# Fishery independent survey of Ballot's Saucer Scallop

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DELIVERING FOR QUEENSLAND

Queensland Government

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# Contents

# Summary

In partnership with the trawl industry, a fishery independent survey of Ballot's Saucer Scallop *(Ylistrum balloti)* was undertaken in October 2025. This was the first time fisher-selected sites have been used, which allowed participating fishers to target sites where they believed scallop densities would be higher.

Surveys have been conducted in the southern inshore trawl management region since 1997**,** and in southern offshore region since 2017, with the last survey in October 2022. Scallops have been a no-take species in the southern inshore and central regions since September 2021.

The completion of the 2025 survey:

- provides an important new data point to track the recovery of the depleted scallop stock in the southern inshore region
- helps improve the understanding of the single biological stock that spans the southern inshore and southern offshore regions
- provides important data for the newly identified biological stock in the central region.

While results for scallops in the 1+ age category in the southern inshore region had improved, they remain below the limit reference point, and densities of 0+ age category scallops are average. Encouragingly, the density of 0+ and 1+ scallops within some of the scallop replenishment areas was high.

In the southern offshore region, estimates suggest there is a significant density of 0+ scallops and a moderate biomass of 1+ scallops.

This year was the first formal survey work undertaken in the central region. While scallop densities are comparable to both southern regions, ongoing surveys will help to better assess the stock dynamics in this region.

# Background

A fishery independent survey for Ballot's Saucer Scallops was first undertaken in 1997 (Jebreen et al., 2008) and had 2 objectives:

1. Create an index of abundance to compliment the commercial fishery catch rate, which could be used in sustainability assessments and future fishery management.
2. Investigate the performance of the scallop replenishment areas after they were introduced in 1996.

A random stratified design was used to survey the main fishing area of the time (Hervey Bay to Yeppoon). The number of sites to sample within each survey area (or strata) was determined using commercial catch and effort data, with high catch rate areas surveyed more extensively.

The survey was completed in this form from 1997 to 2000, at which time the objectives of the survey changed to focus on the performance of the rotational openings of expanded scallop replenishment areas, which continued until 2006.

The annual survey recommenced in 2017 as part of a Fisheries Research and Development Corporation–funded project to investigate scallop natural mortality and an improved assessment method (French et al., 2021). Only minor changes were made to the existing survey design within the southern inshore region, but new survey strata were included in the southern offshore region, largely in response to increased commercial catch from 2010 onwards.

Prior to the 2025 survey, the Department of Primary Industries (DPI), in consultation with trawl fishery stakeholders, further reviewed the existing southern inshore region survey strata and survey design. This review included the addition of fisher-selected (targeted) sites that would allow areas of supposed higher abundance to be sampled each year and provide an alternate index of abundance to be used in analysis. The southern offshore trawl region strata were sampled again as in previous surveys.

New information on the stock structure of scallops that showed separate biological stocks north of latitude 22 degrees south (Scata et al., 2024) led to the expansion of the existing survey into the central trawl region to begin baseline data collection. New strata in the area off Townsville and at Hydrographers Passage were defined.

Importantly, the data collected during the 2025 survey will remain directly comparable with the 1997–2000 and 2017–2022 datasets.

# Methods

In October 2025, 3 separate trawl management regions were surveyed:

3. central – Townsville and Hydrographer's Passage (Figure 1)
4. southern inshore – Bundaberg to Mackay (Figure 2)
5. southern offshore – offshore K'gari (Fraser Island) and Sunshine Coast (Figure 3).

Each site was sampled with trawl gear permitted under existing Queensland fisheries regulations for the east coast otter trawl fishery. Sampling consisted of a 1 nautical mile trawl shot at night. DPI scientific staff were not present during sampling, therefore the data collected from each sampling event was the minimum required to generate the survey indices. The number of sites sampled per region are provided in Table 1 and Table 2 ('Results' section).

Scallops were not measured as per previous surveys. Instead, they were graded into 0+ (less than 77 mm shell height, less than 1 year old) and 1+ (greater than or equal to 78 mm shell height, 1–2 years old) age categories using a standard gauge and counted. The shell height criteria for the age categorisation are described in Dichmont et al. (2000).

Data on site location, time sampled, trawl speed and trawl gear used were recorded for each site. Scallop counts were validated using time-stamped digital camera images. Vessel tracking data was used to validate the location of each vessel during sampling.

