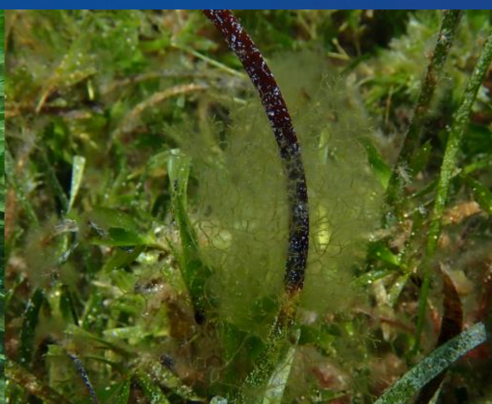
Edith Cowan University
Centre for Marine Ecosystems Research

Keep Watch Seagrass Monitoring 2024 Report for GeoCatch

Ankje Frouws and Kathryn McMahon


Keep Watch Seagrass Monitoring, 2024. Report to GeoCatch

Ankje Frouws and Kathryn McMahon

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Keep Watch Seagrass Monitoring

Annual Report 2024

Investigator: Kathryn McMahon and Ankje Frouws

A project funded by GeoCatch and Water Corporation with in-kind support from the Department of Biodiversity, Conservation and Attractions.

September 2024

1 Executive Summary

1.1 Introduction

This report summarises thirteen years of data (Feb 2012 - Feb 2024) from the Keep Watch Seagrass Monitoring Program in Geographe Bay. The program was developed in 2011 in collaboration with GeoCatch, Edith Cowan University (ECU), Department of Water and Environmental Regulation, Department of Biodiversity, Conservation and Attractions, and the South West Catchment Council and reviewed in 2021. Since 2016 annual seagrass monitoring has been carried out by ECU with in-kind support from the Department of Biodiversity, Conservation and Attractions and funding from the Water Corporation.

The Keep Watch seagrass monitoring program was initiated due to concerns for the health of seagrass meadows in Geographe Bay from predicted increases in catchment nutrients. The aim of the program is to monitor near shore seagrass meadows annually to detect any change in seagrass health. Seagrass shoot density of the dominant seagrass species *Posidonia sinuosa* is monitored at seven sites across Geographe Bay as an indicator of seagrass health. Observations of algal epiphyte cover and seagrass leaf and macroalgae nutrient content and nitrogen isotope signals are also measured to help interpret any changes.

Three management triggers have been established for Geographe Bay to detect changes in shoot density outside normal annual variation. Comparison of shoot densities with temperate seagrass meadows in other areas in Western Australia are also used as a comparison to assess inter-annual and site variations.

1.2 Key findings 2024

Key finding 1

Seagrass meadows in Geographe Bay remain healthy based on seagrass shoot densities, with increases at all sites, except Dunsborough, from 2023. Highest shoot densities were recorded at Dunsborough, Buayanup and Vasse-Wonnerup with lowest at the Vasse Diversion and Port Geographe sites. No managagement triggers were breached in 2024.

Key finding 2

The ephiphyte cover remained consistent at the majority of sites, ranging from low to high, but notably higher cover in Port Geographe and Forrest Beach compared to all previous monitoring years. Despite this, the dominant epiphyte types remains microalgal accumulations which are not the type commonly associated with nutrient enrichment. There were no obvious impacts to seagrass condition from epiphyte cover.

Key finding 3

Nutrient content of seagrasses in Geographe Bay continues to be low and reductions in exposure to nutrients continues at Capel based on the seagrass data, although phosphorus was higher in the macroalgal tissue. The main sources of nitrogen for seagrass at most sites is likely to be from fixation of atmospheric nitrogen and/or agricultural fertilisers. The higher nitrogen isotope signal at Capel suggests that nitrogen derived from animal wastes, septic tanks or from natural vegetation is also a source. There is no evidence that nitrogen derived from treated sewerage is a major source of nitrogen for Geographe Bay seagrasses.

1.3 Recommendations

These recommendations are based on the findings from the 2024 Keep Watch monitoring survey.

Recommendation 1

Continue monitoring seagrass health based on the Keep Watch Monitoring protocol including the quality control in the field and laboratory. This program is the only approach in place at present assessing potential impacts in the marine environment, linking the land to the sea, and is of value as Geographe Bay has been identified as a climate refuge.

Recommendation 2

Continue monitoring *Dictyota* at Dunsborough, Vasse Diversion, Forrest Beach and Capel. Unlike the seagrass samples, macroalgae indicators suggest higher phosphorus exposure at Capel compared to other sites.

2 Introduction

This document is produced for GeoCatch by Kathryn McMahon and Ankje Frouws from Edith Cowan University. It reports on the Keep Watch seagrass monitoring survey that was undertaken in February 2024 and compares to data from the 2012-2023 surveys. The objective for the Keep Watch program is to undertake long-term, cost-effective seagrass monitoring for Geographe Bay to monitor the effects of water quality, particularly catchment nutrients on seagrass distribution and health.

This year the program was funded through collaborative sponsorship from the Water Corporation and in-kind support from the Department of Biodiversity, Conservation and Attractions (DBCA). The aim of this program is to assess seagrass health by examining changes over time. There are three triggers that have been developed to assess change (see 3.1.3 for summary of triggers). This report includes data on two seagrass species (*Posidonia sinuosa* and *Amphibolis antactica*). The program mostly focuses on *P. sinuosa* shoot density and leaf tissue nutrients (C, N, P and N isotopes) from seven sites but also includes leaf tissue nutrient data for *A. antarctica* seagrass from three sites. Based on the 10 year review workshop held in Busselton on 17th November 2021 since 2022 samples of macroalgae have also been collected for nutrient and isotope analysis. Macroalgae from the genus *Dictyota* were selected as most suitable to include as this genus is most commonly observed among sites. This year *Dictyota* was collected from Dunsborough, Vasse-Diversion, Forrest Beach and Capel. All raw data (except for technical replicates) is included in the appendix of this report, and has been submitted to GeoCatch as a digital file.

3 Methods for Keep Watch – Seagrass health monitoring program

3.1 Seagrass monitoring

3.1.1 Field program

The "Keep Watch" annual seagrass monitoring program is based on the methods recommended by McMahon (2012) and reviewed and modified in 2021. Eight seagrass sites were monitored, seven for *P. sinuosa* health (Dunsborough to Forrest Beach) and three for *A. antarctica* nutrient content (Table 1, Figure 1, Figure 6). These were chosen to cover the spatial range of *P. sinuosa* meadows in Geographe Bay, and areas associated with a variety of catchments with different known surface water nutrient inputs. They range from 4-5 m depth. All sites, except for Capel have *P. sinuosa* meadows. Sampling occurred on the 7th and 8th and on the 29th of February 2024. Sampling could not be completed in the initial trip due to a COVID outbreak within the dive team, and was rescheduled at a later date to complete sampling. At Capel (8) there are high relief rocky reefs surrounded by bare sand that can be reached from the shore. On the reef there are patches of *A. antarctica* seagrass and *Dictyota* that were collected for nutrient analysis in 2m depth. *A. antarctica* was collected at Vasse Diversion Drain (3) and Forrest Beach (7) sites as a comparison to Capel (8).

Since 2022, due to the reduced abundance of *Amphibolis* at Busselton Jetty (4) from the dieback of *A. antarctica* in 2017 and no subsequent recovery, no samples were collected here.

Table 1: Details for eight Keep Watch sites, seven in *Posidonia sinuosa (Ps)* meadows (1-7) and one in rocky reef with *Amphibolis antarctica (Aa)* patches (8) in Geographe Bay. One macroalgale species (*D* = *Dictyota*) was also assessed in four of these sites. Coordinates are decimal degrees based on the WGS84 grid system.

Site Name & #	Coordinates	Depth (m)	Date	Seagrass species assessed	Macroalgal species assessed
1. Dunsborough	S 33.61654°, E 115.12865°	4	08/02/2024	*Ps*	*D*
2. Buayanup	S 33.65233°, E 115.24840°	4	08/02/2024	*Ps*	
3. Vasse Diversion Drain	S 33.64746°, E 115.32379°	4.5	08/02/2024	*Ps, Aa*	*D*
4. Busselton Jetty	S 33.63896°, E 115.34315°	4.5	07/02/2024	*Ps*	
5. Port Geographe	S 33.62846°, E 115.38240°	4.5	07/02/2024	*Ps*	
6. Vasse-Wonnerup	S 33.60188°, E 115.42345°	5	29/02/2024	*Ps*	
7. Forrest Beach	S 33.57295°, E 115.44908°	5	29/02/2024	*Ps, Aa*	*D*
8. Capel	S 33.51394°, E 115.51508°	2	07/02/2024	*Aa*	*D*

***Figure 1**: Map of Geographe Bay, showing the location of the 8 seagrass sampling sites (1. Dunsborough, 2. Buayanup, 3. Vasse Diversion Drain, 4. Busselton Jetty, 5. Port Geographe, 6. Vasse-Wonnerup Estuary, 7. Forrest Beach and 8. Capel).*

Each seagrass site was located at least 30 m from the edge of the meadow and the center of the 50 m diameter site marked with a permanent star picket with a plastic cap (Figure 2). A site label was attached to the star picket. The exact locations were determined with a differential GPS (using the WSG 84 grid system), on the water surface, directly above the permanent marker.

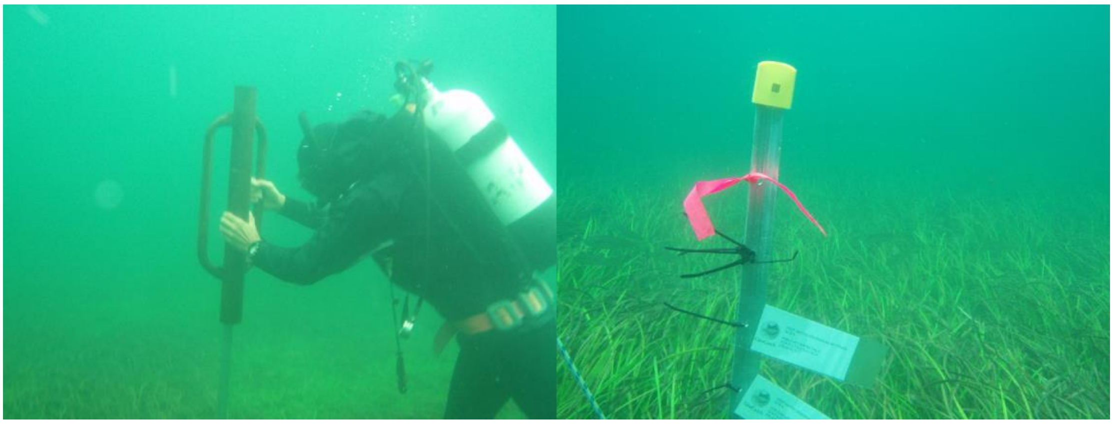


Figure 2: *Left: Banging in permanent marker with pole driver. Right: Star picket with cap and plastic coated site label, indicating center of 50 m diameter Keep Watch seagrass site.*

At each site *P. sinuosa* shoot density was counted in 30 0.2 x 0.2 m quadrats. Only shoots that originated in the quadrat were counted. Seedlings of *P. sinuosa* were also counted; these were identified by the small size of the leaves and the seed that was still attached to the seedling. As it is predicted that there can be high mortality of seedlings, these counts were not included in the shoot density assessment. The position of each quadrat was located randomly using a transect tape swum out on a pre-determined bearing using a compass and the quadrat placed at the pre-determined distance along the transect (Figure 3, See Appendix 1 for the bearing and distance along each transect that the quadrats were positioned). If there was a patch of a different species of seagrass such as *A. antarctica* or *Amphibolis griffithii*, or a blow-out without seagrass, then the quadrat was moved to the next closest point along the transect in the *P. sinuosa* meadow. The quadrats were stabilised by securing them to the sediment with tent pegs, to ensure they did not move during counting.

