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2023 TASMANIAN SCALLOP FISHERY PRESEASON SURVEY REPORT

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Introduction

The 2023 Tasmanian Scallop Fishery (TSF) pre-season assessment was comprised of targeted and exploratory commercial dredge surveys yielding density and size structure in the TSF areas. Similarly to 2022, White Rock (Area 5; Table 1, Appendix 2) was divided into four equal-sized sub-areas to ensure a more even sampling design. In contrast to 2022, the North West (Area 1; Table 1, Appendix 2) had a fifth sub-area added to the sampling to reflect increased fishing effort in the area the previous season.

Survey methods

Dredge Surveys

Dredge surveys consisted of targeted and exploratory tows in the 2023 TSF preseason survey. Two targeted surveys were conducted: one in Area 5 at White Rock consisting of 52 sites in four sub-areas, and one in Area 1 in the North West, with 63 sites in five sub-areas. IMAS developed a random survey design for the targeted component of the dredge survey to better reflect the variation in density of scallops across the defined area of interest. Fishers participating in targeted dredge surveys were commissioned by NRE to sample in accordance with the IMAS random survey design and did not retain scallops. Tows were ~500 m in length for both targeted and exploratory surveys (calculated from the start and finish coordinates). The sites towed were randomly assigned within the boundaries of polygons defined by NRE managers as the regions of commercial interest (Table 1, Appendix 1). An IMAS observer was onboard for targeted surveys and total scallop catch weight (kg) was recorded for each tow. The observer recorded the size structure of each tow by measuring the shell length (width at the widest point of the shell) of up to 100 scallops randomly sampled from the ungraded catch. The weight of the legal sized scallops (≥ 85 mm in the North West and ≥ 90 mm at White Rock) in each tow was calculated by multiplying the total catch weight by the percentage of legal sized scallops in the catch, as determined from the size structure. The density of legal-sized scallops was reported as the ratio of the landed weight of legal sized scallops over the product of dredge width and tow length (calculated from start and finish coordinates).

Exploratory tows (696) for 2023 were conducted across Area 1 (West Bass Strait), 2 (East Bass Strait), 3 (East Flinders & Banks Strait) and 4 (Central East).

Table 1. Tasmanian Scallop Fishery 2023 pre-season survey sites by area, region, vessel, and survey method. Areas refer to Appendix 3.

	Area	Region	Vessel	N Dredge	Video
Targeted	1	North West	Del Richey II	63	
	5	White Rock	Odete C	52	
	Total Sites			115	
Exploratory	1	West Bass Strait	Odete C & Shandara	231	
	2	East Bass Strait	Karmin	16	
	3	East Flinders & Banks Strait	Odete C, Shandara & Karmin	229	
	4	The Gardens	Odete C & Shandara	143	
		Bicheno	Odete C	77	
	Total Sites			696	

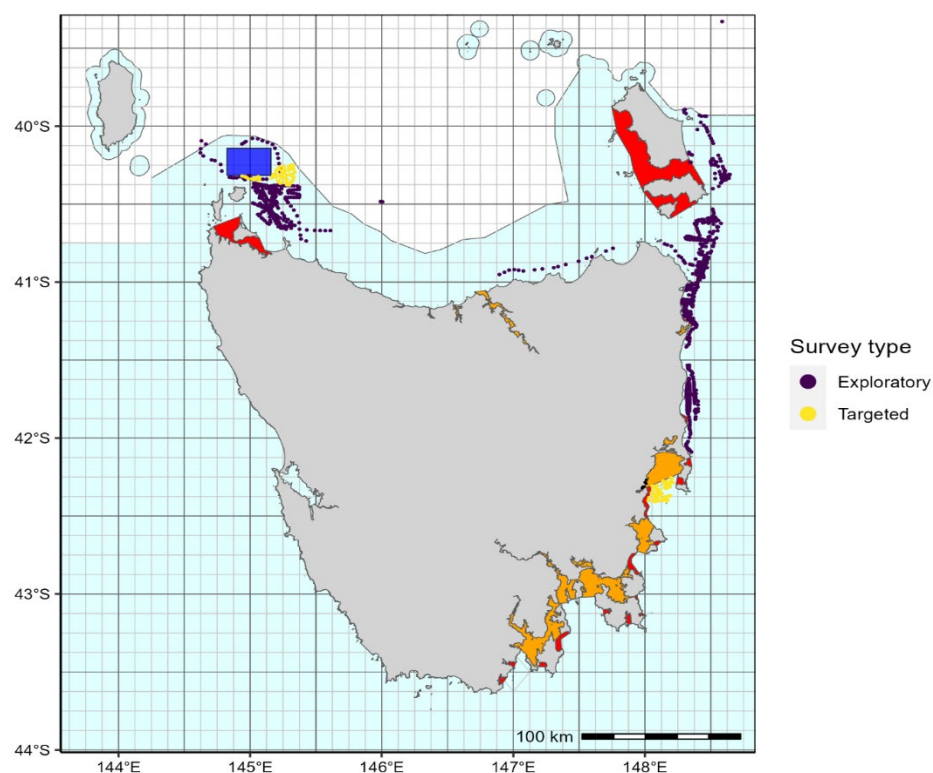


Figure 1. Map of the 2023 TSF pre-season dredge survey sites and notifiable areas within the TSF. The yellow dots indicate targeted survey sites and purple dots indicate exploratory survey sites. The pale blue areas indicate the Tasmanian Offshore Constitutional Settlement (OCS), the red areas indicated dredge prohibited areas, the blue square indicate the Boags Marine Park, and the orange areas indicate shark nursery areas in which dredging is also prohibited.

Survey results by area

North West (Area 1) – Targeted dredge survey

The North West targeted dredge survey consisted of 63 survey dredge tows deployed from the FV Dell Richey II in May 2023 (Table 1, Figures 1, 2 and 3). In 2022, sub-areas 1-4 were sampled. In 2023, a fifth sub-area was included to sample an area fished during the 2022 season. The targeted dredge sites were a random subset of 13 of 20 sites randomly allocated in each of the sub-areas in Area 1.

The North West targeted dredge survey tows yielded an average density of legal-sized (≥ 85 mm) scallops of 51.84 kg/1000 m² (median 19.78 kg/1000 m²), with a discard rate of 2.36% at the minimum legal size of 85 mm (Figures 2 and 3). Sub-area legal yields are provided in Table 2.

Average density of total scallops (legal and sub-legal catch) from the dredge tows was 53.42 kg/1000 m² (median 20.38 kg/1000 m²). Sub-area total yields are provided in Table A1 in Appendix 1.

Average density of total dead shell scallops from the dredge tows was 56.04 kg/1000 m² (median 31.59 kg/1000 m²). Average density of new dead shell scallops from the dredge tows was 5.96 kg/1000 m² (median 2.36 kg/1000 m²). Sub-area new dead shell percentages and densities are provided in Table 3.

The average scallop length for the North West was 95.46 ± 0.12 mm (standard error; Figure 3). Sub-area measurements are provided in Table 4.

Table 2. Estimated total number and density of legal sized scallops (≥ 85 mm) for the entire sampled area (All Area 1) and five sub-areas of North West (Area 1) from the 2023 dredge survey, and previous seasons. Avg. indicates average density of scallops and SD indicates the standard deviation. Dashes indicate values not calculated in previous years.

Year	Method	Sub-area	Average number legal scallops (n/m ²)	Density of legal scallops (kg/1000 m ²)		
				Avg.	SD	Median
2023	Dredge	All Area 1	0.81	51.84	67.71	19.78
		Sub-area 1	2.28	145.62	57.02	142.77
		Sub-area 2	0.63	40.54	61.63	18.06
		Sub-area 3	0.06	3.81	5.60	0.63
		Sub-area 4	0.55	34.95	56.94	7.04
		Sub-area 5	0.50	31.71	32.24	22.13
2022	Dredge	All Area 1	-	36.61	-	6.6
		Sub-area 1	-	65.5	-	30.6
		Sub-area 2	-	52.5	-	18.6
		Sub-area 3	-	5.6	-	0
		Sub-area 4	-	22.7	-	5.5

Table 3. Estimated average percentage (of total dead shell) and density of new dead shell scallops for the entire sampled area (All Area 1) and five sub-areas of North West (Area 1) from the 2023 dredge survey. Avg. indicates average density of scallops and SD indicates the standard deviation.

Year	Method	Sub-area	Average percentage (%) new dead shell	Density of new dead scallops (kg/1000 m ²)		
				Avg.	SD	Median
2023	Dredge	All Area 1	13.72%	5.96	9.40	2.36
		Sub-area 1	19.46%	11.25	7.96	8.78
		Sub-area 2	14.09%	8.33	18.34	2.36
		Sub-area 3	16.38%	2.74	2.61	1.60
		Sub-area 4	12.36%	4.74	4.33	3.22
		Sub-area 5	6.15%	2.89	4.16	1.50

Table 4. Scallop measurements for the whole area (All Area 1) and five sub-areas of North West (Area 1) from the 2023 dredge survey and previous seasons. SE indicates standard error. Dashes indicate values not calculated in previous years. Please note discard rate for 2022 was calculated at 90 mm minimum length.

Year	Method	Sub-area	Minimum scallop length (mm)	Maximum scallop length (mm)	Average scallop length (mm)	Average scallop length SE (mm)	Discard % (<85 mm)
2023	Dredge	All Area 1	69	129	95.46	0.12	2.36
		Sub-area 1	72	112	96.06	0.23	1.92
		Sub-area 2	80	114	94.43	0.24	1.95
		Sub-area 3	83	111	95.58	0.27	2.24
		Sub-area 4	69	129	97.37	0.44	5.77
		Sub-area 5	74	108	94.41	0.22	2.24
2022	Dredge	All Area 1	-	-	92.4	0.1	38.7
		Sub-area 1	-	-	91.8	91.8	38.7
		Sub-area 2	-	-	91.0	91.0	38.2
		Sub-area 3	-	-	90.6	90.6	51.2
		Sub-area 4	-	-	96.0	96.0	27.3

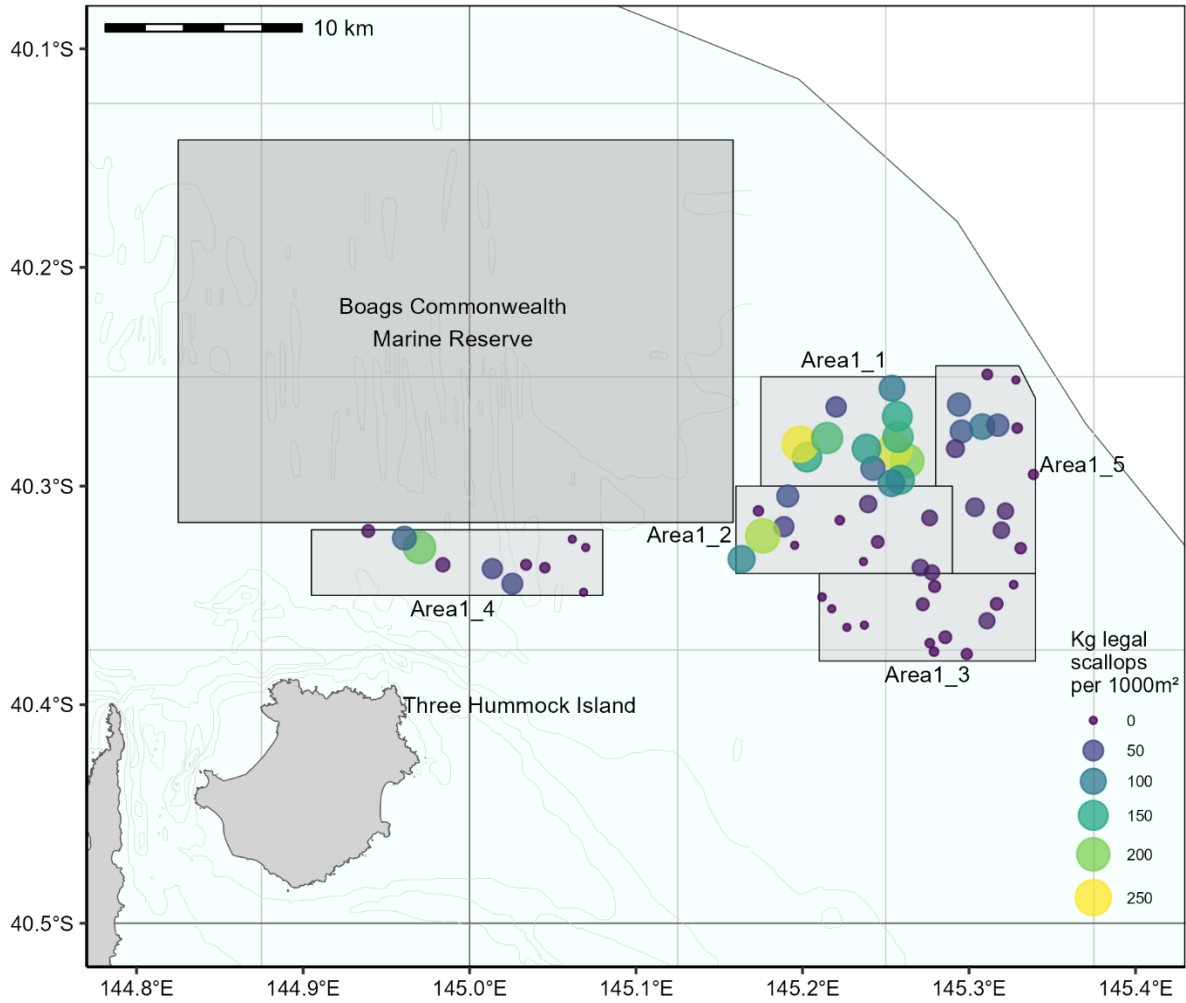


Figure 2. Legal-sized scallop density per tow for the North West (Area 1) targeted dredge survey. Density is displayed as kg of legal scallops (≥ 85 mm) per 1000 m². The pale blue areas indicate the Tasmanian Offshore Constitutional Settlement (OCS), the pale red areas indicated dredge prohibited areas and the pale orange areas indicate shark nursery areas in which dredging is also prohibited.