**Note:** The survey was conducted under relevant federal and state agency permits.

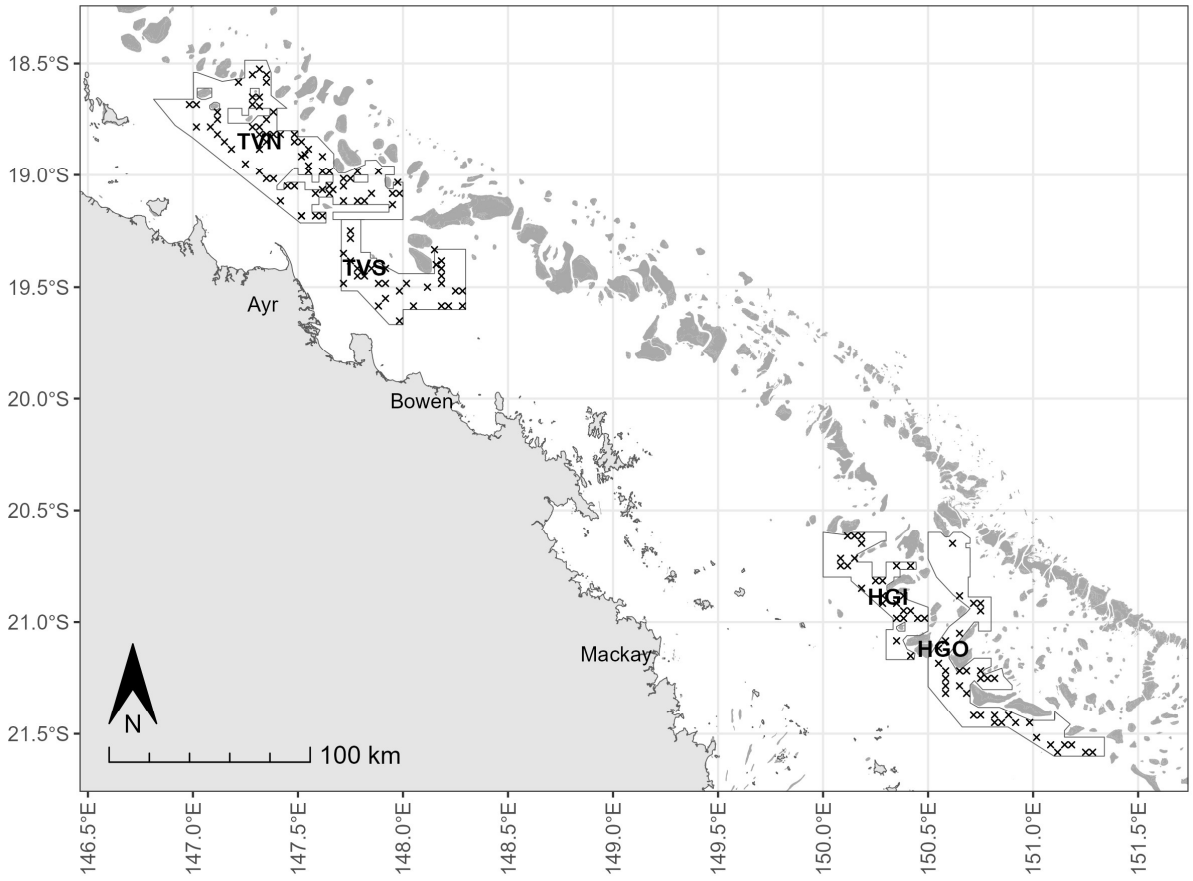



**Figure 1:** Central region selected sites and survey strata for October 2025

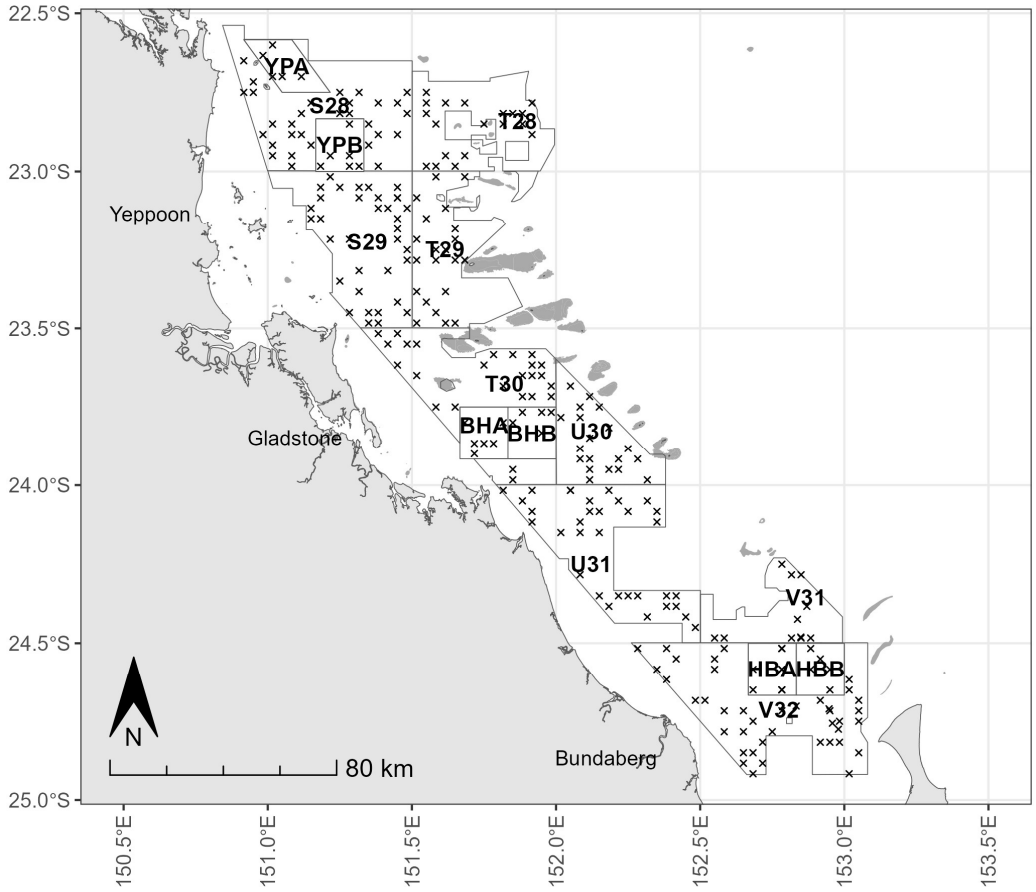



**Figure 2:** Southern inshore region selected sites and survey strata for October 2025

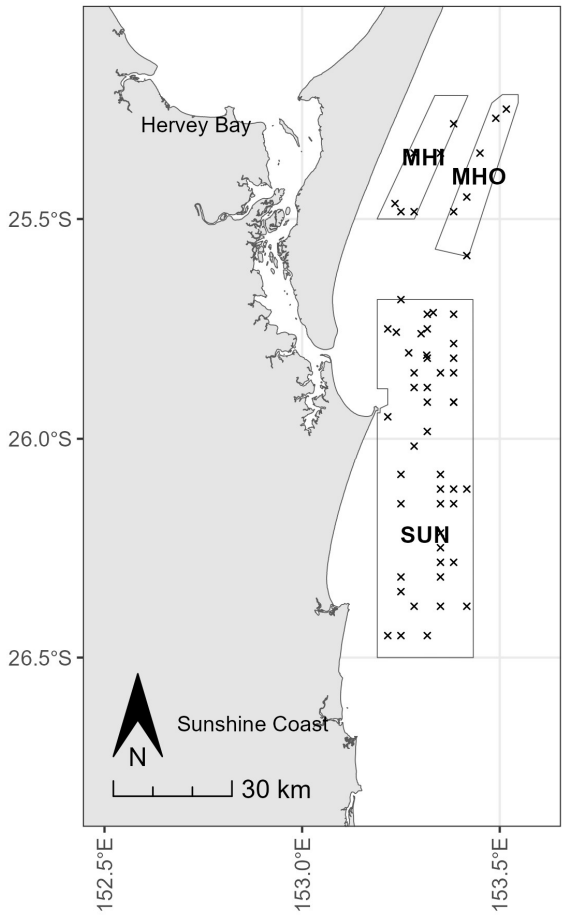



**Figure 3:** Southern offshore selected sites and survey strata for October 2025

# Results

## Summary

Six commercial fishing vessels were contracted to complete the survey work between 8 and 17 October 2025.

**Table 1:** Number of sites sampled per trawl management region during the 2025 survey

| | Selected sites | Fisher-selected sites | Total sites |
|---|---|---|---|
| Central | 137 | 22 | 159 |
| Southern inshore | 244 | 34 | 257 |
| Southern offshore | 50 | 6 | 56 |

**Table 2:** Number of sites sampled per trawl management region for 2017–2022 surveys (note: only selected sites were sampled in this time period)

| | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|
| Southern inshore | 309 | 307 | 306 | 305 | 331 | 234 |
| Southern offshore | 46 | 63 | 64 | 69 | 61 | 59 |

## Vessel calibration

To account for differences in fishing gear efficiency between the vessels contracted to complete the survey, 4 of the 6 participating vessels completed a small number of side-by-side calibration shots at different stages of the survey (Table 3).

As per previous analysis, a linear model was used to determine the calibration factor, with all vessels a benchmarked against vessel 1 (note: vessels 5 and 6 were given a calibration factor of 1).

**Table 3:** Calibration shots undertaken by each vessel during the 2025 survey and the calibration factors determined by linear model (y = vessel participated in calibration shot)

| | Shot 1 | Shot 2 | Shot 3 | Shot 4 | Shot 5 | Shot 6 | Shot 7 | Calibration factor |
|---|---|---|---|---|---|---|---|---|
| Vessel 1 | y | y | y | | | | y | 1 |
| Vessel 2 | y | y | y | | | | y | 1.351 |
| Vessel 3 | y | y | y | y | y | y | | 0.889 |
| Vessel 4 | | | | y | y | y | | 1.453 |
| Vessel 5 | | | | | | | | 1 |
| Vessel 6 | | | | | | | | 1 |

Survey logistics dictated that fewer calibration shots were completed in 2025 compared to previous years. Despite the calibration shots being undertaken in areas of higher scallop density, the number of scallops caught between vessels for individual shots was quite variable.

This resulted in some individual shots having a significant effect on the calibration factor. Despite this higher uncertainty, the calibration factors for the 2025 survey are well within those calculated for past surveys (Table 4).

**Table 4:** Vessel calibration factors for 2017–2022 (note: all vessels for each year are calibrated to vessel 1, which completed every survey, and only 3 vessels participated in total)

| | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|
| **Vessel 1** | 1 | 1 | 1 | 1 | 1 | 1 |
| **Vessel 2** | 3.299 | 0.992 | 1.226 | 1.648 | 2.041 | 1.050 |
| **Vessel 3** | 6.435 | 1.650 | 1.103 | 1.256 | 2.896 | 1.203 |

The calibration factor and swept area (Figure 4) was then applied to the survey scallop counts to provide a survey density estimate for each site (number of scallops per hectare). Further modelling work using the survey data to generate the final indices to inform sustainability assessments and fishery management.

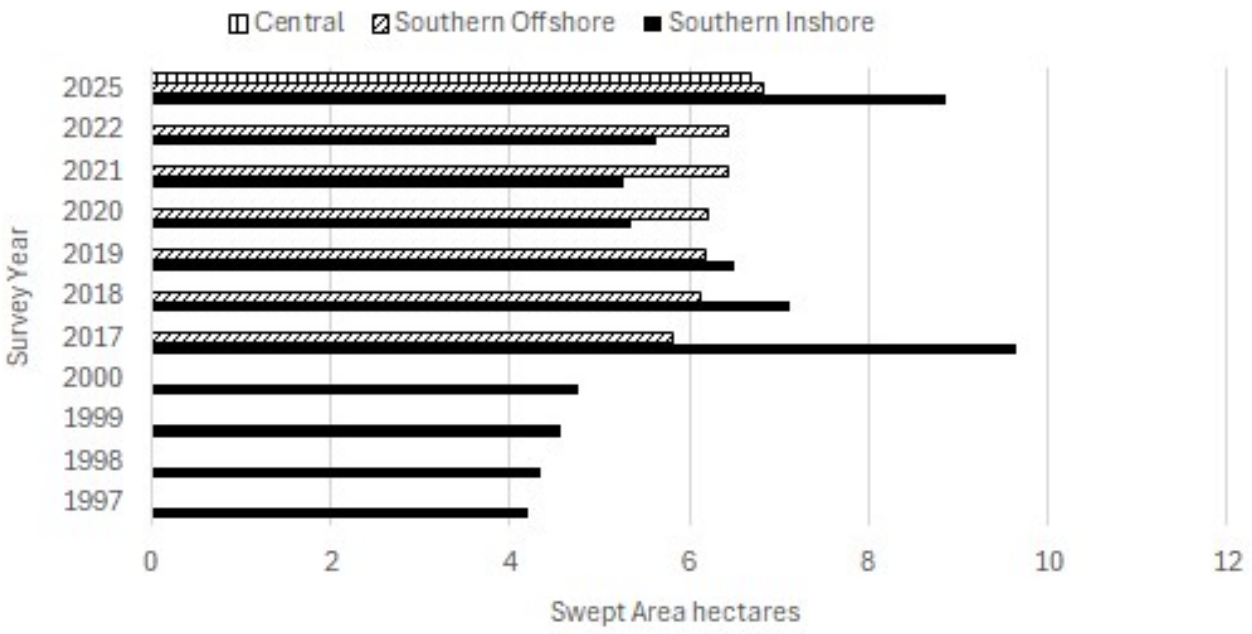



**Figure 4:** Mean swept area (hectares) by year and survey strata

The density indices were higher for the fisher-selected sites than for selected sites (Figure 5); however, the differences were not found to be statistically significant. Based on this result, the selected sites and targeted fisher-selected sites have been grouped together in the results presented below. A times series of data from targeted sites will better inform the ongoing use of these fisher-selected sites.