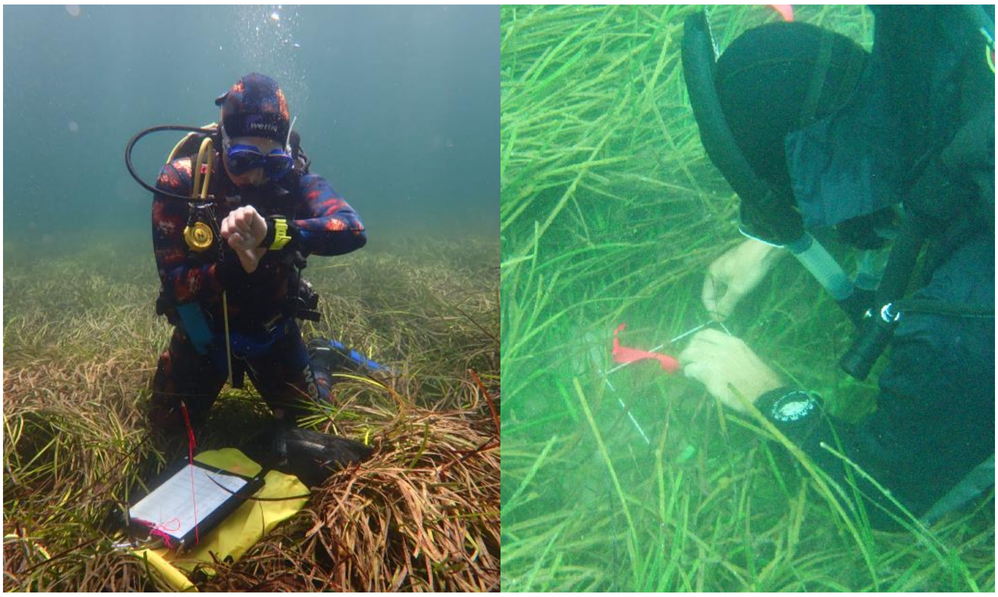


Figure 3*: Left: Determining bearing of transect with compass. Right: Counting P. sinuosa shoots in a quadrat.*

A quality assurance check was carried with all divers before official counts began. Each counter counted a quadrat twice, and this was done with three different quadrats. This was repeated until there was less than a 5% error with counting, i.e. a maximum difference of 1-3 shoots. Then official counting began.

In addition, a photograph of the seagrass meadow and a video in a circle around the star-picket, 5 m distance away from the star-picket was also taken at each site. As well as the cover of algal epiphytes recorded as Very Low, Low, Moderate, High, Very High (See photo-guide for visual representation of these classifications, Figure 4), and the dominant or co-dominant type of algal epiphytes at each site were recorded from observations of the seagrass leaves, based on the following categories: Filamentous algae; Encrusting algae; Microalgal accumulations; and Other epiphytic algae (any type of algae that is not as above such as erect, branched, foliose, leathery or jointed calcareous). A photograph of the dominant epiphytic algae was also taken.

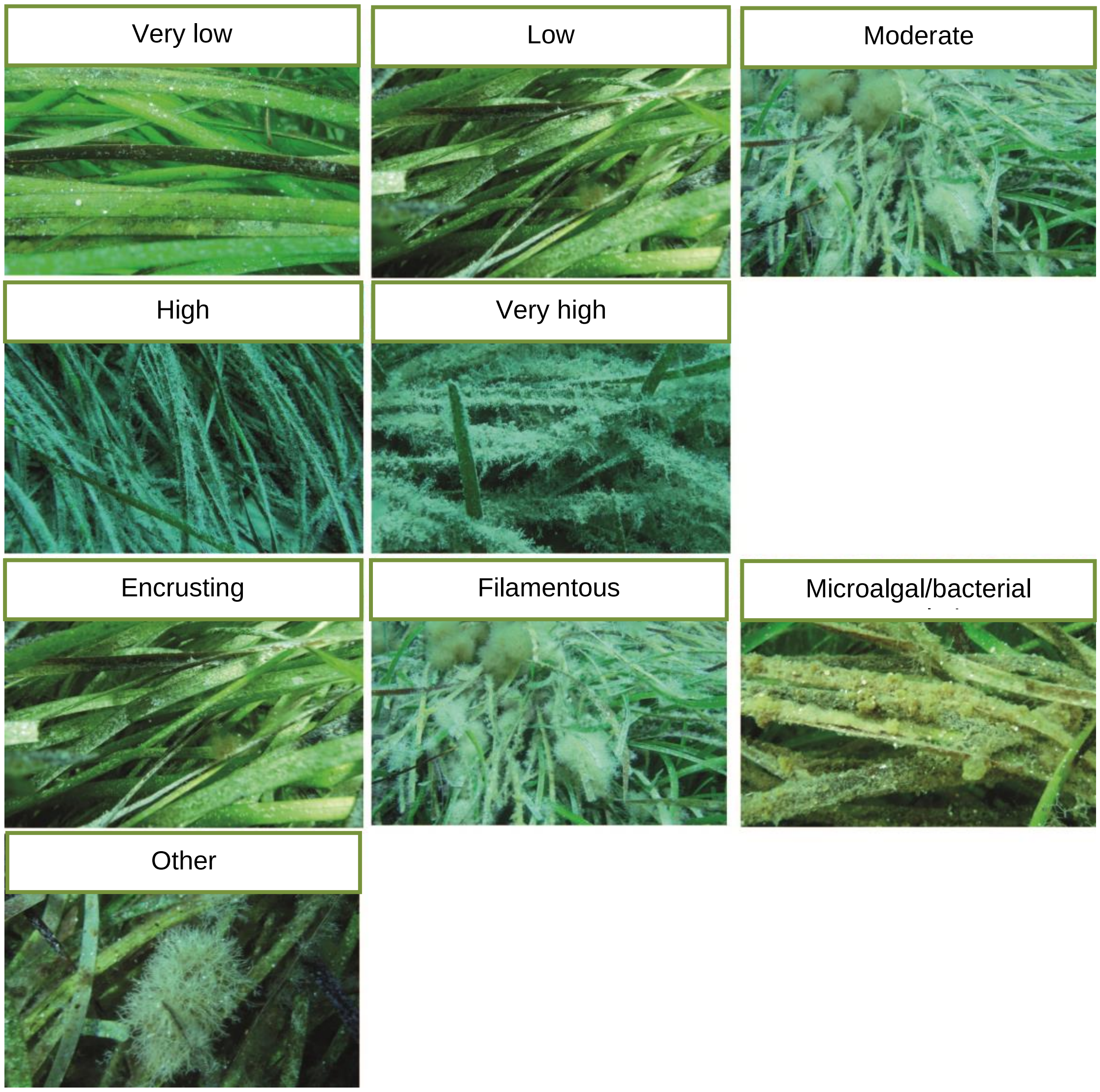


Figure 4: *Classification of epiphytic algal cover (very low-very high) and type (encrusting-other).*

Finally, the following points were noted: if other seagrass species were present at the site; if there were any bare patches of sand within the meadow, and if there was rhizome in the sand, indicating a loss of shoots from the area. Movement of sand bars through the seagrass meadow is common in this area, so it is likely that these will be noted; and any signs of anchor damage in the meadow.

Also three samples of *P. sinuosa* seagrass shoots were collected for total C, N, P as well as nitrogen stable isotope analysis ($\delta^{15}N$) after the counting was completed. Each sample was collected randomly in the meadow, just outside the 50 m diameter of the site and consisted of 5 shoots. These were placed in separate plastic bags and frozen until processed. Three samples of *A. antarctica* stems and leaves were collected at Vasse Diversion, Forrest Beach and Capel sites for the same type of nutrient analysis. Three algal samples (*Dictyota*) were collected at Dunborough, Vasse Diversion, Forrest Beac and Capel for the same type of nutrient analysis as well.

At each site the Secchi disk depth (m) and temperature (°C) were recorded from the boat, salinity was only recorded at a subset of sites due to incorrect salinity calibration of the water quality probe. In addition temperature loggers were installed at two *Posidonia* sites, Buayanup and Port Geographe, to collect local temperature data. These are provided in-kind from ECU.

Field work was carried out by Kathryn McMahon (KM) and Ankje Frouws (AF) from ECU with Tanika Shalders (TS), Josh Reagan (JR), Dave Lierich (DL) and Glen Sutton (GS) from the Department of Biodiversity, Conservation and Attractions. Samples were processed and data analysed by Ankje Frouws. This year the Department of Transport vessel PV2 was used for diving activities. The monitoring program was funded through sponsorship by Water Corporation and in-kind support of Department of Biodiversity, Conservation and Attractions staff.

3.1.2 Laboratory processing

In the laboratory the three seagrass shoot samples were measured for total length and width, just above the sheath. Then all algal epiphytes from both the seagrass and algal samples were removed by gently scraping, and the leaves placed in the oven at 60°C for 24 hours or until dry, then ground into a fine powder with a Ball Mill grinder. This material was then analysed for total C, N and $\delta^{15}N$ (external error of analysis 1 standard deviation) at ECU using a continuous flow Thermo Scientific™ EA IsoLink™ IRMS system consisting of a Flash IRMS Elemental Analyzer, Delta V Advantage IRMS and Conflow IV Univeral Interface. Total phosphorus (<0.05 mg.P.g^{-1}) was analysed at ECU by acid digest followed by ICP-OES, the same method that has previously been used.

As presented in 2021, the laboratory that performed the C, N and $\delta^{15}N$ analysis changed in 2020 from UWA to ECU and there was a slight offset between ECU and UWA laboratories. This offset has been applied again this year to the C and N data. In this report the 2020 to 2024 data was modified as follows N% [y=1.063x - 0.5653], δN [y=1.0725x - 0.55824], δC [y=0.9846x - 2.1902] and C% [y=0.4568x + 24.225] where x is the ECU laboratory result for each respective variable.

