

2022-2023 Ecological indicator report for the Vasse Wonnerup wetlands – Aquatic plants

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Methods

Aquatic plant monitoring was undertaken in the Vasse Wonnerup wetlands in spring on 28th and 29th November 2022 and in summer on 8th February 2023. Monitoring included 16 sites with 8 in each estuary following the methodology of Paice and Chambers (2023). Plant density as ‘percent volume inhabited’ (PVI) was assessed at five points along a transect from bank to bank across the estuary at each site. PVI is a measure of the proportion of volume of water taken up by plant material measured as a function of plant cover and the ration of height to depth. All sites were samples in spring. Parts of the upper regions were dry in February 2023, including sites 27 and 29 in the Vasse Estuary and sites 5, 6 and 8 in the Wonnerup Estuary.

Seasonal growth of macrophytes commences with the onset of winter rains, rapidly reaching peak density in spring, followed by recession in summer as water levels drop. This report focuses on spring data to indicate health of aquatic macrophyte communities.

Spring data was used to calculate the Macrophyte Index using two metrics: the key species metric and the macrophyte dominance metric. Index and metric values were assessed against condition categories to provide ratings that reflect the ecological health of aquatic plant communities: A=excellent, B=good, C=moderate, D=poor and E=very poor. Methodology for development of this index, condition categories and testing procedure is explained in detail in Paice and Chambers (2023).

The Macrophyte Index is based on the condition of these communities during spring, when maximum biomass and diversity is present in the system. This is to allow annual comparison of indicators when macroinvertebrate populations are at their highest to monitor the aim “to maintain diversity and dominance of macrophytes”. This report therefore has a focus on spring monitoring data. Aquatic plants have an annual life cycle, with senescence each year in summer as water level declines and temperature and salinity increase. Summer monitoring data is included in this report to contribute to our understanding of system health and seasonal changes in aquatic plant communities in the Vasse-Wonnerup Wetlands. It is particularly useful for assessing risk of problem macroalgal growth.

Spring – November 2022

Key findings and observations - Spring

- Healthy macrophyte communities were present across the Vasse-Wonnerup wetlands with very high density of key species, despite moderate growth of macroalgae.
- The Vasse Estuary had the greatest density of macroalgae, mostly *Ulva*. Density was consistent throughout the Vasse, showing an increase in the upper region and a decrease in the lower region since 2021.
- High key species density on the upper Vasse was related to growth of *Ruppia megacarpa* and *Ruppia polycarpa*, while *Althenia cylindrocarpa* remained uncommon compared with historical distribution. There has been a shift in main species here to *Ruppia* and *Stuckenia*.
- The lower Vasse again had the highest recorded macrophyte density and greater dominance over macroalgae compared with previous years.
- The Wonnerup Estuary had a healthy plant community with greater density of the charophyte *Lamprothamnium macropogon* throughout than in 2021.
- Macroalgae was consistently found throughout the Wonnerup Estuary, although at lower density in the lower region. This was mainly *Ulva*, which was present at almost all transect points.
- Although moderately high macroalgal growth continued in the upper Wonnerup, this region had the most diverse plant community in the system. All species were present, including a substantial meadow of *Althenia* at the northern end.