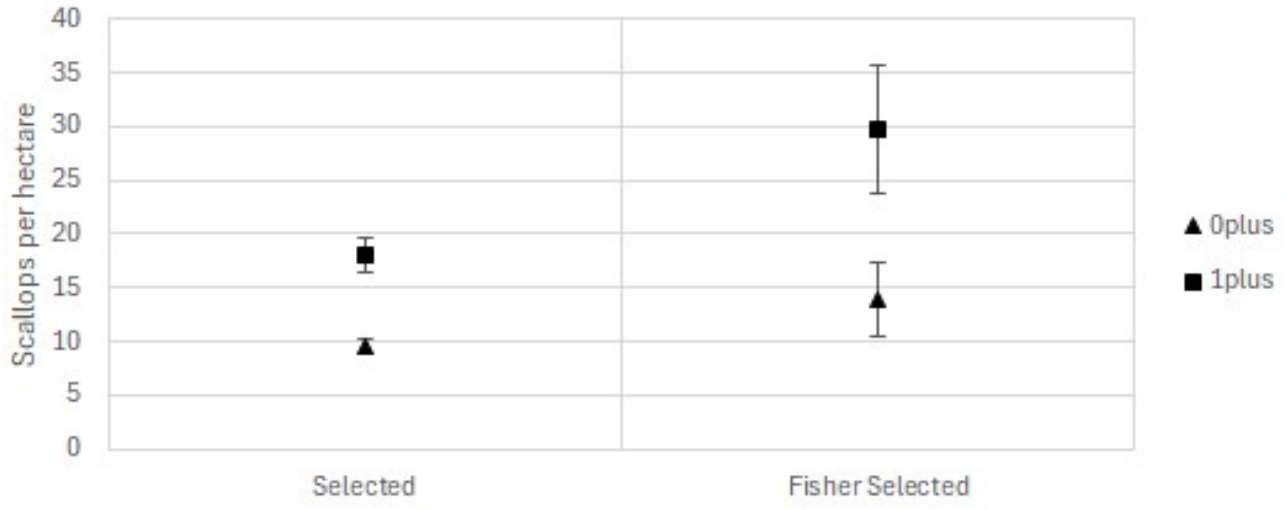



**Figure 5:** Index of 1+ and 0+ scallops per hectare for selected and fisher-selected sites (error bars are ±1 standard error)

## Survey density estimates

Density indices for 0+ and 1+ scallops across all survey strata are presented in Figure 6 and Figure 7.

Indices for 1+ plus scallops ranged from 0.1 scallops per hectare in 'Yeppoon A' scallop replenishment area (SRA) to 47.9 scallops per hectare in 'Bustard Head B' SRA. The results show high density indices for 'Hervey Bay A' SRA, 'Hydrographers outer' and 'T29' survey strata. For 0+ scallops, the highest index was in the 'Sunshine' and 'Yeppoon B' SRA strata.

The central trawl region strata had similar densities of 0+ scallops and higher densities of 1+ scallops when compared to strata within the southern inshore and southern offshore trawl regions.

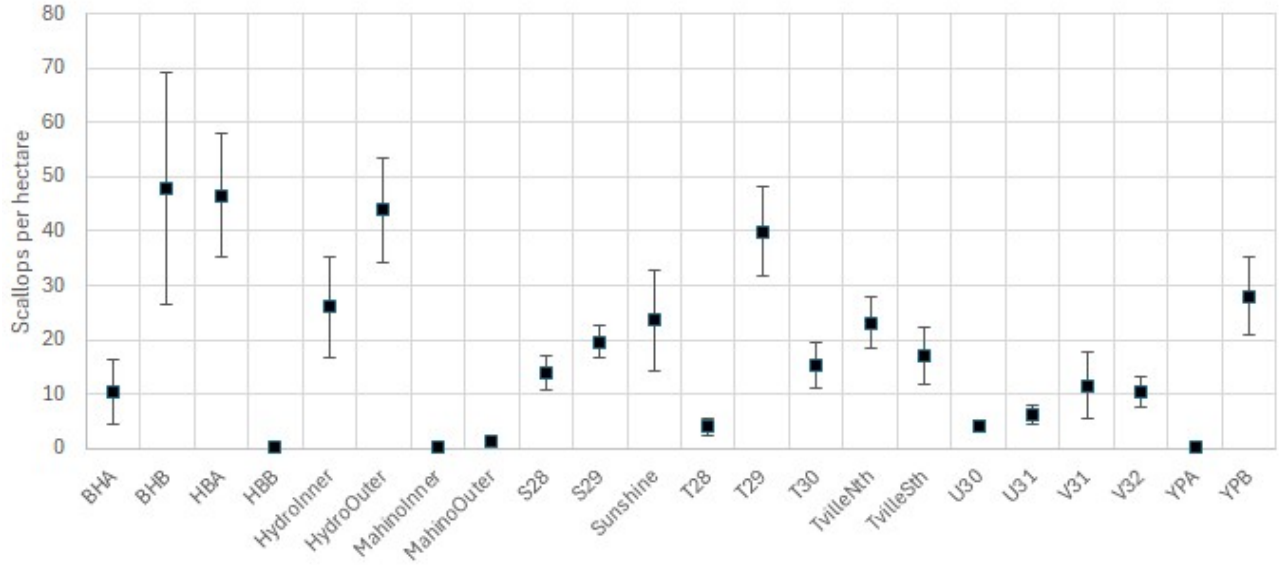



**Figure 6:** Index of 1+ scallops per hectare by survey strata from the 2025 survey (error bars are ±1 standard error)

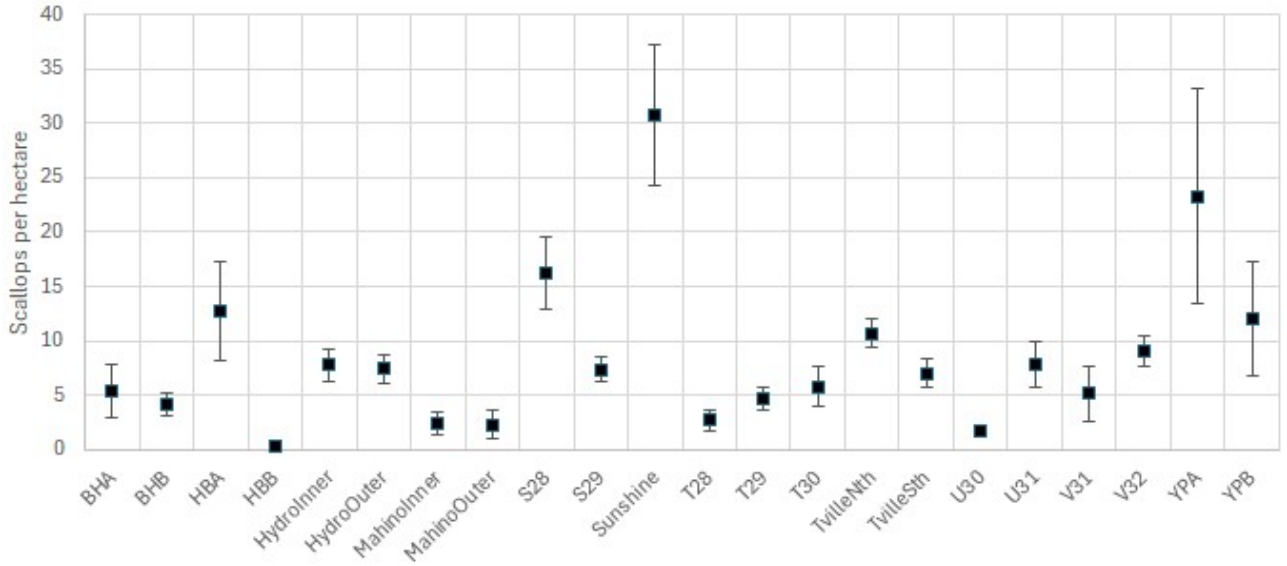



**Figure 7**: Index of 0+ scallops per hectare by survey strata from the 2025 survey (error bars are ±1 standard error)

## Southern inshore management region

In the southern inshore trawl management region, the number of 1+ scallops sampled during the 2025 survey sat within the range of values sampled during previous surveys (Figure 8).

There was not a large difference in the observed number of scallops and the calibrated number of scallops (which considers the vessel calibration factor).

The standard errors around the estimated mean values suggest the calibration factor did significantly change the observed numbers.

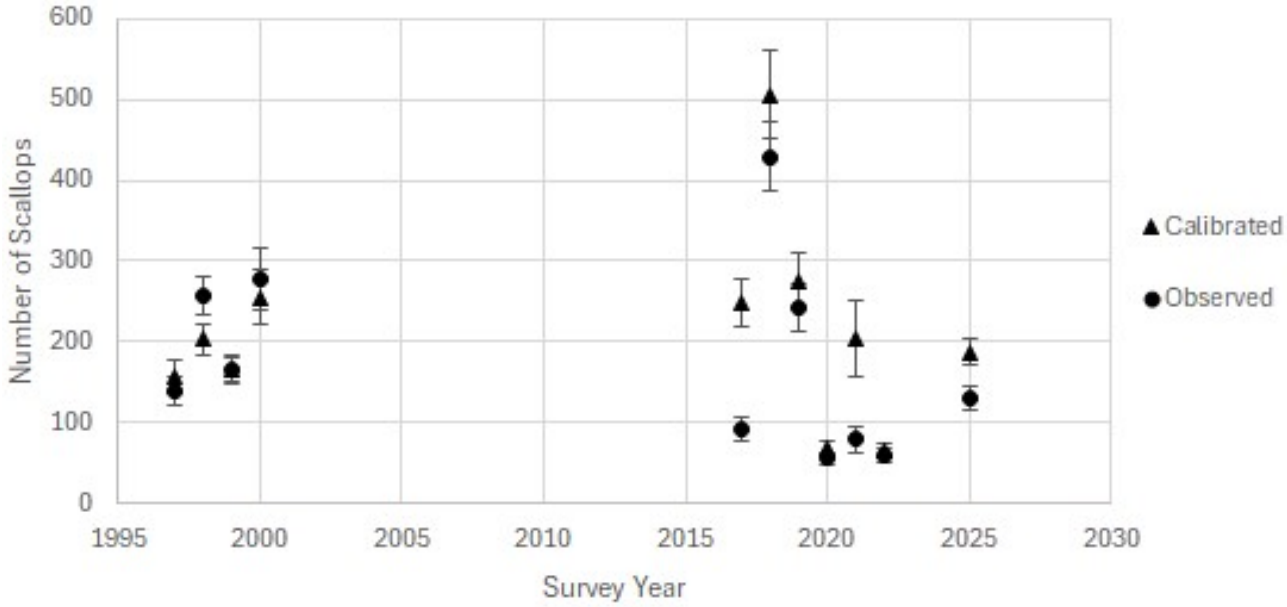



**Figure 8:** The mean number of 1+ scallops per trawl shot sampled each year in the southern inshore management region – 'observed' are scallops sampled and 'calibrated' are numbers adjusted using the vessel calibration factor (error bars are ±1 standard error)

The density index for 1+ scallops considers the swept area of each vessel – the result for the 2025 survey is lower than most of the other values in the time series of data (Figure 9).

