THE FOOD OF WATERFOWL (ANATIDAE) IN THE SOUTHERN COORONG SALTWATER HABITAT OF SOUTH AUSTRALIA

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SUMMARY

Many Mountain Duck, Grey Teal and Chestnut Teal congregate on the southern Coorong in South Australia in the late spring and summer of certain years.

Oesophagus and gizzard specimens were collected from 36 Grey Teal *(Anas gibberifrons)*, 7 Chestnut Teal *(A. castanea)* and 14 Mountain Duck *(Tadorna tadornoides)* in the southern Coorong from March, 1965, to January, 1966. The results are tabulated in Table I and analysed in Figure 2. It is shown that the main food consumed came from two plants, Wigeongrass *(Ruppia spiralis)* (Family Potamogetonaceae), and Muskgrass *(Lamprothamnium papulosum)* (Family Characeae). All components of the two plants were eaten to some extent, but the tubers of Wigeongrass and Muskgrass were the predominant food. The seed of Wigeongrass was also important. Little of the other parts of the plants was eaten by duck, although extensively eaten by swan.

Specimens were collected separately from the oesophagus and the gizzard, in most instances from different birds, although all from the Southern Lagoon. Marked differences were found in the composition of these specimens. These differences were taken to indicate that the specimens collected from gizzards from the above species of waterfowl did not accurately reflect the food eaten by ducks in the study area. This is significant because most research in Australia on the food of duck has been based on gizzard samples.

A brief description is given of the environmental factors which affect the growth of the two aquatic plants, Wigeongrass and Muskgrass.

Under hyposaline conditions Muskgrass developed only a few tubers and Wigeongrass none, although both plants produced dense vegetation growth.

Under hypersaline conditions both plants produced large numbers of tubers but vegetative growth became increasingly stunted as salinity increased; and at salinities greater than 60 per cent. Muskgrass failed to grow. Wigeongrass grew in greater salinities than this, but vegetative growth was very stunted.

Receding water level in the spring and summer was a common cause of death of both plants.

It was concluded that maintenance of satisfactory salinity and water levels in the area was essential for the growth of the two plants.

INTRODUCTION

During late spring and summer, many of the saltwater lagoons and lakes in South Australia form important feeding grounds for ducks which have been displaced from freshwater feeding areas that have dried out in the South-East of the State or in other areas in Australia. In drought years these salt water areas can be especially important because they are not affected by lack of rainfall. Casual oesophagus (throat) samples from duck, taken before this study was undertaken, had indicated that two plants, Wigeongrass and Muskgrass, were supplying some of the food of the waterfowl in these saltwater habitats; so it was decided to carry out two investigations. The first to evaluate the importance of these two plants to waterfowl, and the second to determine the conditions that foster the growth of the plants.

Because of the large concentrations of duck on the Coorong, most samples were taken from that area. Collections of various growth stages of the two plants were made from over 90 areas between Ceduna in the west of the State and the Victorian border. The two plants from the Coorong and Gawler River Area were subsequently identified by H. B. S. Womersley and W. J. Lucas as *Ruppia spiralis* L. ex Dum., and *Lamprothamnium papulosum* (Wallr.) J. Groves, var. *papulosum*, f. macropogon (A.br.), Wood.

AREA OF INVESTIGATION

The main study was confined to the southern Coorong lagoon (see figure 1), a hypersaline stretch of water isolated largely from the sea by narrow passages and sandbanks. Details of this area are to be found in the paper by Dr. B. J. Noye "The Coorong — Past, Present and Future," Department of Adult Education Publication, pub. No. 38, 1973.

METHODS

Specimens were collected from March, 1965, to January, 1966, but mainly during November, 1965; oesophagus and/or gizzard specimens were taken from each individual duck.

A representative sample was taken from each oesophagus or gizzard specimen. The volumes of the samples were measured and Table I was prepared from the results. In the oesophagus samples taken from Grey Teal and Chestnut Teal, green foliage and unattached sheaths amounted to 1.5 per cent. or less by volume of the total and with Mountain Duck 5 per cent. A. F. Tideman, Chief Agronomist in the South Australian Department of Agriculture advises that it is probable that the green foliage would have 10 per cent. or less of the food value of an equivalent volume of the tuber or seed. The outer sheaths of Widgeongrass tubers would similarly have little relative food value. For this reason the small quantity of green foliage and

outer sheaths of Wigeongrass present is considered to have negligible food value and is excluded from the "food material content" column of Table I. With the gizzard samples it is similarly logical to exclude the outer sheaths of Wigeongrass tubers as food material.