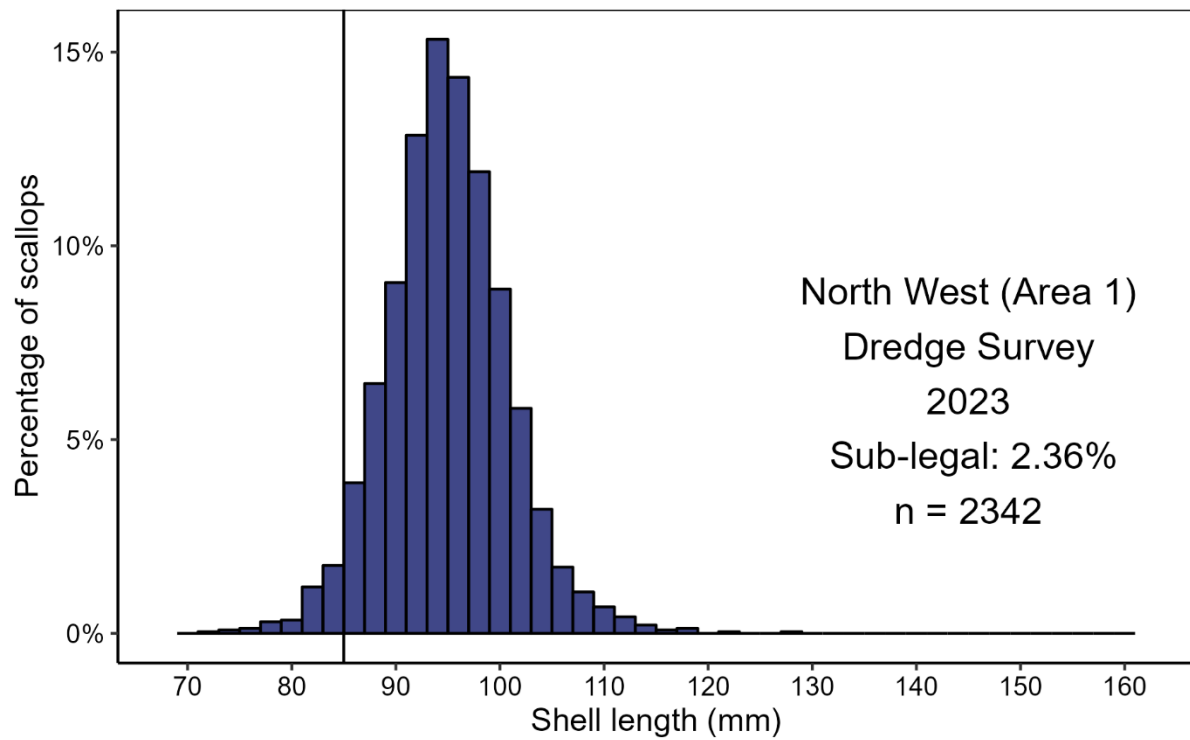


Figure 3. Standardised length frequency distribution for the 63 dredge tows in the North West (Area 1) targeted dredge survey. The dredge discard rate was 2.36% from 2342 scallops measured at 85 mm minimum legal length with a mean size $\pm$ standard error of 95.46 ± 0.12 mm. The vertical line shows the 85 mm minimum length.

White Rock (Area 5) – Targeted dredge survey

The White Rock targeted dredge survey consisted of 52 targeted dredge survey tows in four sub-areas (13 in each sub-area) deployed from FV Odete C in May 2023 (Table 1, Figures 1, 4, 5 and 6). The targeted dredge sites were a random subset of 13 of 20 sites randomly allocated in each of the sub-areas in the White Rock NRE-defined polygon.

The White Rock targeted dredge survey tows yielded an average density of legal-sized scallops of 2.65 kg/1000 m² (median 1.74 kg/1000 m²), with a discard rate of 1.77% at the minimum legal size of 90 mm (Table 5 and 7, Figures 4, 5 and 6).

Average density of total scallops (legal and sub-legal catch) from the dredge tows was 2.71 kg/1000 m² (median 1.78 kg/1000 m²). Sub-area total yields are provided in Table A2 in Appendix 1.

Average density of total dead shell scallops from the dredge tows was 14.18 kg/1000 m² (median 5.58 kg/1000 m²). Average density of new dead shell scallops from the dredge tows was 1.87 kg/1000m² (median 0.77 kg/1000 m²). Sub-area new dead shell percentages and densities are provided in Table 6.

The average scallop length for the White Rock area was 106.44 ± 0.23 mm (standard error; Figure 3). Sub-area measurements are provided in Table 7.

Table 5. Estimated total number and density of legal sized scallops (≥90 mm) for the whole area (All Area 5) and four sub-areas of White Rock (Area 5) from the 2023 dredge survey and previous seasons. Avg. indicates average density of scallops and SD indicates the standard deviation. Dashes indicate values not calculated in previous years.

Year	Method	Sub-area	Average number legal scallops (n/m ²)	Density of legal scallops (kg/1000 m ²)		
				Avg.	SD	Median
2023	Dredge	All Area 5	0.03	2.65	2.80	1.74
		Sub-area 1	0.02	1.41	1.62	0.64
		Sub-area 2	0.04	3.76	2.67	2.29
		Sub-area 3	0.02	1.43	1.37	1.14
		Sub-area 4	0.04	4.00	3.88	3.58
2022	Dredge	All Area 5	-	22.3	-	8.3
		Sub-area 1	-	29.4	-	6.6
		Sub-area 2	-	36.4	-	36.3
		Sub-area 3	-	10.2	-	1.8
		Sub-area 4	-	13.4	-	8.5
2022	Video	All Area 5	-	38.4	-	25.5
		Sub-area 1	-	27.0	-	25.8
		Sub-area 2	-	18.7	-	51.6
		Sub-area 3	-	5.8	-	19.8
		Sub-area 4	-	1.4	-	14.3
2021	Dredge	NA	-	15.6	-	14.2
	Video	NA	-	25.4	-	21.6
2020	Dredge	NA	-	20.9	-	16.6
	Video	NA	-	21.9	-	8.5

2017	Dredge	NA	-	4.7	-	3.9
2016	Dredge	NA	-	4.4	-	3.5
2015	Dredge	NA	-	19.7	-	15.8
2014	Dredge	NA	-	8.6	-	7.2
2013	Dredge	NA	-	6.2	-	-
2011	Dredge	NA	-	>30	-	-

Table 6. Estimated average percentage (of total dead shell) and density of new dead shell scallops for the entire sampled area (All Area 5) and four sub-areas of White Rock (Area 5) from the 2023 dredge survey. Avg. indicates average density of scallops and SD indicates the standard deviation.

Year	Method	Sub-area	Average percentage (%) new dead shell	Density of new dead scallops (kg/1000 m ²)		
				Avg.	SD	Median
2023	Dredge	All Area 5	23.67	1.87	2.71	0.77
		Sub-area 1	6.00	1.18	1.67	0.52
		Sub-area 2	13.31	3.54	3.51	2.17
		Sub-area 3	21.38	1.77	3.06	0.67
		Sub-area 4	54.00	0.98	1.53	0.43

Table 7. Scallop measurements for the whole area (All Area 5) and four sub-areas of White Rock (Area 5) from the 2023 dredge survey and previous seasons. SE indicates standard error. Dashes indicate values not calculated in previous years.

Year	Method	Sub-area	Minimum scallop length (mm)	Maximum scallop length (mm)	Average scallop length (mm)	Average scallop length SE (mm)	Discard % (<90 mm)
2023	Dredge	All Area 5	76	138	106.44	0.23	1.77
		Sub-area 1	80	125	102.35	0.48	6.44
		Sub-area 2	85	124	102.72	0.27	2.08
		Sub-area 3	76	130	107.66	0.39	0.34
		Sub-area 4	86	138	113.40	0.46	0.27
2022	Dredge	All Area 5	-	-	106.4	0.2	3.1
		Sub-area 1	-	-	102.3	2.4	4.7
		Sub-area 2	-	-	101.6	1.7	2.0
		Sub-area 3	-	-	105.5	2.3	7.0
		Sub-area 4	-	-	116.5	2.9	0.5
2022	Video	All Area 5	-	-	108.9	1.6	3.9
		Sub-area 1	-	-	105.1	2.4	-
		Sub-area 2	-	-	106.2	1.4	-
		Sub-area 3	-	-	108.0	2.7	-
		Sub-area 4	-	-	115.3	3.7	-
2021	Dredge	NA	-	-	102.2	0.2	5.7
	Video	NA	-	-	96.3	0.6	28.2
2020	Dredge	NA	-	-	97.9	0.2	7.5
	Video	NA	-	-	85.6	0.4	58.9
2017	Dredge	NA	-	-	100.5	0.1	2.2
2016	Dredge	NA	-	-	96.8	0.2	22.5
2015	Dredge	NA	-	-	99.1	7.7	3.9
2014	Dredge	NA	-	-	98.2	8.2	7.3
2013	Dredge	NA	-	-	93.9	11.1	18.2
2011	Dredge	NA	-	-	-	-	7.5

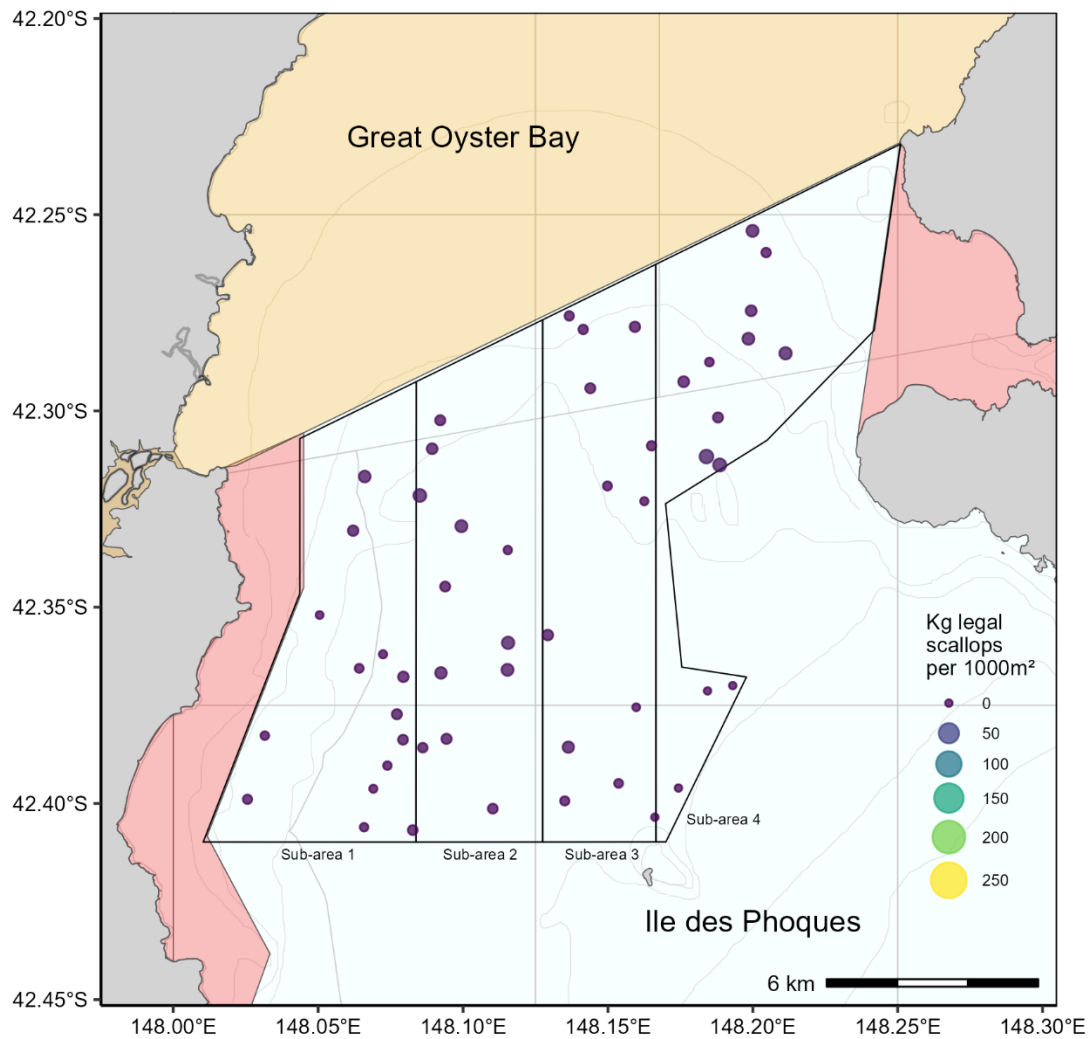


Figure 4. Legal-sized scallop density per tow for the White Rock (Area 5) targeted dredge survey. Density is displayed as kg of legal scallops (≥ 90 mm) per 1000 m², on the same scale as the density of the North West (Area 1, Figure 2). The pale blue areas indicate the Tasmanian Offshore Constitutional Settlement (OCS), the pale red areas indicated dredge prohibited areas and the pale orange areas indicate shark nursery areas in which dredging is also prohibited.

