



Fisheries New Zealand

Tini a Tangaroa

Trawl survey of hoki and middle depth species on the Chatham Rise, January 2024 (TAN2401)

New Zealand Fisheries Assessment Report 2024/77

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ISSN 1179-5352 (online)
ISBN 978-1-991330-22-2 (online)

November 2024



Te Kāwanatanga o Aotearoa
New Zealand Government

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Please cite this report as:

Stevens, D.W.; Ballara, S.L.; Maurice, A.; Escobar-Flores, P.C.; Yeoman, J. (2024). Trawl survey of hoki and middle depth species on the Chatham Rise, January 2024 (TAN2401). *New Zealand Fisheries Assessment Report 2024/77*. 118 p.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
1. INTRODUCTION	2
1.1 Project objectives	3
2. METHODS	3
2.1 Survey area and design	3
2.2 Vessel and gear specifications	4
2.3 Trawling procedure	4
2.4 Acoustic data collection	4
2.5 Hydrology	4
2.6 Catch and biological sampling	5
2.7 Estimation of relative biomass and length frequencies	5
2.8 Estimation of numbers at age	5
2.9 Acoustic data analysis	5
3. RESULTS	6
3.1 2024 survey coverage	6
3.2 Gear performance	7
3.3 Hydrology	7
3.4 Catch composition	7
3.5 Relative biomass estimates	7
3.5.1 Core strata (200–800 m)	7
3.5.2 Deep strata (800–1300 m)	8
3.6 Catch distribution	9
3.7 Biological data	10
3.7.1 Species sampled	10
3.7.2 Length frequencies and age distributions	10
3.7.3 Reproductive status	10
3.8 Acoustic data quality	11
3.8.1 Comparison of acoustics with bottom trawl catches	11
3.8.2 Time series of relative mesopelagic fish abundance	11
3.9 Hoki condition	12
4. CONCLUSIONS	12
5. ACKNOWLEDGEMENTS	13
6. REFERENCES	13
7. TABLES AND FIGURES	16
APPENDIX 1: TAN2401 STATION DATA	103
APPENDIX 2: SPECIES CAUGHT DURING TAN2401	106
APPENDIX 3: MESOPELAGIC AND BENTHIC INVERTEBRATES	117
APPENDIX 4: HOKI AGE CLASS LENGTH RANGES	118

PLAIN LANGUAGE SUMMARY

The 28th trawl survey in a time series to estimate the abundance of hoki and other species on the Chatham Rise was carried out from 4 January to 3 February 2024. A total of 131 bottom trawls were successfully completed.

The estimated abundance of all hoki was about the same as the estimate from the previous survey in January 2022, while the estimate of juvenile (2 year old) hoki was average for the time series. The estimate of the youngest (1 year old) hoki was one of the lowest in the time series, suggesting this year class (fish born in 2022) was weak. The estimated abundance of hake increased by 26.5% from that in 2022 and was the highest estimate since 2009. The abundance of ling was about the same as in 2022 and the time series for ling shows no overall trend.

Most hoki were aged less than 5 years. Hake and ling ages were broad, with most hake aged between 4 and 13 years and most ling between 3 and 16 years old.

Acoustic data were collected throughout the trawl survey. The acoustic estimate of mesopelagic fish abundance (thought to be an index of the amount of food available to hoki) in 2024 was 13% lower than that in 2022, and below the average for the acoustic time-series (since 2001).

EXECUTIVE SUMMARY

Stevens, D.W.¹; Ballara, S.L.; Maurice, A.; Escobar-Flores, P.C.; Yeoman, J. (2024). Trawl survey of hoki and middle depth species on the Chatham Rise, January 2024 (TAN2401).

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The 28th trawl survey in a time series to estimate the relative biomass of hoki and other middle depth species on the Chatham Rise was carried out from 4 January to 3 February 2024. A random stratified sampling design was used, and 131 bottom trawls were successfully completed. These comprised 81 core (200–800 m) phase 1 biomass tows, 7 core phase 2 tows, and 43 deep (800–1300 m) tows.

Estimated relative biomass of all hoki in core strata was 96 426 t (CV 13.4%), about the same as (1% lower than) the estimate from January 2022. The estimate for 2+ year old hoki (2021 year-class) of 31 079 t, was 13.7% lower than in 2022, but average for the time series. The biomass estimate for 1+ hoki (2022 year-class) of 2784 t was one of the lowest estimates in the time series. The relative biomass of recruited hoki (ages 3+ years and older) in core strata was 62 564 t, an increase of 18.1% from that in 2022, and one of the higher estimates since 2000. The relative biomass of hake in core strata increased by 26.5% to 2088 t (CV 47.9%) from that in 2022 and is the highest estimate since 2009. This was largely due to a 3.2 t catch, the largest in the time series. The relative biomass of ling of 7310 t (CV 8.3%) was about the same as the 2022 estimate, but the time series for ling shows no overall trend.

The age frequency distribution for hoki was dominated by 2+ year old fish, with most hoki less than age 5+. The age frequency distribution for hake was broad, with most aged between 4 and 13 years. The age distribution for ling was also broad, with most aged between 3 and 16 years.

In 2024 the survey again covered 800–1300 m depths around the entire rise. The deep strata provide relative biomass indices for a range of deepwater sharks and other species associated with orange roughy and oreo fisheries.

Acoustic data were collected throughout the trawl survey. As in previous surveys, there was a weak positive correlation ($\rho = 0.35$) between acoustic density from bottom marks and trawl catch rates. The acoustic index of mesopelagic fish abundance in 2024 was 13% lower than that in 2022, and below the average for the acoustic time-series (since 2001). Hoki liver condition was higher than that in 2022, but below average in the time-series of condition indices (that goes back to 2004). There was a strong positive correlation ($r = 0.66$) between hoki liver condition, and indices of mesopelagic fish scaled by hoki abundance (“food per fish”).

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1. INTRODUCTION

In January 2024, the 28th in a time series of random trawl surveys on the Chatham Rise was completed. This, and all previous surveys in the series, were carried out from RV *Tangaroa* and form the most comprehensive time series of relative species abundance at water depths of 200 to 800 m in New Zealand's 200-mile Exclusive Economic Zone (EEZ). Previous surveys in this time series were documented by Horn (1994a, 1994b), Schofield & Horn (1994), Schofield & Livingston (1995, 1996, 1997), Bagley & Hurst (1998), Bagley & Livingston (2000), Stevens et al. (2001, 2002, 2008, 2009a, 2009b, 2011, 2012, 2013, 2014, 2015, 2017, 2018, 2021, 2023), Stevens & Livingston (2003), Livingston et al. (2004), Livingston & Stevens (2005), and Stevens & O'Driscoll (2006, 2007). Trends in relative biomass, and the spatial and depth distributions of 142 species or species groups, were reviewed for the surveys from 1992–2010 by O'Driscoll et al. (2011b).

The main aim of the Chatham Rise surveys is to provide relative biomass estimates of adult and juvenile hoki. Hoki is New Zealand's largest finfish fishery, with a current annual catch limit of 110 000 t (Fisheries New Zealand 2024). Although managed as a single stock, hoki is assessed as two stocks in the New Zealand region, western and eastern, having respective annual catch limits currently set at 45 000 and 65 00 t. The hypothesis is that juveniles from both stocks mix on the Chatham Rise and recruit to their respective stocks as they approach sexual maturity. The Chatham Rise is also the principal residence area for hoki that spawn in Cook Strait and off the east coast South Island in winter (eastern stock). Annual catches of hoki on the Chatham Rise peaked at over 73 000 t in 1997–98 and 1998–99. The catch from the Chatham Rise in 2022–23 was 36 926 t, making this the largest hoki fishery in the EEZ and contributing about 35% of the total New Zealand hoki catch (Fisheries New Zealand 2024).

To manage the fishery and minimise potential risks, predictive ability concerning recruitment to the fishery is important. Extensive sampling throughout the EEZ has shown that the Chatham Rise is the main nursery ground for juvenile hoki. Abundance estimation of two year old hoki provides the best index of potential recruitment to the adult fisheries, while the index of one year old hoki is also informative. The survey data of both juvenile and adult abundance are used directly in the stock assessment to estimate recruitment parameters, determine current stock size, and inform projections of future stock status. The continuation of the time series of trawl surveys on the Chatham Rise is considered of high priority as it provides information required to update the assessment of hoki, hake, ling, and other middle depth species and to provide abundance information for a wide range of bycatch species.

Information is also collected on a range of other commercial and non-commercial fish and invertebrates. A review of the time series showed that biomass was estimated for 142 species or groups, with 49 of these species considered relatively well estimated (coefficient of variation (CV) less than 40%) (O'Driscoll et al. 2011b). For most of these species, the trawl survey is the only fisheries-independent estimate of abundance on the Chatham Rise and the survey time-series fulfils an important “ecosystem monitoring” role (e.g., Tuck et al. 2009), as well as providing inputs into single-species stock assessment.

In January 2010, the survey was extended to sample deeper strata (800 to 1300 m) on the north and east of the Chatham Rise. In January 2016, the survey duration was increased by 6 days to also include deeper strata to the south and west of the Chatham Rise. The 2024 survey again covered 800–1300 m depths around the whole Chatham Rise, providing fishery independent abundance indices for a range of common deepwater bycatch species in the orange roughy and oreo fisheries.

Acoustic data have been recorded during trawls and while steaming between stations on all trawl surveys on the Chatham Rise since 1995, except in 2004. Data from previous surveys were analysed to describe mark types (Cordue et al. 1998, Bull 2000, O'Driscoll 2001, Livingston et al. 2004, Stevens & O'Driscoll 2006, 2007, Stevens et al. 2008, 2009a, 2009b, 2011, 2012, 2013, 2014), to provide estimates of the ratio of acoustic vulnerability to trawl catchability for hoki and other species (O'Driscoll 2002, 2003), and to estimate abundance of mesopelagic fish (McClatchie & Dunford 2003, McClatchie et al. 2005, O'Driscoll et al. 2009, 2011a, Stevens et al. 2009b, 2011, 2012, 2013, 2014, 2015, 2017, 2018, 2021, 2023, Escobar-Flores et al. 2019). Acoustic data also provide qualitative information on the amount of backscatter that is not available to the bottom trawl, either through being off the bottom, or over areas of foul ground. Other

work carried out concurrently with the trawl survey included sampling and preservation of unidentified organisms caught in the trawl and collection of oceanographic data.

1.1 Project objectives

The trawl survey was carried out under contract to the Ministry for Primary Industries (project MID2021-02). The specific objectives for the project were as follows:

1. To continue the time series of relative abundance indices of recruited hoki and other middle depth and deepwater species on the Chatham Rise in January 2024 using trawl surveys and to determine year class strengths of juvenile hoki (1, 2 and 3 year olds), with a target CV of 20% for the number of two year olds.
2. To collect data for determining the population age, size structure, and reproductive biology of hoki, hake, and ling on the Chatham Rise.
3. To collect acoustic and related data during the trawl survey.
4. To collect and preserve specimens of unidentified organisms taken during the trawl survey and identify them later ashore.
5. To sample deeper strata for deepwater species using a random trawl survey design.

2. METHODS

2.1 Survey area and design

As in previous years, the survey followed a two-phase random design (after Francis 1984). The main survey area of 200–800 m depth (Figure 1) was divided into 23 strata. Nineteen of these strata are the same as those used in 2003–11 (Livingston et al. 2004, Livingston & Stevens 2005, Stevens & O’Driscoll 2006, 2007, Stevens et al. 2008, 2009a, 2009b, 2011, 2012). In 2012, stratum 7 was divided into strata 7A and 7B at 175° 30' E to more precisely assess the biomass of hake which appeared to be spawning northeast of Mernoo Bank (in Stratum 7B). In 2013, the survey duration was reduced from 27 to 25 days, removing the contingency for bad weather and reducing the available time for phase 2 stations. To increase the time available for phase 2 stations in 2014, strata 10A and 10B were re-combined into a single stratum 10 and stratum 11A, 11B, 11C, 11D into a single stratum 11. These strata are in the 400–600 m depth range on the northeast Chatham Rise (Figure 1) and were originally split to reduce hake CVs. However, few hake have been caught in these strata since 2000 and 18 phase 1 tows (3 in each sub-strata) assigned to this area is no longer justified.

Station allocation for phase 1 was determined from simulations based on catch rates from all previous Chatham Rise trawl surveys (1992–2022), using an optimisation programme (‘allocate’, written in the R programming language) that estimates the optimal number of stations to be allocated in each stratum to achieve the target CV for 2-year-old hoki (Francis 2006). The initial allocation of 82 core stations in phase 1 is given in Table 1. Phase 2 stations for core strata were allocated at sea, to improve the CV for 1+ and 2+ hoki and hake biomass.

As in 2022, the 2024 survey area included 11 deep strata from 800–1300 m around the entire Chatham Rise (Figure 1). The station allocation for the deep strata was determined based on catch rates of eight bycatch species (basketwork eel, four-rayed rattail, longnose velvet dogfish, Baxter’s dogfish, ribaldo, bigscaled brown slickhead, shovelnose dogfish, and smallscaled brown slickhead) in the 2010–22 surveys. Orange roughy, black oreo, and smooth oreo are no longer considered target species. The ‘allocate’ programme (Francis 2006) was used to estimate the optimal number of stations to be allocated in each of strata 21A–30 to achieve a target CV of 25% for these eight bycatch species. A minimum of three stations per stratum was used. This gave a total of 43 phase 1 deep stations (Table 1). There was no allowance for phase 2 trawling in deep strata.

2.2 Vessel and gear specifications

Tangaroa is a purpose-built, research stern trawler of 70 m overall length, a beam of 14 m, 3000 kW (4000 hp) of power, and a gross tonnage of 2282 t.

The bottom trawl was the same as that used on previous surveys of middle depth species by *Tangaroa*. The net is an eight-seam hoki bottom trawl with 100 m sweeps, 50 m bridles, 12 m backstops, 58.8 m groundrope, 45 m headline, and 60 mm codend mesh (see Hurst & Bagley (1994) for net plan and rigging details). The trawl doors were Super Vee type with an area of 6.1 m². Measurements of doorspread (from a Scanmar system) and headline height (from a Furuno net monitor) were recorded every five minutes during each tow and average values calculated.

2.3 Trawling procedure

Trawling followed the standardised procedures described by Hurst et al. (1992). Station positions were selected randomly before the voyage using the Random Stations Generation Program (Version 1.6) developed by NIWA. To maximise the amount of time spent trawling in the deep strata (800–1300 m) at night, the time spent searching for suitable core (200–800 m) tows at night was reduced by using the nearest known successful tow position to the random station. Care was taken to ensure that the centre positions of survey tows were at least 3 n. miles apart. For deep strata, there was often insufficient bathymetric data and few known tow positions, so these tows followed the standard survey methodology described by Hurst et al. (1992). If a random station position was found to be on foul ground, a search was made for suitable ground within 3 n. miles of the station position. If no suitable ground could be found, the station was abandoned, and another random position was substituted. Core biomass tows were carried out during daylight hours (as defined by Hurst et al. (1992)), with all trawling between 0503 h and 1838 h NZST. Exemption was received from Fisheries New Zealand on 7 December 2023 to carry out research trawling on known successful tow positions in the Mid Chatham Rise and the East Chatham Rise benthic protected areas (BPAs).

At each station the trawl was towed for 3 n. miles at a speed over the ground of 3.5 knots. If foul ground was encountered, or the tow hauled early due to reducing daylight, the tow was included as valid only if at least 2 n. miles was covered. If time ran short at the end of the day and it was not possible to reach the last station, the vessel headed towards the next station and the trawl gear was shot in time to ensure completion of the tow by sunset, if at least 50% of the steaming distance to the next station was covered.

Towing speed and gear configuration were maintained as constant as possible during the survey, following the guidelines given by Hurst et al. (1992). The average speed over the ground was calculated from readings taken every five minutes during the tow.

2.4 Acoustic data collection

Acoustic data were collected during trawling and while steaming between trawl stations (both day and night) with the *Tangaroa* multi-frequency (18, 38, 70, 120, and 200 kHz) Simrad EK60/EK80 echosounders with hull-mounted transducers. All frequencies are regularly calibrated following standard procedures (Demer et al. 2015), with the most recent calibration being used for any data processing. For this report, the latest calibration of *Tangaroa* echosounders was done on 28 August 2022 north of Banks Peninsula at the start of the Campbell southern blue whiting acoustic survey (TAN2210; Escobar-Flores et al. 2023).

2.5 Hydrology

Temperature and salinity data were collected using a calibrated Seabird SM-37 Microcat CTD datalogger mounted on the headline of the trawl. Data were collected at 5 s intervals throughout the trawl, providing vertical profiles. Surface values were read off the vertical profile at the beginning of each tow at a depth of about 5 m, which corresponded to the depth of the hull temperature sensor used in previous surveys. Bottom values were from about 7.0 m above the seabed (i.e., the height of the trawl headline).

2.6 Catch and biological sampling

At each station all items in the catch were sorted into species and weighed on Marel motion-compensating electronic scales accurate to about 0.1 kg. Where possible, fish, squid, and crustaceans were identified to species and other benthic fauna to species or family. Unidentified organisms were collected and frozen at sea and returned to NIWA for later identification.

An approximately random sample of up to 200 individuals of each commercial, and some common non-commercial, species from every successful tow was measured and the sex determined. More detailed biological data were also collected on a subset of species and included fish weight, gonad stage, and gonad weight. Otoliths were taken from hake, hoki, ling, black oreo, smooth oreo, orange roughy, and silver warehou, for age determination. Additional data on liver condition were also collected from a subsample of 20 hoki per tow by recording gutted and liver weights.

2.7 Estimation of relative biomass and length frequencies

Doorspread biomass was estimated by the swept area method of Francis (1981, 1989) using the formulae given by Vignaux (1994) as implemented in NIWA custom software SurvCalc (Francis 2009). The catchability coefficient (an estimate of the proportion of fish in the path of the net which are caught) is the product of vulnerability, vertical availability, and areal availability. These factors were set at 1 for the analysis.

Scaled length frequencies were calculated for the major species with SurvCalc, using length-weight data from this survey.

2.8 Estimation of numbers at age

Hoki, hake, and ling otoliths were prepared and aged using validated ageing methods: hoki, Horn & Sullivan (1996) as modified by Cordue et al. (2000); hake, Horn (1997); ling, Horn (1993).

Subsamples of 758 hoki otoliths, 607 ling otoliths, and 307 hake otoliths were selected from those collected during the trawl survey. Subsamples were obtained by randomly selecting otoliths from 1 cm length bins covering the bulk of the catch and then systematically selecting additional otoliths to ensure that the tails of the length distributions were represented. The numbers aged approximated the sample size necessary to produce mean weighted CVs of less than 20% for hoki, 30% for ling, and 30% for hake across all age classes.

Numbers-at-age were calculated from observed length frequencies and age-length keys using customised NIWA catch-at-age software (Bull & Dunn 2002). For hoki, this software also applied the “consistency scoring” method of Francis (2001), which uses otolith zone radii measurements to improve the consistency of age estimation.

2.9 Acoustic data analysis

Acoustic data analysis followed the methods applied to recent Chatham Rise trawl surveys (e.g., Stevens et al. 2021), and generalised by O’Driscoll et al. (2011a). This report does not include discussion of mark classification or descriptive statistics on the frequency of occurrence of different mark types, as these were based on subjective classification, and were found not to vary much between surveys (e.g., Stevens et al. 2014).

Quantitative analysis was based on 38 kHz acoustic data from daytime trawl and night steam recordings. The 38 kHz data were used as this frequency was the only one available (other than uncalibrated 12 kHz data) for surveys before 2008 that used the old CREST acoustic system (Coombs et al. 2003). Analysis was carried out using the custom analysis software ESP3 (Ladroit et al. 2020). ESP3 includes an algorithm to identify ‘bad pings’ in each acoustic recording. “Bad pings” are defined as pings for which backscatter data were significantly different from surrounding pings, usually due to bubble aeration or noise spikes. Only acoustic

data files where the proportion of bad pings was less than 30% of all pings in the file were considered suitable for quantitative analysis.

Estimates of the mean acoustic backscatter per km² from bottom-referenced marks were calculated for each recording, based on integration heights of 10 m, 50 m, and 100 m above the bottom. Total acoustic backscatter was also integrated throughout the water column in 50 m depth bins. Acoustic density estimates (m² per km²) from bottom-referenced marks were compared with trawl catch rates (kg per km²). No attempt was made to scale acoustic estimates by target strength, correct for differences in catchability, or carry out species decomposition (O’Driscoll 2002, 2003).

O’Driscoll et al. (2009, 2011a) developed a time series of relative abundance estimates for mesopelagic fish on the Chatham Rise based on that component of the acoustic backscatter that migrates into the upper 200 m of the water column at night. Because some of the mesopelagic fish migrate very close to the surface at night, they move into the surface ‘dead zone’ (shallower than 14 m) where they are not detectable by the vessel’s downward-looking hull-mounted transducer. Consequently, there is a substantial negative bias in night-time acoustic estimates. To correct for this bias, O’Driscoll et al. (2009) used night estimates of demersal backscatter (which remains deeper than 200 m at night) to correct daytime estimates of total backscatter.

We updated the mesopelagic time series to include data from 2024. Day estimates of total backscatter were calculated using total mean area backscattering coefficients estimated from each trawl recording. Night estimates of demersal backscatter were based on data recorded while steaming between 2000 h and 0500 h NZST. Acoustic data were stratified into four broad geographic sub-areas (O’Driscoll et al. 2011a). Stratum boundaries were:

- Northwest – north of 43° 30’ S and west of 177° 00’ E;
- Northeast – north of 43° 30’ S and east of 177° 00’ E;
- Southwest – south of 43° 30’ S and west of 177° 00’ E;
- Southeast – south of 43° 30’ S and east of 177° 00’ E.

The amount of mesopelagic backscatter at each day trawl station was estimated by multiplying the total backscatter observed at the station by the estimated proportion of night-time backscatter in the same sub-area that was observed in the upper 200 m corrected for the estimated proportion in the surface dead zone:

$$sa(meso)_i = p(meso)_s * sa(all)_i$$

where $sa(meso)_i$ is the estimated mesopelagic backscatter at station i , $sa(all)_i$ is the observed total backscatter at station i , and $p(meso)_s$ is the estimated proportion of mesopelagic backscatter in the stratum s where station i is found. $p(meso)_s$ was calculated from the observed proportion of night-time backscatter observed in the upper 200 m in stratum s , $p(200)_s$, and the estimated proportion of the total backscatter in the surface dead zone, p_{sz} . p_{sz} was estimated as 0.2 by O’Driscoll et al (2009) and was assumed to be the same for all years and strata:

$$p(meso)_s = p_{sz} + p(200)_s * (1 - p_{sz})$$

3. RESULTS

3.1 2024 survey coverage

The trawl survey was successfully completed. The deepwater trawling objective meant that trawling was carried out both day (core and some deep tows) and night (deep tows only). Weather conditions during the survey were generally good, although on occasions the wind reached 30 to 40 knots. About five hours were lost due to winch issues and nine hours were lost due to inclement weather.

A total of 133 successful trawl survey tows were completed, comprising 81 of 82 planned phase 1 tows, 7 phase 2 tows in core 200–800 m strata, and all 42 planned deep tows (Tables 1 and 2, Figure 2, Appendix 1). Two further tows were considered unsuitable for estimating abundance: tow 19 was rejected due to the gear sensors not working and was substituted; and tow 48 was conducted in the wrong stratum, and therefore not suitable for biomass estimation. A single fine meshed midwater trawl was conducted (tow 37) but unfortunately the net was badly ripped on retrieval. Station details for all tows are given in Appendix 1.

Five bottom trawl tows were carried out in the Mid Chatham Rise BPA and three bottom trawl tows in the East Chatham Rise BPA.

Core station density ranged from 1 per 145 km² in stratum 7B (400–600 m, NE of Mernoo Bank) to 1 per 3841 km² in stratum 16 (400–600 m, southwest Chatham Rise). Deepwater station density ranged from 1 per 416 km² in stratum 21A (800–1000 m, NE Chatham Rise) to 1 per 3655 km² in stratum 29 (1000–1300 m, southwest Chatham Rise). Mean station density was 1 per 1649 km² (see Table 1).

3.2 Gear performance

Gear parameters are summarised in Table 3. Doorspread and headline height readings were obtained for all 131 successful tows. Mean headline heights by 200 m depth intervals were 6.5–6.9 m, averaged 6.7 m, and were consistent with previous surveys and within the optimal range (Hurst et al. 1992) (Table 3). Mean doorspread measurements by 200 m depth intervals were 116.7–125.2 m, and averaged 122.2 m, and within the optimal range (Hurst et al. 1992).

3.3 Hydrology

Surface temperatures in 2024 were 12.7–18.7 °C (mean 16.8 °C) and bottom temperatures were 3.1–11.5 °C (mean 7.5 °C) (Figure 3). Surface temperatures within the survey area were the same on average as the 2022 survey and similar to the very warm surface temperatures observed in 2018 (Figure 4 top panel). Average bottom temperature in the core area in 2024 were slightly lower than that in 2022 but continue to remain at relatively high levels (Figure 4 lower panel).

3.4 Catch composition

The total catch from all 131 valid biomass stations was 142.7 t, of which 43.9 t (30.7%) was hoki, 18.0 t (12.6%) was smooth oreo, 10.1 t (7.0%) was black oreo, 7.5 t was shovelnose dogfish (5.2%), 7.0 t (4.9%) was silver warehou, 5.6 t (3.9%) was dark ghost shark, 3.8 t (2.7%) was hake, 2.9 t (2.0%) was ling, and 1.6 t (1.1%) was orange roughy (Table 4).

Of the 343 species or species groups identified from valid biomass tows, 165 were teleosts, 37 were elasmobranchs, 38 were crustaceans, and 21 were cephalopods. The remainder consisted of assorted benthic and pelagic invertebrates. A full list of species caught in valid biomass tows, and the number of stations at which they occurred, is given in Appendix 2. Twenty-eight invertebrate taxa were later identified ashore (Appendix 3).

3.5 Relative biomass estimates

3.5.1 Core strata (200–800 m)

Relative biomass in core strata was estimated for 54 species (Table 4). The CVs achieved for hoki, hake, and ling from core strata were 13.4%, 47.9%, and 8.3% respectively. The CV for 2+ hoki (2021 year-class) was 21.9%, just above the target CV of 20%. High CVs (over 30%) generally occurred when species were not well sampled by the gear. For example, alfonsino, barracouta, frostoffish, and slender mackerel are not strictly demersal and exhibit strong schooling behaviour and consequently catch rates of these are highly variable. Others, such as bluenose, hāpuku, red cod, lemon sole, rough skate, sea perch (*Helicolenus percoides*), and tarakihi, have high CVs because they are mainly distributed outside the core survey depth range (O’Driscoll et al. 2011b).

The combined relative biomass for the top 31 species in the core strata that are tracked annually (Livingston et al. 2002, see Table 4) was 12.7% lower than in 2022, but higher than the 2020 estimate (Figure 5, top panel). As in previous years, hoki was the most abundant species caught (Table 4, Figure 5, lower panel). The relative proportion of hoki in 2024 was 44.5%, 13.3% higher than in 2022 and slightly lower than the previous 3 surveys. The next most abundant QMS species in core strata were black oreo, silver warehou, dark ghost shark, spiny dogfish, ling, lookdown dory, bigeye sea perch, smooth oreo, white warehou, pale ghost shark, frostfish, giant stargazer, and hake, each with an estimated relative biomass of over 2000 t (Table 4). The most abundant non-QMS species were javelinfish, Bollons' rattail, shovelnose dogfish, and silver dory (Table 4).

Estimated relative biomass of hoki in the core strata in 2024 was 96 426 t, about the same as the hoki biomass in January 2022 (Table 5, Figures 6a, 7a, 7b). The relative biomass of recruited hoki (ages 3+ years and older) was 62 564 t, 18.1% higher than in the 2022 survey and one of the higher estimates since 2000 (Table 6). The relative biomass of 2+ hoki (2021 year class) of 31 079 t was 13.7% lower than in the 2022 survey, but average for the time series. The biomass estimate for 1+ hoki (2022 year class) of 2784 t was one of the lowest estimates for the time series (Table 6).

The relative biomass of hake in core strata was 2088 t, 26.5% higher than that in 2022, and the highest biomass estimate since 2009. This was due to a single large catch (3.2 t) in stratum 7B, the largest in the time series (see Table 5, Figures 6a, 7a, 7b).

The relative biomass of ling was 7310 t, about the same as in January 2022, and 3.5% higher than that in January 2020, although the time series for ling shows no overall trend (Figures 6a, 7a, 7b).

The relative biomass estimates for dark ghost shark and white warehou were higher than in 2022 and among the highest estimates in the time series; spiny dogfish were slightly higher; giant stargazer, lookdown dory, sea perch (both species combined) were about the same; pale ghost shark and silver warehou were lower than the 2022 estimate but higher than the previous four survey estimates (Figures 6a, 7a, 7b).

3.5.2 Deep strata (800–1300 m)

Relative biomass and CVs were estimated for 26 species in deep (800–1300 m) strata (Table 4). The relative biomass of orange roughy in all strata in 2024 was 3575 t, compared with 1967 t in 2022, and 3087 t in 2020 (Figures 6b, 7c). Although the survey was not optimised for orange roughy, there were no large catches in 2024 (the largest was 192 kg), and the precision was reasonable with a CV of 25.2%. The relative biomass estimate for black oreo was one of the highest in the time series due to a single 5 t catch, but was still lower than the 2018 and 2022 estimates. The relative biomass estimate for smooth oreo was higher than in 2020 and 2022 and the highest in the time series due to four large catches of 2.0–4.4 t (Figure 6b).

Deepwater sharks were relatively abundant in deep strata, with 42%, 94%, and 68% of the total survey biomass of shovelnose dogfish, longnose velvet dogfish, and Baxter's dogfish occurring in deep strata (Figures 6b, 7c). Bigscaled and smallscaled brown slickhead, basketwork eel, and four-rayed rattail were almost entirely restricted to deeper strata. Spiky oreo were mainly caught in core strata (Figures 6b, 7c).

The deep strata contained 2.3% of the total survey hoki biomass, 6.8% of total survey hake biomass, and 0.9% of total survey ling biomass. This indicates that the core survey strata are likely to have sampled most of the ling available to the trawl survey method on the Chatham Rise but missed some hoki and hake (Table 4). The deep biomass estimate for hoki was 2258 t with a CV of 17.7%.

3.6 Catch distribution

Spatial distribution maps of catches (Figures 8–9) were generally similar to those from previous surveys.

Hoki

In the 2024 survey, hoki were caught in 80 of the 88 core biomass stations. Hoki were not captured in 8 shallower (max. depth 248–359 m) core biomass stations on the Verman and Reserve Banks (strata 17, 18, 19, and 20); and north of the Chatham Islands (stratum 9). The highest catch rates were at 300–400 m depths on the Reserve Bank (strata 19 and 20) and around the Mernoo Bank (stratum 18), and 400–600 m in strata 7A, 7B, 15 and 16 (Table 7a, Figure 8). The highest individual catch of hoki in 2024 was 4136 kg on Reserve Bank in stratum 20 and was mostly 2+ hoki (Figure 8, Appendix 1). Hoki aged 1+ (2022 year class) were largely restricted to the western Rise on the Verman Bank (stratum 17), Mernoo Bank (stratum 18), and Reserve Bank (strata 19 and 20). Hoki aged 2+ (2021 year class) were mainly found on the western Rise around Mernoo Bank and Reserve Bank (strata 18–20) and the adjacent 400–600 m strata (strata 7A, 7B, 14, 15, 16) (Figure 8). Recruited hoki (3+ and older) were widespread but the highest catch rates were in 400–600 m strata adjacent to the Mernoo Bank (strata 7A, 7B, 16), Reserve Bank (strata 8A, 8B, 14, 15), and west of Chatham Islands (strata 12) (Figure 8).

Hake

Hake catches were dominated by a single large catch of 3.2 t in stratum 7B (northeast of Mernoo Bank), the highest in the times series. The next largest catch (134 kg) was north of Matheson Bank in stratum 10. The remaining catches were relatively low and throughout most strata in the survey area (Figure 9).

Ling

As in previous years, catches of ling were distributed throughout most strata in the core survey area (Figure 7a, 9). The highest catch rates were on the south rise in 400–600 m (strata 12, 13, 14, 15, 16) and in 600–800 m (stratum 4).

Other species

As with previous surveys, lookdown dory, sea perch (mainly *Helicolenus barathri*), and spiny dogfish were widely distributed throughout the survey area in mainly 200–600 m depths. The highest catch rates for sea perch were taken at 200–400 m on the eastern Reserve Bank (stratum 20); the highest catch rates of lookdown dory were taken in 400–600 m on the south Rise (strata 12–15); and the highest catch rates of spiny dogfish were taken east of the Mernoo Bank, along the Reserve Bank, and west of Chatham Islands (Figure 9). Dark ghost shark was mainly caught at 200–400 m depths on the western Rise and was particularly abundant on the Verman Bank, east of the Mernoo Bank, and along the Reserve Bank; pale ghost shark was mostly caught in deeper water at 400–800 m depth, with higher catch rates to the south. Giant stargazer was mainly caught in shallower strata, with the largest catches taken around the Mernoo Bank in strata 1, 7A and 7B. Silver warehou and white warehou were patchily distributed at depths of 200–600 m, with the largest catches of silver warehou northwest of Chatham Islands and on Verman Bank, and of white warehou west of Verman Bank and west of Chatham Islands (Figure 9). Javelinfish and Bollons' rattail were widely distributed throughout the survey area. The highest catch rate of javelinfish was taken southeast of Matheson Bank in stratum 13, and the highest catch rate of Bollons' rattail was taken east of Mernoo Bank (Figure 7a). Ribaldo were widespread at 400–1000 m with the highest catch rates mainly to the north (Figure 9).

Orange roughy was widespread on the northern and eastern rise at 800–1300 m depths (Figure 9). The largest catch was 192 kg taken on the mid northern Rise in 1095 m in stratum 23 (Table 7b, Figure 9). As with previous surveys, black oreo was mostly caught on the southwest Rise at 600–1000 m depths. Smooth oreo were mainly taken on the southern Rise at 800–1300 m depths, with the highest catch rates in 800–1000 m on the southwestern Rise (stratum 27 and 26, Table 7a, Figure 9). Spiky oreo were widespread and abundant on the northern Rise at 500–850 m (Table 7a). Shovelnose dogfish, longnose velvet dogfish, and four-rayed rattail were more widespread and abundant on the northern Rise. Baxter's dogfish and smallscaled brown slickhead were more abundant on the southern Rise, and basketwork eel and bigscaled brown slickhead were widespread (Table 7a, Figures 7c and 9).

3.7 Biological data

3.7.1 Species sampled

The number of species and the number of samples for which length and length-weight data were collected are given in Table 8.

3.7.2 Length frequencies and age distributions

Length-weight relationships used in the SurvCalc program to scale length frequencies and calculate relative biomass and catch rates are given in Table 9.

Hoki

Length and age frequency distributions in the 2024 survey were comprised mainly of hoki 48–56 cm and aged 2+ (Figures 10 and 11). There were few hoki aged 1+ (less than 48 cm) and few fish longer than 70 cm (Figure 10) or older than 5+ years (Figure 11). Female hoki were estimated to be slightly more abundant than males (ratio of 1.04 female:1 male).

Hake

Length frequency and calculated number at age distributions (Figures 12 and 13) in the 2024 survey were relatively broad, although most male fish were aged 4–12 years and female fish were aged 7–13 years. Male hake were estimated to be more abundant than females (1.31 male:1 female).

Ling

Length frequency and calculated number-at-age distributions (Figures 14 and 15) in the 2024 survey indicated a wide range of ages, with most fish aged 3–16. There is evidence of a period of good recruitment from 1999–2006 (Figure 15). Male ling were estimated to be more abundant than females (1.18 male:1 female).

Other species

Length frequency distributions for other key core and deepwater species are shown in Figures 16a–b. Clear modes are apparent in the size distribution of silver and white warehou which may correspond to individual cohorts.

Length frequencies for giant stargazer, lookdown dory, dark ghost shark, pale ghost shark, and several shark species (spiny dogfish, Baxter's dogfish, longnose velvet dogfish, and shovelnose dogfish) indicate that females grow larger than males (Figures 16a–b).

The deep strata contained a high proportion of large longnose velvet dogfish, shovelnose dogfish, and Baxter's dogfish, and most, or all, black and smooth oreo, orange roughy, basketwork eel, bigscaled brown slickhead, four-rayed rattail, and smallscaled brown slickhead (Figure 16b).

Length frequency distributions were similar for males and females of sea perch (mainly *H. barathri*), silver warehou, white warehou, orange roughy, and black oreo. The length frequency distribution for orange roughy was broad, with good numbers of smaller fish, most fish between about 15–40 cm but included fish as small as 7 cm (Figure 16b).

The catches of Baxter's dogfish, spiny dogfish, bigscaled brown slickhead, basketwork eel, and four-rayed rattail were dominated by females (greater than 1.5 female:1 male), whereas the catch of smooth oreo (1.27 male:1 female) was dominated by males (Figures 16a–b).

3.7.3 Reproductive status

Gonad stages of hake, hoki, ling, and several other species are summarised in Table 10. Almost all hoki were recorded as either resting or immature. About 24% of male ling were ripe, with few females showing signs of spawning. About 74% of male hake were ripe or running ripe, but most females were ripening (63%) (Table 10). A high proportion of male jack mackerel and slender jack mackerel appeared to be reproductively active. Most other species for which reproductive state was recorded did not appear

to be reproductively active, except spiny dogfish and some deepwater sharks (Table 10) About 40% of male and 75% of female Sloan's arrow squid (*Nototodarus sloanii*) appeared to be reproductively active.

3.8 Acoustic data quality

Acoustic data were recorded continuously throughout the survey. Over 2 TB of data were collected during trawling and steaming between stations. The substantial increase in volume of data collected is due to the collection of acoustic data in frequency modulated (FM) or broadband mode at 18 and 70 kHz using the EK80 systems. Weather and sea conditions during the survey were generally very good, meaning that acoustic data quality was high overall. Only 8 out of the 88 core day trawl transects exceeded the threshold of 30% bad pings and so were not suitable for quantitative analysis. Nine out of the 47 night-time steam transects were not suitable for analysis.

Expanding symbol plots of the distribution of total acoustic backscatter from daytime trawls and night transects in the overall survey area (200–1300 m) are shown in Figure 17. O'Driscoll et al. (2011a) noted a consistent spatial pattern in total backscatter on the Chatham Rise, with higher backscatter in the west. This was consistent with what was observed in 2024, where the highest values were observed in the western area (Figure 17).

3.8.1 Comparison of acoustics with bottom trawl catches

Acoustic data from 80 core trawl files were integrated and compared with trawl catch rates (Table 11). Data from the other 8 recordings during successful core daytime tows were not included in the analysis because the acoustic data were too noisy. Average acoustic backscatter values from the entire water column in 2024 was 38% more than that in 2022. Average acoustic backscatter in the bottom 10 m, 50 m, and 100 m were also higher than equivalent values in 2022 (Table 11).

There was a positive correlation (Spearman's rank correlation, $\rho = 0.35$, $p < 0.05$) between acoustic backscatter in the bottom 100 m during the day and trawl catch rates (Figure 18). In previous Chatham Rise surveys from 2001–22, rank correlations between trawl catch rates and acoustic density estimates ranged from 0.15 (in 2006) to 0.50 (in 2013). One reason that the correlation between acoustic backscatter and trawl catch rates (Figure 18) is not perfect ($\rho = 1$) is that the daytime bottom-referenced layers on the Chatham Rise may also contain a high proportion of mesopelagic species, which contribute to the acoustic backscatter, but which are not sampled by the bottom trawl (O'Driscoll 2003, O'Driscoll et al. 2009), and conversely some fish caught by the trawl may not be measured acoustically. For example, there were two tows in 2020 (stations 87 and 88) that had large catches, dominated by dark ghost shark, but low acoustic backscatter (Stevens et al. 2021). Dark ghost sharks do not have a swimbladder, so are likely to be a weak acoustic target.

3.8.2 Time series of relative mesopelagic fish abundance

In 2024, most acoustic backscatter was deeper than 200 m depth during the day (Figure 19). There was a particularly strong daytime layer at about 400 m observed during daytime trawl #94 in stratum 17 (Figure 20), which had a strong influence on the overall vertical distribution (Figure 19). The nighttime vertical distribution in 2024 was similar to that observed in 2018 and 2020 (Stevens et al. 2018, 2021), where a higher proportion of backscatter remained at depths greater than 200 m during the night than in some previous years.

The vertically migrating component of acoustic backscatter is assumed to be dominated by mesopelagic fish (see McClatchie & Dunford, 2003 for rationale and caveats). In 2022, between 43 and 84% of the total backscatter in each of the four sub-areas was in the upper 200 m at night and was estimated to be from vertically migrating mesopelagic fish (Table 12). The proportion of backscatter attributed to mesopelagic fish in 2024 was low in the eastern two sub-areas (Table 12).

Day estimates of total acoustic backscatter over the Chatham Rise are consistently higher than night estimates (Figure 21) because of the movement of fish into the surface deadzone (shallower than 14 m) at night (O'Driscoll et al. 2009). The only exception to this general pattern was in 2011, when night estimates were higher than day estimates (Figure 21). However, there was relatively little good quality

acoustic data available from the southeast Chatham Rise in 2011 due to poor weather conditions (Stevens et al. 2012). Although backscatter close to the bottom at night has been relatively low throughout the time-series, it showed an increasing trend from 2010 to 2020, before declining in 2022 (Figure 21).

Acoustic indices of mesopelagic fish abundance are summarised in Table 13 and plotted in Figure 22 for the entire Chatham Rise and for the four sub-areas. The overall mesopelagic estimate for the Chatham Rise decreased by 13% from 2022 and was below average for the acoustic time-series. The decrease in the mesopelagic index in 2024 was driven mainly by declines in the two largest sub-areas located in the east with the highest percentage decrease (45%) in the southeast. This was due to the lower estimated proportion of backscatter attributed to mesopelagic fish in eastern sub-areas in 2024 (Table 12), as total backscatter increased from 2022 (Figure 21). Mesopelagic indices increased from 2022 to 2024 in both western sub-areas (Figure 22).

3.9 Hoki condition

Liver condition (defined as liver weight divided by gutted weight) for all hoki on the Chatham Rise increased by 8% from 2022 to 2024, but was below average in the time-series of condition indices that goes back to 2004 (Figure 23). This slight increase in overall condition in comparison to 2022 was driven by hoki less than 80 cm (Figure 23).

At the start of the time series, hoki condition indices on the Chatham Rise were consistently higher than those from the Sub-Antarctic trawl survey series, but this pattern is less apparent since the surveys became biennial (Figure 24). Hoki on the Chatham Rise in January 2016 and in the Sub-Antarctic in November-December 2016 were in relatively good condition. Condition indices in both areas were lower in 2018 but increased in 2020 (Figure 24) before decreasing again in 2022. The next Sub-Antarctic trawl survey is in November-December 2024.

Stevens et al. (2014) suggested that hoki condition may be related to both food availability and hoki density and estimated an index of “food per fish” from the ratio of the acoustic estimate of mesopelagic fish abundance divided by the trawl estimate of hoki abundance. The significant positive correlation between liver condition and the food per fish index was maintained with the addition of the 2024 data (Figure 25, Pearson’s correlation coefficient, $r = 0.66$, $n = 15$, $p < 0.01$).

4. CONCLUSIONS

The 2024 survey successfully extended the core 200–800 m January Chatham Rise time series to 28 points (annual from 1992–2014, then biennial), and provided abundance indices for hoki, hake, ling, and a range of associated middle depth species.

The estimated relative biomass of hoki in core strata was about the same as that in 2022. The biomass estimate of 2+ hoki (2021 year class) was average while the estimate for 1+ hoki (2022 year class) was one of the lowest estimates in the time series. The estimated biomass of 3++ (recruited) hoki increased by 18.1% from that in 2022 and is one of the higher estimates since 2000. Fewer 3++ hoki were observed in deep water (800–1300 m) than in 2018 and 2020.

The relative biomass of hake in core strata was 26.5% higher than in 2022 and the highest estimate since 2009. This was largely due to a single 3.2 t catch – the largest in the time series, although hake estimates in the time series remain at low levels compared with the early 1990s. The relative biomass of ling in core strata was about the same as the 2022 estimate, but the time series for ling shows no overall trend.

In 2024 the survey area covered 800–1300 m depths around the entire Chatham Rise for the fifth time since 2016. The deep strata provide relative biomass estimates for a range of deepwater species associated with orange roughy and oreo fisheries. A high proportion of the estimated biomass of deepwater sharks (shovelnose dogfish, longnose velvet dogfish, and Baxter’s dogfish) occurred in deep

strata, and bigscaled brown slickheads, smallscaled brown slickheads, basketwork eels, and four-rayed rattails were largely restricted to deeper strata.

5. ACKNOWLEDGEMENTS

We thank the scientific staff and the master, officers, and crew of *Tangaroa* who contributed to the success of this voyage. We are grateful to Blake Ambassadors Brianna Marvin and Clémence Williams for their assistance with biological sampling at sea. We also thank Jeremy Yeoman for loading the survey data, and NIWA National Invertebrate Collection staff for identification of invertebrates. Thank you to Keren Spong, Niki Davey, Colin Sutton, and Tom Barnes for processing and reading the otoliths. A draft of this report was reviewed by Richard O'Driscoll. We thank MPI project scientist Gretchen Skea for her contributions. This work was carried out by NIWA under contract to the Ministry for Primary Industries (Project MID2021/02).

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7. TABLES AND FIGURES

Table 1: The number of completed valid biomass tows (200–1300 m) by stratum during the 2024 Chatham Rise trawl survey.

Stratum number	Depth range (m)	Location	Area (km ²)	Phase 1 allocation	Phase 1 stations	Phase 2 stations	Total stations	Station density (1: km ²)
1	600–800	NW Chatham Rise	2 439	3	3		3	1:813
2A	600–800	NW Chatham Rise	3 253	3	3		3	1:1 084
2B	600–800	NE Chatham Rise	8 503	4	4		4	1:2 126
3	200–400	Matheson Bank	3 499	3	3		3	1:1 166
4	600–800	SE Chatham Rise	11 315	3	3		3	1:3 772
5	200–400	SE Chatham Rise	4 078	3	2		2	1:2 039
6	600–800	SW Chatham Rise	8 266	3	3		3	1:2 755
7A	400–600	NW Chatham Rise	4 364	4	4		4	1:1 091
7B	400–600	NW Chatham Rise	869	3	3	3	6	1:145
8A	400–600	NW Chatham Rise	3 286	3	3		3	1:1 095
8B	400–600	NW Chatham Rise	5 722	3	3		3	1:1 907
9	200–400	NE Chatham Rise	5 136	3	3		3	1:1 712
10	400–600	NE Chatham Rise	6 321	3	3		3	1:2 107
11	400–600	NE Chatham Rise	11 748	6	6		6	1:1 958
12	400–600	SE Chatham Rise	6 578	3	3		3	1:2 193
13	400–600	SE Chatham Rise	6 681	3	3		3	1:2 227
14	400–600	SW Chatham Rise	5 928	3	3		3	1:1 976
15	400–600	SW Chatham Rise	5 842	4	4		4	1:1 461
16	400–600	SW Chatham Rise	11 522	3	3		3	1:3 841
17	200–400	Veryan Bank	865	3	3		3	1:288
18	200–400	Mernoo Bank	4 687	4	4		4	1:1 172
19	200–400	Reserve Bank	9 012	6	6		6	1:1 502
20	200–400	Reserve Bank	9 584	6	6	4	10	1:958
Core	200–800		139 492	82	81	7	88	1:1 585
21A	800–1000	NE Chatham Rise	1 249	3	3		3	1:416
21B	800–1000	NE Chatham Rise	5 819	6	6		6	1:970
22	800–1000	NW Chatham Rise	7 357	7	7		7	1:1 051
23	1000–1300	NW Chatham Rise	7 014	4	4		4	1:1 754
24	1000–1300	NE Chatham Rise	5 672	3	3		3	1:1 891
25	800–1000	SE Chatham Rise	5 596	5	5		5	1:1 119
26	800–1000	SW Chatham Rise	5 158	3	3		3	1:1 719
27	800–1000	SW Chatham Rise	7 185	3	3		3	1:2 395
28	1000–1300	SE Chatham Rise	9 494	3	3		3	1:3 165
29	1000–1300	SW Chatham Rise	10 965	3	3		3	1:3 655
30	1000–1300	SW Chatham Rise	10 960	3	3		3	1:3 653
Deep	800–1300		76 469	43	43		43	1:1 778
Total	200–1300		215 967	125	124	7	131	1:1 649

Table 2: Survey dates and number of valid core (200–800 m depth) biomass tows in surveys of the Chatham Rise from 1992 to 2024. †, years where the deep component of the survey was carried out. The TAN1401 survey included an additional two days for ratcatcher bottom tows.

Trip code	Start date	End date	No. of valid core biomass tows
TAN9106	28 Dec 1991	1 Feb 1992	184
TAN9212	30 Dec 1992	6 Feb 1993	194
TAN9401	2 Jan 1994	31 Jan 1994	165
TAN9501	4 Jan 1995	27 Jan 1995	122
TAN9601	27 Dec 1995	14 Jan 1996	89
TAN9701	2 Jan 1997	24 Jan 1997	103
TAN9801	3 Jan 1998	21 Jan 1998	91
TAN9901	3 Jan 1999	26 Jan 1999	100
TAN0001	27 Dec 1999	22 Jan 2000	128
TAN0101	28 Dec 2000	25 Jan 2001	119
TAN0201	5 Jan 2002	25 Jan 2002	107
TAN0301	29 Dec 2002	21 Jan 2003	115
TAN0401	27 Dec 2003	23 Jan 2004	110
TAN0501	27 Dec 2004	23 Jan 2005	106
TAN0601	27 Dec 2005	23 Jan 2006	96
TAN0701	27 Dec 2006	23 Jan 2007	101
TAN0801	27 Dec 2007	23 Jan 2008	101
TAN0901	27 Dec 2008	23 Jan 2009	108
TAN1001†	2 Jan 2010	28 Jan 2010	91
TAN1101†	2 Jan 2011	28 Jan 2011	90
TAN1201†	2 Jan 2012	28 Jan 2012	100
TAN1301†	2 Jan 2013	26 Jan 2013	91
TAN1401†	2 Jan 2014	28 Jan 2014	87
TAN1601†	3 Jan 2016	2 Feb 2016	93
TAN1801†	4 Jan 2018	3 Feb 2018	87
TAN2001†	4 Jan 2020	3 Feb 2020	87
TAN2201†	4 Jan 2022	3 Feb 2022	88
TAN2401†	4 Jan 2024	3 Feb 2024	88

Table 3: Tow and gear parameters by depth range for valid biomass tows (TAN2401). Values shown are sample size (*n*), and for each parameter the mean, standard deviation (s.d.), and range.

