15

LESCHENAULT INLET

MACROPHYTE ABUNDANCE AND DISTRIBUTION

Waterways Commission
Report No. 15
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184 St. George's Terrace, Perth, W.A. 6000

Leschenault Inlet - Macrophyte Abundance and Distribution

Report to the Waterways Commission

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INDEX

1. Introduction

1.1 Study Objectives

A number of surveys have been undertaken by the Centre for Water Research to determine the spatial distribution and biomass of aquatic macrophytes in Leschenault Inlet. Estimates were made of total plant biomass and individual species biomass for the dominant species and their distribution mapped. The results are compared with data from other southwestern Australian estuaries.

1.2 Study Area

Leschenault Inlet (ca. 27km^2), is a long, shallow (up to 2m deep) coastal lagoon in an interdunal depression. Shallow platforms of sand and muddy sand occur along the eastern side of the inlet, but marginal platforms on the western side are deep muds. Leschenault Inlet is connected to the ocean by an artificial channel (The Cut, Fig. 1). Both the Collie and Preston Rivers enter the inlet, and construction of Wellington Dam on the Collie River has significantly reduced the volume of fresh water entering the inlet (Le Provost *et al.* 1983). The inlet is essentially marine with respect to salinity most of the year, and the northern end of the inlet (north of Waterloo Head, Fig. 1) becomes hypersaline in summer.

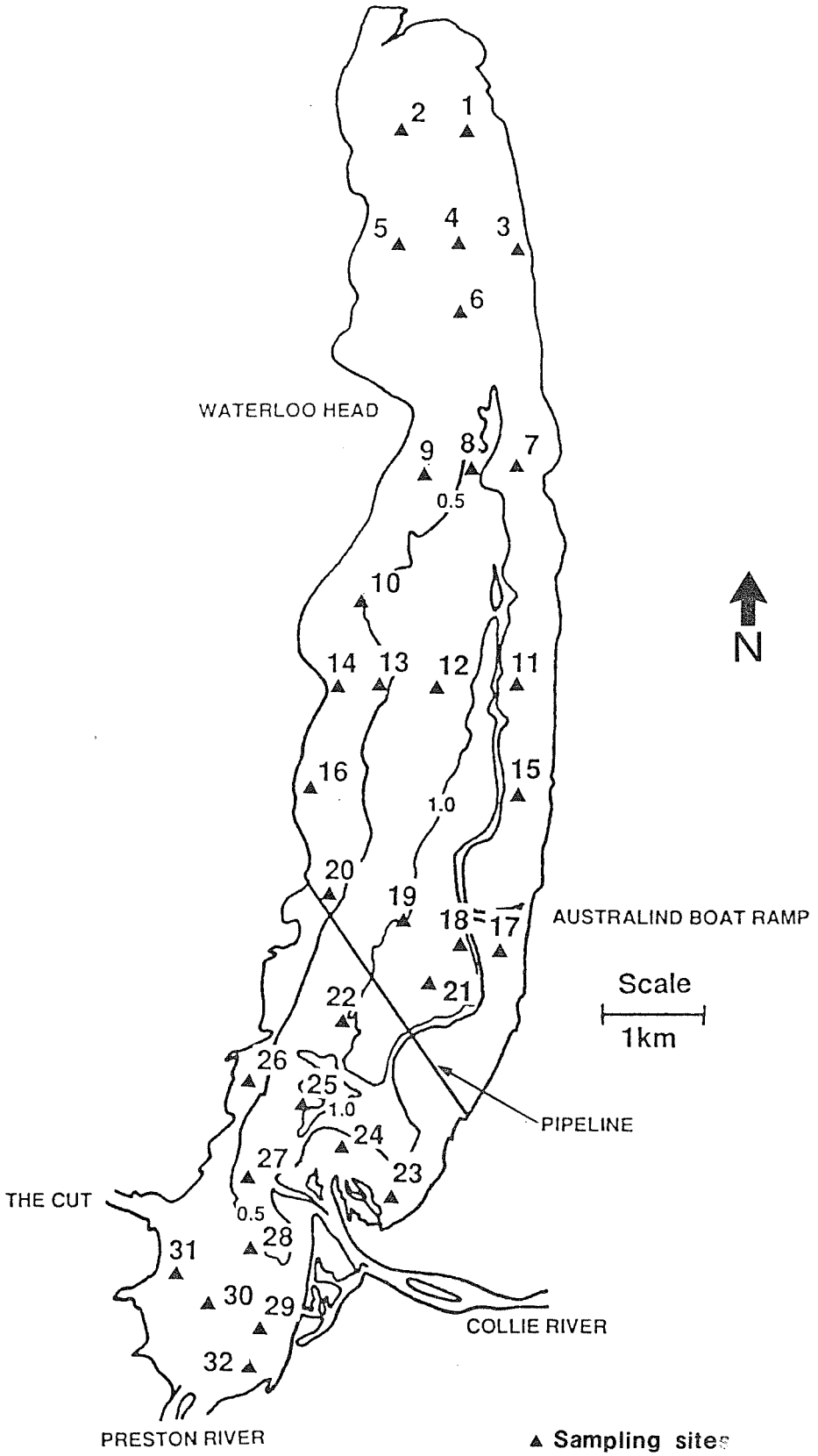

Figure 1. Leschenault Inlet - the location of the macrophyte biomass sampling sites are shown.

2. Materials and Methods

Macrophyte sampling was carried out at 32 sites (Fig. 1) on 13 Nov. 1984, 24 April 1985, 8 Aug. 1985, 29 Nov. 1985, 29 Oct. 1987, 4 Feb. 1988 and 5 May 1988. The sites were selected so as to give representation to the main sectors of the system. Plant biomass was estimated from 5 replicate cores (64 cm^2) at each site. Samples were sorted, oven dried at 70°C, and dry weight converted to grams per unit area. The amounts collected from the different sites ranged from 0-997 g dry weight m^{-2}. Standard errors were generally 15-40% of the mean at a particular site.

The total biomass of macroalgae in the system was estimated by using a computer mapping technique (SYMAP; Dougenik and Sheehan, 1977), which provided contours of different classes of biomass (e.g. Fig. 2). The areas were planimetered and mean biomass for each class interval used to compute biomass. Such an estimate of biomass if of course very crude, considering the small number of sites sampled in such a large water body. Nevertheless, if the same sites are sampled and the same method used, it is reasoned that while the absolute estimates may be subject to inaccuracy, the estimates will provide a reasonable representation of changes in total biomass with time.