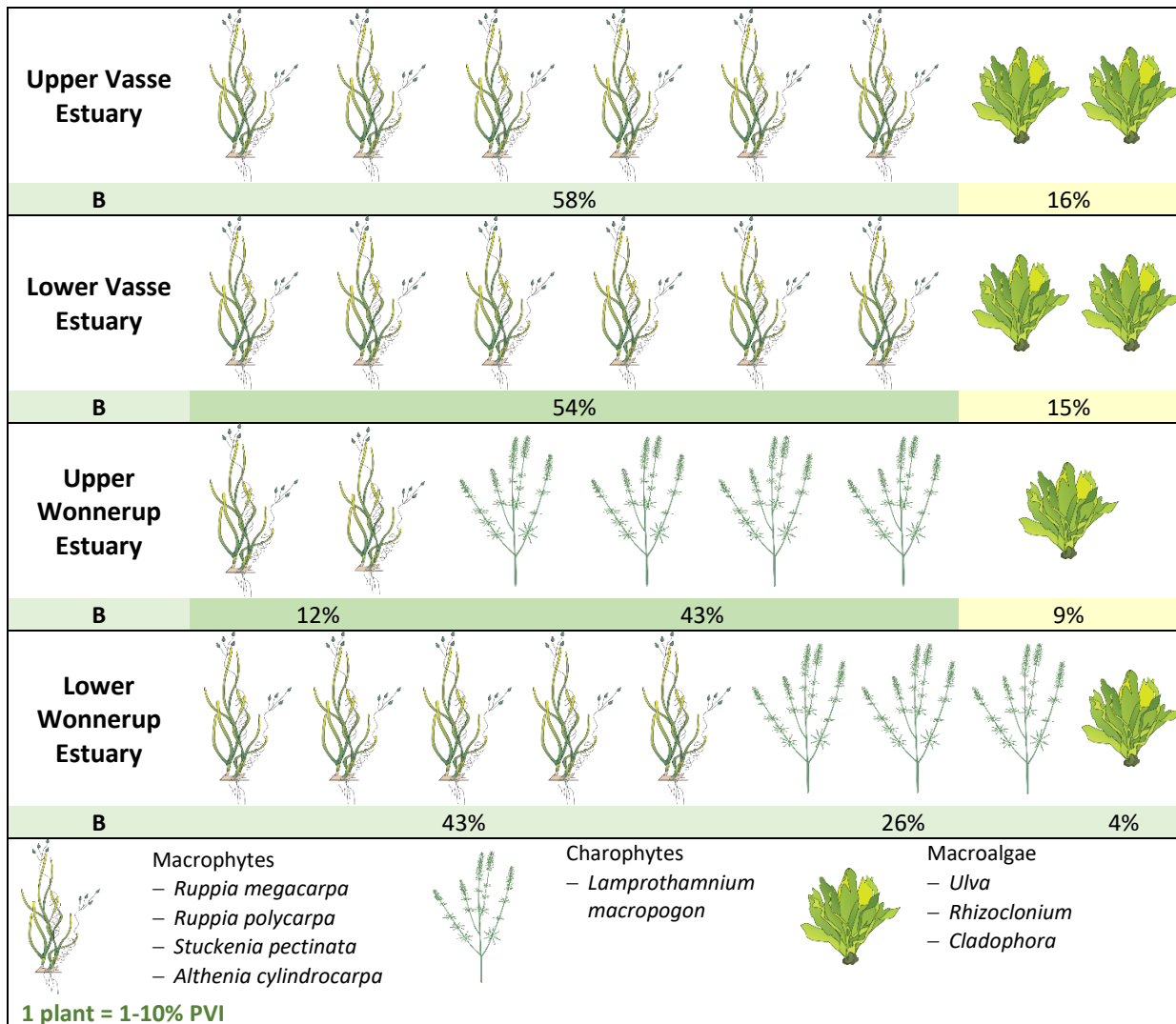
2022 Whole-system condition rating

Indicator	Condition	Score	Description
Macrophyte Index	B	80	Healthy macrophyte community with some macroalgae present
Key Species	A	83	Key species density very high
Macrophyte Dominance	C	76	Macroalgae growth may impact macrophytes

Ecological region condition ratings

Ecological region	Indicator	Score	Rating
Upper Vasse	Macrophyte Index	70	B
	Key species	72	B
	Macrophyte dominance	69	C
Lower Vasse	Macrophyte Index	77	B
	Key species	89	A
	Macrophyte dominance	65	C
Upper Wonnerup	Macrophyte Index	85	B
	Key species	92	A
	Macrophyte dominance	79	C
Lower Wonnerup	Macrophyte Index	85	B
	Key species	79	B
	Macrophyte dominance	91	B

Summary of PVI results - Spring



Aquatic plant community description overview - Spring

Spring 2022 aquatic plant communities were healthy across the whole of the Vasse-Wonnerup Wetlands with very high density of key species overall. Macrophytes and charophytes dominated the system, with greater density than in 2021. However, macroalgal growth remained at levels which could impact plant health.

Elevated density of macroalgae occurred mainly in the upper and lower Vasse and the upper Wonnerup regions. Despite this, growth of key species in these regions was high to very high. The lower Wonnerup had both high macrophyte species density and low macroalgae.