	<i>n</i>	Mean	s.d.	Range
Core tow parameters				
Tow length (n. miles)	88	2.8	0.34	2.0–3.2
Tow speed (knots)	88	3.5	0.01	3.5–3.6
All tow parameters				
Tow length (n. miles)	131	2.8	0.37	1.5–3.2
Tow speed (knots)	131	3.5	0.01	3.5–3.6
Headline height (m)				
200–400 m	31	6.8	0.23	6.4–7.7
400–600 m	41	6.6	0.27	6.1–7.2
600–800 m	16	6.5	0.21	6.2–6.9
800–1000 m	27	6.8	0.21	6.5–7.4
1000–1300 m	16	6.9	0.26	6.5–7.3
Core stations 200–800 m	88	6.6	0.29	6.1–7.7
All stations 200–1300 m	131	6.7	0.29	6.1–7.7
Doorspread (m)				
200–400 m	31	116.7	4.59	104.7–124.7
400–600 m	41	124.3	3.01	119.2–130.2
600–800 m	16	125.2	3.43	119.7–129.8
800–1000 m	27	123.5	3.71	115.6–131.3
1000–1300 m	16	122.2	4.39	113.9–128.6
Core stations 200–800 m	88	121.8	5.25	104.7–130.2
All stations 200–1300 m	131	122.2	4.89	104.7–131.3

Table 4: Catch (kg) and relative biomass (t) estimates with coefficient of variation (CV, %) for QMS species, other commercial species, and key non-commercial species for valid biomass tows in the 2024 survey core strata (200–800 m); and catch and biomass estimates for deep strata (800–1300 m). Arranged in descending relative biomass estimates for the core strata. -, no data. *, indicates hoki and the 30 key species defined by Livingston et al. (2002). Note: Two species of sea perch (formerly species code SPE) are now recognised (bigeye sea perch, *H. barathri*, HBA; and sea perch, *H. percooides*, HPC).

Species code	Common name	Catch (kg)		Biomass (t)	
		Core	Deep	Core total	Deep
HOK*	Hoki	42 741	1 129	96 426 (13.40)	2 258 (17.68)
BOE*	Black oreo	3 958	6 098	21 282 (32.53)	36 135 (90.57)
SWA*	Silver warehou	6 990	-	15 429 (15.95)	-
GSH*	Dark ghost shark	5 559	-	10 946 (12.20)	-
JAV*	Javelinfish	3 265	133	8 605 (15.06)	230 (31.24)
SPD*	Spiny dogfish	3 599	-	8 480 (10.12)	-
LIN*	Ling	2 881	44	7 310 (8.34)	69 (42.54)
CBO*	Bollon's rattail	3 302	5	7 289 (12.93)	7 (64.86)
SND*	Shovelnose dogfish	4 311	3 176	6 941 (28.34)	5 107 (35.19)
LDO*	Lookdown dory	2 467	13	6 548 (10.23)	21 (41.23)
HBA*	Bigeye sea perch	2 575	7	5 366 (11.78)	10 (61.87)
SSO*	Smooth oreo	873	17 145	3 462 (41.93)	73 344 (38.37)
WWA*	White warehou	1 148	-	3 374 (31.71)	-
GSP*	Pale ghost shark	1 398	204	3 306 (7.96)	504 (20.03)
FRO	Frostfish	1 286	-	3 112 (91.93)	-
GIZ*	Giant stargazer	1 075	-	2 337 (13.55)	-
HAK*	Hake	3 701	96	2 088 (47.91)	153 (26.56)
SRB	Southern Ray's bream	512	-	1 360 (37.89)	-
SOR*	Spiky oreo	719	178	1 322 (34.11)	298 (27.28)
ETB	Baxter's lantern dogfish	240	571	1 060 (37.06)	2 216 (31.24)
BYS*	Alfonsino	446	-	1 043 (46.05)	- (100.00)
SSK	Smooth skate	571	20	986 (34.52)	31 (100.00)
CAS*	Oblique banded rattail	597	-	973 (13.26)	-
RCO*	Red cod	1 093	-	841 (70.30)	-
COL*	Oliver's rattail	214	5	791 (34.29)	9 (89.20)
BBE	Banded bellowsfish	275	6	661 (9.22)	9 (39.95)
NOS*	Arrow squid	233	1	552 (21.01)	2 (78.32)
HPC*	Sea perch	191	-	454 (37.29)	-
RIB*	Ribaldo	202	110	414 (16.59)	163 (37.52)
SCH*	School shark	149	-	346 (34.18)	-
EPT	Deepsea cardinalfish	749	13	277 (72.97)	42 (65.93)
OPE*	Orange perch	120	-	232 (53.40)	-
CYP	Longnose velvet dogfish	41	798	103 (43.92)	1 561 (23.74)
RSO	Gemfish	33	-	99 (59.07)	-
JMM*	Slender mackerel	33	-	89 (72.95)	-
HAP*	Hāpuku	36	-	85 (48.12)	-
RBT	Redbait	29	-	71 (25.63)	-
BAR*	Barracouta	30	-	59 (45.78)	-
LSO*	Lemon sole	15	-	46 (55.34)	-
JMD	Jack mackerel	14	-	37 (58.41)	-
SBW	Southern blue whiting	21	-	35 (55.47)	-
BNS*	Bluenose	11	-	34 (55.11)	-
NMP*	Tarakihi	8	-	28 (88.80)	-
SCI	Scampi	13	-	25 (17.37)	-
RSK	Rough skate	9	-	23 (100.00)	-
HAS	Australasian slender cod	10	530	17 (61.40)	1 505 (16.74)
NSD	Northern spiny dogfish	3	-	14 (100.00)	-
CSU	Four-rayed rattail	4	745	12 (86.52)	1 714 (23.43)
RBY	Rubyfish	3	-	9 (59.08)	-
BYD	Longfinned Beryx	2	-	5 (100)	-
BEE	Basketwork eel	3	641	5 (72.09)	2 320 (13.31)
ORH	Orange roughy	-	1 567	-	3 574 (25.20)
SBI	Bigscaled brown slickhead	-	786	-	3 137 (15.55)
SSM	Smallscaled brown slickhead	-	527	-	2 486 (31.26)

Table 5: Estimated core 200–800 m relative biomass (t) with coefficient of variation (%) for hoki, hake, and ling sampled by annual trawl surveys of the Chatham Rise, January 1992–2014, 2016, 2018, 2020, 2022, and 2024. No. stns, number of valid stations; CV, coefficient of variation. See also Figure 6.

Year	Survey	No. stns	Hoki		Hake		Ling	
			Biomass	CV	Biomass	CV	Biomass	CV
1992	TAN9106	184	120 190	7.7	4 180	14.9	8 930	5.8
1993	TAN9212	194	185 570	10.3	2 950	17.2	9 360	7.9
1994	TAN9401	165	145 633	9.8	3 353	9.6	10 129	6.5
1995	TAN9501	122	120 441	7.6	3 303	22.7	7 363	7.9
1996	TAN9601	89	152 813	9.8	2 457	13.3	8 424	8.2
1997	TAN9701	103	157 974	8.4	2 811	16.7	8 543	9.8
1998	TAN9801	91	86 678	10.9	2 873	18.4	7 313	8.3
1999	TAN9901	100	109 336	11.6	2 302	11.8	10 309	16.1
2000	TAN0001	128	72 151	12.3	2 152	9.2	8 348	7.8
2001	TAN0101	119	60 330	9.7	1 589	12.7	9 352	7.5
2002	TAN0201	107	74 351	11.4	1 567	15.3	9 442	7.8
2003	TAN0301	115	52 531	11.6	888	15.5	7 261	9.9
2004	TAN0401	110	52 687	12.6	1 547	17.1	8 248	7.0
2005	TAN0501	106	84 594	11.5	1 048	18.0	8 929	9.4
2006	TAN0601	96	99 208	10.6	1 384	19.3	9 301	7.4
2007	TAN0701	101	70 479	8.4	1 824	12.2	7 907	7.2
2008	TAN0801	101	76 859	11.4	1 257	12.9	7 504	6.7
2009	TAN0901	108	144 088	10.6	2 419	20.7	10 615	11.5
2010	TAN1001	91	97 503	14.6	1 701	25.1	8 846	10.0
2011	TAN1101	90	93 904	14.0	1 099	14.9	7 027	13.8
2012	TAN1201	100	87 505	9.8	1 292	14.7	8 098	7.4
2013	TAN1301	91	124 112	15.3	1 793	15.3	8 714	10.1
2014	TAN1401	87	101 944	9.8	1 377	15.2	7 489	7.2
2016	TAN1601	93	114 514	14.2	1 299	18.5	10 201	7.2
2018	TAN1801	87	122 097	16.0	1 660	34.3	8 758	11.5
2020	TAN2001	87	89 557	14.4	1 037	20.1	7 577	7.9
2022	TAN2201	88	97 419	10.1	1 651	20.4	7 293	10.7
2024	TAN2401	88	96 426	13.4	2 088	47.9	7 310	8.3

Table 6: Relative biomass estimates (t in thousands) for hoki, 200–800 m depths, Chatham Rise trawl surveys January 1992–2014, 2016, 2018, 2020, 2022, and 2024 (CV, coefficient of variation; 3++, all hoki aged 3 years and older; (see Appendix 4 for length ranges used to define age classes.). See also Figure 6.

Survey year	1+			2+			3++		Total (core)	
	YC	Biomass	CV	YC	Biomass	CV	Biomass	CV	Biomass	CV
1992	1990	3.0	(27.8)	1989	23.9	(13.1)	94.7	(7.8)	121.6	(7.7)
1993	1991	33.0	(33.4)	1990	8.8	(18.2)	144.5	(9.0)	186.2	(10.2)
1994	1992	14.7	(20.2)	1991	44.8	(18.4)	87.2	(9.4)	146.7	(9.8)
1995	1993	6.6	(12.9)	1992	42.7	(11.4)	71.8	(8.3)	121.2	(7.4)
1996	1994	27.6	(24.4)	1993	15.0	(13.3)	110.3	(10.3)	152.8	(9.7)
1997	1995	3.2	(40.3)	1994	61.4	(12.0)	93.4	(8.2)	158.0	(8.4)
1998	1996	4.4	(33.0)	1995	15.6	(19.1)	66.7	(10.7)	86.7	(10.9)
1999	1997	25.5	(30.6)	1996	13.8	(19.0)	70.1	(10.2)	109.3	(11.6)
2000	1998	14.4	(32.4)	1997	28.2	(20.7)	29.1	(9.2)	71.7	(12.4)
2001	1999	0.4	(72.9)	1998	26.3	(17.1)	33.7	(8.8)	60.3	(9.7)
2002	2000	22.5	(26.1)	1999	1.2	(21.2)	50.6	(12.7)	74.4	(11.4)
2003	2001	4.9	(46.0)	2000	27.2	(15.1)	20.4	(9.3)	52.5	(11.6)
2004	2002	14.4	(32.5)	2001	5.5	(20.4)	32.8	(12.9)	52.7	(12.6)
2005	2003	17.5	(23.4)	2002	45.8	(16.3)	21.2	(11.4)	84.6	(11.5)
2006	2004	25.9	(21.5)	2003	33.6	(18.8)	39.7	(10.3)	99.2	(10.6)
2007	2005	9.1	(27.5)	2004	32.8	(13.1)	28.8	(8.9)	70.7	(8.5)
2008	2006	15.6	(31.6)	2005	23.8	(15.6)	37.5	(7.8)	76.9	(11.4)
2009	2007	25.2	(28.8)	2006	65.2	(17.2)	53.7	(7.8)	144.1	(10.6)
2010	2008	19.3	(30.7)	2007	28.6	(15.4)	49.6	(16.3)	97.5	(14.6)
2011	2009	26.9	(36.9)	2008	26.3	(14.1)	40.7	(7.8)	93.9	(14.0)
2012	2010	2.6	(30.1)	2009	29.1	(16.6)	55.9	(8.0)	87.5	(9.8)
2013	2011	50.9	(24.5)	2010	1.0	(43.6)	72.1	(12.8)	124.1	(15.3)
2014	2012	5.7	(36.6)	2011	43.3	(14.2)	53.0	(10.9)	101.9	(9.8)
2016	2014	47.6	(27.6)	2013	12.9	(18.6)	54.0	(12.8)	114.5	(14.2)
2018	2016	30.5	(38.8)	2015	51.3	(19.1)	40.3	(14.8)	122.1	(16.0)
2020	2018	28.3	(34.2)	2017	12.3	(17.4)	48.9	(14.7)	89.6	(14.4)
2022	2020	8.4	(33.7)	2019	36.0	(17.3)	53.0	(9.0)	97.4	(10.1)
2024	2022	2.8	(33.1)	2021	31.1	(21.9)	62.6	(13.4)	96.4	(13.4)

Table 7a: Estimated relative biomass (t) and coefficient of variation (% CV) for hoki, hake, ling, other key core strata species, and key deep strata species by stratum for the 2024 survey. See Table 4 for species code definitions. Core, total biomass from valid core tows (200–800 m); Deep, total biomass from valid deep tows (800–1300 m); Total, total biomass from all valid tows (200–1300 m); -, no biomass.

Stratum	Species code					
	HOK	HAK	LIN	GSH	GSP	LDO
1	736 (22.4)	47 (28.2)	108 (34.4)	-	229 (14.2)	65 (22.2)
2A	697 (23.3)	7 (100.0)	98 (63.8)	-	145 (19.3)	56 (25.4)
2B	2 024 (16.3)	125 (34.5)	220 (29.2)	-	164 (10.2)	66 (27.7)
3	1 027 (15.5)	8 (100.0)	101 (52.9)	604 (6.3)	-	276 (10.6)
4	5 635 (13.7)	-	815 (12.7)	-	392 (14.9)	255 (31.5)
5	1 189 (9.9)	-	152 (32.3)	1 187 (32.5)	-	385 (38.6)
6	2 483 (18.7)	-	270 (34.9)	-	397 (21.9)	9 (55.9)
7A	5 212 (25.7)	24 (50.0)	379 (8.2)	-	251 (20.3)	95 (26.4)
7B	1 937 (31.5)	952 (96.8)	113 (18.8)	11 (66.2)	35 (56.6)	37 (9.8)
8A	1 237 (32.7)	65 (53.4)	267 (27.2)	3 (100.0)	138 (24.1)	71 (14.6)
8B	2 487 (15.0)	41 (56.2)	322 (46.0)	-	207 (15.6)	320 (37.3)
9	593 (50.9)	-	65 (56.0)	783 (54.0)	-	65 (90.3)
10	1 565 (22.8)	438 (83.3)	193 (35.4)	2 (100.0)	63 (29.3)	234 (32.0)
11	4 757 (20.6)	143 (32.6)	429 (30.0)	383 (52.4)	91 (57.2)	593 (13.6)
12	4 201 (4.6)	130 (63.7)	568 (39.5)	70 (61.4)	189 (12.8)	650 (13.4)
13	2 363 (27.7)	58 (100.0)	675 (35.8)	170 (43.3)	300 (42.0)	894 (55.2)
14	5 437 (19.4)	33 (100.0)	611 (46.6)	206 (57.1)	194 (58.6)	823 (34.7)
15	11 272 (60.8)	6 (53.4)	523 (21.3)	2 (100.0)	328 (12.3)	403 (35.1)
16	17 504 (40.5)	-	879 (26.9)	1 027 (53.8)	167 (77.4)	407 (12.7)
17	653 (100.0)	-	-	692 (51.0)	-	9 (80.8)
18	4 708 (57.6)	-	- 100.0	1 942 (36.7)	-	102 (75.7)
19	6 708 (60.7)	5 (100.0)	194 (63.7)	1 520 (39.8)	-	152 (62.9)
20	11 990 (52.2)	-	318 (35.2)	2 340 (12.8)	10 (100.0)	572 (22.6)
Core	96 427 (13.4)	2 088 (47.9)	7 311 (8.3)	10 946 (12.2)	3 307 (8.0)	6 548 (10.2)
21A	63 (40.5)	17 (51.1)	4 (100.0)	-	1 (100.0)	-
21B	281 (23.7)	29 (75.0)	-	-	71 (35.8)	4 (47.4)
22	793 (40.1)	54 (43.2)	33 (53.8)	-	125 (37.6)	10 (57.3)
23	6 (100.0)	-	-	-	5 (100.0)	-
24	177 (94.8)	16 (100.0)	-	-	-	-
25	201 (27.9)	10 (100.0)	31 (72.5)	-	18 (69.0)	6 (100.0)
26	71 (60.1)	25 (50.8)	-	-	70 (11.4)	-
27	557 (21.3)	-	-	-	212 (39.6)	-
28	105 (72.0)	-	-	-	-	-
29	-	-	-	-	-	-
30	-	-	-	-	-	-
Deep	2 259 (17.7)	153 (26.6)	69 (42.5)	-	504 (20.0)	22 (41.2)
Total	98 686 (13.1)	2 242 (44.7)	7 380 (8.3)	10 946 (12.2)	3 811 (7.4)	6 570 (10.2)

Table 7a (continued)

Stratum	Species code					
	HBA	HPC	GIZ	SPD	SWA	WWA
1	37 (18.8)	-	16 (50.4)	3 (100.0)	-	-
2A	51 (8.8)	-	18 (50.6)	-	-	-
2B	22 (35.8)	-	-	-	-	-
3	180 (49.1)	- 100.0	99 (36.4)	192 (7.3)	791 (67.6)	18 (66.1)
4	90 (44.4)	-	9 (100.0)	25 (56.2)	145 (65.1)	19 (100.0)
5	94 (98.4)	99 (100.0)	152 (100.0)	299 (17.9)	1 239 (24.5)	90 (100.0)
6	-	-	-	-	12 (100.0)	1 125 (80.3)
7A	15 (52.3)	-	34 (67.0)	119 (68.9)	-	10 (59.0)
7B	24 (15.8)	-	23 (43.7)	86 (35.7)	- 100.0	5 (39.9)
8A	120 (14.0)	-	2 (100.0)	35 (51.8)	-	19 (60.4)
8B	155 (24.9)	-	-	242 (51.2)	-	66 (52.6)
9	45 (37.7)	73 (100.0)	362 (22.6)	847 (13.1)	871 (25.3)	48 (68.1)
10	79 (8.0)	-	-	36 (55.0)	-	191 (93.9)
11	388 (23.9)	-	63 (62.5)	433 (39.2)	305 (49.4)	818 (53.3)
12	33 (58.0)	-	146 (56.4)	82 (19.7)	855 (59.6)	-
13	160 (41.6)	-	87 (100.0)	271 (39.7)	746 (67.9)	58 (29.7)
14	672 (42.2)	-	62 (72.2)	519 (26.1)	1 130 (42.9)	231 (49.3)
15	355 (23.1)	-	148 (33.9)	792 (9.5)	1 148 (32.7)	202 (81.9)
16	376 (96.5)	-	169 (46.5)	1 375 (40.8)	791 (83.0)	59 (58.7)
17	30 (73.1)	- 100.0	46 (13.3)	56 (56.9)	797 (96.0)	- 100.0
18	29 (40.9)	-	408 (38.4)	1 033 (23.9)	443 (56.8)	13 (47.5)
19	620 (35.1)	171 (52.6)	316 (36.4)	738 (20.2)	4 756 (37.1)	32 (78.3)
20	1 781 (17.5)	108 (66.2)	168 (34.3)	1 290 (37.4)	1 393 (50.8)	363 (63.0)
Core	5 366 (11.8)	454 (37.3)	2 337 (13.5)	8 480 (10.1)	15 430 (15.9)	3 374 (31.7)
21A	- 100.0	-	-	-	-	-
21B	-	-	-	-	-	-
22	10 (66.5)	-	-	-	-	-
23	-	-	-	-	-	-
24	-	-	-	-	-	-
25	-	-	-	-	-	-
26	-	-	-	-	-	-
27	-	-	-	-	-	-
28	-	-	-	-	-	-
29	-	-	-	-	-	-
30	-	-	-	-	-	-
Deep	11 (61.9)	-	-	-	-	-
Total	5 377 (11.8)	454 (37.3)	2 337 (13.5)	8 480 (10.1)	15 430 (15.9)	3 374 (31.7)

Table 7a (continued)

Stratum	Species code					
	RIB	BOE	SSO	SOR	CSU	CBO
1	34 (28.6)	-	-	370 (56.1)	- 100.0	130 (32.1)
2A	45 (44.1)	1 (100.0)	-	232 (53.0)	-	20 (4.8)
2B	37 (37.1)	1 (100.0)	-	694 (54.8)	10 (100.0)	201 (61.7)
3	-	-	-	-	-	103 (52.4)
4	49 (76.6)	14 725 (46.7)	-	4 (58.4)	-	390 (38.6)
5	-	-	-	-	-	183 (49.6)
6	84 (29.2)	6 524 (12.1)	3 462 (41.9)	-	-	77 (70.8)
7A	20 (41.9)	-	-	-	-	417 (30.2)
7B	8 (66.6)	-	-	1 (100.0)	-	255 (65.9)
8A	31 (20.6)	-	-	18 (100.0)	- (52.3)	90 (12.2)
8B	-	-	-	-	-	202 (18.8)
9	-	-	-	-	-	22 (100.0)
10	10 (100.0)	-	-	-	-	69 (79.2)
11	27 (55.5)	-	-	-	-	536 (17.4)
12	7 (100.0)	-	-	-	-	556 (23.9)
13	19 (100.0)	-	-	-	-	728 (66.8)
14	-	30 (100.0)	-	-	-	1 101 (54.7)
15	5 (100.0)	-	-	-	-	1 119 (28.7)
16	32 (100.0)	-	-	-	-	807 (26.6)
17	-	-	-	-	-	-
18	-	-	-	-	-	-
19	-	-	-	-	-	27 (66.4)
20	-	-	-	2 (100.0)	-	246 (40.0)
Core	414 (16.6)	21 282 (32.5)	3 463 (41.9)	1 323 (34.1)	12 (86.5)	7 290 (12.9)
21A	-	1 (100.0)	1 (92.2)	- 100.0	20 (62.3)	-
21B	90 (52.8)	-	14 (32.2)	186 (34.9)	193 (22.6)	3 (71.1)
22	40 (49.2)	2 (69.9)	22 (97.7)	10 (79.1)	214 (40.5)	4 (100.0)
23	-	5 (100.0)	6 307 (93.9)	-	180 (46.5)	-
24	-	-	4 (21.1)	-	787 (47.7)	-
25	33 (100.0)	603 (68.9)	2 608 (70.4)	45 (69.6)	53 (39.2)	-
26	-	1 626 (79.9)	22 927 (53.5)	-	11 (42.7)	-
27	-	33 589 (97.4)	38 843 (63.1)	-	12 (26.8)	-
28	-	-	2 416 (64.0)	55 (65.4)	232 (24.4)	-
29	-	215 (55.3)	180 (21.6)	-	8 (100.0)	-
30	-	91 (97.5)	18 (100.0)	-	1 (50.0)	-
Deep	164 (37.5)	36 136 (90.6)	73 344 (38.4)	298 (27.3)	1 715 (23.4)	8 (64.9)
Total	578 (16.0)	57 418 (58.3)	76 807 (36.7)	1 621 (28.3)	1 727 (23.3)	7 298 (12.9)

Table 7a (continued)

Stratum	Species code					
	BEE	SND	CYP	ETB	SBI	SSM
1	3 (100.0)	1 181 (31.0)	6 (82.9)	- 100.0	-	-
2A	-	4 101 (45.9)	6 (30.0)	-	-	-
2B	-	1 114 (36.3)	54 (67.7)	-	-	-
3	-	-	-	-	-	-
4	-	144 (69.5)	-	241 (32.7)	-	-
5	-	-	-	-	-	-
6	2 (100.0)	46 (55.0)	26 (91.0)	688 (55.3)	-	-
7A	-	176 (50.3)	10 (100.0)	- 100.0	-	-
7B	-	12 (77.1)	-	-	-	-
8A	-	95 (96.4)	-	-	-	-
8B	-	6 (100.0)	-	-	-	-
9	-	-	-	-	-	-
10	-	53 (76.4)	-	-	-	-
11	-	7 (100.0)	-	1 (100.0)	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	-	-	-	51 (82.5)	-	-
15	-	-	-	-	-	-
16	-	-	-	76 (50.1)	-	-
17	-	-	-	-	-	-
18	-	-	-	-	-	-
19	-	-	-	-	-	-
20	-	2 (100.0)	-	-	-	-
Core	6 (72.1)	6 941 (28.3)	103 (43.9)	1 060 (37.1)	-	-
21A	8 (45.1)	49 (31.5)	59 (22.2)	11 (54.6)	20 (84.3)	- 100.0
21B	26 (91.9)	2 611 (51.1)	397 (10.1)	-	60 (78.8)	-
22	35 (41.5)	309 (40.2)	166 (12.6)	12 (41.3)	8 (49.8)	85 (60.9)
23	469 (34.2)	82 (79.0)	42 (100.0)	86 (37.0)	487 (37.2)	25 (41.7)
24	261 (34.8)	490 (96.7)	352 (91.1)	77 (50.3)	267 (50.6)	8 (71.1)
25	59 (57.8)	1 330 (82.3)	168 (49.4)	215 (46.9)	3 (58.4)	43 (73.8)
26	49 (52.6)	79 (76.0)	78 (31.2)	151 (12.3)	-	21 (22.2)
27	110 (38.2)	-	54 (65.0)	1 071 (59.6)	-	-
28	473 (2.8)	153 (39.4)	232 (62.9)	105 (50.2)	285 (50.9)	267 (50.9)
29	563 (40.9)	-	-	409 (55.6)	1 271 (30.5)	1 740 (43.7)
30	262 (22.8)	-	9 (100.0)	76 (84.8)	733 (15.2)	294 (16.3)
Deep	2 320 (13.3)	5 108 (35.2)	1 562 (23.7)	2 217 (31.2)	3 138 (15.6)	2 487 (31.3)
Total	2 326 (13.3)	12 049 (22.1)	1 665 (22.4)	3 277 (24.3)	3 138 (15.6)	2 487 (31.3)

Table 7b: Estimated relative biomass (t) and coefficient of variation (% CV) for pre-recruit (small, nominally < 20 cm SL), medium, 20–30 cm, recruited (nominally > 30 cm SL), and total orange roughy for the 2024 survey. Core, total biomass from valid core tows (200–800 m; Deep, total biomass from valid deep tows (800–1300 m); Total, total biomass from all valid tows (200–1300 m); -, no biomass.

Stratum	Small	Medium	Large	Total
1	-	-	-	-
2A	-	-	-	-
2B	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-
7A	-	-	-	-
7B	-	-	-	-
8A	-	-	-	-
8B	-	-	-	-
9	-	-	-	-
10	-	-	-	-
11	-	-	-	-
12	-	-	-	-
13	-	-	-	-
14	-	-	-	-
15	-	-	-	-
16	-	-	-	-
17	-	-	-	-
18	-	-	-	-
19	-	-	-	-
20	-	-	-	-
Core	-	-	-	-
21A	8 (95.8)	29 (76.8)	19 (67.2)	58 (56.6)
21B	10 (36.9)	56 (20.9)	184 (36.5)	251 (28.5)
22	32 (32.4)	290 (22.1)	500 (40.3)	823 (28.5)
23	19 (76.7)	113 (59.4)	1 032 (56.4)	1 166 (56.2)
24	2 (59.9)	50 (52.5)	436 (57.8)	489 (57.0)
25	6 (41.8)	105 (34.0)	52 (75.1)	164 (41.3)
26	-	-	-	-
27	-	-	4 (100.0)	4 (100.0)
28	66 (76.3)	193 (75.8)	347 (84.0)	607 (80.4)
29	- 100.0	9 (100.0)	-	10 (100.0)
30	-	-	-	-
Deep	147 (37.1)	849 (21.4)	2 578 (28.4)	3 574 (25.2)
Total	147 (37.1)	849 (21.4)	2 578 (28.4)	3 574 (25.2)

Table 7c: Estimated relative biomass (t) and coefficient of variation (% CV) for “small” pre-recruit (nominally < 20 cm SL), “medium” 20–30 cm, “large” recruited (nominally > 30 cm SL), and total orange roughy for Chatham Rise trawl surveys January 2010–2014, 2016, 2018, 2020, 2022, and 2024. Core, total biomass from valid core tows (200–800 m); All, total biomass from all valid tows (200–1300 m). -, no biomass.

Survey	Population	Biomass (CV)	
		Core	All
TAN1001	Small	6 (59.3)	57 (42.1)
	Medium	29 (71.5)	627 (15.0)
	Large	454 (91.5)	3 701 (19.5)
	Total	489 (88.6)	4 386 (17.7)
TAN1101	Small	4 (48.1)	370 (92.1)
	Medium	9 (65.0)	1 857 (75.9)
	Large	11 (50.5)	5 310 (52.1)
	Total	24 (53.5)	7 537 (59.7)
TAN1201	Small	1 (100.0)	61 (30.2)
	Medium	2 (100.0)	867 (43.3)
	Large	0 (0.0)	4 278 (27.0)
	Total	3 (100.0)	5 206 (26.7)
TAN1301	Small	1 (100.0)	85 (59.0)
	Medium	0 (0.0)	530 (24.5)
	Large	2 (100.0)	2 163 (37.5)
	Total	3 (75.1)	2 778 (32.3)
TAN1401	Small	4 (100.0)	6 916 (37.7)
	Medium	0 (100.0)	45 (28.5)
	Large	2 (100.0)	468 (22.2)
	Total	2 (100.0)	6 404 (40.8)
TAN1601	Small	2 (100.0)	74 (75.7)
	Medium	4 (100.0)	468 (36.0)
	Large	8 (72.7)	4 495 (55.0)
	Total	14 (54.6)	5 037 (53.3)
TAN1801	Small	14 (94.8)	54 (35.0)
	Medium	16 (58.8)	251 (19.2)
	Large	10 (46.3)	997 (24.2)
	Total	40 (59.6)	1 302 (20.8)
TAN2001	Small	2 (73.9)	88 (28.8)
	Medium	10 (54.2)	652 (39.1)
	Large	2 (100.0)	2 347 (33.3)
	Total	13 (59.8)	3 087 (31.1)
TAN2201	Small	0 100.0	89 (53.4)
	Medium	1 (100.0)	558 (34.7)
	Large	4 (71.4)	1 321 (20.0)
	Total	5 (69.7)	1 967 (22.1)
TAN2401	Small	-	147 (37.1)
	Medium	-	849 (21.4)
	Large	-	2 578 (28.4)
	Total	-	3 574 (25.2)

Table 8: Total numbers of fish, squid, and scampi measured for length frequency distributions and biological samples from all tows on TAN2401. The total number of fish measured is sometimes greater than the sum of males and females because some fish were unsexed.

Common name	Species code	Number measured			Number of biological samples
		Males	Females	Total	
Abyssal rattail	CMU	-	10	12	12
Alert pigfish	API	1	-	1	1
Alfonsino	BYS	375	373	791	316
Arrow squid	NOS	350	264	765	320
Australasian slender cod	HAS	565	649	1,231	650
Banded bellowsfish	BBE	36	44	1,872	443
Banded rattail	CFA	257	533	803	372
Barracouta	BAR	7	10	17	15
Basketwork eel	BEE	172	507	682	398
Baxter's lantern dogfish	ETB	324	347	671	441
Bigeye cardinalfish	EPL	33	33	67	67
Bigeye sea perch	HBA	1 598	1 589	3 209	1 063
Bigscaled brown slickhead	SBI	724	799	1 530	391
Black ghost shark	HYB	-	1	1	1
Black javelinfish	BJA	106	112	224	83
Black oreo	BOE	1 197	1 339	2 539	442
Black slickhead	BSL	449	686	1,138	215
Blackspot rattail	VNI	6	27	35	33
Blue-eye lantern shark	EVI	19	22	41	41
Blue mackerel	EMA	1	-	1	1
Blue skate	BRL	1	-	1	1
Bluenose	BNS	3	1	4	4
Bollon's rattail	CBO	1 940	1 635	3 635	959
Cape scorpionfish	TRS	3	14	17	17
Capro dory	CDO	73	113	331	63
Chimaera, brown	CHP	10	10	20	20
Common halosaur	HPE	4	4	8	8
Common roughy	RHY	272	216	488	95
Cosmopolitan rattail	COM	-	1	1	1
Crested bellowsfish	CBE	3	2	90	25
Cubehead	CUB	46	30	76	29
Dark ghost shark	GSH	1 577	1 829	3 406	740
Dawson's catshark	DCS	1	-	1	1
Deepsea cardinalfish	EPT	72	99	218	136
Deepsea flathead	FHD	7	23	30	28
Deepwater spiny skate (arctic skate)	DSK	2	1	3	3
Dwarf cod	DCO	-	-	1	1
Electric ray	ERA	-	2	2	2
<i>Etmopterus villosus</i>	ETV	-	1	1	1
Eucla cod	EUC	-	2	2	2
Filamentous rattail	GAO	2	1	3	3
Finless flounder	MAN	8	6	14	14
Fleshynose catshark	AML	2	4	6	6
Four-rayed rattail	CSU	1 199	1 979	3 227	574
Freckled catshark	ASU	11	3	14	14
Frostfish	FRO	79	88	174	74
Garrick's catshark	AGK	4	4	8	8
Gemfish	RSO	3	7	10	10
Giant stargazer	GIZ	123	224	348	307
<i>Gonorynchus forsteri</i> & <i>G. greyi</i>	GON	-	1	1	1
Grenadier cod	GRC	-	1	1	1
Hairy conger	HCO	35	63	98	79
Hairy conger	HCO	35	63	98	79
Hake	HAK	314	219	533	533
Hapuku	HAP	3	3	6	6
Hoki	HOK	7 772	9 715	17 588	1 974
Humpback rattail (slender rattail)	CBA	1	20	21	21
Jack mackerel	JMD	16	5	21	20
Javelinfinch	JAV	1 076	5 951	7 109	1 319
Johnson's cod	HJC	59	1	60	43

Common name	Species code	Number measured			Number of biological samples
		Males	Females	Total	
Johnson's cod	HJO	150	9	159	82
Kaiyomaru rattail	CKA	57	42	100	99
Lancetfish	LAT	-	-	1	1
Leafscale gulper shark	CSQ	8	23	31	31
Lemon sole	LSO	14	19	33	33
Lighthouse fish	PHO	4	5	9	9
Ling	LIN	496	490	986	943
Long-nosed chimaera	LCH	202	302	504	423
Longfinned beryx	BYD	1	-	1	1
Longnose velvet dogfish	CYP	278	353	632	453
Longnosed deepsea skate	PSK	14	3	17	17
Lookdown dory	LDO	1 407	1 927	3 377	1 303
Lucifer dogfish	ETL	136	143	279	226
Mahia rattail	CMA	41	82	123	120
Mirror dory	MDO	-	1	1	1
New Zealand catshark	AEX	34	19	53	52
Northern spiny dogfish	NSD	6	-	6	6
Notable rattail	CIN	173	227	415	327
Numbfish	BER	1	-	1	1
Oblique banded rattail	CAS	475	1 783	2 306	541
Oliver's rattail	COL	894	969	1 906	771
Orange perch	OPE	96	98	195	69
Orange roughy	ORH	902	1 000	1 926	523
Pale ghost shark	GSP	427	474	901	765
Plunket's shark	PLS	2	4	6	6
Pointynose blue ghost shark	HYP	1	1	2	2
Prickly deepsea skate	BTS	9	5	14	14
Prickly dogfish	PDG	4	3	7	7
Ragfish	RAG	-	1	1	1
Ray's bream	RBM	-	3	3	3
Red cod	RCO	309	138	451	193
Red gurnard	GUR	1	2	3	3
Redbait	RBT	34	32	89	86
Ribaldo	RIB	131	71	203	171
Ridge scaled rattail	MCA	274	204	482	256
Robust cardinalfish	ERB	5	7	12	12
Rough skate	RSK	-	1	1	1
Roughhead rattail	CHY	20	34	54	54
Roughhead rattail	CTH	1	1	2	2
Rubyfish	RBY	2	2	4	4
Rudderfish	RUD	8	2	10	10
Scaly gurnard	SCG	27	76	104	55
Scampi	SCI	66	73	142	127
School shark	SCH	6	5	11	10
Sea perch	HPC	289	282	572	124
Seal shark	BSH	21	25	46	41
Serrulate rattail	CSE	203	190	394	309
Sharpnose sevengill shark	HEP	-	1	1	1
Shortsnouted lancetfish	ABR	-	1	1	1
Shovelnose dogfish	SND	820	941	1 765	658
Silver dory	SDO	120	88	298	61
Silver roughy	SRH	53	94	148	68
Silver warehou	SWA	1 712	1 711	3 435	813
Silverside	SSI	126	36	182	143
Slender mackerel	JMM	17	6	23	23
Small-headed cod	SMC	20	12	34	34
Small banded rattail	CCX	42	49	91	59

Common name	Species code	Number measured			Number of biological samples
		Males	Females	Total	
Smallscaled brown slickhead	SSM	246	316	569	251
Smooth deepsea skate	BTA	12	8	20	18
Smooth oreo	SSO	1 928	1 696	3 630	574
Smooth skate	SSK	28	20	48	34
Smooth skin dogfish	CYO	67	24	91	91
Snubnosed eel	SNE	-	1	2	2
Southern blue whiting	SBW	35	12	47	47
Southern Ray's bream	SRB	231	244	478	265
Spiky oreo	SOR	515	549	1,082	354
Spineback	SBK	20	351	373	227
Spiny dogfish	SPD	517	1 965	2 482	1 103
Spinyfin	SFN	1	-	1	1
Squashedface rattail	NNA	-	1	2	2
Swollenhead conger	SCO	59	102	161	114
Tarakihi	NMP	28	45	73	28
Tasmanian ruffe	TUB	-	-	1	1
Thin tongue cardinalfish	EPM	95	113	208	114
Two saddle rattail	CBI	208	220	429	144
Unicorn rattail	WHR	10	14	24	24
Velcro skate	NAL	-	1	1	1
Velvet rattail	TRX	1	-	3	3
Violet cod	VCO	54	32	86	86
Warty oreo	WOE	34	31	67	40
White brotula	CAX	-	1	1	1
White cardinalfish	EPD	11	18	61	61
White rattail	WHX	178	289	471	410
White warehou	WWA	259	352	611	-
Widenosed chimaera	RCH	94	27	121	110
Witch	WIT	14	13	28	28
Yellow cod	YCO	-	1	1	-
Total		35 725	48 139	86 932	26 731

Table 9: Length-weight regression parameters* used to scale length frequencies (data from TAN2401). “All CHAT surveys”: data from all surveys used because the r^2 value was less than 90% for TAN2401 data or n was less than 50.

Common name	Species code	a (intercept)	b (slope)	r^2	n	Length range (cm)	Source
Alfonsino	BYS	0.030698	2.891077	95.91	311	17.5–51.5	TAN2401
Arrow squid	NOS	0.013685	3.151855	95.46	291	12.3–36.2	TAN2401
Banded bellowsfish	BBE	0.003643	3.308921	91.42	425	14.7–28.6	TAN2401
Banded rattail	CFA	0.00133	3.355964	88.82	1 941	16.2–39.5	All CHAT surveys
Basketwork eel	BEE	0.000567	3.148259	92.45	344	48.3–125.4	TAN2401
Baxter's lantern dogfish	ETB	0.002575	3.176745	97.09	433	27.1–79.5	TAN2401
Bigscaled brown slickhead	SBI	0.002905	3.298731	94.77	379	25.6–54.1	TAN2401
Black oreo	BOE	0.020658	2.986003	90.63	441	23.4–42.0	TAN2401
Black slickhead	BSL	0.007317	3.014518	91.90	1 341	17.7–40.6	All CHAT surveys
Bollon's rattail	CBO	0.002089	3.251266	92.80	918	23.0–60.6	TAN2401
Dark ghost shark	GSH	0.003008	3.169887	95.43	733	32.6–73.0	TAN2401
Four-rayed rattail	CSU	0.018723	2.364278	71.81	2 672	17.9–39.5	All CHAT surveys
Giant stargazer	GIZ	0.008778	3.149307	98.47	285	16.3–84.8	TAN2401
Hake	HAK	0.001392	3.371105	96.33	515	58.4–133.5	TAN2401
Hoki	HOK	0.003980	2.928833	98.26	1 958	35.2–112.4	TAN2401
Javelinfish	JAV	0.001281	3.163956	96.64	1 235	16.3–61.9	TAN2401
Johnson's cod	HJO	0.002123	3.265800	97.37	750	19.0–63.8	TAN2401
Ling	LIN	0.001698	3.219313	99.42	937	33.5–151.8	TAN2401
Long-nosed chimaera	LCH	0.003087	3.004649	96.97	416	26.4–91.3	TAN2401
Longnose velvet dogfish	CYP	0.002938	3.094158	98.66	443	30.9–94.7	TAN2401
Lookdown dory	LDO	0.030771	2.885652	97.70	1 273	11.2–55.4	TAN2401
Lucifer dogfish	ETL	0.001036	3.314570	97.55	200	18.8–52.9	TAN2401
Mahia rattail	CMA	0.001286	3.335362	96.80	107	26.5–67.0	TAN2401
Notable rattail	CIN	0.020407	2.353990	79.00	1 331	14.1–40.5	All CHAT surveys
Oblique banded rattail	CAS	0.001896	3.249599	95.97	508	17.5–46.8	TAN2401
Oliver's rattail	COL	0.004875	2.827512	90.36	6 758	11.8–42.2	All CHAT surveys
Orange roughy	ORH	0.045496	2.900806	98.16	519	13.1–42.2	TAN2401
Pale ghost shark	GSP	0.008841	2.895925	94.16	756	33.9–86.8	TAN2401
Ray's bream	RBM	0.020601	2.959515	92.65	2 609	21.3–66.4	All CHAT surveys
Red cod	RCO	0.007146	3.067927	98.95	188	8.7–63.8	TAN2401
Ribaldo	RIB	0.005029	3.190992	95.18	168	31.4–75.2	TAN2401
Ridge scaled rattail	MCA	0.002254	3.192062	97.79	244	24.0–83.6	TAN2401
Scampi	SCI	0.788903	2.770268	88.27	1 673	2.7–7.5	All CHAT surveys
Sea perch	SPE	0.010250	3.124746	98.39	1 149	14.0–48.7	TAN2401
Serrulate rattail	CSE	0.009293	2.742439	84.79	1 554	18.6–52.0	All CHAT surveys
Shovelnose dogfish	SND	0.002096	3.127640	98.16	10 701	29.2–126.5	All CHAT surveys
Silver warehou	SWA	0.008686	3.183875	98.77	791	12.9–52.5	TAN2401
Silverside	SSI	0.007926	2.946248	85.00	1 825	16.9–31.9	All CHAT surveys
Smallscaled brown slickhead	SSM	0.003545	3.229418	97.72	246	22.8–68.4	TAN2401
Smooth oreo	SSO	0.020714	3.002132	98.70	561	16.5–51.5	TAN2401
Spiky oreo	SOR	0.032892	2.874136	98.53	351	11.4–41.2	TAN2401
Spineback	SBK	0.000755	3.220633	88.74	1 606	32.2–80.4	All CHAT surveys
Spiny dogfish	SPD	0.000691	3.418397	93.91	1 072	50.9–100.2	TAN2401
Swollenhead conger	SCO	0.000142	3.593536	93.38	110	56.0–110.0	TAN2401
Thin tongue cardinalfish	EPM	0.007473	3.192842	97.79	349	10.7–70.2	TAN2401
Two saddle rattail	CBI	0.001187	3.367423	97.71	136	28.5–67.4	TAN2401
White rattail	WHX	0.000763	3.531205	98.28	400	27.6–89.5	TAN2401
White warehou	WWA	0.014154	3.106511	98.64	354	24.2–58.3	TAN2401
Widenosed chimaera	RCH	0.000324	3.348235	97.41	106	52.5–154.3	TAN2401

* $W = aL^b$ where W is weight (g) and L is length (cm); r^2 is the correlation coefficient, n is the sample size.

Table 10: Numbers of TAN2401 fish measured at each reproductive stage. MD, middle depths staging method; SS, Cartilaginous fish gonad stages — see footnote below table for staging details. -, no data.

Species code	Common name	Sex	Staging method	Reproductive stage							Total
				1	2	3	4	5	6	7	
AEX	New Zealand catshark	Female	MD	5	1	5	1	-	3	-	15
		Male		9	5	20	-	-	-	-	34
AGK	Garrick's catshark	Female	MD	2	-	-	-	-	-	-	2
		Male		2	-	1	-	-	-	-	3
AML	Fleshynose catshark	Female	MD	1	-	1	1	-	1	-	4
		Male		2	-	-	-	-	-	-	2
API	Alert pigfish	Female	MD	-	-	-	-	-	-	-	-
		Male		1	-	-	-	-	-	-	1
ASI	Freckled catshark	Female	MD	-	-	1	-	-	2	-	3
		Male		-	1	9	-	-	-	-	10
BAR	Barracouta	Female	MD	-	-	6	-	-	-	-	6
		Male		-	2	-	-	4	-	-	6
BEE	Basketwork eel	Female	MD	7	29	2	-	-	-	-	38
		Male		1	5	4	-	-	-	-	10
BJA	Black javelinfish	Female	MD	1	5	-	-	1	-	-	7
		Male		1	1	-	-	-	-	-	2
BNS	Bluenose	Female	MD	-	1	-	-	-	-	-	1
		Male		2	-	1	-	-	-	-	3
BOE	Black oreo	Female	MD	97	55	97	3	-	2	1	255
		Male		123	82	29	22	7	2	1	266
BSH	Seal shark	Female	SS	19	-	-	-	-	1	-	20
		Male		18	-	-	-	-	-	-	18
BSL	Black slickhead	Female	MD	4	12	32	8	-	-	-	56
		Male		1	17	6	-	-	-	-	24
BTA	Smooth deepsea skate	Female	SS	2	-	-	1	-	2	-	5
		Male		1	3	5	-	-	-	-	9
BTS	Prickly deepsea skate	Female	SS	1	2	1	-	-	1	-	5
		Male		2	3	4	-	-	-	-	9
BYS	Alfonsino	Female	MD	38	33	2	-	-	-	-	73
		Male		47	38	-	-	-	-	1	86
CAS	Oblique banded rattail	Female	MD	1	27	-	-	-	-	1	29
		Male		-	9	1	-	-	-	-	10
CAX	White brotula	Female	MD	-	-	1	-	-	-	-	1
		Male		-	-	-	-	-	-	-	-
CBA	Humpback rattail (slender rattail)	Female	MD	1	10	1	-	-	-	-	12
		Male		-	-	-	1	-	-	-	1
CBO	Bollon's rattail	Female	MD	1	35	-	-	-	-	1	37
		Male		3	46	-	-	-	-	-	49
CDO	Capro dory	Female	MD	-	2	-	-	-	-	-	2
		Male		-	2	-	-	-	-	-	2
CFA	Banded rattail	Female	MD	1	26	2	-	-	-	-	29
		Male		5	11	-	-	-	-	-	16
CHP	Chimaera, brown	Female	SS	1	2	-	-	-	6	-	9
		Male		1	1	8	-	-	-	-	10
CHY	Roughhead rattail	Female	MD	-	8	3	5	2	4	-	22
		Male		1	18	-	-	-	-	-	19
CIN	Notable rattail	Female	MD	-	8	4	-	-	-	-	12
		Male		3	12	-	-	-	-	-	15
CKA	Kaiyomaru rattail	Female	MD	1	-	-	-	-	-	-	1
		Male		-	-	-	-	-	-	-	-
CMA	Mahia rattail	Female	MD	5	23	-	1	-	-	-	29
		Male		5	7	-	-	-	-	-	12
CMU	Abyssal rattail	Female	MD	1	2	-	-	-	-	-	3
		Male		-	-	-	-	-	-	-	-
COL	Oliver's rattail	Female	MD	1	3	-	-	-	-	-	4
		Male		-	2	-	-	-	-	-	2
CSE	Serrulate rattail	Female	MD	-	17	8	-	-	-	-	25
		Male		-	19	-	-	-	-	-	19
CSQ	Leafscale gulper shark	Female	SS	6	2	-	-	-	2	-	10
		Male		4	-	3	-	-	-	-	7

Species code	Common name	Sex	Staging method	Reproductive stage							
				1	2	3	4	5	6	7	Total
CSU	Four-rayed rattail	Female	MD	-	11	7	-	-	-	-	18
		Male		-	3	-	-	-	-	-	3
CTH	Roughhead rattail	Female	MD	-	1	-	-	-	-	-	1
		Male		-	1	-	-	-	-	-	1
CUB	Cubehead	Female	MD	-	3	1	-	-	-	-	4
		Male		-	4	1	-	-	-	-	5
CYO	Smooth skin dogfish	Female	SS	9	6	3	-	-	4	-	22
		Male		9	3	55	-	-	-	-	67
CYP	Longnose velvet dogfish	Female	SS	165	15	21	6	2	37	-	246
		Male		104	9	104	-	-	-	-	217
DCS	Dawson's catshark	Female	SS	-	-	-	-	-	-	-	-
		Male		-	-	1	-	-	-	-	1
DSK	Deepwater spiny skate (arctic skate)	Female	SS	1	-	-	-	-	-	-	1
		Male		2	-	-	-	-	-	-	2
EMA	Blue mackerel	Female	MD	-	-	-	-	-	-	-	-
		Male		-	-	-	1	-	-	-	1
EPL	Bigeye cardinalfish	Female	MD	-	23	-	-	-	-	-	23
		Male		1	17	-	-	-	-	-	18
EPM	Thin tongue cardinalfish	Female	MD	1	5	24	1	-	-	-	31
		Male		1	16	9	2	-	-	-	28
EPT	Deepsea cardinalfish	Female	MD	9	12	-	-	-	-	-	21
		Male		28	8	-	-	-	-	-	36
ERB	Robust cardinalfish	Female	MD	1	1	4	-	-	-	-	6
		Male		1	1	2	1	-	-	-	5
ETB	Baxter's lantern dogfish	Female	SS	82	50	38	11	6	49	-	236
		Male		57	27	133	-	-	-	-	217
ETL	Lucifer dogfish	Female	SS	42	22	21	5	3	11	-	104
		Male		28	17	58	-	-	-	-	103
ETV	Etmopterus villosus	Female	MD	1	-	-	-	-	-	-	1
		Male		-	-	-	-	-	-	-	-
EUC	Eucla cod	Female	MD	-	-	1	1	-	-	-	2
		Male		-	-	-	-	-	-	-	-
EVI	Blue-eye lantern shark	Female	MD	19	-	-	-	-	-	-	19
		Male		17	1	1	-	-	-	-	19
FHD	Deepsea flathead	Female	MD	-	-	-	-	-	-	1	1
		Male		-	-	-	-	-	-	-	-
FRO	Frostfish	Female	MD	3	1	19	2	-	-	-	25
		Male		4	4	-	2	-	-	-	10
GAO	Filamentous rattail	Female	MD	1	-	-	-	-	-	-	1
		Male		2	-	-	-	-	-	-	2
GIZ	Giant stargazer	Female	MD	7	70	50	9	1	1	11	149
		Male		9	61	4	-	-	1	-	75
GSH	Dark ghost shark	Female	SS	166	185	86	-	11	84	-	532
		Male		83	255	202	-	-	-	-	540
GSP	Pale ghost shark	Female	SS	141	97	106	7	22	51	-	424
		Male		100	17	257	-	-	-	-	374
GUR	Red gurnard	Female	MD	-	1	-	-	1	-	-	2
		Male		-	-	-	-	-	1	-	1
HAK	Hake	Female	MD	4	13	137	30	3	25	7	219
		Male		5	5	12	106	128	41	17	314
HAP	Hapuku	Female	MD	-	1	1	-	-	-	-	2
		Male		-	2	-	-	-	-	-	2
HAS	Australasian slender cod	Female	MD	32	81	60	-	-	-	-	173
		Male		52	100	7	-	-	-	-	159
HBA	Bigeye sea perch	Female	MD	27	149	1	1	-	-	-	178
		Male		11	97	32	38	1	-	-	179
HCO	Hairy conger	Female	MD	1	1	2	-	-	-	-	4
		Male		-	-	-	1	-	-	-	1
HJC	Johnson's cod	Female	MD	-	1	-	-	-	-	-	1

Species code	Common name	Sex	Staging method	Reproductive stage							
				1	2	3	4	5	6	7	Total
HJO	Johnson's cod	Male	MD	1	40	1	-	-	-	-	42
		Female		-	1	-	-	-	-	-	1
		Male		-	11	9	-	-	-	-	20
HOK	Hoki	Female	MD	5 208	3 856	19	1	-	1	-	9 085
		Male		3 542	3 159	2	-	-	-	1	6 704
HPC	Sea perch	Female	MD	5	12	4	6	8	-	1	36
		Male		1	25	1	-	-	-	-	27
HYB	Black ghost shark	Female	SS	-	-	-	-	-	1	-	1
		Male		-	-	-	-	-	-	-	-
HYP	Pointynose blue ghost shark	Female	SS	-	-	1	-	-	-	-	1
		Male		-	-	1	-	-	-	-	1
JAV	Javelinfish	Female	MD	10	67	10	-	-	-	6	93
		Male		-	5	2	-	-	-	-	7
JMD	Jack mackerel	Female	MD	-	-	1	1	-	-	-	2
		Male		-	-	1	6	4	-	-	11
JMM	Slender mackerel	Female	MD	-	1	3	1	-	-	-	5
		Male		-	1	1	9	5	-	-	16
LCH	Long-nosed chimaera	Female	SS	99	30	98	9	7	28	-	271
		Male		34	39	114	-	-	-	-	187
LDO	Lookdown dory	Female	MD	45	158	137	20	2	9	13	384
		Male		11	150	13	35	2	3	-	214
LIN	Ling	Female	MD	182	297	1	3	-	-	2	485
		Male		218	135	16	119	4	-	-	492
MCA	Ridge scaled rattail	Female	MD	21	11	1	-	-	-	-	33
		Male		14	9	-	-	-	-	-	23
MDO	Mirror dory	Female	MD	-	-	1	-	-	-	-	1
		Male		-	-	-	-	-	-	-	-
NMP	Tarakihi	Female	MD	1	14	2	1	-	-	-	18
		Male		2	8	-	-	-	-	-	10
NOS	Arrow squid	Female	MD	4	12	3	32	26	-	-	77
		Male		34	22	33	26	33	-	-	148
NSD	Northern spiny dogfish	Female	SS	-	-	-	-	-	-	-	-
		Male		2	1	3	-	-	-	-	6
OPE	Orange perch	Female	MD	1	3	-	-	-	-	-	4
		Male		1	-	-	-	-	-	-	1
ORH	Orange roughy	Female	MD	130	74	133	-	-	-	-	337
		Male		190	50	59	-	-	-	-	299
PDG	Prickly dogfish	Female	SS	-	-	-	-	-	-	-	-
		Male		2	-	2	-	-	-	-	4
PLS	Plunket's shark	Female	SS	2	-	-	-	-	-	-	2
		Male		-	1	-	-	-	-	-	1
PSK	Longnosed deepsea skate	Female	SS	2	-	-	-	-	-	-	2
		Male		1	2	11	-	-	-	-	14
RAG	Ragfish	Female	MD	-	-	1	-	-	-	-	1
		Male		-	-	-	-	-	-	-	-
RBM	Ray's bream	Female	MD	1	-	-	-	-	-	-	1
		Male		-	-	-	-	-	-	-	-
RBT	Redbait	Female	MD	2	10	3	1	-	-	-	16
		Male		3	4	3	1	1	-	-	12
RCH	Widenosed chimaera	Female	SS	8	3	7	3	-	6	-	27
		Male		17	39	37	-	-	-	-	93
RCO	Red cod	Female	MD	32	31	1	12	1	-	1	78
		Male		23	36	8	12	6	1	2	88
RHY	Common roughy	Female	MD	-	1	4	13	-	-	-	18
		Male		2	11	25	-	-	-	-	38
RIB	Ribaldo	Female	MD	3	30	4	-	-	-	1	38
		Male		-	78	1	-	-	-	1	80
RSK	Rough skate	Female	MD	-	-	1	-	-	-	-	1
		Male		-	-	-	-	-	-	-	-
RSO	Gemfish	Female	MD	-	7	-	-	-	-	-	7
		Male		-	3	-	-	-	-	-	3
RUD	Rudderfish	Female	MD	-	1	-	-	-	-	-	1
		Male		-	-	1	-	-	3	-	4
SBI	Bigscaled brown slickhead	Female	MD	24	32	25	9	8	3	1	102

Species code	Common name	Sex	Staging method	Reproductive stage							Total
				1	2	3	4	5	6	7	
SBK	Spineback	Male	MD	9	27	19	5	1	-	-	61
		Female		-	4	26	30	32	1	-	93
		Male		-	1	2	3	-	-	-	6
SBW	Southern blue whiting	Female	MD	2	8	-	-	-	-	-	10
		Male		15	16	-	-	-	-	-	31
SCH	School shark	Female	SS	1	-	-	-	-	1	-	2
		Male		-	1	5	-	-	-	-	6
SCO	Swollenhead conger	Female	MD	-	5	4	-	-	1	-	10
		Male		1	2	1	1	-	1	-	6
SDO	Silver dory	Female	MD	-	9	-	-	-	-	-	9
		Male		-	9	1	-	-	-	-	10
SMC	Small-headed cod	Female	MD	1	6	-	-	-	-	-	7
		Male		9	4	-	-	-	-	-	13
SND	Shovelnose dogfish	Female	SS	189	100	20	-	1	24	-	334
		Male		43	39	228	-	-	-	-	310
SNE	Snubnosed eel	Female	MD	-	1	-	-	-	-	-	1
		Male		-	-	-	-	-	-	-	-
SOR	Spiky oreo	Female	MD	45	60	67	4	-	8	16	200
		Male		47	73	11	16	-	-	12	159
SPD	Spiny dogfish	Female	SS	198	291	35	133	278	53	-	988
		Male		4	19	268	-	-	-	-	291
SRB	Southern Ray's bream	Female	MD	2	108	5	-	-	-	2	117
		Male		5	102	3	-	-	-	1	111
SRH	Silver roughy	Female	MD	-	1	-	-	-	-	-	1
		Male		-	3	2	-	-	-	-	5
SSI	Silverside	Female	MD	7	1	-	-	-	-	-	8
		Male		14	6	-	9	-	-	-	29
SSK	Smooth skate	Female	SS	3	1	-	-	-	1	-	5
		Male		10	6	4	-	-	-	-	20
SSM	Smallscaled brown slickhead	Female	MD	27	28	3	2	-	-	-	60
		Male		28	18	3	1	-	-	-	50
SSO	Smooth oreo	Female	MD	133	49	78	6	1	6	2	275
		Male		131	42	83	24	18	2	-	300
SWA	Silver warehou	Female	MD	48	291	42	-	-	2	11	394
		Male		82	248	35	1	-	-	8	374
TRS	Cape scorpionfish	Female	MD	-	2	-	-	-	-	2	4
		Male		-	1	-	-	-	-	-	1
TRX	Velvet rattail	Female	MD	-	-	-	-	-	-	-	-
		Male		-	1	-	-	-	-	-	1
VCO	Violet cod	Female	MD	5	5	-	-	-	-	-	10
		Male		12	1	-	-	-	-	-	13
VNI	Blackspot rattail	Female	MD	-	-	9	-	-	-	-	9
		Male		1	4	-	-	-	-	-	5
WHR	Unicorn rattail	Female	MD	1	10	3	-	-	-	-	14
		Male		3	7	-	-	-	-	-	10
WHX	White rattail	Female	MD	32	149	37	1	-	-	-	219
		Male		42	65	2	-	-	-	-	109
WOE	Warty oreo	Female	MD	12	1	8	-	-	-	-	21
		Male		8	2	6	1	-	-	-	17
WWA	White warehou	Female	MD	23	46	49	-	1	1	3	123
		Male		52	69	11	-	-	-	1	133

Middle depths (MD) gonad stages: 1, immature; 2, resting; 3, ripening; 4, ripe; 5, running ripe; 6, partially spent; 7, spent (after Hurst et al. 1992).