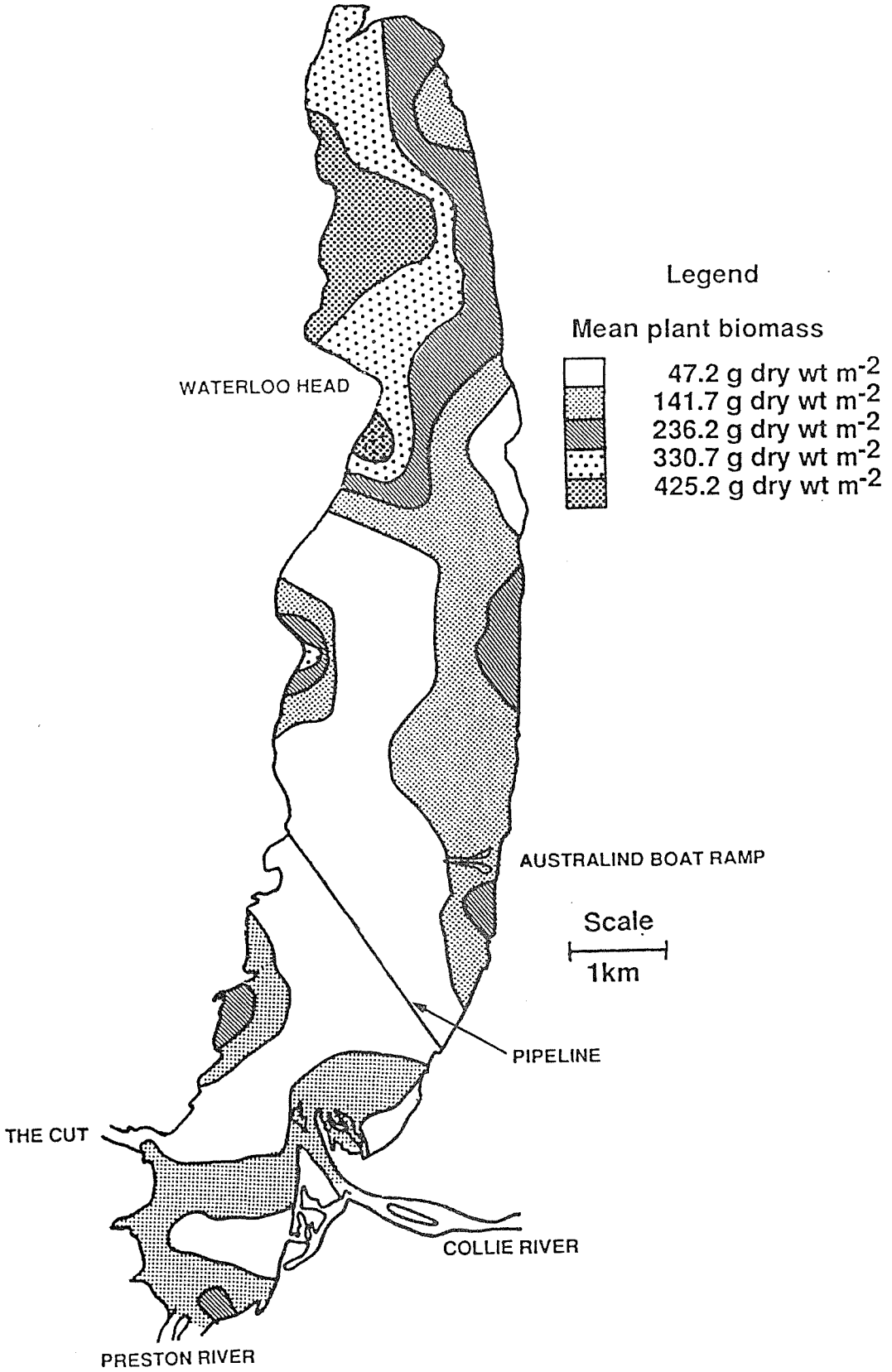

Figure 2. Distribution of plant biomass in Leschenault Inlet on 13 November, 1984. The data are divided into 5 equal size classes between 0.01 and 472.4 g dry weight m^{-2}.

3. Results and Discussion

3.1 Total Biomass

Total plant biomass estimates for the studies are shown in Table 1. Total biomass was similar (ca. 3500 tonnes dry weight) on all occasions except August 1985, but the biomass of seagrass and algae changed significantly between sampling occasions. The biomass of the dominant seagrass *Halophila ovalis* varied from a minimum of 318 tonnes (Nov. 1985) to a maximum of 1629 tonnes (May 1988). This is consistent with seasonal changes in biomass found in other southwestern Australian estuaries where maximum biomass of *Halophila* usually occurs in summer - autumn (eg. Hillman, 1985). Major fluctuations were also recorded in the biomass of red, brown and green algae. The biomass of red and brown algae has varied by almost 1000 tonnes dry weight, while the biomass of green algae varied by some 800 tonnes dry weight.

It is instructive to compare the estimates of total plant biomass for Leschenault Inlet with data from the Peel-Harvey system; however, because of the large difference in the size of Leschenault Inlet (27km^2) and the Peel-Harvey system (133km^2) it is necessary to make the comparison on an areal basis. Mean areal biomass estimates for the Peel-Harvey (Lukatelich and McComb 1985) for the same sampling dates as Leschenault Inlet ranged from 62 to 229 g dry wt m^{-2} with an average value of 160 g dry wt m^{-2}. Mean areal biomass in Leschenault Inlet ranged from 67 to 148 g dry wt m^{-2} (Table 1) with an average value of 123 g dry wt m^{-2}. On the basis of the surveys carried out so far it appears that total plant biomass per unit area is similar in the Peel-Harvey and Leschenault systems. Plant biomass in the Peel-Harvey system fluctuated more widely than in Leschenault Inlet.

Table 1. Plant Biomass in Leschenault Inlet.

	November 1984		April 1985		August 1985		November 1985		October 1987		February 1988		May 1988	
	Total Biomass (tonnes dry wt.)	Mean Areal Biomass (g dry wt m^{-2})	Total Biomass (tonnes dry wt.)	Mean Areal Biomass (g dry wt m^{-2})	Total Biomass (tonnes dry wt.)	Mean Areal Biomass (g dry wt m^{-2})	Total Biomass (tonnes dry wt.)	Mean Areal Biomass (g dry wt m^{-2})	Total Biomass (tonnes dry wt.)	Mean Areal Biomass (g dry wt m^{-2})	Total Biomass (tonnes dry wt.)	Mean Areal Biomass (g dry wt m^{-2})	Total Biomass (tonnes dry wt.)	Mean Areal Biomass (g dry wt m^{-2})
Seagrass	673.7	27.8	955.9	35.1	569.3	20.9	378.9	13.9	1114.7	41.3	1680.7	62.2	2070.8	76.7
Red Algae	1153.6	42.4	177.6	6.5	120.9	4.4	850.8	31.3	1092.0	40.4	252.4	9.3	162.4	6.0
Brown Algae	1107.5	40.7	1780.1	65.4	674.0	24.8	1236.6	45.5	565.3	20.9	622.3	23.0	764.8	28.3
Green Algae	624.2	22.9	699.6	25.7	465.7	17.1	641.8	23.6	1217.8	45.1	1200.7	44.5	355.1	13.2
Total	3559.0	133.8	3613.2	132.7	1829.9	67.3	3108.1	114.3	3989.8	147.8	3756.1	139.1	3353.1	124.2

The major difference between the Peel-Harvey and Leschenault systems is the composition of the biomass. In Leschenault Inlet green algae made up 11-32% of total plant biomass, whereas in the Peel-Harvey system greens generally account for >85% of total plant biomass. Brown algae accounted for 14-49% of macrophyte biomass in Leschenault Inlet. In contrast, in the Peel-Harvey system brown algae generally account for <0.5% of total biomass. Maximum mean areal biomass of brown algae recorded for the Peel-Harvey system is 3.7 g dry wt m^{-2}, compared with 65.4 g dry wt m^{-2} in Leschenault Inlet. The other major difference between the Peel-Harvey and Leschenault systems is the proportion of the biomass accounted for by seagrass. Seagrasses generally account for <15% of total biomass in the Peel-Harvey system, whereas in Leschenault Inlet seagrasses generally account for >30% (range 12-62%) of total biomass. The maximum contribution of seagrasses to total biomass is 26.9% in the Peel-Harvey system compared with 62% in Leschenault Inlet.

The fact that a large proportion of the total macrophyte biomass in Leschenault Inlet is accounted for by seagrasses suggests that overall the water quality in Leschenault Inlet is good. In estuaries and enclosed marine embayments with high nutrient loads, the macrophytes are generally dominated by green algae (e.g. Buttermore 1977, Lowthion 1985, Lukatelich and McComb 1985, Sawyer 1965 and Steffensen 1974).