The 2025 index, when compared to the 2020 and 2022 results, does indicate an improvement in the abundance of 1+ scallops and the small error estimates (error bars) suggest densities of this magnitude were present across much of the sampling strata.

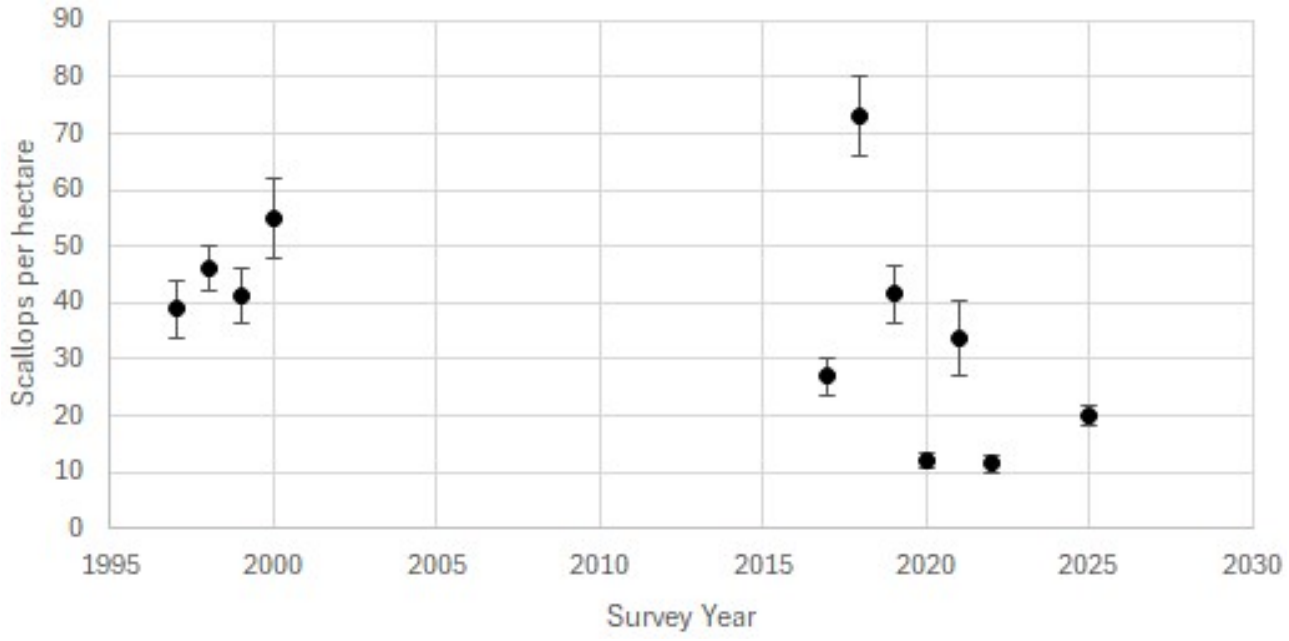



**Figure 9:** Index of 1+ scallop density per hectare by year in the southern inshore management region (error bars are ±1 standard error)

There was an increase in the densities of 0+ scallops (Figure 10), but the value was still below those measured during 1997–2000 and 2017–2018. The steady rise shown from 2019 is an encouraging sign of improved recruitment.

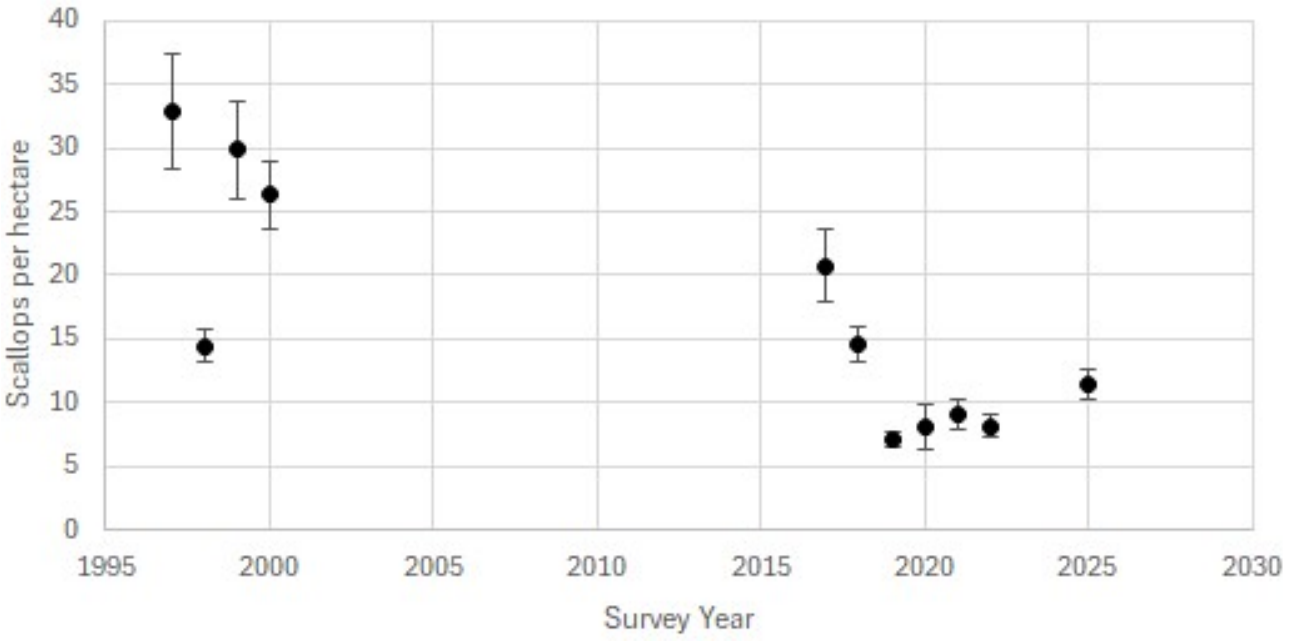



**Figure 10:** Index of 0+ scallop density per hectare by year in the southern inshore management region (error bars are ±1 standard error)

# Southern offshore management region

In the southern offshore trawl management region, the number of 1+ scallops (Figure 11) sampled and the density indices (Figure 12) from the 2025 survey was low when compared to 2017, 2019 and 2020.

The data does show a substantial density of 0+ scallops (Figure 13), which exceeds all other data points in the 2017–2022 time series.

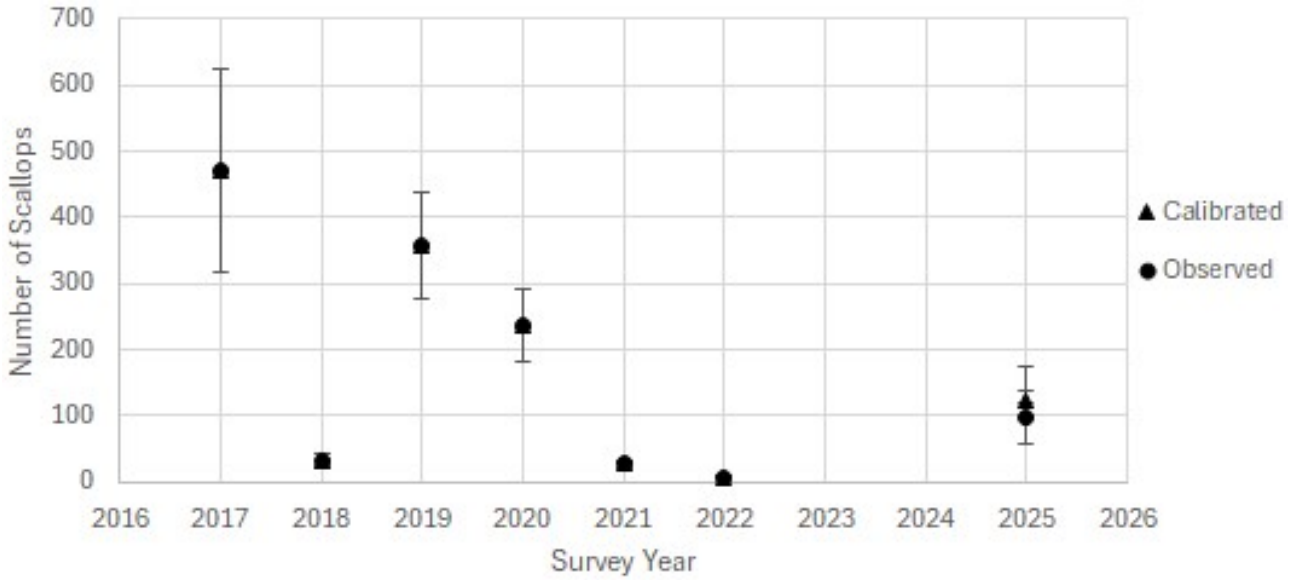



**Figure 11:** The mean number of 1+ scallops per trawl shot sampled each year in the southern offshore management region – 'observed' are scallops sampled and 'calibrated' are numbers adjusted using the vessel calibration factor (error bars are ±1 standard error)