Cartilaginous fish (SS) gonad stages: male – 1, immature; 2, maturing; 3, mature: female – 1, immature; 2, maturing; 3, mature; 4, gravid I; 5, gravid II; 6, post-partum.

Table 11: Average trawl catch (excluding benthic organisms) and acoustic backscatter from daytime core tows where acoustic data quality was suitable for echo integration on the Chatham Rise in 2001–24.

Year	No. of recordings	Average trawl catch (kg km ⁻²)	Average acoustic backscatter (m ² km ⁻²)			
			Bottom 10 m	Bottom 50 m	All bottom marks (to 100 m)	Entire echogram
2001	117	1 858	3.63	22.39	31.80	57.60
2002	102	1 849	4.50	18.39	22.60	49.32
2003	117	1 508	3.43	19.56	29.41	53.22
2005	86	1 783	2.78	12.69	15.64	40.24
2006	88	1 782	3.24	13.19	19.46	48.86
2007	100	1 510	2.00	10.83	15.40	41.07
2008	103	2 012	2.03	9.65	13.23	37.98
2009	105	2 480	2.98	15.89	25.01	58.88
2010	90	2 205	1.87	10.80	17.68	44.49
2011	73	1 997	1.79	8.72	12.94	34.79
2012	85	1 793	2.60	15.96	26.36	54.77
2013	76	2 323	3.74	15.87	27.07	56.89
2014	48	1 790	3.15	14.96	24.42	48.45
2016	90	1 890	3.49	20.79	31.81	61.34
2018	85	2 429	2.66	13.88	23.18	42.95
2020	78	1 787	3.52	16.09	26.28	53.59
2022	75	1 224	2.62	11.57	18.08	34.83
2024	80	1 165	5.39	26.26	33.75	47.97

Table 12: Estimates of the proportion of total day backscatter in each stratum and year on the Chatham Rise which is assumed to be mesopelagic fish (p(meso)s). Estimates were derived from the observed proportion of night backscatter in the upper 200 m corrected for the proportion of backscatter estimated to be in the surface acoustic deadzone.

Year	Stratum			
	Northeast	Northwest	Southeast	Southwest
2001	0.64	0.83	0.81	0.88
2002	0.58	0.78	0.66	0.86
2003	0.67	0.82	0.81	0.77
2005	0.72	0.83	0.73	0.69
2006	0.69	0.77	0.76	0.80
2007	0.67	0.85	0.73	0.80
2008	0.61	0.64	0.84	0.85
2009	0.58	0.75	0.83	0.86
2010	0.48	0.64	0.76	0.63
2011	0.63	0.49	0.76	0.54
2012	0.40	0.52	0.68	0.79
2013	0.34	0.50	0.54	0.66
2014	0.54	0.62	0.74	0.78
2016	0.69	0.57	0.71	0.84
2018	0.44	0.50	0.75	0.60
2020	0.56	0.57	0.76	0.63
2022	0.59	0.43	0.84	0.60
2024	0.38	0.50	0.47	0.60

Table 13: Mesopelagic indices for the Chatham Rise. Indices were derived by multiplying the total backscatter observed at each daytime trawl station by the estimated proportion of night-time backscatter in the same sub-area observed in the upper 200 m (see Table 12) corrected for the estimated proportion in the surface deadzone (from O’Driscoll et al. 2009). Unstratified indices for the Chatham Rise were calculated as the unweighted average over all available acoustic data. Stratified indices were obtained as the weighted average of stratum estimates, where weighting was the proportional area of the stratum (northwest 11.3% of total area, southwest 18.7%, northeast 33.6%, southeast 36.4%).

Survey	Year	Acoustic index (m ² km ⁻²)											
		Unstratified		Northeast		Northwest		Southeast		Southwest		Stratified	
		Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV
TAN0101	2002	47.1	8	21.8	11	61.1	13	36.8	12	92.6	16	44.9	8
TAN0201	2003	35.8	6	25.1	11	40.3	11	29.6	13	54.7	13	34.0	7
TAN0301	2004	40.6	10	30.3	23	32.0	12	52.4	19	53.9	11	42.9	10
TAN0501	2005	30.4	7	28.4	12	44.5	21	25.2	8	29.5	23	29.3	7
TAN0601	2006	37.0	6	30.7	10	47.9	12	38.1	12	36.7	19	36.4	7
TAN0701	2007	32.4	7	23.0	10	43.3	12	27.2	13	35.9	20	29.2	7
TAN0801	2008	29.1	6	17.8	5	27.9	19	38.1	10	36.2	12	29.8	6
TAN0901	2009	44.7	10	22.4	22	54.3	12	39.3	16	84.8	18	43.8	9
TAN1001	2010	27.0	8	16.5	11	33.4	11	35.1	17	34.0	24	28.5	10
TAN1101	2011	21.4	9	23.4	15	27.2	14	12.6	23	15.8	17	18.5	9
TAN1201	2012	30.8	8	17.6	13	41.1	34	33.5	11	51.1	12	32.3	8
TAN1301	2013	28.8	7	15.5	15	45.9	12	27.3	13	31.7	13	26.3	7
TAN1401	2014	31.7	9	19.4	8	37.6	12	35.8	18	44.6	24	32.1	10
TAN1601	2016	41.7	8	27.8	14	40.1	13	41.6	15	68.7	16	41.8	8
TAN1801	2018	24.1	8	16.1	10	26.7	16	30.9	22	28.6	20	25.0	11
TAN2001	2020	32.2	7	22.8	12	34.9	13	50.6	13	26.1	15	34.9	8
TAN2201	2022	20.1	8	17.6	13	17.5	12	42.6	22	17.6	19	26.7	5
TAN2401	2024	22.6	11	10.8	12	26.4	12	20.7	15	47.9	27	23.1	12

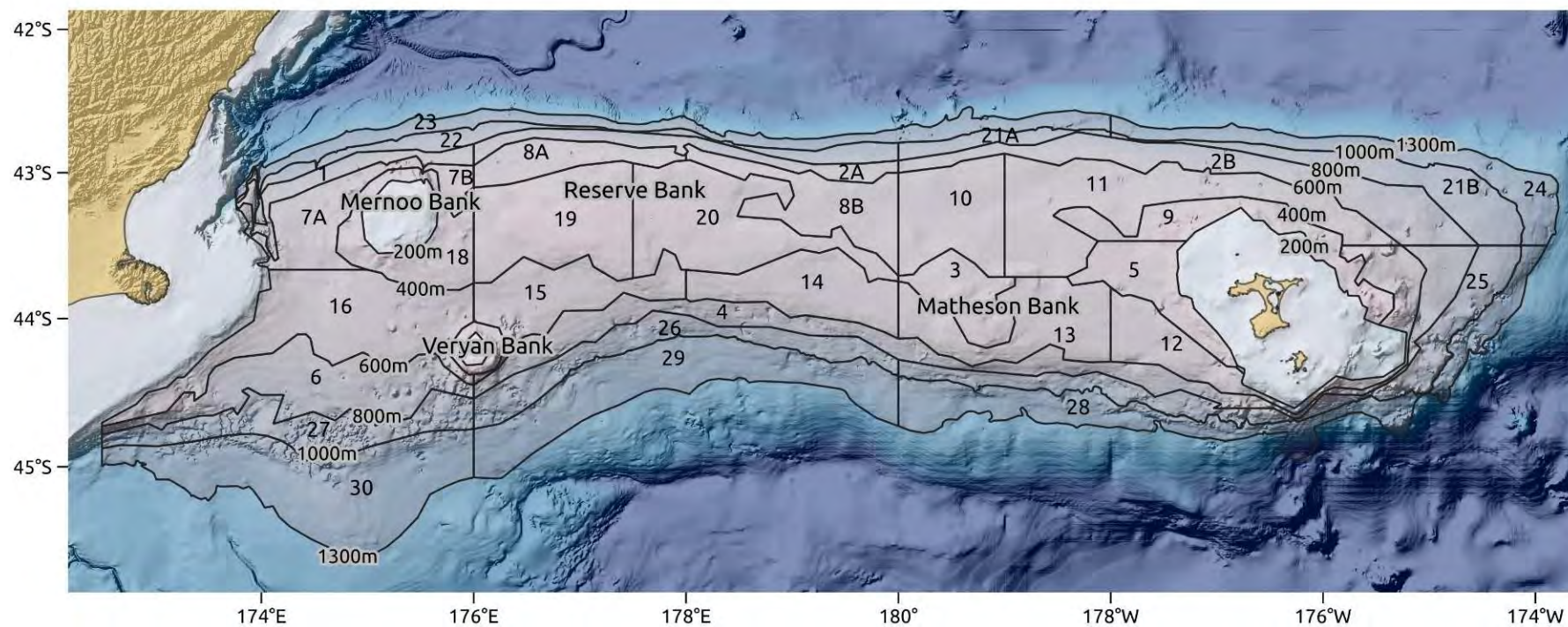


Figure 1: Chatham Rise trawl survey area showing stratum boundaries.

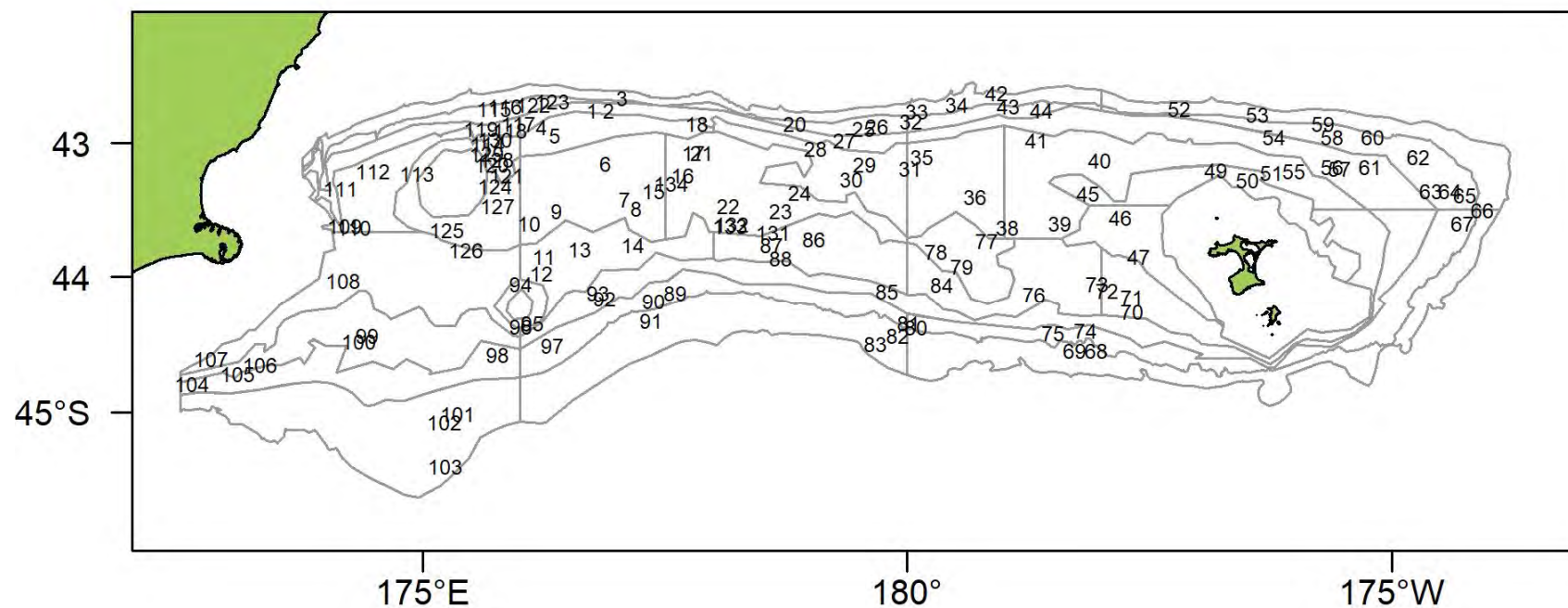


Figure 2: Trawl survey area showing positions of valid biomass stations (n = 131 stations) for TAN2401. In this and subsequent figures actual stratum boundaries are drawn for the deepwater strata.

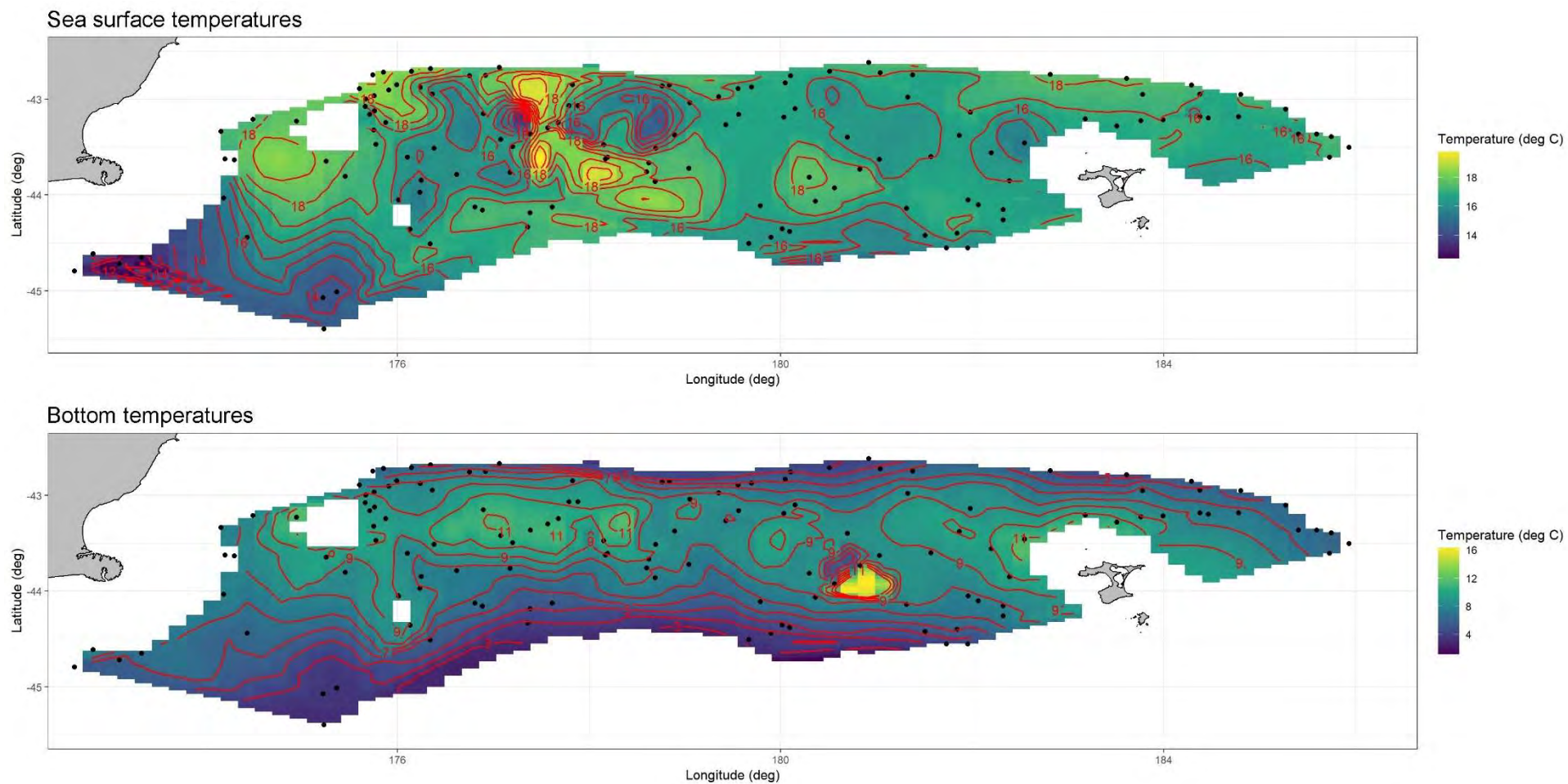


Figure 3: Positions of sea surface and bottom temperature recordings and approximate locations of isotherms ($^{\circ}\text{C}$) following an interpolation grid calculated using a cubic spline fitted to the temperature values. The temperatures shown are from the calibrated Seabird CTD recordings made during each tow in TAN2401.

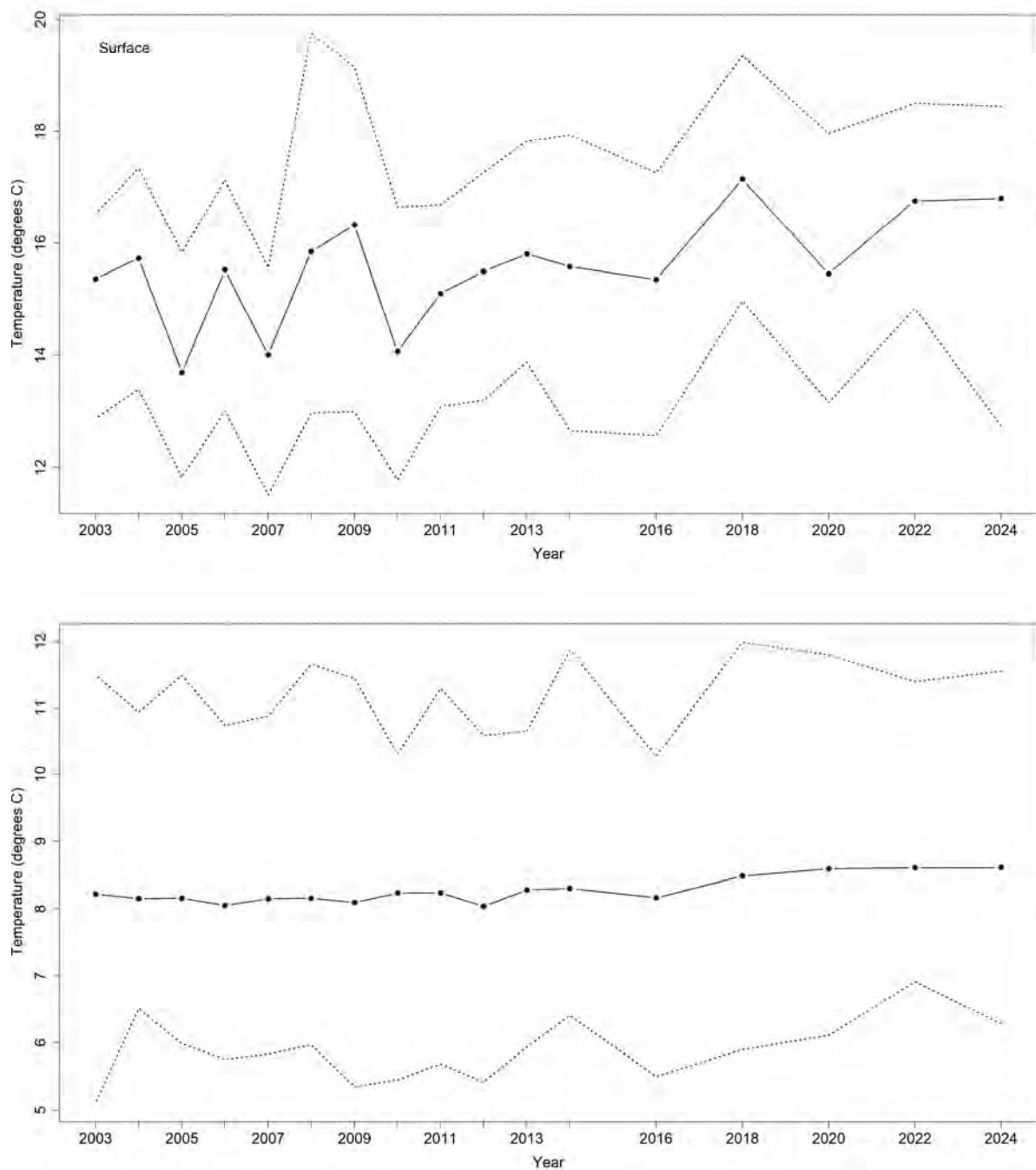


Figure 4: Time series of sea surface (upper panel) and bottom (lower panel) temperature recordings within the core (200–800 m) survey area from the calibrated Seabird CTD recordings made during each tow. Solid line is the mean temperature. Dashed lines are minimum and maximum values in each year.

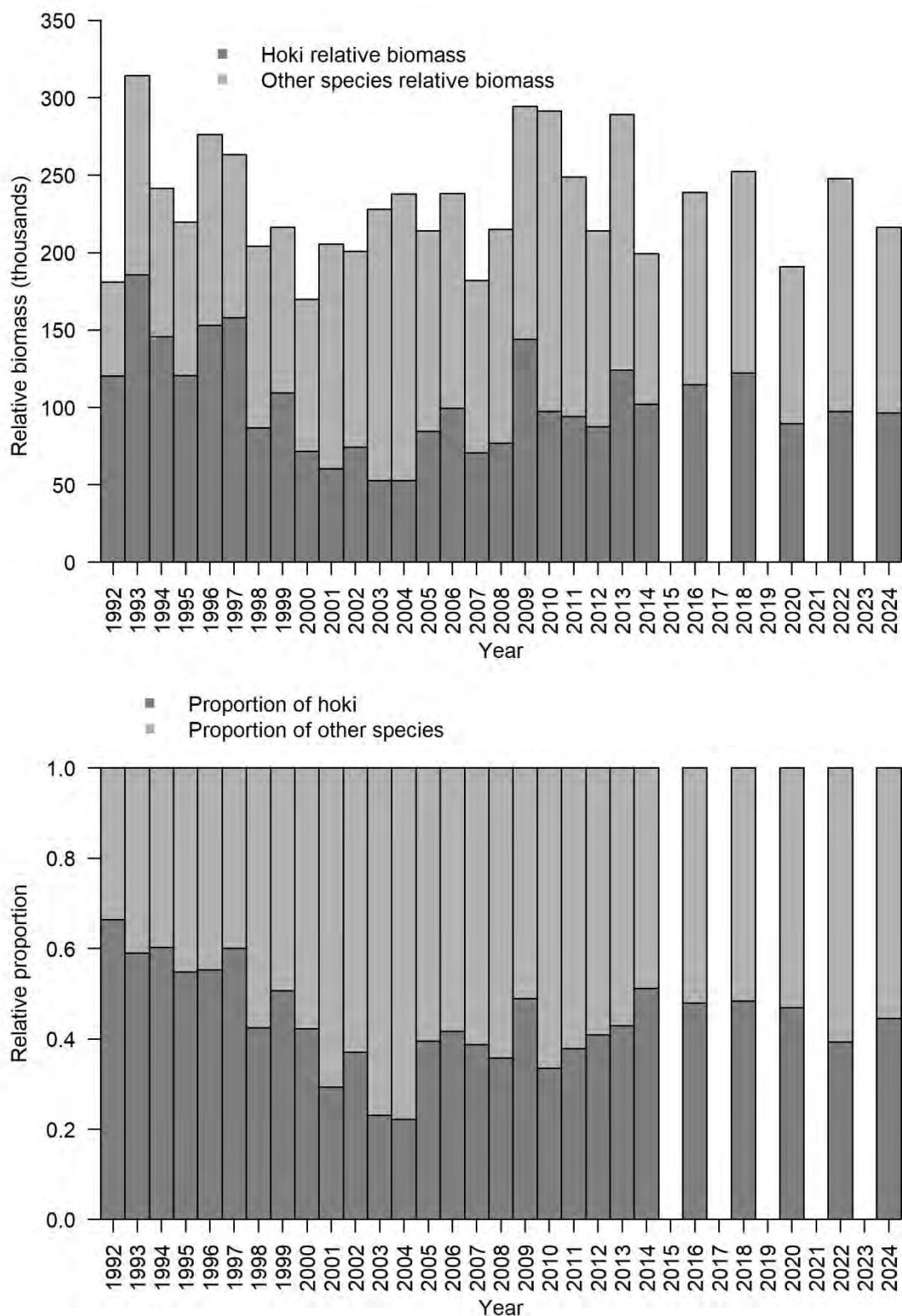


Figure 5: Relative biomass (top panel) and relative proportions (lower panel) of hoki and 30 other key species, as defined by Livingston et al. (2002) and indicated in Table 4, from trawl surveys of the Chatham Rise, January 1992–2024 (core strata only).

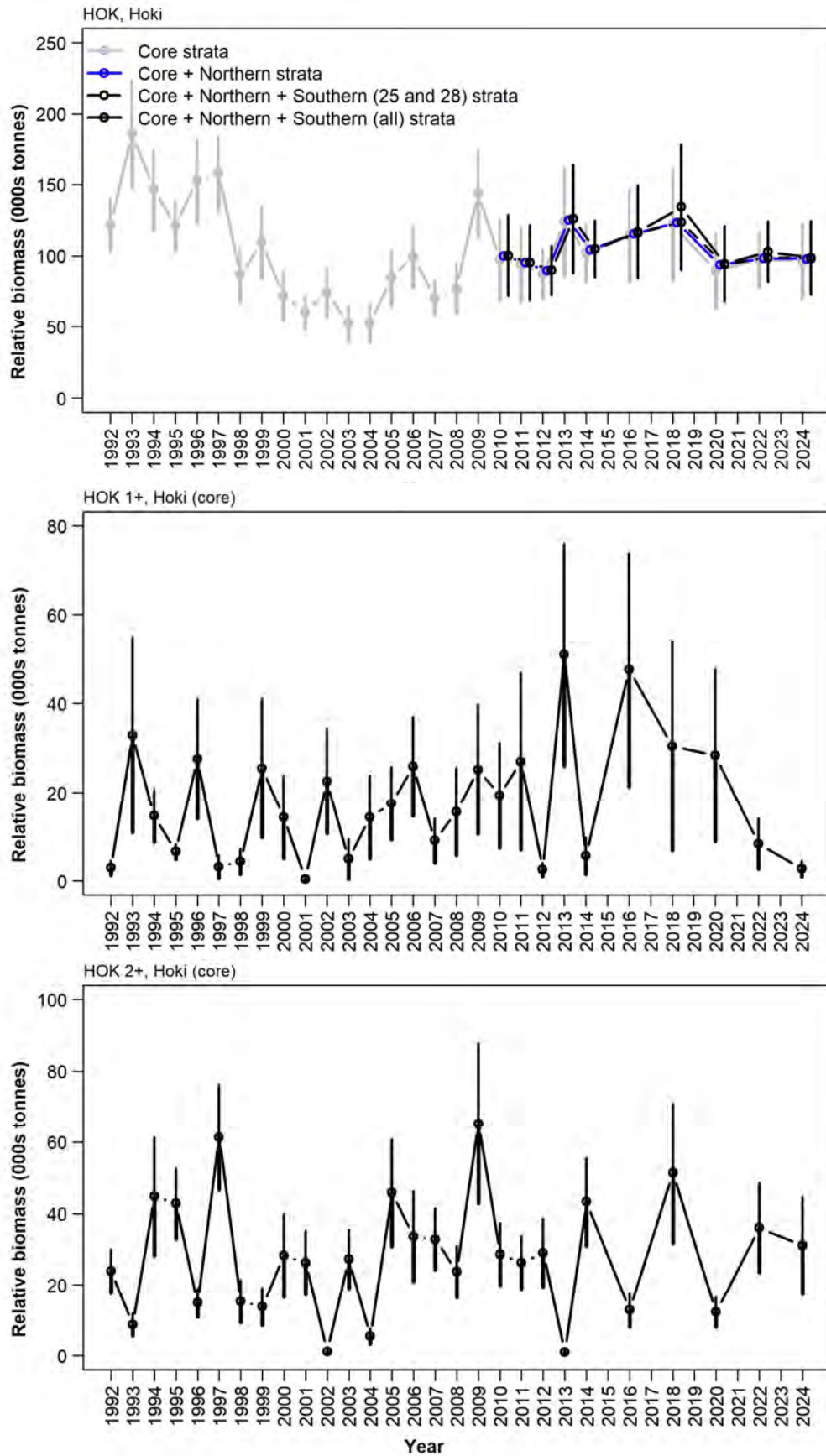


Figure 6a: Relative biomass estimates (thousands of tonnes) of hoki, hake, ling, and 8 other selected commercial species sampled by trawl surveys of the Chatham Rise from 1992 to 2024 (core and all strata). Error bars show ± 2 standard errors.

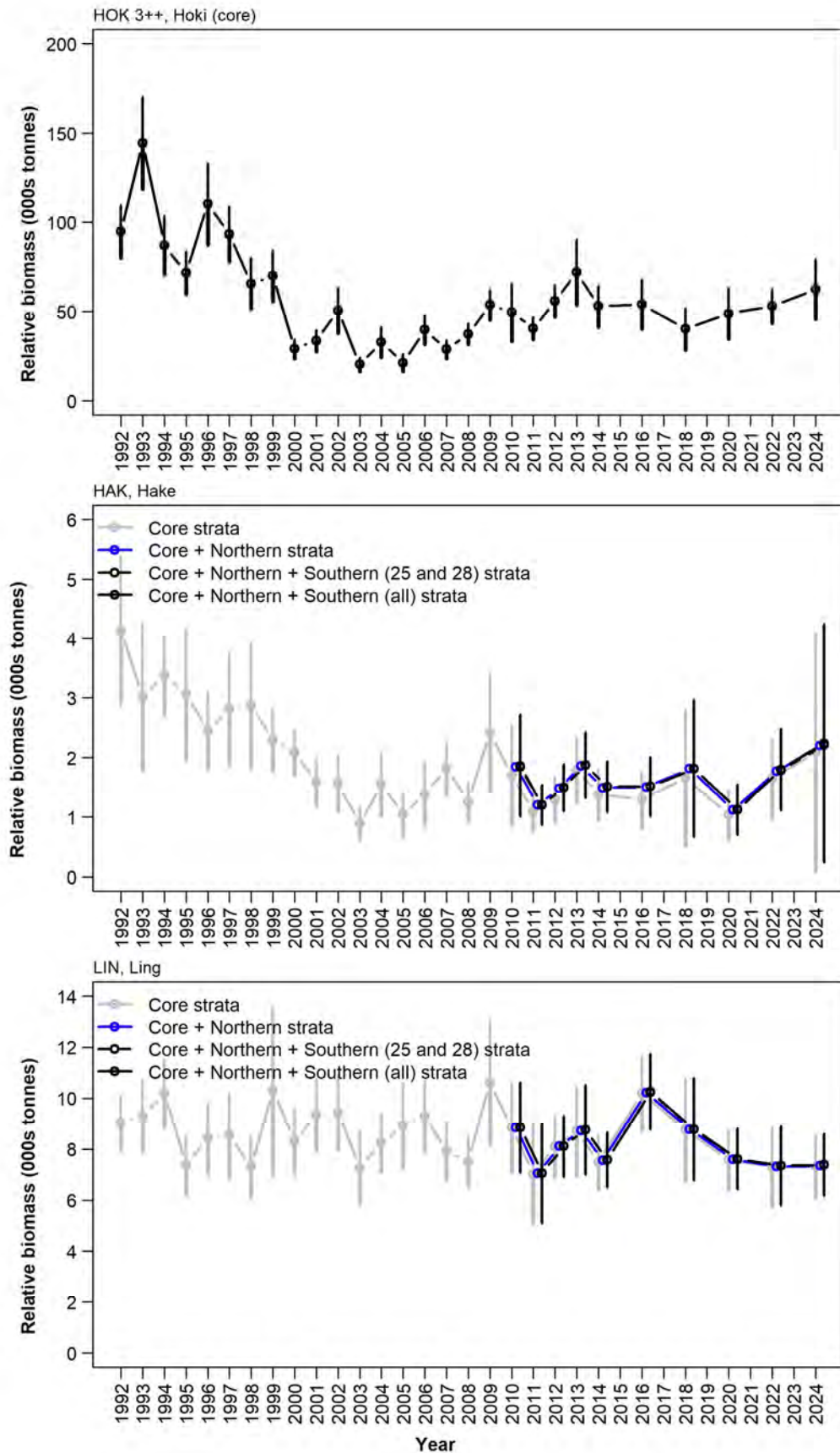


Figure 6a (continued)

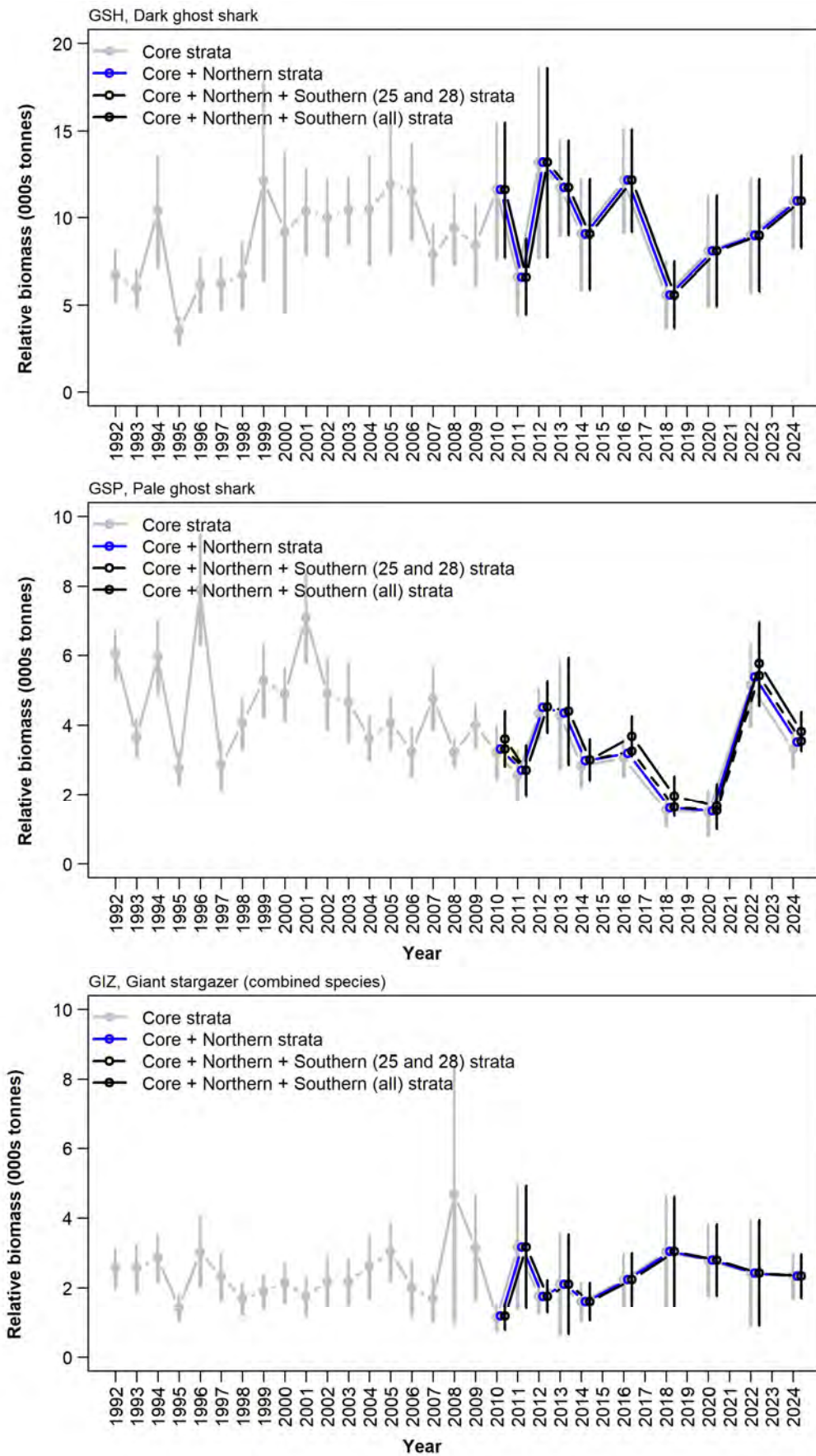


Figure 6a (continued)

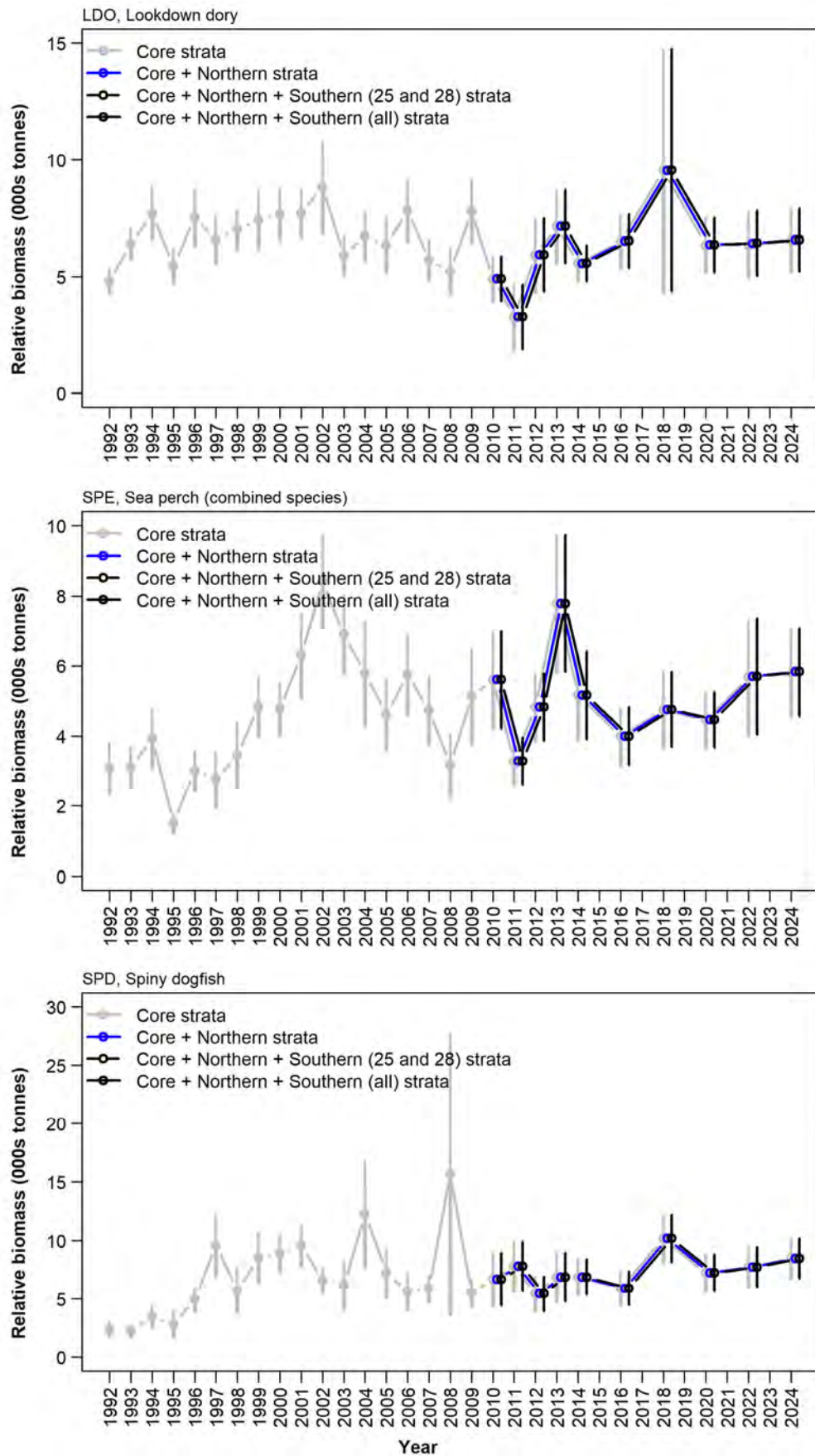


Figure 6a (continued)

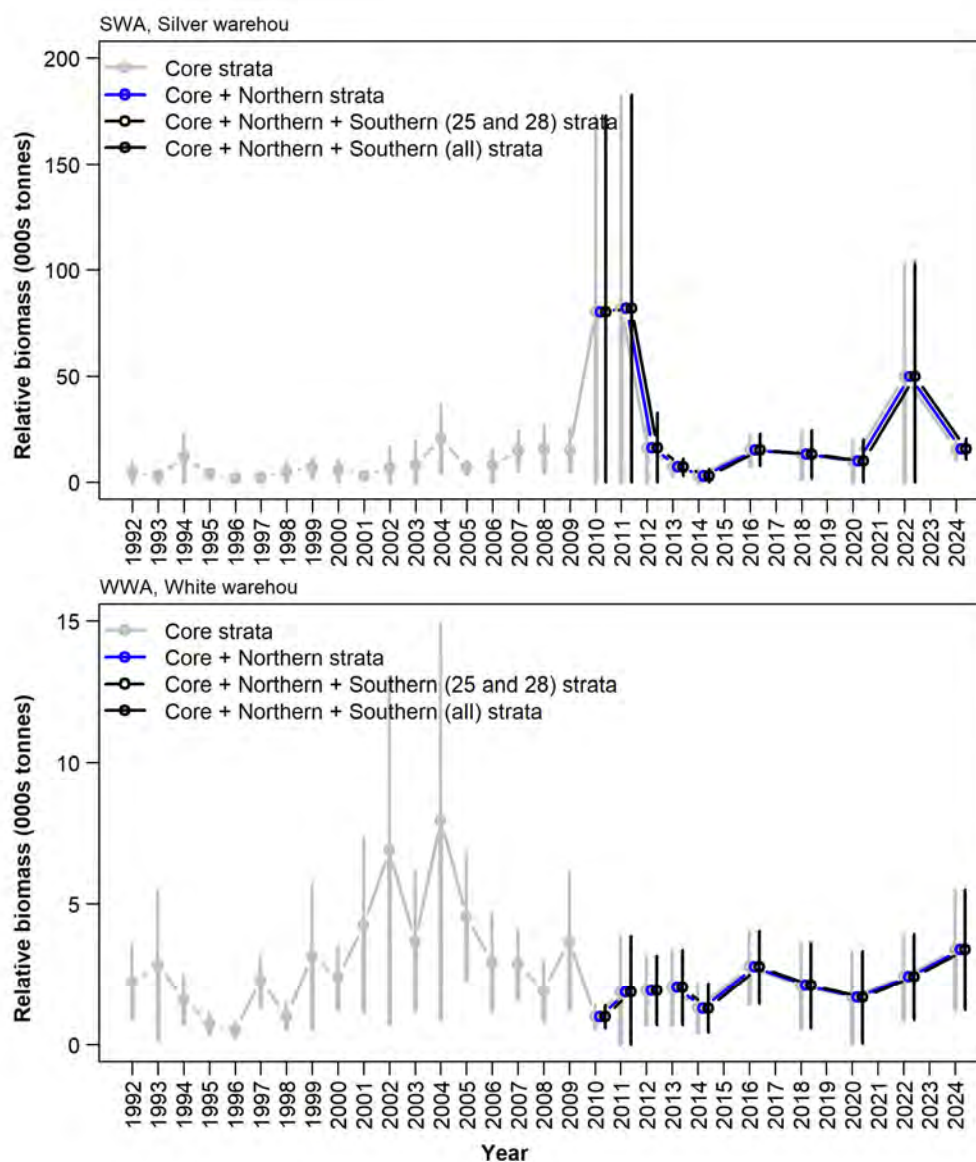


Figure 6a (continued)

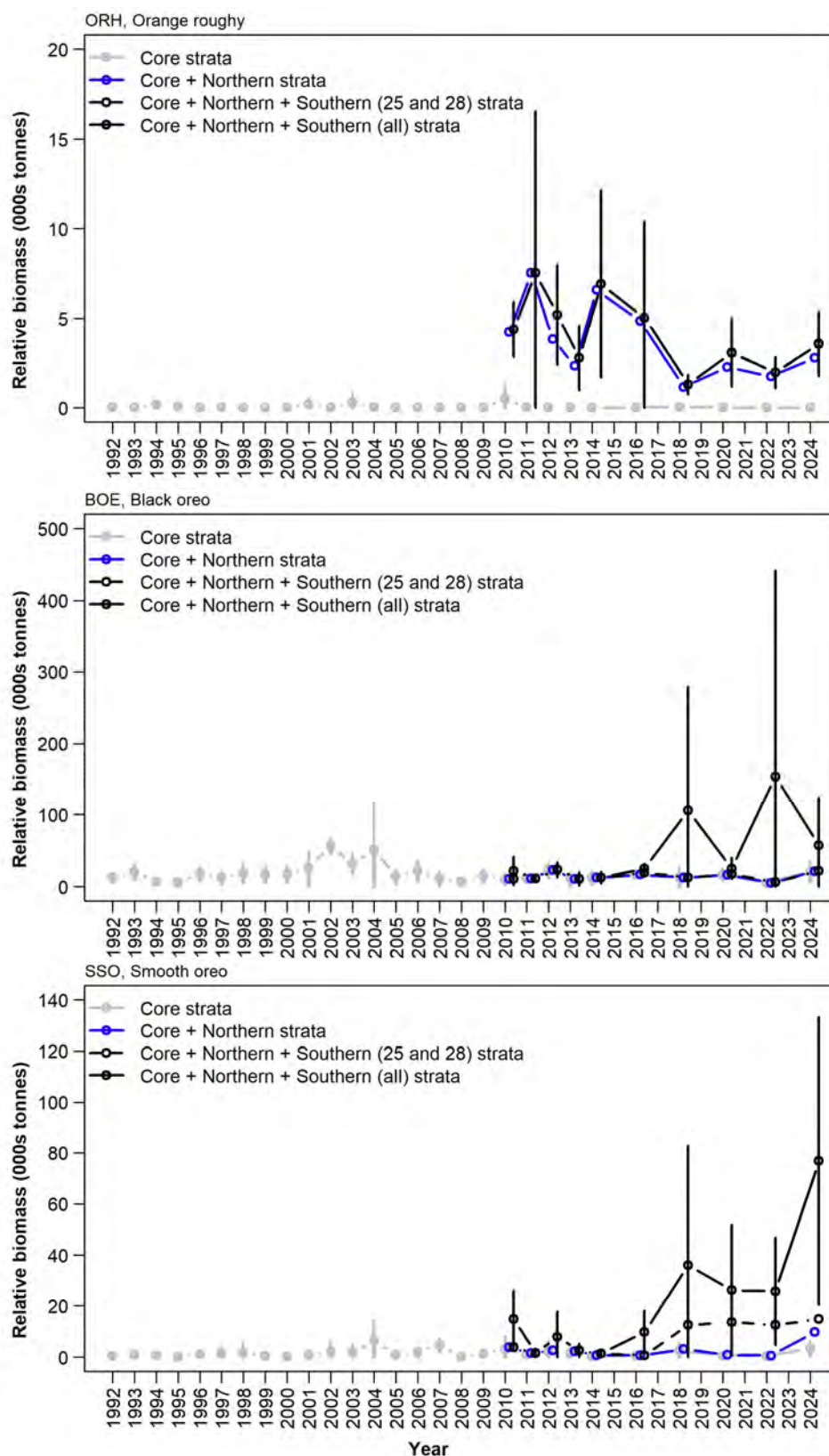


Figure 6b: Relative biomass estimates (thousands of tonnes) of orange roughy, black oreo, smooth oreo, and other selected deepwater species sampled by trawl surveys of the Chatham Rise from 1992 to 2024. Grey lines show fish from core (200–800 m) strata. Blue lines show fish from core strata plus the northern deep (800–1300 m) strata. Black solid lines show fish from core strata plus the northern and southern deep (800–1300 m) strata, and black dotted lines show fish from core strata plus the northern and southern 25 and 28 deep strata (800–1300 m). Error bars show ± 2 standard errors.

