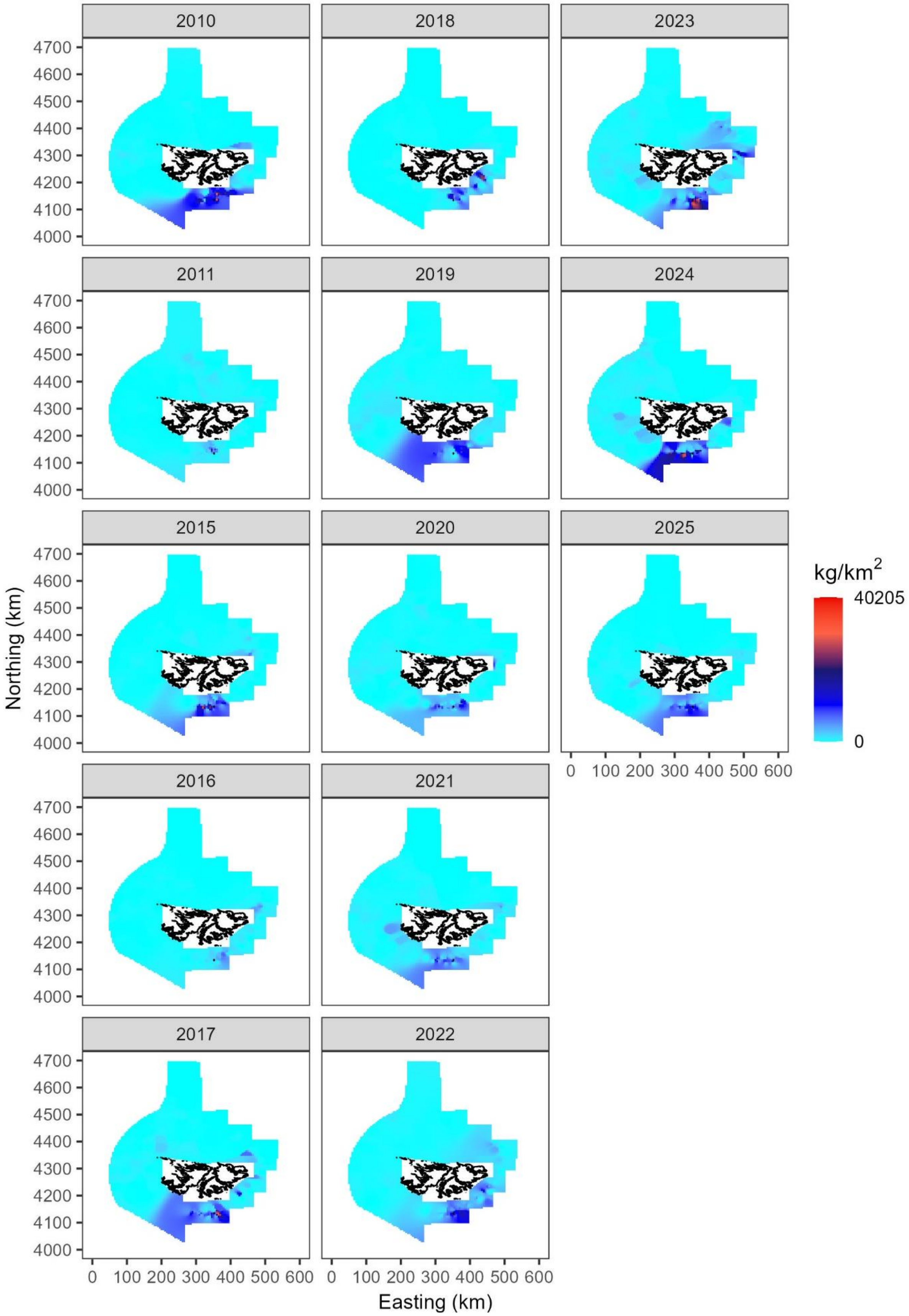
Appendix X. Kingclip inter-annual distribution

Comparative density distribution of kingclip (*Genypterus blacodes*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.