The upper Vasse Estuary had a healthy aquatic plant community in 2022, similar to 2021 and relatively good compared with 2019 and 2020. Key species density in 2022 was high, although this was due to widespread growth of *Ruppia* spp. and *Althenia cylindrocarpa* was uncommon (as found in 2021). *Stuckenia pectinata*, which is not a key species in the upper Vasse, had variable distribution and high densities in some parts. Interestingly, *S. pectinata* had much higher density where it co-occurred with *Ruppia polycarpa* than where *Ruppia megacarpa* was dominant. While macrophytes remained dominant, macroalgae growth in the upper Vasse was moderately high. This consisted mostly of *Ulva* present as a dense layer, mostly 10cm thick, within macrophytes with average cover of 53%. Charophytes were found only at one location.

In the lower Vasse region, the Macrophyte Index indicated a healthy aquatic plant community in 2022. Growth of macroalga *Ulva* was moderately high but was lower than 2021 and macrophyte key species density remained very high. Extensive meadows of *S. pectinata* were present throughout this region, while growth of *Ruppia* spp. was patchy. No charophytes were encountered in the lower Vasse Estuary.

The upper Wonnerup Estuary had a healthy aquatic plant community in 2022, with very high key species density contributing to this improved overall condition rating. The charophyte *Lamprothamnium macropogon* was the dominant species present. This region had the most diverse plant community, with *Ruppia* spp. and *S. pectinata* scattered throughout, and a meadow of *A. cylindrocarpa* present at the northern end. Notwithstanding this, macroalgae growth was also widespread: *Ulva* was present at all transect points with varying density and average cover of 33%.

The macrophyte community in the lower Wonnerup Estuary remained in a healthy condition with very similar (good) metric scores to 2021. Key species density was slightly higher, with this and the Index scores borderline A-B. Macroalgal growth was rated low overall, although *Ulva* did occur consistently throughout this region as well as small amounts of *Cladophora*. High density of key species has been maintained since 2020, and low growth of macroalgae since 2018 in the lower Wonnerup. *Ruppia megacarpa* continues to dominate deeper channel sections in this region, with *S. pectinata* and *L. macropogon* more common in shallow expanses. *Althenia cylindrocarpa* has been uncommon in this region in the last two years.

2017-2022 Results summary

Ecological region	Year	Macrophyte Index	Key species	Macrophyte dominance
Upper Vasse	2022	B	B	C
	2021	B	B	C
	2020	D	C	D
	2019	C	C	C
	2018	B	B	C
	2017	C	C	C
Lower Vasse	2022	B	A	C
	2021	C	A	C
	2020	D	C	D
	2019	C	B	D
	2018	C	B	C
	2017	E	D	E
Upper Wonnerup	2022	B	A	C
	2021	C	B	C
	2020	B	B	A
	2019	B	B	A
	2018	B	B	B
	2017	C	C	C
Lower Wonnerup	2022	B	B	B
	2021	B	B	B
	2020	B	B	A
	2019	B	C	B
	2018	B	B	A
	2017	C	B	C