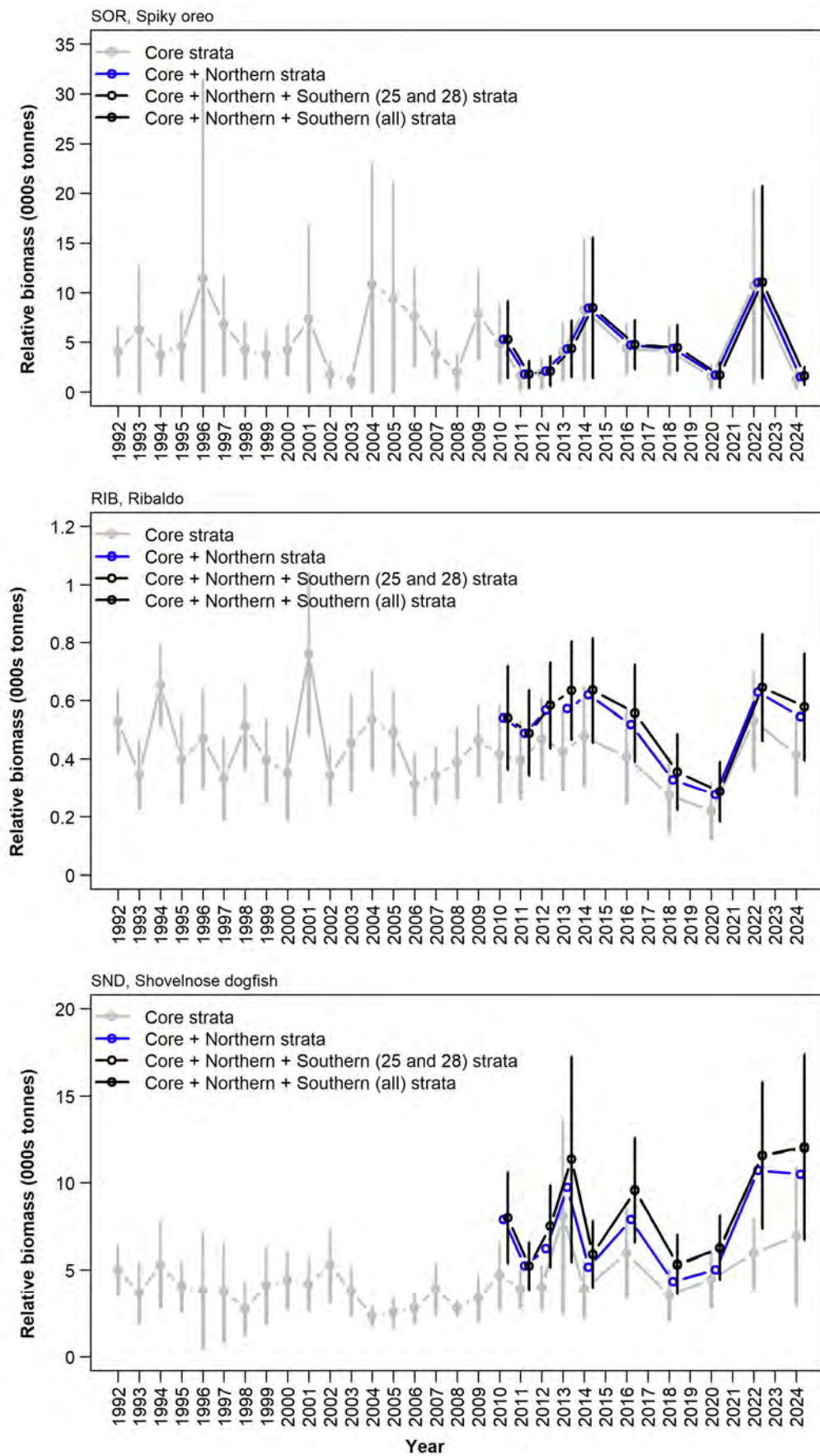


Figure 6b (continued)

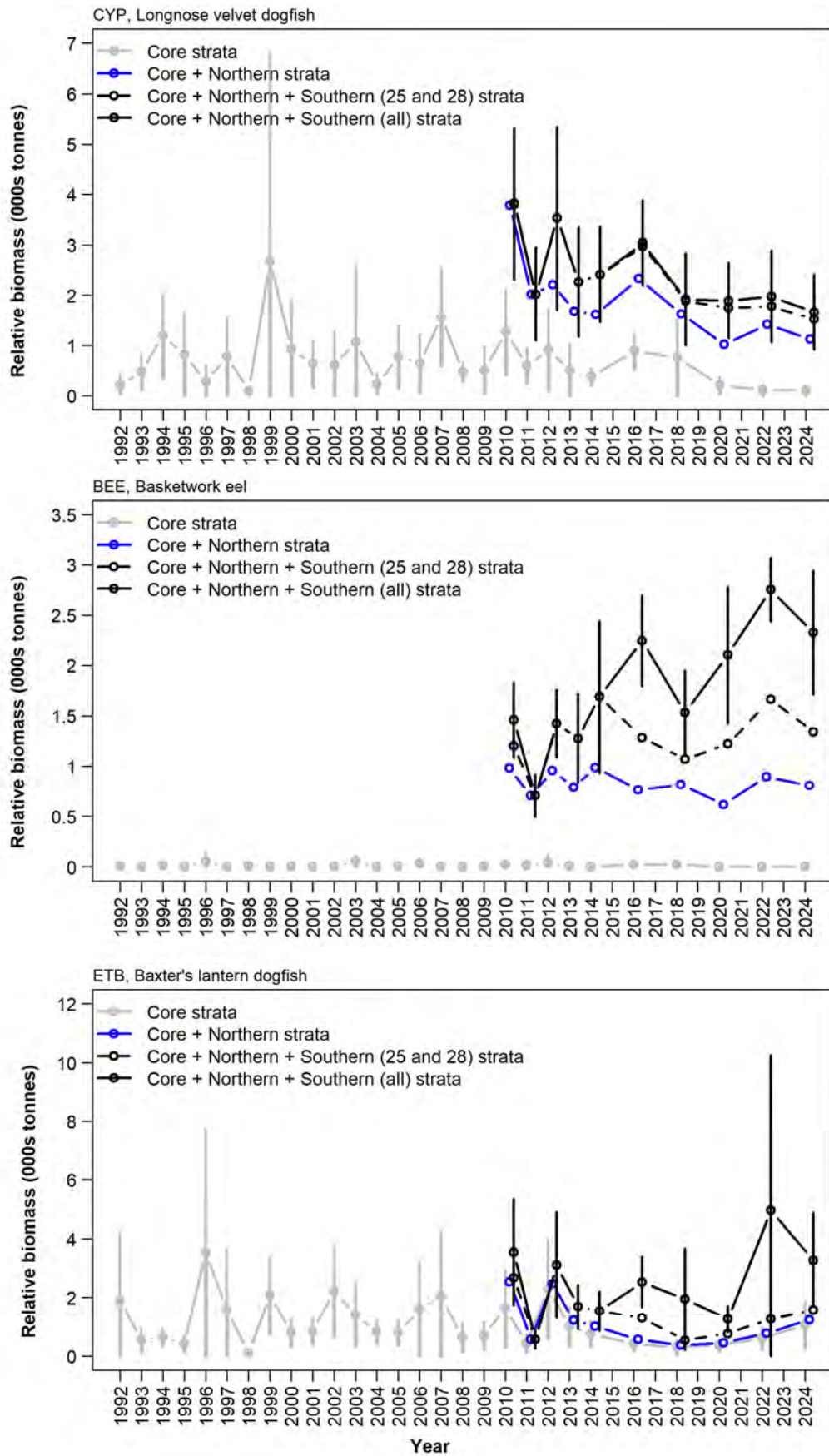


Figure 6b (continued)

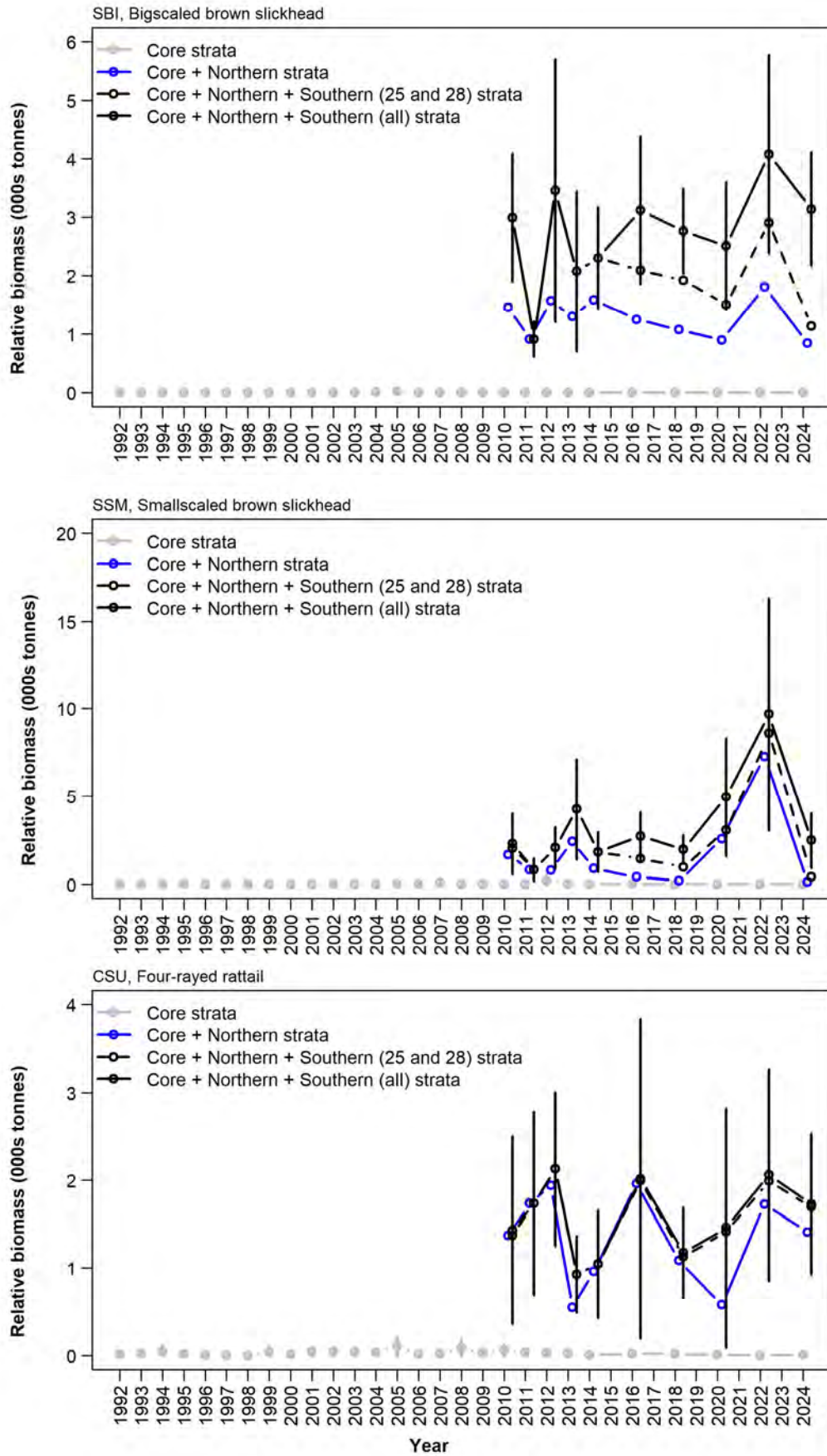


Figure 6b (continued)

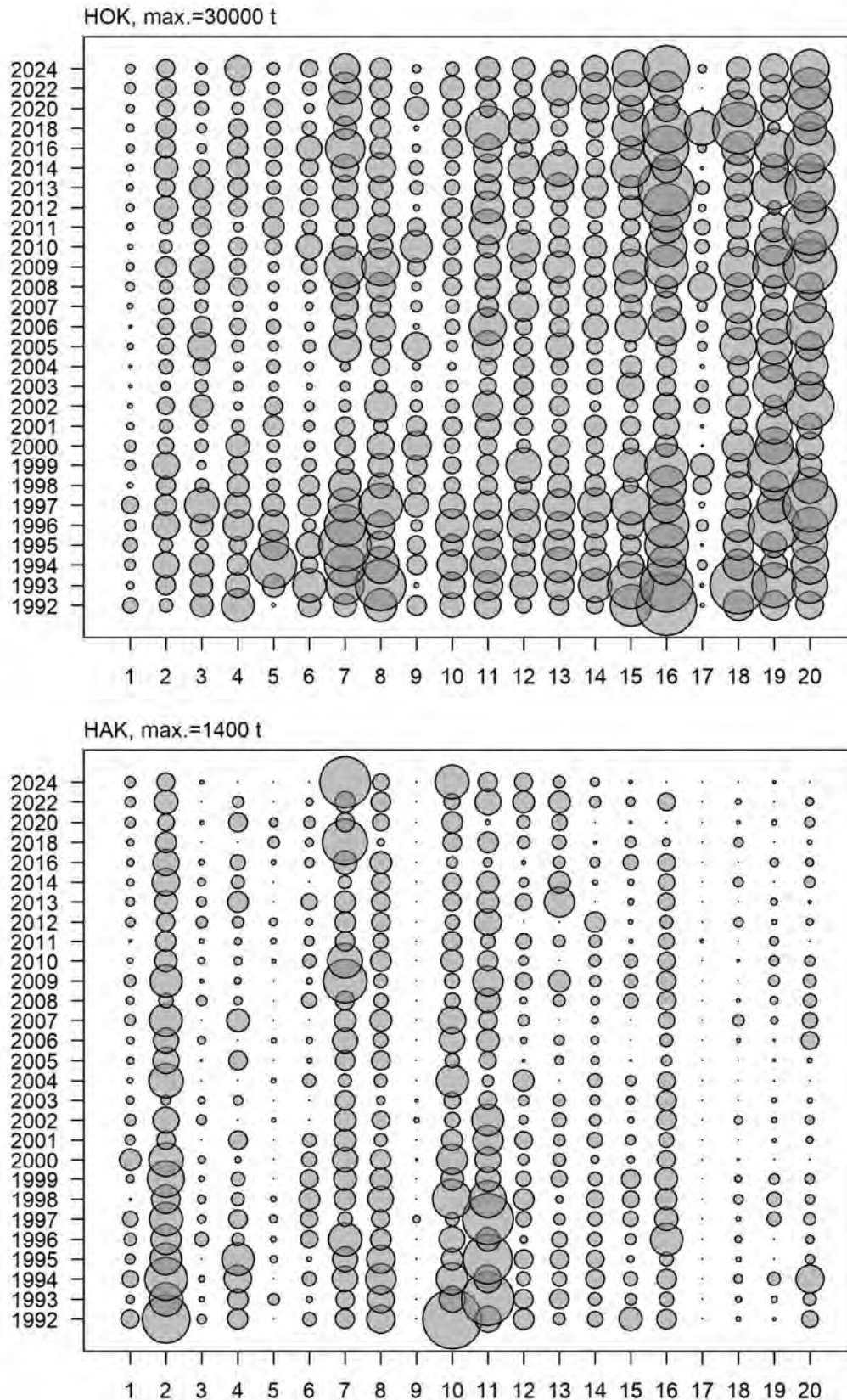


Figure 7a: Relative core (200–800 m) biomass estimates by stratum (1–20, x-axis) for hoki and 10 other selected species sampled by trawl surveys of the Chatham Rise from 1992 to 2024. Species codes are given in Table 4.

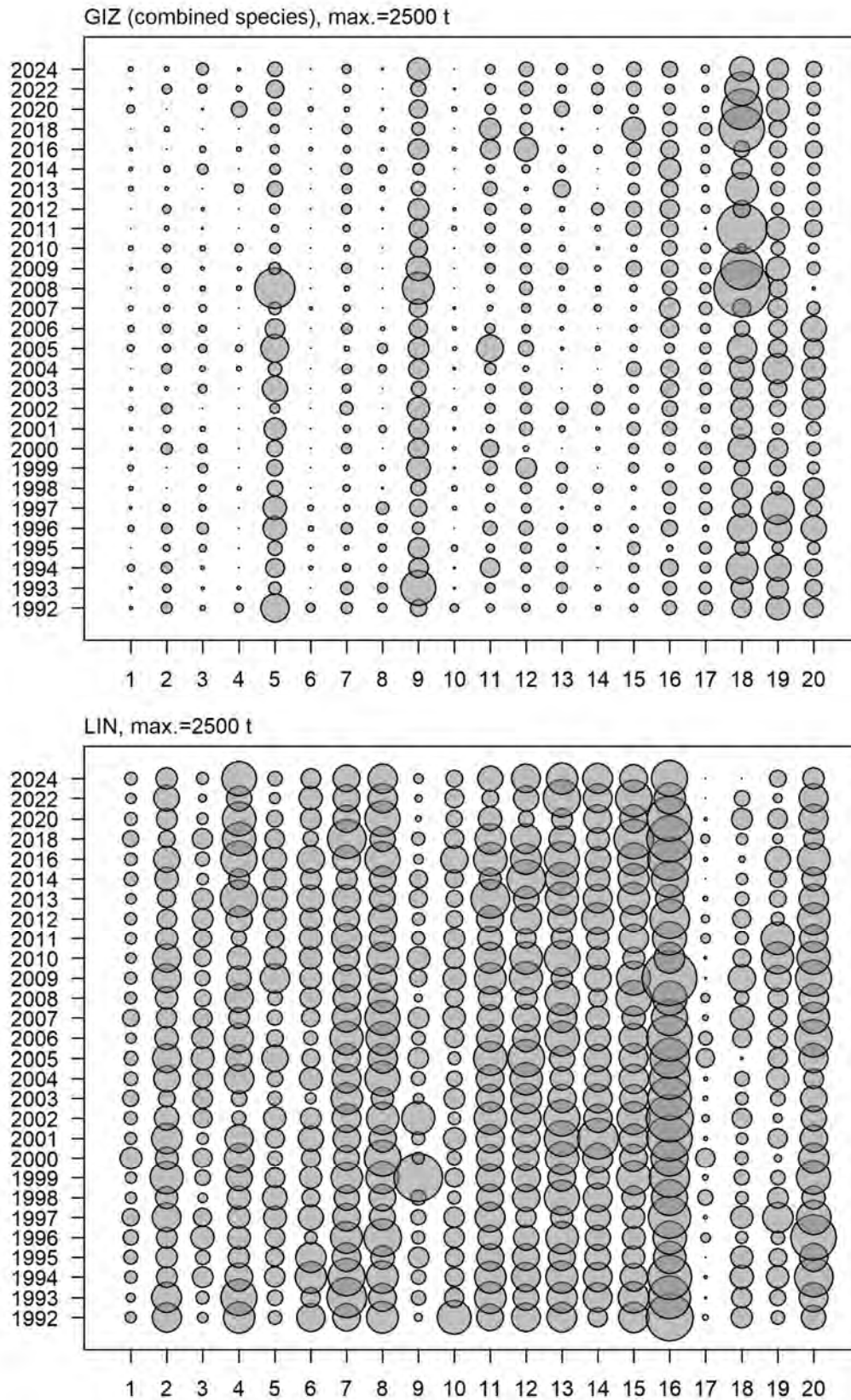


Figure 7a (continued)

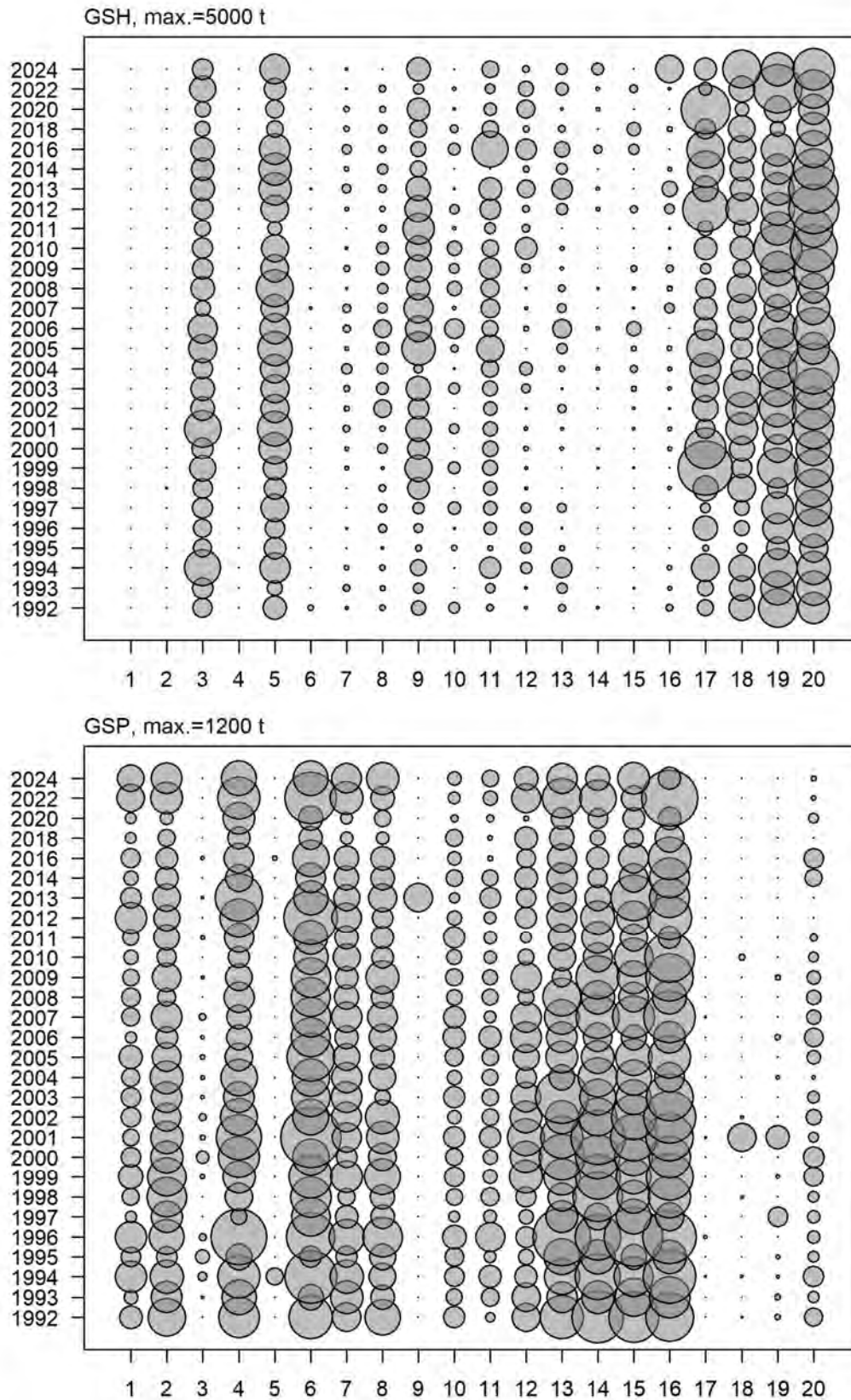


Figure 7a (continued)

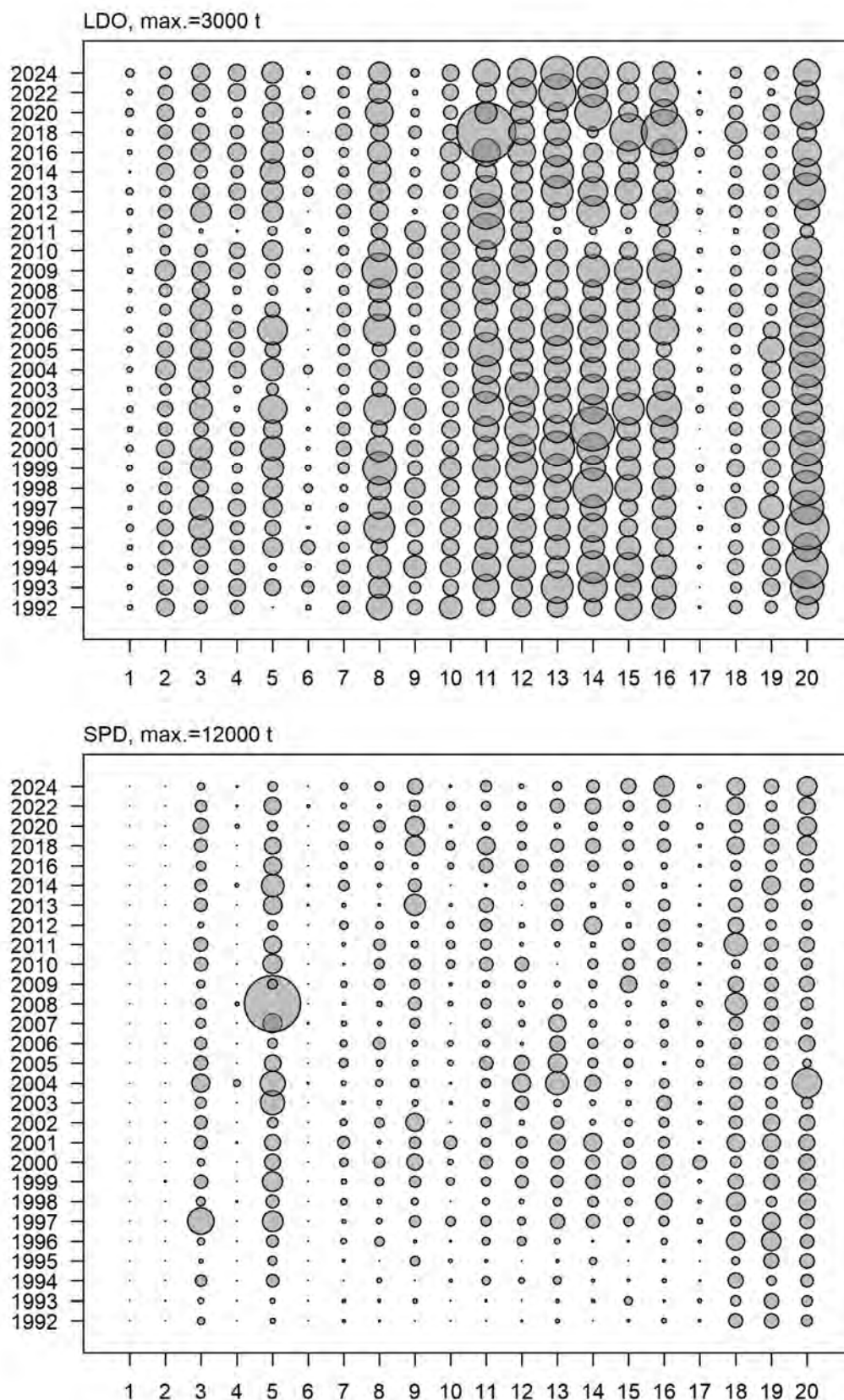


Figure 7a (continued)

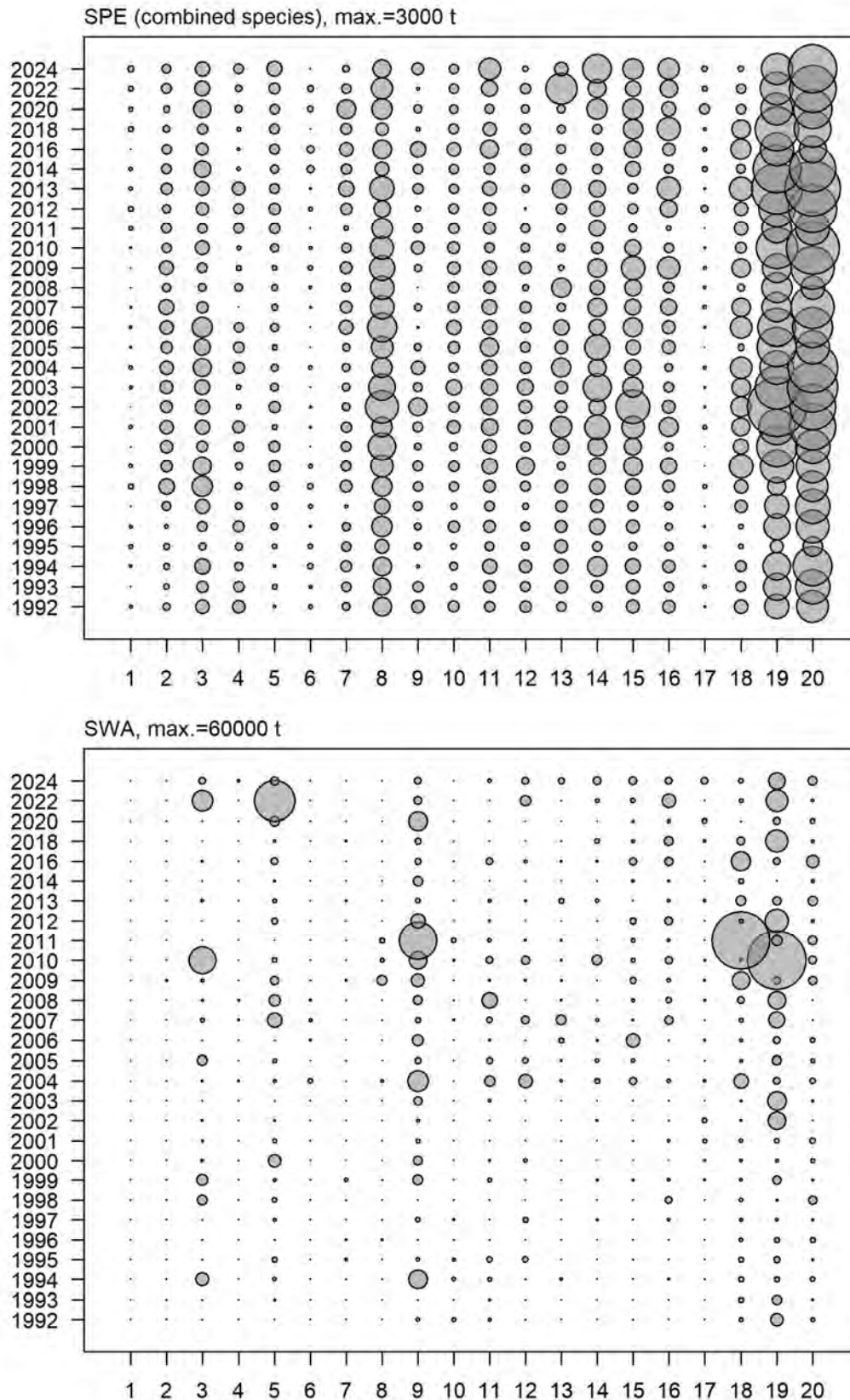


Figure 7a (continued)

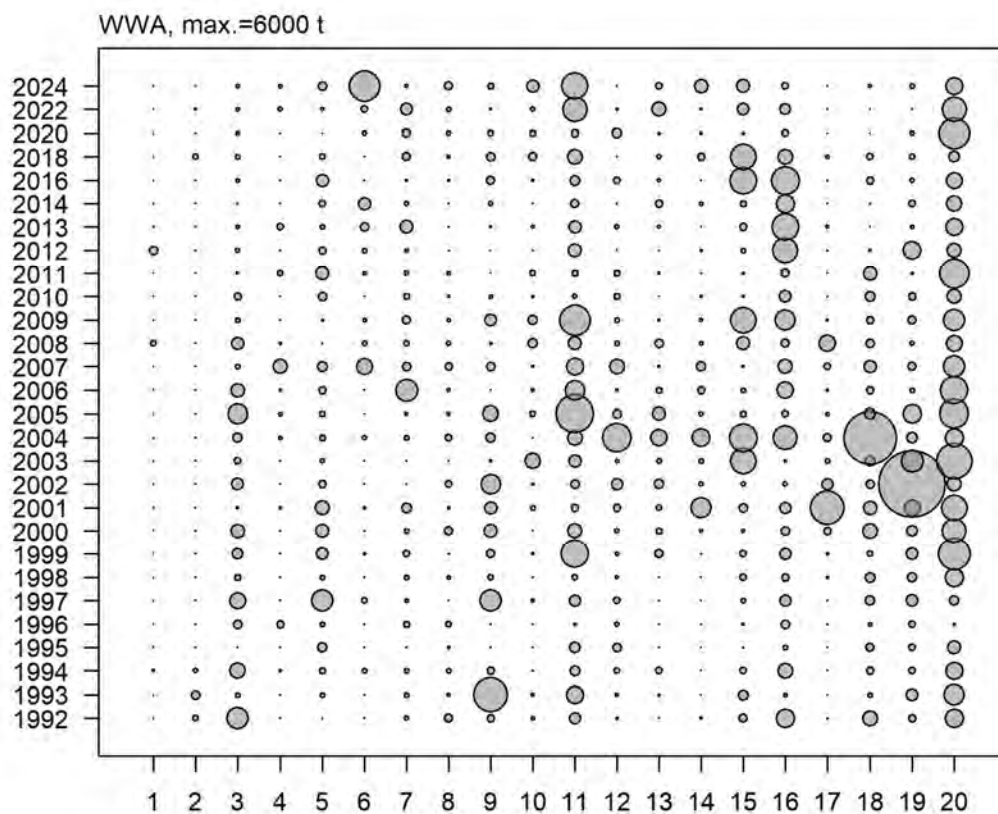


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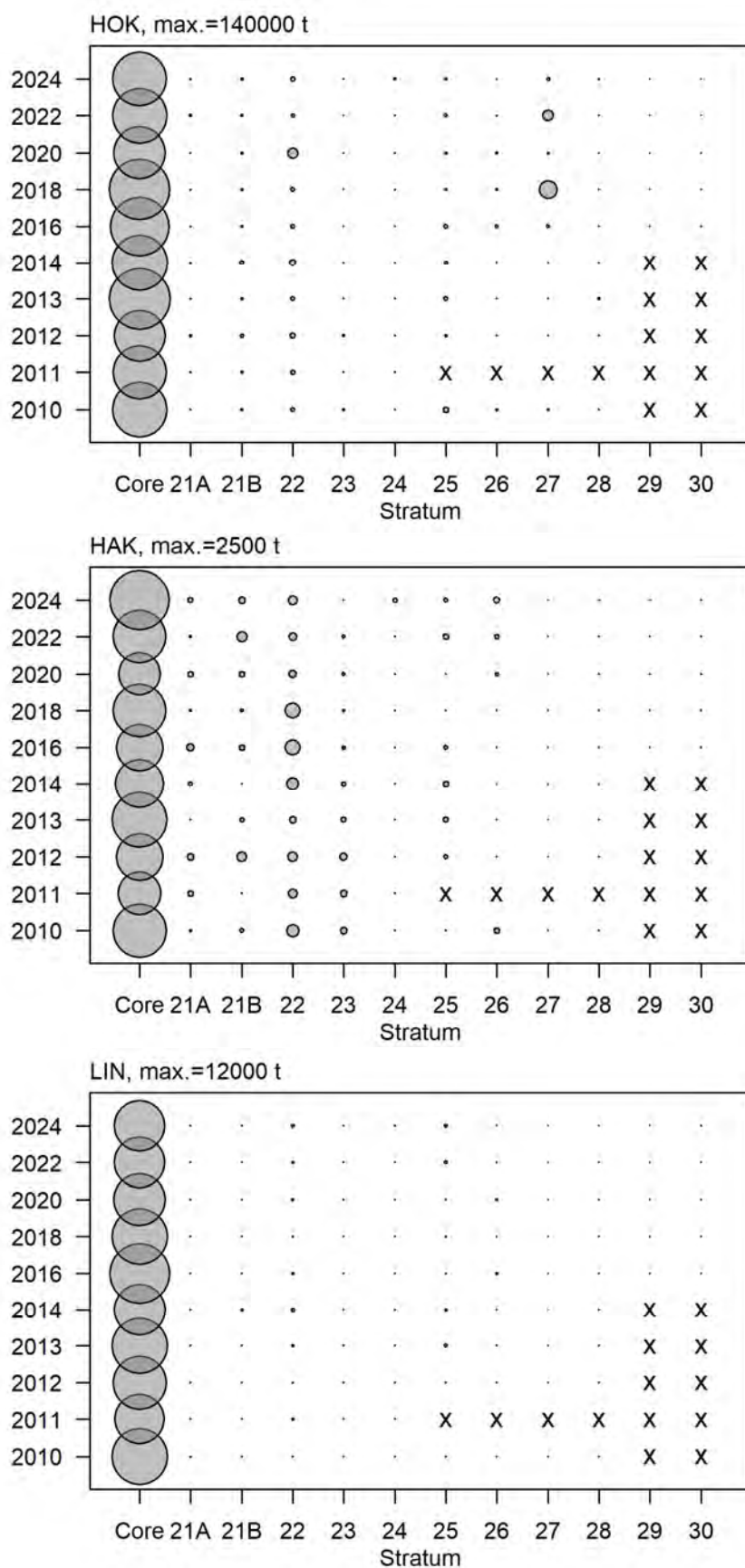


Figure 7b: Total core and deep (800–1300 m) relative biomass estimates by stratum for hoki and 10 other selected species sampled by trawl surveys of the Chatham Rise from 2010 to 2024. X indicates stratum not sampled. Species codes are given in Table 4.

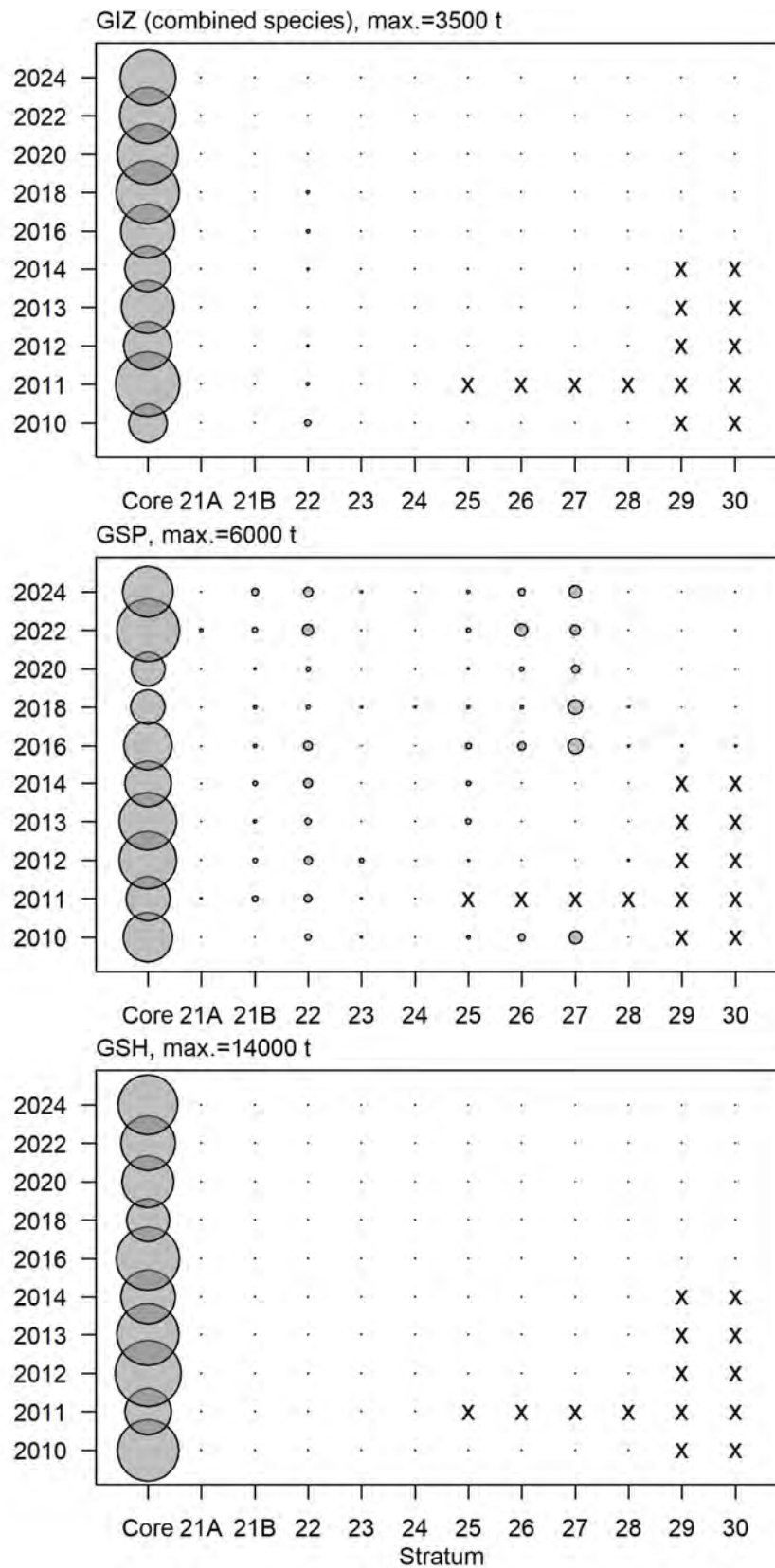


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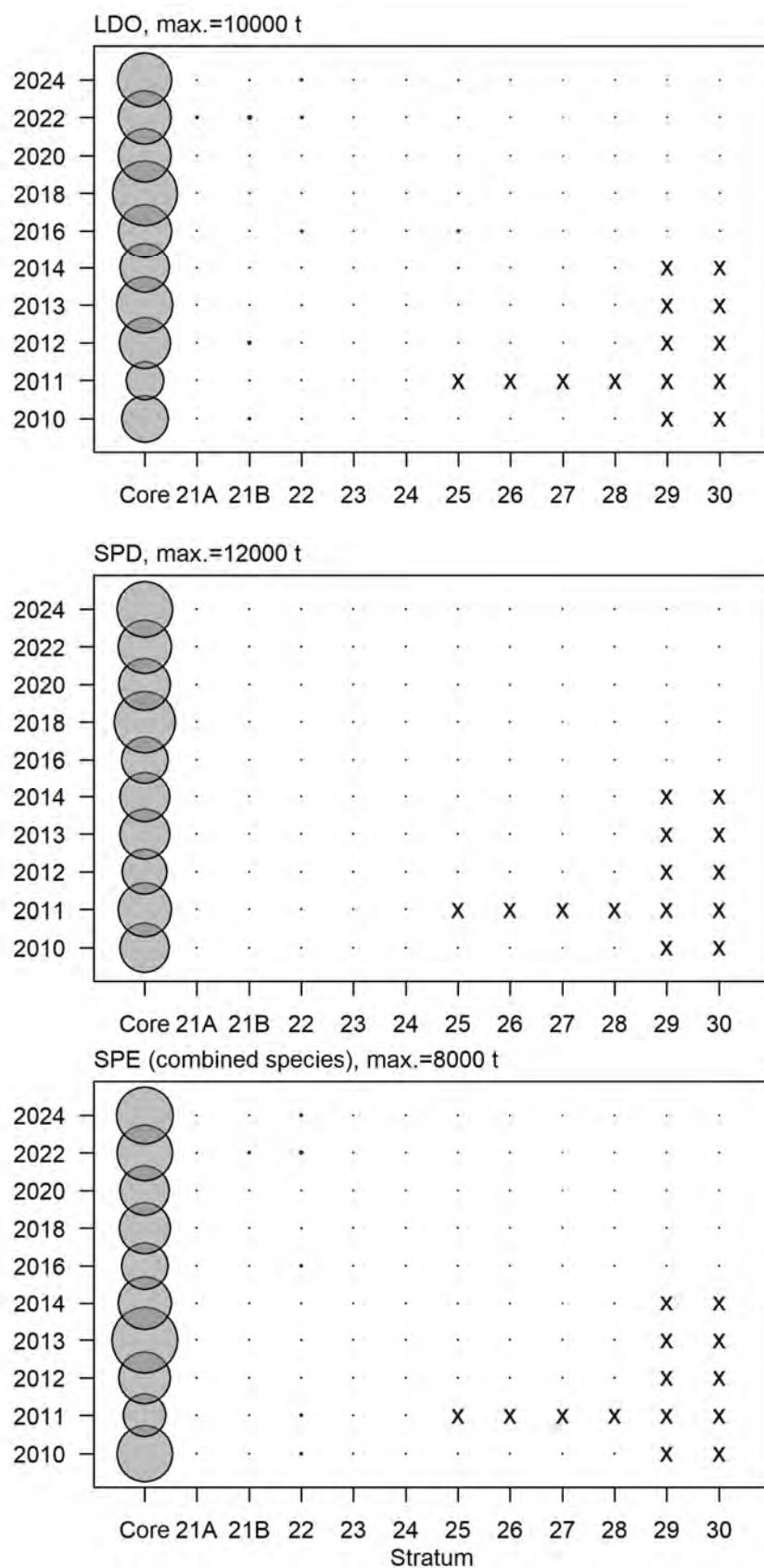


Figure 7b (continued)

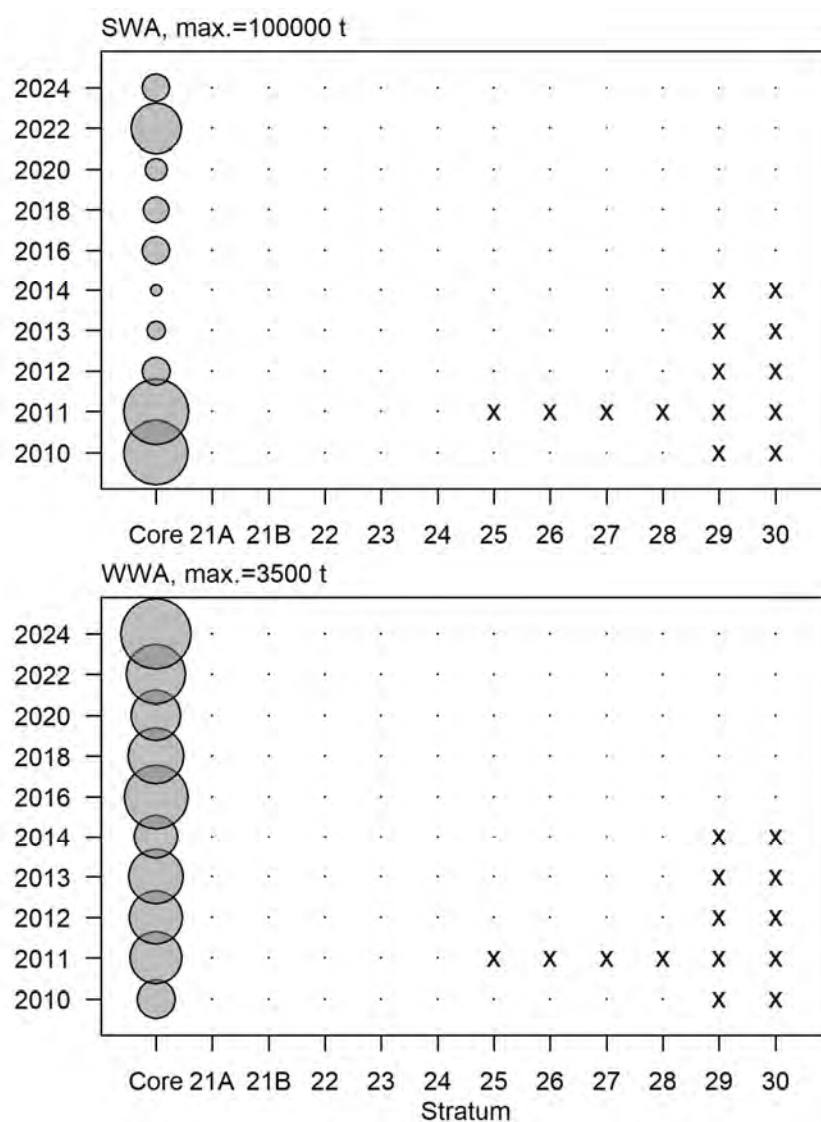


Figure 7b (continued)

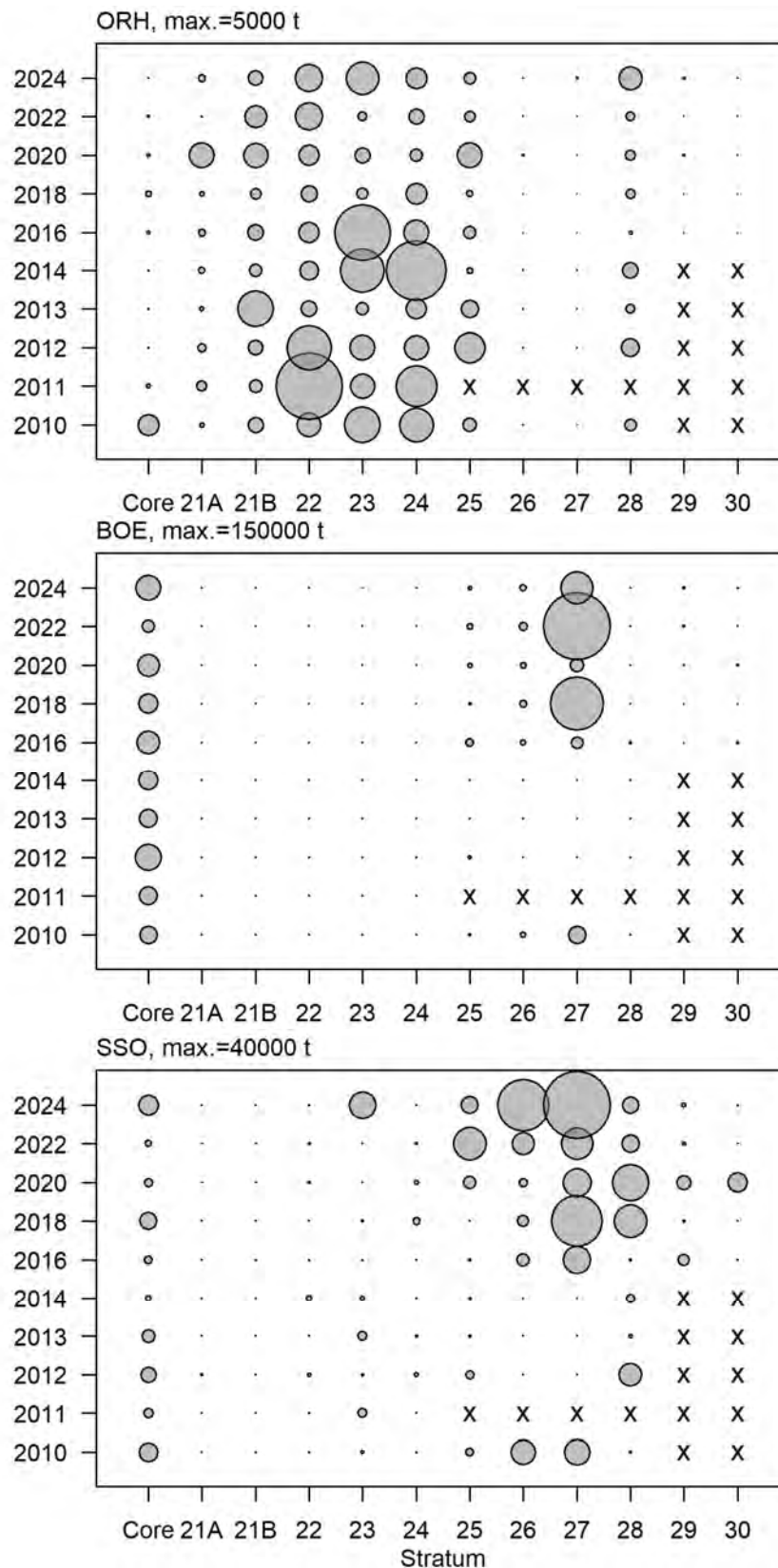


Figure 7c: Relative deep (800–1300 m) biomass estimates by strata for orange roughly, oreo species, and other selected deepwater species sampled by sampled by trawl surveys of the Chatham Rise from 2010 to 2024. X indicates stratum not sampled. Species codes are given in Table 4.