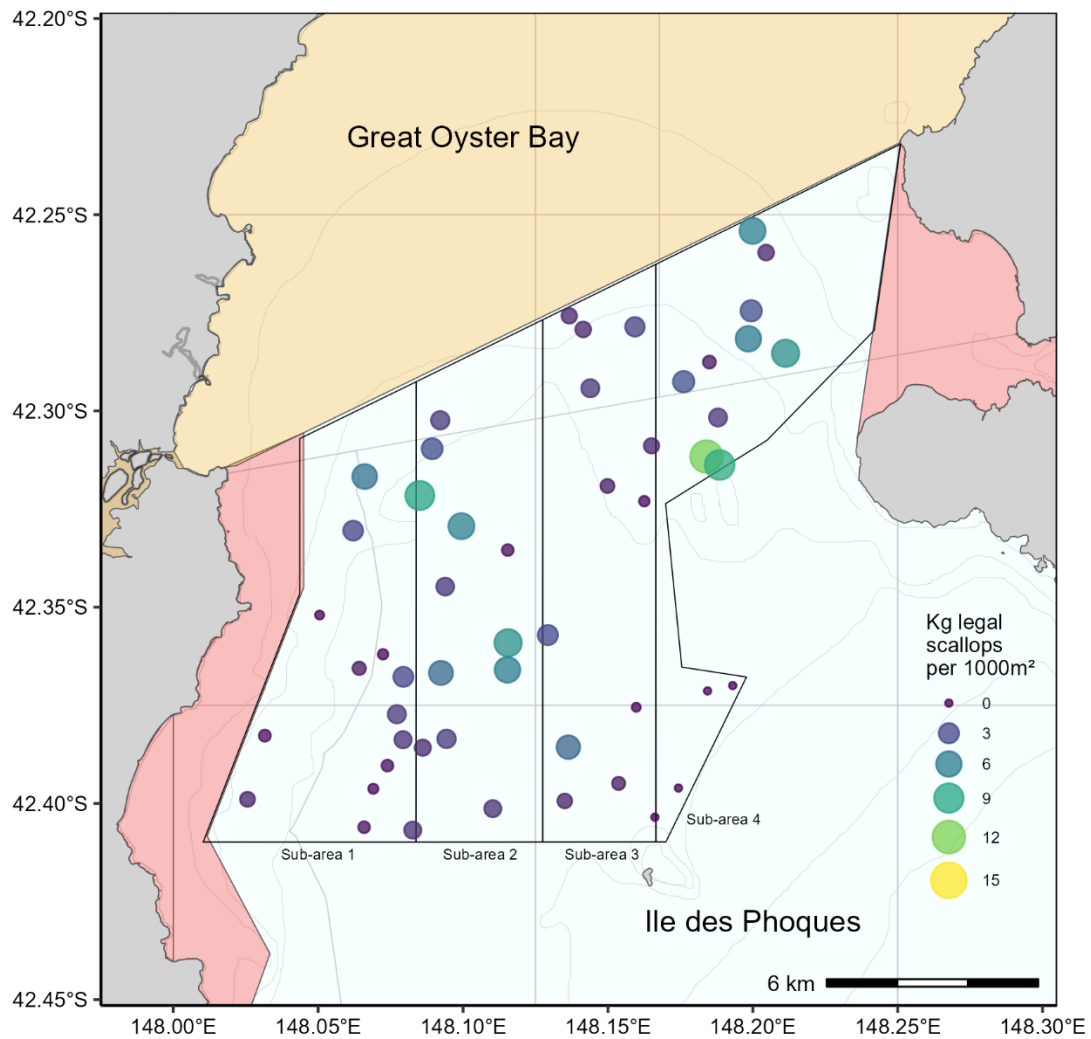


Figure 5. Legal-sized scallop density per tow for the White Rock (Area 5) targeted dredge survey. Density is displayed as kg of legal scallops (≥ 90 mm) per 1000 m². Please note the different scale to Figure 4. This plot has been provided to show details not visible at the previous plot's scale. The pale blue areas indicate the Tasmanian Offshore Constitutional Settlement (OCS), the pale red areas indicated dredge prohibited areas and the pale orange areas indicate shark nursery areas in which dredging is also prohibited.

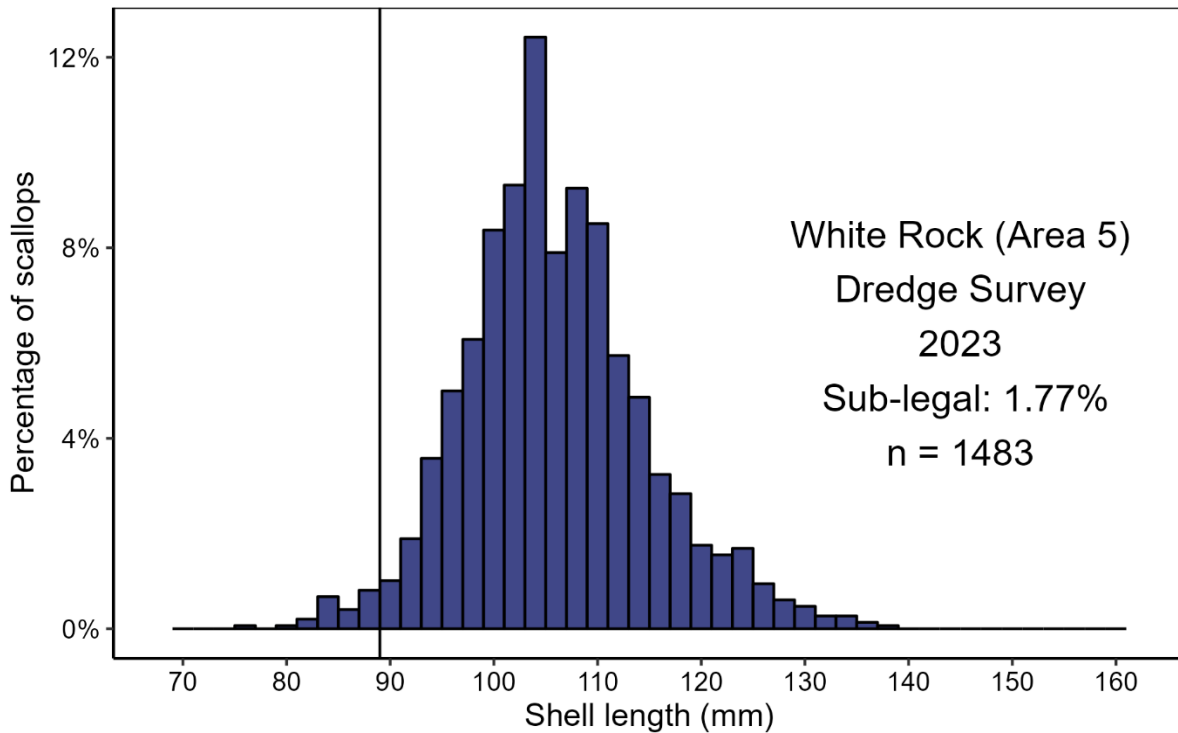


Figure 6. Standardised length frequency distribution for the 52 dredge tows in the White Rock (Area 5) targeted dredge survey. The dredge discard rate was 1.77% from 1483 scallops measured at 90 mm minimum legal length with a mean size $\pm$ standard error of 106.44 ± 0.23 mm. The vertical line shows the 90 mm minimum length.

Area 1 - Exploratory survey

The West Bass Strait (Area 1) exploratory survey consisted of 231 dredge survey tows deployed from FV Odete C and FV Shandara during June and July 2023 (Table 1, Figures 1 & 7)

The West Bass Strait survey tows yielded an average density of legal-sized scallops of 5.24 kg/1000 m² (median 0.26 kg/1000 m²), with a discard rate of 2.4 % at the minimum legal size of 85 mm (Table 8, Figures 7).

Average density of total scallops (legal and sub-legal catch) from the dredge tows was 5.63 kg/1000 m² (median 0.28 kg/1000 m²).

The average scallop length for the White Rock area was 100.1 ± 0.12 mm (standard error; Table 8 & Figure 8).

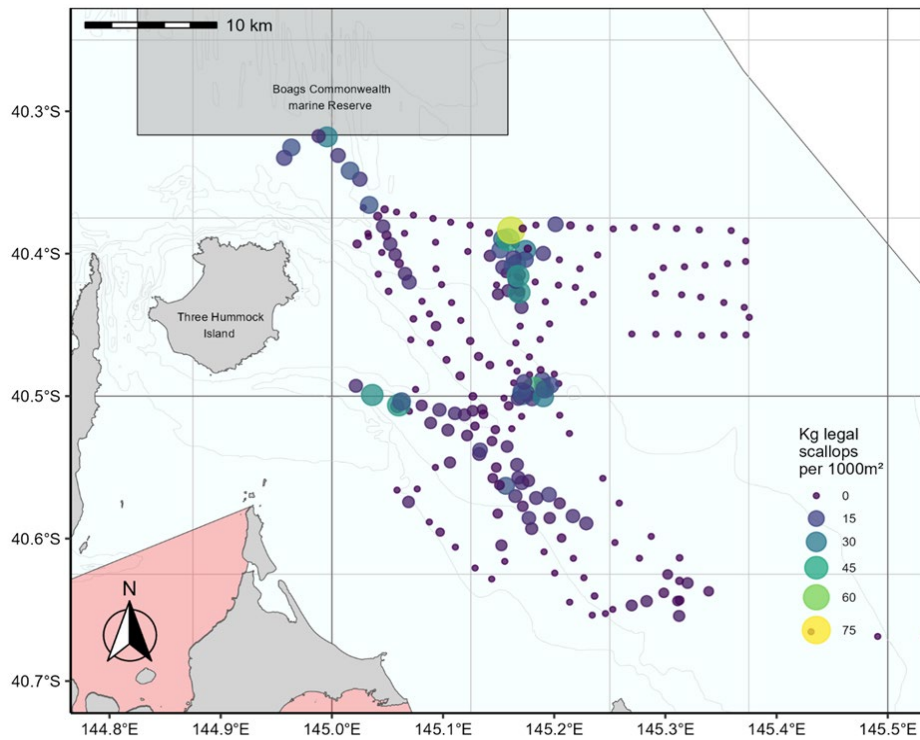


Figure 7. Legal-sized scallop density per tow for the West Bass Strait (Area 1) exploratory dredge survey. Density is displayed as kg of legal scallops (≥ 85 mm) per 1000 m². The pale blue areas indicate the Tasmanian Offshore Constitutional Settlement (OCS), the pale red areas indicated dredge prohibited areas.

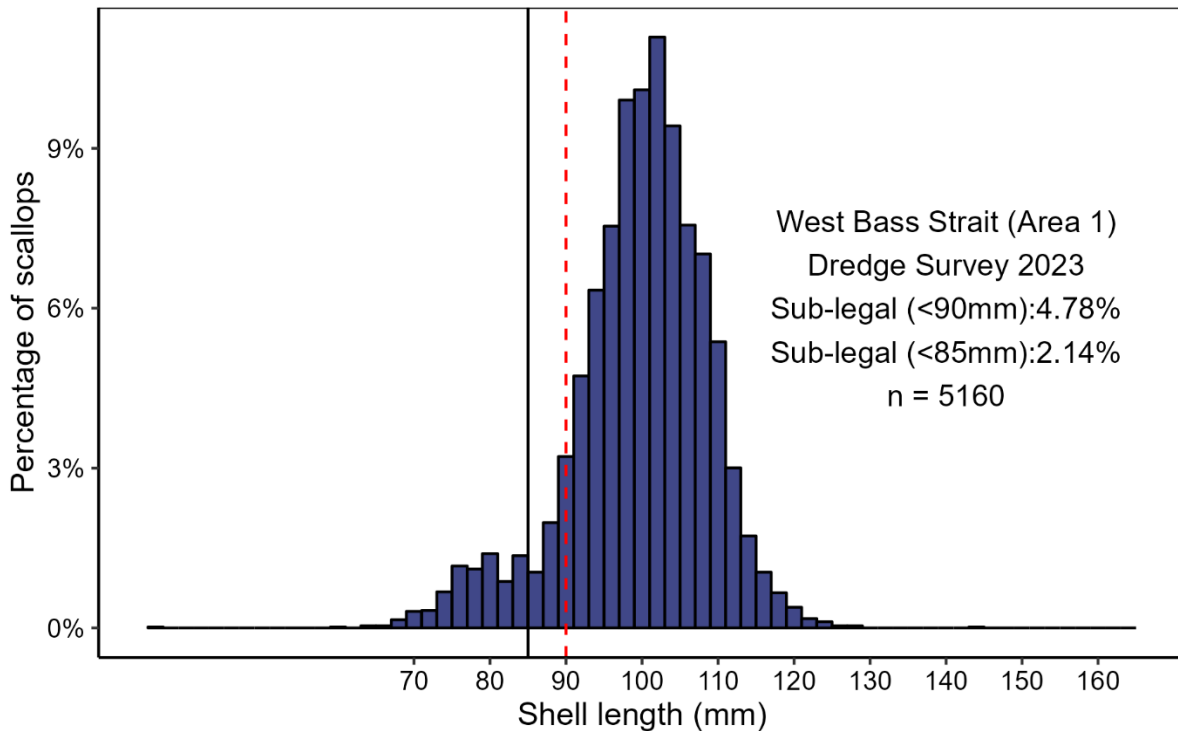


Figure 8. Standardised length frequency distribution for the 231 dredge tows in the West Bass Strait (Area 1) exploratory dredge survey. The dredge discard rate was 2.14 % from 5160 scallops measured at 85 mm minimum legal length. The black vertical line shows the 85 mm minimum length, while the red line shows the 90 mm minimum length.

Area 2 – Exploratory survey

The area 2 exploratory dredge survey consisted of 16 survey dredge tows deployed from FV Karmin in June 2023 (Table 1, and Figure 9).

The area 2 exploratory dredge survey tows yielded an average density of legal-sized scallops of 3.1 kg/1000 m² (median 0.75 kg/1000 m²), with a discard rate of 94.7 % at the minimum legal size of 90 mm (Table 8, Figures 9 & 10).

Average density of total scallops (legal and sub-legal catch) from the dredge tows was 13.87 kg/1000 m² (median 3.34 kg/1000 m²).

The average scallop length for the area 2 was 78.12 ± 0.39 mm (standard error; Figure 10).