3.1.3 *Trigger assessment*

To assess change over time, and to keep watch on the health of the seagrass, three triggers proposed by McMahon (2012) and agreed upon by GeoCatch were used. If these thresholds are triggered it indicates a potential issue with seagrass health at a particular site that warrants further investigation. These trigger values are for shoot density. All other information collected i.e. seagrass nutrient concentration, water quality and algal cover are complimentary information to help interpret any changes observed in the seagrass shoot density. The trigger value will be triggered as follows:

Trigger 1:

If there is a > 50% reduction in shoot density at a particular site compared to the previous year (Need 2 years of data to assess this, always compare the current year with the previous year).

Trigger 2:

If there is > 20% reduction in shoot density at a particular site compared to the previous year, two years in a row (Need 3 years of data to assess this).

Trigger 3:

If there is a significant trend of a reduction in shoot density at a particular site over all time periods, as determined by trend analysis (Makesens Mann-Kendall trend statistic, need at least 5 years of data to assess this).

4 Results

4.1 Shoot density

Shoot density varied from a site average of 1079-1561 shoots m^{-2} across the seven sites (Figure 5). Dunsborough (1561 shoots m^{-2}) continues to have the highest shoot density. With a large increase compared to last year, Vasse-Wonnerup (1422 shoots m^{-2}) had the second highest shoot density and the lowest was at Port Geographe (1195 shoots m^{-2}) and Vasse-Diversion (1079 shoots m^{-2}).The remaining sites ranged between 1263-1382 shoots m^{-2} and shoot density in three of the seven sites (Busselton Jetty, Port Geographe, Vasse-Wonnerup) showed a strong upward trajectory after a dip in shoot density in the previous year. All raw data is in Appendix 2.

Last year six of the seven sites declined by 1-22%, with two, Busselton Jetty and Port Geographe declining by more than 20% (Table 2). This year six out of seven sites increased in shoot density from 9-55%. The three sites that had the greatest decline from 2022-2023 had the largest increase this year (31-55%). Since the first year of monitoring there has been net increase at all sites (1-51%), with the greatest increases in the central sites.

P. sinuosa average shoot length ranged from a minimum of 27.5 cm at Forrest Beach to a maximum of 58.5 cm at Vasse-Wonnerup and a range in average width of 5.3-6.1 mm (Appendix 3).

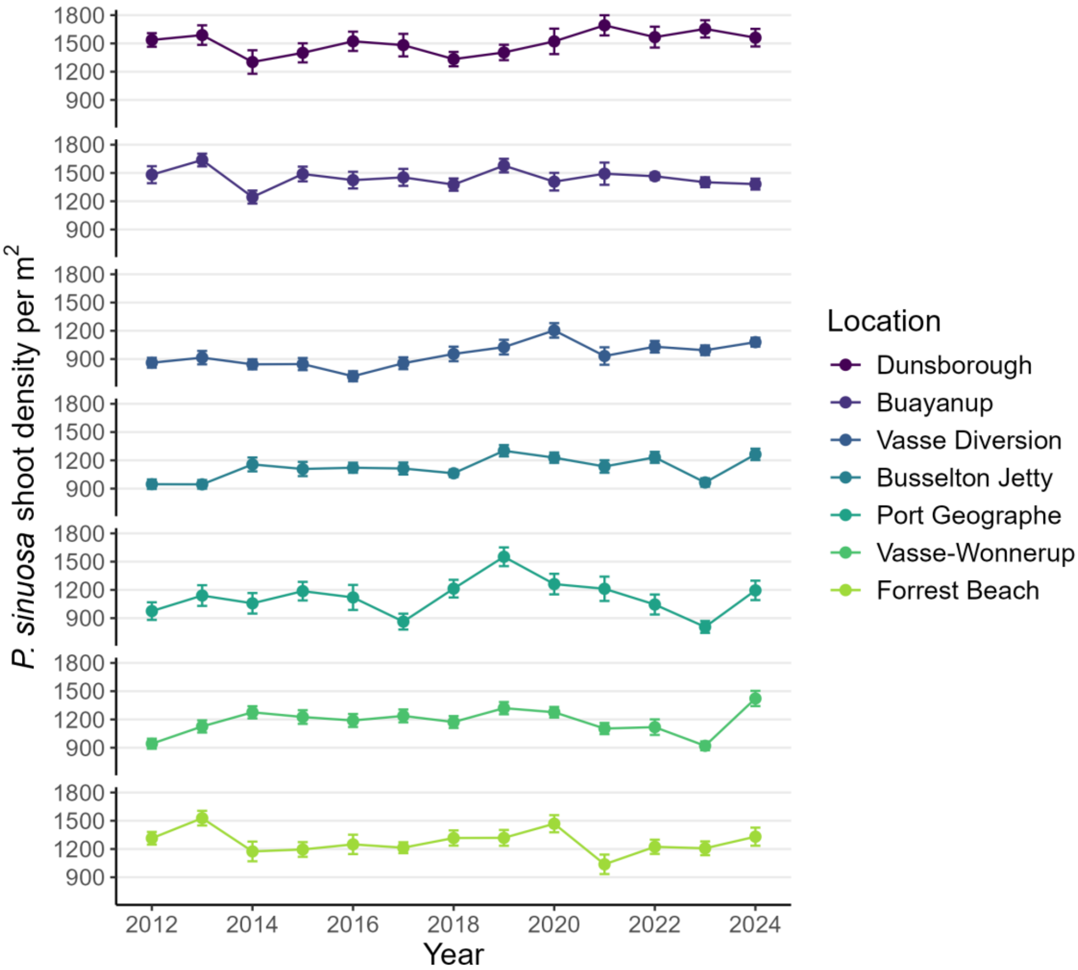


Figure 5*: Shoot density (average m^{-2} ± se) at the seven Keep Watch seagrass monitoring sites with* P. sinuosa *meadows in January or February 2012-2024.*

***Table 2**: Change assessment based on Trigger 1 and 2, shown as percentage change in* P. sinuosa *shoot density between years. There is a concern with seagrass health when there is a 50% decline in shoot density from one year to the next (Trigger 1) or when there is more than a 20% decline two years in a row. A negative number indicates a decline in shoot density and orange shading is a decline of more than 20%. Note that the last column shows change over the duration of the monitoring, between 2012-2024.*

Percentage change in shoot density between years							
Site	**12-13**	**13-14**	**14-15**	**15-16**	**16-17**	**17-18**	**18-19**
1. Dunsborough	3	-18	7	9	-3	-10	5
2. Buayanup	11	-24	20	-7	2	-5	15
3. Vasse Diversion	6	-8	0	-15	19	12	8
4. Busselton Jetty	0	22	-4	1	-1	-5	23
5. Port Geographe	17	-7	12	-6	-23	41	28
6. Vasse-Wonnerup	19	13	-4	-3	4	-5	13
7. Forrest Beach	16	-23	2	5	-3	8	0

Site	**19-20**	**20-21**	**21-22**	**22-23**	**23-24**	**12-24**
1. Dunsborough	8	11	-7	6	-6	2
2. Buayanup	-11	6	11	-17	9	2
3. Vasse Diversion	17	-23	11	-4	9	25
4. Busselton Jetty	-6	-8	9	-22	31	33
5. Port Geographe	-19	-8	-10	-21	48	25
6. Vasse-Wonnerup	-3	-14	1	-18	55	51
7. Forrest Beach	11	-29	18	-1	10	1

4.2 Trigger assessment

4.2.1 Trigger 1

As a decline of 50% was not detected at any of the seven sites, this threshold was not triggered (Table 2, % change 2023-2024).

4.2.2 Trigger 2

As there were no declines of 20% or more over two consecutive years this threshold was not triggered (Table 2, % change 2022-2023 & 2023-2024). The two sites that had a >20% decline last year both showed large increases (31-48%).

4.2.3 Trigger 3

This threshold was not triggered as no sites showed a significant decline over time. One of the sites, Vasse Diversion, continues to show a significant, positive, linear trend over the thirteen years, indicating increases in shoot density over this time period (Table 3).

Table 3*: Mann-Kendall Trend statistic to assess if there has been a significant decline over time in shoot density from 2012-2024.*

Site Name & #	**Significance ($p<0.05$)**	**Overall slope**	**R^2**
1. Dunsborough	ns	+ve	18%
2. Buayanup	ns	+ve	2%
3. Vasse Diversion	significant	+ve	43%
4. Busselton Jetty	ns	+ve	25%
5. Port Geographe	ns	+ve	1%
6. Vasse-Wonnerup	ns	+ve	3%
7. Forrest Beach	ns	-ve	3%

4.3 Epiphytes

This year epiphyte cover mainly remained stable (moderate at Dunsborough and Busselton Jetty and high at Buayanup) or increased (moderate to high at Vasse Diversion and Port Geographe and low to moderate at Forrest Beach) compared to the previous year and only declined at one site (moderate to low at Vasse-Wonnerup) (Table 4). The levels and spatial patterns are similar to what has been observed since 2020 except for Port Geographe and Forrest Beach, where epiphyte cover was high compared to previous years. The type of epiphyte cover was very consistent amongst the five central sites, with microalgae being dominant. At Dunsborough, Port Geographe, Vasse-Wonnerup and Forrest Beach fine branching brown algae such as *Dictyota* was the dominant type. Other epiphytes observed were forams (Figure 6, Table 4). These are not the species of epiphyte expected to dominate with nutrient enrichment.