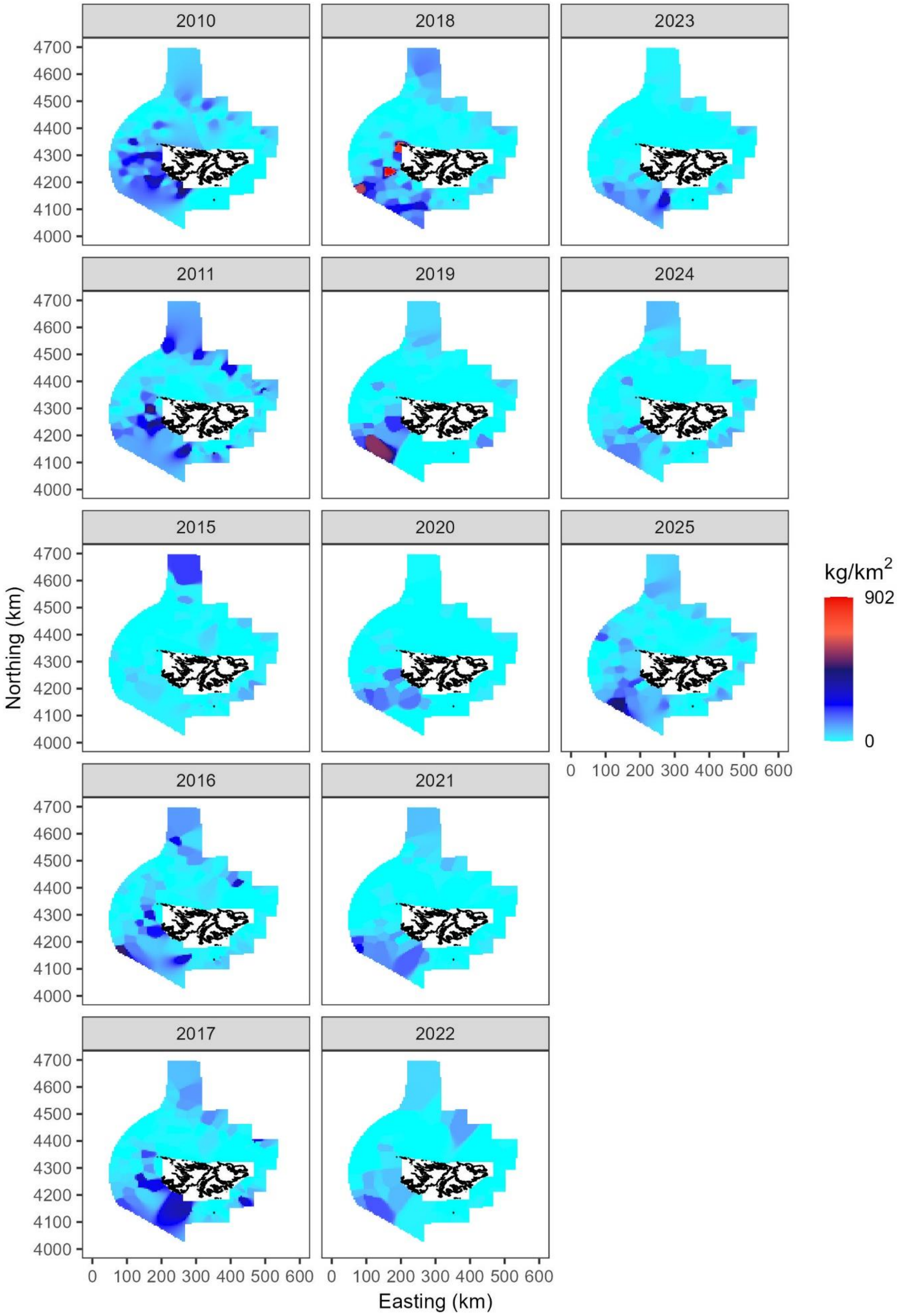
Appendix XI. Patagonian squid inter-annual distribution

Comparative density distribution of the Patagonian squid (*Doryteuthis gahi*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.