The items which were considered as food material in Table I are analysed in Figure 2.

RESULTS

The results are tabulated in Table I and graphed in Figure 2. The apparent composition of food consumed in Figure 2 is shown to vary markedly according to whether the samples were taken from the oesophagus or gizzard (the reason for this difference appears to be related to differential digestibility of tubers and seed and is discussed below). Nevertheless, by both methods of sampling, Wigeongrass and Muskgrass tubers and seed together provided in excess of 90 per cent. of the total food of the duck (see Table I).

In addition to the data in Table I, fourteen food specimens from duck (including 3 collected in April, 1965) were collected from the Coorong with an unrecorded or mixed percentage of food from the oesophagus and gizzard. Wigeongrass and Muskgrass tubers and seed accounted for 99.5 per cent. of the food material in these samples. Three other specimens were collected from duck from three small lakes north-west of Sheringa on Eyre Peninsula in October, 1965. They contained 98 per cent. *Wigeongrass* and 2 per cent. *Lepilaena* food material. The per cent. oesophagus/gizzard ratio was not recorded for these 3 specimens.

DISCUSSION OF RESULTS

The results show that the gizzard samples contained a larger proportion of less digestible matter such as sand, shellgrit and hard seeds, whereas the oesophagus contained more of the readily digestible Muskgrass tubers (see Fig. 2). The difference between the two sample types is important, because most research on duck foods in Australia has been based on gizzard sampling (e.g. Frith, H. J., 1959, *C.S.I.R.O. Wildlife Research,* Vol. 4, No. 2, p. 131-155; Frith, H. J., Braithwaite, L. W., and McKean, J. L., *C.S.I.R.O. Wildlife Research,* 1969, Vol. 14, p. 17-64).

These varying results by sampling from oesophagus and gizzard are shown in Figure 2. *Oesophagus* samples collected from Grey Teal *Anas gibberifrons* show that 41 per cent. of the food intake is Muskgrass tubers, whereas gizzard samples show that 3 per cent. of the food is Muskgrass tubers. Similar results are noted for Chestnut Teal *Anas castanea* and Mountain Duck *Tadorna tadornoides.* It would have been preferable if both gizzard and oesophagus specimens had been collected from each bird for a direct comparison of the results. This was not done because such a comparison had not been an original aim of the study; but all samples were collected in the southern Coorong study area and nearly all during the same limited period of time, although actual dates and times of day varied with some specimens. For these reasons, and because there are too few samples to be statistically analysed, the results cannot be considered conclusive. However, because of the marked similarity in the results for each of the three species of duck the result can be taken as indicative of errors that arise in gizzard sampling. Frith and others were aware of the limitations of using gizzards and refer to them in their 1969 paper. However it would appear that no systematic study of comparative sampling techniques has been undertaken in Australia.

ENVIRONMENTAL FACTORS CONTROLLING THE GROWTH OF *RUPPIA SPIRALIS* AND *LAMPROTHAMNIUM PAPULOSUM* IN SOUTH AUSTRALIA

In 1965, data on environmental factors at 83 localities along the coastline of South Australia, where Wigeongrass or Muskgrass grew or was likely to grow, were collected. In 1971-72, a further more detailed study of environmental factors at 20 stations in St. Vincent and Spencer Gulfs and the southern Coorong was made. In addition "Preliminary Laboratory Studies on the Growth of *Ruppia spiralis* and *Lamprothamnium papulosum*" were made for the Department of Fisheries and Fauna Conservation by W. J. Lucas and H. B. S. Womersley of the Botany Department of the University of Adelaide.

From the above studies on environmental factors relative to the growth of the two plants it was found that:

1. Wigeongrass and Muskgrass produced dense vegetative growth in the hyposaline (brackish) water of Salt Creek where it runs into the southern Coorong. These salinities varied from 3°/00 to 20°/00. Under these conditions Wigeongrass produced no tubers and Muskgrass only a few tubers. Seed and oogonia production was heavy.