On all occasions highest plant biomass was found in the northern section of Leschenault Inlet. The distribution of total plant biomass in November 1984 is shown in Fig. 2. The northern section (north of Waterloo Head, Fig. 1) is very shallow (<0.5m) and exchange with the ocean is restricted due to its distance from the Cut, as evidenced by the large difference in salinities between the lower portion of the inlet and this section. The southern section of the inlet is essentially marine and is dominated by the seagrass *Halophila ovalis*. In the northern section plant biomass is dominated by the brown alga *Hormophysa triquetra* and the green algae *Lamprothamnium papulosum* and *Chaetomorpha linum* (see below).

3.2 Aquatic Flora

The aquatic vegetation of Leschenault Inlet has been recorded by Meagher (1971), Semeniuk and Meagher (1981), and LeProvost *et al.* (1983). Table 2 lists the species observed during the studies reported here. The major differences between this list and the list recorded by LeProvost *et al.* (1983) are that the seagrasses *Amphibolis antarctica* and *Posidonia australis* were omitted from Table 2; and more complete lists of red and brown algae have been included here. The seagrasses *Amphibolis antarctica* and *Posidonia australia* were collected in Vittoria Bay and around the channel entrance, but this was only drift material brought into the inlet by tide and wave action. Neither of these species was observed growing in the inlet. The list of red algae in Table 2 is still incomplete as several species still require identification.

Those species found in Leschenault Inlet which also occur in the Peel-Harvey, Wilson and Oyster Harbour estuaries are also shown in Table 2. Most of the seagrass and algal species found in Leschenault Inlet are also found in these other estuarine systems. The brown alga *Hormophysa triquetra* has only been found in Leschenault Inlet, where it is largely confined to the northern section of the inlet (see below). Another difference is the high diversity of red algae in Leschenault Inlet compared to the Peel-Harvey and Wilson estuaries. Biogeographically the southwestern Australian coast has the highest diversity of red algae in the world, and Leschenault Inlet obviously provides a suitable habitat for some of these species.

Table 2 Aquatic angiosperms and macroalgae observed in Leschenault Inlet and their presence in other southwestern Australian estuaries.

	Leschenault Inlet	Peel-Harvey[#] Estuaries	Wilson[*] Inlet	Oyster[+] Harbour
AQUATIC ANGIOSPERMS				
Halophila ovalis	*	*		*
Ruppia megacarpa	*	*	*	
Heterozostera sp	*			*
Zostera muelleri	*	*		
MACROALGAE				
CHLOROPHYTA				
Chaetomorpha linum	*	*	*	*
Lamprothamnium papulosum	*	*	*	
Enteromorpha sp	*	*	*	*
Cladophora sp	*	*	*	*
Caulerpa sp	*	*		*
PHAEOPHYTA				
Hormophysa triquetra	*			
Dictyota paniculata	*		*	*
RHODOPHYTA				
Gracilaria spp	*	*	*	*
Chondria spp	*	*	*	*
Laurencia spp	*	*		*
Spyridia filamentosa	*			*
Ceramium sp	*	*	*	*
Hypnea episcopalis	*			

[#] Lukatelich (unpublished)

[*] Lukatelich et al. 1984

[+] Bastyan (unpublished)

3.3 Plant Distribution and Biomass

3.3.1 Seagrass

Halophila ovalis is widely distributed in Leschenault Inlet, it is only absent from a small area of deep water in the centre of the inlet (Fig. 3). Leschenault Inlet lies parallel to the prevailing SW winds and the fine, muddy sediments are easily resuspended by wind induced mixing. This results in high turbidity, which is probably the reason for the absence of *Halophila* in the deepest sections of the inlet. Maximum areal biomass of *Halophila* was generally found south of Waterloo Head on the sandy marginal platforms of the eastern side of the inlet. The high biomass of *Halophila* recorded in 1987/88 (835-1629 tonnes) compared to 1984/85 (318-955 tonnes) may have been due to improved light penetration following very low riverflow in winter 1987. *Halophila* biomass at some of the deeper sites (eg. 18, 19, 22, 25; see Fig. 1) was much higher in May 1988 compared to April 1985 (see appendix).

Ruppia and *Heterozostera* are largely confined to the shallower sections of the sandy marginal platform on the eastern side of the inlet. *Zostera* was only found around the entrance channel to the ocean.

3.3.2 Green Algae

The dominant green alga in Leschenault Inlet is *Chaetomorpha linum*, which is largely confined to the northern section of the inlet (Fig. 4). The biomass of *Chaetomorpha* has ranged from 290 tonnes (May 1988) to 1100 tonnes (Feb. 1988). Maximum areal biomass recorded was 365 g dry wt m^{-2} (Oct. 1987) at site 8.

Lamprothamnium papulosum is also restricted to the northern section of Leschenault Inlet (Fig. 5). The biomass of *Lamprothamnium* (5-137 tonnes) was much lower than *Chaetomorpha* biomass.

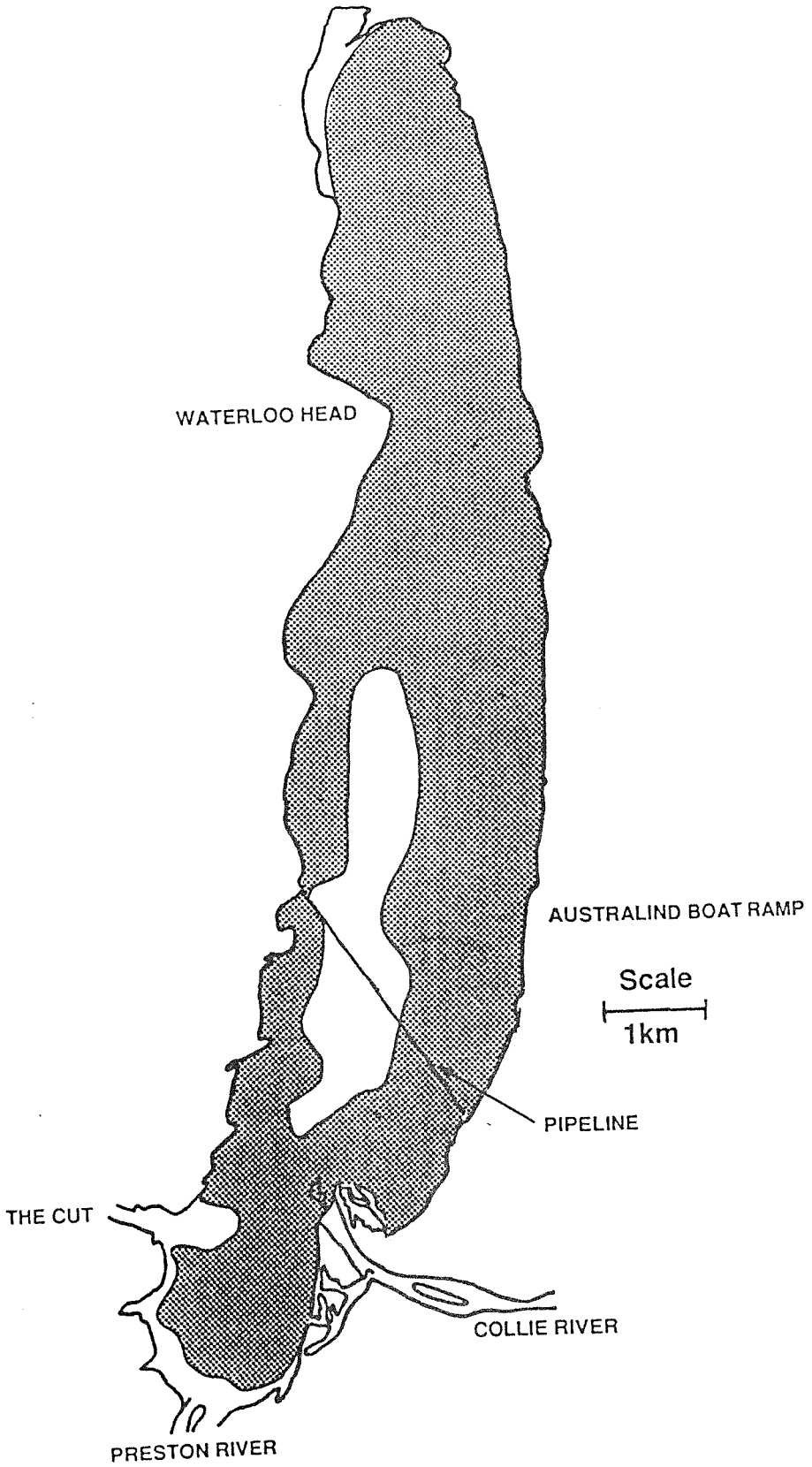

Figure 3. Distribution of Halophila ovalis (shaded area).