2017-2022 Macrophyte Index testing outcomes

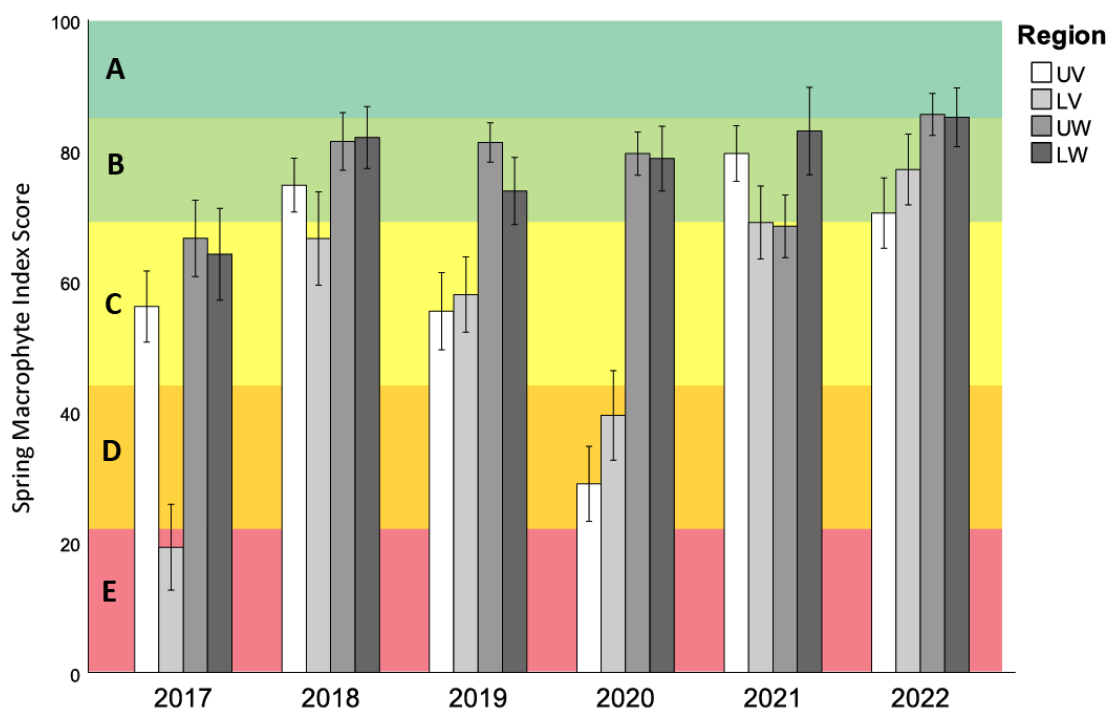


Figure 1. Spring macrophyte index scores relative to condition categories in ecological regions of the Vasse-Wonnerup Wetlands 2017-2022. Values are average of transect points in each region \pm SE. (Regions: UV = upper Vasse, LV = lower Vasse, UW = upper Wonnerup, LW = lower Wonnerup).