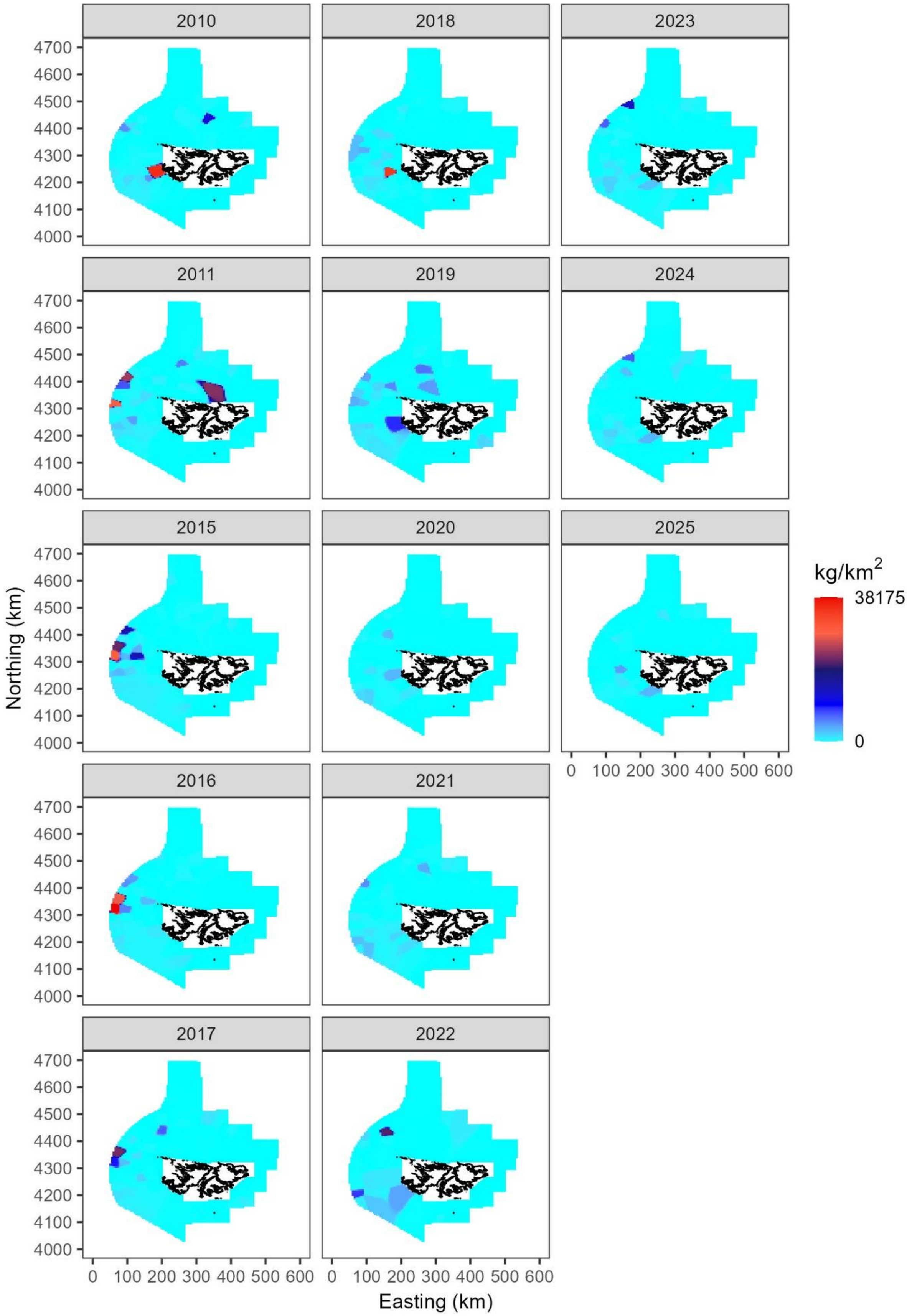
Appendix XII. Patagonian toothfish inter-annual distribution

Comparative density distribution of Patagonian toothfish (*Dissostichus eleginoides*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.