3.3.3 Brown Algae

Hormophysa triquetra was widely distributed in the northern section of the inlet and was also found along the eastern side as far south as the entrance to the Collie River (Fig. 6). *Dictyota paniculata*, a small unattached alga, was found on the eastern side of the inlet between Waterloo head and the entrance to the Collie River. *Hormophysa* is the dominant brown alga with a maximum recorded biomass of 1692 tonnes (April 1985) compared to 397 tonnes (Nov. 1985) for *Dictyota*.

3.3.4 Red Algae

Red algae are widely distributed in Leschenault Inlet, their distribution is similar to that of *Halophila* (Fig. 7). Some of the reds, in fact, occur as epiphytes on *Halophila*. The dominant red genus was *Gracilaria*, whose biomass ranged from 52 to 862 tonnes. Maximum areal biomass of red algae was 510 g dry wt m^{-2} (Site 8, Oct. 1987). Red algae comprised a significant proportion of the total biomass (~30%) each spring.

3.4 Plant Tissue Nutrient Content

An estimate of the amount of nutrient contained in plant material in Leschenault Inlet was computed by using total plant biomass (Table 1) and converting this, using average tissue nutrient concentrations of N and P from other southwestern Australian estuaries (Lukatelich *et al.* 1984; Hillman, 1985), to total nutrient content. Expressing these as the mean nutrient content per unit area, the amount of P in plant material ranged between 60-160 mg m^{-2} and 1150-2800 mg m^{-2} for N.

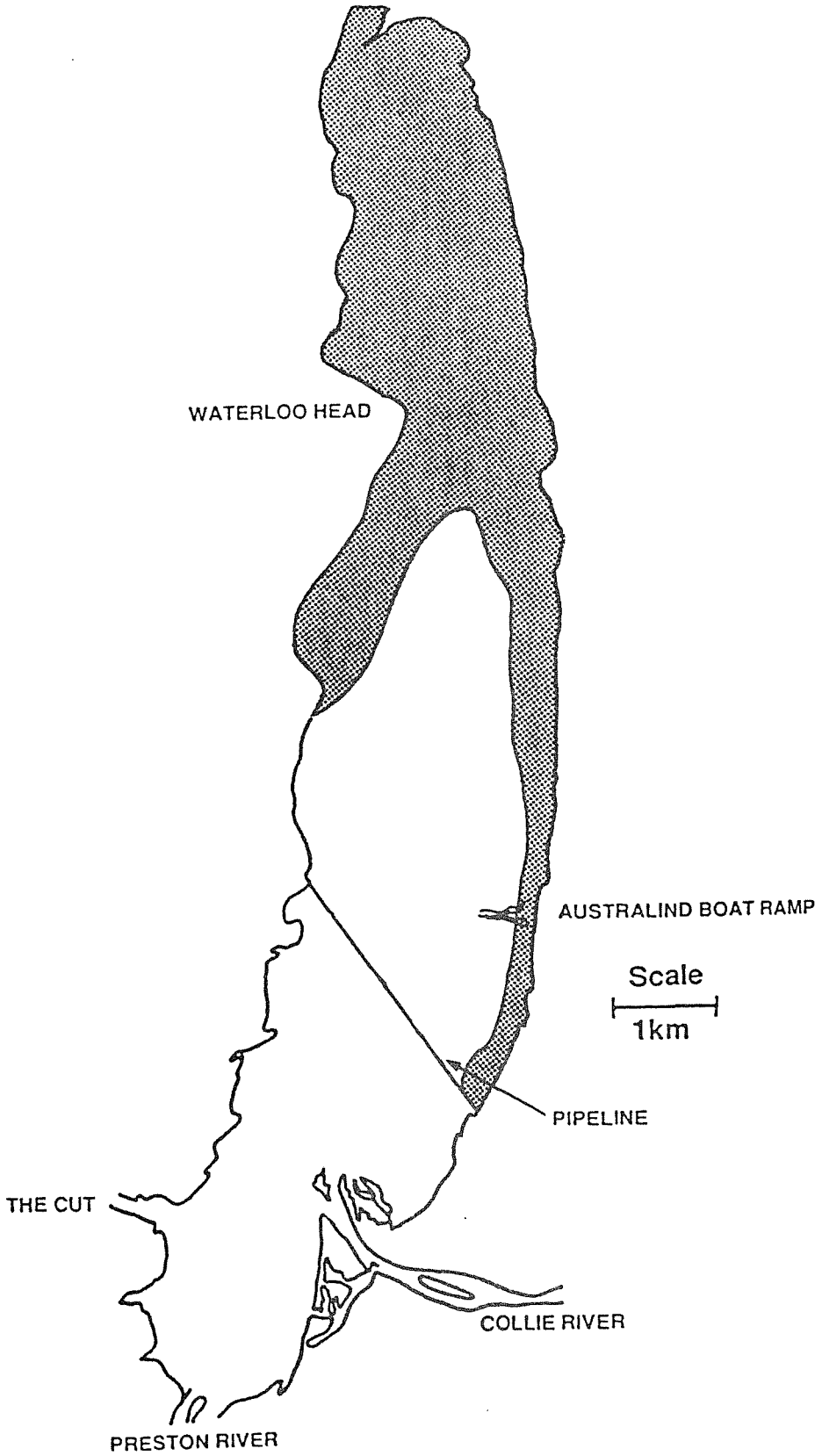

Figure 4. Distribution of Chaetomorpha linum (shaded area).