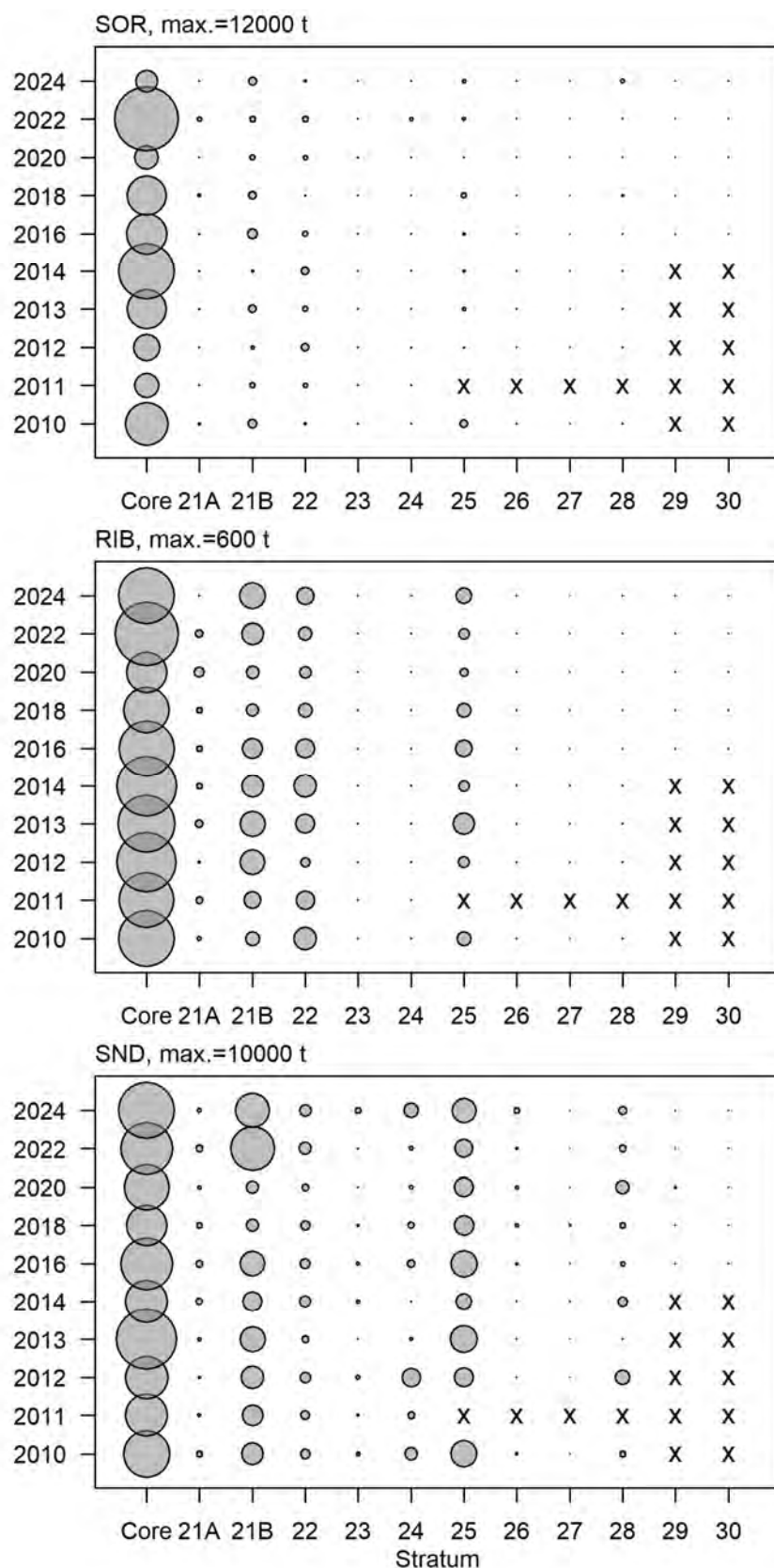


Figure 7c (continued)

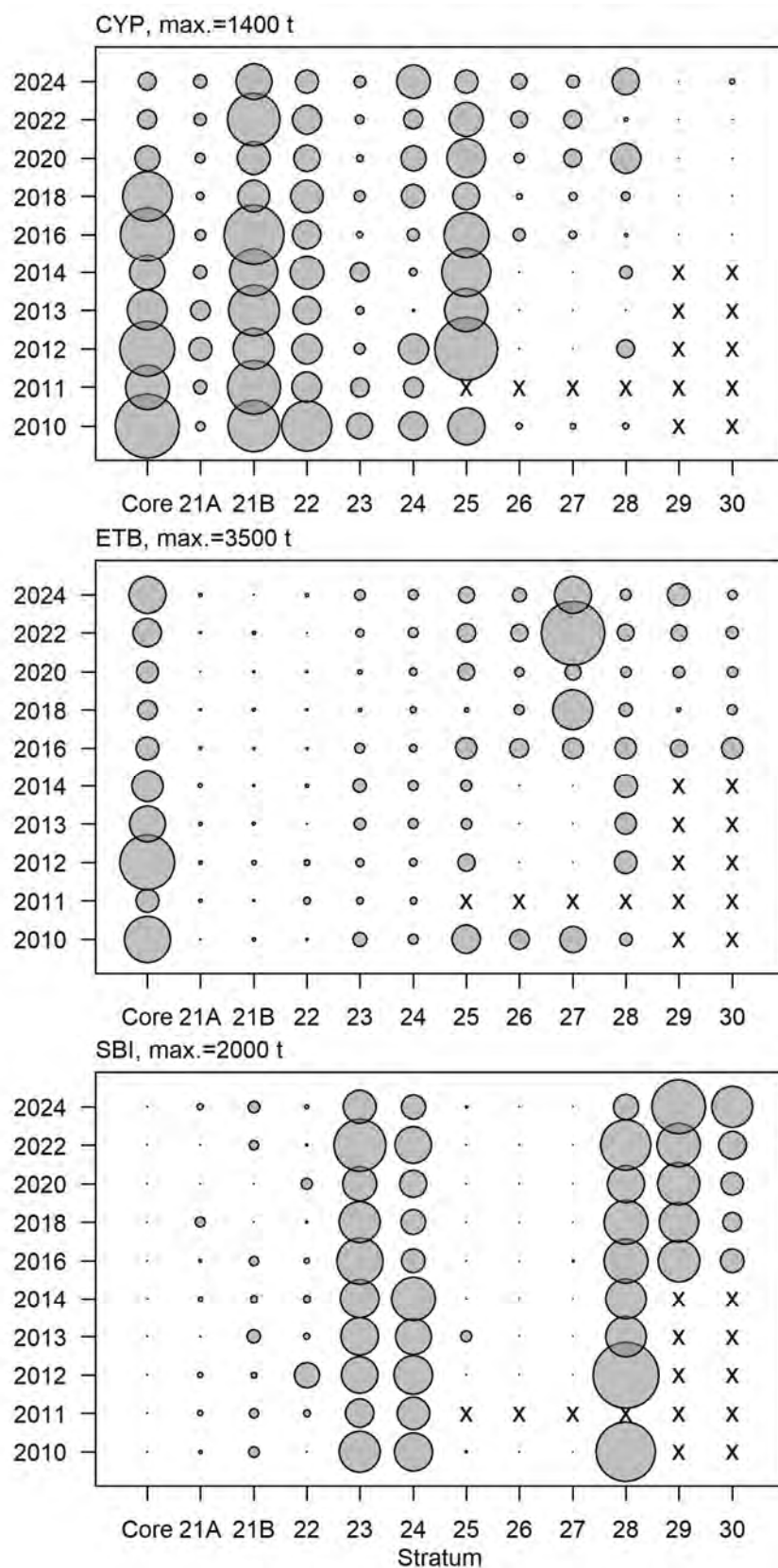


Figure 7c (continued)

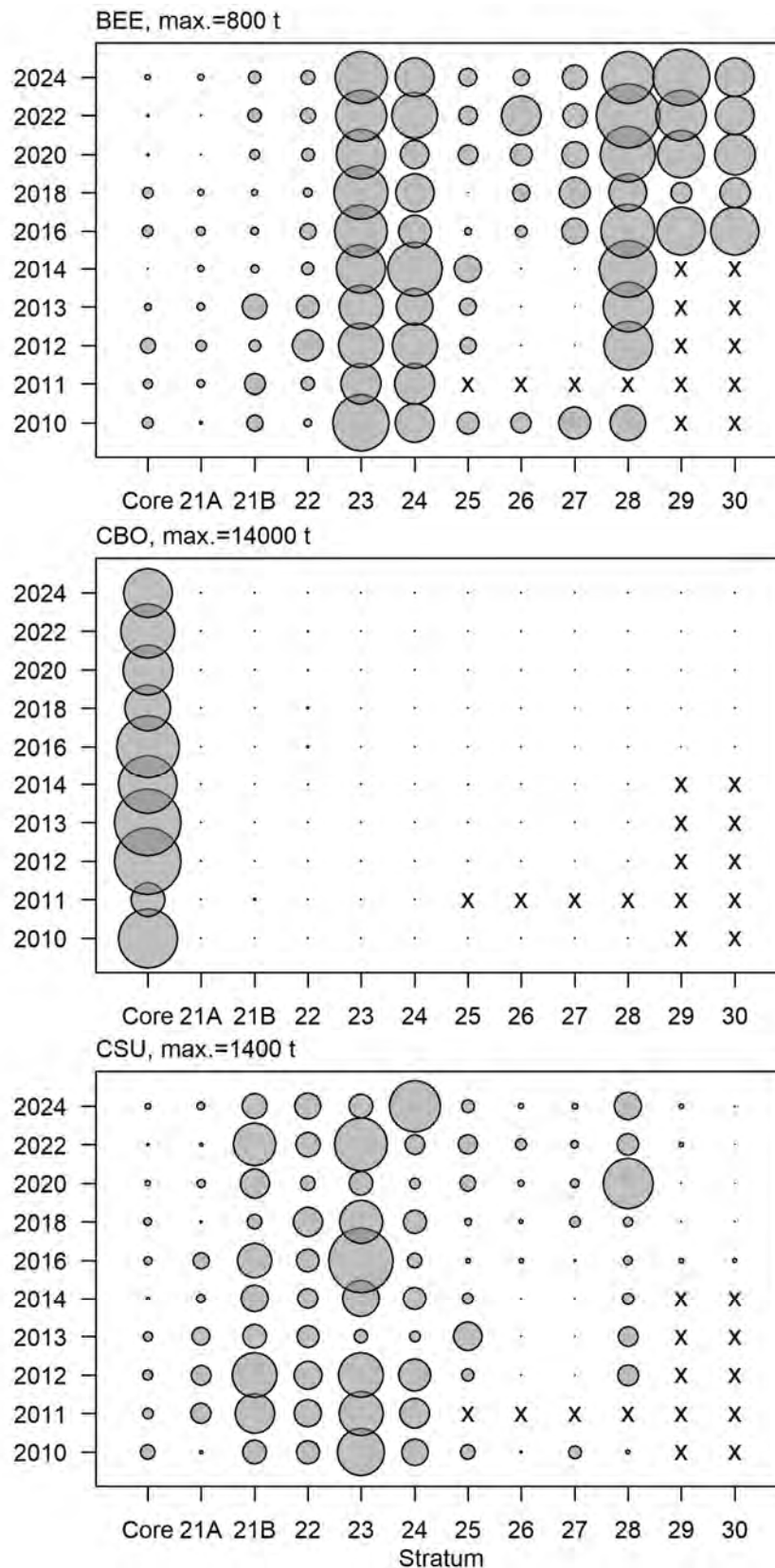


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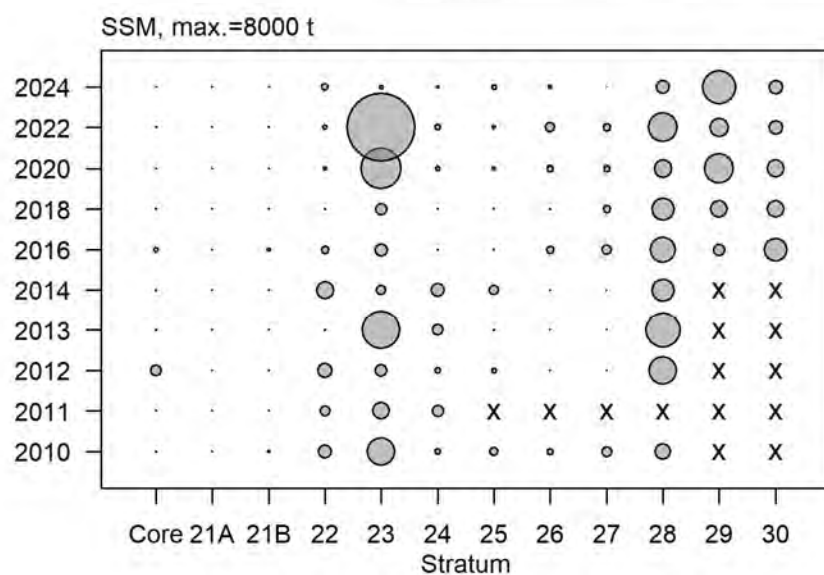
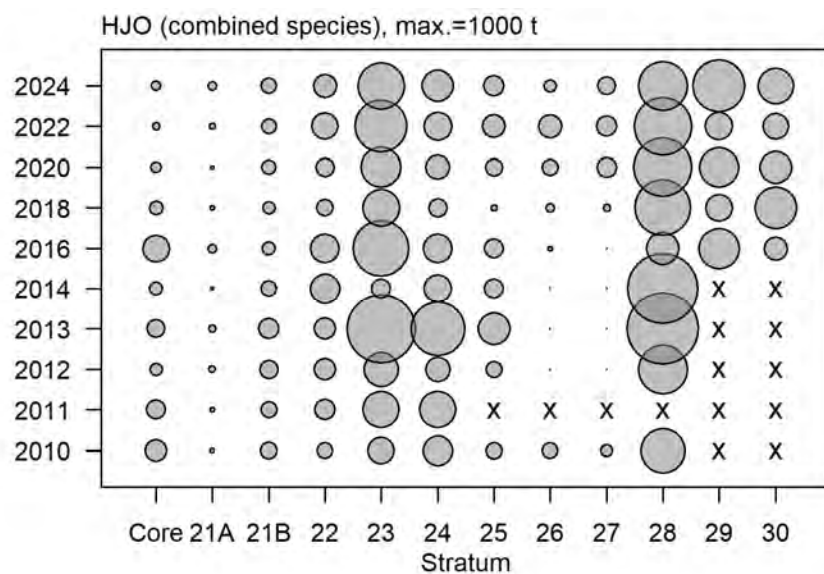


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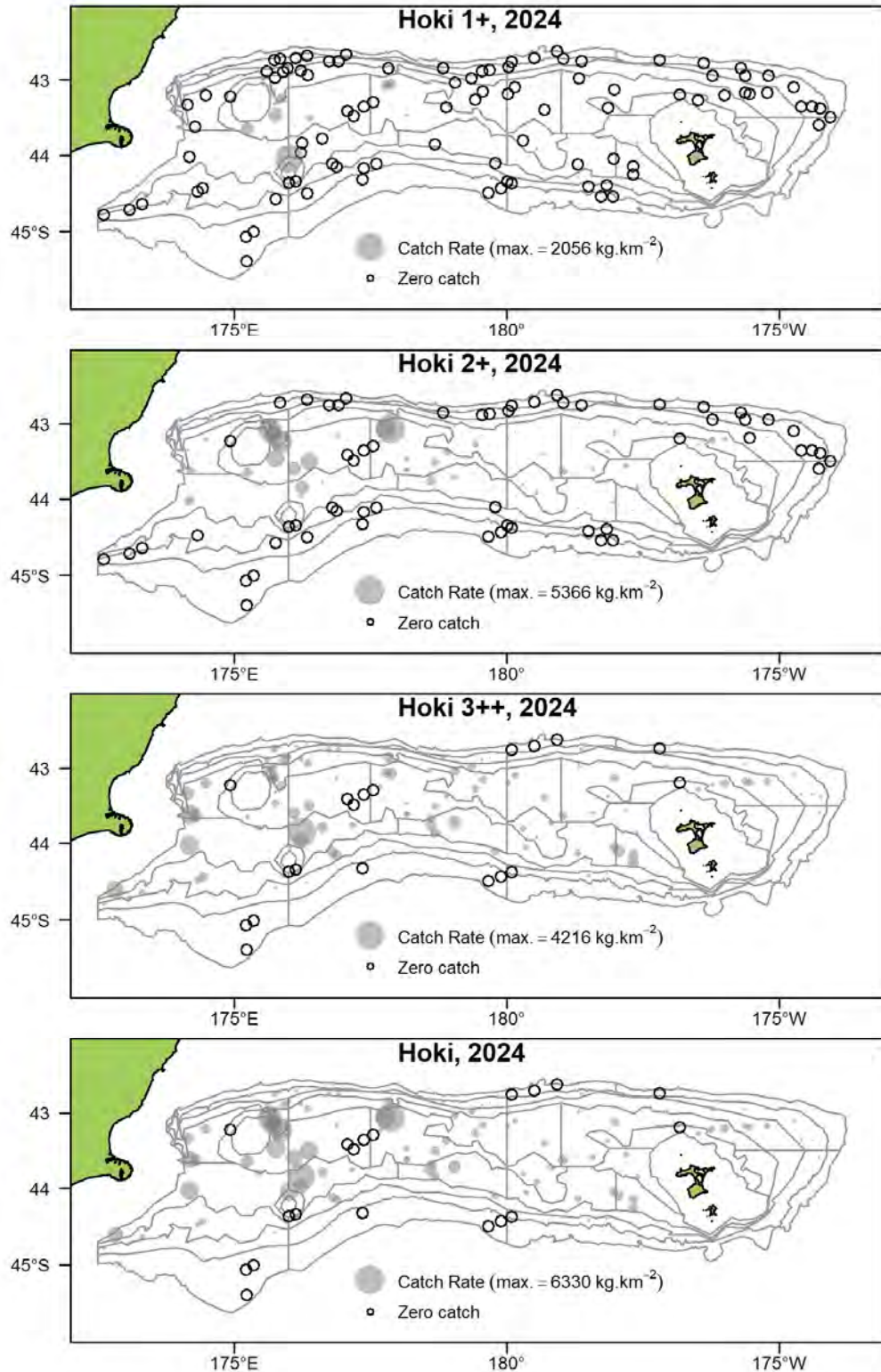


Figure 8: Hoki 1+, 2+, 3++ age class (year) and total catch distribution in 2024. Filled circle area is proportional to catch rate (kg km⁻²). Open circles are zero catch. Maximum catch rate (max.) is shown on each plot.

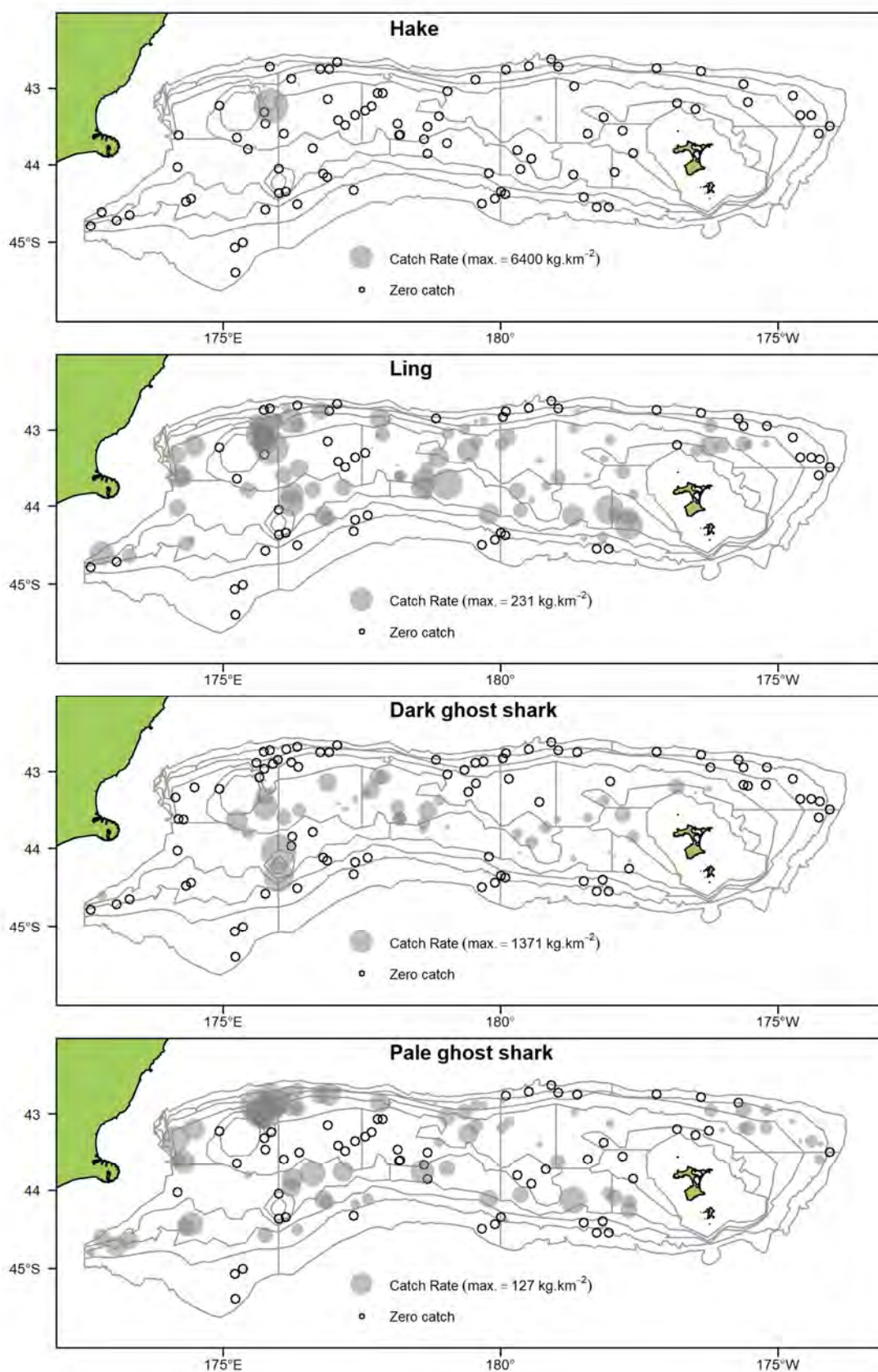


Figure 9: Catch rates (kg km⁻²) of selected core and deepwater commercial and bycatch species in 2024. Filled circle area is proportional to catch rate. Open circles are zero catch. max., maximum catch rate.

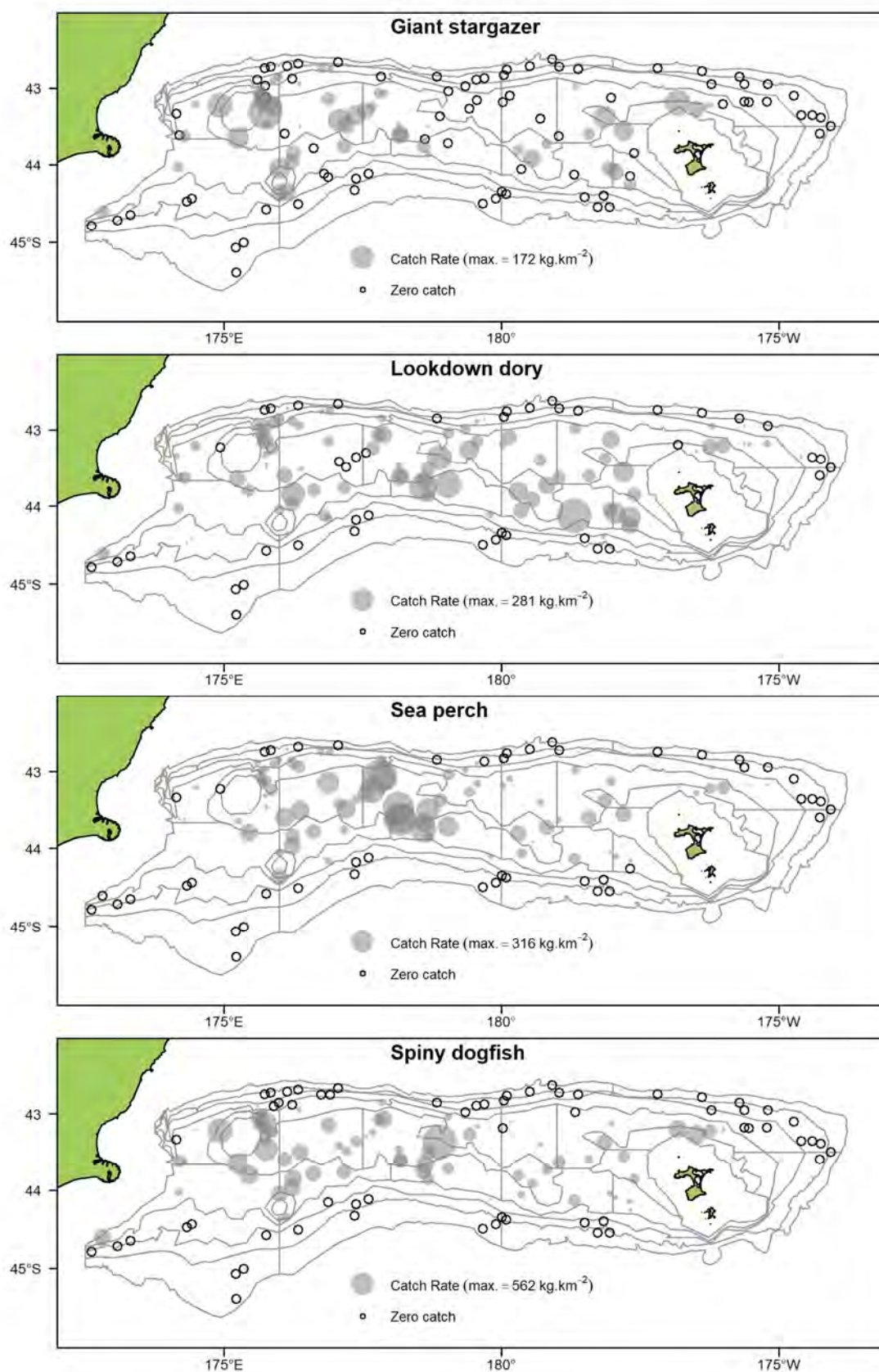


Figure 9 (continued)

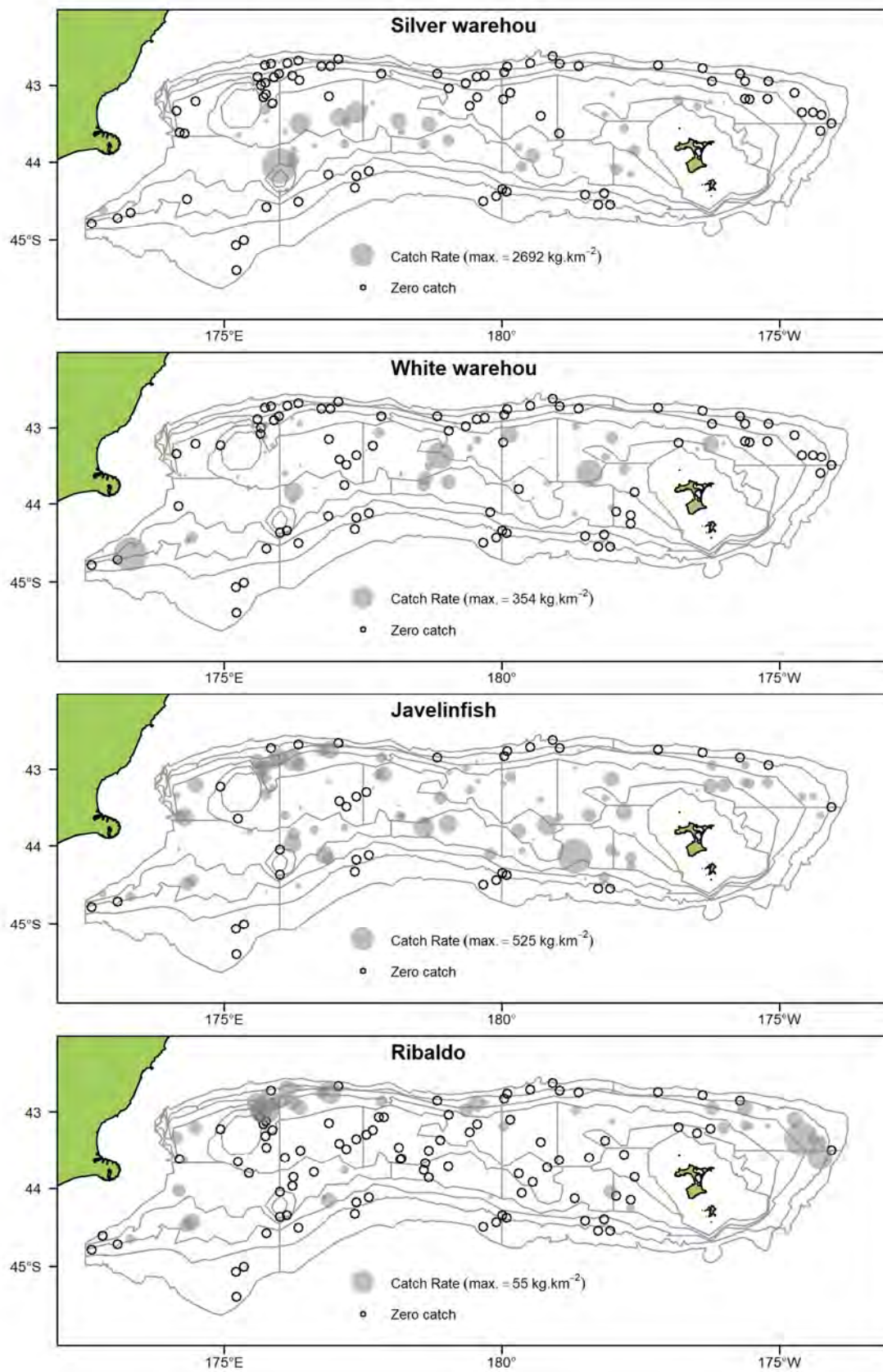


Figure 9 (continued)

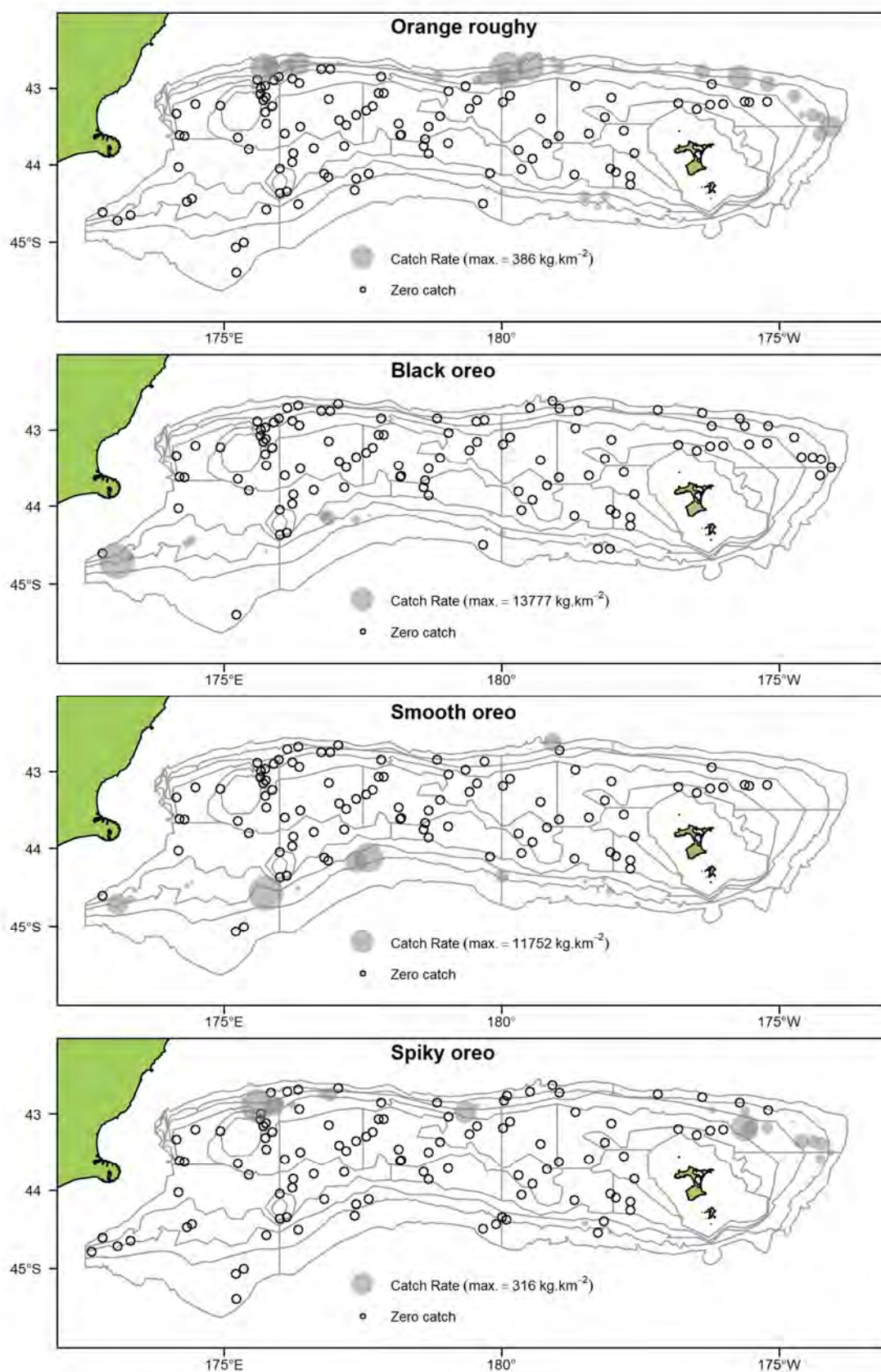


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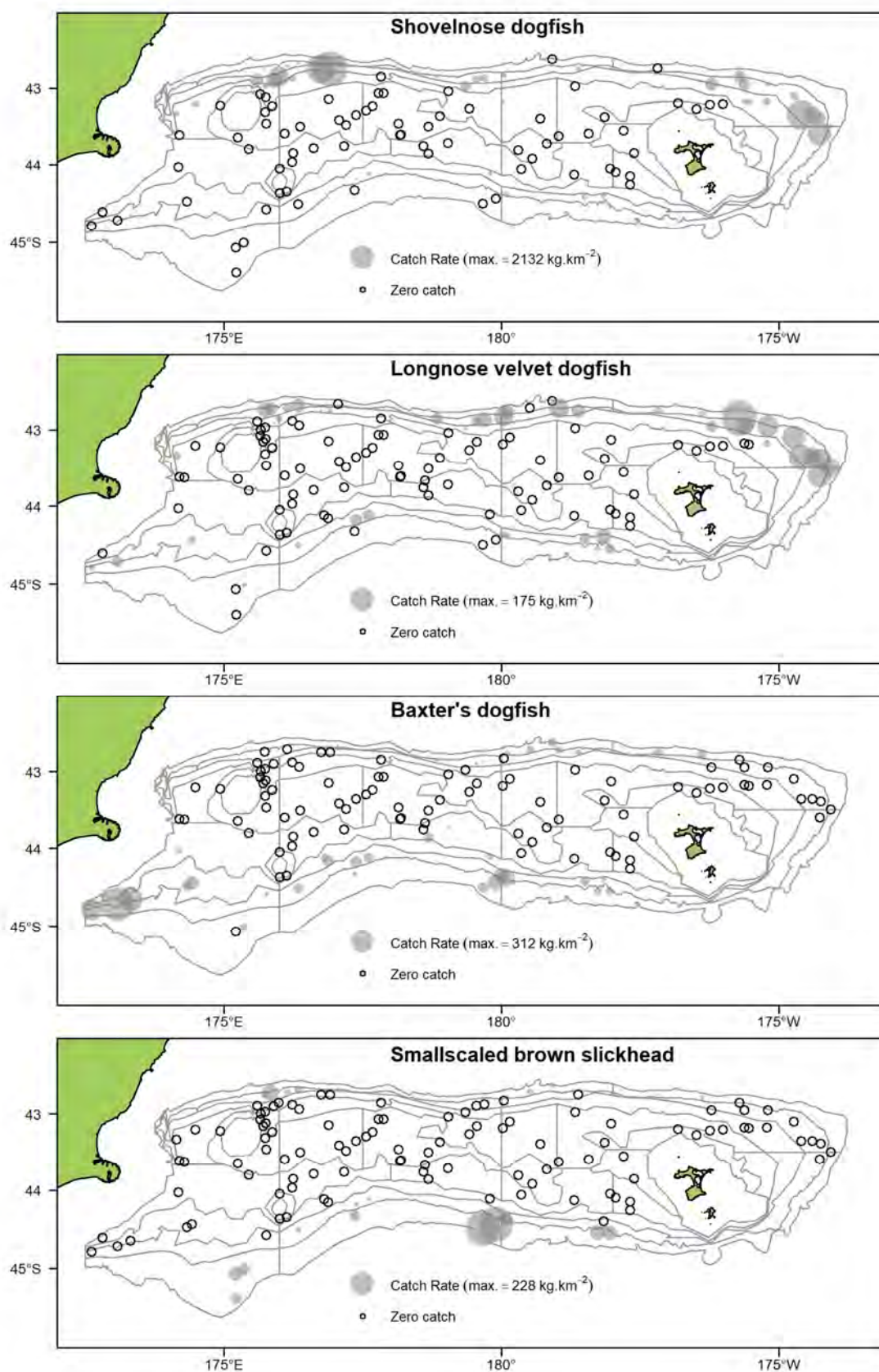


Figure 9 (continued)

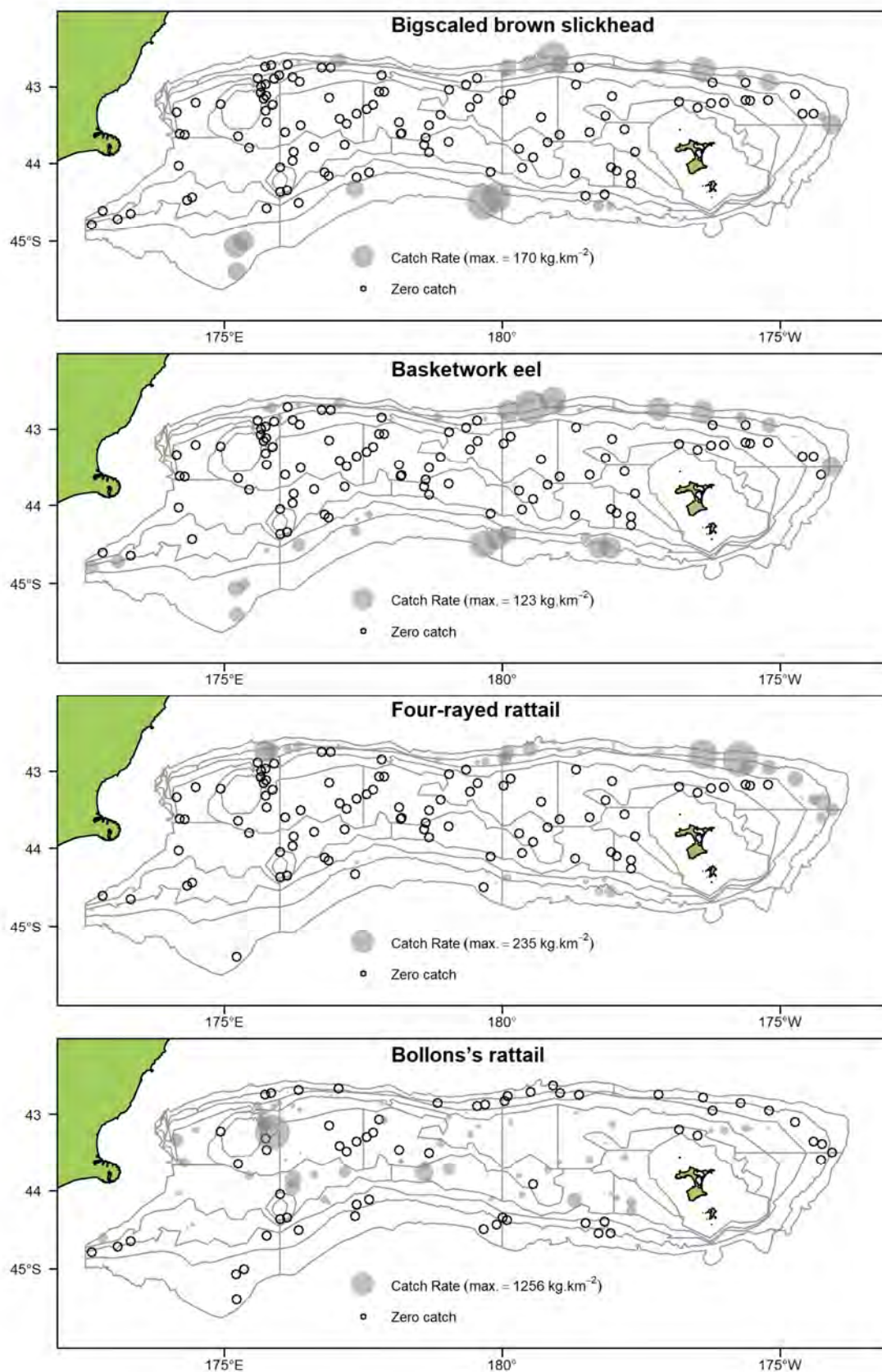


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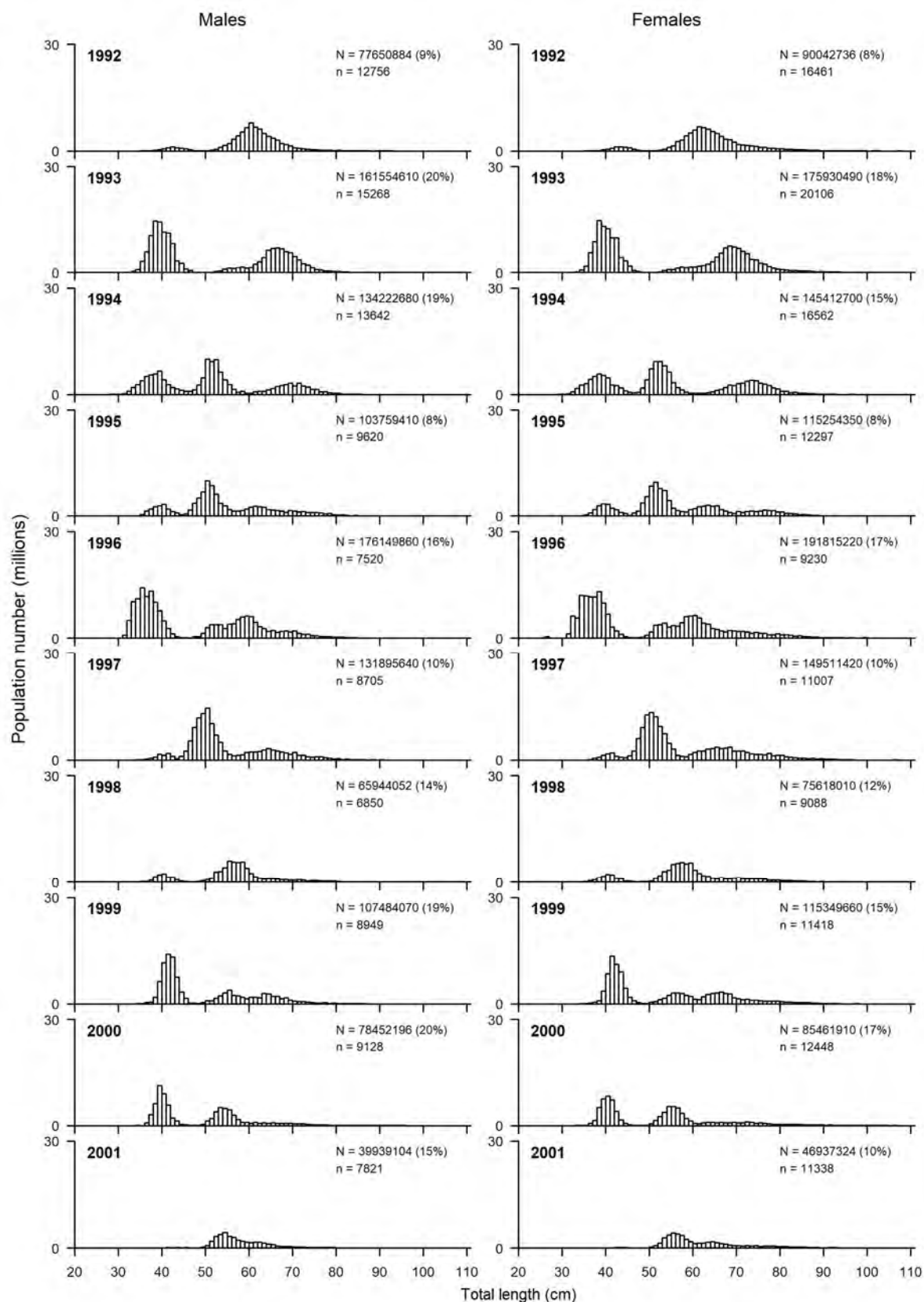


Figure 10: Estimated length frequency distributions of the male and female hoki population from *Tangaroa* trawl surveys of the Chatham Rise from 1992 to 2024 for core strata. N, estimated population number of male hoki (left panel) and female hoki (right panel); CV (in parentheses), coefficient of variation; n., numbers of fish measured.