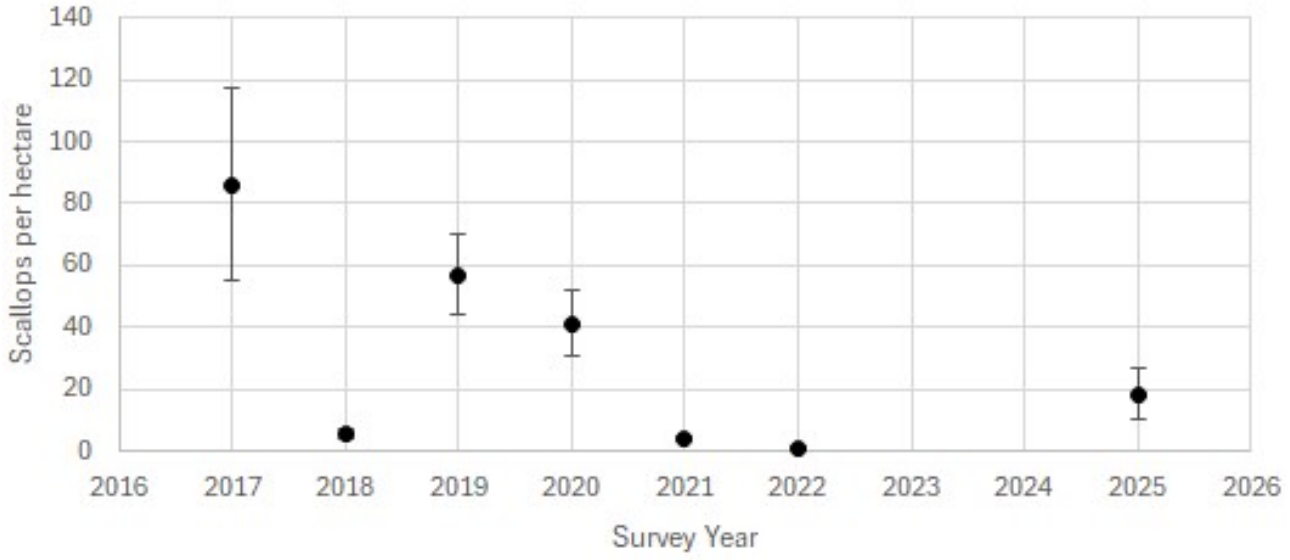



**Figure 12:** Index of 1+ scallop density per hectare by year in the southern offshore management region (error bars are ±1 standard error)

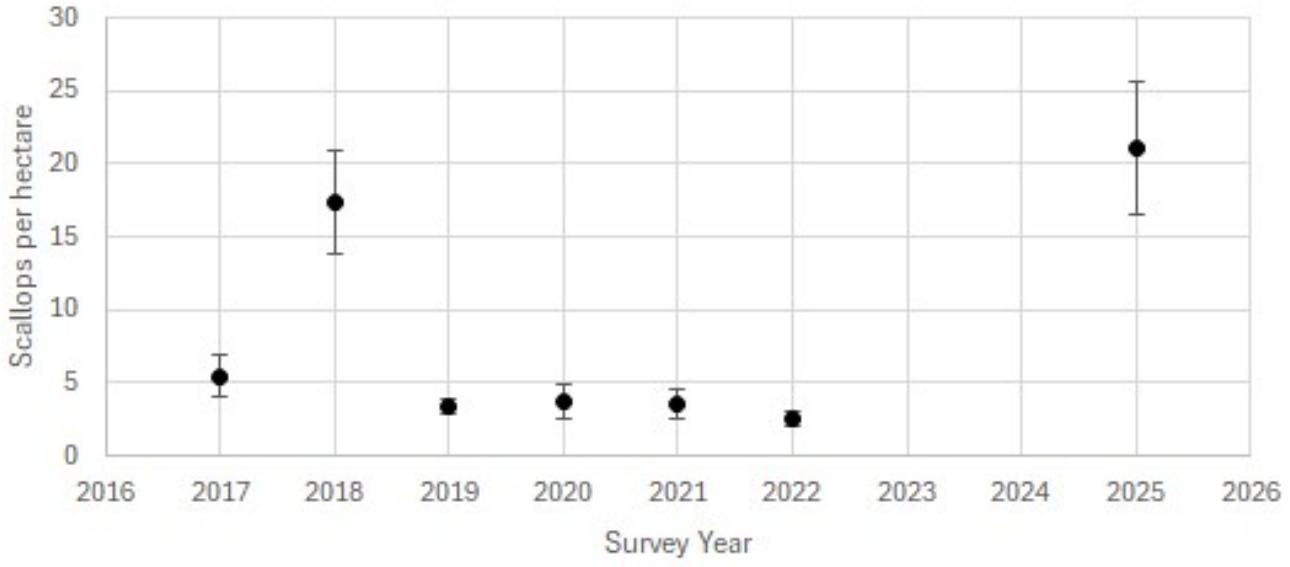



**Figure 13:** Index of 0+ scallop density per hectare by year in the southern offshore management region (error bars are ±1 standard error)

# Central management region

It is not possible to make conclusive comments about scallop densities in the central trawl region as this was the first formal survey work undertaken.

While densities of scallops are comparable to both southern management regions, ongoing annual surveys will form a time series of data that can better describe the stock dynamics of this region.

Detailed density plots of 0+ scallops for this region and the other regions are presented in Appendix 1.

# Final modelled density estimates and reference points

A generalised linear model (GLM) was used to generate the final indices from the survey. The modelled survey density indices may differ slightly from the survey density, as additional explanatory factors are applied – moon phase, time of night, year by strata interaction, and swept area.

Analyses used calibrated numbers of scallop from all survey and industry sites. Statistical methods were maintained from previous work (French et al., 2021) and calibration analyses and strata definitions were examined. Data and analysis codes were checked by DPI staff.

The GLM equation using 'R' software was:

$$CalibratedNumber \sim \exp\left(Year \times Strata + LunarQuarter + Time + \text{offset}(LogSweptArea)\right)$$

The model variables were:

- CalibratedNumber: number of scallops per trawl shot adjusted by the vessel calibrations (standardised to vessel 1)
- Year: survey years between 1997 and 2025 (factor)
- Strata: representing spatial areas (factor)
- LunarQuarter: lunar quarters based on lunar phase and luminance (factor)
- Time: Time of night of trawling categorised in 2-hour blocks (factor)
- LogSweptArea: trawl swept area in hectares (variate, log transformed and offset)
- GLM family and link function: Quasi-Poisson and log link.

Density predictions (mean number per hectare per year) were spatially averaged by the hectares of each stratum. Standard errors on predictions were calculated from bootstrapping GLM residuals (n = 2000).

Limit biomass $B_{20}$ and interim target $B_{40}$ reference points for densities of 1+ aged scallops were calculated for the southern inshore region using the stock assessment model from O'Neill et al. (2020). The survey density reference points were not published in that report (only commercial indices) as they were not required at the time of its publication.

Two key realignments of the reference points were completed (catchability rescaling removed and differences in survey data standardisations) to ensure comparability to the modelled survey densities.

Mean standard error estimates of the 2025 survey and the reference points were used to predict the value where the modelled survey mean density would give a 90% certainty that it was above the limit reference point.

Figures 14, 15 and 16 show the modelled density estimates and reference points for 0+ and 1+ scallops in each management region.