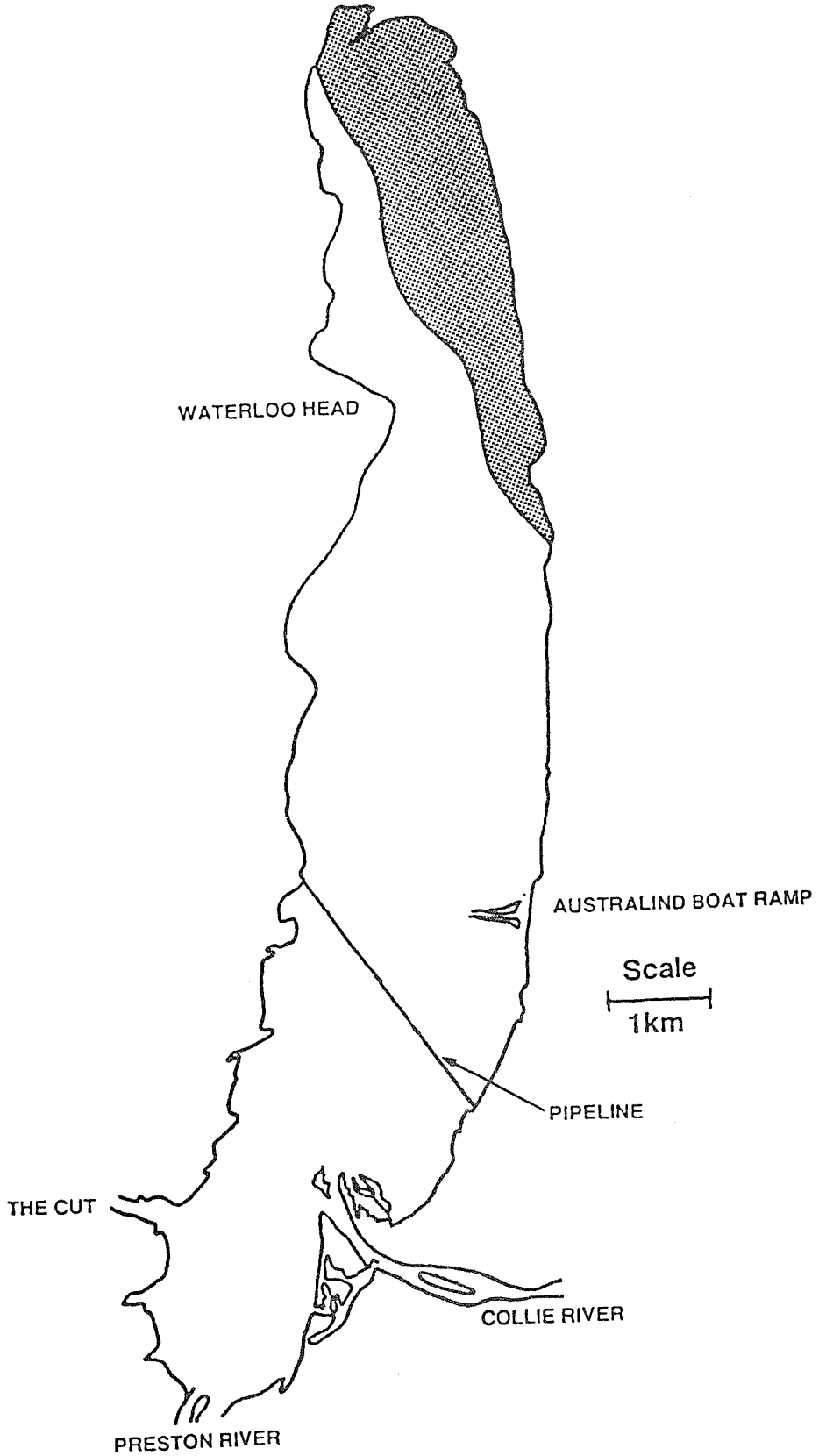

Figure 5. Distribution of Lamprothamnium papulosum (shaded area).

An indication of the potential impact of the macrophytes in Leschenault Inlet on the trophic state of the inlet can be gained by adding the nutrients contained in macrophytes to those in the water. Canfield *et al.* (1983) proposed this approach for assessing the trophic state of water bodies having growths of aquatic macrophytes because conventional criteria for classifying trophic state emphasize conditions in the open water and ignore the nutrients bound within plant biomass, and production of the macrophytes. If the mean depth of Leschenault Inlet is assumed to be 1 m, then potential nutrient concentrations of the order of 130 mg m^{-3} P and 2400 mg m^{-3} N can be calculated. These compare with mean water column concentrations of 28-70 mg m^{-3} P, and 45-360 mg m^{-3} N (Klemm pers. comm.). The macrophytes are potentially a much larger nutrient pool than the open water in Leschenault Inlet.

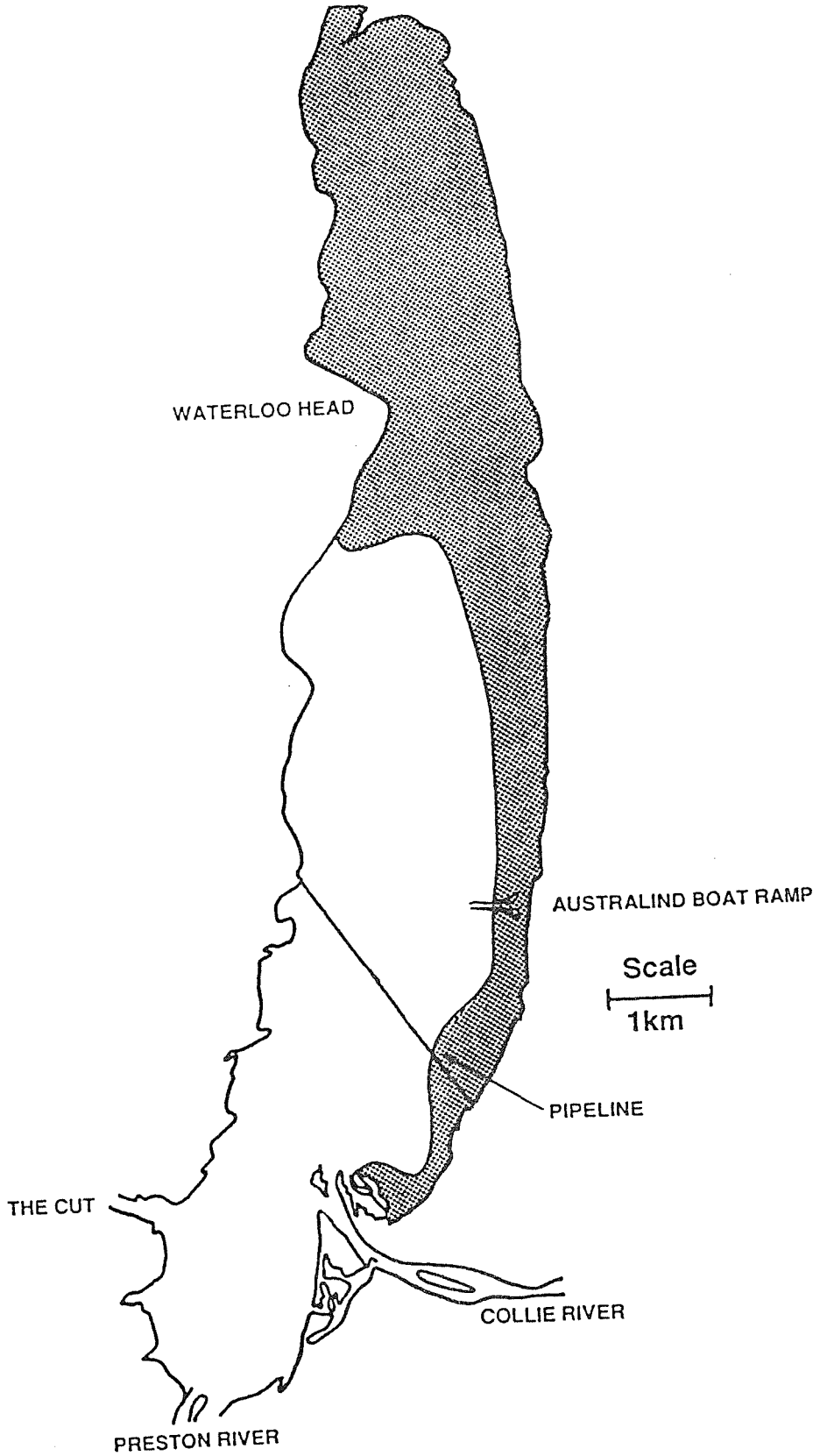

Figure 6. Distribution of Hormophysa triquetra (shaded area).