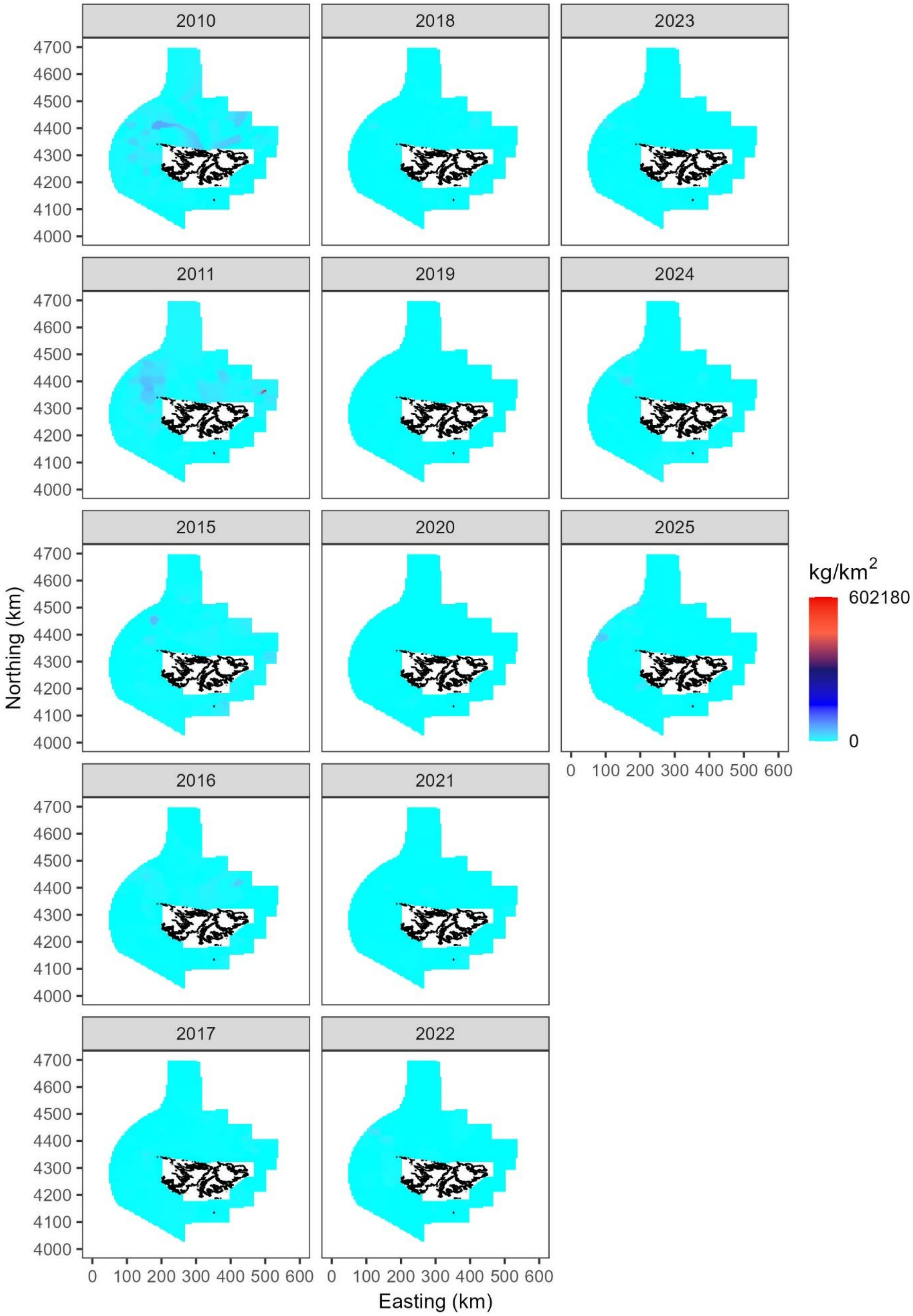
Appendix XIII. Red cod inter-annual distribution

Comparative density distribution of red cod (*Salilota australis*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.