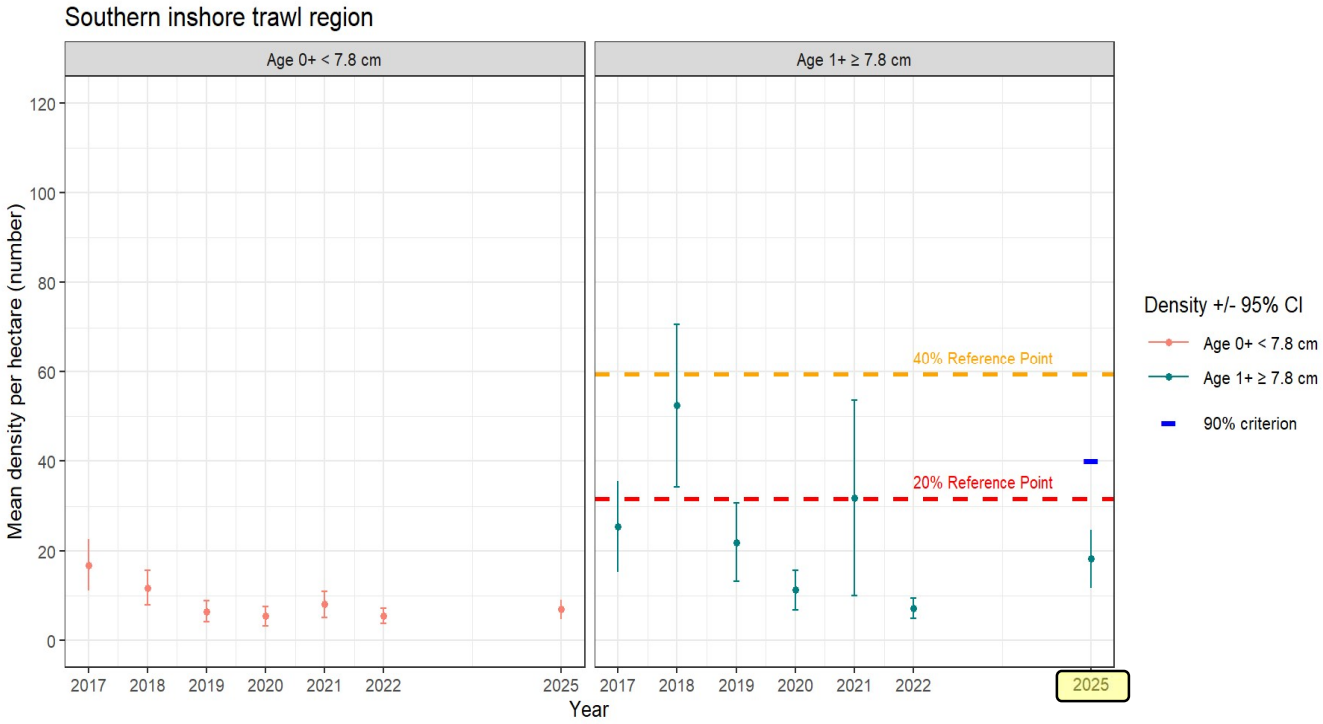



**Figure 14:** Modelled density estimates and reference points for 0+ and 1+ aged scallop by survey year in the southern inshore trawl region – figure confidence intervals (CI error bars) were normal at 95%

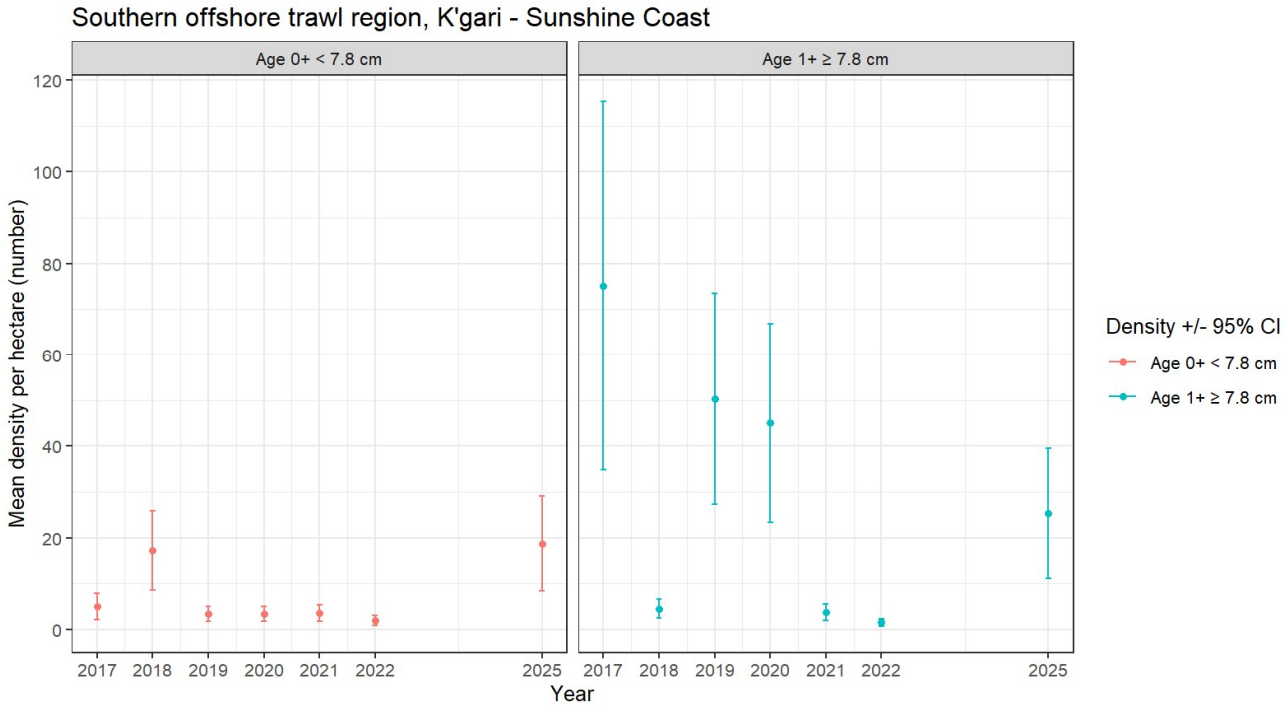



**Figure 15:** Modelled density estimates and reference points for 0+ and 1+ aged scallop by survey year in the southern offshore trawl region – figure confidence intervals (CI error bars) were normal at 95%

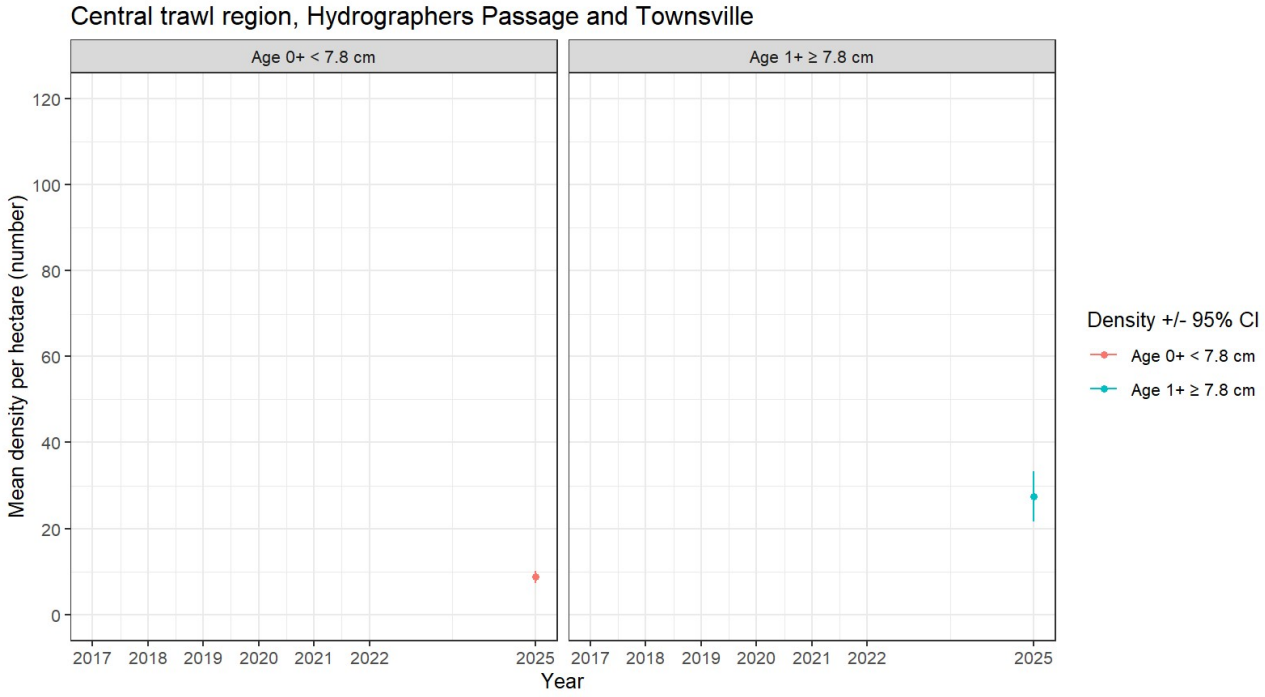



**Figure 16:** Modelled density estimates and reference points for 0+ and 1+ aged scallop by survey year in the central trawl region – figure confidence intervals (CI error bars) were normal at 95%

# Discussion and recommendations

The completion of the 2025 survey provides an important new data point to the existing time series, which can be used to track the recovery of the depleted scallop stock within the historical fishery grounds of the southern inshore region.

The survey also helps improve the understanding of the dynamics of the single biological stock that spans the southern inshore and southern offshore management regions and provided important data for the newly identified scallop stock in the central region.

Encouragingly, the survey results show improvements in the 1+ modelled scallop densities within the southern inshore region when compared to 2020 and 2022 (Figure 14). However, the density estimate in southern inshore region for 1+ scallops remains below the limit reference point and densities of 0+ scallops in this region are only average.

There is a significant modelled density of 0+ scallops in the southern offshore region (Figure 15), and the 1+ density estimate for this region suggests a moderate biomass is present.

Unmodelled densities of both 0+ and 1+ scallops within some of the scallop replenishment areas was also high (Figure 6 and Figure 7).

The 2025 survey results were influenced by the vessel calibration factor. Therefore, it is recommended that DPI investigate the methods to collect and analyse data to determine the calibration factor. Survey results for other years in the time series have shown similar sensitivities. French et al. (2021) observed that DPI has very little control over the participating vessels and gear used, and that accounting for these differences remains a significant challenge.