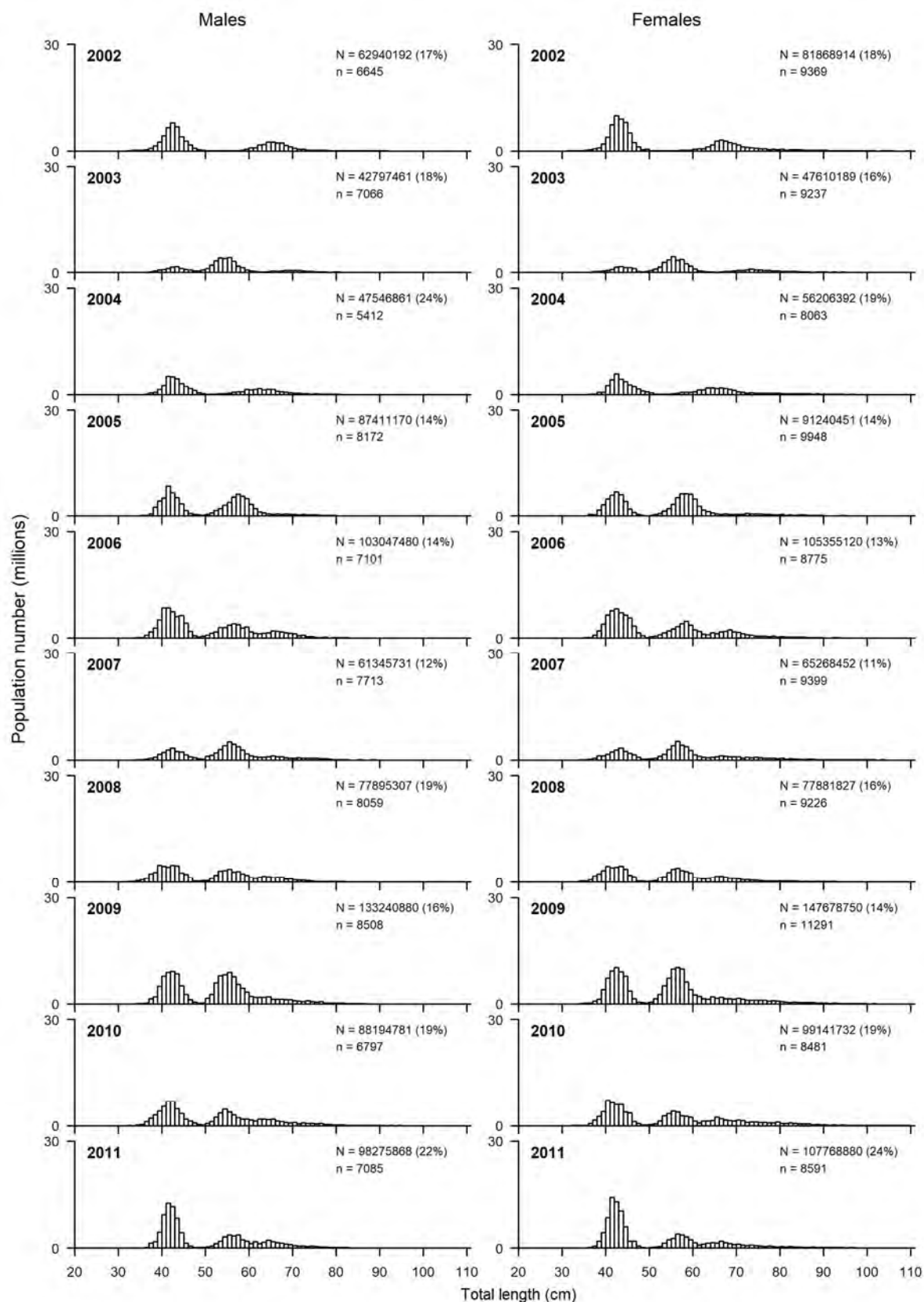


Figure 10 (continued)

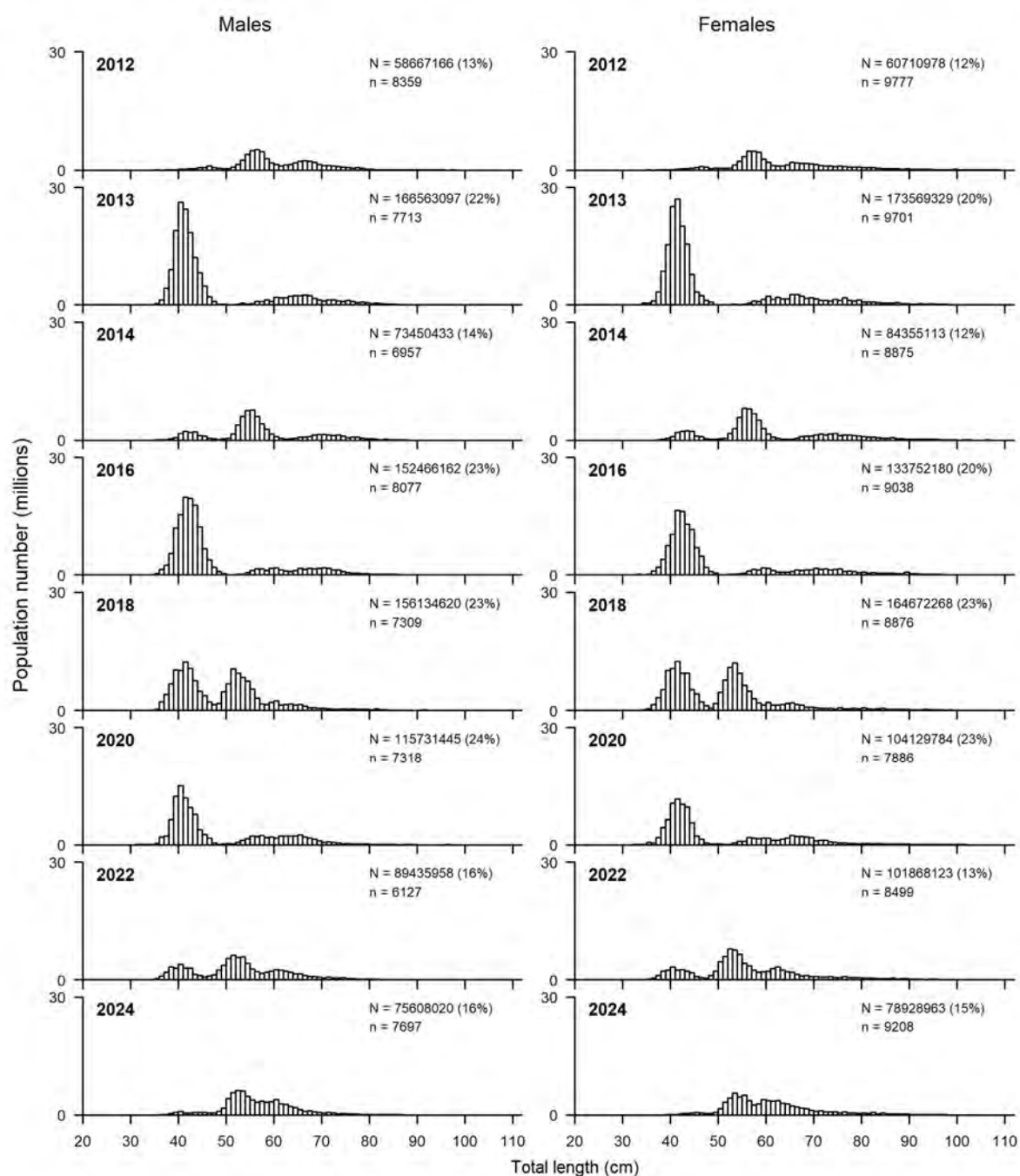


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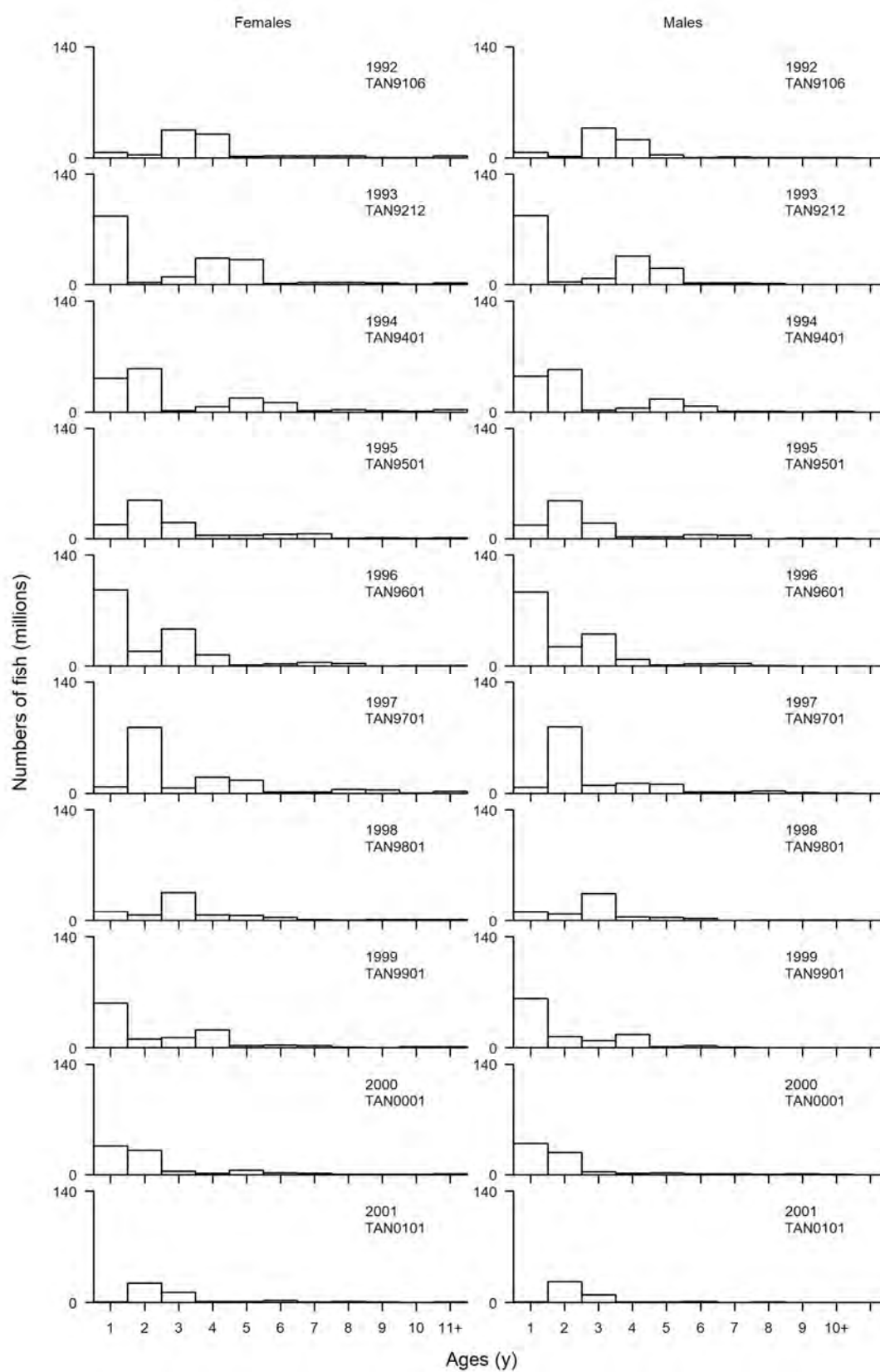


Figure 11: Estimated population numbers-at-age for hoki from *Tangaroa* surveys of the Chatham Rise, January 1992 to 2024. +, indicates plus group of combined ages.

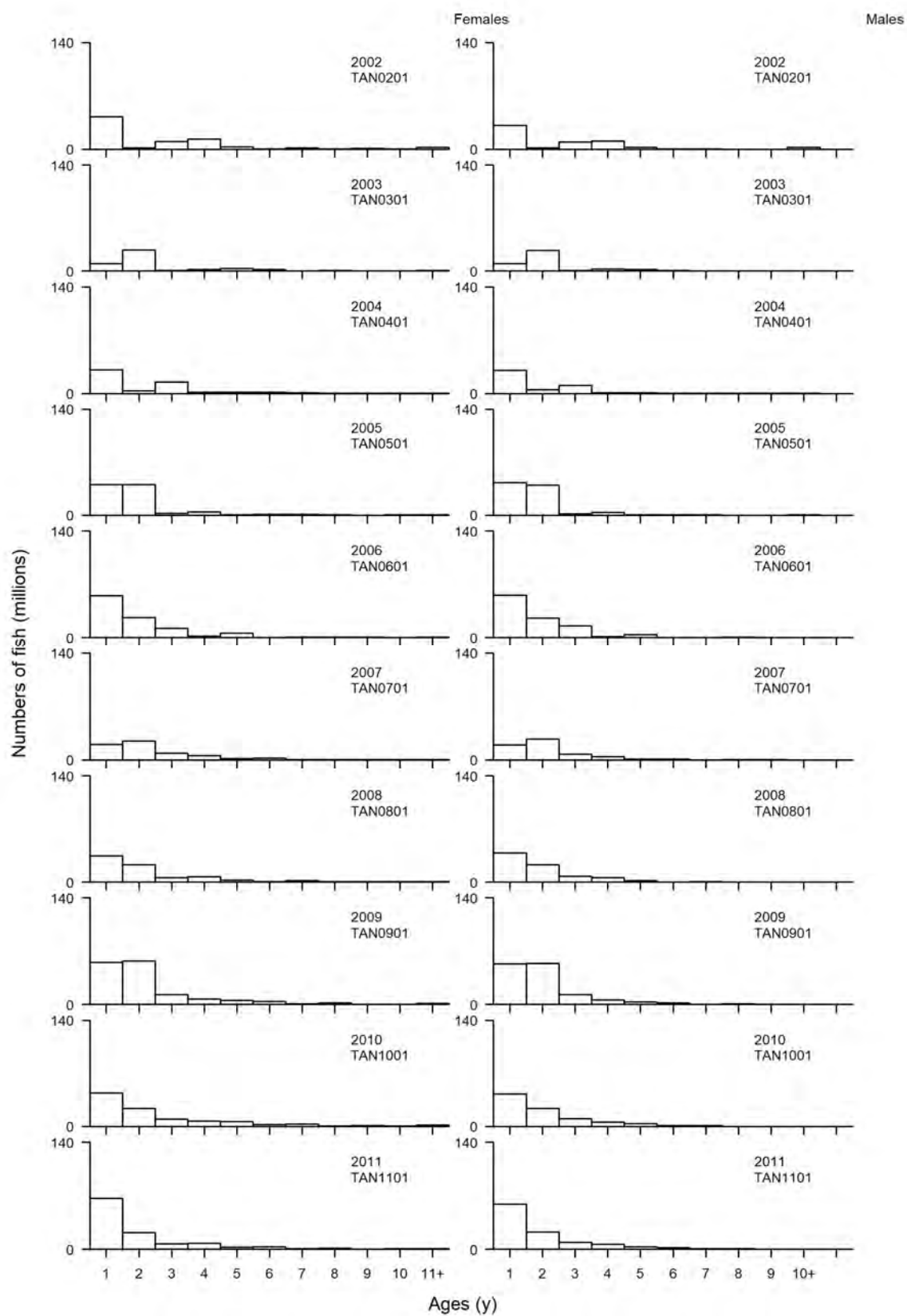


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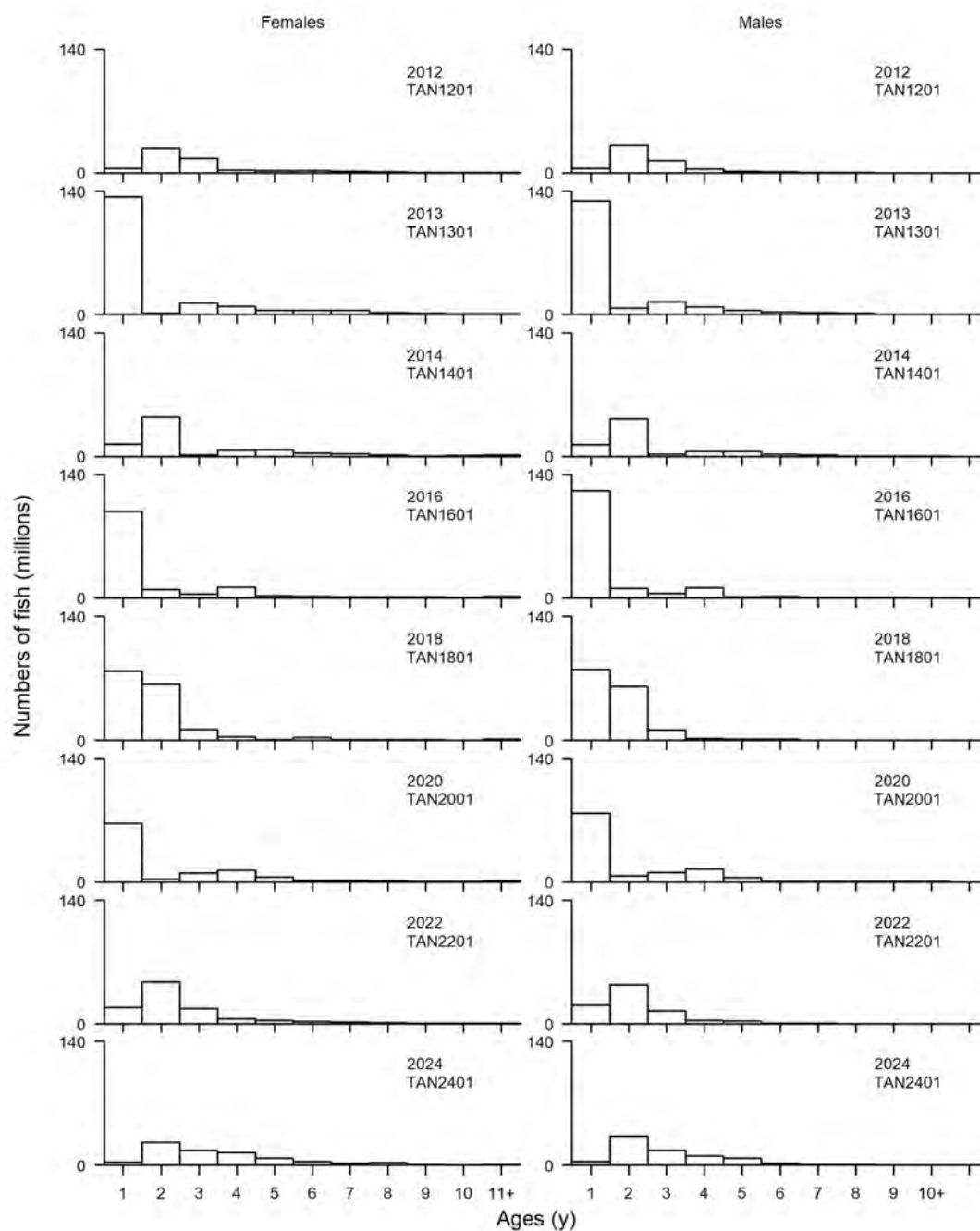


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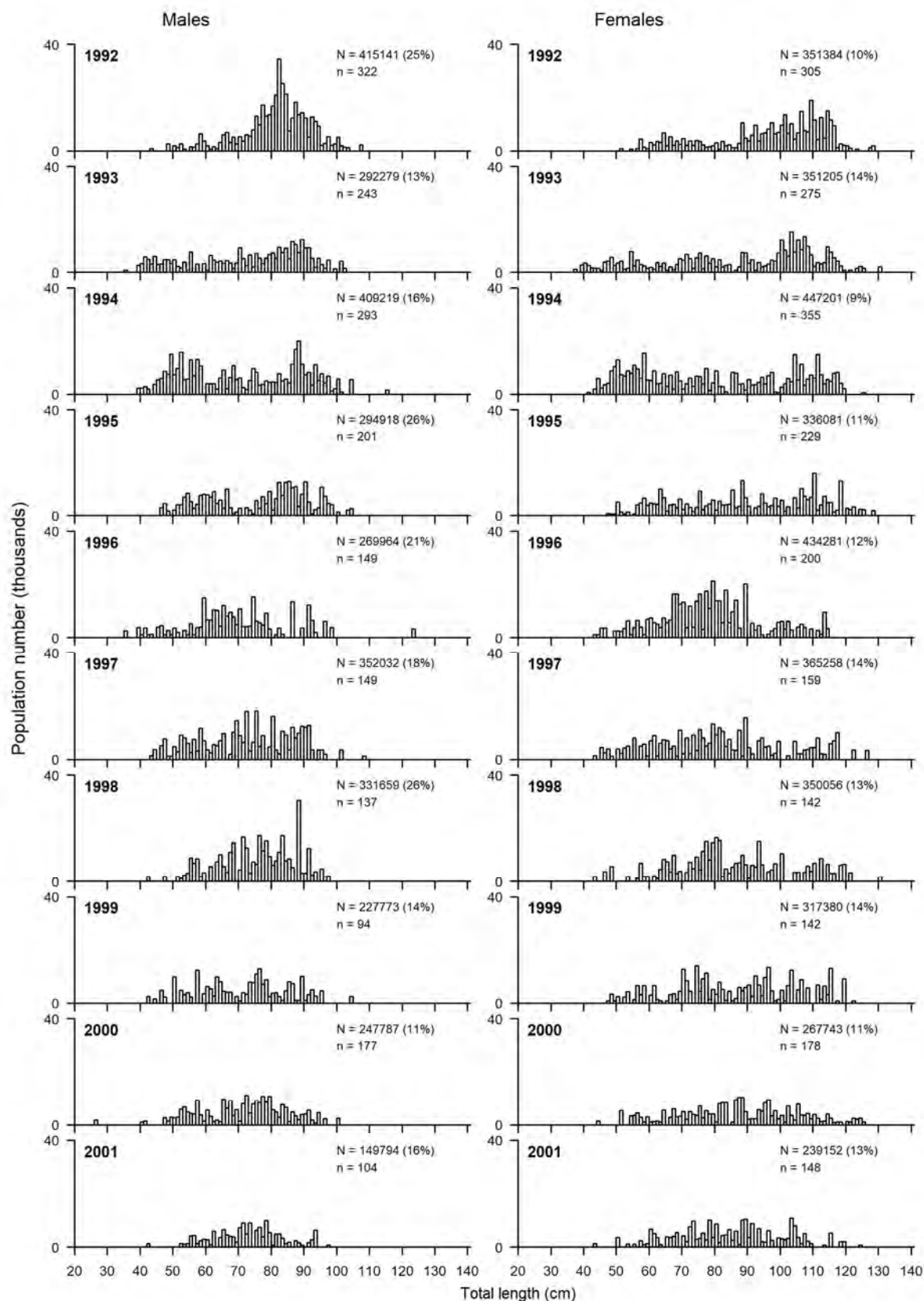


Figure 12: Estimated length frequency distributions of the male and female hake population from *Tangaroa* surveys of the Chatham Rise from 1992 to 2024 for core strata. N, estimated population number of male hake (left panel) and female hake (right panel); CV (in parentheses), coefficient of variation; n, numbers of fish measured.

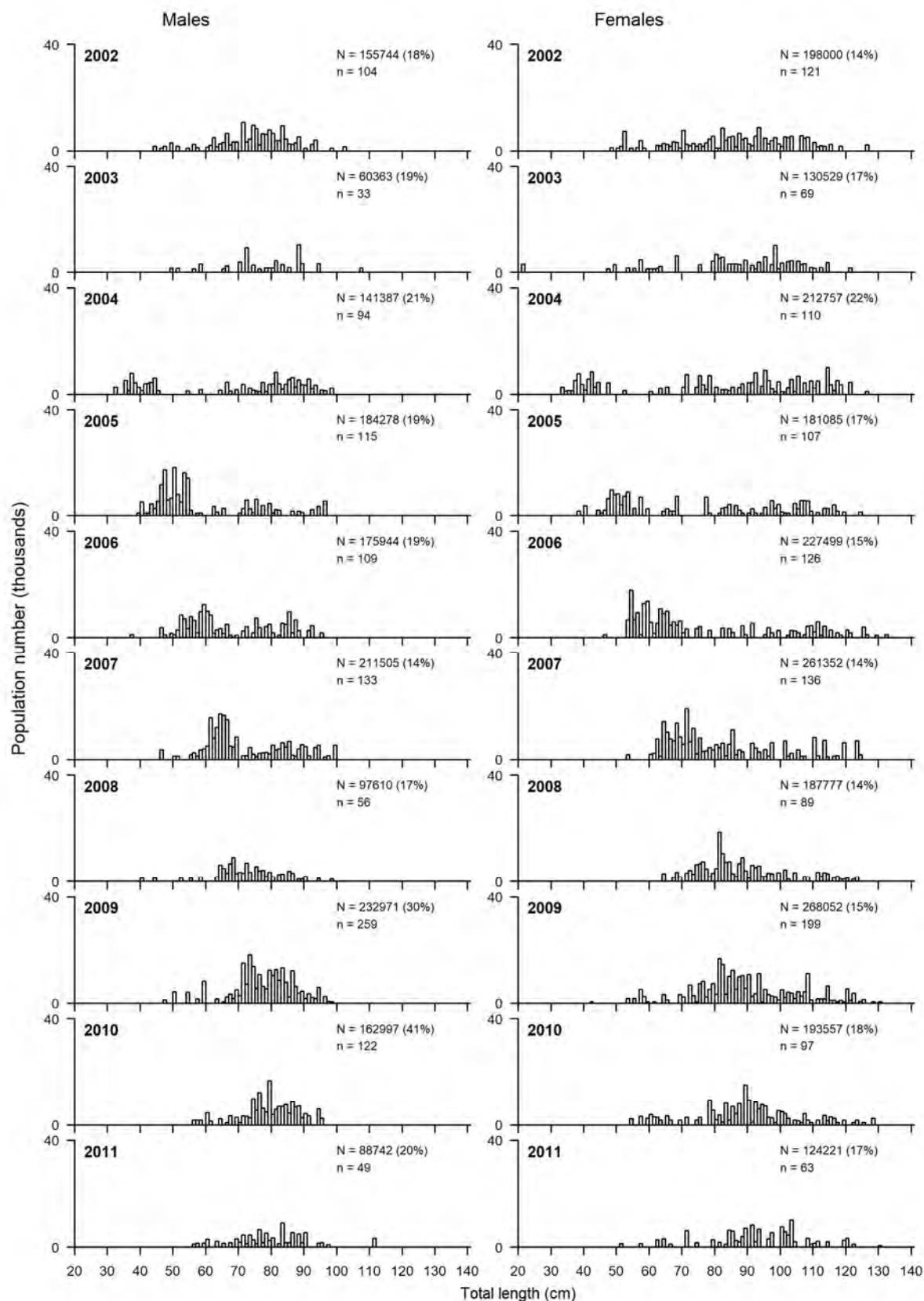


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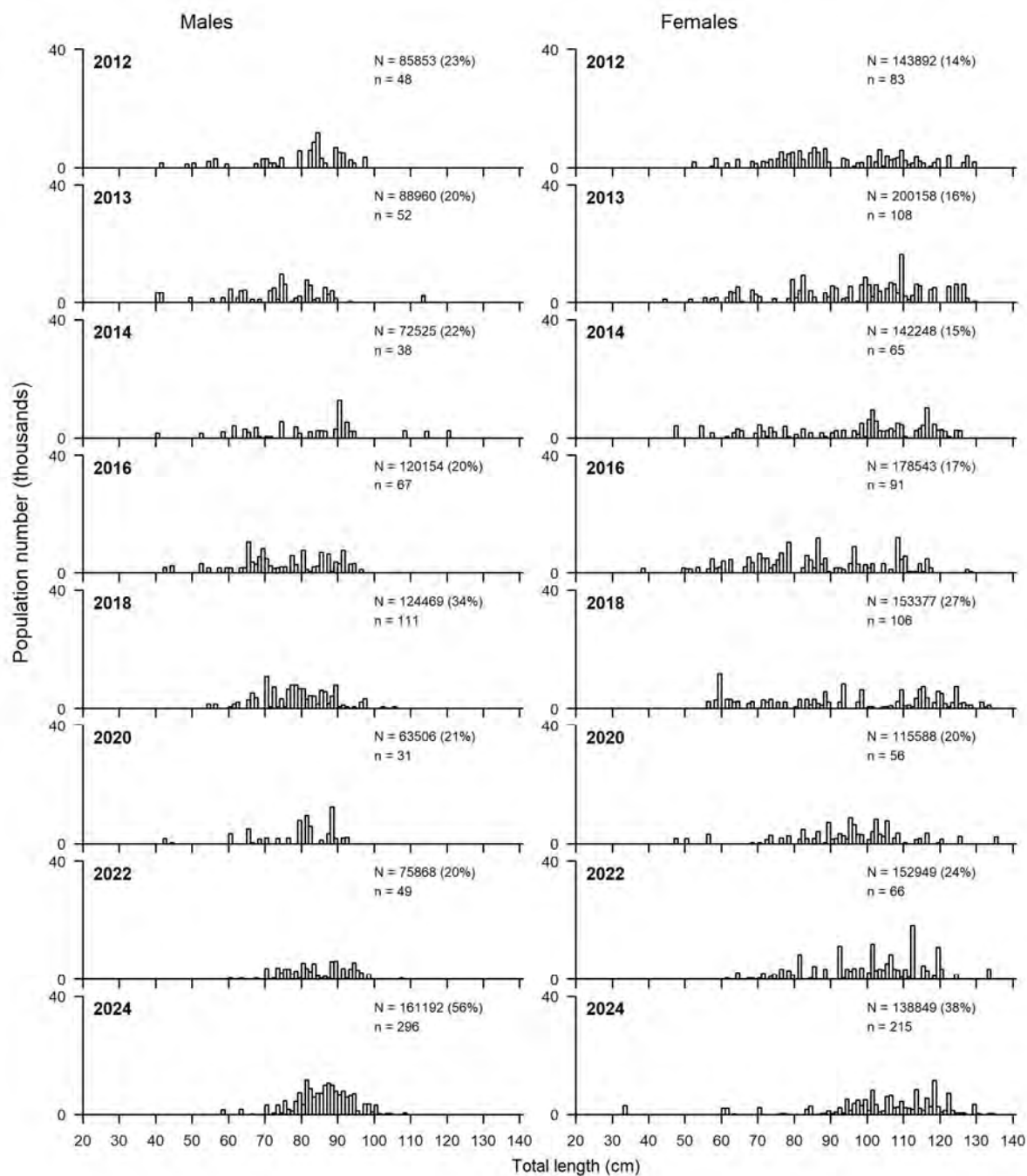


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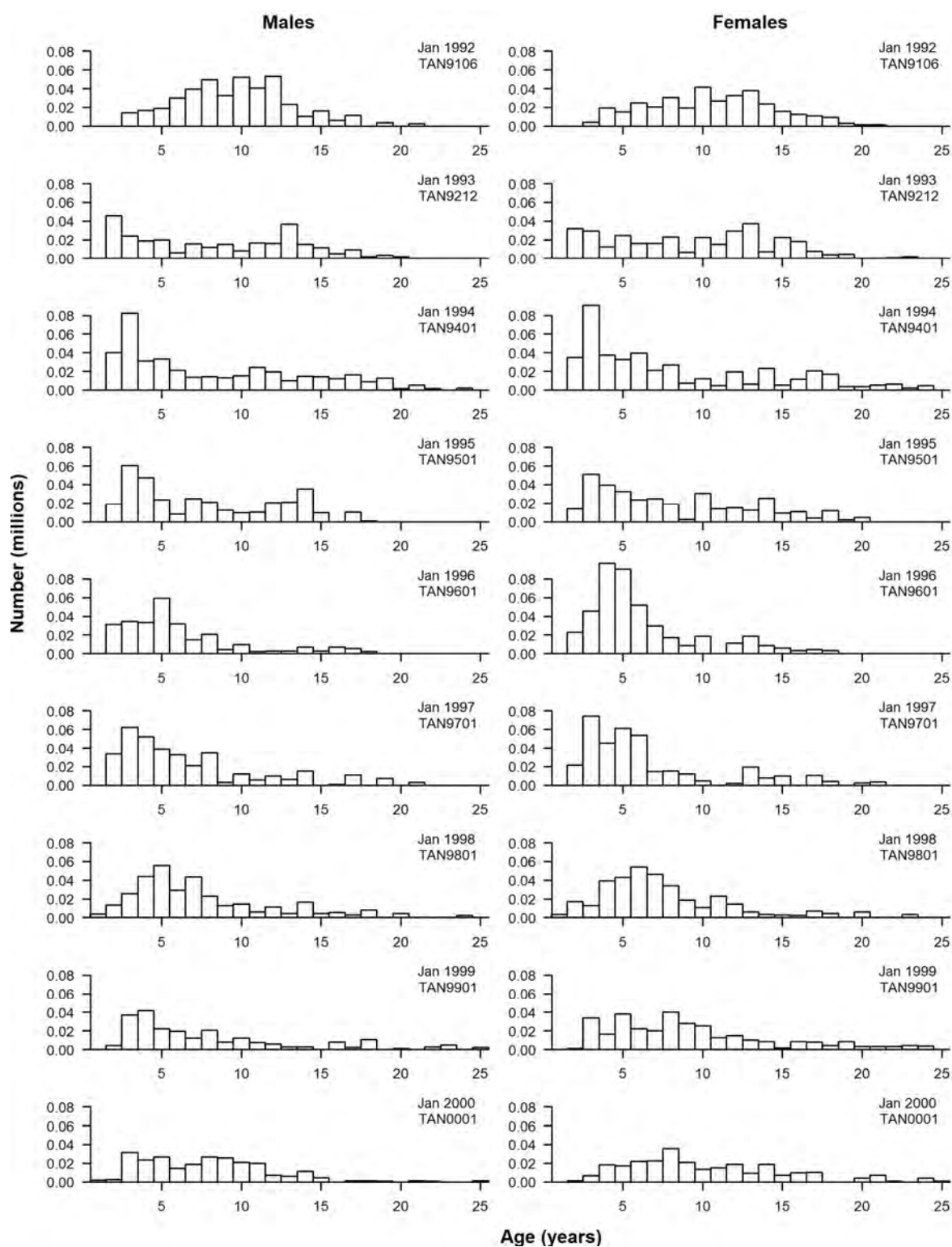


Figure 13: Estimated population numbers-at-age for male and female hake from *Tangaroa* surveys of the Chatham Rise from 1992 to 2024.

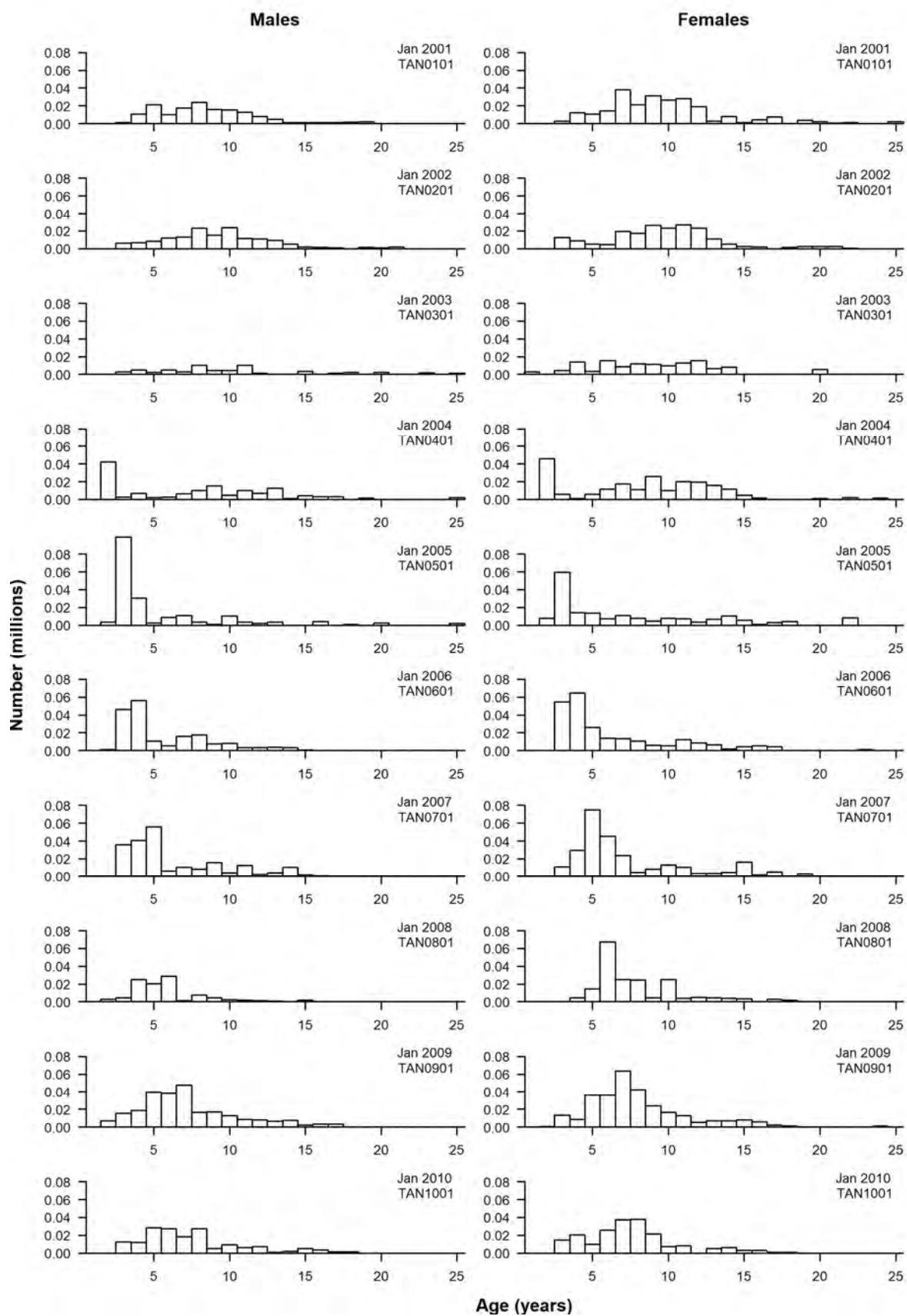


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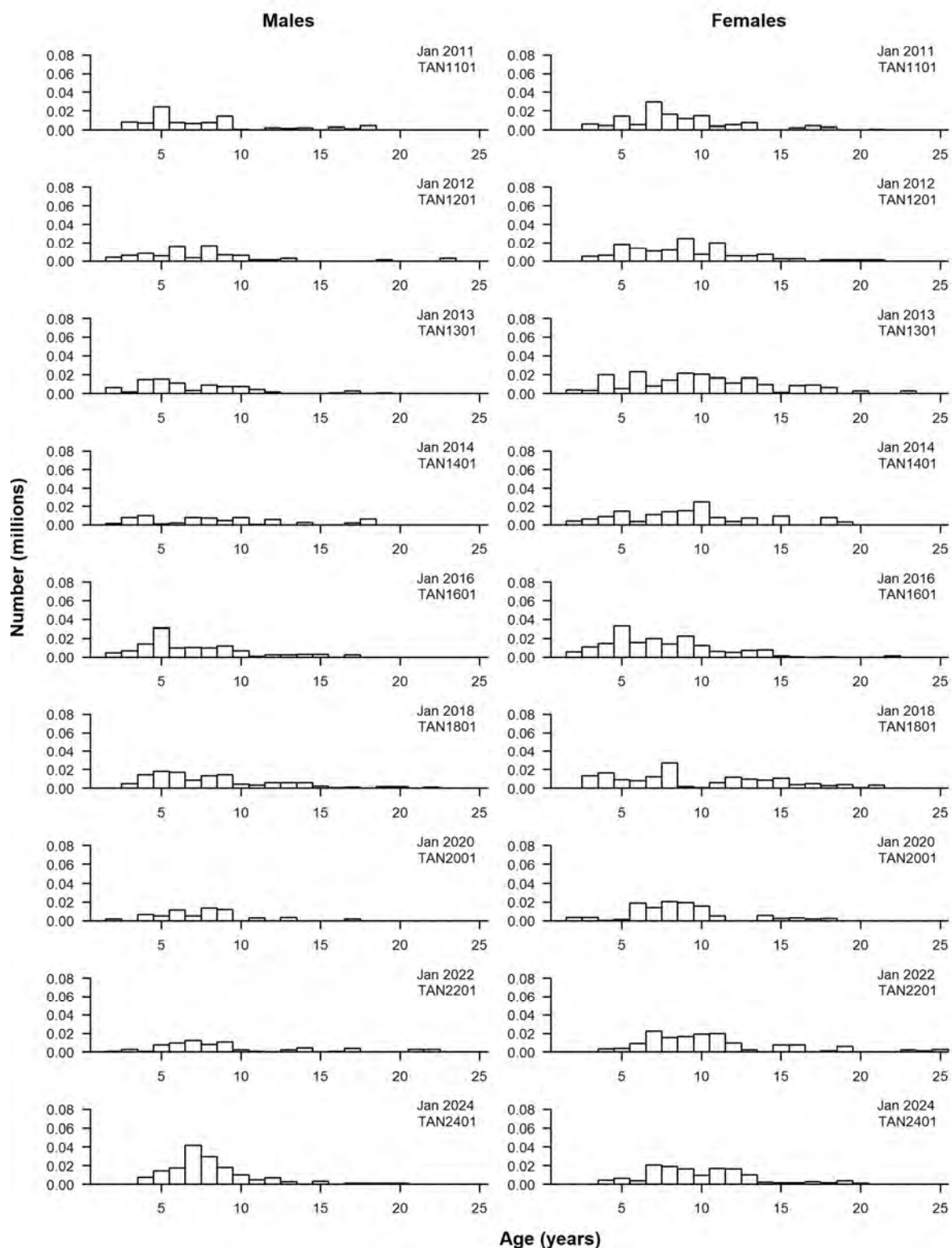


Figure 13 (continued)

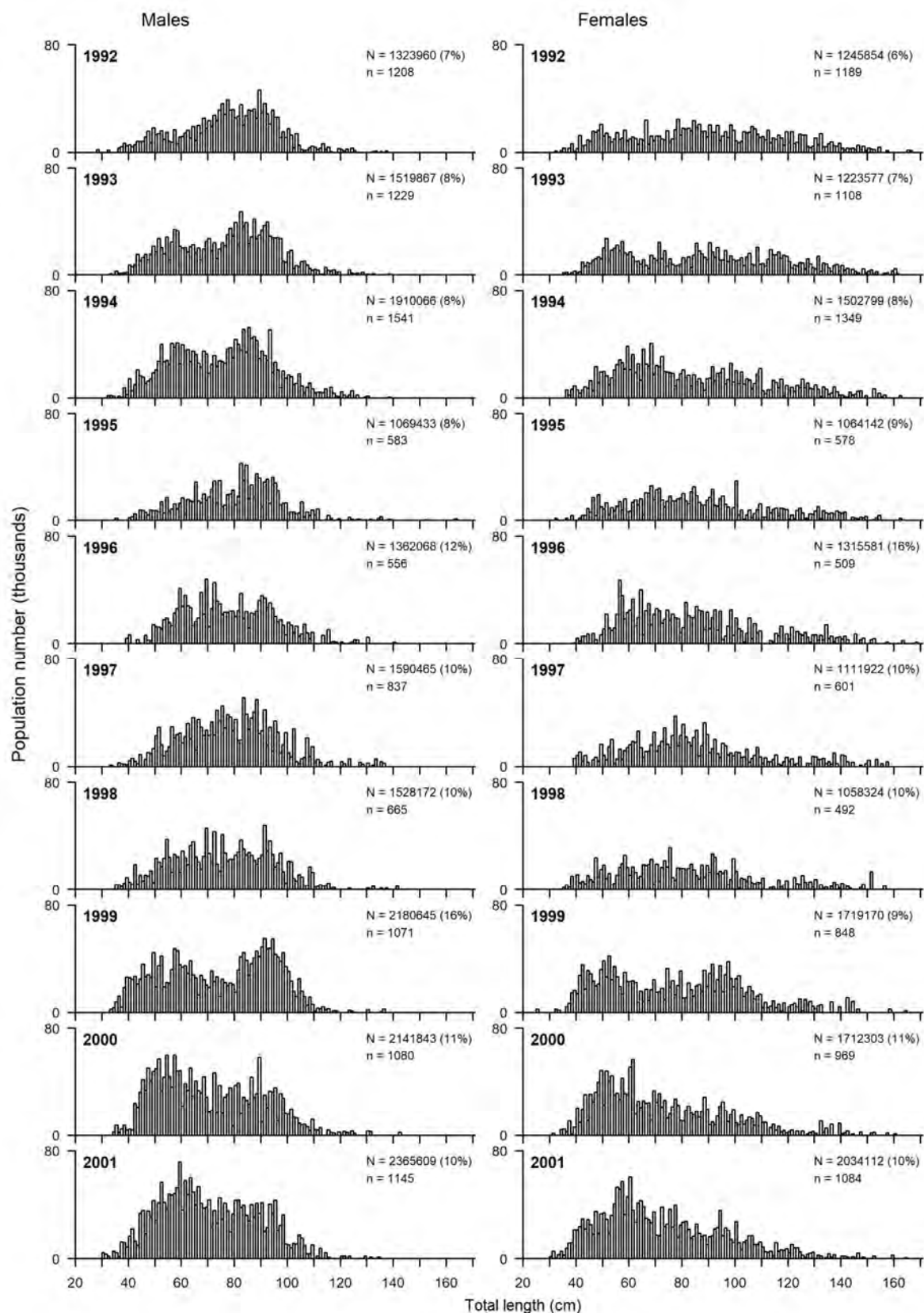


Figure 14: Estimated length frequency distributions of the ling population from *Tangaroa* surveys of the Chatham Rise from 1992 to 2024 for core strata. N, estimated population number of male ling (left panel) and female ling (right panel); CV (in parentheses), coefficient of variation; n, numbers of fish measured.

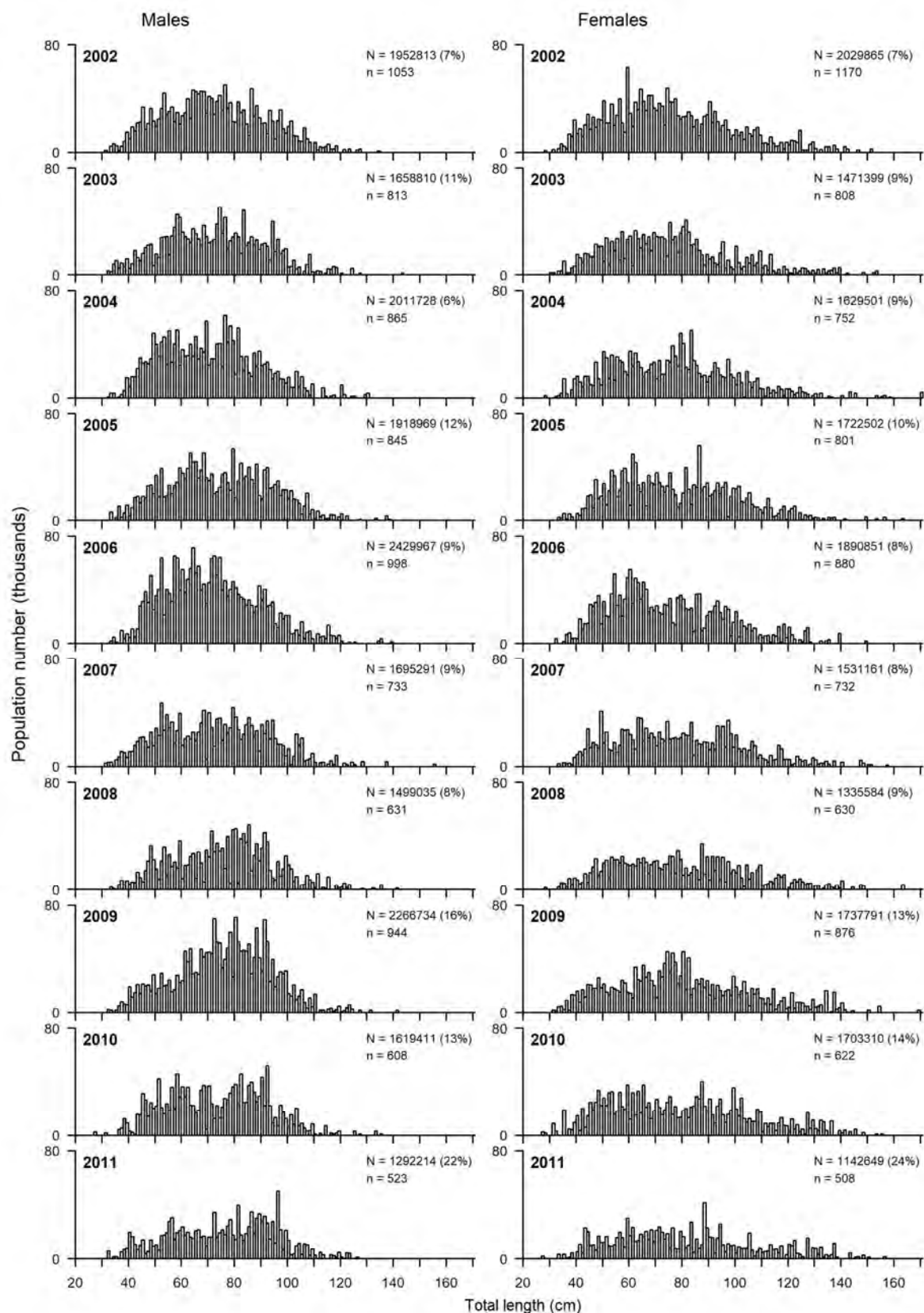


Figure 14 (continued)

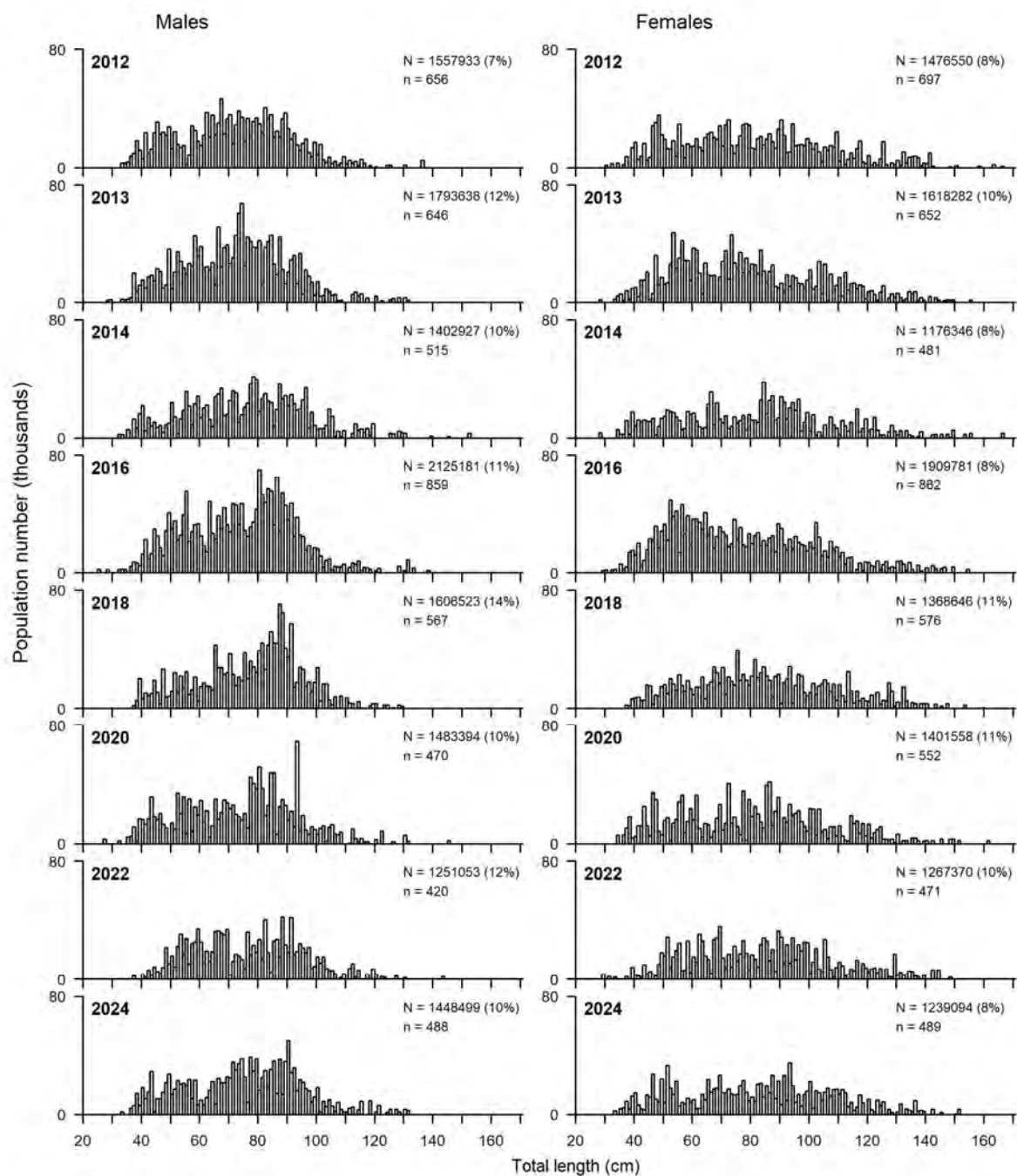


Figure 14 (continued)

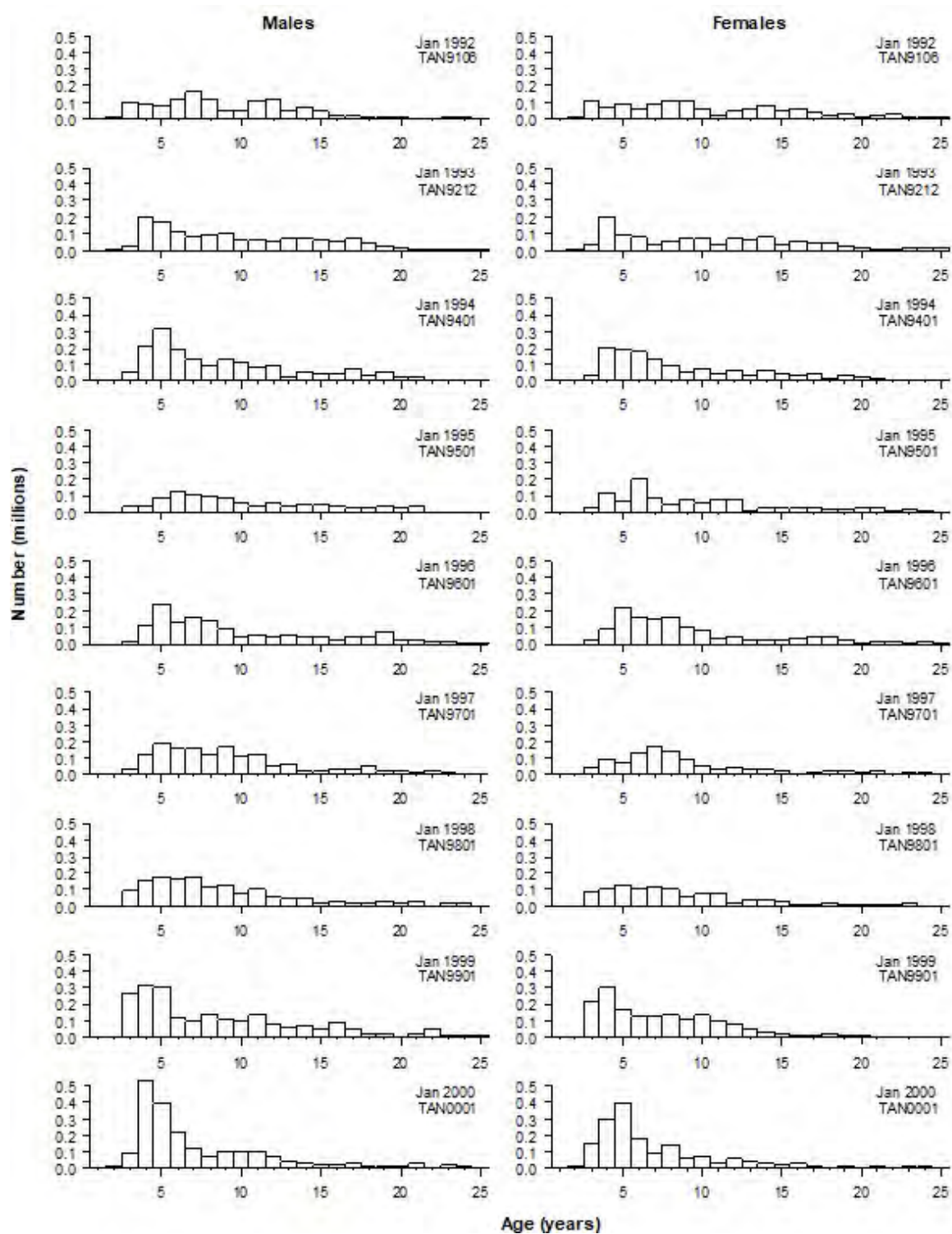


Figure 15: Estimated population numbers-at-age for male and female ling from *Tangaroa* surveys of the Chatham Rise from 1992 to 2024.