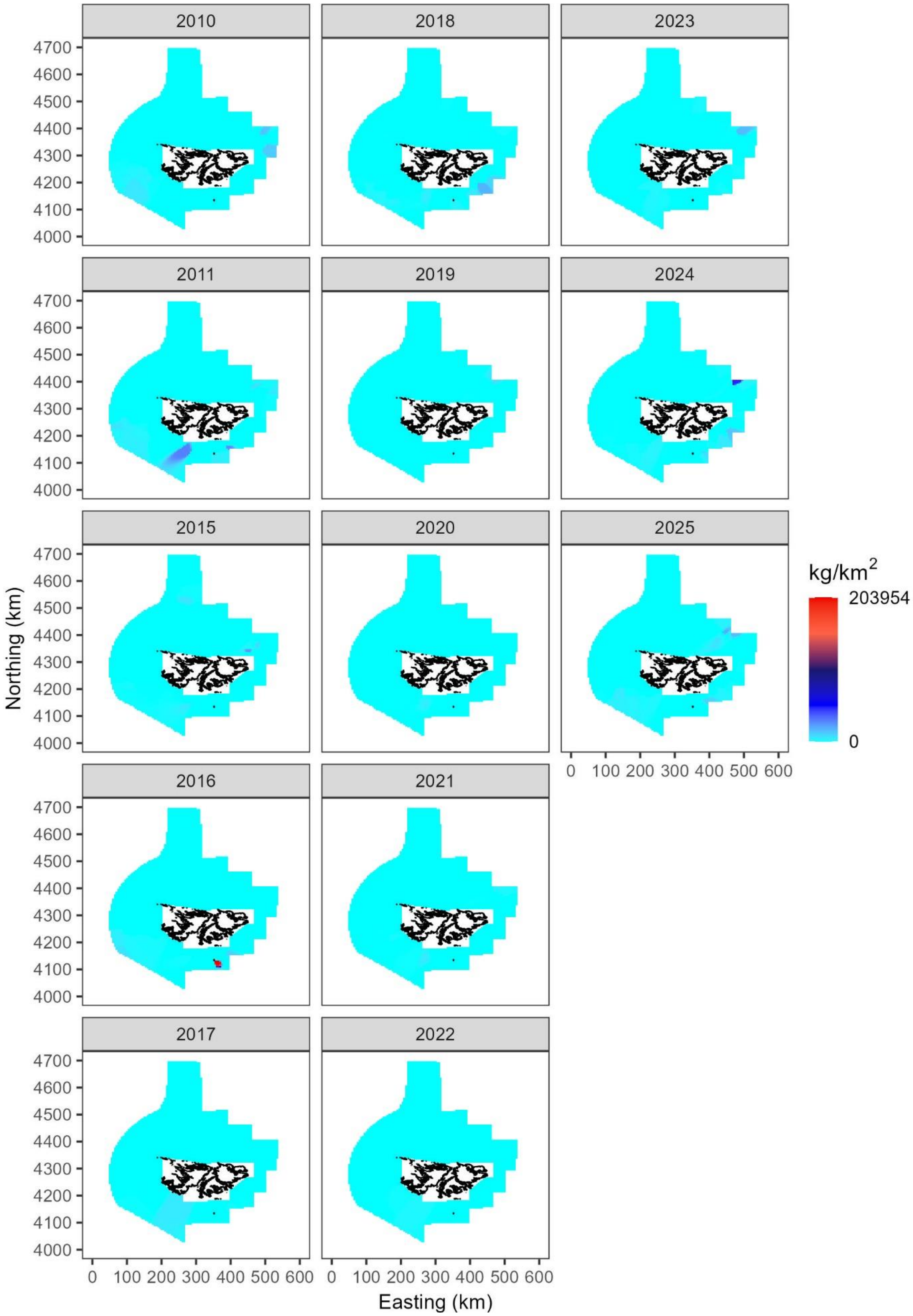
Appendix XIV. Rock cod inter-annual distribution

Comparative density distribution of rock cod (*Patagonotothen ramsayi*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.



Appendix XV. Southern blue whiting inter-annual distribution

Comparative density distribution of southern blue whiting (*Micromesistius australis*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.



Appendix XVI. Southern hake inter-annual distribution

Comparative density distribution of southern hake (*Merluccius australis*) during the February 2010–2011 and 2015–2025 groundfish and calamari pre-season surveys in Falkland Islands waters.