2. In hypersaline conditions in the Coorong, Gulfs and elsewhere, both plants produced many tubers and seed/oogonia where other

FIGURE 1

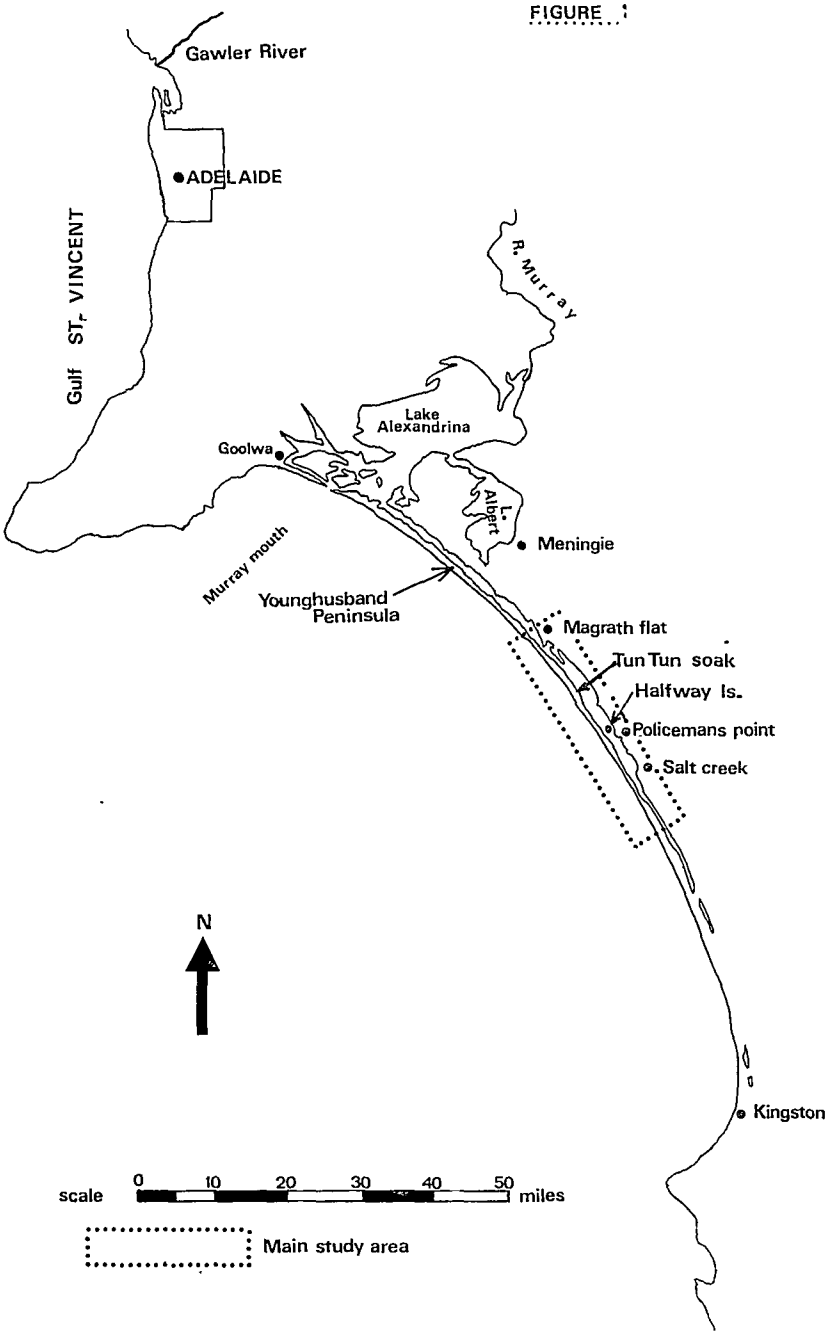
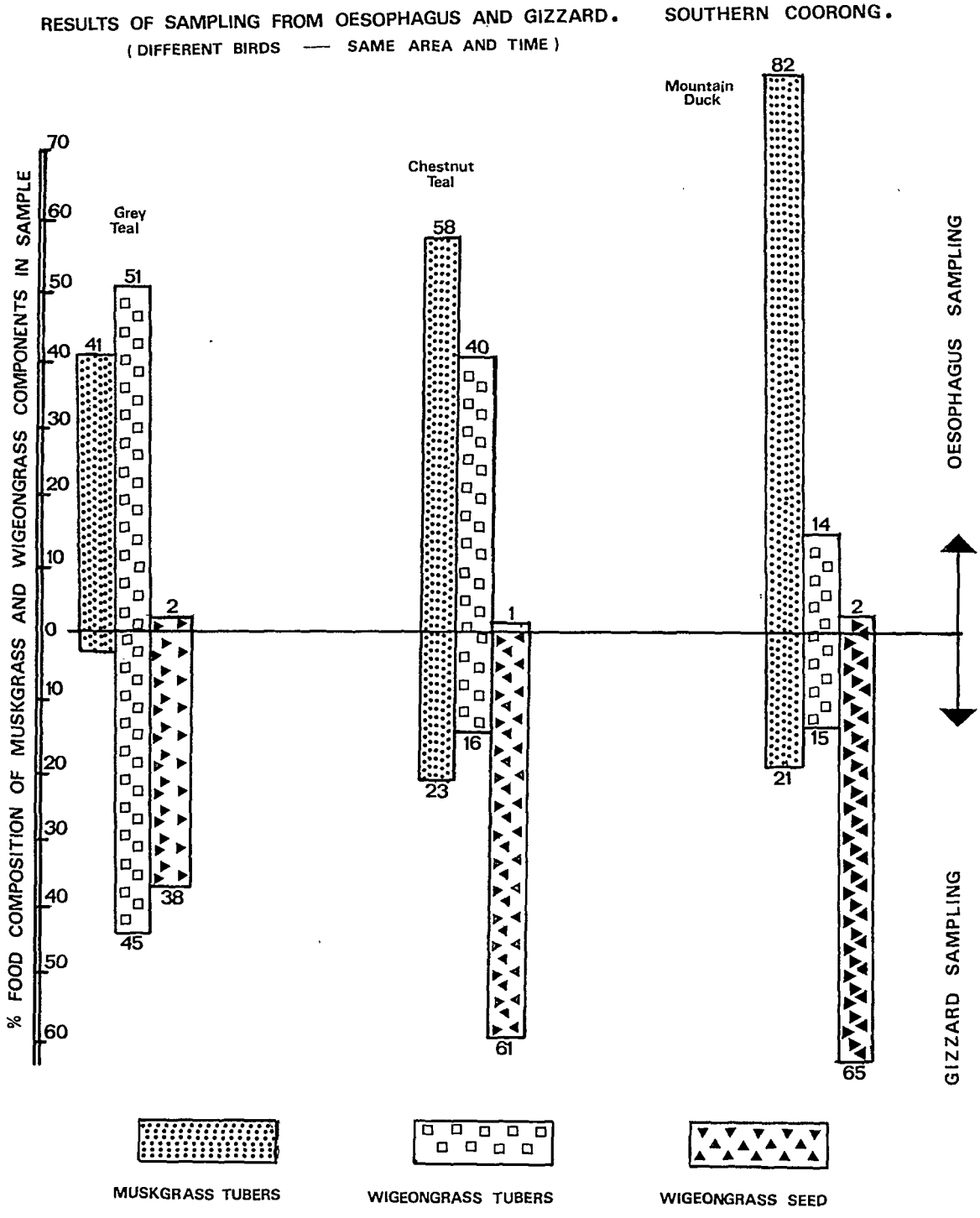