2017-2022 Species density in ecological regions - Spring

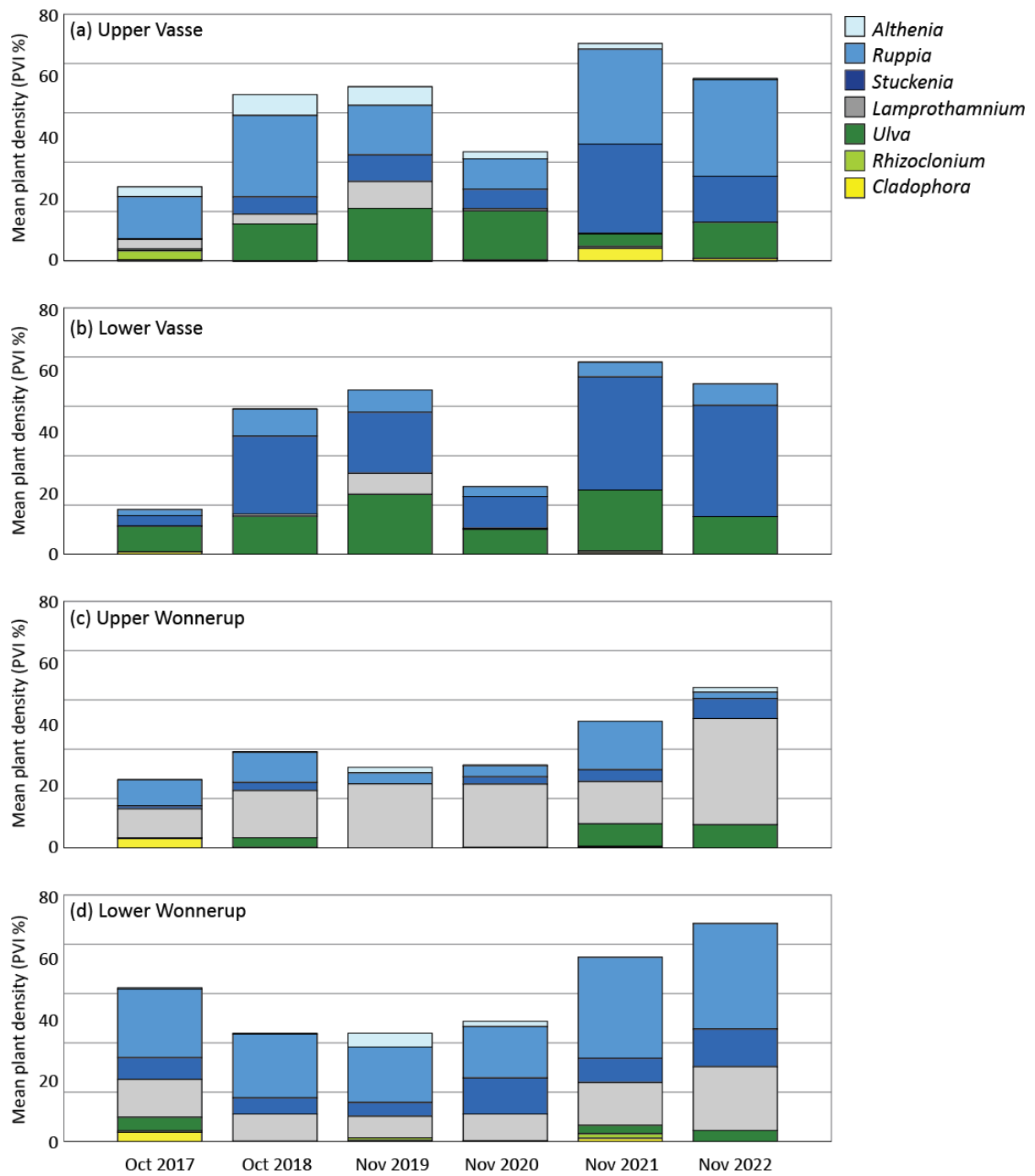


Figure 2. Mean species density of aquatic plants in each ecological region of the Vasse-Wonnerup Wetlands in spring as percent volume inhabited (PVI) from 2017-2022.

Summer – February 2023

Key findings summer 2023 (February)

- The macroalga *Rhizoclonium* grew throughout the upper Vasse Estuary, forming algal mats in some areas. Macroalgae has been dominant in summer here since 2019.
- The lower Vasse Estuary had low density of *Rhizoclonium* and *Ulva* and senescing *Ruppia* spp. in deeper sites. Summer macroalgal growth in the lower Vasse has been relatively low in this region low since 2020.
- Very little plant material occurred in the upper to middle regions of the Wonnerup Estuary. There was a small amount of senescing *Lamprothamnium macropogon*, which persists from spring to a varying extent each year.
- In the Lower Wonnerup, perennial meadows of perennial meadows of *R. megacarpa* were present, as is usual for this region due to deep channel habitat.