Table 4: *Algal epiphyte cover at the Keep Watch seagrass monitoring sites, 2012-2024. Algal cover categories were Very low, Low, Moderate, High and Very High. Algal types were F=filamentous, E= encrusting, M=microalgal aggregations and O=other. If the category is capitalised it means it is dominant, lowercase indicates present but not dominant.*

Site	**Algal cover**												
	-12	**-13**	**-14**	**-15**	**-16**	**-17**	**-18**	**-19**	**-20**	**-21**	**-22**	**-23**	**-24**
1. Dunsborough	M	L	M	M	L	L	M	M	M	L	M	M	M
2. Buayanup	M	L	M	M	H	H	M	VL	H	H	H	H	H
3. Vasse Diversion	L	M	H	H	H	H	H	L	H	H	H	M	H
4. Busselton Jetty	L	L	H	H	M	M	M	L	H	H	H	M	M
5. Port Geographe	L	VL	L	L	M	M	M	L	M	M	M	M	H
6. Vasse-Wonn.	L	VL	L	M	L	L	L	VL	L	M	L	M	L
7. Forrest Beach	L	VL	L	L	L	VL	L	VL	L	L	VL	L	M
	Algal Type												
	-12	**-13**	**-14**	**-15**	**-16**	**-17**	**-18**	**-19**	**-20**	**-21**	**-22**	**-23**	**-24**
1. Dunsborough	O,f,m	F,O	O	O,m	O	O,e,m	O,m	O,m	O,m	O	O,m	O	M,o
2. Buayanup	M,o	E,O	M,o	M,o	M,o	M,e,o	M,o	O,m	M,o,e	M,o	M	M	M,o,f
3. Vasse Diversion	M,o	E,O	M,o	M,o	M,o	M,o	M,o	O,m	M,o,e,f	M	M,o	M	M,o
4. Busselton Jetty	M,o	O	M	M,f	O,e,m	M,o,e	O,M	O,m	O,m,e,f	M	M,o	M	M,O
5. Port Geographe	E,o	E,M	M,e	M,f	O,f	M,o,e	O,M	M	M,o	M,o	M,o	M	M,O
6. Vasse-Wonn.	E,o,m	E,O	M,f	O	E,o,m	E,m	O,M	O	O,e	M	M	O	O
7. Forrest Beach	E,M,o	F,E	M,f	O,e	E,o	E,o	O,e	O	E,m,o	O	E,m	E	O,m

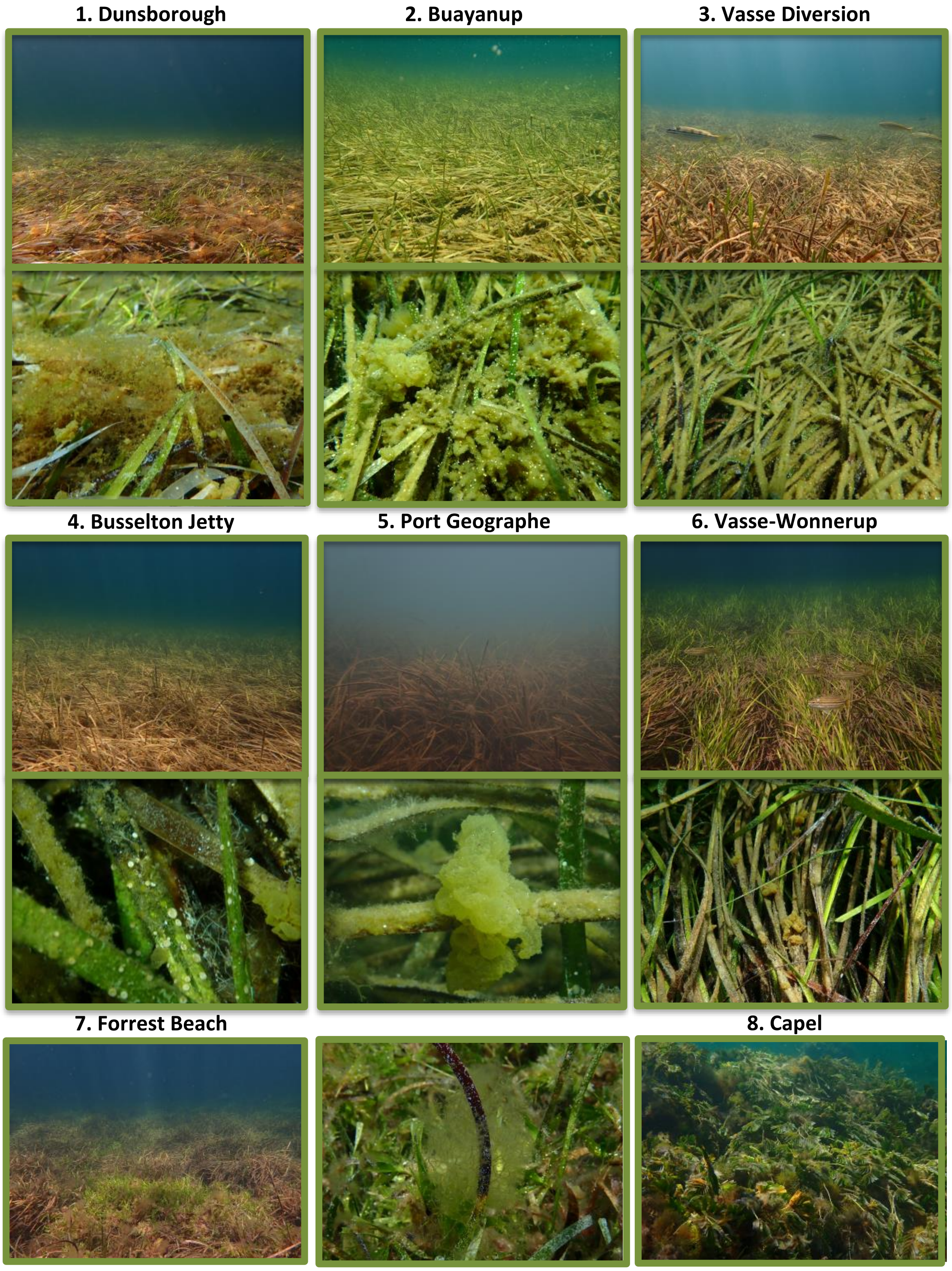


Figure 6*: Pictures of seagrass meadow and the dominant algal epiphytes at each* P. sinuosa *site. (1. Dunsborough, 2. Buayanup, 3. Vasse Diversion Drain, 4. Busselton Jetty, 5. Port Geographe, 6. Vasse-Wonnerup Estuary, 7. Forrest Beach (dominant algal type is shown on the right of the seagrass meadow picture)). And a picture of the rocky substrate with macroalgae at the* A. antarctica *site (8. Capel).*

4.4 Other observations

A. antarctica was observed at all sites except Buayanup and Vasse Wonnerup and *A. griffithii* was also growing at Forrest Beach and Capel while *Halophila ovalis* was seen at Forrest Beach. Seedlings of *P. sinuosa* were observed at Dunsborough, Vasse-Wonnerup and Forrest Beach and flowering shoots were observed at all *P. sinuosa* sites except for Port Geographe, Vasse-Wonnerup and Forrest Beach (Appendix 2). No anchor damage was observed at any site and blowouts remain at the Dunsborough site, most likely from water movement. Bare or sparse patches were noted at Vasse Diversion Drain and Port Geographe and dead blackened leaves where observed at Busselton Jetty, indicating historical and some small scale recent shoot loss.

4.5 Nutrient content

The nitrogen content of *P. sinuosa* leaves ranged from 0.40-0.89 %N dry weight (DW), very similar to the range observed in 2023 (Figure 7). Some sites had a slight increase in N dry weight compared to recent years, Dunsborough, Vasse Diversion and Vasse-Wonnerup, although the values were in the range observed historically. The nitrogen content of *A. antarctica* leaves ranged from 0.32-0.83 %N DW (Figure 8).

The phosphorus content of *P. sinuosa* leaves in 2024 ranged from 0.10-0.16 %P DW (Figure 7). All sites were similar or very slightly increased compared to last year on average and at several sites (Vasse Diversion, Busselton Jetty, Port Geographe and Vasse-Wonnerup) there was a high variability between samples. For *A. antarctica* leaves, the phosphorus content ranged from 0.07-0.10 %P DW (Figure 8) with the highest concentration at Vasse Diversion. All raw data is in Appendix 5.

The nitrogen and phosphorus concentrations continue to be in the range that has been observed in Geographe Bay in the past and these levels are not considered high (Table 5).

Table 5*: Comparison of shoot tissue nutrient concentrations and $\delta^{15}N$ values of* P. sinuosa *and* A. antarctica *leaves in Geographe Bay. Data are expressed as averages of all sites from the study with the range of observations in brackets, min-max.*

Date collected	Study	***P. sinuosa*** TN (% DW)	TP (% DW)	$\delta^{15}N$	***A. antarctica*** TN (% DW)	TP (% DW)	$\delta^{15}N$
1994/95 Apr, Jan	(McMahon & Walker 2008) Geographe Bay	0.8 Jan 1.032 Apr	0.13	-	-	-	-
1994 Apr, Jul, Sep	(McMahon 1994) Geographe Bay	1.26 (0.06-1.66)	0.18 (0.9-0.28)	3.30 (2.61-5.24)	0.95 (0.79-1.14)	0.10 (0.07-0.14)	2.52 (0.8-4.18)
2008 Aug	(Oldham et al. 2010) Geographe Bay	1.43 (1.30-1.56)	-	3.66 (3.30-4.36)	0.97 (0.9-1.16)	-	4.51 (4.01-4.8)
Autumn	(Paling & McComb 2000) Shoalwater Bay	1.8	-	-	0.6	-	-
Summer 2003	(Collier et al. 2008) Cockburn Sound	1.2-1.4	-	-			
Autumn 2008	(Hyndes et al. 2012) Warnbro Sound	-	-	4			