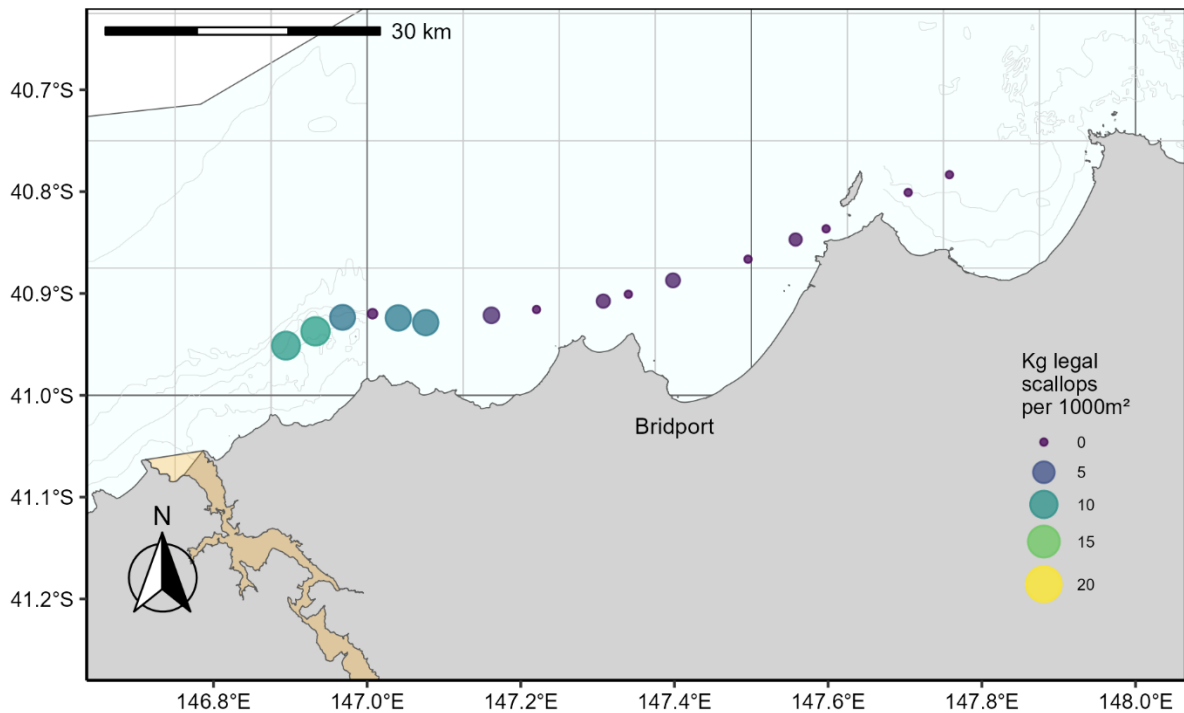


Figure 9. Legal-sized scallop density per dredge for East Bass Strait (Area 2) exploratory survey. Density is displayed as kg of legal scallops (≥ 90 mm) per 1000 m². The pale blue areas indicate the Tasmanian Offshore Constitutional Settlement (OCS).

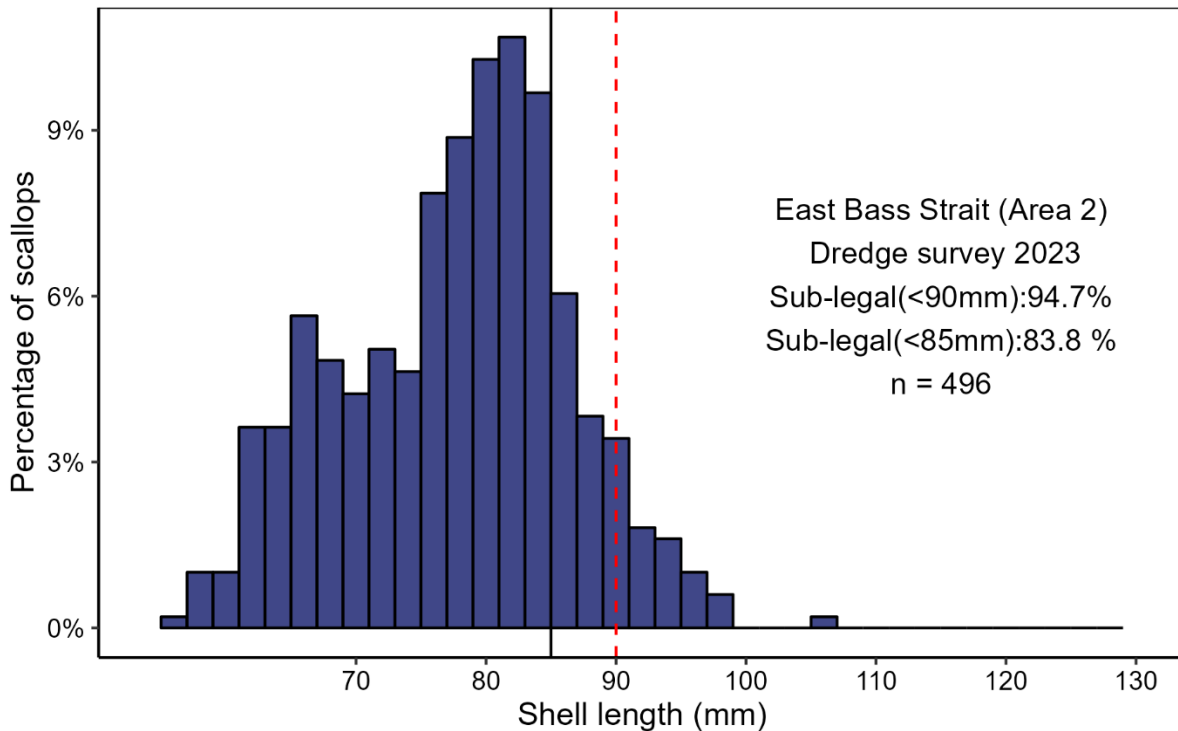


Figure 10. Standardised length frequency distribution for the 16 dredge tows in the East Bass Strait (Area 2) exploratory dredge survey. The dredge discard rate was 94.7 % and 83.8 % from 496 scallops measured at 90 and 85 mm minimum legal length respectively with an average length size $\pm$ standard error of 78.12 ± 0.39 mm. The vertical red line shows the 90 mm lengths and the black line 85 mm minimum length.

Area 3 - Exploratory survey

The East Flinders and Banks Straits (area 3) exploratory dredge survey consisted of 229 survey dredge tows deployed from FV Shandara, FV Karmin and FV Odete C during April, June, and July 2023 (Table 1, Figure 1 and 11).

The area 3 exploratory dredge survey tows yielded an average density of legal-sized scallops of 4.48 kg/1000 m² (median 1.28 kg/1000 m²), with a discard rate of 10% at the minimum legal size of 90 mm (Table 8 and Figure 12).

Average density of total scallops (legal and sub-legal catch) from the dredge tows was 4.69 kg/1000 m² (median 1.34 kg/1000 m²).

The average scallop length for the area 3 was 99.4 ± 0.12 mm (standard error; Figure 12).

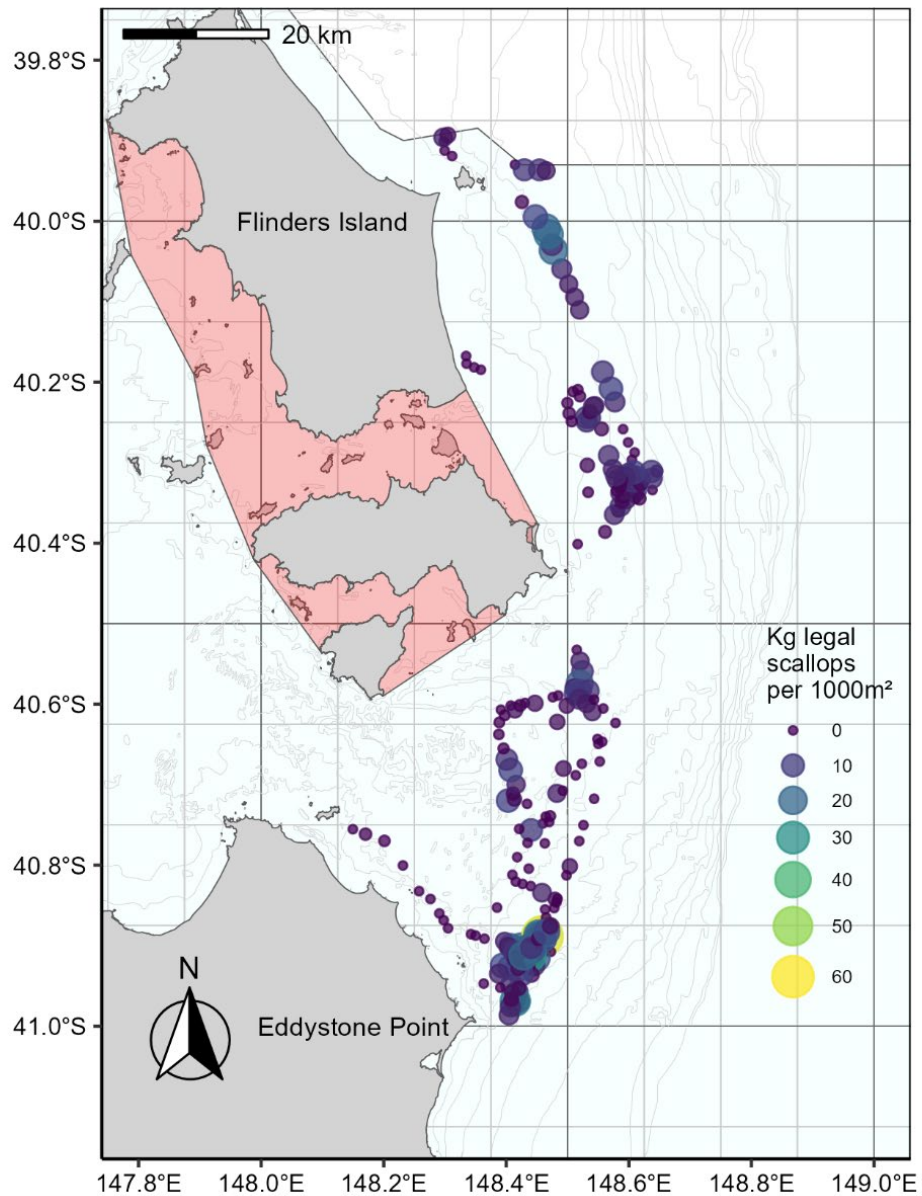


Figure 11. Legal-sized scallop density per tow for the East Flinders and Banks Straits (area 3) exploratory dredge survey. Density is displayed as kg of legal scallops (≥ 85 mm) per 1000 m². The pale blue areas indicate the Tasmanian Offshore Constitutional Settlement (OCS), and the pale red areas indicated dredge prohibited areas.

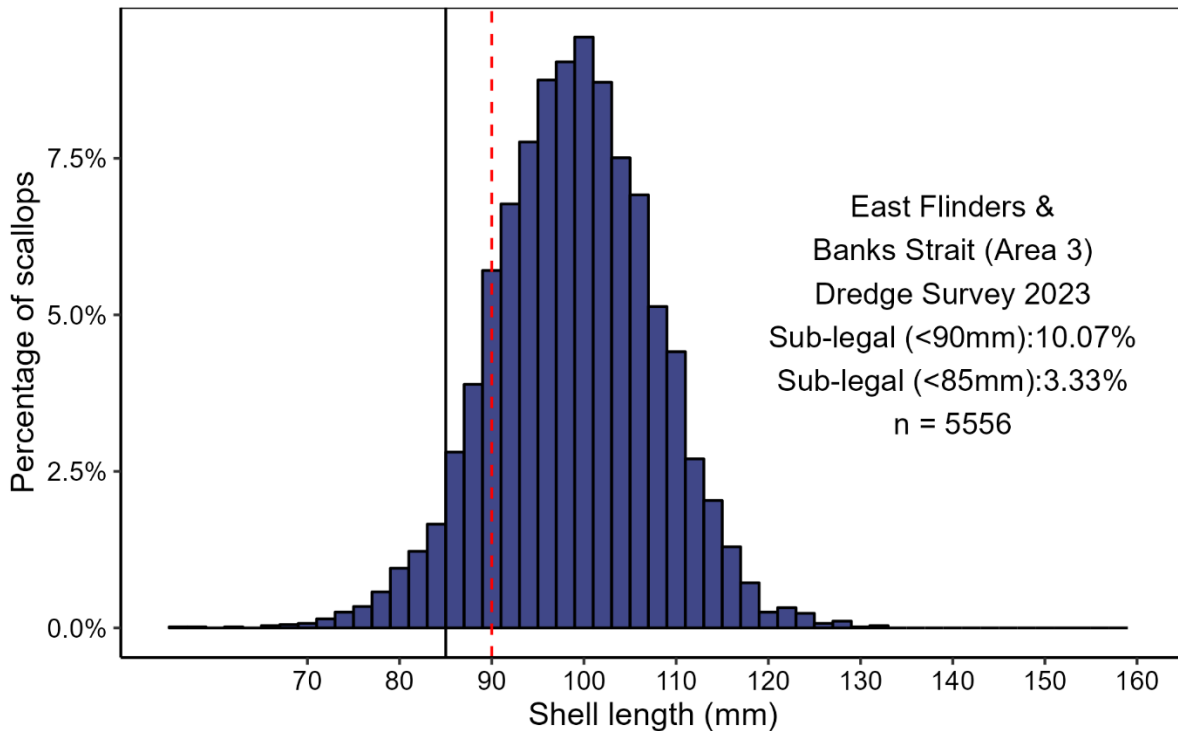


Figure 12. Standardised length frequency distribution for the 229 dredge tows in the Area 3 exploratory dredge survey. The dredge discard rate was 10.07 % from 5556 scallops measured at 90 mm minimum legal length with a mean size $\pm$ standard error of 99.4 ± 0.12 mm. The vertical line shows the 85 mm minimum length.

Area 4 – Exploratory survey

The Central East (Area 4) exploratory survey is divided into two zones, The Gardens and Bicheno.

The Gardens – exploratory survey

The gardens dredge exploratory survey consisted of 143 dredges tows deployed by FV Odete C and Shandara during May 2023 (Table 1).

The gardens exploratory dredge survey tows yielded an average density of legal-sized scallops of $6.44 \text{ kg}/1000 \text{ m}^2$ (median $0.51 \text{ kg}/1000 \text{ m}^2$), with a discard rate of 6.65 % at the minimum legal size of 95 mm (Table 8, Figures 13 and 14).