Summary of PVI results – Summer

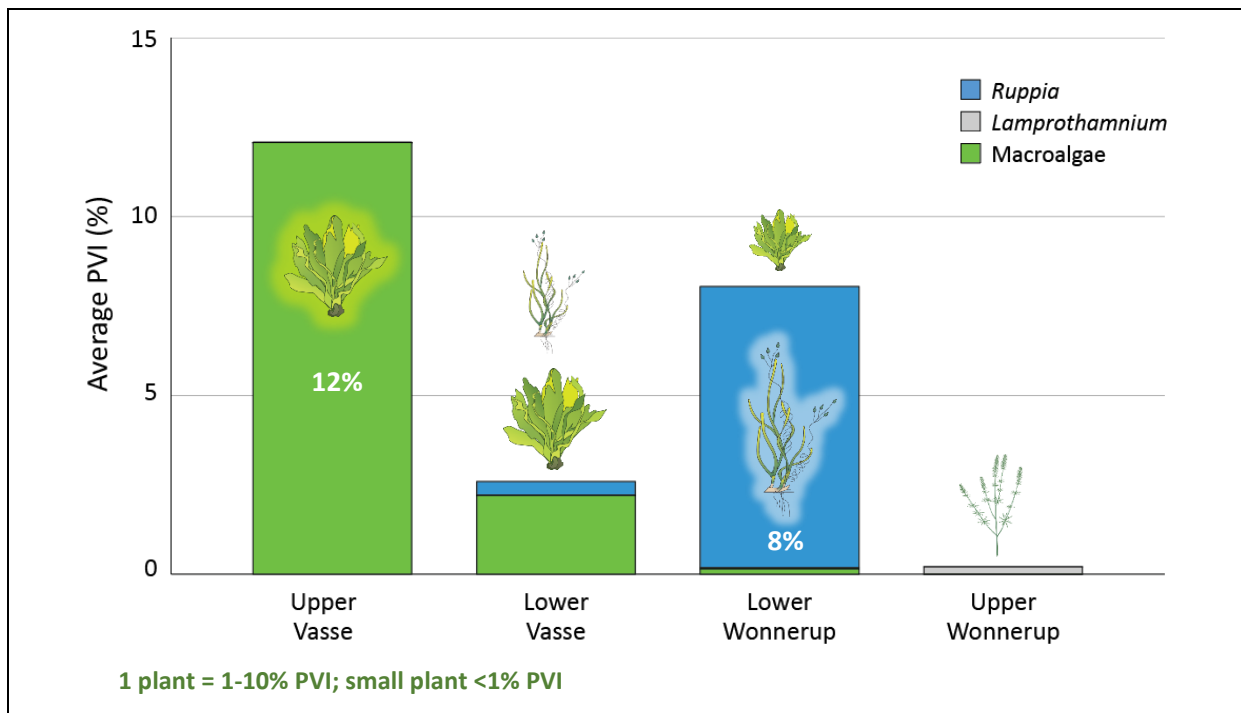


Figure 3. Summer 2023 mean species density of aquatic plants in each ecological region of the Vasse-Wonnerup Wetlands as percent volume inhabited (PVI). 1 plant = 1-10% PVI; small plant <1% PVI.

Aquatic plant community description overview - Summer

Summer monitoring took place in February 2023, when some upper areas of both estuaries were dry. Aquatic plants present at this time were macroalgae throughout the Vasse Estuary, small amounts of senescing *Ruppia* spp. in the lower Vasse, and perennial meadows of *Ruppia megacarpa* in the lower Wonnerup Estuary. Summer aquatic plant communities in the Vasse-Wonnerup have varied substantially since 2018 in terms of plant density in most regions, although the species present within each region has been relatively consistent.

The macroalga *Rhizoclonium* was the only species present in the upper Vasse in early 2023 and was found at all transect points in inundated parts of this region. Density was highest at the most upstream site (26), with very moderate to high density and up to 80% cover. The more downstream site (23) had lower density of *Rhizoclonium*, although it remained very common.

This contrasts with conditions in 2018, when meadows of *Althenia cylindrocarpa* and *Ruppia* spp. were present in summer and there was negligible macroalgal growth. The only historical summer data for the upper Vasse region is from January 2012, when biomass was dominated by *A. cylindrocarpa* (75%) over macroalgae (25%) and very small amounts of *Ruppia* spp.

The lower Vasse region had less *Rhizoclonium* than the upper region in early 2023, occurring as isolated patches, and *Ulva* was also present at very low density. *Ruppia* spp. was common throughout the lower two sites (17 and 18), which are the deeper sites, however plant health was very poor as plants senesced (this prevented further identification). Summer growth of filamentous macroalgae has been common in the lower Vasse since 2018, when there was an extensive bloom of *Cladophora*, however density has been much lower in subsequent years.

Very little plant material occurred in the upper region of the Wonnerup Estuary in early 2023: the three most upstream sites were dry, and the adjacent inundated site had no plants. The middle region of the Wonnerup Estuary (sites 11-13) also had very little plant material present with small, isolated occurrences of senescing *Lamprothamnium macropogon* and macroalgae (*Ulva* and *Rhizoclonium*). These upper and middle regions are typically dominated by *L. macropogon* in the spring and this species persist into summer to varying extent, likely depending on environmental factors.

In the lower Wonnerup region, perennial meadows of perennial meadows of *R. megacarpa* were present in the deeper areas in early 2023 perennial meadows of perennial meadows of *R. megacarpa* were present in the deeper areas in early 2023, as is common in this part of the Estuary. These plants occurred at moderate but variable density and was mainly restricted to the lower sites (14 and 15). Small amounts of *L. macropogon* and the three macroalgae species were also found in the lower Wonnerup. The lower Wonnerup has had the least variable summer plant community since 2018, owing to the relatively deep channel habitat which supports *R. megacarpa* throughout summer and autumn.