The 2025 survey was the first time fisher-selected sites have been used within the survey design. It allowed participating fishers to target sites where they believed scallop densities would be higher. It will take a time series of data points to determine the true usefulness of this data (compared to the selected sites of previous surveys) and it is therefore recommended that future surveys maintain this option.

# References

Dichmont C.M., Dredge M.C.L., Yeomans K. (2000) The First Large Scale Fishery Indepoendent Survey of the Saucer Scallop *Amusium Japonicum Balloti* in Queensland, Australia. Journal of Shellfish Research, Vol 40, No. 2, 731-739.

French S.M., Courtney A.J., Yang W. (2021) Quantitative Analysis of the Fishery-Independent Queensland Saucer Scallop (*Ylistrum balloti*) Trawl Survey. Journal of Shellfish Research, Vol 19, No. 2, 297-309.

Jebreen, E., Whybird, O. and O'Sullivan, S. (2008) Fisheries long term monitoring program : Scallop (*Amusium japonicum balloti*) survey results: 1997-2006. Technical Report. State of Queensland. Department of Primary Industries and Fisheries

O'Neill, M. F., Yang, W.H., Wortmann, J., Courtney, A. J., Leigh, G. M., Campbell, M. J. and Filar, J. (2020) Stock predictions and population indicators for Australia's east coast saucer scallop fishery. Project Report. Fisheries Research and Development Corporation.

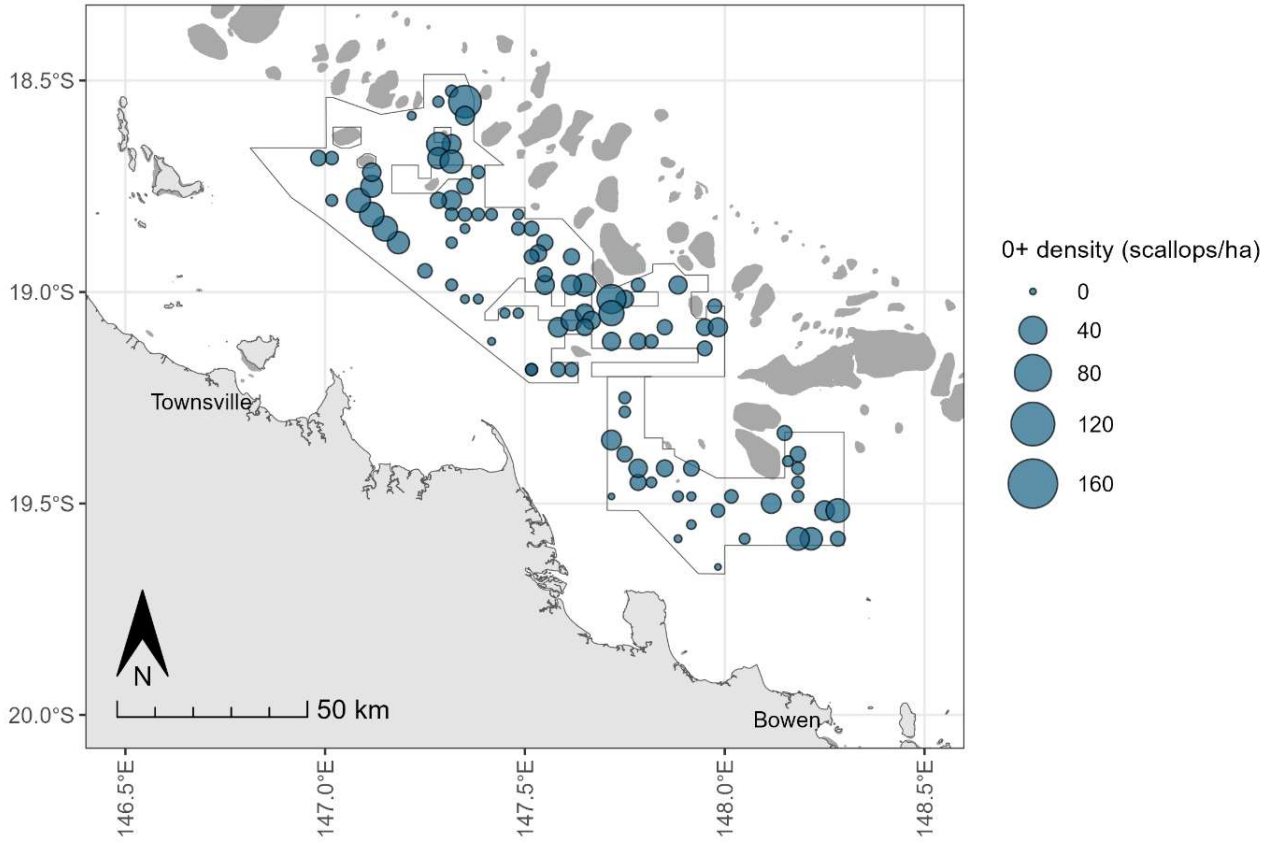
Scata, G., McGilvray, J. G., Masci, K. D. and Thomas, S. M. (2024) Population structure of Ballot's saucer scallop (*Ylistrum balloti*) for the east coast of Queensland. Technical Report. State of Queensland, Brisbane.

# Appendix 1: Density index of 0+ scallops

Density index of 0+ scallops from the 2025 survey:

- central region – Townsville **(a)** and Hydrographers Passage **(b)**
- southern inshore region – Gladstone north **(c)** and Gladstone south **(d)**
- southern offshore region – Double Island Point **(e)**.

**(a)**

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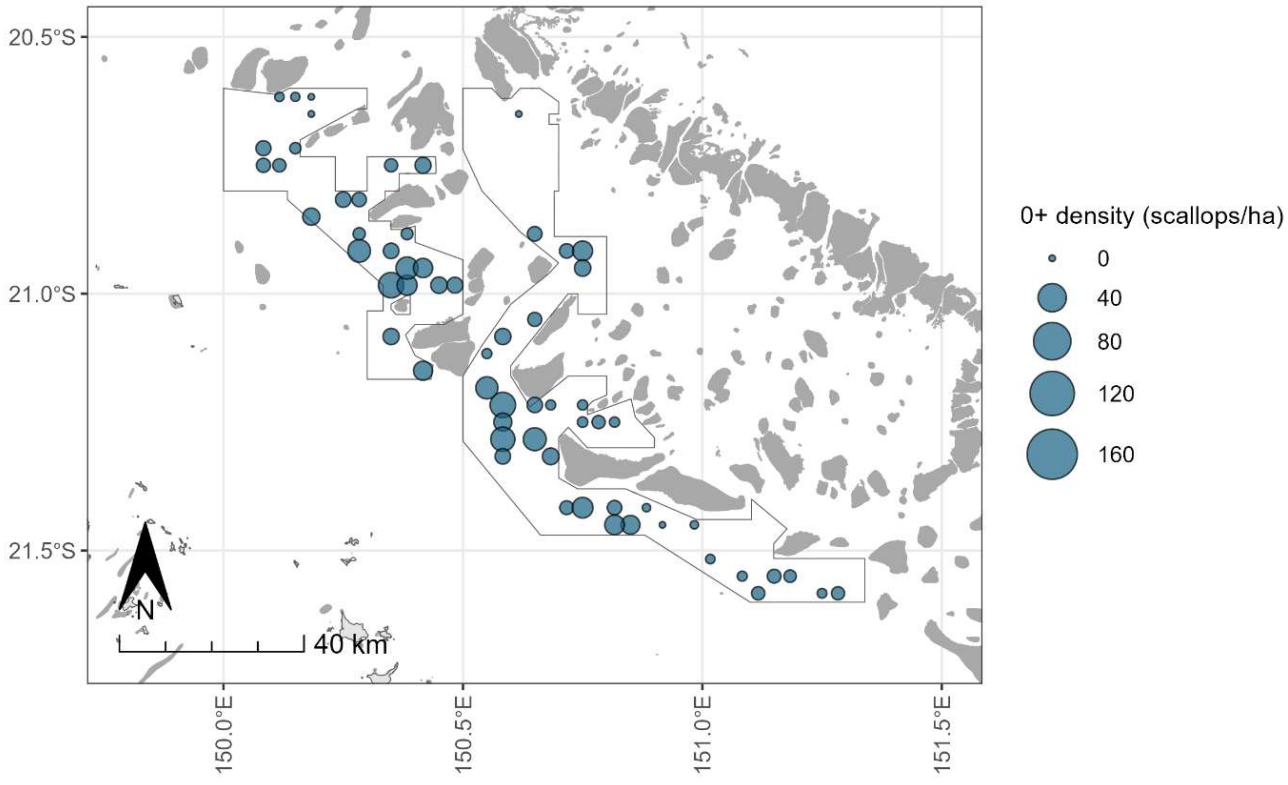