Average density of total scallops (legal and sub-legal catch) from the dredge tows was $6.8 \text{ kg}/1000 \text{ m}^2$ (median $0.54 \text{ kg}/1000 \text{ m}^2$).

The average scallop length for the area 3 was 100.4 ± 0.16 mm (standard error; Figure).

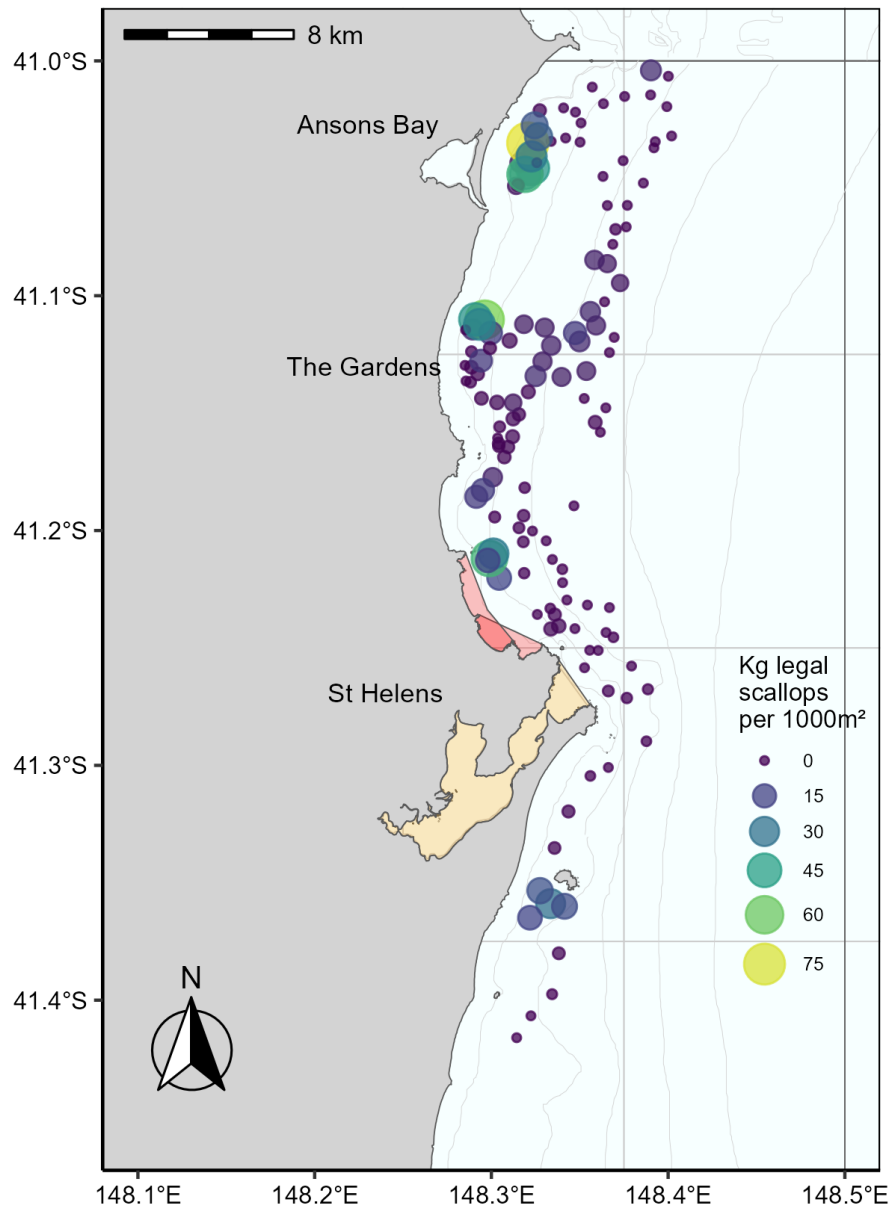


Figure 13. Legal-sized scallop density per tow for the East Flinders and Banks Straits (area 3) exploratory dredge survey. Density is displayed as kg of legal scallops (≥ 90 mm) per 1000 m². The pale blue areas indicate the Tasmanian Offshore Constitutional Settlement (OCS), and the pale red areas indicated dredge prohibited areas.

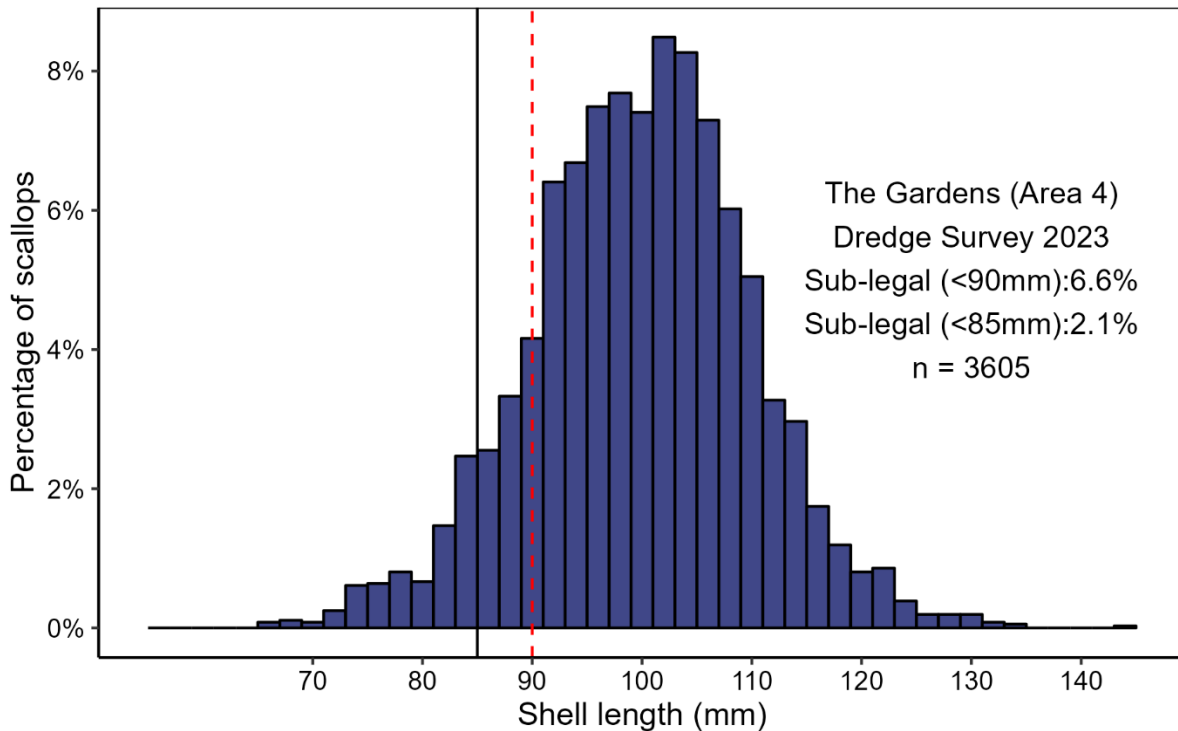


Figure 14. Standardised length frequency distribution for the 143 dredge tows in the gardens (Area 4) exploratory dredge survey. The dredge discard rate was 6.6 and 2.12 % from 5556 scallops measured at 90 and 85 mm minimum legal length respectively with a mean size $\pm$ standard error of 99.4 ± 0.12 mm. The vertical red line shows the 90 mm minimum length and the black line the 85 mm minimum length.

Bicheno – exploratory survey

The central area exploratory survey around Bicheno consisted of 77 dredges tows deployed by FV Odete C during May 2023 (Table 1).

The gardens exploratory dredge survey tows yielded an average density of legal-sized scallops of $0.95 \text{ kg}/1000 \text{ m}^2$ (median $0.23 \text{ kg}/1000 \text{ m}^2$), with a discard rate of 11.4% at the minimum legal size of 90 mm (Table 8, Figures 15).

Average density of total scallops (legal and sub-legal catch) from the dredge tows was $1.01 \text{ kg}/1000 \text{ m}^2$ (median $0.25 \text{ kg}/1000 \text{ m}^2$).

The average scallop length for Bicheno (Area 4) was 102.01 ± 0.39 mm (standard error; Figure 16).

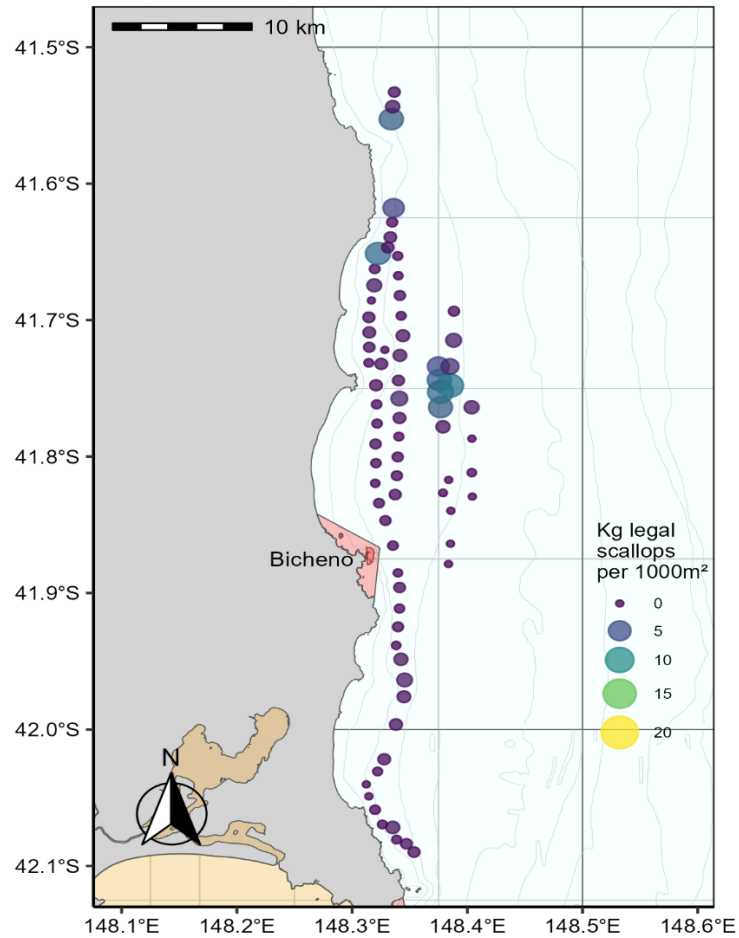


Figure 15. Legal-sized scallop density per tow for Bicheno (Area 4) exploratory dredge survey. Density is displayed as kg of legal scallops (≥ 90 mm) per 1000 m². The pale blue areas indicate the Tasmanian Offshore Constitutional Settlement (OCS), and the pale red areas indicated dredge prohibited areas.

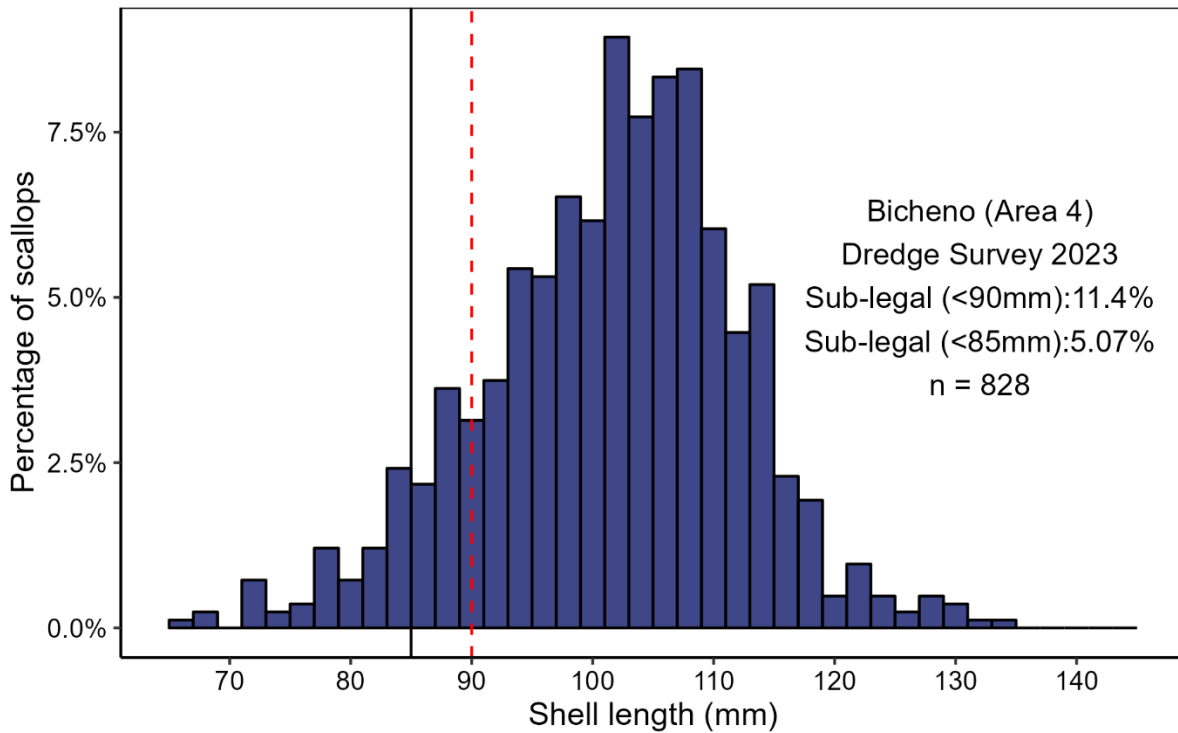


Figure 16. Standardised length frequency distribution for 77 dredge tows in the gardens (Area 4) exploratory dredge survey. The red vertical line shows the 90 mm legal size length, and the black line show the 85 mm minimum length.

Table 8. Scallop measurement for the 4 different areas of the 2023 exploratory survey.