Gawler River
ADELAIDE
Gulf St. VINCENT
R. Murray
Lake Alexandrina
Goolwa
L. Albert
Meningie
Murray mouth
Younghusband Peninsula
Magrath flat
Tun Tun soak
Halfway Is.
Policemans point
Salt creek
Kingston
N
scale 0 10 20 30 40 50 miles
Main study area

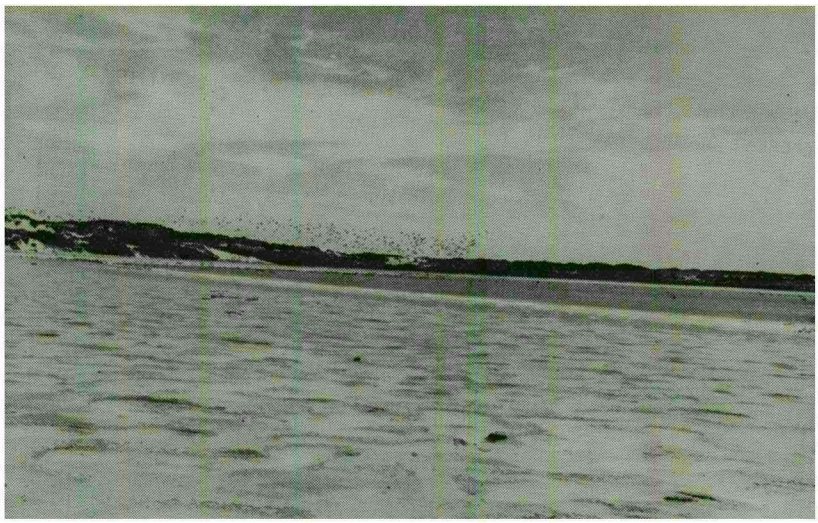
TABLE I

SPECIES	CONTENTS OF DUCK SHOT ON THE COORONG LAGOON				CONTENT OF OESOPHAGUS OR GIZZARD.							FOOD - MATERIAL CONTENT, CALCULATIONS.			
					% Muskgrass (Lamprothanium papulosum)		% Wigeongrass (Ruppia spiralis)			% Sand or shell-grit	% Other	% Musk-grass	% Wigeon-grass	% Other (Mainly Lepilaena cylindrocarpa seed).	COMMENTS
	* sample % taken from Oesophagus	* % sample taken from Gizzard	Number of ducks involved	Date when shot	% Tuber	% Foliage	% Tuber	% Seed	% Foliage						
GREY TEAL	100	0	19	1 on 4. 3.65 3 on 18.11.65 13 on 19.11.65 1 on 13. 1.66 1 on 14. 1.66	41	0	50	2	1	0	6 (Lepilaena cylindrocarpa seed)	41	53	6 (Lepilaena cylindrocarpa seed)	Lepilaena cylindrocarpa seed considered as food.
GREY TEAL	0	100	17	1 on 9.11.65 1 on 10.11.65 11 on 18.11.65 4 on 19.11.65	1	0	13	11	0	53	22 (4% Lepilaena cylindrocarpa seed otherwise the outside sheaths of Wigeongrass tubers)	3	83	14 (Lepilaena cylindrocarpa seed)	Lepilaena cylindrocarpa seed considered as food, but not the outside sheaths of Wigeongrass tubers.
CHESTNUT TEAL	100	0	2	2 on 19.11.65	57	0	40	1	1.5	0	0.5	58	41	1	Lepilaena cylindrocarpa as food
CHESTNUT TEAL	0	100	5	2 on 18.11.65 3 on 19.11.65	7	0	5	19	0	67	3 (outside sheaths of Wigeongrass tubers)	23	77	0	
MOUNTAIN DUCK	100	0	10	7 on 19.11.65 3 on 21.11.65	69	5	12	2	0	11	1 (Lepilaena cylindrocarpa seed and larvae)	82	17	1 (Lepilaena cylindrocarpa seed and larvae)	Seed and larvae both considered as food.
MOUNTAIN DUCK	0	100	4	1 on 18.11.65 3 on 19.11.65	7	0	5	22	0	66	0	21	79	0	

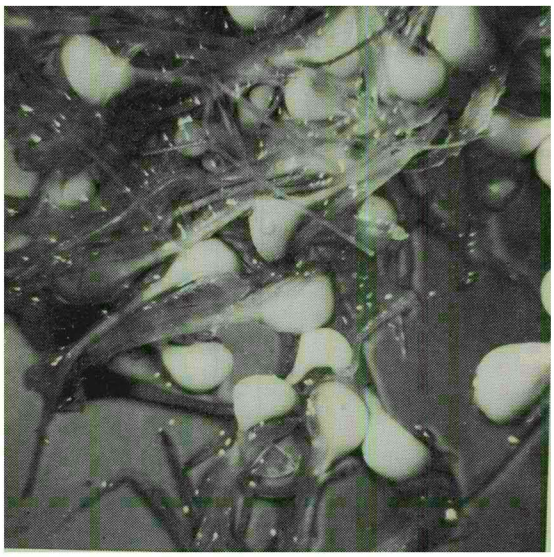
* NOTE: Samples were taken either from the Oesophagus or Gizzard but not from both. All samples were taken in the same general locality.