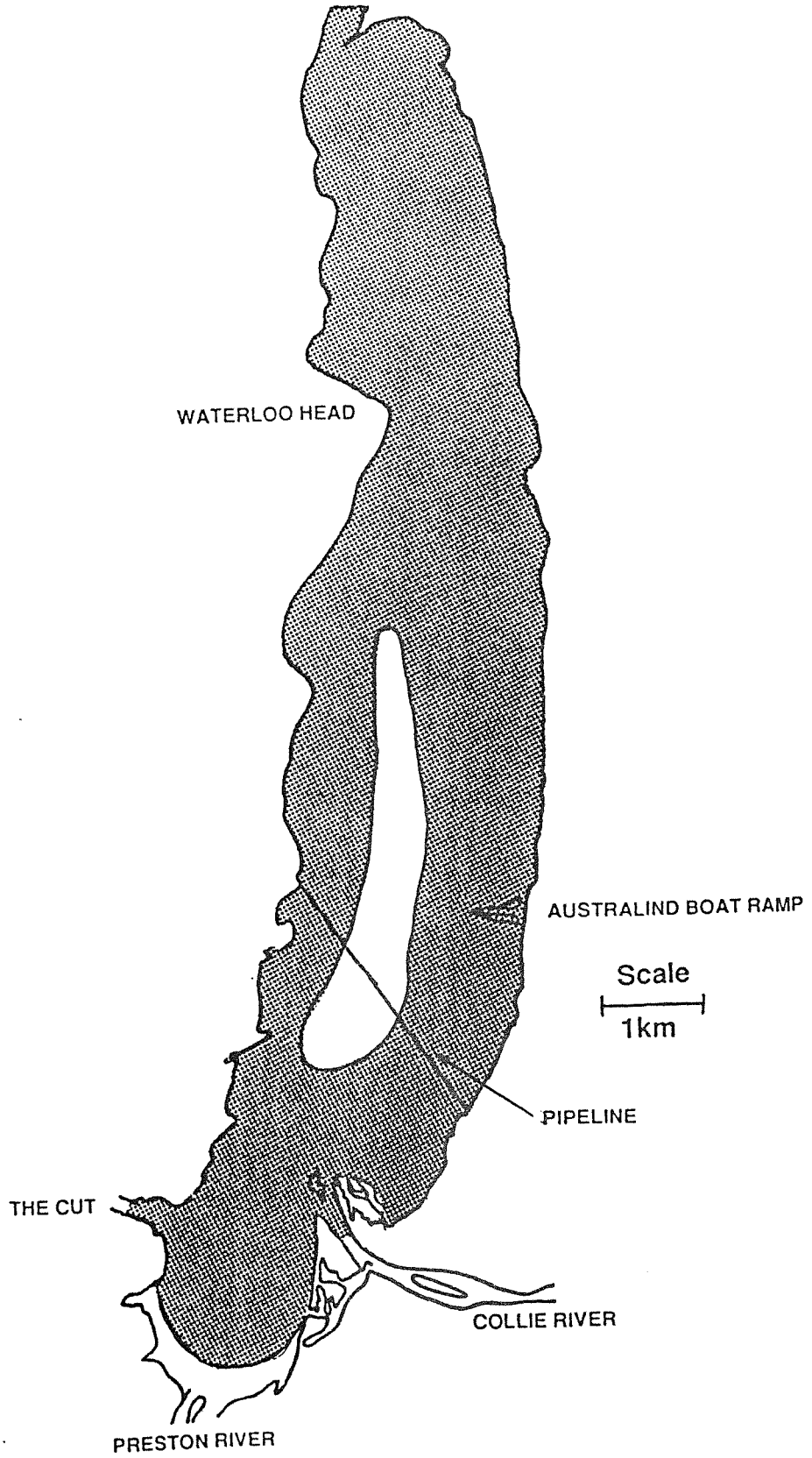

Figure 7. Distribution of red algae (shaded area).

4. Summary and Conclusions

Total plant biomass in Leschenault Inlet was generally 3000 - 4000 tonnes dry weight. There were large differences in the biomass of seagrass and algae between individual surveys.

On the basis of the surveys conducted to date it appears as though total plant biomass per unit area in Leschenault Inlet is similar to that found in the Peel-Harvey system. The major differences between Leschenault Inlet and the Peel-Harvey system are the relative proportions of total biomass accounted for by brown and green algae, and seagrass. Plant biomass in the Peel-Harvey system is dominated by green algae, whereas in Leschenault Inlet seagrass and brown algae generally dominate biomass.

The aquatic flora found in Leschenault Inlet is similar to that found in other southern estuaries, except that Leschenault Inlet has a relatively high diversity of red algae. *Hormophysa triquetra*, the dominant brown alga, is not common in other southern estuaries.

The results of these studies indicate that the southern section of Leschenault Inlet is well flushed and is essentially marine. Plant biomass is relatively low and is dominated by seagrasses. The northern section of the inlet appears to be poorly flushed, and has a relatively high plant biomass dominated by brown and green algae.

At the present time rooted (*Halophila*) and attached (*Hormophysa*) macrophytes dominate plant biomass in Leschenault Inlet. If conditions change to favour the dominance of free floating green algae then Leschenault Inlet may experience beach fouling problems similar to those experienced in the Peel-Harvey System, especially in the northern section of the inlet.

Acknowledgements

G. Bastyan helped process the data, sort and identify the plant samples. Thanks are also due to M. Borowitzka, G.G. Smith and D. Walker for assistance with plant identifications.

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Appendix

Leschenault Inlet

Macrophyte Biomass (g dry wt.m^{-2})

13 November 1984

Site	Total Biomass	*Halophila ovalis*	Other Seagrasses	Reds	Browns	Greens
1	148.6	54.8	30.6	0.1	32.7	30.4
2	358.4	23.2	0.2	37.7	227.1	70.1
3	202.4	14.4	0.6	1.2	98.0	88.2
4	472.4	0.4	0	40.5	271.7	159.8
5	434.6	13.7	0	191.8	140.0	89.1
6	295.6	36.6	0	43.1	103.2	112.8
7	70.1	38.6	0	6.3	18.6	6.6
8	178.4	59.7	0	55.2	2.8	60.6
9	384.8	23.4	0	0	0	361.5
10	22.9	12.7	0	4.5	0	5.7
11	206.7	167.7	9.2	1.4	27.7	0.8
12	7.1	6.9	0	0	0	0.1
13	0	0	0	0	0	0
14	311.5	46.2	0	260.2	0	5.1
15	177.1	120.0	28.5	0.6	0	28.0
16	66.6	38.7	0	26.0	0	1.9
17	211.3	157.0	28.3	17.1	0	8.9
18	19.1	16.1	0	1.5	0	1.5
19	24.0	20.8	0	2.7	0	0.6
20	43.8	31.9	0	11.9	0	0
21	2.9	1.3	0	0.5	0	1.1
22	32.8	0	5.0	27.8	0	0
23	75.0	7.2	0	52.4	9.8	5.7
24	159.8	36.1	35.6	39.4	0	48.6
25	17.3	0	10.8	6.5	0	0
26	243.8	12.1	84.3	147.5	0	0
27	14.6	2.2	11.7	0.8	0	0
28	136.8	12.4	21.0	103.4	0	0
29	56.1	20.4	0	28.7	6.5	0.5
30	62.5	13.4	0	49.1	0	0
31	116.9	25.0	53.6	26.7	0	11.7
32	197.1	148.0	0	34.4	0	14.7

Leschenault Inlet

Macrophyte Biomass (g dry wt.m^{-2})