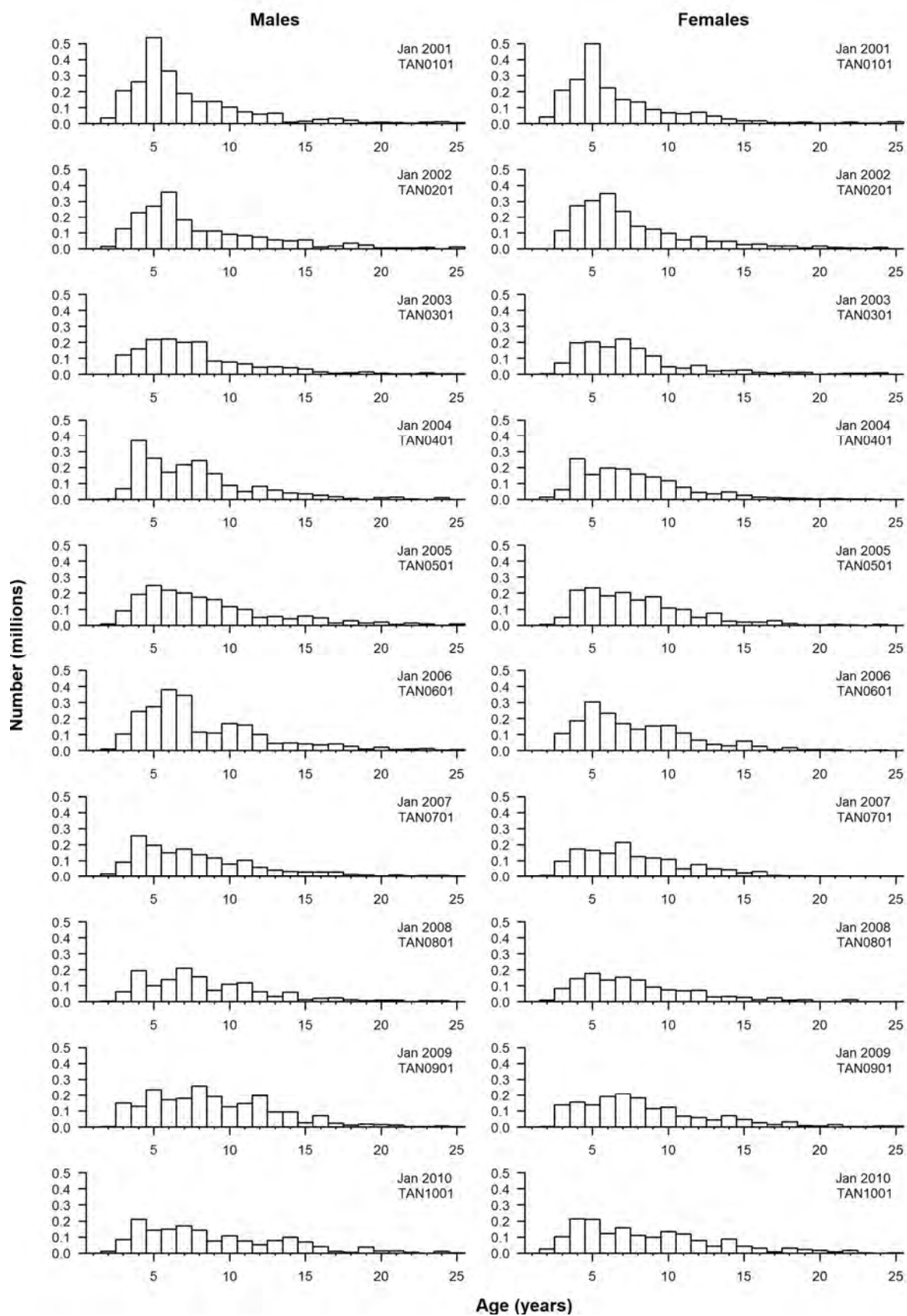


Figure 15 (continued)

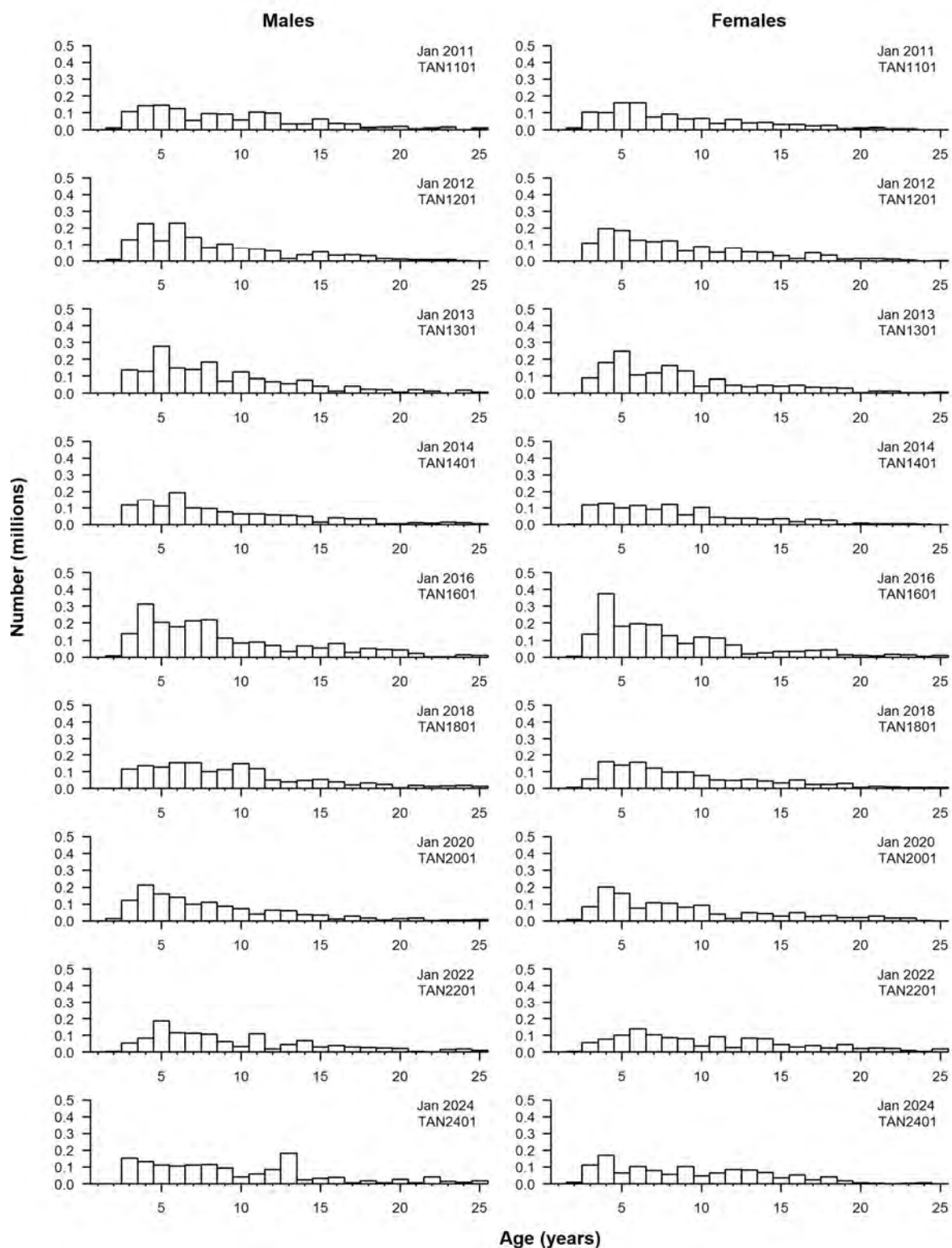


Figure 15 (continued)

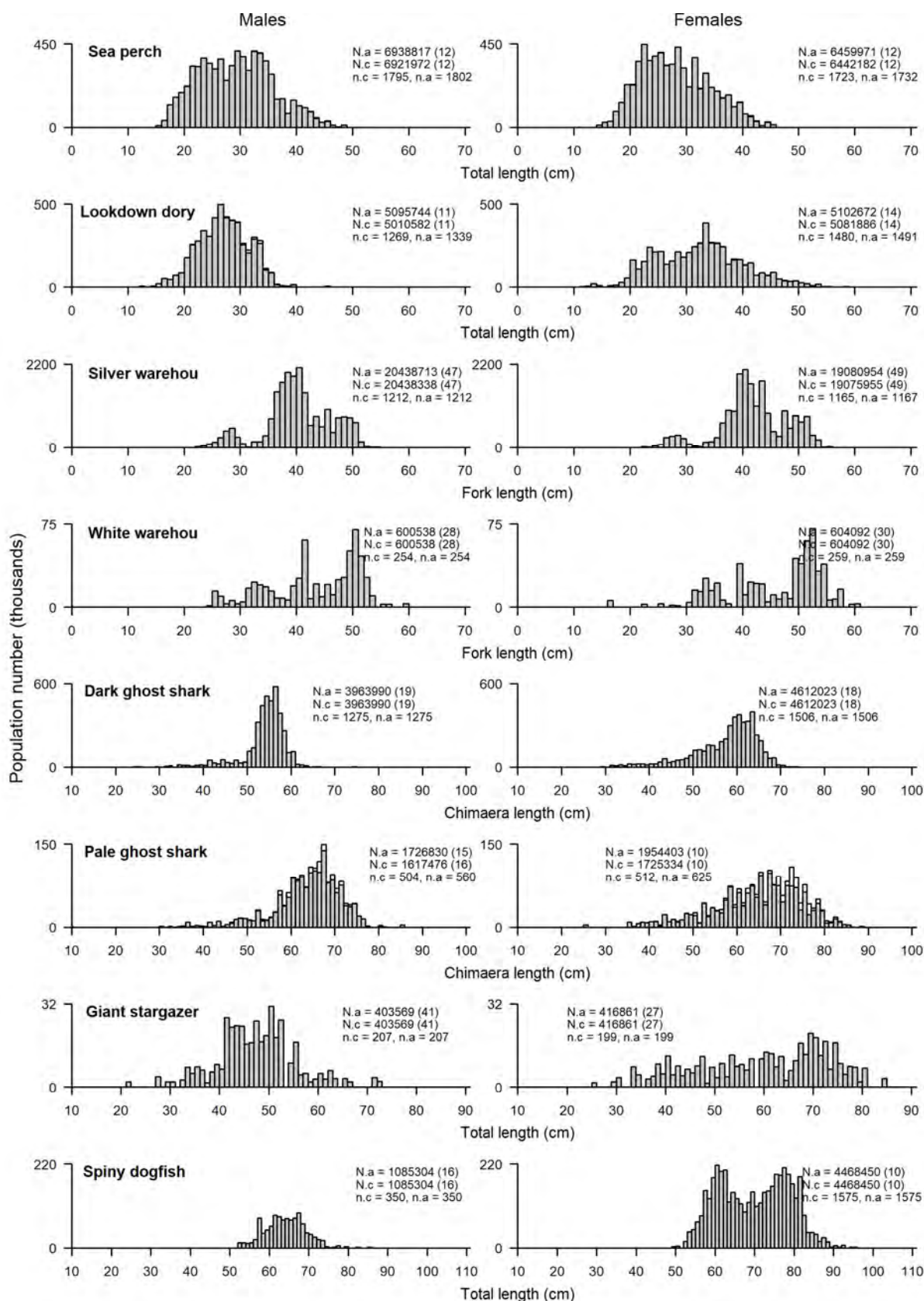


Figure 16a: Length frequency distributions of eight selected commercial species on the Chatham Rise 2024, scaled to population size by sex. N.a, estimated number of male fish (left panel) and female fish (right panel) from all (200–1300 m) strata; N.c, estimated number of male fish (left panel) and female fish (right panel) from core (200–800 m) strata; CV (in parentheses), coefficient of variation; n.c, number of fish measured from core strata; n.a, number of fish measured from all strata. White bars show fish from all strata. Black bars show fish from core strata.

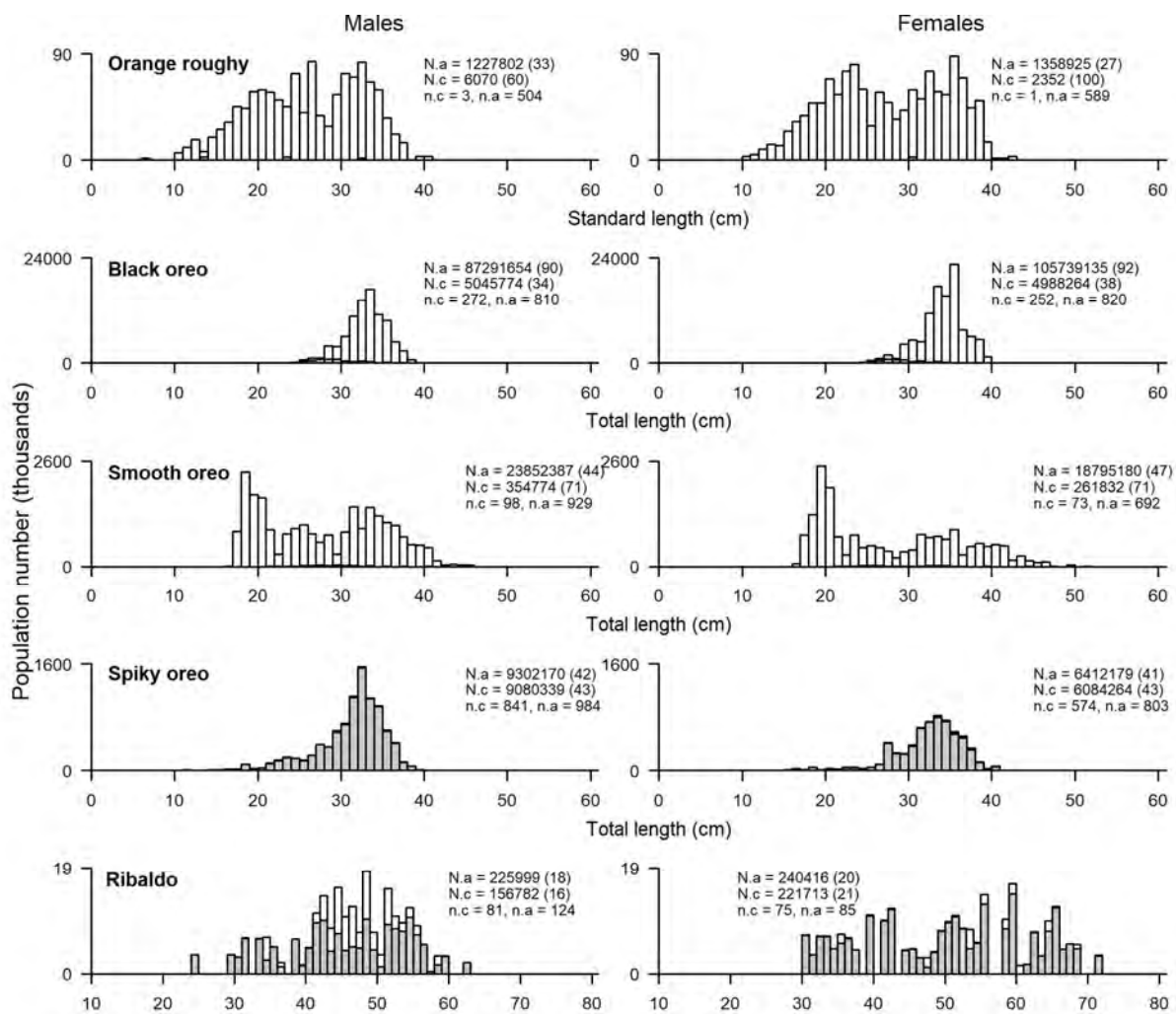


Figure 16b: Length frequencies of orange roughy, oreo species, and other selected deepwater species on the Chatham Rise 2024, scaled to population size by sex. N.a, estimated number of male fish (left panel) and female fish (right panel) from all (200–1300 m) strata; N.c, estimated number of male fish (left panel) and female fish (right panel) from core (200–800 m) strata; CV (in parentheses), coefficient of variation; n.c, number of fish measured from core strata; n.a, number of fish measured from all strata. White bars show fish from all strata. Black bars show fish from core strata.

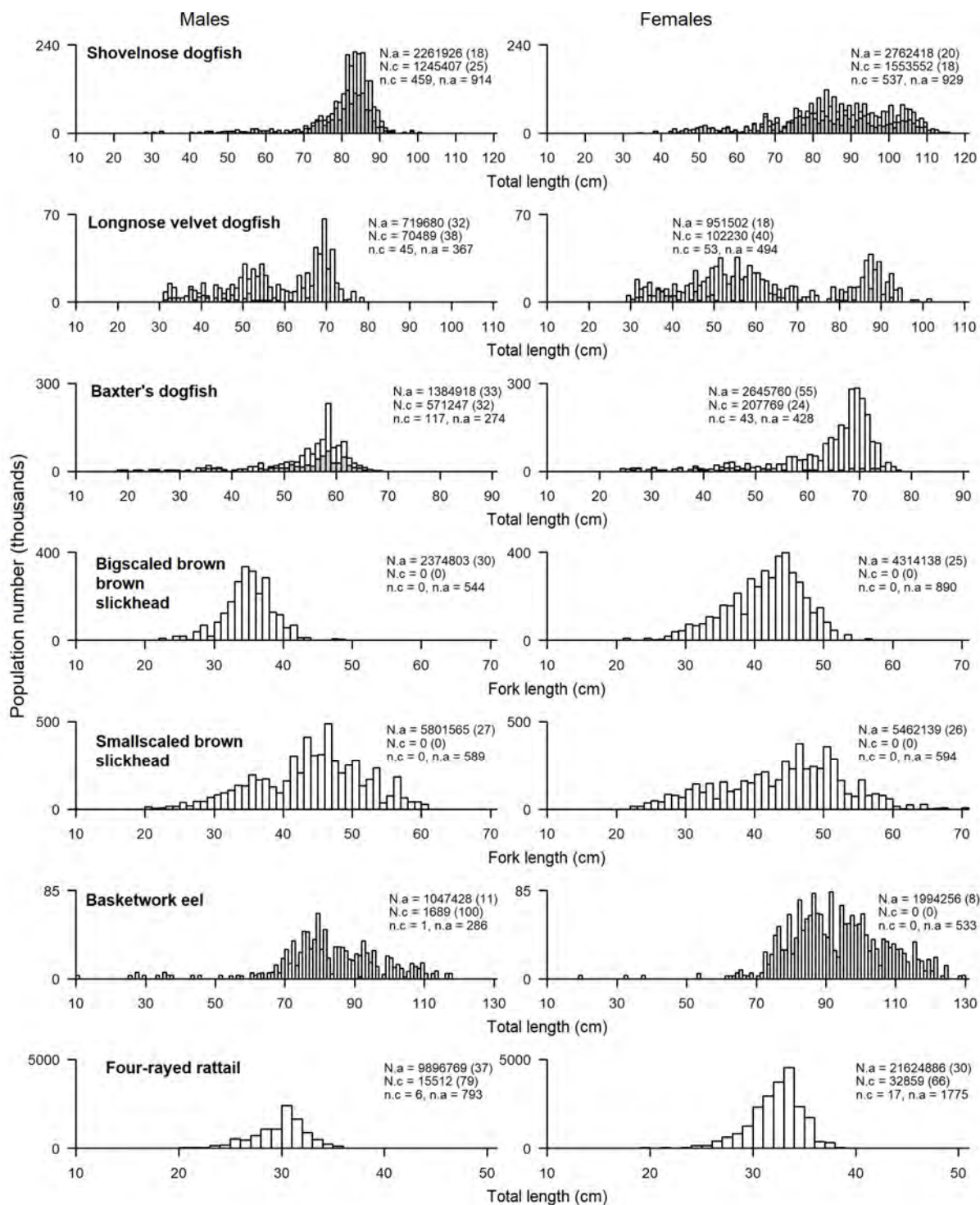


Figure 16b (continued)

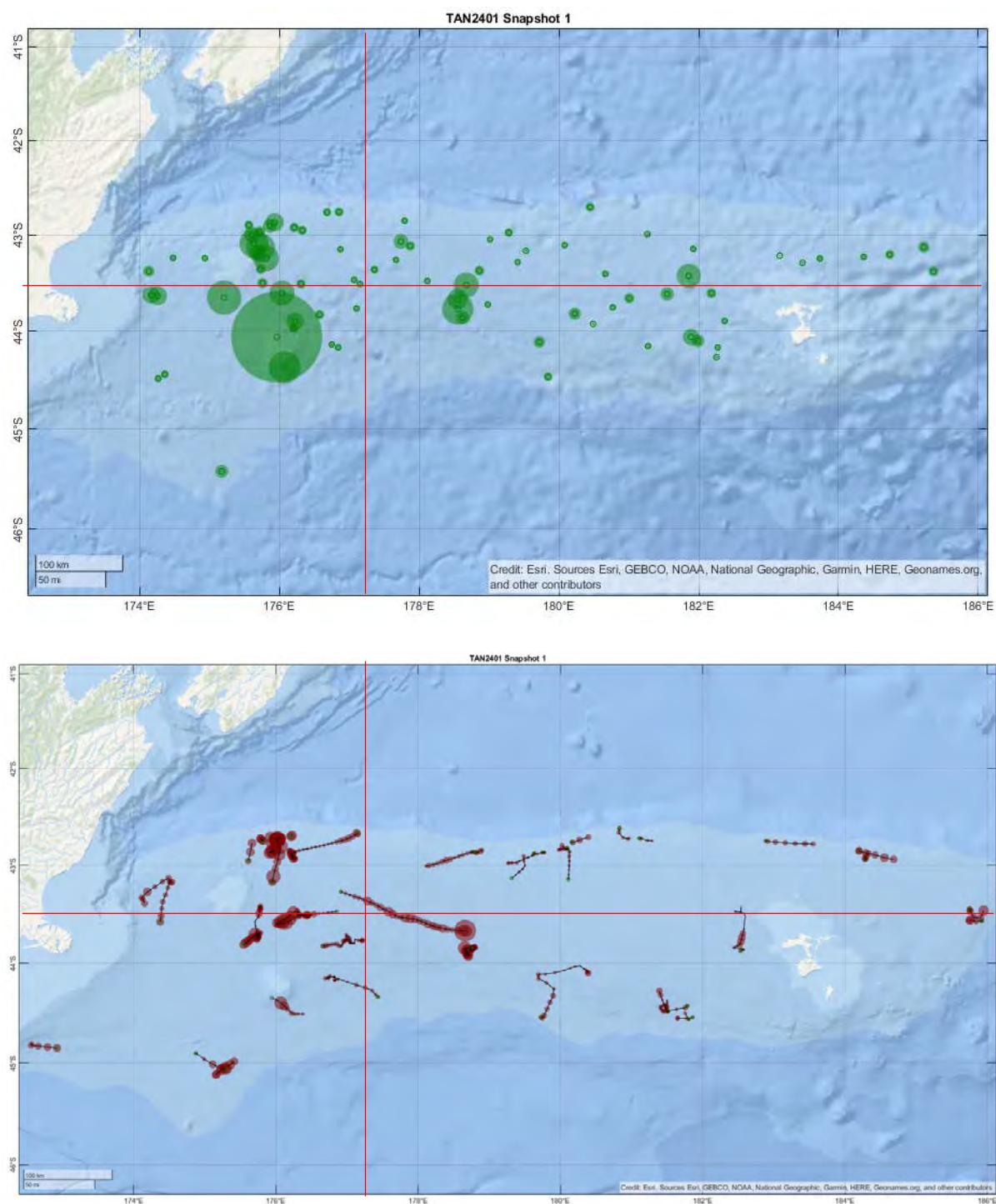


Figure 17: Distribution of total acoustic backscatter through the water column (10 m deep to bottom) (black circles) observed on the Chatham Rise during trawls (upper panel) and night-time steams (lower panel) throughout the entire survey area in January 2024. Horizontal and vertical lines divide the Rise into four subareas (northwest, northeast, southwest, and southeast), Measurement is the (sliced) area backscattering coefficient s_a (in $\text{m}^2 \text{km}^{-2}$) represented in linear scale. A value of $1 \text{ m}^2 \text{km}^{-2}$ is shown as a circle of 0.1 km radius.

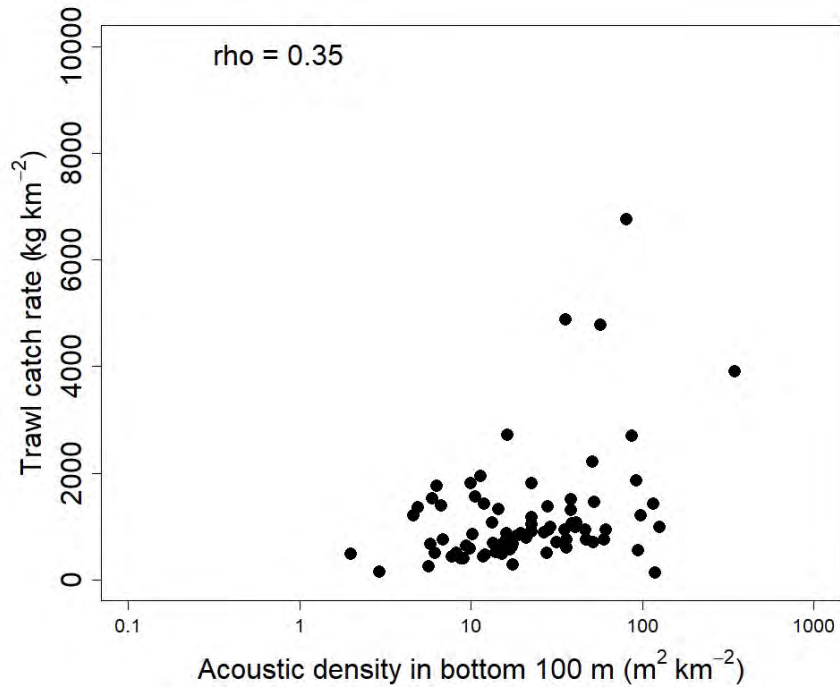


Figure 18: Relationship between total trawl catch rate (all species combined) and bottom-referenced acoustic backscatter recorded during the trawl on the Chatham Rise in 2024. Rho value is Spearman's rank correlation coefficient.

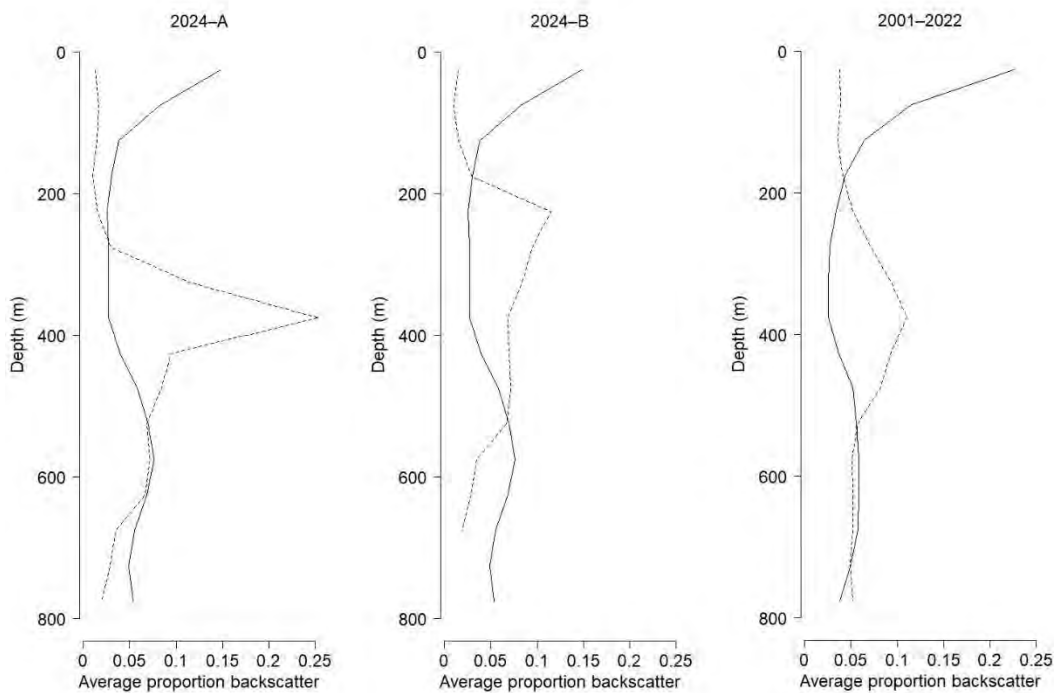


Figure 19: Vertical distribution of the average acoustic backscatter for the day (dashed lines) and at night (solid lines) for the Chatham Rise surveys in 2024 (left and centre plots) and in 2001–22 (right plot, averaged across all previous surveys). Plot on the left (2024–A) shows vertical distribution of the average acoustic backscatter during the daytime in 2024 including core daytime trawl #94 responsible for the peak at 375–425 m. Plot in the centre (2024–B) shows vertical distribution of the average acoustic backscatter during the daytime in 2024 excluding core daytime trawl # 94.

Sv(dB) for GPT 0090720580ea-1 ES38B_ES_31378 : EK80_23_Jan_2024__TAN2401_Snap_1_Trawl_Strat_17_Trans_94

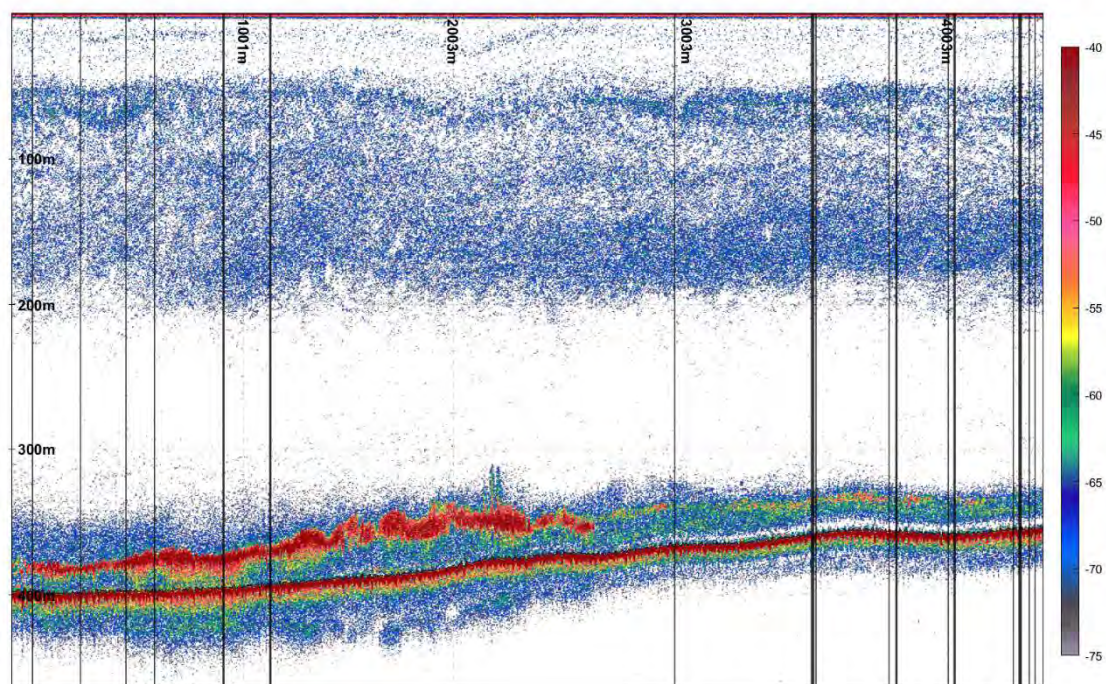


Figure 20: Echogram from daytime trawl #94 in stratum 17 (Southwest Chatham Rise) showing dense marks 100 m off the bottom. Black vertical lines show transmits where data quality was degraded which were removed from analysis.

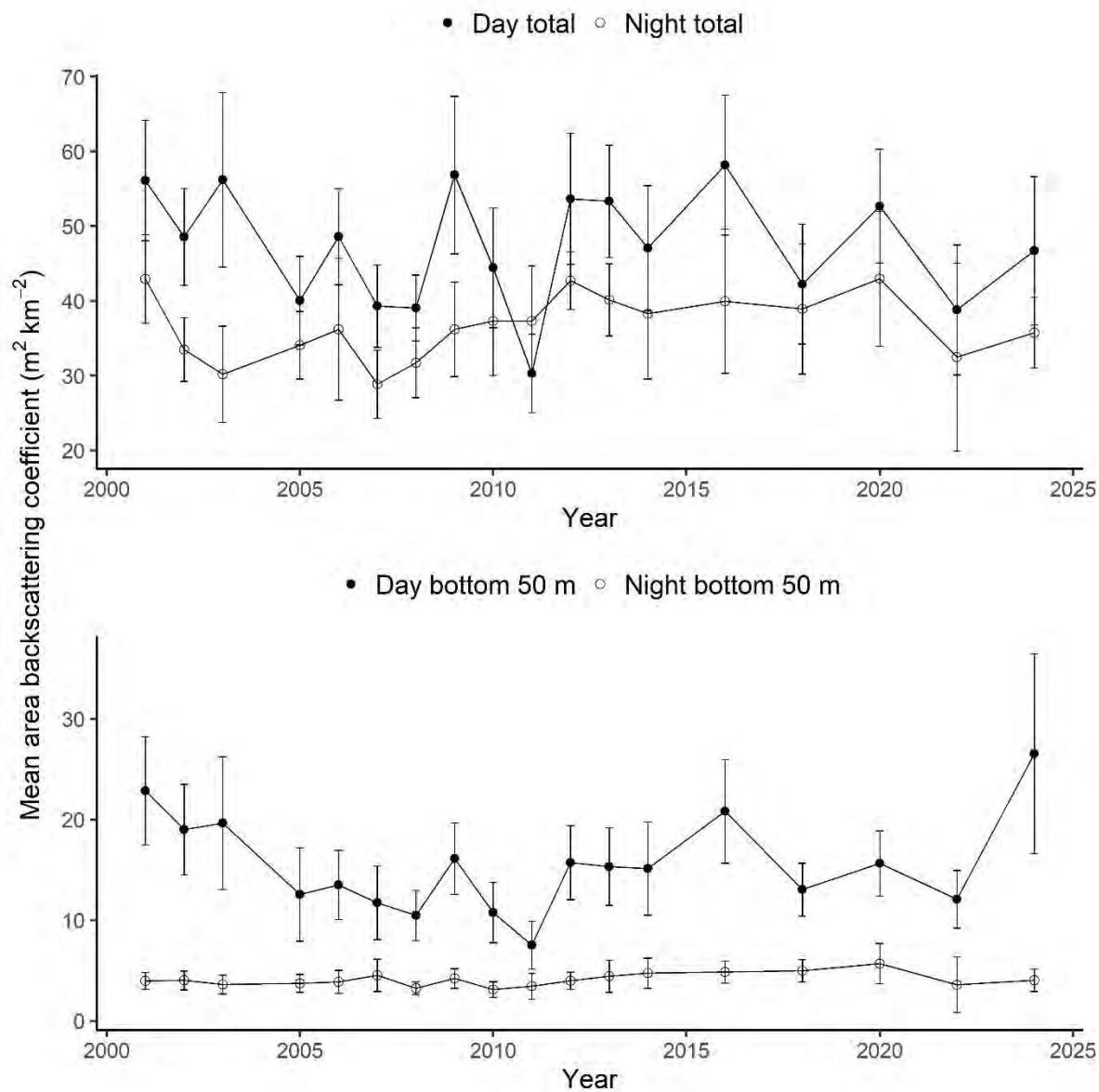


Figure 21: Comparison of relative acoustic abundance indices for the core Chatham Rise area based on (strata-averaged) mean areal backscatter. Error bars are ± 2 standard errors.

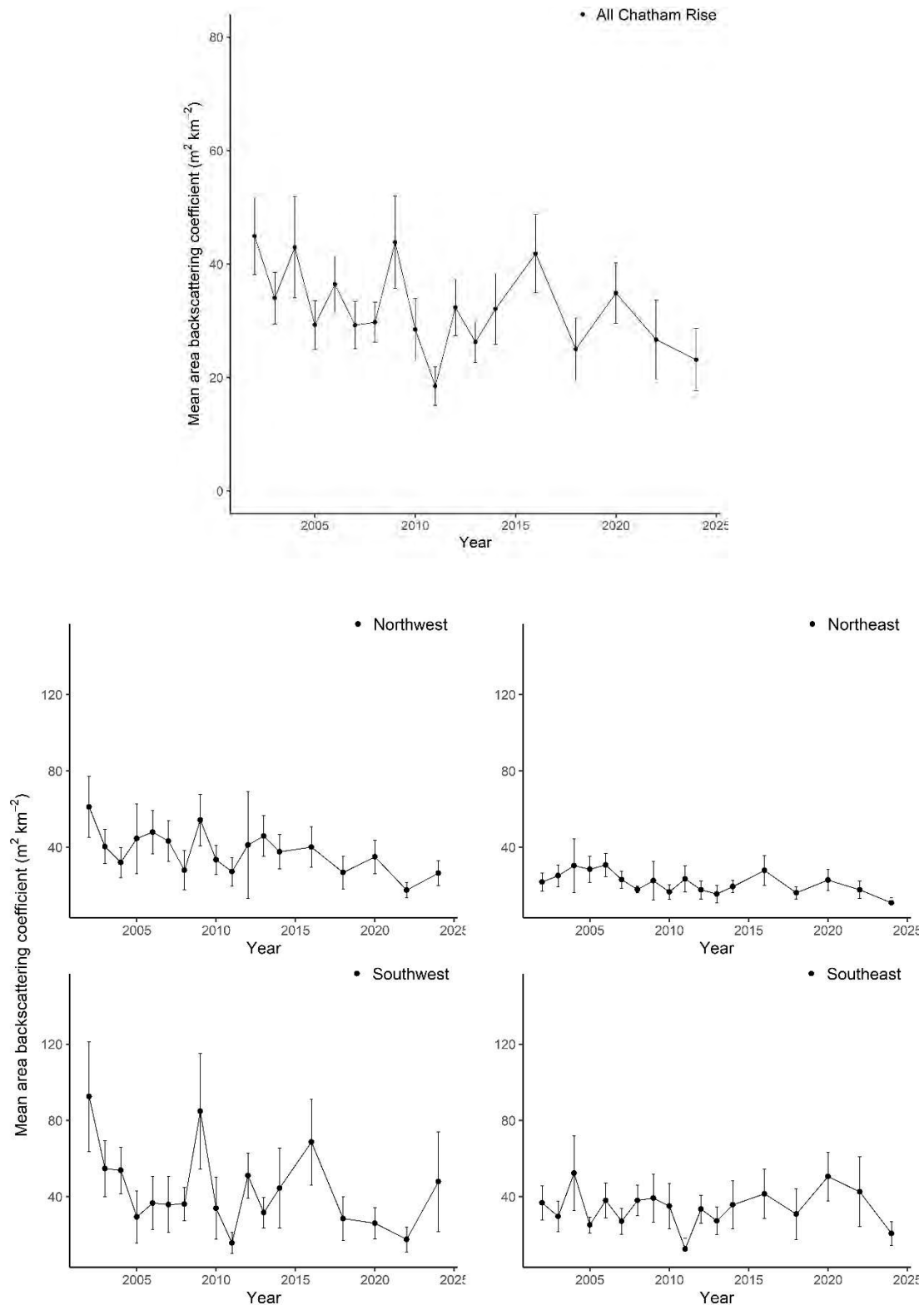


Figure 22: Relative acoustic abundance indices for mesopelagic fish on the Chatham Rise. Indices were derived by multiplying the total backscatter observed at each daytime trawl station by the estimated proportion of night-time backscatter in the same sub-area observed in the upper 200m corrected for the estimated proportion in the surface deadzone. Panels show indices for the entire Chatham Rise and for four sub-areas. Error bars are ± 2 standard errors.

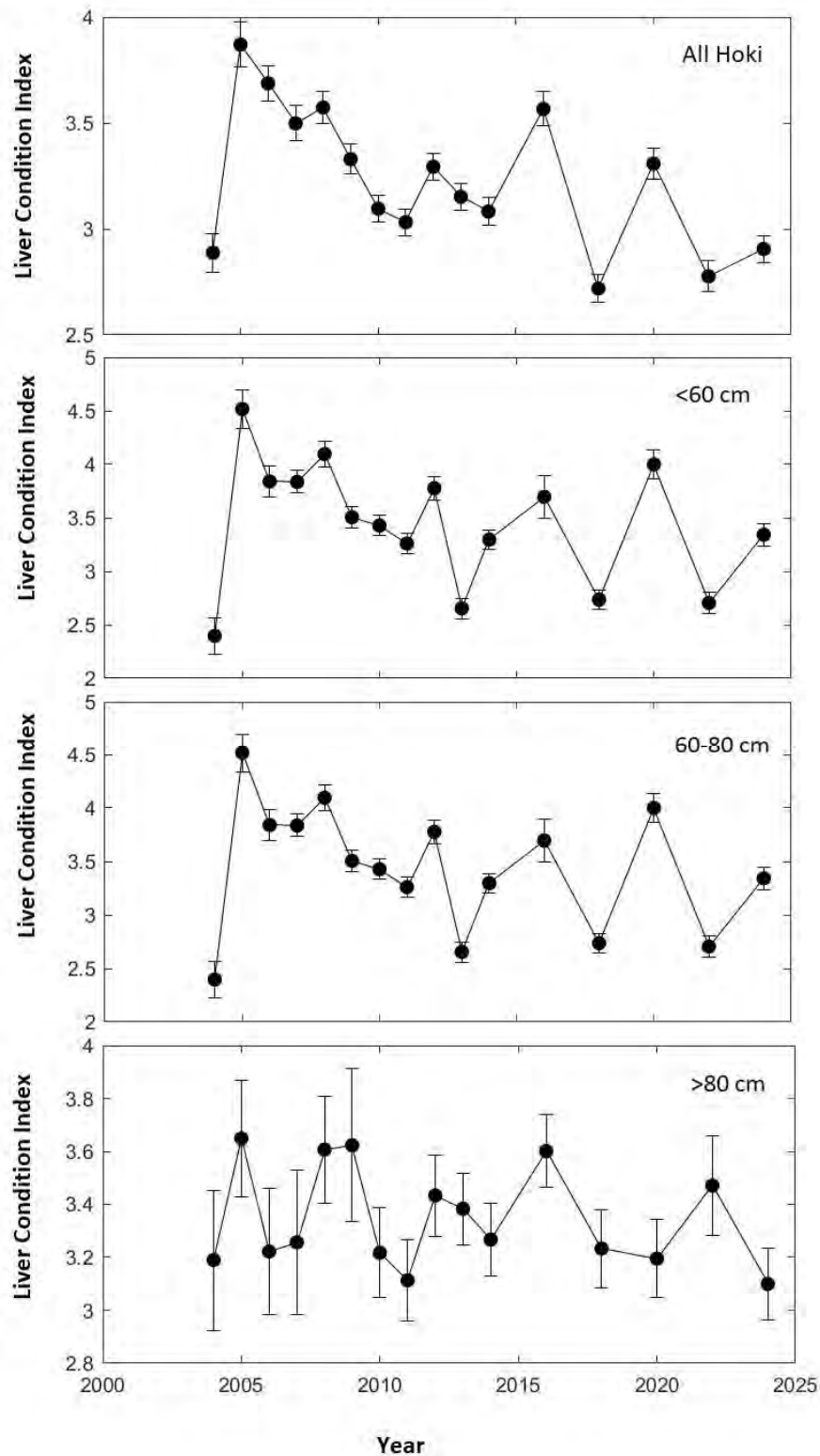


Figure 23: Time-series of hoki liver condition indices on the Chatham Rise from 2004–24. Data are plotted for all hoki, then three different size classes (<60 cm, 60–80 cm, and >80 cm). Error bars show ± 2 standard errors.

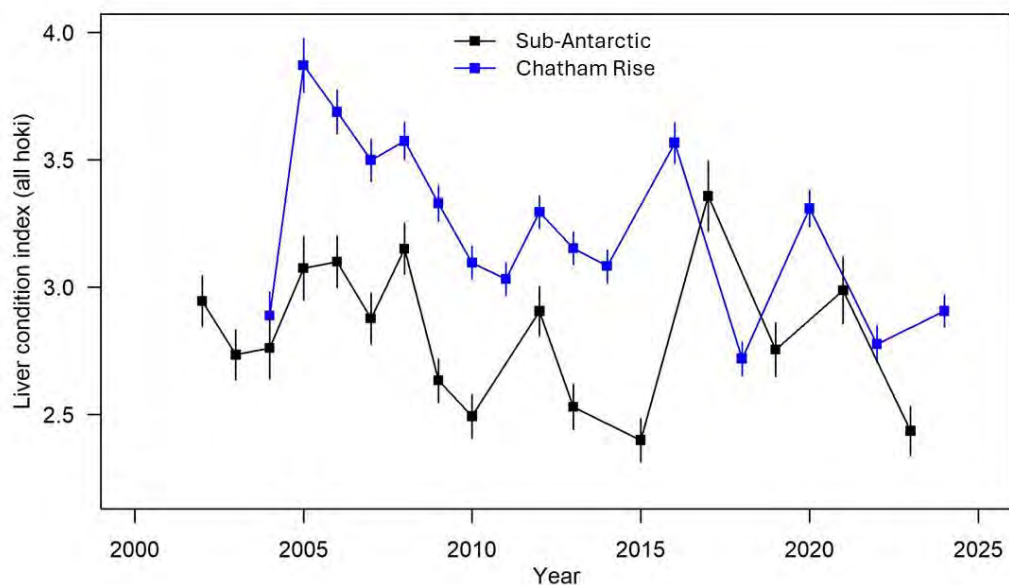


Figure 24: Comparison of time-series of hoki liver condition indices (all sizes combined) on the Chatham Rise with indices from the Sub-Antarctic from 2002–22. Error bars show ± 2 standard errors.

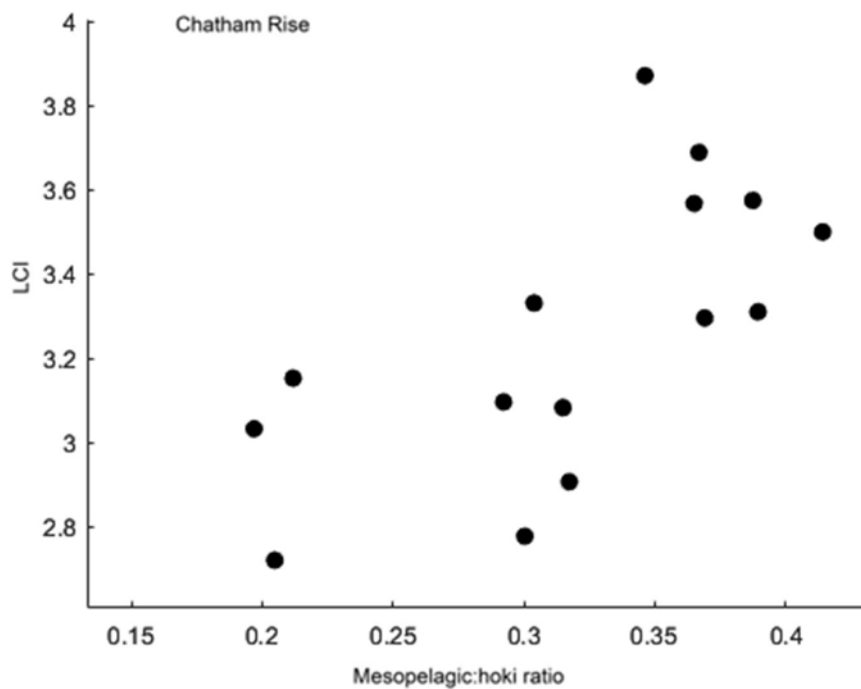


Figure 25: Correlation between hoki liver condition index (LCI) on the Chatham Rise with index of ‘food per fish’ derived by dividing the mesopelagic acoustic index by the estimated hoki biomass. Pearson correlation coefficient is 0.66.

APPENDIX 1: TAN2401 STATION DATA

Individual station data for all stations conducted during the survey (TAN2401). Stn., station number. Type: P1, phase 1 trawl survey biomass tow; P2, phase 2 trawl survey biomass tow. Strat., Stratum number; *, foul trawl stations. Time is NZST, latitude (S), and longitude as degrees and minutes. Dist., distance towed. *, indicates tow was not considered suitable for abundance estimation.