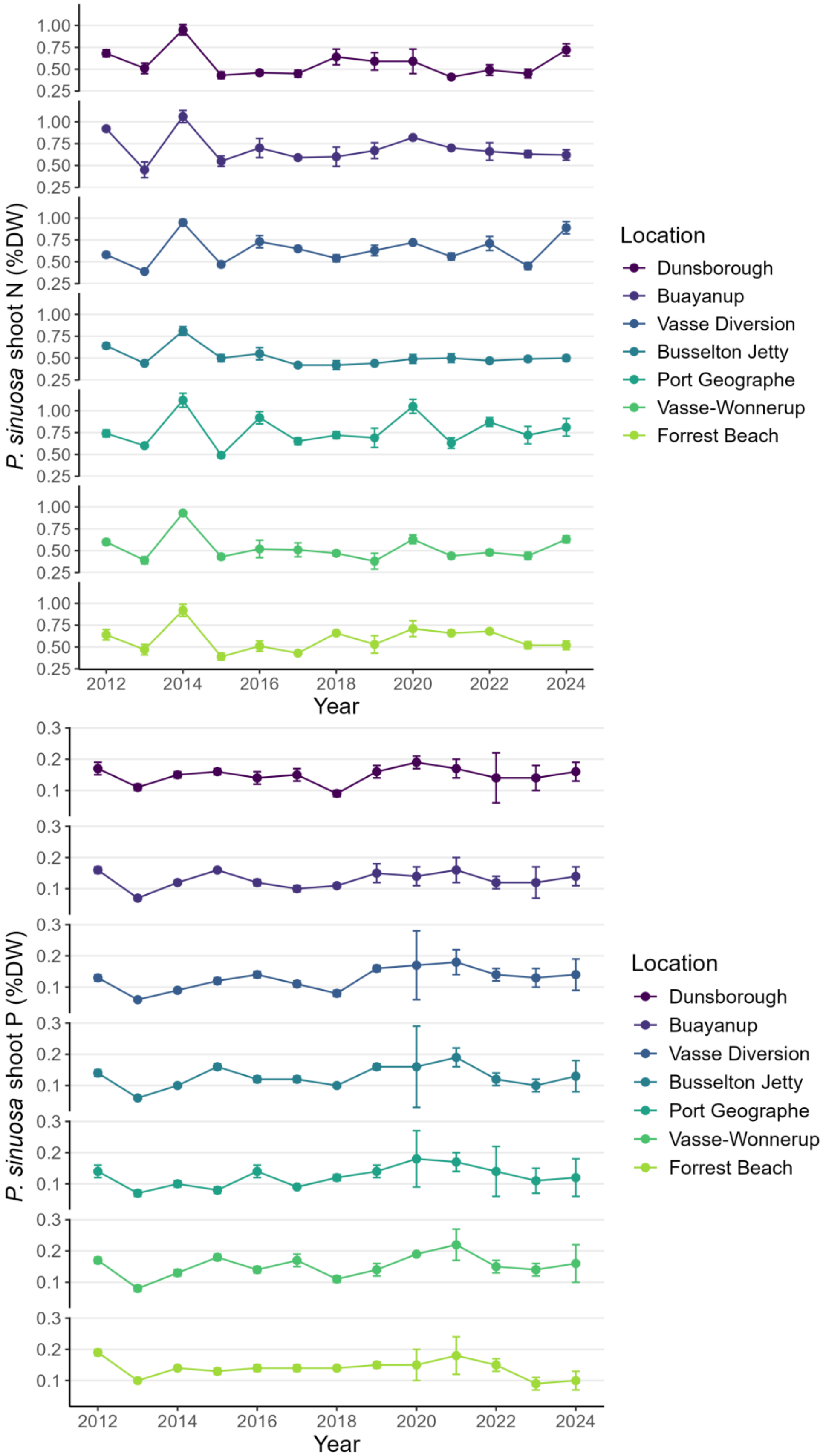
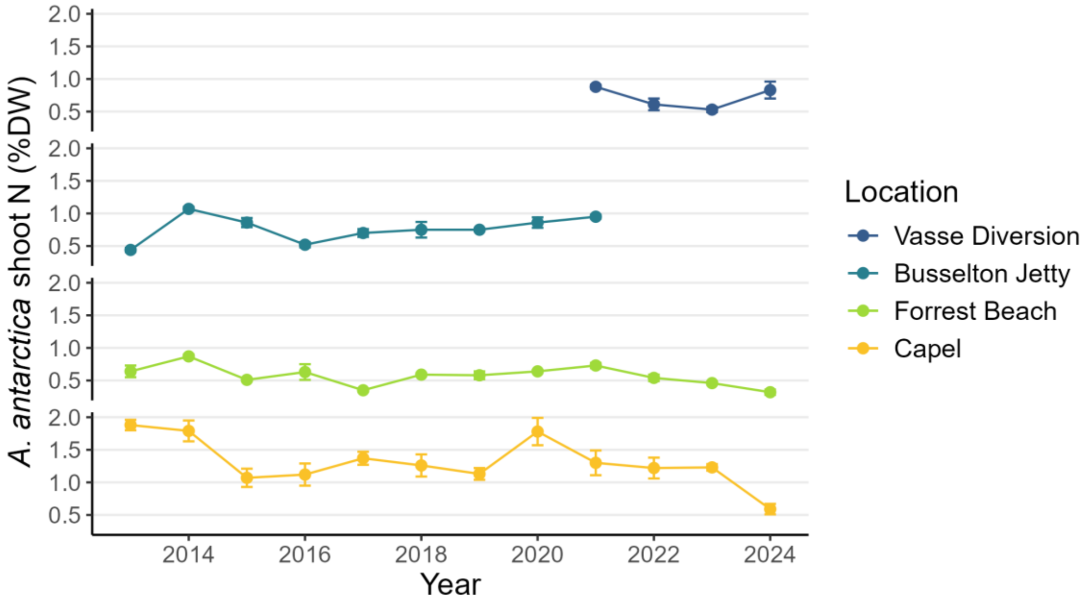


Figure 7: *Nitrogen (top) and phosphorus (bottom) content (% DW) of* P. sinuosa *leaves (average ± se) at the Keep Watch seagrass monitoring sites (Dunsborough-Forrest Beach) in 2012-2024.*



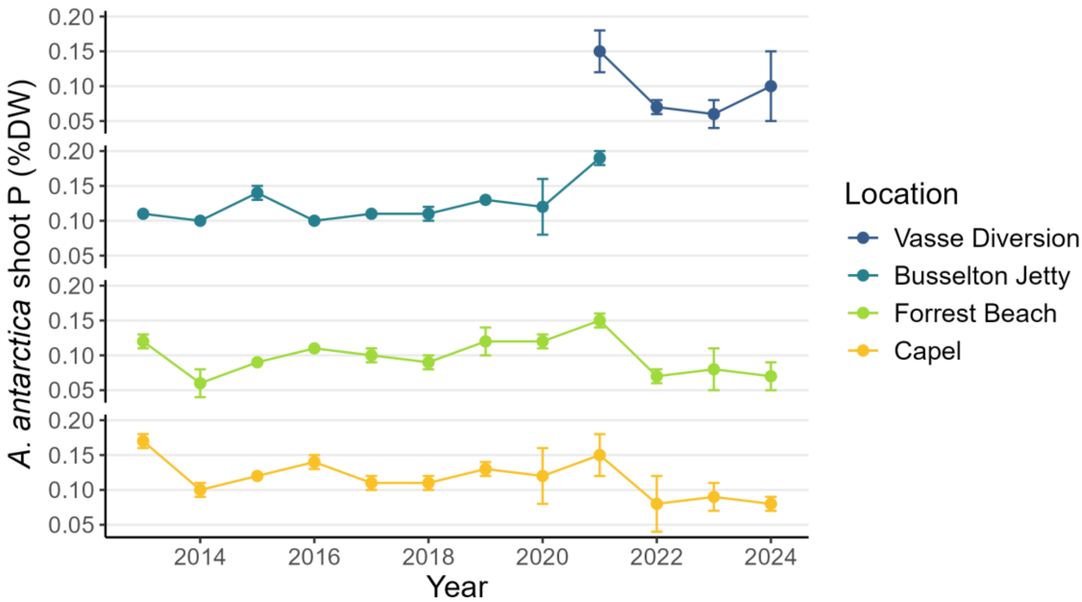


Figure 8: *Nitrogen and phosphorus content (% DW) of* A. antarctica *leaves (average ± se) at the Keep Watch seagrass monitoring sites in 2013-2024. Note that sampling at Busselton Jetty ended in 2021 and with a new site established at Vasse-Diversion drain.*

Nitrogen isotope signals can indicate the main sources of nitrogen seagrasses are accessing. Nitrogen derived from the fixation of atmospheric nitrogen or agricultural fertilisers has a signature close to 0‰. Nitrogen derived from native bushland has a signal between 2-5 ‰, whereas nitrogen derived from animal waste or septic tanks is usually in the order of 5-6 ‰ and nitrogen from treated sewerage is usually around 9 ‰ (Jones & Saxby 2003). In Geographe Bay, nitrogen isotope signals measured in seagrass leaves indicate that the meadows are accessing different sources of nitrogen, and these sources vary among sites.

The $\delta^{15}N$ of *P. sinuosa* leaves ranged from 1.04-1.77 ‰. $\delta^{15}N$ signals increased or stayed similar compared to last year, but all values are in the range that has been observed over the monitoring period, except for Dunsborough where average $\delta^{15}N$ is higher than has been observed in previous years (1.38 ‰) (Figure 9). The nitrogen isotope signals in the seagrass leaves indicate that this year seagrasses are mostly receiving a mix of sources, but the main sources could be either from fixation of atmospheric nitrogen or agricultural fertilisers, as the signal is close to 0‰ with other sources contributing a small amount. There is no evidence that nitrogen derived from treated sewerage is the main source for seagrasses, if this was the case, we would expect the signal to be much higher, around 9 ‰.

The $\delta^{15}N$ signal of *Amphibolis* leaves ranged from 1.30-2.64 ‰, declining on average at all sites this year compared to 2023 (Figure 9). As in previous years, the highest values were observed at Capel indicating a different source of nitrogen at this site. All raw data is in Appendix 5.

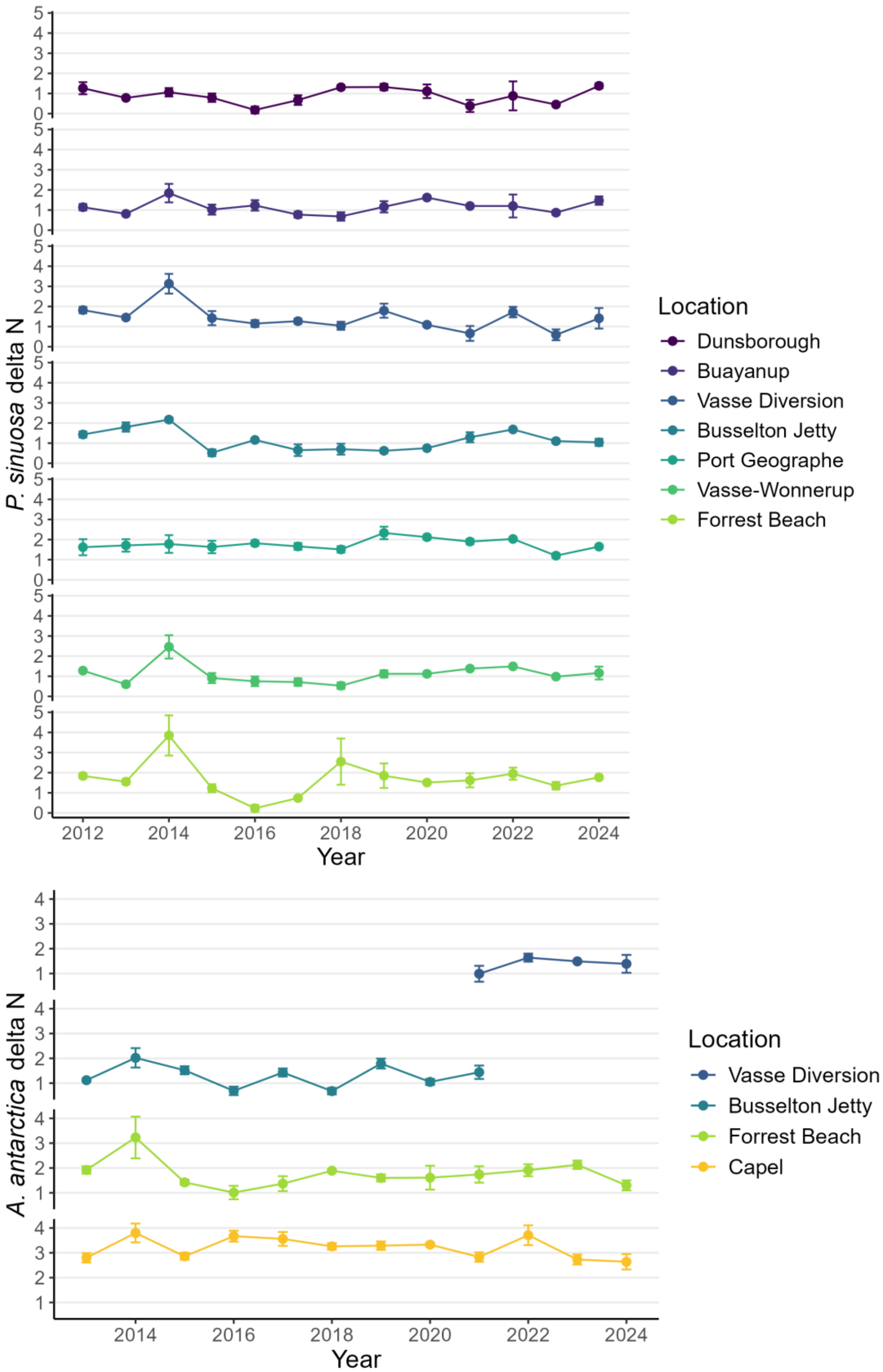


***Figure 9:** δ[15]N of* P. sinuosa *leaves at all sites and* A. antarctica *leaves at a subset of the Keep Watch seagrass monitoring sites in 2012-2024 for* P. sinuosa *and 2013-2024 for* A. antarctica*. Note that only Capel was measured in 2012 for* A. antarctica*, and is not included in these graphs.*