Year	Method	Area	Sub-area	Minimum scallop length (mm)	Maximum scallop length (mm)	Average scallop length (mm)	Average scallop length Sd (mm)	Discard % (<90 mm)	Discard % (<85 mm)
2023	Dredge	Area 1		35	182	100.1	0.12	4.78	2.14
2023	Dredge	Area 2		54	107	78.12	0.39	94.7	83.78
2023	Dredge	Area 3		57	133	99.4	0.11	10	3.33
2023	Dredge	Area 4	The gardens	67	145	100.4	0.16	6.65	2.12
			Bicheno	67	135	102.01	0.37	11.4	5.07

Biomass estimates

An estimated biomass of scallops within each of the polygons defined by NRE managers as the regions of commercial interest was calculated using the standard method of scaling-up the mean density across the survey area (Tables 6 and 7).

An adjustment for dredge efficiency of 33% (Harrington et al. 2008) has been applied to the dredge biomass estimates and is also presented in Tables 9 and 10. It should, however, be noted that the comparison between the dredge and video biomass estimates in the White Rock region in the 2021, and 2022 surveys raises questions around the validity of the adjustment applied for dredge efficiency. The dredge estimates of the mean and lower and upper 95% confidence intervals for biomass were 61.3, 63.4 and 60.3% of those for video in 2021, respectively. Similarly, the dredge estimates of the mean and lower and upper 95% confidence intervals for biomass were 58.1, 54.3 and 60.2% of those for video in 2022. This suggests that dredge efficiency, at least in the White Rock region, is significantly higher than 33% and closer to 60%. Consequently, dredge biomass values provided here should only be used as a relative value for comparison between the regions surveyed.

The total mean estimated legal biomass for 2023 from the targeted surveys in the North West (Area 1) and White Rock (Area 5) is 13,341 t. The dredge efficiency adjusted biomass is 40,024 t.

References

Harrington, J.J., Semmens, J.M., Haddon, M., 2008. 2008 Commonwealth Bass Strait Central Zone Scallop Fishery Survey. Survey Final Report. Tasmanian Aquaculture and Fisheries Institute. University of Tasmania.

Table 9. Estimated biomass of legal-sized (≥ 85 mm) commercial scallops (*Pecten fumatus*) within the North West (Area 1) sampling area defined by NRE managers as the regions of commercial interest, based on dredge survey methods for 2023 and previous seasons. Dredge-derived biomass estimates adjusted for dredge efficiency should be interpreted with caution as recent White Rock video surveys raise questions about their validity. Biomass confidence intervals (CI) are 95%.

Year	Method	Sub-areas	Area (km ²)	Sites sampled (n)	Biomass (t)			Adjusted biomass (t)		
					Lower CI	Mean	Higher CI	Lower CI	Mean	Higher CI
2023	Dredge	All Area 1	246	63	8569	12769	16969	25707	38307	50908
		Sub-area 1	50	13	5506	7212	8919	16517	21636	26756
		Sub-area 2	50	13	161	1987	3813	484	5961	11438
		Sub-area 3	50	13	21	186	352	62	559	1056
		Sub-area 4	50	11	-163	1729	3622	-490	5188	10866
		Sub-area 5	50	13	602	1562	2522	1807	4687	7567
2022	Dredge	All Area 1	200	52	4089	7208	10327	12267	21624	30981
		Sub-area 1	50	13	1064	3243	5422	3192	9729	16266
		Sub-area 2	50	13	462	2573	4684	1386	7719	14052
		Sub-area 3	50	13	-21	276	573	-7	828	1719
		Sub-area 4	50	13	258	1125	1993	774	3375	5979

Table 10. Estimated biomass of legal-sized (≥ 90 mm) commercial scallops (*Pecten fumatus*) within the White Rock (Area 5) sampling area defined by NRE managers as the regions of commercial interest, based on dredge survey methods for 2023 and previous seasons. Dredge-derived biomass estimates adjusted for dredge efficiency should be interpreted with caution as recent White Rock video surveys raise questions about their validity. Biomass confidence intervals (CI) are 95%. Dashes indicate values not calculated in previous years.

Year	Method	Sub-areas	Area (km ²)	Sites sampled (n)	Biomass (t)			Adjusted biomass (t)		
					Lower CI	Mean	Higher CI	Lower CI	Mean	Higher CI
2023	Dredge	All Area 5	200	52	374	530	686	1123	1590	2057
		Sub-area 1	50	13	22	70	119	65	211	358
		Sub-area 2	50	13	107	188	269	321	563	806
		Sub-area 3	50	13	30	72	113	91	215	340
		Sub-area 4	50	13	83	200	317	249	600	952
2022	Dredge	All Area 5	200	52	2960	4471	5982	8880	13413	17946
		Sub-area 1	50	13	388	1469	2549	1164	4407	7647
		Sub-area 2	50	13	914	1817	2721	2742	5451	8163
		Sub-area 3	50	13	9	509	1008	27	1527	3024
		Sub-area 4	50	13	284	671	1058	852	2013	3174
2022	Video	All Area 5	200	29	5456	7694	9932	-	-	-
		Sub-area 1	50	9	668	1743	2817	-	-	-
		Sub-area 2	50	7	1582	3328	5074	-	-	-
		Sub-area 3	50	4	470	1412	2353	-	-	-
		Sub-area 4	50	9	533	1233	1933	-	-	-
2021	Dredge	NA	200	29	2025	3122	4220	6072	9366	12660
	Video	NA	200	14	3191	5093	6995	-	-	-
2020	Video	NA	200	48	2077	3161	4246	-	-	-

Appendix 1

Total scallop estimates (legal + sub-legal)

Table A1. Estimated number and density of total scallops (total = legal + sub legal) for the entire sampled area (All Area 1) and five sub-areas of North West (Area 1) from the 2023 dredge survey. Avg. indicates average density of scallops and SD indicates the standard deviation.

Year	Method	Sub-area	Average number total scallops (n/m ²)	Density of total scallops (kg/1000 m ²)		
				Avg.	SD	Median
2023	Dredge	All Area 1	0.84	53.42	69.77	20.38
		Sub-area 1	2.37	150.04	58.75	147.10
		Sub-area 2	0.66	41.77	63.50	18.61
		Sub-area 3	0.06	3.92	5.77	0.65
		Sub-area 4	0.57	36.01	58.67	7.25
		Sub-area 5	0.52	32.67	33.22	22.80

Table A2. Estimated number and density of total scallops (total = legal + sub legal) for the entire sampled area (All Area 5) and four sub-areas of White Rock (Area 5) from the 2023 dredge survey. Avg. indicates average density of scallops and SD indicates the standard deviation.

Year	Method	Sub-area	Average number total scallops (n/m ²)	Density of total scallops (kg/1000 m ²)		
				Avg.	SD	Median
2023	Dredge	All Area 5	0.03	2.71	2.86	1.78
		Sub-area 1	0.02	1.44	1.65	0.66
		Sub-area 2	0.04	3.84	2.73	2.34
		Sub-area 3	0.02	1.47	1.41	1.17
		Sub-area 4	0.05	4.10	3.97	3.66

Appendix 2

Targeted Survey Sites 2023

North West (Area 1) preseason targeted dredge survey 2023

In 2022, a targeted dredge survey was designed following exploratory dredge surveys in the North West (Area 1). The area contains four sub-area sample sites of approximately the same size. The same sampling areas will be sampled in 2023. Twenty random sites have been selected per sub-area, of which 13 are to be sampled (blue), with seven alternate sites (grey) in case of unsuitable sampling conditions (Figure 1, Table 1). To qualify as a valid survey tow, the dredge must pass within 100 m of the site mark at some point during the tow. Survey tows must be 500 m in length.

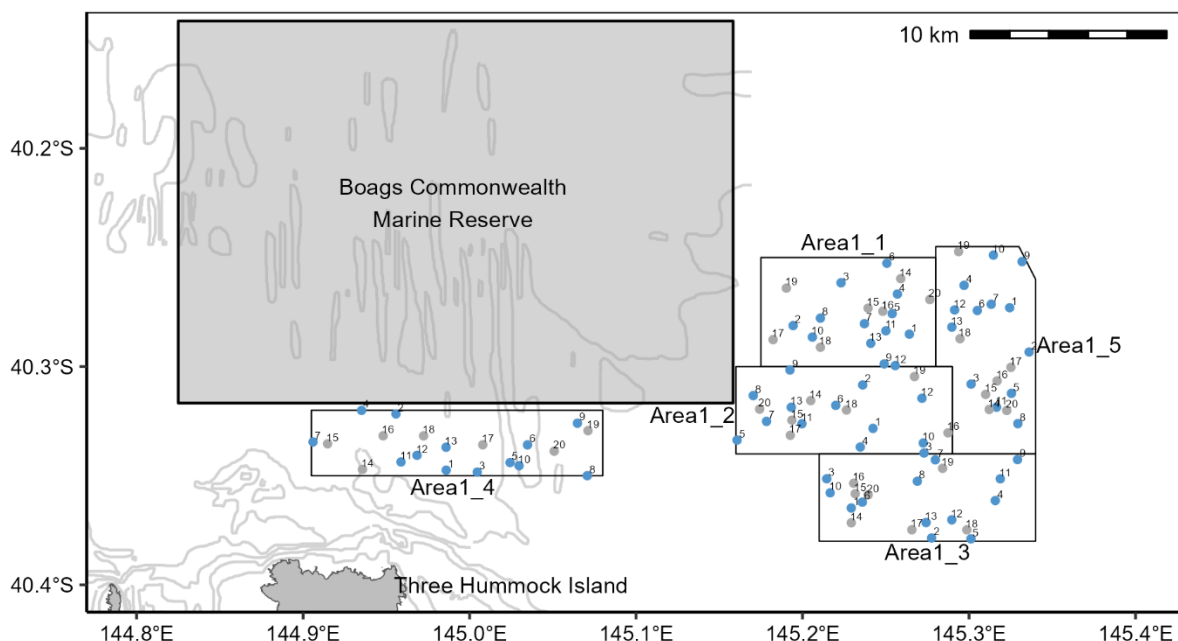


Figure 1. Commercial Scallop (*Pecten fumatus*) survey sites (with site numbers) for the four sub-areas of Area 1, North West Tasmania. Blue sites indicate the primary sampling sites and grey sites indicate the alternate sites in case of unsuitable sampling conditions. See Figures 2-6 for each sub-area in closer detail.

Table 1. Dredge survey sites listed in randomised order per sub-area for Area 1 (North West). Primary tow sites are shaded in blue (random order numbers 1-13) and alternate tow sites are shaded in grey (random order numbers 14-20).

Sub-area	Random order	Decimal Degrees Latitude	Decimal Degrees Longitude	Degrees Latitude	Decimal Minutes Latitude	Degrees Longitude	Decimal Minutes Longitude
1	1	-40.285099	145.264165	-40	17.106	145	15.850
1	2	-40.281211	145.194334	-40	16.873	145	11.660
1	3	-40.261591	145.223118	-40	15.695	145	13.387
1	4	-40.266739	145.256977	-40	16.004	145	15.419
1	5	-40.275721	145.253855	-40	16.543	145	15.231
1	6	-40.252618	145.250654	-40	15.157	145	15.039
1	7	-40.280335	145.237162	-40	16.820	145	14.230
1	8	-40.277786	145.210733	-40	16.667	145	12.644
1	9	-40.298748	145.249072	-40	17.925	145	14.944
1	10	-40.286483	145.205915	-40	17.189	145	12.355
1	11	-40.283588	145.250072	-40	17.015	145	15.004
1	12	-40.299549	145.255672	-40	17.973	145	15.340
1	13	-40.289305	145.240981	-40	17.358	145	14.459
1	14	-40.259686	145.258989	-40	15.581	145	15.539
1	15	-40.273215	145.239364	-40	16.393	145	14.362
1	16	-40.274654	145.248191	-40	16.479	145	14.891
1	17	-40.287634	145.182308	-40	17.258	145	10.939
1	18	-40.291120	145.210748	-40	17.467	145	12.645
1	19	-40.264038	145.190289	-40	15.842	145	11.417
1	20	-40.269259	145.276462	-40	16.156	145	16.588
2	1	-40.328309	145.242321	-40	19.699	145	14.539
2	2	-40.308395	145.236133	-40	18.504	145	14.168
2	3	-40.339586	145.272979	-40	20.375	145	16.379
2	4	-40.336831	145.234698	-40	20.210	145	14.082
2	5	-40.333660	145.160692	-40	20.020	145	9.642
2	6	-40.317753	145.219933	-40	19.065	145	13.196
2	7	-40.325092	145.178353	-40	19.506	145	10.701
2	8	-40.313265	145.170399	-40	18.796	145	10.224
2	9	-40.301544	145.192452	-40	18.093	145	11.547
2	10	-40.335008	145.272485	-40	20.100	145	16.349
2	11	-40.326152	145.199635	-40	19.569	145	11.978
2	12	-40.314500	145.271739	-40	18.870	145	16.304
2	13	-40.318629	145.193240	-40	19.118	145	11.594
2	14	-40.315575	145.204927	-40	18.935	145	12.296
2	15	-40.324544	145.193609	-40	19.473	145	11.617
2	16	-40.330334	145.287397	-40	19.820	145	17.244
2	17	-40.331467	145.192654	-40	19.888	145	11.559
2	18	-40.319878	145.226396	-40	19.193	145	13.584
2	19	-40.304554	145.267256	-40	18.273	145	16.035
2	20	-40.319466	145.174204	-40	19.168	145	10.452