2018-2022 Species density in ecological regions- Summer

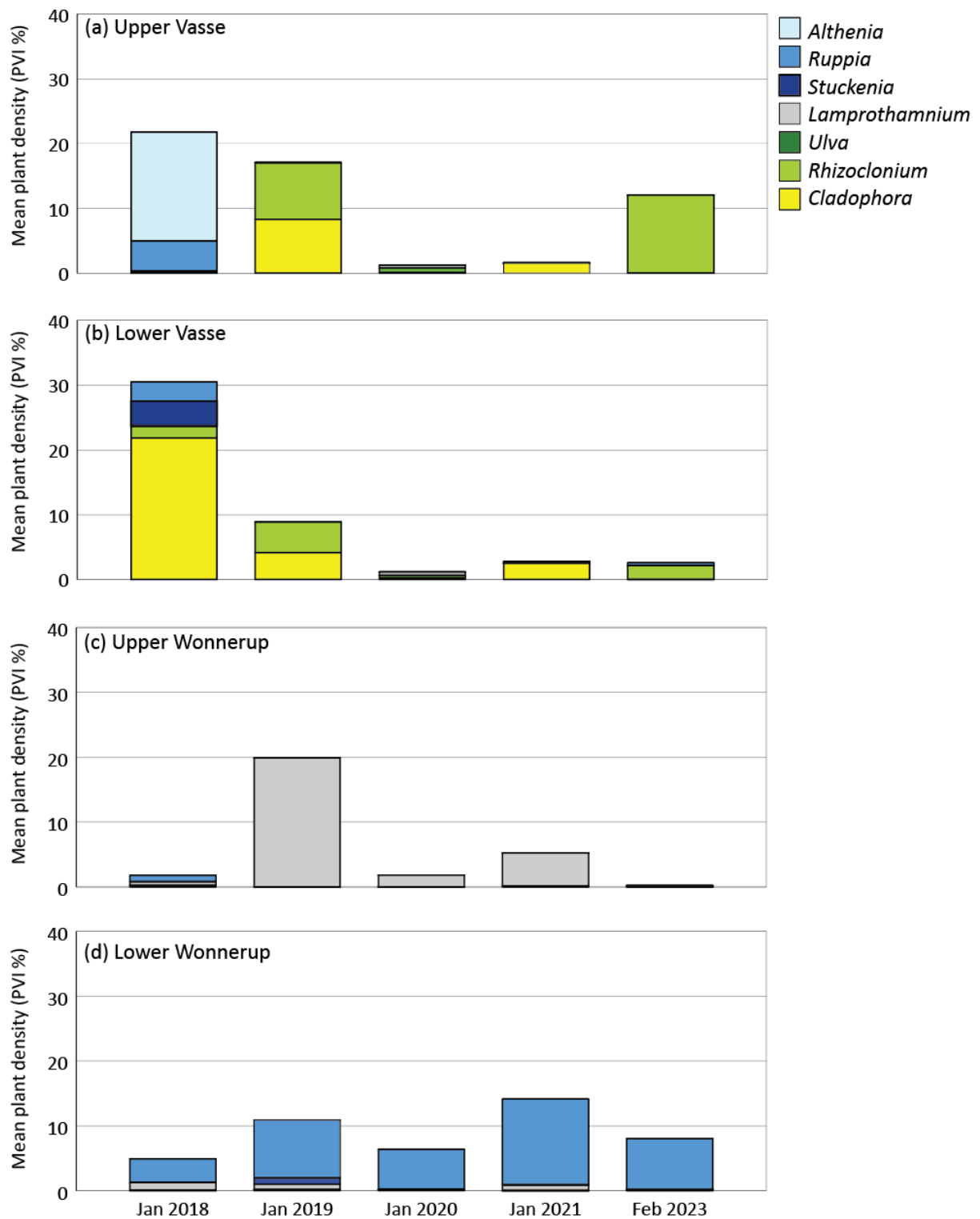


Figure 4. Mean species density of aquatic plants in each ecological region of the Vasse-Wonnerup Wetlands in summer as percent volume inhabited (PVI) from 2018-2022.