The epiphytic macroalgae, *Dictyota* had higher phosphorus content (% DW) at Capel (0.09 %DW) compared to the other sites (~0.04 %DW). Nitrogen content (% DW) at Capel was similar to Vasse Diversion and Forrest Beach (~1.4-1.5 %DW) but lowest at Dunsborough (0.5 %DW, Figure 10). The $\delta^{15}N$ for *Dictyota* was highest at Capel and Forrest Beach (~0.26-0.29 ‰) compared to Vasse Diversion and Dunsborough (~-1.0 ‰), indicating different sources of nitrogen between these two sets of sites (Figure 10).

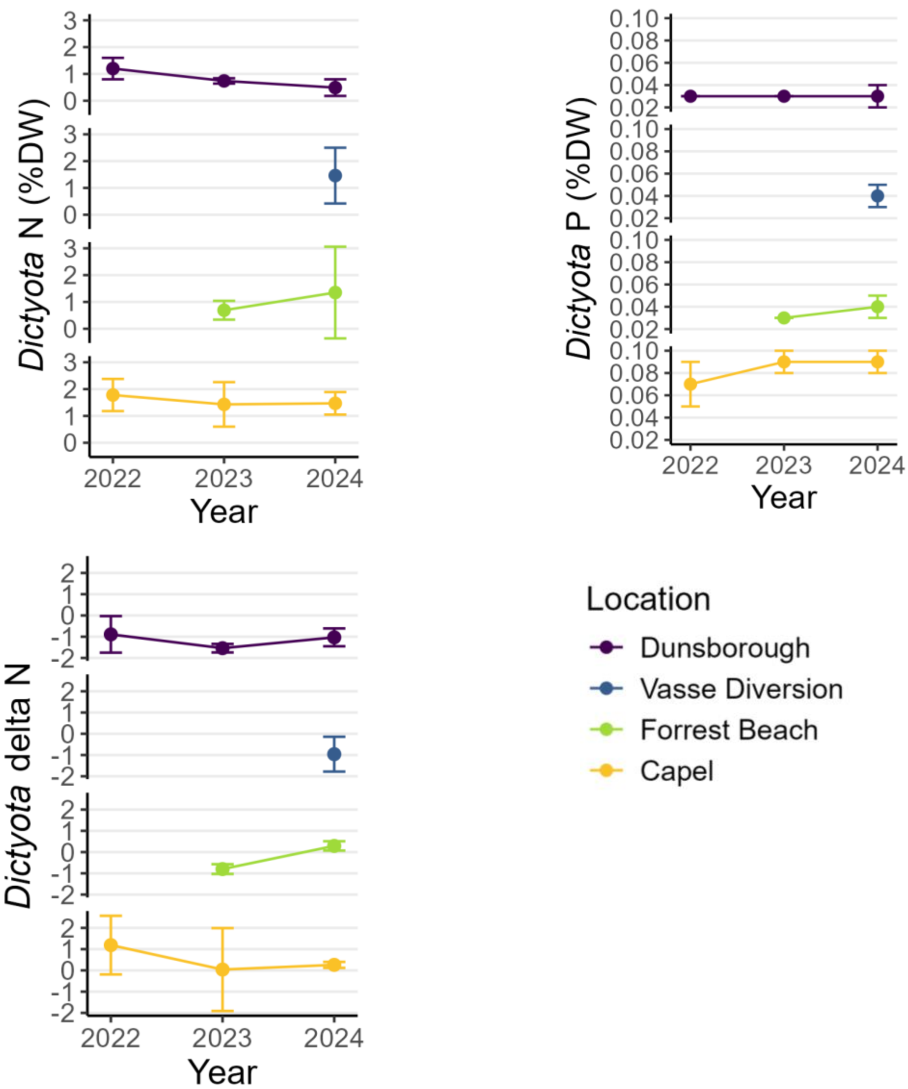


Figure 10: *Nutrient (N, P) and $\delta^{15}N$ of the epiphytic macroalgae* Dictyota *from Keep Watch Seagrass monitoring sites from 2022-2024. Note that Forrest Beach only has been sampled in 2023-2024 and Vasse Diversion only in 2024.*

4.6 Water quality

Water temperature at the Keep Watch seagrass sites ranged from 21.6-23.4°C, within the range observed for previous years. Water clarity was high and the Secchi disk was always observed on the bottom (Table 6).

Table 6: *Water quality measures at the Keep Watch seagrass monitoring sites from 2012-2024, *=Secchi disk depth on bottom.*

Site	Secchi disk depth (m)												
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
1. Dunsborough	4.2*	3.0	3.0	3.2*	3.0*	3.5*	2.7	2.7	4.0*	3.3	4.0*	3.5*	3.4*
2. Buayanup	3.5	2.5	3.0*	3.2*	3.5*	2.5*	3.0*	2.8	3.5*	3.2	3.5*	3.5*	3.2*
3. Vasse Diversion	4.0	3.2	3.5*	3.6*	3.5*	5.0*	3.3	3.0	3.5*	3.4	4.0*	4.0*	3.7*
4. Busselton Jetty	4.2	2.5	3.5	3.6*	3.5*	2.5*	4.0*	2.9	3.5*	3.1	4.5*	3.7*	3.3*
5. Port Geographe	3.75	2.5	4.0	4.1*	3.5	4.5*	3.5*	3.2	3.0*	4.5*	3.5*	3.6*	3.3*
6. Vasse-Wonnerup	4.0	2.0	4.5	4.6*	4.5*	4.0*	4.5*	4.0	4.5*	5.4*	5.0*	4.6*	4.1*
7. Forrest Beach	5.0*	2.0	4.0	4.2*	4.5*	4.0*	3.5	3.8	4.5*	5.0*	5.0*	4.3*	4.4*

Site	Temperature (°C)												
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
1. Dunsborough	22.0	22.5	23.1	23.3	22.9	22.5	21.2	20.6	23.5	20.0	23.6	22.9	21.6
2. Buayanup	22.8	22.6	23.5	25.2	23.7	22.8	21.7	21.7	24.4	20.1	23.9	24.3	23.3
3. Vasse Diversion Drain	23.4	23.8	23.5	24.5	23.9	22	22.1	21.7	24.7	20.9		24.4	23.4
4. Busselton Jetty	23.4	27.3	23.3	26.3	22.6	22.5	22.6	22.8	23.6	20.9		23.3	22.0
5. Port Geographe	23.4	25.5	23.3	24.3	23	22.5	22.3	22.8	23.7	20.9		24.1	23.1
6. Vasse-Wonnerup	23.1	28.4	22.2	26.1	22.3	22.3	21.9	21.6	23.6	21.2	24.4	24.3	22.0
7. Forrest Beach	22.5	23.5	22.1	25.1	23.3	22.5	21.5	21.7	24.0	21.4		23.6	22.6

5 General conclusions

5.1 Rebound in shoot density

No management criteria were triggered in 2024 for all three triggers indicating no concerns with the condition of seagrass meadows in Geographe Bay. Last year, six sites declined, with two, Busselton Jetty and Port Geographe declining more than 20% but this was reversed this year and these sites had the greatest increases (Figure 11). Vasse-Wonnerup also had a large increase this year, recording the highest shoot count ever in this program for this site. In addition, all central sites, that generally have the lowest shoot density (Vasse-Diversion-Port Geographe) increased highlighting that the environmental conditions are conducive for increases in seagrass condition. This aligns with the findings from a regional analysis on *P. sinuosa* seagrass condition that highlighted shoot densities in Geographe Bay were significantly higher than meadows in Perth waters and the cooler sea surface temperatures in Geographe Bay are buffering seagrass here from climate change effects (Webster et al. 2024). In addition, the physiological characteristics of the Geographe Bay populations support that these meadows are resilient to future warming as the optimum temperature for productivity, 29.9^{o}C is much higher than the current average summer temperatures, 23 ^{o}C and with ocean warming predictions (23 ^{o}C) or heatwave anomalies (26 ^{o}C, Said et al. 2024). This indicates that human activities and ocean warming are not currently impacting meadows in Geographe Bay as is observed further north and Geographe Bay is a climate refuge site for temperate seagrass meadows and of high conservation value. Continued monitoring to keep track on the condition of the meadows is warranted.

Site	2012	13	14	15	16	17	18	19	20	21	22	23	2024
1. Dunsborough	61	64	52	56	61	59	53	56	61	68	63	66	62
2. Buayanup	59	66	50	60	57	58	55	63	56	60	59	56	61
3. Vasse Diversion	34	37	34	34	29	34	38	41	48	37	41	40	43
4. Busselton Jetty	38	38	46	44	45	45	43	52	49	45	49	39	51
5. Port Geographe	39	46	42	47	45	35	49	62	50	48	42	32	49
6. Vasse-Wonnerup	38	45	51	49	48	50	47	53	51	44	45	37	57
7. Forrest Beach	53	61	47	48	50	49	53	53	59	42	49	48	53

Figure 11: *Heatmap of changes in average shoot density of* P. sinuosa *per quadrat (0.04m^2) over time, 2012-2024, at each Keep Watch seagrass monitoring sites.*

5.2 Algal epiphyte cover consistent

The cover of algae has remained consistent at most sites but it is not a concern following this years sampling as there are no obvious impacts to seagrass condition (Figure 12). Although there have been increases at three sites, the dominant algal types remains microalgal accumulations which are not the type commonly associated with nutrient enrichment. Although it is important to note that both Port Geographe and Forrest Beach show their highest algal cover since the program began, emphasizing the need to keep monitoring changes in algal cover.