3	1	-40.364765	145.229279	-40	21.886	145	13.757
3	2	-40.378503	145.277532	-40	22.710	145	16.652
3	3	-40.351392	145.214537	-40	21.084	145	12.872
3	4	-40.361357	145.315790	-40	21.681	145	18.947
3	5	-40.378922	145.301144	-40	22.735	145	18.069
3	6	-40.362106	145.235899	-40	21.726	145	14.154
3	7	-40.342712	145.279752	-40	20.563	145	16.785
3	8	-40.352510	145.268969	-40	21.151	145	16.138
3	9	-40.342595	145.329138	-40	20.556	145	19.748
3	10	-40.357815	145.216609	-40	21.469	145	12.997
3	11	-40.351409	145.318801	-40	21.085	145	19.128
3	12	-40.370208	145.289654	-40	22.212	145	17.379
3	13	-40.371439	145.274205	-40	22.286	145	16.452
3	14	-40.371554	145.229288	-40	22.293	145	13.757
3	15	-40.358212	145.231652	-40	21.493	145	13.899
3	16	-40.353437	145.230723	-40	21.206	145	13.843
3	17	-40.374760	145.265669	-40	22.486	145	15.940
3	18	-40.374783	145.298717	-40	22.487	145	17.923
3	19	-40.346609	145.284110	-40	20.797	145	17.047
3	20	-40.358735	145.239399	-40	21.524	145	14.364
4	1	-40.347442	144.985959	-40	20.846	144	59.158
4	2	-40.321667	144.955812	-40	19.300	144	57.349
4	3	-40.348319	145.004603	-40	20.899	145	0.276
4	4	-40.320064	144.935129	-40	19.204	144	56.108
4	5	-40.343963	145.024325	-40	20.638	145	1.459
4	6	-40.335846	145.034783	-40	20.151	145	2.087
4	7	-40.334493	144.905981	-40	20.070	144	54.359
4	8	-40.349971	145.070699	-40	20.998	145	4.242
4	9	-40.325927	145.064772	-40	19.556	145	3.886
4	10	-40.345380	145.029737	-40	20.723	145	1.784
4	11	-40.343696	144.958823	-40	20.622	144	57.529
4	12	-40.340648	144.968435	-40	20.439	144	58.106
4	13	-40.336947	144.985895	-40	20.217	144	59.154
4	14	-40.347080	144.935700	-40	20.825	144	56.142
4	15	-40.335360	144.914734	-40	20.122	144	54.884
4	16	-40.331701	144.948100	-40	19.902	144	56.886
4	17	-40.335813	145.007935	-40	20.149	145	0.476
4	18	-40.331731	144.972393	-40	19.904	144	58.344
4	19	-40.329321	145.071149	-40	19.759	145	4.269
4	20	-40.338744	145.050845	-40	20.325	145	3.051
5	1	-40.272994	145.324430	-40	16.380	145	19.466
5	2	-40.293316	145.336095	-40	17.599	145	20.166
5	3	-40.308004	145.301248	-40	18.480	145	18.075
5	4	-40.262756	145.297020	-40	15.765	145	17.821
5	5	-40.312259	145.325465	-40	18.736	145	19.528
5	6	-40.274281	145.304971	-40	16.457	145	18.298

5	7	-40.271432	145.313321	-40	16.286	145	18.799
5	8	-40.326117	145.329308	-40	19.567	145	19.758
5	9	-40.251875	145.331872	-40	15.112	145	19.912
5	10	-40.248913	145.314660	-40	14.935	145	18.880
5	11	-40.318583	145.316524	-40	19.115	145	18.991
5	12	-40.274018	145.291354	-40	16.441	145	17.481
5	13	-40.281880	145.289682	-40	16.913	145	17.381
5	14	-40.319616	145.312124	-40	19.177	145	18.727
5	15	-40.312731	145.309990	-40	18.764	145	18.599
5	16	-40.306524	145.316850	-40	18.391	145	19.011
5	17	-40.300316	145.325167	-40	18.019	145	19.510
5	18	-40.287187	145.294615	-40	17.231	145	17.677
5	19	-40.247290	145.293739	-40	14.837	145	17.624
5	20	-40.320101	145.322659	-40	19.206	145	19.360

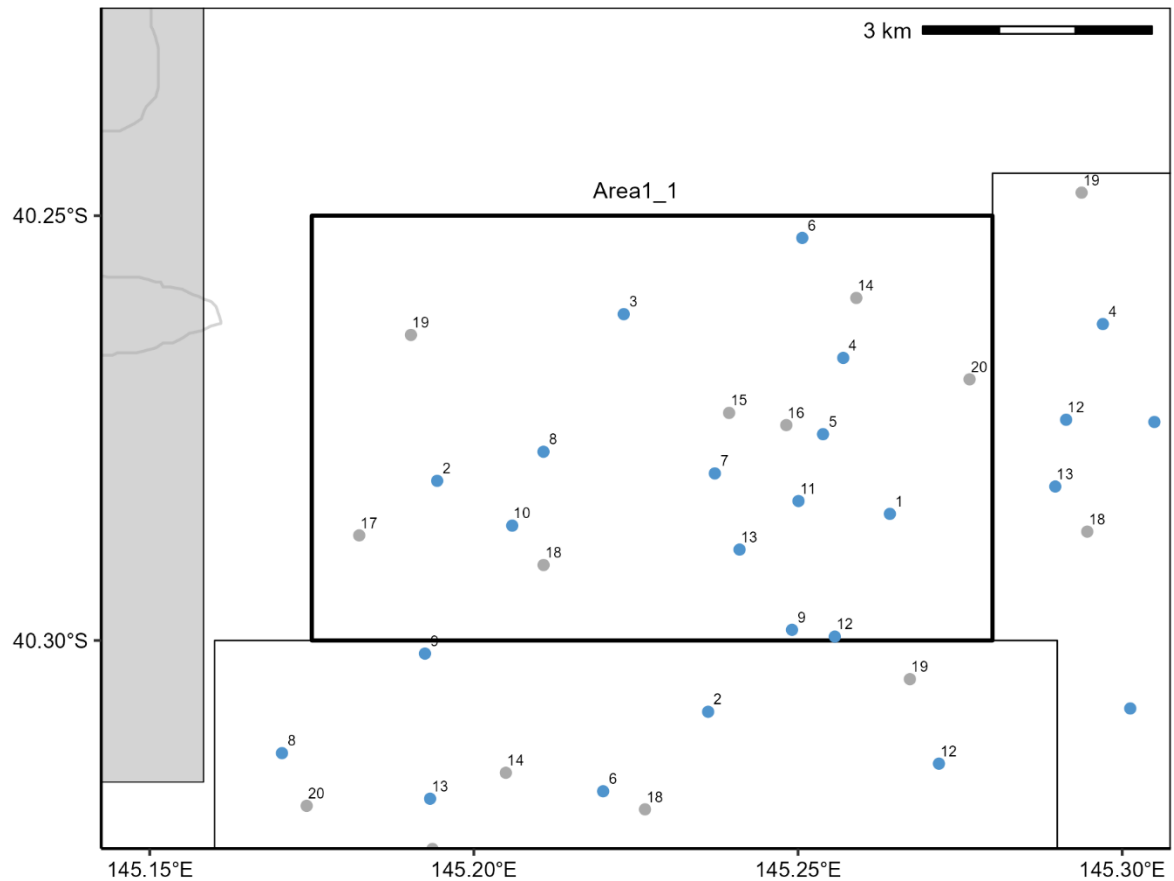


Figure 2. Commercial Scallop (*Pecten fumatus*) survey sites (with site numbers) for sub-area 1 of Area 1 (Area1_1), North West Tasmania. Blue sites indicate the primary sampling sites and grey sites indicate the alternate sites in case of unsuitable sampling conditions.

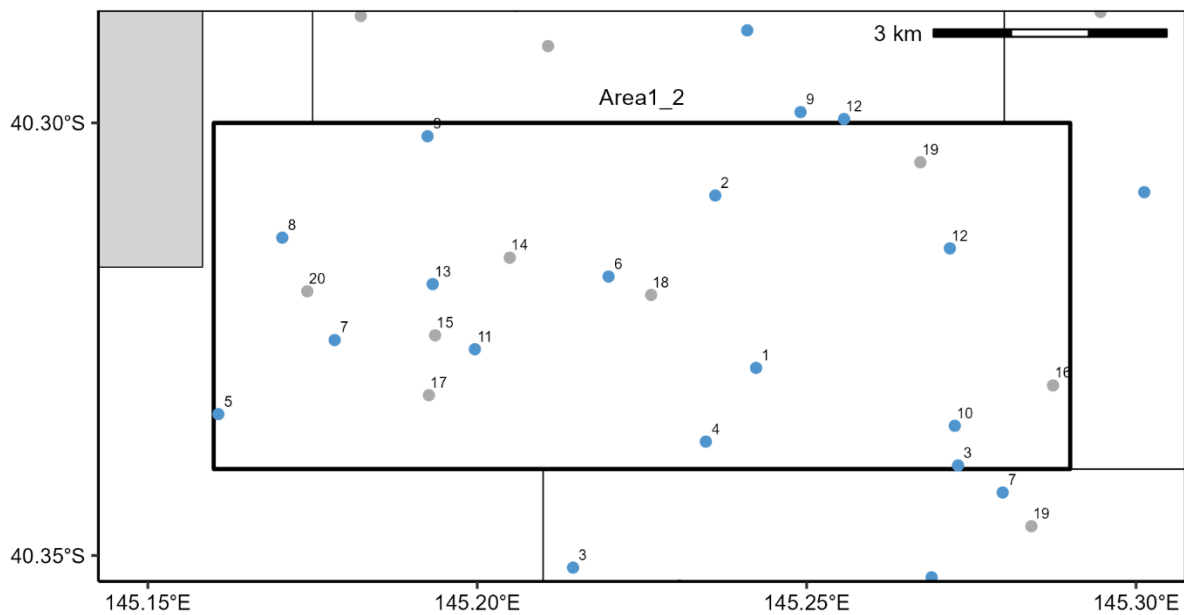


Figure 3. Commercial Scallop (*Pecten fumatus*) survey sites (with site numbers) for sub-area 2 of Area 1 (Area1_2), North West Tasmania. Blue sites indicate the primary sampling sites and grey sites indicate the alternate sites in case of unsuitable sampling conditions.

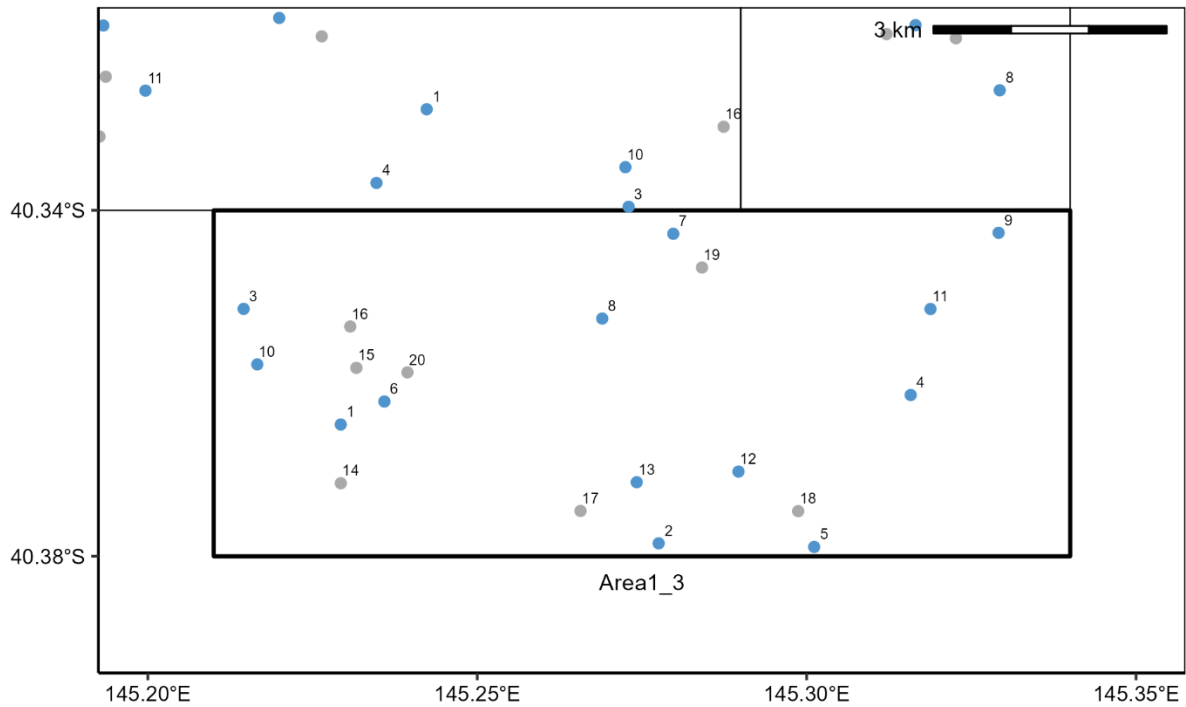


Figure 4. Commercial Scallop (*Pecten fumatus*) survey sites (with site numbers) for sub-area 3 of Area 1 (Area1_3), North West Tasmania. Blue sites indicate the primary sampling sites and grey sites indicate the alternate sites in case of unsuitable sampling conditions.

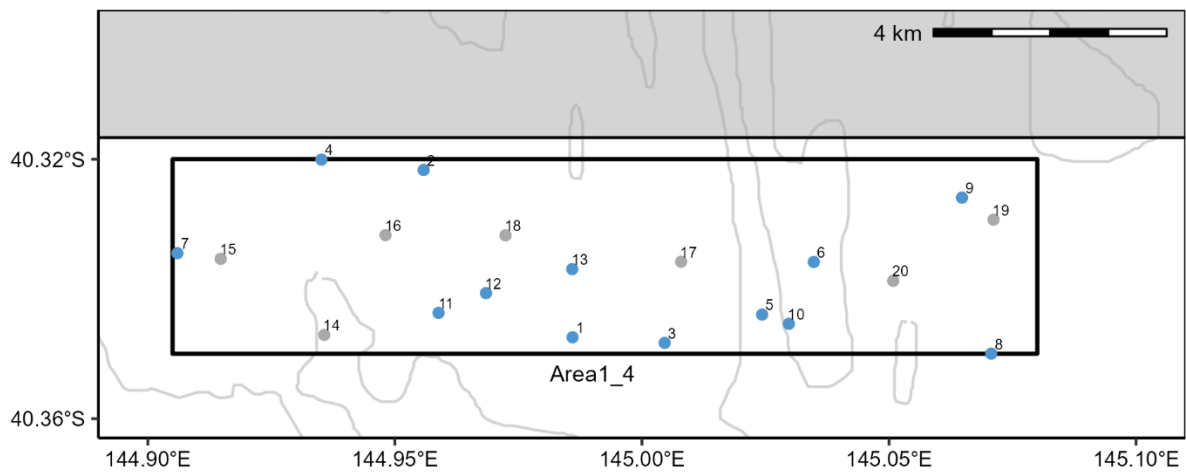


Figure 5. Commercial Scallop (*Pecten fumatus*) survey sites (with site numbers) for sub-area 4 of Area 1 (Area1_4), North West Tasmania. Blue sites indicate the primary sampling sites and grey sites indicate the alternate sites in case of unsuitable sampling conditions.