24 April 1985

Site	Total Biomass	*Halophila ovalis*	Other Seagrasses	*Gracilaria* spp.	Other Reds	*Hormophysa triquetra*	*Dictyota paniculata*	*Chaetomorpha linum*	*Lamprothamnium papulosum*	Other Greens
1	223.4	6.0	0	0	0	6.2	0	211.3	0	0
2	577.5	6.1	0	0.1	0	566.6	0	4.9	0	0
3	19.5	7.4	0.1	0	0.1	7.3	0	4.	0.5	0
4	119.3	0.1	0	0	0	112.8	0	6.5	0	0
5	200.2	3.4	0	0	0	125.5	0	71.3	0	0
6	173.1	14.6	0	0	0	98.5	0	60.0	0	0
7	0	0	0	0	0	0	0	0	0	0
8	34.4	31.4	0	1.6	0	0	0	1.4	0	0
9	206.7	20.7	0	0	1.7	145.9	0	38.3	0	0.1
10	22.5	22.2	0	0.3	0.1	0	0	0	0	0
11	174.4	93.6	0	0	42.5	1.5	29.9	6.9	0	0
12	0	0	0	0	0	0	0	0	0	0
13	8.0	7.5	0	0.1	0	0	0	0.5	0	0
14	59.7	50.6	0	6.3	0.1	0	0	2.8	0	0
15	235.7	206.8	0	0.8	8.4	6.5	11.5	1.7	0	0
16	50.1	44.4	0	5.5	1.4	0	0	0.1	0	0
17	123.3	122.5	0	0	0.7	0	0	0.1	0	0
18	4.2	1.7	0	0.2	0	0	2.3	0	0	0
19	3.6	3.6	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0
23	19.4	17.4	0	2.1	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0
26	158.4	104.7	6.6	21.6	23.3	0	0	2.2	0	0
27	55.9	55.9	0	0	0	0	0	0	0	0
28	3.8	3.7	0	0.1	0	0	0	0	0	0
29	7.5	7.4	0	0.1	0	0.1	0	0	0	0
30	18.3	18.3	0	0	0	0	0	0	0	0
31	130.9	109.8	19.9	0.2	0.9	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0

Leschenault Inlet

Macrophyte Biomass (g dry wt.m^{-2})

8 August 1985

Site	Total Biomass	*Halophila ovalis*	Other Seagrasses	*Gracilaria* spp.	Other Reds	*Hormophysa triquetra*	*Dictyota paniculata*	*Chaetomorpha linum*	*Lamprothamnium papulosum*	Other Greens
1	36.58	0	0	0	0	13.03	0	11.47	12.08	0
2	319.99	0	0	0.03	0	310.36	0	9.60	0	0
3	85.63	7.75	0	0.03	0.52	63.29	0.03	12.97	1.04	0
4	98.89	0	0	0	0.03	87.76	0	11.10	0	0
5	64.84	0	0	0	0.03	2.96	0	1.53	50.32	0
6	106.40	9.19	0	0	0	26.51	0	70.67	0.03	0
7	62.07	49.60	0	0	8.18	0.40	0	3.89	0	0
8	127.10	35.80	0	11.47	0.06	0	0	82.77	0	0
9	6.38	6.23	0	0.03	0	0	0	0.12	0	0
10	37.65	6.86	0	23.88	1.40	0	0	5.51	0	0
11	119.37	105.02	0	0.06	4.11	0	0	6.62	3.53	0.03
12	0	0	0	0	0	0	0	0	0	0
13	1.53	1.53	0	0	0	0	0	0	0	0
14	39.08	37.65	0	1.43	0	0	0	0	0	0
15	98.33	64.04	0.23	0.70	10.73	0	0	22.63	0	0
16	48.40	47.53	0	0	0	0	0	0.87	0	0
17	45.51	25.25	15.19	0	2.68	0	0	0.93	1.46	0
18	6.39	6.24	0	0.06	0	0	0	0.09	0	0
19	0	0	0	0	0	0	0	0	0	0
20	32.01	13.44	0	0.52	1.31	0	0	13.91	0	2.83
21	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0
23	4.24	3.91	0	0.21	0	0	0	0.09	0.03	0
24	0	0	0	0	0	0	0	0	0	0
25	1.84	0	0	1.84	0	0	0	0	0	0
26	18.67	6.30	0	1.43	10.38	0	0	0.41	0	0.15
27	5.33	3.06	0.58	0	0	0	0	0	0	0
28	1.69	1.69	0	0	0	0	0	0	0	0
29	2.04	2.04	0	0	0	0	0	0	0	0
30	0.73	0.73	0	0	0	0	0	0	0	0
31	3.53	3.38	0	0	0	0	0	0.15	0	0
32	11.64	10.26	0.09	0.06	0	0	0	0.50	0	0.73

Leschenault Inlet

Macrophyte Biomass (g dry wt.m^{-2})

29 November 1985

Site	Total Biomass	*Halophila ovalis*	Other Seagrasses	*Gracilaria* spp.	Other Reds	*Hormophysa triquetra*	*Dictyota paniculata*	*Chaetomorpha linum*	*Lamprothamnium papulosum*	Other Greens
1	64.40	4.44	2.39	0.06	4.61	49.77	0	2.28	0.61	0.24
2	309.65	0	0	0	1.19	292.12	0	9.42	0	6.92
3	154.39	0	0	0.06	15.02	91.24	0	9.71	38.36	0
4	325.57	0.12	0	0.03	2.80	47.73	216.9	57.27	0.72	0
5	190.74	9.68	0	0.24	0	43.37	73.87	63.58	0	0
6	231.92	19.63	0	0.40	0.09	72.66	45.85	72.37	0	20.92
7	70.24	26.28	0	5.91	0.61	0	0	20.2	16.66	0.58
8	81.45	9.22	0	68.07	4.01	0	0	0.15	0	0
9	18.88	14.93	0	1.27	0	0	0	2.68	0	0
10	317.60	2.65	0	307.08	0.92	0	0	6.95	0	0
11	38.05	28.21	0	0.40	0	0	0	0.58	8.56	0.3
12	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0
14	78.14	2.56	0	55.77	1.38	0	0	18.19	0.24	0
15	44.99	44.99	0	0	0	0	0	0	0	0
16	47.87	16.57	0	12.88	0	0	0	18.42	0	0
17	56.38	45.85	5.71	0.55	0	0	0	0	0	0
18	0.40	0.40	0	0	0	0	0	0	0	0
19	4.30	1.73	0	2.08	0	0	0	0	0.49	0
20	35.45	0	0	35.45	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0
23	13.78	10.81	0	2.48	0	0	0	0.49	0	0
24	18.59	11.79	6.80	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0
26	45.56	16.57	0	28.99	0	0	0	0	0	0
27	2.54	2.54	0	0	0	0	0	0	0	0
28	2.33	2.33	0	0	0	0	0	0	0	0
29	1.98	0.86	0	1.12	0	0	0	0	0	0
30	1.44	1.44	0	0	0	0	0	0	0	0
31	113.21	12.51	52.08	46.17	2.45	0	0	0	0	0
32	4.93	0	3.29	0.89	0	0	0	0	0	0.75

Leschenault Inlet

Macrophyte Biomass (g dry wt.m^{-2})