Site	2012	13	14	15	16	17	18	19	20	21	22	23	2024
1. Dunsborough	3	2	3	3	2	2	3	3	3	2	3	3	3
2. Buayanup	3	2	3	3	4	4	3	1	4	4	4	4	4
3. Vasse Diversion Drain	2	3	4	4	4	4	4	2	4	4	4	3	4
4. Busselton Jetty	2	2	4	4	3	3	3	2	4	4	4	3	3
5. Port Geographe	2	1	2	2	3	3	3	2	3	3	3	3	4
6. Vasse-Wonnerup	2	1	2	3	2	2	2	1	2	3	2	3	2
7. Forrest Beach	2	1	2	2	2	1	2	1	2	2	1	2	3

Figure 12: *Heatmap of changes algal cover on* P. sinuosa *over time, 2012-2024, at each Keep Watch seagrass monitoring sites.The numbers and colours reflect the cover of epiphytic algae with 1=Very low, 2=Low, 3=Moderate, 4=High and 5=Very High*

5.3 Nitrogen exposure is low and no obvious changes in the sources

Overall the nutrient concentrations in seagrass are very low and do not indicate exposure to excess nutrients. This is the first year that Capel has not had the highest nitrogen content in seagrass tissue, indicating nitrogen loads have been reduced in this region. Although the phosphorus content was at these sites was also not elevated in seagrass, the macroalgae did show higher phosphorus content compared to other sites, indicating that Capel may have had slightly higher phosphorus concentration in the previous months compared to other sites in Geographe Bay. The main potential nitrogen sources based on the higher nitrogen isotope signal in seagrass leaves (2.64 ‰) at Capel indicate nitrogen is likely derived form a range of sources such as animal wastes or septic tanks or sources from natural vegetation. Despite the higher nitrogen isotope values at Capel, and considering the low phosphorus levels and the first time that nitrogen content (% DW) has not been highest in *A. antarctica* this indicates that there continues to be less exposure to phosphorus compared to earlier years and that exposure to nitrogen could be lessening as well. This is a positive indicator of the success of nutrient management activities around Capel.

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Appendix 1: Randomly generated quadrat positions from 2024 survey.

Quadrat #	Bearing	Distance
1	0	8
2	0	11
3	0	16
4	0	18
5	0	22
6	0	24
7	40	4
8	40	14
9	40	17
10	40	21
11	40	23
12	40	25
13	100	4
14	100	16
15	100	18
16	100	20
17	100	23
18	100	25
19	220	2
20	220	9
21	220	10
22	220	11
23	220	17
24	220	19
25	300	3
26	300	5
27	300	7
28	300	10
29	300	13
30	300	19

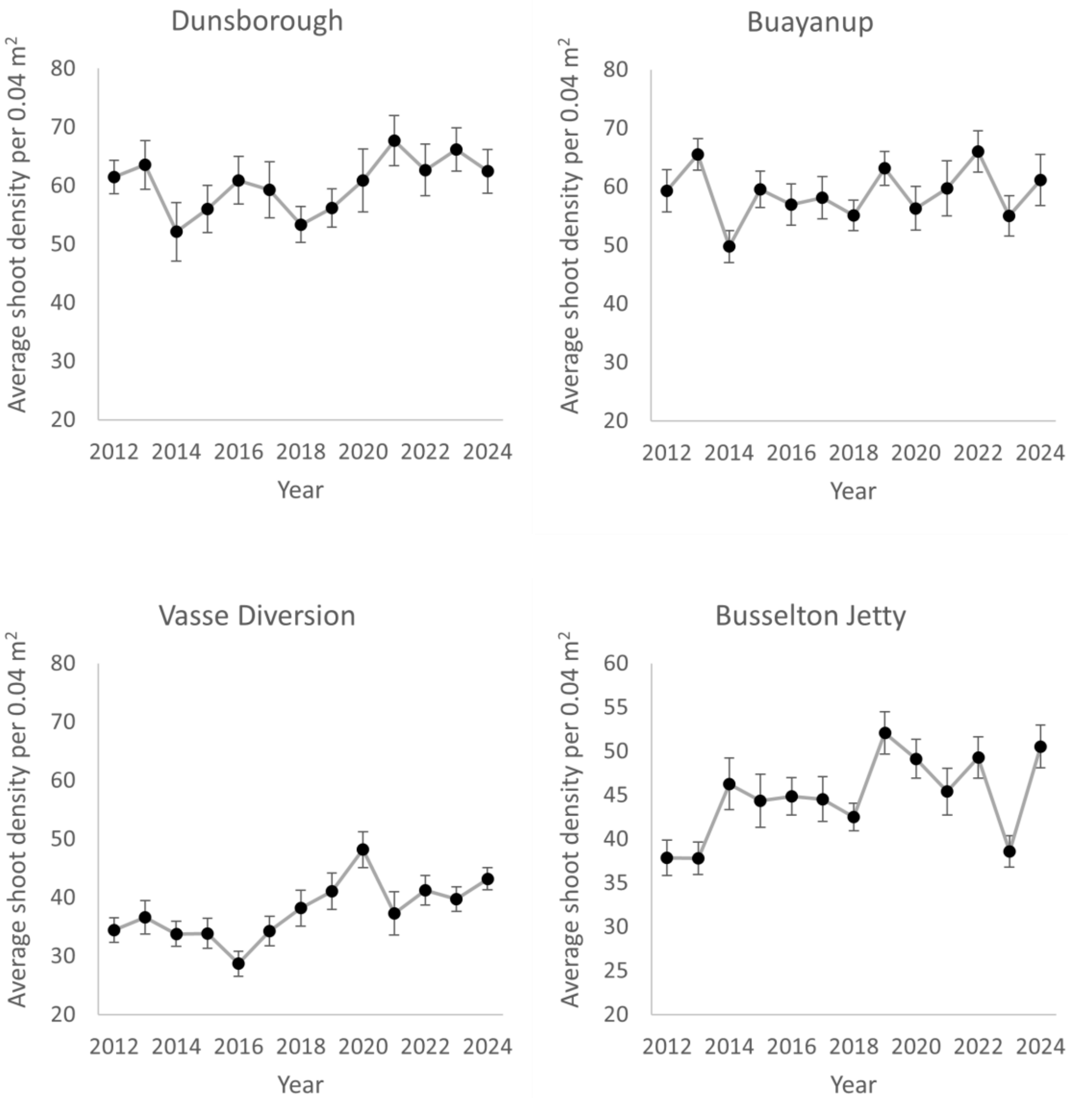
Appendix 2: **Raw and summary statistics for shoot density data for the seven Keep Watch Seagrass Monitoring Sites in 2024. Shoot counts (Sh), number of seedlings (Sl) and the number of flowering shoots (FSh) per quadrat (0.04 m²) are given and the initials of the person who counted each quadrat is also included (C). Columns for Seedlings and/or Flowering shoots are excluded from sites where no seedlings or flowering shoots were observed. The table continues on the next page.**

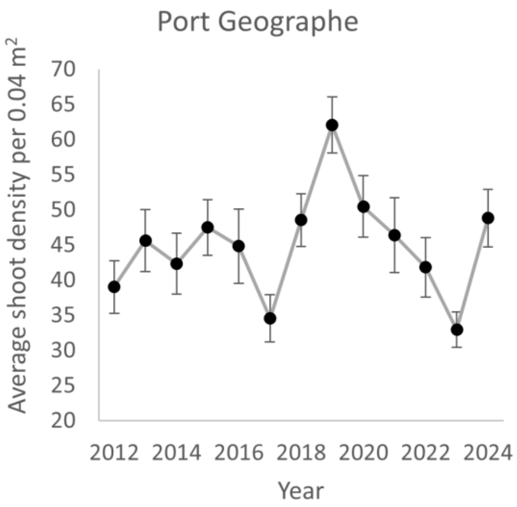
	1. Dunsborough			2. Buayanup		3. Vasse Diversion		4. Busselton Jetty		5. Port Geographe	6. Vasse-Wonnerup		7. Forrest Beach	
Rep	Shoots	Seedlings	Flowering shoots	Shoots	Flowering shoots	Shoots	Flowering shoots	Shoots	Flowering shoots	Shoots	Shoots	Seedlings	Shoots	Seedlings
1	42	0	0	89	0	44	0	55	0	26	55	0	54	1
2	30	0	0	43	0	47	0	31	0	32	62	0	79	0
3	52	0	0	22	0	47	0	37	0	75	74	0	60	0
4	63	0	0	76	0	27	0	45	0	58	50	0	84	0
5	68	0	0	15	0	40	0	60	0	78	62	0	65	0
6	54	0	0	53	0	47	0	43	0	41	44	0	62	0
7	78	0	1	97	0	45	0	37	0	21	65	0	33	0
8	47	0	0	76	0	27	0	35	0	25	36	0	38	2
9	104	0	0	78	1	43	0	47	0	52	40	0	63	0
10	57	0	0	45	0	48	0	48	0	56	44	0	34	0
11	57	0	0	90	1	29	0	44	0	15	42	0	49	0
12	56	0	0	53	0	26	0	44	0	41	23	0	37	1
13	61	0	0	48	0	48	0	59	0	68	63	1	40	0
14	57	0	0	35	0	49	0	37	0	29	79	0	52	0
15	48	0	0	33	0	45	0	82	0	51	57	0	39	0
16	62	0	0	50	0	33	0	50	0	16	61	0	64	0
17	47	0	0	47	0	26	0	61	0	55	73	0	107	1
18	44	0	0	54	0	44	0	53	0	42	44	0	55	0
19	37	0	0	108	0	60	0	48	0	11	39	0	63	0
20	51	0	0	65	0	45	1	37	0	75	81	0	76	1
21	34	0	0	29	0	56	0	29	0	66	79	0	19	0
22	116	0	0	96	0	54	0	51	0	51	61	0	58	0
23	81	0	0	61	0	32	0	50	1	68	58	0	22	1
24	64	0	0	79	0	59	0	48	2	34	59	0	41	2
25	68	1	1	40	1	54	0	44	0	39	32	0	58	0
26	58	0	0	72	0	45	0	66	0	106	85	0	8	0
27	67	0	1	67	0	55	0	74	0	60	55	0	47	1
28	100	0	0	46	0	27	0	73	0	35	93	0	40	0
29	83	0	0	85	0	41	0	58	0	78	25	0	71	0
30	87	0	0	83	0	52	0	70	0	60	66	0	79	0
Average	**62.4**	**0.0**	**0.1**	**61.2**	**0.1**	**43.2**	**0.0**	**50.5**	**0.1**	**48.8**	**56.9**	**0.0**	**53.2**	**0.3**
Median	**57.5**	**0.0**	**0.0**	**57.5**	**0.0**	**45.0**	**0.0**	**48.0**	**0.0**	**51.0**	**58.5**	**0.0**	**54.5**	**0.0**
SE	**3.7**	**0.0**	**0.1**	**4.4**	**0.1**	**1.9**	**0.0**	**2.4**	**0.1**	**4.1**	**3.2**	**0.0**	**3.8**	**0.1**
Stdev	**20.4**	**0.2**	**0.3**	**24.0**	**0.3**	**10.4**	**0.2**	**13.2**	**0.4**	**22.5**	**17.7**	**0.2**	**21.0**	**0.6**
CV	**0.3**	**5.5**	**3.1**	**0.4**	**3.1**	**0.2**	**5.5**	**0.3**	**4.0**	**0.5**	**0.3**	**5.5**	**0.4**	**1.8**