Stn	Date	Start time (NZST)	Stratum	Start latitude (° S)	Start longitude (°)	E or W	Max. depth (m)	Distance towed (n. mile)	Catch hoki (kg)	Catch ling (kg)	Catch hake (kg)
1	5/01/2024	1352	002A	42 45.19	176 44.95	E	720	306	136.0	46.4	0
2	5/01/2024	1700	002A	42 45.11	176 55.00	E	729	315	101.1	0	0
3	5/01/2024	1948	0023	42 39.90	177 03.71	E	1 062	302	2.6	0	0
4	6/01/2024	0542	008A	42 52.66	176 13.97	E	581	313	126.0	83.4	0
5	6/01/2024	0748	008A	42 56.64	176 21.56	E	512	299	234.2	28.2	24.5
6	6/01/2024	1200	0019	43 09.01	176 53.68	E	301	300	114.5	0	0
7	6/01/2024	1500	0019	43 24.97	177 04.51	E	252	306	0	0	0
8	6/01/2024	1736	0019	43 29.46	177 12.10	E	276	304	0	0	0
9	7/01/2024	0527	0019	43 30.63	176 22.74	E	375	305	1 628.7	46.7	2.4
10	7/01/2024	0809	0019	43 36.11	176 06.11	E	361	298	1 205.8	39.1	0
11	7/01/2024	1139	0015	43 50.78	176 14.78	E	501	312	3 864.8	79.6	1.4
12	7/01/2024	1428	0015	43 58.29	176 13.95	E	494	216	705.1	64.9	0.1
13	7/01/2024	1801	0015	43 47.17	176 36.92	E	476	306	461.0	37.4	0
14	8/01/2024	0532	0015	43 45.61	177 10.27	E	498	309	163.0	42.2	1.7
15	8/01/2024	0829	0019	43 21.64	177 23.06	E	256	289	0	0	0
16	8/01/2024	1158	0020	43 14.48	177 40.75	E	313	262	94.3	0.7	0
17	8/01/2024	1451	0020	43 04.07	177 47.31	E	328	219	1 716.5	2.6	0
18	8/01/2024	1738	008A	42 50.90	177 49.64	E	501	302	413.4	57.5	16.1
19*	8/01/2024	2240	0022	42 51.70	178 45.70	E	920	0	0	0	0
20	9/01/2024	0041	0022	42 51.19	178 50.14	E	983	218	66.6	0	11.7
21	9/01/2024	0634	0020	43 03.97	177 52.85	E	358	297	4 136.1	30.8	0
22	9/01/2024	1029	0020	43 28.37	178 08.93	E	355	307	185.2	1.3	0
23	9/01/2024	1351	0020	43 30.65	178 41.55	E	350	304	409.7	24.3	0
24	9/01/2024	1707	0020	43 22.33	178 53.41	E	398	215	266.8	41.6	0
25	9/01/2024	2223	0022	42 53.37	179 33.16	E	839	310	41.2	3.1	0
26	10/01/2024	0031	0022	42 52.25	179 41.69	E	883	304	13.7	8.6	1.6
27	10/01/2024	0537	002A	42 58.50	179 21.06	E	617	319	232.4	18.4	4.9
28	10/01/2024	0828	008B	43 02.21	179 02.88	E	475	303	258.4	19.6	0
29	10/01/2024	1155	008B	43 09.43	179 33.49	E	490	304	252.4	22.6	5.3
30	10/01/2024	1452	008B	43 15.95	179 25.49	E	440	268	350.9	67.2	8.7
31	10/01/2024	1836	0010	43 11.30	179 58.06	W	522	298	106.3	23.8	10.5
32	10/01/2024	2352	021A	42 49.85	179 57.32	W	931	223	24.2	0	9.3
33	11/01/2024	0233	0023	42 45.39	179 53.80	W	1 095	219	0	0	0
34	11/01/2024	0541	0023	42 42.43	179 29.54	W	1 119	307	0	0	0
35	11/01/2024	1024	0010	43 05.82	179 51.06	W	540	306	174.8	34.3	5.8
36	11/01/2024	1613	0010	43 23.70	179 18.23	W	471	305	252.5	7.3	133.6
37*	11/01/2024	2124	0010	43 33.26	179 04.86	W	380	90	0	0	0
38	12/01/2024	0518	0011	43 37.57	178 58.26	W	454	305	486.5	29.5	11.8
39	12/01/2024	0859	0011	43 35.89	178 25.99	W	425	290	162.0	4.5	0
40	12/01/2024	1336	0011	43 08.02	178 01.11	W	509	305	321.0	15.6	10.6
41	12/01/2024	1732	0011	42 58.75	178 40.46	W	536	305	89.7	16.3	0
42	12/01/2024	2144	0023	42 37.00	179 05.04	W	1 281	280	0	0	0
43	13/01/2024	0120	021A	42 43.38	178 57.69	W	999	299	11.7	0	0
44	13/01/2024	0411	021A	42 44.82	178 37.40	W	862	316	62.1	6.9	16.4
45	13/01/2024	1211	0009	43 22.67	178 08.20	W	378	302	99.2	8.7	0
46	13/01/2024	1508	0005	43 33.43	177 48.27	W	398	306	174.8	27.0	0
47	13/01/2024	1800	0005	43 50.87	177 36.88	W	390	304	143.2	13.8	0
48*	14/01/2024	0503	0009	43 27.33	177 27.43	W	271	302	0.9	0	0
49	14/01/2024	0936	0009	43 12.26	176 49.09	W	359	213	0	0	0
50	14/01/2024	1158	0009	43 16.64	176 29.54	W	366	297	129.6	16.6	0
51	14/01/2024	1427	0011	43 13.36	176 14.45	W	479	303	254.0	58.0	13.7
52	14/01/2024	2221	0024	42 44.53	177 11.28	W	1 122	307	0	0	0
53	15/01/2024	0315	0024	42 47.08	176 23.26	W	1 132	305	2.4	0	0
54	15/01/2024	0622	002B	42 56.95	176 13.43	W	770	300	91.8	24.9	12.7
55	15/01/2024	1034	0011	43 12.80	176 00.49	W	543	306	399.4	30.8	15.9

Appendix 1: (continued)

Stn	Date	Start time (NZST)	Stratum	Start latitude (° ' S)	Start longitude (° ')	E or W	Max. depth (m)	Distance towed (n. mile)	Catch hoki (kg)	Catch ling (kg)	Catch hake (kg)
56	15/01/2024	1418	002B	43 10.79	175 37.49	W	688	312	181.5	30.4	16.7
57	15/01/2024	1632	002B	43 11.61	175 32.10	W	705	305	224.0	12.0	0
58	15/01/2024	2052	021B	42 56.76	175 37.45	W	871	301	49.6	0	0
59	15/01/2024	2345	0024	42 51.03	175 42.60	W	1 024	305	63.5	0	6.0
60	16/01/2024	0421	021B	42 57.07	175 11.83	W	990	307	2.0	0	5.0
61	16/01/2024	0851	002B	43 10.92	175 13.09	W	746	306	192.6	7.4	13.3
62	16/01/2024	1258	021B	43 06.13	174 43.82	W	885	302	48.5	0	0
63	16/01/2024	1610	021B	43 21.76	174 35.78	W	844	304	48.5	0	0
64	16/01/2024	1849	021B	43 21.79	174 24.14	W	885	300	21.0	0	0
65	16/01/2024	2145	021B	43 23.50	174 15.06	W	943	307	29.3	0	16.1
66	17/01/2024	0127	0028	43 30.23	174 03.95	W	1 074	304	2.2	0	0
67	17/01/2024	0425	0025	43 36.25	174 16.08	W	911	305	34.3	0	0
68	17/01/2024	2319	0028	44 33.01	178 03.03	W	1 052	305	18.8	0	0
69	18/01/2024	0236	0028	44 33.11	178 16.19	W	1 069	305	2.1	0	0
70	18/01/2024	0934	0012	44 15.52	177 40.78	W	522	300	405.9	100.4	28.7
71	18/01/2024	1153	0012	44 09.03	177 40.53	W	486	304	419.6	49.2	11.2
72	18/01/2024	1409	0012	44 05.89	177 56.29	W	491	305	482.1	25.2	0
73	18/01/2024	1603	0013	44 03.03	178 02.55	W	473	304	364.8	112.5	17.7
74	18/01/2024	1950	0025	44 23.88	178 09.63	W	882	230	19.0	10.8	4.7
75	19/01/2024	0211	0025	44 25.16	178 29.74	W	926	303	41.1	5.0	0
76	19/01/2024	0611	0013	44 08.09	178 41.41	W	486	222	155.8	47.4	0
77	19/01/2024	1029	0003	43 43.63	179 10.63	W	396	286	254.2	13.0	4.8
78	19/01/2024	1350	0003	43 48.82	179 42.24	W	385	304	170.0	40.7	0
79	19/01/2024	1706	0003	43 55.30	179 26.39	W	316	306	169.5	5.6	0
80	19/01/2024	2247	0025	44 22.79	179 54.45	W	960	222	0	0	0
81	20/01/2024	0227	0025	44 21.14	179 59.18	W	965	301	23.4	0	0
82	20/01/2024	1438	0029	44 26.32	179 53.87	E	1 123	303	0	0	0
83	20/01/2024	1855	0029	44 30.11	179 40.07	E	1 283	301	0	0	0
84	21/01/2024	0524	0013	44 03.67	179 38.42	W	444	305	146.3	29.2	0
85	21/01/2024	0911	0004	44 06.58	179 47.22	E	666	298	247.0	59.1	0
86	21/01/2024	1434	0014	43 43.24	179 02.33	E	449	240	570.7	99.8	0
87	21/01/2024	1725	0014	43 45.41	178 35.96	E	435	216	559.0	52.8	8.3
88	22/01/2024	0546	0014	43 51.51	178 41.35	E	506	305	397.0	12.7	0
89	22/01/2024	1205	0026	44 07.35	177 36.74	E	921	214	3.3	0	3.4
90	22/01/2024	1547	0026	44 10.99	177 22.71	E	928	221	2.4	0	4.3
91	22/01/2024	1932	0029	44 20.03	177 21.31	E	1 168	304	0	0	0
92	23/01/2024	0551	0004	44 09.41	176 53.05	E	697	241	291.1	31.3	0
93	23/01/2024	0810	0004	44 07.40	176 48.31	E	640	269	368.3	43.9	0
94	23/01/2024	1306	0017	44 03.07	176 00.59	E	378	216	1 009.9	0	0
95	23/01/2024	1701	0017	44 21.21	176 07.84	E	337	251	0	0	0
96	23/01/2024	1838	0017	44 22.02	176 00.60	E	290	280	0	0	0
97	23/01/2024	2257	0026	44 30.43	176 20.20	E	890	276	20.3	0	0
98	24/01/2024	0520	0027	44 35.01	175 46.29	E	849	154	24.4	0	0
99	24/01/2024	1220	0006	44 26.32	174 25.72	E	725	303	293.5	7.1	0
100	24/01/2024	1502	0006	44 29.00	174 20.25	E	752	305	166.8	31.3	0
101	24/01/2024	2352	0030	45 00.59	175 21.87	E	1 214	303	0	0	0
102	25/01/2024	0348	0030	45 04.09	175 13.31	E	1 216	306	0	0	0
103	25/01/2024	0853	0030	45 23.48	175 13.76	E	1 259	303	0	0	0
104	25/01/2024	2251	0027	44 47.41	172 37.41	E	943	304	42.2	0	0
105	26/01/2024	0222	0027	44 42.90	173 05.47	E	873	155	40.5	0	0
106	26/01/2024	0955	0006	44 38.71	173 19.50	E	798	282	176.6	30.7	0
107	26/01/2024	1425	0016	44 36.73	172 49.17	E	435	240	941.1	66.0	0
108	27/01/2024	1249	0016	44 01.72	174 10.81	E	540	216	1 301.3	31.1	0
109	27/01/2024	1643	007A	43 37.24	174 11.83	E	521	217	1 080.7	52.7	0
110	27/01/2024	1819	007A	43 37.77	174 17.59	E	555	288	669.6	49.6	6.6
111	28/01/2024	0612	007A	43 20.17	174 09.25	E	581	301	688.1	55.9	1.2
112	28/01/2024	0930	007A	43 12.59	174 29.20	E	560	294	515.8	66.1	8.0
113	28/01/2024	1307	0018	43 13.81	174 56.60	E	248	304	0	0	0

Appendix 1: (continued)

Stn	Date	Start time (NZST)	Stratum	Start latitude (° ' S)	Start longitude (° ')	E or W	Max. depth (m)	Distance towed (n. mile)	Catch hoki (kg)	Catch ling (kg)	Catch hake (kg)
114	28/01/2024	1815	007B	42 59.89	175 39.91	E	530	271	514.8	33.9	6.5
115	28/01/2024	2135	0022	42 44.69	175 44.24	E	913	295	237.2	0	3.3
116	29/01/2024	0042	0022	42 43.04	175 50.97	E	950	304	45.6	0	0
117	29/01/2024	0614	0001	42 50.98	175 59.36	E	657	278	169.9	11.4	5.8
118	29/01/2024	0832	0001	42 54.12	175 54.30	E	619	299	285.6	47.4	18.6
119	29/01/2024	1226	0001	42 53.41	175 36.12	E	633	301	137.1	30.0	14.0
120	29/01/2024	1539	007B	43 09.50	175 42.49	E	433	213	1 247.1	46.2	5.4
121	29/01/2024	1815	007B	43 14.55	175 52.48	E	445	211	1 974.6	114.1	3 161.2
122	30/01/2024	0209	0022	42 42.62	176 08.47	E	852	304	70.9	10.4	9.4
123	30/01/2024	0424	0022	42 40.90	176 20.52	E	903	278	14.9	0	4.8
124	30/01/2024	1053	0018	43 19.36	175 45.03	E	314	303	219.6	0	0
125	30/01/2024	1604	0018	43 38.83	175 15.26	E	316	205	458.4	0	0
126	30/01/2024	1837	0016	43 48.13	175 27.19	E	430	300	263.0	35.4	0
127	31/01/2024	0541	0018	43 28.05	175 46.16	E	314	217	1 216.2	0.3	0
128	31/01/2024	0855	007B	43 07.32	175 45.56	E	471	216	660.5	60.5	32.2
129	31/01/2024	1137	007B	43 04.50	175 39.58	E	464	235	2 374.7	85.2	6.8
130	31/01/2024	1409	007B	42 57.94	175 45.13	E	562	303	166.5	83.8	54.3
131	1/02/2024	0539	0020	43 39.96	178 37.32	E	399	309	336.2	72.5	0
132	1/02/2024	0948	0020	43 36.31	178 11.60	E	380	288	99.7	17.6	0
133	1/02/2024	1148	0020	43 37.46	178 10.03	E	384	303	233.5	14.1	0
134	1/02/2024	1609	0020	43 17.88	177 33.90	E	266	304	0	0	0

APPENDIX 2: SPECIES CAUGHT DURING TAN2401

Scientific and common names of species caught from all core and deep tows (TAN2401). The occurrence (Occ.) of each species (number of tows caught) in all 130 core and deep tows is also shown. Note that species codes are continually updated on the database following this and other surveys.

Scientific name	Common name	Species	Occ.
Algae	unspecified seaweed	SEO	6
Phaeophyta	brown seaweed	PHA	1
Porifera	unspecified sponges	ONG	2
Demospongiae (siliceous sponges)			
Astrophorida (sandpaper sponges)			
Ancorinidae			
<i>Ecionemia novaezelandiae</i>	knobbly sandpaper sponge	ANZ	5
Geodiidae			
<i>Geodia regina</i>	curling stone sponge	GRE	1
Pachastrellidae			
<i>Thenia novaezelandiae</i>	yoyo sponge	THN	7
Hadromerida (woody sponges)			
Suberitidae			
<i>Suberites affinis</i>	fleshy club sponge	SUA	7
Spirophorida (spiral sponges)			
Tetillidae			
<i>Tetilla australe</i>	bristle ball sponge	TTL	1
<i>T. leptoderma</i>	furry oval sponge	TLD	4
Hexactinellida (glass sponges)		GLS	2
Hexactinosida (lacey honeycomb sponges)			
Lyssacinosida (glass horn sponges)			
Euplectellidae			
<i>Euplectella regalis</i>	basket-weave horn sponge	ERE	1
<i>Hyalascus</i> sp.	floppy tubular sponge	HYA	34
Poecilosclerida (bright sponges)			
Coelosphaeridae			
<i>Lissodendoryx bifacialis</i>	floppy chocolate plate sponge	LBI	5
Hymedesmiidae			
<i>Phorbas</i> spp.	grey fibrous massive sponge	PHB	1
Cnidaria			
Scyphozoa	unspecified jellyfish	JFI	47
Anthozoa			
Octocorallia			
Malacalcyonacea/Scleralcyonacea	gorgonian octocoral	GOC	1
Scleralcyonacea		SOC	2
Coralliidae			
<i>Anthomastus (Bathyalcyon) robustus</i>	gigantic coral	ARO	1
Primnoidae			
<i>Thouarella</i> spp.	bottlebrush coral	THO	2
Isididae (bamboo corals)		ISI	1
<i>Keratosia</i> spp.	branching bamboo coral	BOO	1
Pennatulacea (sea pens)	unspecified sea pens	PTU	29
Pennatulidae			
<i>Pennatula</i> spp.	purple sea pen	PNN	1
Hexacorallia			
Actinaria (anemones)	unspecified anemone	ANT	1
Actiniidae			
<i>Bolocera</i> spp.	deepsea anemone	BOC	4
Actinostolididae (smooth deepsea anemones)		ACS	46
Hormathiidae (warty deepsea anemones)		HMT	30
Corallimorpharia (coral-like anemones)		CLM	4

Appendix 2 (continued)

Scientific name	Common name	Species	Occ.
Scleractinia (stony corals)			
Caryophyllidae			
<i>Desmophyllum dianthus</i>	crested cup coral	DDI	1
<i>Goniocorella dumosa</i>	bushy hard coral	GDU	5
<i>Stephanocyathus platypus</i>	solitary bowl coral	STP	5
Flabellidae			
<i>Flabellum</i> spp.	flabellum coral	COF	8
Zoantharia (zoanthids)			
Epizoanthidae			
<i>Epizoanthus</i> sp.		EPZ	6
Hydrozoa (hydroids)	unspecified hydroids	HDR	3
Siphonophorae (siphonophores)	unspecified siphonophores	ZSP	3
Tunicata			
Ascidacea (sea squirts)		ASC	2
Thaliacea			
Pyrosomida (pyrosomes)			
Pyrosomatidae			
<i>Pyrosoma atlanticum</i>		PYR	73
Salpida (salps)	unspecified salps	SAL	6
Salpidae			
<i>Soestia zonaria</i>		ZZO	1
<i>Thetys vagina</i>		ZVA	82
Mollusca			
Gastropoda (gastropods)			
Buccinidae (whelks)			
<i>Penion chathamensis</i>		PCH	6
Nudibranchia (nudibranchs)		NUD	3
Ranellidae (tritons)			
<i>Fusitriton magellanicus</i>		FMA	21
Volutidae (volutes)			
<i>Provocator mirabilis</i>	golden volute	GVO	1
Cephalopoda			
Teuthoidea (squids)	unspecified squid	SQX	2
Sepiida			
Sepiolida (bobtail squids)			
Sepiadariidae			
<i>Sepioloidea virgilioi</i>	bobtail squid	SSQ	1
Oegopsida			
Enoploteuthididae			
<i>Enoploteuthis</i> spp.	squid	ESQ	1
Neoteuthidae			
<i>Nototeuthis dimegacotyle</i>	squid	SQX	1
Histioteuthidae (violet squids)			
<i>Histioteuthis atlantica</i>	violet squid	HAA	1
<i>H. macrohista</i>	violet squid	HMC	1
<i>H. spp.</i>	violet squid	VSQ	7
Octopoteuthidae			
<i>Octopoteuthis</i> spp.	squid	OPO	3
Pholidoteuthidae			
<i>Pholidoteuthis</i> spp.	large red scaly squid	PSQ	1
Ommastrephidae			
<i>Nototodaros sloanii</i>	Sloan's arrow squid	NOS	47
<i>Todarodes filippovae</i>	Todarodes squid	TSQ	42

Appendix 2 (continued)

Scientific name	Common name	Species	Occ.
Cranchiidae	unspecified cranchiid	CHQ	1
<i>Teuthowenia pellucida</i>	squid	TPE	5
Onychoteuthidae			
<i>Brachioeteuthis</i> spp.	squid	SQB	1
<i>Moroteuthopsis ingens</i>	rough-skinned clubhook squid	MIQ	71
<i>Notonykia</i> spp.	squid	NON	1
<i>Onykia robsoni</i> / <i>O. n. sp.</i> 'splendens'	slender clubhook squid	MRQ	12
Octopodiformes			
Octopoda			
Cirrata (cirrate octopus)			
Opisthoteuthidae			
<i>Opisthoteuthis</i> spp.	umbrella octopus	OPI	2
Incirrata (incirrate octopus)			
Amphitretidae			
<i>Amphitretus</i> sp.	deepwater octopod	AMP	1
Octopodidae			
<i>Enteroctopus zealandicus</i>	yellow octopus	EZE	3
<i>Graneledone kubodera</i> & <i>G. taniwha</i>	deepwater octopus	DWO	6
<i>Octopus</i> spp.	octopus	OCO	1
Polychaeta	unspecified polychaete	POL	1
Eunicidae		EUN	4
Onuphidae			
<i>Hyalinoecia tubicola</i>	quill worm	HTU	2
Crustacea	unspecified crustacean	CRU	1
Malacostraca			
Decapoda			
Dendrobranchiata			
Aristeidae			
<i>Aristaeomorpha foliacea</i>	royal red prawn	AFO	1
<i>Austropenaeus nitidus</i>	prawn	ANI	2
Sergestidae			
<i>Sergia potens</i>	prawn	SEP	2
Solenoceridae			
<i>Haliporoides sibogae</i>	jackknife prawn	HSI	1
Pleocyemata			
Axiidea			
Axiidae			
<i>Spongiaxius novaezealandiae</i>	prawn	NAT	2
Caridea			
Campylonotidae			
<i>Campylonotus rathbunae</i>	sabre prawn	CAM	2
Oplophoridae			
<i>AcanthePHYra</i> spp.	Sub-Antarctic ruby prawn	ACA	6
<i>Notostomus auriculatus</i>	scarlet prawn	NAU	1
<i>Oplophorus</i> spp.	deepwater prawn	OPP	4
Pandalidae			
<i>Notopandalus magnoculus</i>	deepwater prawn	NMA	2
Pasiphaeidae			
<i>Pasiphaea barnardi</i>	deepwater prawn	PBA	11
Nematocarcinidae			
<i>Lipkius holthuisi</i>	omega prawn	LHO	28
<i>Nematocarcinus</i> spp.	spider prawn	NEC	3

Appendix 2 (continued)

Scientific name	Common name	Species	Occ.
Achelata			
Astacidea			
Nephropidae (clawed lobsters)			
<i>Metanephrops challengeri</i>	scampi	SCI	39
Palinura			
Polychelidae			
<i>Polycheles</i> spp.	deepsea blind lobster	PLY	8
Anomura			
Chirostyloidea			
Chirostylidae			
<i>Gastroptychus</i> spp.		GAT	2
<i>Uroptychus</i> spp.		URP	1
Galatheaidea			
Munididae			
<i>Grimothea gregaria</i>		MGA	1
Lithodidae (king crabs)			
<i>Lithodes aotearoa</i>	New Zealand king crab	LAO	4
<i>Neolithodes brodiei</i>	Brodie's king crab	NEB	8
<i>Paralomis zealandica</i>	prickly king crab	PZE	2
Paguroidea (hermit crabs)	unspecified hermit crab	PAG	7
Paguridae (Parapagurid hermit crabs)			
<i>Diacanthurus rubricatus</i>	hermit crab	DIR	5
Parapaguridae (Parapagurid hermit crabs)			
<i>Sympagurus dimorphus</i>	hermit crab	SDM	18
Lophogastrida			
Gnathophausiidae			
<i>Neognathophausia ingens</i>	giant red mysid	NEI	1
Brachyura (true crabs)	unspecified crab	CRB	3
Atelecyclidae			
<i>Pteropeltarion novaezealandiae</i>	Pteropeltarion crab	PNO	1
<i>Trichopeltarion fantasticum</i>	frilled crab	TFA	9
Goneplacidae			
<i>Pycnoplax victoriensis</i>	two-spined crab	CVI	2
Homolidae			
<i>Dagnaudus petterdi</i>	antlered crab	DAP	13
Inachidae			
<i>Vitjazmaia</i> cf. <i>latidactyla</i>	deep-sea spider crab	VIT	3
Majidae (spider crabs)			
<i>Jacquiniotia edwardsii</i>	giant spider crab	GSC	2
<i>Leptomithrax garricki</i>	Garrick's masking crab	GMC	2
<i>Teratomaia richardsoni</i>	spiny masking crab	SMK	7
Portunidae (paddle crabs)			
<i>Nectocarcinus antarcticus</i>	hairy red swimming crab	NCA	1
<i>N. bennetti</i>	smooth red swimming crab	NCB	2
<i>Ovalipes mollerii</i>	swimming crab	OVM	2
Echinodermata			
Asterozoa			
Asteroidea (starfish)	unspecified starfish	ASR	2
Asteriidae			
<i>Sclerasterias mollis</i>	cross-fish	SMO	6
Astropectinidae			
<i>Dipsacaster magnificus</i>	magnificent sea-star	DMG	25
<i>Plutonaster knoxi</i>	abyssal star	PKN	23
<i>Proserpinaster neozelanicus</i>	starfish	PNE	16
<i>Psilaster acuminatus</i>	geometric star	PSI	22

Appendix 2 (continued)

Scientific name	Common name	Species	Occ.
Benthopectinidae			
<i>Benthopecten</i> spp.	starfish	BES	4
<i>Cheiraster monopedicellaris</i>	starfish	CMP	2
Brisingida	unspecified brisingid	BRG	28
Goniasteridae			
<i>Hippasteria phrygiana</i>	trojan starfish	HTR	16
<i>Lithosoma novaezelandiae</i>	rock star	LNV	1
<i>Mediaster sladeni</i>	starfish	MSL	12
<i>Pillsburiaster aoteanus</i>	starfish	PAO	10
Solasteridae			
<i>Crossaster multispinus</i>	sun star	CJA	7
<i>Solaster torulatus</i>	chubby sun-star	SOT	12
Stichasteridae			
<i>Cosmasterias dyscrita</i>	cat's-foot star	CDY	4
<i>Pseudechinaster rubens</i>	starfish	PRU	21
Pterasteridae			
<i>Diplopteraster</i> sp.	starfish	DPP	3
Zoroasteridae			
<i>Zoroaster</i> spp.	rat-tail star	ZOR	53
Ophiuroidea (basket & brittle stars)	unspecified brittle star	OPH	1
Euryalina (basket stars)			
Gorgonocephalidae			
<i>Gorgonocephalus</i> spp.	Gorgon's head basket stars	GOR	5
Ophiurida (brittle stars)			
Ophiuridae			
<i>Ophiomusium lymani</i>	deepsea brittle star	OLY	7
Crinozoa (crinoids)			
Comatulida (feather stars)		CMT	1
Echinozoa			
Echinoidea (sea urchins)			
Crinoidea			
Regularia			
Cidaridae			
<i>Goniocidaris parasol</i>	parasol urchin	GPA	8
Histiocidaridae			
<i>Histiocidaris</i> spp.	cidarid urchin	HIS	3
<i>Poriocidaris purpurata</i>	cidarid urchin	PCD	1
Echinothuriidae/Phormosomatidae	unspecified Tam O'Shanter urchin	TAM	57
Echinothuriidae (Tam O'Shanter)	unspecified Tam O'Shanter urchin	ECT	3
Phormosomatidae			
<i>Phormosoma</i> spp.		PHM	3
Echinidae			
<i>Dermechinus horridus</i>	deepsea urchin	DHO	2
<i>Gracilechinus multidentatus</i>	deepsea kina	GRM	26
Spatangoida (heart urchins)			
Spatangidae			
<i>Spatangus multispinus</i>	purple-heart urchin	SPT	22
Holothuroidea	unspecified holothurian	HTH	4
Aspidochirotida			
Synallactidae			
<i>Bathyplores</i> sp.	sea cucumber	BAM	8
<i>Pseudostichopus mollis</i>	sea cucumber	PMO	41
Elasipodida			
Laetmogonidae			
<i>Laetmogone</i> sp.	sea cucumber	LAG	9
<i>Pannychia moseleyi</i>	sea cucumber	PAM	1

Appendix 2 (continued)

Scientific name	Common name	Species	Occ.
Pelagothuridae			
<i>Enypniastes eximia</i>	sea cucumber	EEX	1
Psychropotidae			
<i>Benthodytes</i> sp.	sea cucumber	BTD	3
Brachiopoda	unspecified brachiopod	BPD	1
Chondrichthyes (cartilaginous fishes)			
Chimaeridae: chimaeras, ghost sharks			
<i>Chimaera carophila</i>	brown chimaera	CHP	10
<i>Hydrolagus bemisi</i>	pale ghost shark	GSP	75
<i>H. homonycteris</i>	black ghost shark	HYB	1
<i>H. novaezealandiae</i>	dark ghost shark	GSH	52
<i>H. trolli</i>	pointynose blue ghost shark	HYP	2
Rhinochimaeridae: longnosed chimaeras			
<i>Harriotta raleighana</i>	longnose spookfish	LCH	69
<i>Rhinochimaera pacifica</i>	Pacific spookfish	RCH	28
Scyliorhinidae: cat sharks			
<i>Apristurus exsanguis</i>	New Zealand catshark	AEX	19
<i>A. garracki</i>	Garrick's catshark	AGK	5
<i>A. melanoasper</i>	fleshynose catshark	AML	3
<i>A. cf. sinensis</i>	freckled catshark	ASI	6
<i>Bythaelurus dawsoni</i>	Dawson's catshark	DCS	1
<i>Cephaloscyllium isabella</i>	carpet shark	CAR	1
Triakidae: smoothhounds			
<i>Galeorhinus galeus</i>	school shark	SCH	9
Hexanchidae: cow sharks			
<i>Heptanchias perlo</i>	sharpnose sevengill shark	HEP	1
Squalidae: dogfishes			
<i>Squalus acanthias</i>	spiny dogfish	SPD	72
<i>S. griffini</i>	northern spiny dogfish	NSD	2
Centrophoridae: gulper sharks			
<i>Centrophorus squamosus</i>	leafscale gulper shark	CSQ	16
<i>Deania</i> spp.	shovelnose spiny dogfish	SND	59
Etmopteridae: lantern sharks			
<i>Etmopterus granulosus</i>	Baxter's dogfish	ETB	43
<i>E. lucifer</i>	lucifer dogfish	ETL	53
<i>E. viator</i>	blue-eye lantern dogfish	EVI	3
Somniosidae: sleeper sharks			
<i>Centroscyrnus owstoni</i>	Owston's dogfish	CYO	25
<i>C. crepidater</i>	longnose velvet dogfish	CYP	45
<i>Scymnodon macracanthus</i>	Plunket's shark	PLS	6
Oxynotidae: rough sharks			
<i>Oxynotus bruniensis</i>	prickly dogfish	PDG	7
Dalatiidae: kitefin sharks			
<i>Dalatias licha</i>	seal shark	BSH	24
Torpedinidae: electric rays			
<i>Tetronarce nobiliana</i>	electric ray	ERA	4
Narkidae: numbfishes, sleeper rays			
<i>Typhlonarke</i> spp.	numbfish	BER	4
Rajidae: skates			
<i>Amblyraja hyperborea</i>	deepwater spiny skate	DSK	3
<i>Dipturus innominatus</i>	smooth skate	SSK	26
<i>Zearaja nasuta</i>	rough skate	RSK	1

Appendix 2 (continued)

Scientific name	Common name	Species	Occ.
Arhynchobatidae: softnose skates			
<i>Bathraja shuntovi</i>	longnosed deepsea skate	PSK	12
<i>Brochiraja asperula</i>	smooth deepsea skate	BTA	16
<i>B. leviveneta</i>	blue skate	BRL	1
<i>B. spinifera</i>	prickly deepsea skate	BTS	13
<i>Notoraja alisae</i>	velcro skate	NAL	1
Osteichthyes (bony fishes)			
Halosauridae: halosaurs			
<i>Halosaurus pectoralis</i>	common halosaur	HPE	2
Notocanthidae: spiny eels			
<i>N. sexspinis</i>	spineback	SBK	52
Synphobranchidae: cutthroat eels			
<i>Diastobranchius capensis</i>	basketwork eel	BEE	39
<i>Simenchelys parasitica</i>	snubnosed eel	SNE	2
Nemichthyidae: snipe eels			
<i>Nemichthys curvirostris</i>	black spot snipe eel	NCU	1
Congridae: conger eels			
<i>Bassanago bulbiceps</i>	swollenhead conger	SCO	39
<i>B. hirsutus</i>	hairy conger	HCO	39
Nettastomatidae: duckbill eels			
<i>Venefica proboscidea</i>	periscope duckbill eel	VEN	1
Serrivomeridae: sawtooth eels			
<i>Serrivomer samoensis</i>	common sawtooth eel	SSA	1
Gonorynchidae: sandfishes			
<i>Gonorynchus forsteri</i>	sandfish	GFO	1
Argentinidae: silversides			
<i>Argentina elongata</i>	silverside	SSI	41
Microstomatidae: white smelts			
<i>Nansenia</i> spp.	white smelts	NAN	3
Bathylagidae: deepsea smelts			
<i>Bathylagichthys parini</i>	deepsea smelts	BPA	1
<i>Bathylagus tenuis</i>	deepsea black smelt	BTN	2
<i>Melanolagus bericoides</i>	bigscale deepsea smelt	MEB	5
Platytroutidae: tubeshoulders			
<i>Persparia kopua</i>	common tubeshoulder	PER	3
Alepocephalidae: slickheads			
<i>Alepocephalus antipodanus</i>	smallscaled brown slickhead	SSM	26
<i>A. australis</i>	bigscaled brown slickhead	SBI	26
<i>Rouleina guentheri</i>	bordello slickhead	RGN	1
<i>Xenodermichthys copei</i>	black slickhead	BSL	18
Diplophidae: portholefishes			
<i>Diplophos rebaini</i>	Rebain's portholefish	DRB	1
Sternoptychidae: hatchetfishes			
<i>Argyropelecus gigas</i>	giant hatchetfish	AGI	5
<i>A. olfersii</i>	Olfer's hatchetfish	AOL	1
<i>Maurollicus australis</i>	pearlsides	MMU	1
Phosichthyidae: lighthouse fishes			
<i>Phosichthys argenteus</i>	lighthouse fish	PHO	32
Stomiidae (dragonfishes)			
Astronesthinidae: snaggleteeths			
<i>Borostomias antarcticus</i>	southern snaggleteeth	BAN	1
<i>Rhadinesthes decimus</i>	slender snaggleteeth	RDE	1
Stomiinae: scaly dragonfishes			
<i>Stomias boa</i>	scaly dragonfish	SBB	5

Appendix 2 (continued)

Scientific name	Common name	Species	Occ.
Chauliodontinae: viperfishes			
<i>Chauliodus sloani</i>	viperfish	CHA	24
Melanostomiinae: barbeled dragonfishes		MST	1
<i>Melanostomias niger</i>	black dragonfish	MNG	1
<i>Opostomias micripnus</i>	giant black dragonfish	OMI	2
Idiacanthinae: black dragonfishes			
<i>Idiacanthus atlanticus</i>	common black dragonfish	IAT	6
Malacosteinae: loosejaws			
<i>Malacosteus australis</i>	southern loosejaw	MAU	4
Notosudidae: waryfishes			
<i>Scopelosaurus</i> spp.	unspecified waryfish	SPL	1
Paralepididae: barracudinas			
<i>Magnisudis prionosa</i>	giant barracudina	BCA	1
Evermannellidae: sabretoothfishes			
<i>Evermannella balbo</i>	brown sabretooth	EVB	1
Alepisauridae: lancetfishes			
<i>Alepisaurus brevirostris</i>	shortsnouted lancetfish	ABR	1
Myctophidae: lanternfishes			
<i>Diaphus danae</i>	Dana lanternfish	DDA	4
<i>D. hudsoni</i>	Hudson's lanternfish	DHU	1
<i>Gymnoscopelus bolini</i>	Bolin's lanternfish	GYB	3
<i>G. hintonoides</i>	false midas lanternfish	GYH	1
<i>G. microlampas</i>	minispotted lanternfish	GYI	1
<i>G. cf. piabilis</i>	southern blacktip lanternfish	GYP	1
<i>Lampadena speculigera</i>	mirror lanternfish	LSP	1
<i>Lampanyctodes hectoris</i>	Hector's lanternfish	LHE	9
<i>Lampanyctus achirus</i>	cripplefin lanternfish	LAC	6
<i>L. australis</i>	austral lanternfish	LAU	10
<i>L. intricarius</i>	intricate lanternfish	LIT	24
<i>L. macdonaldi</i>	MacDonald's lanternfish	LMD	2
<i>Metelectrona ventralis</i>	Flaccid lanternfish	MVE	1
<i>Symbolophorus boops</i>	bogue lanternfish	SBP	4
Carapidae: pearlfishes			
<i>Echiodon cryomargarites</i>	messmate fish	ECR	4
Ophidiidae: cuskeels			
<i>Brotulotaenia nigra</i>	blue cusk eel	BCR	1
<i>Genypterus blacodes</i>	ling	LIN	81
Bythitidae: viviparous brotulas			
<i>Cataetx chthamallorhynchus</i>	white brotula	CAX	1
Chaunacidae: coffinfishes			
<i>Chaunax russatus</i>	pink frogmouth	CHX	1
Ceratiidae: seadevils			
<i>Ceratius</i> spp.	seadevils	CER	2
Regalecidae: oarfishes			
<i>Agrostichthys parkeri</i>	ribbonfish	AGR	1
Euclichthyidae: eucla cods			
<i>Euclichthys polynemus</i>	eucla cod	EUC	2
Macrouridae: rattails			
<i>Cetonus crassiceps</i>	thickhead rattail	CCR	1
<i>Coelorinchus acanthiger</i>	spotty faced rattail	CTH	1
<i>C. aspercephalus</i>	oblique banded rattail	CAS	44
<i>C. biclinozonalis</i>	two saddle rattail	CBI	15
<i>C. bollonsi</i>	Bollons' rattail	CBO	70
<i>C. fasciatus</i>	banded rattail	CFA	45
<i>C. innotabilis</i>	notable rattail	CIN	43
<i>C. kaiyomaru</i>	Kaiyomaru rattail	CKA	12

Appendix 2 (continued)

Scientific name	Common name	Species	Occ.
Macrouridae (cont.)			
<i>Coelorinchus matamua</i>	Mahia rattail	CMA	20
<i>C. oliverianus</i>	Oliver's rattail	COL	57
<i>C. parvifasciatus</i>	small banded rattail	CCX	11
<i>C. trachycarus</i>	roughhead rattail	CHY	6
<i>Coryphaenoides dosseus</i>	humpback rattail	CBA	15
<i>C. murrayi</i>	Murray's rattail	CMU	6
<i>Coryphaenoides serrulatus</i>	serrulate rattail	CSE	34
<i>C. striatulus</i>	striate rattail	CTR	1
<i>C. subserrulatus</i>	four-rayed rattail	CSU	44
<i>Gadomus aoteanus</i>	filamentous rattail	GAO	1
<i>Lepidorhynchus denticulatus</i>	javelinfin	JAV	95
<i>Nezumia namatahi</i>	squashedfaced rattail	NNA	5
<i>Trachonurus gagates</i>	velvet rattail	TRX	2
<i>Lucigadus nigromaculatus</i>	blackspot rattail	VNI	18
<i>Macrourus carinatus</i>	ridge scaled rattail	MCA	26
<i>Mesobius antipodum</i>	black javelinfin	BJA	16
Trachyrincidae: rough rattails			
<i>Trachyrincus aphyodes</i>	white rattail	WHX	39
<i>T. longirostris</i>	unicorn rattail	WHR	4
Moridae: morid cods			
<i>Antimora rostrata</i>	violet cod	VCO	8
<i>Halargyreus johnsonii</i>	Johnson's cod	HJC	8
<i>H. sp.</i>	Australasian slender cod	HAS	39
<i>Lepidion microcephalus</i>	small-headed cod	SMC	21
<i>Mora moro</i>	ribaldo	RIB	44
<i>Notophycis marginata</i>	dwarf cod	DCO	3
<i>Pseudophycis bachus</i>	red cod	RCO	27
<i>Tripteryphycis gilchristi</i>	grenadier cod	GRC	1
Melanonidae: pelagic cods			
<i>Melanonus zugmayeri</i>	largetooth pelagic cod	MEZ	1
Merlucciidae: hakes			
<i>Lyconus pinnatus</i>	fangtooth hake	LYC	1
<i>Macruronus novaezelandiae</i>	hoki	HOK	113
<i>Merluccius australis</i>	hake	HAK	49
Gadidae: true cods			
<i>Micromesistius australis</i>	southern blue whiting	SBW	11
Oneirodidae: dreamers			
<i>Oneirodes sp.</i>	dreamer	ONE	1
Ceratiidae: seadevils			
<i>Cryptosaras couesii</i>	warty seadevil	SDE	2
Melamphidae: bigscalefishes			
<i>Poromitra atlantica</i>	southern bigscale	CBS	3
Anoplogastridae: fangtooths			
<i>Anoplogaster cornuta</i>	fangtooth	ANO	1
Diretmidae: discfishes			
<i>Diretmichthys parini</i>	spinyfin	SFN	1
<i>Diretmus argenteus</i>	discfish	DIS	3
Trachichthyidae: roughies, slimeheads			
<i>Hoplostethus atlanticus</i>	orange roughy	ORH	33
<i>H. mediterraneus</i>	silver roughy	SRH	25
<i>Paratrachichthys trailli</i>	common roughy	RHY	9
Berycidae: alfonosinos			
<i>Beryx decadactylus</i>	longfinned beryx	BYD	1
<i>B. splendens</i>	alfonsino	BYS	38

Appendix 2 (continued)

Scientific name	Common name	Species	Occ.
Cyttidae: cyttid dories			
<i>Cyttus novaezealandiae</i>	silver dory	SDO	8
<i>C. traversi</i>	lookdown dory	LDO	88
Zeniontidae: armoureye dories			
<i>Capromimus abbreviatus</i>	capro dory	CDO	16
Zeidae: dories			
<i>Zenopsis nebulosa</i>	mirror dory	MDO	1
Oreosomatidae: oreos			
<i>Allocyttus niger</i>	black oreo	BOE	27
<i>A. verrucosus</i>	warty oreo	WOE	7
<i>Neocyttus rhomboidalis</i>	spiky oreo	SOR	28
<i>Pseudocyttus maculatus</i>	smooth oreo	SSO	38
Macrorhamphosidae: snipefishes			
<i>Centriscomus humerosus</i>	banded bellowsfish	BBE	65
<i>Notopogon lilliei</i>	crested bellowsfish	CBE	3
Sebastidae: seaperches			
<i>Helicolenus barathri</i>	bigeye sea perch	HBA	84
<i>H. percoides</i>	sea perch	HPC	11
<i>Trachyscorpia eschmeyerii</i>	Cape scorpionfish	TRS	7
Congiopodidae: pigfishes			
<i>Alertichthys blacki</i>	alert pigfish	API	2
<i>Congiopodus leucopaecilus</i>	pigfish	PIG	2
Triglidae: gurnards			
<i>Chelidonichthys kumu</i>	red gurnard	GUR	1
<i>Lepidotrigla brachyoptera</i>	scaly gurnard	SCG	12
Hoplichthyidae: ghostflatheads			
<i>Hoplichthys cf. haswelli</i>	deepsea flathead	FHD	45
Psychrolutidae: toadfishes			
<i>Amblophthalmos angustus</i>	pale toadfish	TOP	19
<i>Cottunculus nudus</i>	bonyskull toadfish	COT	1
<i>Psychrolutes microporos</i>	blobfish	PSY	8
Polyprionidae: wreckfishes			
<i>Polyprion oxygeneios</i>	hāpuku	HAP	5
Serranidae: sea perches, groper			
<i>Lepidoperca aurantia</i>	orange perch	OPE	9
Epigonidae: deepwater cardinalfishes			
<i>Epigonus denticulatus</i>	white cardinalfish	EPD	9
<i>E. lenimen</i>	bigeye cardinalfish	EPL	7
<i>E. machaera</i>	thin tongue cardinalfish	EPM	17
<i>E. robustus</i>	robust cardinalfish	ERB	3
<i>E. telescopus</i>	deepsea cardinalfish	EPT	22
Carangidae: trevallies, kingfishes			
<i>Trachurus declivis</i>	greenback jack mackerel	JMD	4
<i>T. murphyi</i>	slender jack mackerel	JMM	6
Bramidae: pomfrets			
<i>Brama australis</i>	southern Ray's bream	SRB	30
<i>B. brama</i>	Ray's bream	RBM	3
Emmelichthyidae: bonnetmouths, rovers			
<i>Emmelichthys nitidus</i>	redbait	RBT	25
<i>Plagiogeneion rubiginosum</i>	rubyfish	RBV	3
Cheilodactylidae: tarakihi, morwongs			
<i>Nemadactylus macropterus</i>	tarakihi	NMP	4
Zoarcidae: eelpouts			
<i>Melanostigma gelatinosum</i>	limp eelpout	EPO	1
Pinguipedidae: sandperches			
<i>Parapercis gilliesii</i>	yellow cod	YCO	1

Appendix 2 (continued)

Scientific name	Common name	Species	Occ.
Percophidae: opalfishes			
<i>Hemerocoetes</i> spp.	opalfishes	OPA	2
Uranoscopidae: armourhead stargazers			
<i>Kathetostoma giganteum</i>	giant stargazer	GIZ	54
Gempylidae: snake mackerels			
<i>Paradiplospinus gracilis</i>	false frostfish	PDS	1
<i>Rexea solandri</i>	gemfish	RSO	7
<i>Thyrsites atun</i>	barracouta	BAR	6
Trichiuridae: cutlassfishes			
<i>Lepidopus caudatus</i>	frostfish	FRO	8
Scombridae: mackerels, tunas			
<i>Scomber australasicus</i>	blue mackerel	EMA	1
Centrolophidae: raftfishes, medusafishes			
<i>Centrolophus niger</i>	rudderfish	RUD	9
<i>Hyperoglyphe antarctica</i>	bluenose	BNS	4
<i>Pseudoicichthys australis</i>	ragfish	RAG	1
<i>Schedophilus huttoni</i>	slender ragfish	SUH	2
<i>S. maculatus</i>	pelagic butterfish	SUM	3
<i>Seriolella caerulea</i>	white warehou	WWA	53
<i>S. punctata</i>	silver warehou	SWA	56
<i>Tubbia tasmanica</i>	Tasmanian ruffe	TUB	1
Nomeidae: eyebrowfishes, driftfishes			
<i>Cubiceps</i> spp.	cubehead	CUB	9
Bothidae: lefteyed flounders			
<i>Arnoglossus scapha</i>	witch	WIT	13
Achiropsettidae: finless flounders			
<i>Achiropsetta tricholepis</i>	prickly flounder	ACT	1
<i>Neoachiropsetta milfordi</i>	finless flounder	MAN	9
Rhombosoleidae: southern righteyed flounders			
<i>Azygopus flemingi</i>	spotted flounder	SDF	1
<i>Pelotretis flavilatus</i>	lemon sole	LSO	7

APPENDIX 3: MESOPELAGIC AND BENTHIC INVERTEBRATES

Scientific and common names of mesopelagic and benthic invertebrates identified following the voyage.

NIWA No.	Station ID	Class	Order	Family	Genus	Species
172923	TAN2401/95	Malacostraca	Decapoda	Axiidae	<i>Spongiaxius</i>	<i>novaezealandiae</i>
172925	TAN2401/96	Malacostraca	Decapoda	Axiidae	<i>Spongiaxius</i>	<i>novaezealandiae</i>
172918	TAN2401/73	Asteroidea	Forcipulatida	Zoroasteridae	<i>Zoroaster</i>	sp.
172917	TAN2401/73	Asteroidea	Paxillosida	Astropectinidae	<i>Plutonaster</i>	<i>knoxii</i>
172920	TAN2401/83	Asteroidea	Paxillosida	Astropectinidae	<i>Plutonaster</i>	<i>knoxii</i>
172922	TAN2401/86	Crinoidea	Comatulida			
172915	TAN2401/11	Echinoidea	Echinothurioida	Phormosomatidae	<i>Phormosoma</i>	<i>bursarium</i>
172919	TAN2401/73	Echinoidea	Echinothurioida	Phormosomatidae	<i>Phormosoma</i>	<i>bursarium</i>
172921	TAN2401/86	Holothuroidea	Aspidochirotida	Synallactidae	<i>Bathyplores</i>	sp.
172928	TAN2401/110	Holothuroidea	Aspidochirotida	Synallactidae	<i>Bathyplores</i>	sp.
172927	TAN2401/102	Ophiuroidea	Euryalida	Asteronychidae	<i>Asteronyx</i>	<i>loveni</i>
176002	TAN2401/39	Cephalopoda	Oegopsida	Brachioteuthidae	<i>Brachioteuthis</i>	sp.
176008	TAN2401/34	Cephalopoda	Oegopsida	Brachioteuthidae	<i>Brachioteuthis</i>	sp.
176005	TAN2401/85	Cephalopoda	Oegopsida	Brachioteuthidae	<i>Brachioteuthis</i>	sp.
176006	TAN2401/75	Cephalopoda	Oegopsida	Chiroteuthidae	<i>Chiroteuthis</i>	sp.
176009	TAN2401/119	Cephalopoda	Oegopsida	Cranchiidae		
176012	TAN2401/122	Cephalopoda	Oegopsida	Cranchiidae		
176004	TAN2401/54	Cephalopoda	Oegopsida	Enoploteuthidae	<i>Enoploteuthis</i>	sp.
176007	TAN2401/102	Cephalopoda	Oegopsida	Gonatidae	<i>Gonatus</i>	sp.
176014	TAN2401/67	Cephalopoda	Oegopsida	Histioteuthidae	<i>Histioteuthis</i>	<i>atlantica</i>
176001	TAN2401/66	Cephalopoda	Oegopsida	Histioteuthidae	<i>Histioteuthis</i>	<i>macrohista</i>
176020	TAN2401/74	Cephalopoda	Oegopsida	Neoteuthidae	<i>Nototeuthis</i>	<i>dimegacotyle</i>
176010	TAN2401/69	Cephalopoda	Oegopsida	Onychoteuthidae	<i>Moroteuthopsis</i>	<i>ingens</i>
176011	TAN2401/105	Cephalopoda	Oegopsida	Onychoteuthidae	<i>Moroteuthopsis</i>	<i>ingens</i>
176019	TAN2401/93	Cephalopoda	Oegopsida	Onychoteuthidae	<i>Moroteuthopsis</i>	<i>ingens</i>
176018	TAN2401/80	Cephalopoda	Oegopsida	Onychoteuthidae	<i>Onykia</i>	n. sp. 'splendens'
176013	TAN2401/61	Cephalopoda	Oegopsida	Onychoteuthidae	<i>Onykia</i>	<i>robsoni</i>
176003	TAN2401/43	Cephalopoda	Oegopsida	Pholidoteuthidae	<i>Pholidoteuthis</i>	sp.

APPENDIX 4: HOKI AGE CLASS LENGTH RANGES

Length ranges (cm) used to identify 1+, 2+ and 3++ hoki age classes to estimate relative biomass values given in Figure 8. 1992 and 1993 length ranges were revised from those in Stevens et al. (2017).

Survey	Age group		
	1+	2+	3++
Jan 1992	< 50	50 – 60	≥ 60
Jan 1993	< 50	50 – 60	≥ 60
Jan 1994	< 46	46 – 58	≥ 59
Jan 1995	< 46	46 – 58	≥ 59
Jan 1996	< 46	46 – 54	≥ 55
Jan 1997	< 44	44 – 55	≥ 56
Jan 1998	< 47	47 – 55	≥ 53
Jan 1999	< 47	47 – 56	≥ 57
Jan 2000	< 47	47 – 60	≥ 61
Jan 2001	< 49	49 – 59	≥ 60
Jan 2002	< 52	52 – 59	≥ 60
Jan 2003	< 49	49 – 61	≥ 62
Jan 2004	< 51	51 – 60	≥ 61
Jan 2005	< 48	48 – 64	≥ 65
Jan 2006	< 49	49 – 62	≥ 63
Jan 2007	< 48	48 – 62	≥ 63
Jan 2008	< 49	49 – 59	≥ 60
Jan 2009	< 48	48 – 61	≥ 62
Jan 2010	< 48	48 – 61	≥ 62
Jan 2011	< 48	48 – 61	≥ 62
Jan 2012	< 49	49 – 59	≥ 60
Jan 2013	< 47	47 – 54	≥ 55
Jan 2014	< 48	48 – 60	≥ 61
Jan 2016	< 49	49 – 62	≥ 62
Jan 2018	< 48	48 – 59	≥ 59
Jan 2020	< 48	48 – 59	≥ 59
Jan 2022	< 46	46 – 56	≥ 56
Jan 2024	< 48	48 – 56	≥ 56