28 October 1987

Site	Total Biomass	*Halophila ovalis*	Other Seagrasses	*Gracilaria* spp.	Other Reds	*Hormophysa triquetra*	*Dictyota paniculata*	*Chaetomorpha linum*	*Lamprothamnium papulosum*	Other Greens
1	223.1	53.9	27.2	1.1	30.2	11.4	1.5	118.5	9.2	0
2	63.1	9.2	0.2	0	31.2	7.4	0	15.1	0	0
3	272.2	64.6	0.5	5.6	37.0	11.5	0	132.4	0.5	10.1
4	165.7	12.5	0	0.2	2.2	98.9	5.2	44.3	0	2.3
5	177.5	50.9	0	0	13.2	109.4	0	3.9	0	0
6	211.0	67.1	0	0.5	21.4	15.0	25.6	81.3	0	0
7	120.6	41.2	37.2	0	40.1	0	0	0.6	1.5	0
8	997.2	0	0	104.2	405.9	0	79.9	364.9	0	42.2
9	201.3	92.5	33.8	2.1	7.0	51.5	0	4.8	0	9.6
10	200.5	31.6	0	45.9	33.9	70.8	0	11.9	0	6.2
11	87.5	3.4	0	6.0	19.1	0	3.5	0	55.5	0
12	8.5	0	0	0	8.2	0	0	0.4	0	0
13	2.1	0	0	0	2.1	0	0	0	0	0
14	55.8	32.5	0	0	23.3	0	0	0	0	0
15	113.9	74.4	4.1	0.9	33.4	0	0	0.3	0	0
16	89.4	27.6	0	32.7	19.8	0	0	2.6	0	6.7
17	158.3	48.9	55.1	7.4	38.9	0	0	0	0	7.4
18	61.1	34.8	0	4.7	21.6	0	0	0	0	0
19	9.7	0	0	5.3	4.1	0	0	0.3	0	0
20	54.6	51.6	0	1.3	0.4	0	0	1.4	0	0
21	21.9	0.3	0	21.6	0	0	0	0	0	0
22	18.5	0	0	9.8	0	0	0	0	0	8.7
23	64.3	15.3	4.4	34.9	8.1	0	0	0	0	0
24	137.6	71.1	8.9	35.7	10.4	0	0	0	0	0
25	13.9	0	0	8.6	5.3	0	0	0	0	0
26	76.5	26.9	0	25.9	23.4	0	0	0	0	0.2
27	38.7	25.8	0	1.7	11.1	0	0	0	0	0
28	6.3	3.9	0	0	0	0	0	0	0	1.0
29	82.2	45.5	0	28.9	0	0	0	6.1	0	0
30	74.3	29.0	0	36.6	6.9	0	0	1.2	0	0
31	129.4	11.9	115.6	1.9	0	0	0	0	0	0
32	44.8	0	0	37.4	0	0	0	0	0	7.4

Leschenault Inlet

Macrophyte Biomass (g dry wt.m^{-2})

4 February 1988

Site	Total Biomass	*Halophila ovalis*	Other Seagrasses	*Gracilaria* spp.	Other Reds	*Hormophysa triquetra*	*Dictyota paniculata*	*Chaetomorpha linum*	*Lamprothamnium papulosum*	Other Greens
1	242.8	5.7	46.2	0.2	0	18.6	0	169.4	0.63	2.1
2	315.6	0	75.9	0	0	170.2	0	67.3	2.0	0
3	328.9	63.7	0	0	0	19.0	0	245.6	0.4	0
4	195.8	96.6	0	0	1.7	88.4	0	9.0	0	0
5	151.7	55.9	0	0	1.2	73.5	0	20.9	0	0
6	175.4	60.7	0	0	1.0	72.3	0	41.3	0	0
7	183.3	13.8	0	2.3	0	1.3	0	165.8	0	0
8	40.1	35.2	0	3.3	0	0	0	1.4	0	0
9	147.4	93.1	0	0.5	1.1	0.5	0	51.9	0	0
10	79.3	77.3	0	0.3	0	0	0	0.6	0.9	0
11	135.1	50.1	34.2	0	6.6	31.5	29.9	0.3	2.0	10.2
12	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0
14	51.2	51.1	0	0	0	0	0	0	0	0
15	149.0	47.2	92.3	2.4	6.5	0	0.4	0	0	0
16	106.4	106.4	0	0	0	0	0	0	0	0
17	89.7	20.3	46.9	0	13.7	6.2	0	0	0	2.3
18	61.8	38.4	0	4.8	16.0	0	2.3	0	0	2.5
19	58.5	49.8	0	4.4	4.2	0	0	0	0	0
20	113.7	85.5	0	5.0	9.8	10.8	0	0	0	2.4
21	49.5	28.8	0	5.2	15.5	0	0	0	0	2.4
22	0	0	0	0	0	0	0	0	0	0
23	122.2	64.3	0	1.6	45.0	10.3	0.8	0	0	0
24	105.4	78.4	8.2	12.1	6.5	0	0	0	0	0
25	24.9	19.7	0	1.9	3.3	0	0	0	0	0
26	99.7	82.3	0	7.3	6.3	0	3.5	0	0	0
27	97.2	81.9	0	0	15.3	0	0	0	0	0
28	74.9	63.2	0	11.6	0	0	0	0	0	0
29	89.8	50.4	0	18.3	20.5	0	0	0.4	0	0
30	76.3	48.4	0	14.4	12.2	0	1.2	0	0	0
31	113.6	65.8	0	0	3.8	0	0	0	0	0
32	0	0	43.9	0	0	0	0	0	0	0

Leschenault Inlet

Macrophyte Biomass (g dry wt.m^{-2})

5 May 1988

Site	Total Biomass	*Halophila ovalis*	Other Seagrasses	*Gracilaria* spp.	Other Reds	*Hormophysa triquetra*	*Dictyota paniculata*	*Chaetomorpha linum*	*Lamprothamnium papulosum*	Other Greens
1	77.5	1.8	57.0	0	0	207.5	0	18.6	0	0
2	281.1	0	0	0	0	0.8	0	73.5	0	0
3	51.0	13.0	0	0	6.9	89.5	0	30.2	0	0
4	163.6	51.3	0	0	0	20.0	0	22.7	0	0
5	84.3	57.5	0	0	0	158.5	0	6.7	0	0
6	227.7	42.9	0	0	0	0	0	26.2	0	0
7	82.4	75.4	0	0.8	0	0	1.0	0	0	4.9
8	87.9	42.4	0	3.6	0.7	3.8	0	41.1	0	0
9	126.7	118.6	0	0	1.8	0	0	2.4	0	0
10	135.1	118.9	0	5.6	0	0	0	10.4	0	0
11	159.8	131.0	16.6	5.5	0	0	0	0	3.5	3.6
12	7.7	0	0	0.7	7.0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0
14	155.1	143.6	0	0	11.39	0	0	0	0	0
15	233.3	47.8	179.5	4.18	0	0	10	0	0	1.7
16	91.2	91.2	0	0	0	0	0	0	0	0
17	137.3	126.0	11.3	0	0	0	0	0	0	0
18	89.3	65.4	0	2.9	20.4	0	0	0.5	0	0
19	51.7	51.8	0	0	0	0	0	0	0	0
20	102.1	94.5	0	3.3	1.2	0	0.5	0	0	0
21	50.8	35.4	0	9.3	3.9	0	0	0	0	0
22	2.9	2.9	0	0	0	0	0	0	0	0
23	68.5	59.9	8.2	0.4	0	0	0	0	0	0
24	138.0	126.9	8.1	0.7	1.6	0	0	0	0	0.5
25	71.3	48.3	0	10.1	12.8	0	0	0	0	0
26	73.7	32.5	0	10.6	19.8	0	5.8	0	0	4.8
27	122.3	97.5	0	0.6	10.7	0	0	0	0	13.4
28	102.0	82.8	0	11.0	1.1	0	2.4	0	0	4.5
29	86.2	40.4	0	8.4	26.4	0	9.3	1.6	0	0
30	94.9	65.6	0	8.9	14.5	0	5.8	0	0	0
31	103.5	50.2	16.3	0	0	0	0	0	0	37.0
32	0	0	0	0	0	0	0	0	0	0