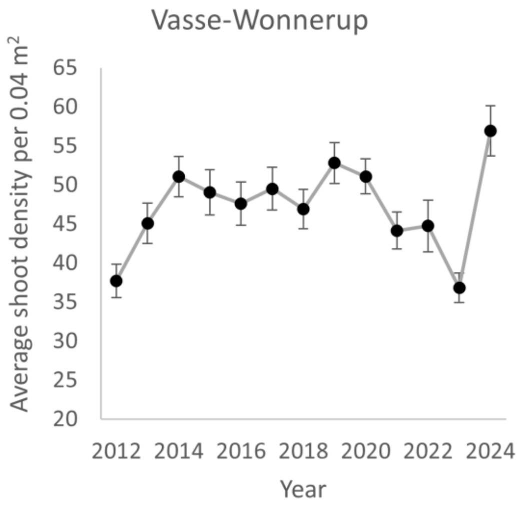
Appendix 3: Leaf morphology data of *Posidonia sinuosa* for 2024

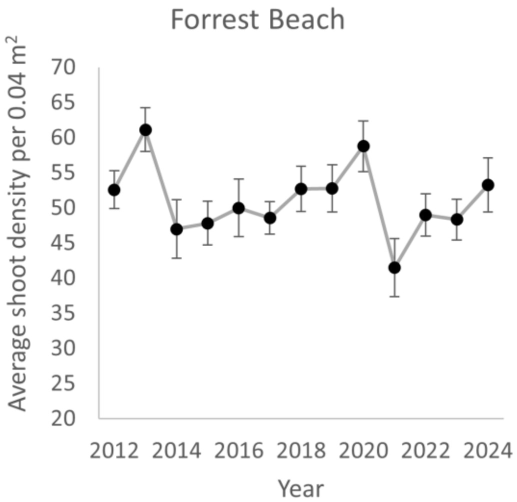
	S1. Dunsborough		S2. Buayanup		S3. Vasse Diversion		S4. Busselton Jetty		S5. Port Geographe		S6. Vasse-Wonnerup		S7. Forrest Beach	
Rep	Shoot Length (cm)	Shoot Width (mm)	Shoot Length (cm)	Shoot Width (mm)	Shoot Length (cm)	Shoot Width (mm)	Shoot Length (cm)	Shoot Width (mm)	Shoot Length (cm)	Shoot Width (mm)	Shoot Length (cm)	Shoot Width (mm)	Shoot Length (cm)	Shoot Width (mm)
1	58	6	36.5	5	70	5.5	58	5.5	46.5	5.5	30.5	6.5	22.5	5
2	35.5	6	49.5	6	42.5	5.5	37.5	5.5	71.5	5	68	6.5	26.5	4
3	31.5	5.5	63.5	6	41	6	54.5	7	39	5.5	80	6.5	24	6
4	28	4.5	38	5	47	6	54	6	66.5	5.5	40	6	20.5	5
5	39.5	5.5	48	5.5	44.5	5	59.5	5	74	6	102	7	26	5
6	50.5	6.5	55	5	50	5.5	52	6	53.5	6	65	6	33	6.5
7	58	6	42	5	44.5	5	54	6	52.5	5.5	69	6	27.5	6
8	41.5	4.5	35	4	70.5	5.5	67.5	7	53	6	34.5	6.5	21.5	7
9	47	6	65	6	73	5	64	6	48	4.5	75.5	6	22.5	6
10	40	5	49.5	5	55	5.5	49	6	45	5.5	78.5	6.5	26.5	7
11	45	7	57.5	5.5	57	5	42	5.5	44	6	38.5	5	30	5.5
12	51	6.5	55	5	41	5.5	50	5.5	42	5.5	69.5	6.5	44	6
13	40	6	60.5	6	44	5.5	36.5	6	45.5	5.5	43	5.5	27	6
14	39	4.5	39.5	6	49	5	37	6	40	5.5	44	5.5	32	6
15	50.5	5.5	59	5	56.5	5.5	29	5.5	36.5	5.5	38.7	6	29	5
Mean	43.67	5.67	50.23	5.33	52.37	5.40	49.63	5.90	50.50	5.53	58.45	6.13	27.50	5.73
SE	2.29	0.20	2.61	0.15	2.85	0.09	2.87	0.14	3.01	0.10	5.50	0.13	1.52	0.21
Min	28	4.5	35	4	41	5	29	5	36.5	4.5	30.5	5	20.5	4
Max	58	7	65	6	73	6	67.5	7	74	6	102	7	44	7

Appendix 4: Trends over time in seagrass shoot density of *Posidonia sinuosa* from 2012 to 2024.




Port Geographe
Average shoot density per 0.04 m2
70
65
60
55
50
45
40
35
30
25
20
2012 2014 2016 2018 2020 2022 2024
Year


Vasse-Wonnerup
Average shoot density per 0.04 m2
65
60
55
50
45
40
35
30
25
20
2012 2014 2016 2018 2020 2022 2024
Year


Forrest Beach
Average shoot density per 0.04 m2
70
65
60
55
50
45
40
35
30
25
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2012 2014 2016 2018 2020 2022 2024
Year

Appendix 5: Nutrient data for 2024 including the original (O) and modified (M) calibrated values for 2020 as well as the calibrated values for 2024 for several species (Spec) of seagrasses (*Ps* = *Posidonia sinuosa*, *Aa* = *Amphibolis antarctica*) and macroalgae (*D* = *Dictyota*).

Site	Spec	2020					2024				
		δ15N		N (% DW)		P (% DW)	δ15N		N (% DW)		P (% DW)
		O	M	O	M	O	O	M	O	M	O
1. Dunsborough	*Ps*	2.09	1.66	1.03	0.53	0.21	2.07	1.64	1.34	0.86	0.16
1. Dunsborough	*Ps*	1.63	1.17	1.33	0.85	0.19	1.66	1.19	1.19	0.70	0.15
1. Dunsborough	*Ps*	1.00	0.49	0.90	0.39	0.18	1.77	1.31	1.11	0.62	0.18
2. Buayanup	*Ps*	1.90	1.46	1.30	0.82	0.16	1.95	1.51	1.04	0.54	0.13
2. Buayanup	*Ps*	2.22	1.80	1.34	0.86	0.13	2.23	1.81	1.22	0.73	0.13
2. Buayanup	*Ps*	2.03	1.59	1.28	0.80	0.14	1.55	1.08	1.09	0.60	0.16
3. Vasse-Diversion	*Ps*	1.38	0.90	1.19	0.70	0.23	2.81	2.43	1.31	0.82	0.13
3. Vasse-Diversion	*Ps*	1.65	1.19	1.26	0.77	0.17	1.33	0.85	1.51	1.04	0.17
3. Vasse-Diversion	*Ps*	1.66	1.20	1.19	0.70	0.11	1.43	0.95	1.30	0.82	0.12
4. Busselton Jetty	*Ps*	1.09	0.59	1.08	0.58	0.24	1.85	1.40	1.02	0.52	0.12
4. Busselton Jetty	*Ps*	1.38	0.90	0.91	0.40	0.10	1.32	0.83	1.03	0.53	0.11
4. Busselton Jetty	*Ps*	1.27	0.78	0.99	0.49	0.12	1.39	0.91	0.95	0.44	0.17
5. Port Geographe	*Ps*	2.31	1.90	1.60	1.14	0.19	1.98	1.54	1.36	0.88	0.15
5. Port Geographe	*Ps*	2.55	2.15	1.38	0.90	0.12	2.14	1.71	1.10	0.61	0.12
5. Port Geographe	*Ps*	2.70	2.31	1.59	1.12	0.23	2.13	1.70	1.42	0.94	0.08
6. Vasse-Wonnerup	*Ps*	1.76	1.31	1.22	0.73	0.19	1.19	0.70	1.04	0.54	0.15
6. Vasse-Wonnerup	*Ps*	1.60	1.13	1.11	0.61	0.19	1.49	1.02	1.16	0.67	0.21
6. Vasse-Wonnerup	*Ps*	1.39	0.91	1.05	0.55	0.20	2.19	1.76	1.16	0.66	0.14
7. Forrest Beach	*Ps*	2.01	1.57	1.08	0.58	0.12	2.05	1.61	1.09	0.59	0.10
7. Forrest Beach	*Ps*	1.98	1.54	1.37	0.89	0.16	2.31	1.90	1.03	0.53	0.11
7. Forrest Beach	*Ps*	1.86	1.41	1.15	0.66	0.17	2.21	1.79	0.94	0.43	0.08
3. Vasse-Diversion	*Aa*						2.03	1.60	1.17	0.68	0.09
3. Vasse-Diversion	*Aa*						1.19	0.69	1.56	1.09	0.14
3. Vasse-Diversion	*Aa*						2.29	1.88	1.21	0.73	0.09
7. Forrest Beach	*Aa*	2.90	2.53	1.17	0.68	0.12	1.39	0.90	0.90	0.39	0.09
7. Forrest Beach	*Aa*	1.38	0.90	1.12	0.63	0.12	1.85	1.41	0.77	0.25	0.07
7. Forrest Beach	*Aa*	1.86	1.41	1.12	0.63	0.11	2.01	1.57	0.83	0.32	0.07
8. Capel	*Aa*	3.52	3.19	2.48	2.07	0.15	3.36	3.03	1.23	0.75	0.08
8. Capel	*Aa*	3.75	3.44	1.83	1.38	0.10	2.44	2.03	0.98	0.48	0.08
8. Capel	*Aa*	3.66	3.34	2.30	1.88	0.11	3.21	2.86	1.04	0.54	0.07
1. Dunsborough	*D*						-0.54	-1.17	0.92	0.42	0.03
1. Dunsborough	*D*						-0.55	-1.17	1.19	0.70	0.03
1. Dunsborough	*D*						-0.16	-0.75	0.87	0.36	0.02
3. Vasse-Diversion	*D*						-0.77	-1.41	2.26	1.83	0.04
3. Vasse-Diversion	*D*						0.11	-0.47	1.26	0.77	0.04
3. Vasse-Diversion	*D*						-0.39	-1.00	2.21	1.78	0.05
7. Forrest Beach	*D*						0.86	0.34	1.18	0.69	0.03
7. Forrest Beach	*D*						0.68	0.15	1.36	0.88	0.05
7. Forrest Beach	*D*						0.91	0.39	2.87	2.48	0.04
8. Capel	*D*						0.86	0.34	1.76	1.31	0.08
8. Capel	*D*						0.71	0.18	2.17	1.75	0.09
8. Capel	*D*						0.78	0.26	1.79	1.34	0.10