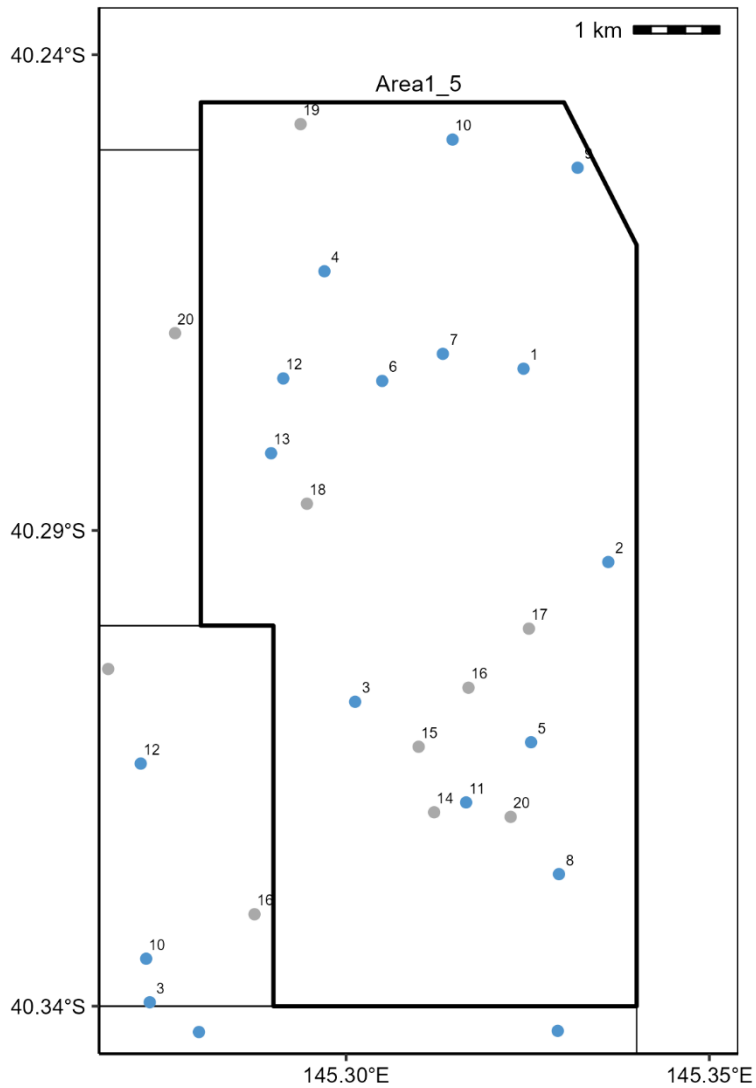


Figure 6. Commercial Scallop (*Pecten fumatus*) survey sites (with site numbers) for sub-area 5 of Area 1 (Area1_5), North West Tasmania. Blue sites indicate the primary sampling sites and grey sites indicate the alternate sites in case of unsuitable sampling conditions.

White Rock (Area 5) preseason dredge survey 2023

Similarly to 2022, the White Rock region of Scallop Fishery Area 5 has been divided into four equal-sized sub-areas (Figure 1). Twenty random sites have been selected per sub-area, of which 13 are to be sampled (blue), with seven alternate sites in case of unsuitable sampling conditions (grey, Table 1). To qualify as a valid survey tow, the dredge must pass within 100 m of the site mark at some point during the tow. Survey tows will be 500 m in length.

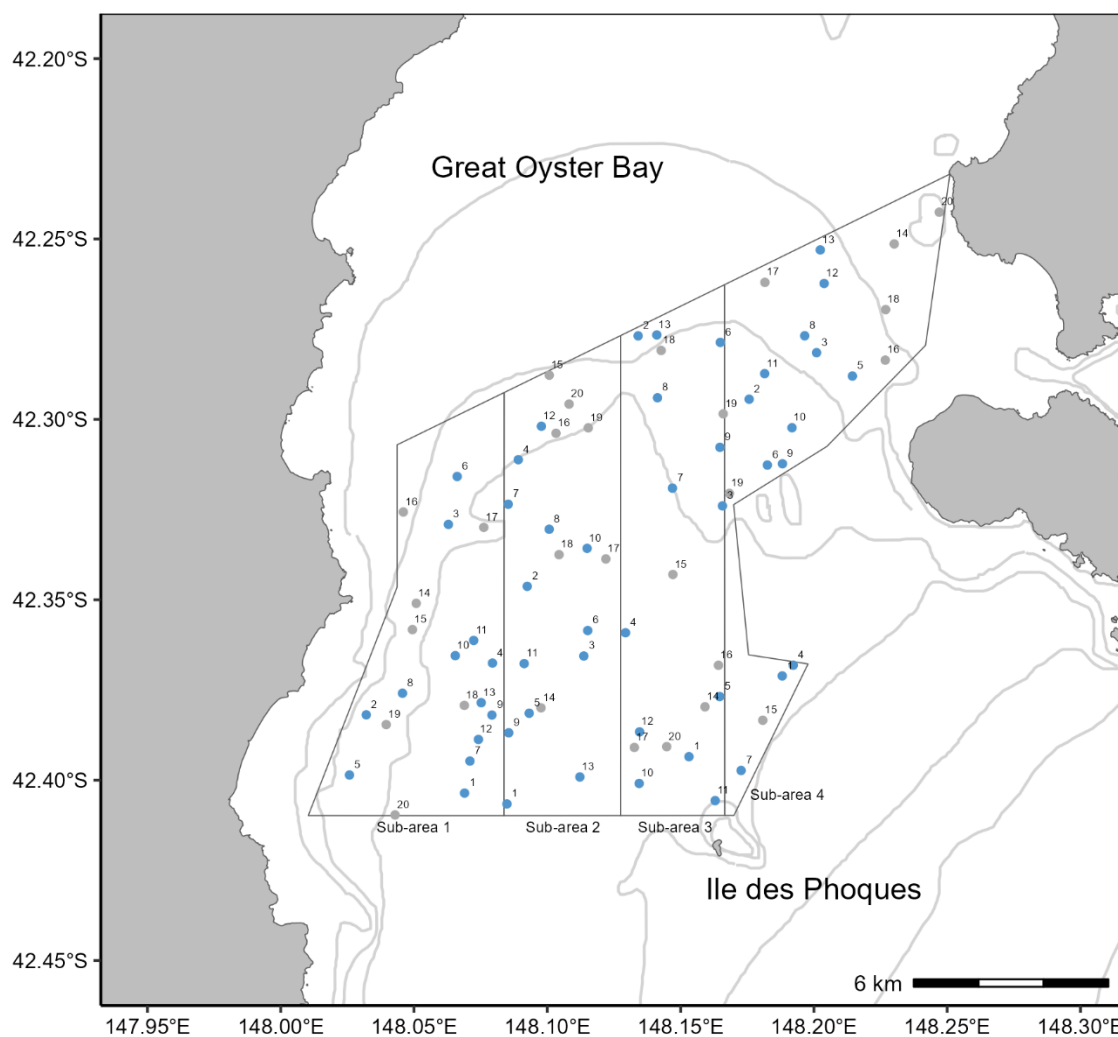


Figure 1. Commercial Scallop (*Pecten fumatus*) video survey sites (with site numbers) for the four sub-areas of the White Rock region of Scallop Fishery Area 5. Blue sites indicate the primary sampling sites and grey sites indicate the alternate sites in case of unsuitable sampling conditions.

Table 1. Dredge survey sites listed in randomised order per sub-area. Primary tow sites are shaded in blue (random order numbers 1-13) and alternate tow sites are shaded in grey (random order numbers 14-20).

Sub-area	Random order	Decimal Degrees Latitude	Decimal Degrees Longitude	Degrees Latitude	Decimal Minutes Latitude	Degrees Longitude	Decimal Minutes Longitude
1	1	-42.403593	148.068956	-42	24.216	148	4.137
1	2	-42.381905	148.032089	-42	22.914	148	1.925
1	3	-42.329126	148.062904	-42	19.748	148	3.774
1	4	-42.367559	148.079422	-42	22.054	148	4.765
1	5	-42.398584	148.025785	-42	23.915	148	1.547
1	6	-42.315833	148.066191	-42	18.950	148	3.971
1	7	-42.394717	148.070977	-42	23.683	148	4.259
1	8	-42.375921	148.045678	-42	22.555	148	2.741
1	9	-42.381966	148.079226	-42	22.918	148	4.754
1	10	-42.365500	148.065480	-42	21.930	148	3.929
1	11	-42.361276	148.072380	-42	21.677	148	4.343
1	12	-42.388723	148.074158	-42	23.323	148	4.449
1	13	-42.378538	148.075209	-42	22.712	148	4.513
1	14	-42.350992	148.050831	-42	21.060	148	3.050
1	15	-42.358281	148.049404	-42	21.497	148	2.964
1	16	-42.325671	148.045986	-42	19.540	148	2.759
1	17	-42.329925	148.076170	-42	19.796	148	4.570
1	18	-42.379289	148.068880	-42	22.757	148	4.133
1	19	-42.384597	148.039574	-42	23.076	148	2.374
1	20	-42.409653	148.042893	-42	24.579	148	2.574
2	1	-42.406609	148.084857	-42	24.397	148	5.091
2	2	-42.346286	148.092466	-42	20.777	148	5.548
2	3	-42.365603	148.113689	-42	21.936	148	6.821
2	4	-42.311178	148.089112	-42	18.671	148	5.347
2	5	-42.381462	148.093206	-42	22.888	148	5.592
2	6	-42.358538	148.115161	-42	21.512	148	6.910
2	7	-42.323521	148.085343	-42	19.411	148	5.121
2	8	-42.330455	148.100708	-42	19.827	148	6.042
2	9	-42.386882	148.085528	-42	23.213	148	5.132
2	10	-42.335749	148.114929	-42	20.145	148	6.896
2	11	-42.367702	148.091329	-42	22.062	148	5.480
2	12	-42.301909	148.097775	-42	18.115	148	5.866
2	13	-42.399128	148.112213	-42	23.948	148	6.733
2	14	-42.379969	148.097635	-42	22.798	148	5.858
2	15	-42.287745	148.100727	-42	17.265	148	6.044
2	16	-42.303851	148.103264	-42	18.231	148	6.196
2	17	-42.338691	148.121957	-42	20.321	148	7.317
2	18	-42.337504	148.104401	-42	20.250	148	6.264
2	19	-42.302343	148.115365	-42	18.141	148	6.922
2	20	-42.295761	148.108175	-42	17.746	148	6.490

3	1	-42.393509	148.153136	-42	23.611	148	9.188
3	2	-42.276846	148.134071	-42	16.611	148	8.044
3	3	-42.323982	148.165689	-42	19.439	148	9.941
3	4	-42.359148	148.129338	-42	21.549	148	7.760
3	5	-42.376825	148.164668	-42	22.610	148	9.880
3	6	-42.278658	148.164892	-42	16.719	148	9.894
3	7	-42.319061	148.146931	-42	19.144	148	8.816
3	8	-42.294014	148.141323	-42	17.641	148	8.479
3	9	-42.307750	148.164749	-42	18.465	148	9.885
3	10	-42.400929	148.134462	-42	24.056	148	8.068
3	11	-42.405680	148.162962	-42	24.341	148	9.778
3	12	-42.386616	148.134616	-42	23.197	148	8.077
3	13	-42.276597	148.141073	-42	16.596	148	8.464
3	14	-42.379680	148.159147	-42	22.781	148	9.549
3	15	-42.342997	148.147104	-42	20.580	148	8.826
3	16	-42.368172	148.164192	-42	22.090	148	9.852
3	17	-42.390949	148.132647	-42	23.457	148	7.959
3	18	-42.280901	148.142711	-42	16.854	148	8.563
3	19	-42.298461	148.165982	-42	17.908	148	9.959
3	20	-42.390720	148.144793	-42	23.443	148	8.688
4	1	-42.371111	148.188119	-42	22.267	148	11.287
4	2	-42.294409	148.175718	-42	17.665	148	10.543
4	3	-42.281512	148.201003	-42	16.891	148	12.060
4	4	-42.368154	148.192251	-42	22.089	148	11.535
4	5	-42.287994	148.214441	-42	17.280	148	12.866
4	6	-42.312660	148.182538	-42	18.760	148	10.952
4	7	-42.397332	148.172693	-42	23.840	148	10.362
4	8	-42.276829	148.196544	-42	16.610	148	11.793
4	9	-42.312301	148.188213	-42	18.738	148	11.293
4	10	-42.302318	148.191781	-42	18.139	148	11.507
4	11	-42.287318	148.181514	-42	17.239	148	10.891
4	12	-42.262322	148.203833	-42	15.739	148	12.230
4	13	-42.253025	148.202392	-42	15.182	148	12.144
4	14	-42.251367	148.230126	-42	15.082	148	13.808
4	15	-42.383405	148.180820	-42	23.004	148	10.849
4	16	-42.283574	148.226772	-42	17.014	148	13.606
4	17	-42.262019	148.181611	-42	15.721	148	10.897
4	18	-42.269557	148.226911	-42	16.173	148	13.615
4	19	-42.320522	148.168289	-42	19.231	148	10.097
4	20	-42.242565	148.247030	-42	14.554	148	14.822

Appendix 3

Tasmanian Scallop Fishery Areas