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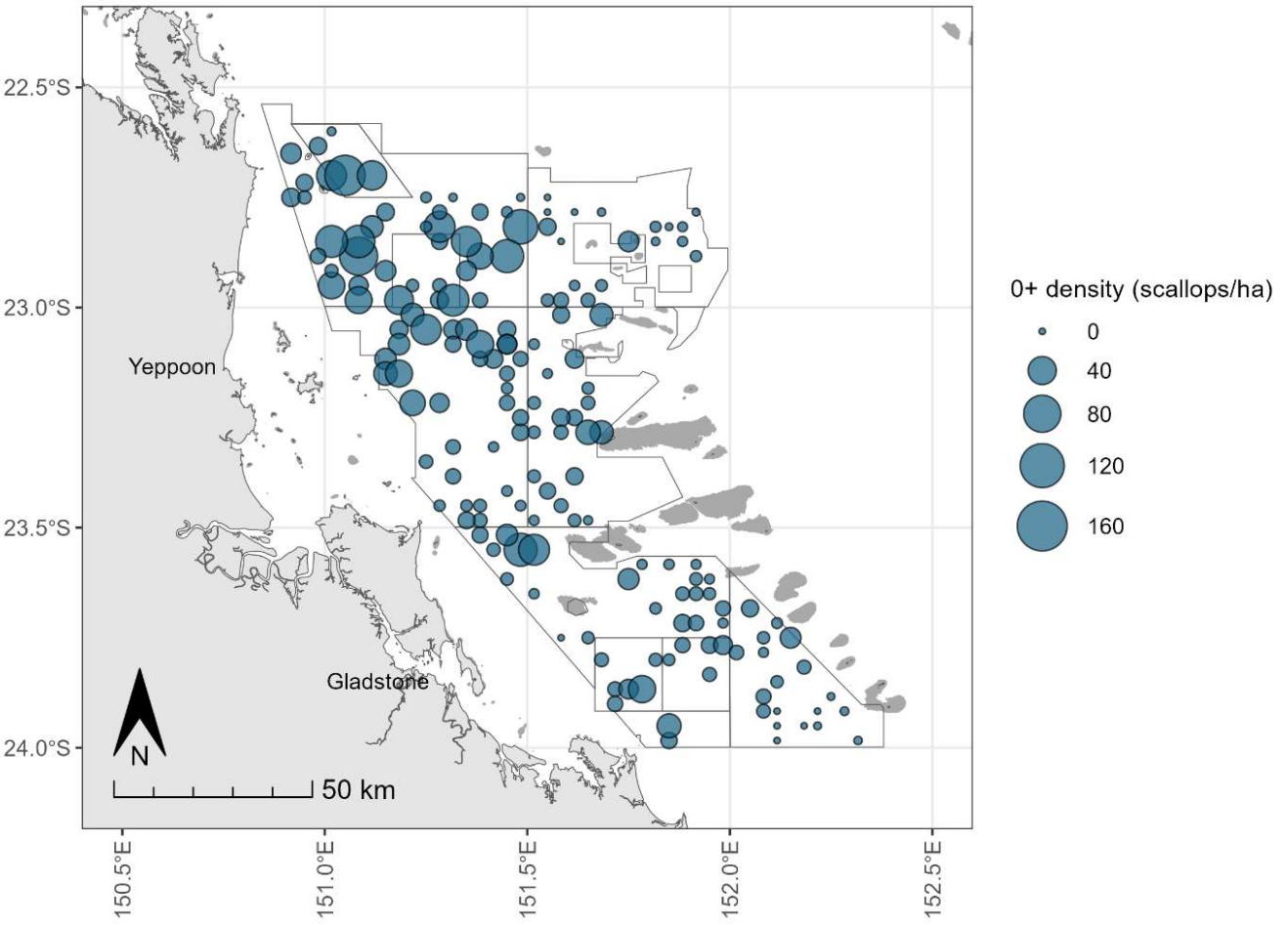
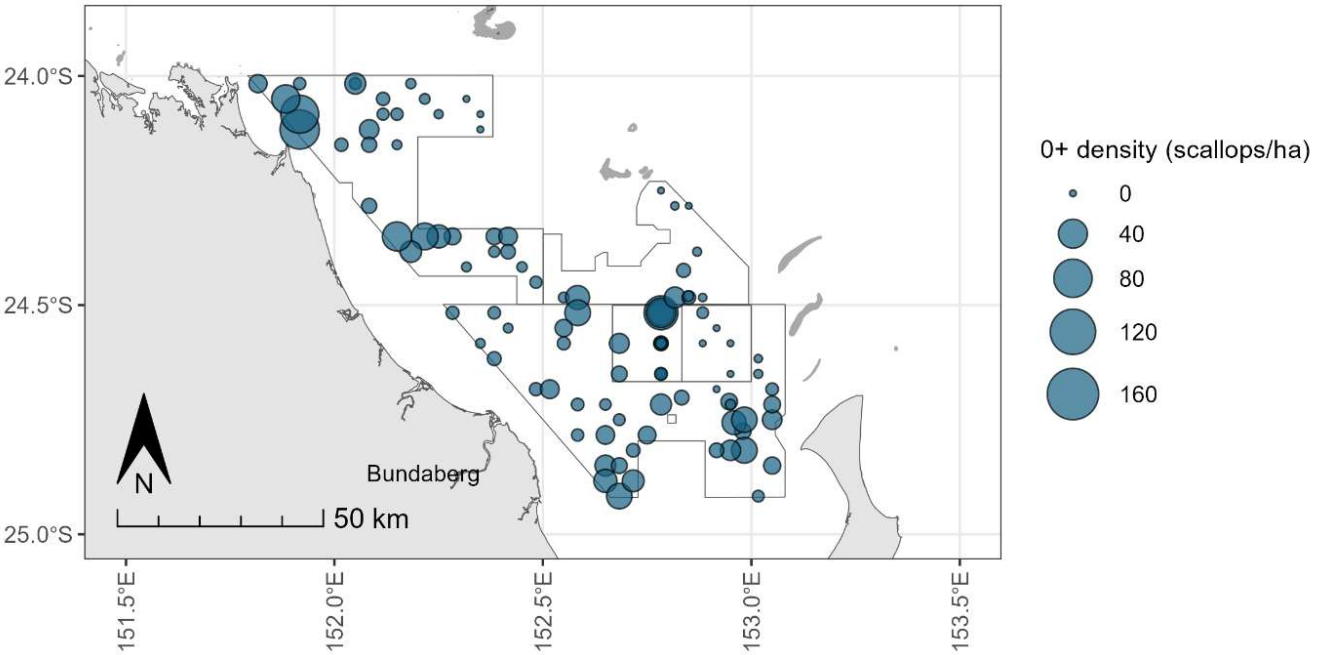
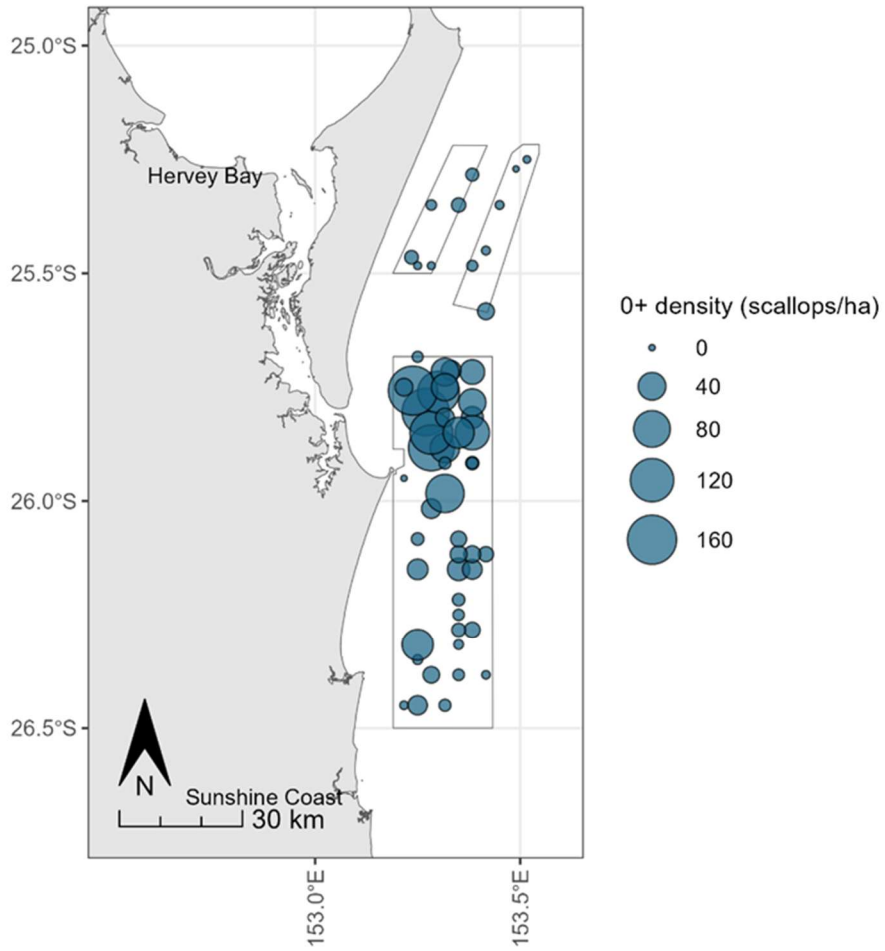

22.5°S
23.0°S
23.5°S
24.0°S
Yeppoon
Gladstone
N
50 km
150.5°E
151.0°E
151.5°E
152.0°E
152.5°E
0+ density (scallops/ha)
0
40
80
120
160

**(d)**


24.0°S
24.5°S
25.0°S
Bundaberg
N
50 km
151.5°E
152.0°E
152.5°E
153.0°E
153.5°E
0+ density (scallops/ha)
0
40
80
120
160

**(e)**


25.0°S
25.5°S
26.0°S
26.5°S
Hervey Bay
N
Sunshine Coast
30 km
153.0°E
153.5°E
0+ density (scallops/ha)
0
40
80
120
160