FIGURE 2. (composed from TABLE I .)





"Tun Tun" soak in 1964, showing pot holes caused by waterfowl feeding on the tubers of Wigeongrass and Muskgrass. Large numbers of swan and duck can be seen awaiting to drink at the freshwater soak.



A sample taken from an oesophagus, clearly showing the Wigeongrass tubers with attached sheaths.

conditions were favourable for plant growth. Vegetative growth was observed to be more stunted as salinity increased. Wigeongrass continued to grow in salinities greater than 71°/00 (i.e. twice the salinity of seawater), especially where these salinities occurred in the later stages of growth. However, Muskgrass in the areas studied failed to grow satisfactorily where salinity was in excess of about 60°/00. Although Muskgrass was widespread in the summers of 1965-66 and 1971-72 in the southern Coorong, it was only present in very small quantities and then only in a sickly condition in the summer of 1970-71, when salinities were higher than normal in the Coorong. The plant was only found growing in one area in the Gulfs, although Wigeongrass was common. In the area where it grew, near the mouth of the Gawler River, the salinity was only 43°/00, and lower than salinities normally found in Wigeongrass habitat around the Gulfs.

It was found that the salinity in the southern Coorong was reduced by about 20 per cent. following a severe gale on 3rd October, 1971, when winds up to 60 m.p.h. with direction W.-S.W. were recorded at Pelican Point. These winds held water levels up at the mouth of the Murray; and gravity pushed fresh water (which was being released through the barrages) south. These salinity changes markedly improved vegetative growth of the two species in the southern Coorong. A similar but less spectacular change had been noted in the autumn of 1971.

3. Both plants normally grew only where normal tidal influence was absent or at a minimum. Absence of water turbulence may be a reason for this relationship with non-tidal habitat.

4. The maintenance of suitable water levels was essential for the growth of both plants. Wigeongrass grew in most pools adjacent to the Gulfs which were filled by extreme high tides, where water to a depth of at least 3 centimetres remained between tidal replenishments. In the southern Coorong, winter/spring levels are normally a little over a metre above summer levels. In considerable areas of the Coorong, both plants were able to complete their life cycle before the water receded completely. However, in other areas, falling water levels in the spring were responsible for killing extensive areas of Wigeongrass, and less often the Muskgrass, which often grows in deeper water. When this happens the waterfowl food potential of an area is greatly diminished. In the summers of 1964-65 and 1971-72 there were good waterfowl seasons, when water levels were maintained; and there were poor seasons in 1965-66 and 1970-71, when water levels fell away at the critical spring period of the year. In 1970 this fall-away in level was only for a short period in late October-early November; but it killed large areas of Wigeongrass.

5. Wigeongrass normally forms tubers in the warmer months of the year in spring or summer, when water levels are falling gradually, and salinities increasing as a consequence. Lucas and Womersley were able to show that under laboratory conditions, Wigeongrass formed tubers actively at 20°C but not at 16°C or 12°C, while germination of its tubers was better at 12°C than at higher temperatures. Muskgrass germinated and grew at 16°C and 20° but not 12°C.

6. Where both plants grew pH was always alkaline. The significance of this is not known.

CONCLUSION ON ENVIRONMENTAL FACTORS

Because water levels and salinity are critical environmental factors controlling the growth of Wigeongrass and Muskgrass, and because both these factors in the Coorong are directly influenced by water movement from the Murray Mouth region, attention should be given to manipulating such water movement, and to the maintenance of satisfactory water levels, for the benefit of waterfowl foods in the southern Coorong. The Environmental Protection Council of South Australia is now investigating the feasibility of doing so.

ACKNOWLEDGMENT

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Summary — salinities greater than 60% should read salinities greater than 60⁰/00.