THE FREE-LIVING *HORMOSIRA BANKSII* IN BOTANY BAY, AUSTRALIA: TWENTY YEARS ON.

Wendy J. Laursen[1] and Robert J. King[2]
[1]School of Biological Science, University of New South Wales, Sydney, NSW, 2052, Australia
[2]Rector, University College, ADFA, University of New South Wales, Canberra, ACT, 2600, Australia

Introduction

Hormosira banksii is the most common fucoid alga on rocky shores in temperate Australasia. It is the only fucoid alga in the region which also exists in free-living populations, and in this it is comparable with the unattached saltmarsh fucoids occurring in the northern hemisphere. The unattached populations of *Hormosira* are most often associated with mangroves, and the characteristics of such plants have been described from New Zealand (Moore 1950, Bergquist 1959) and south eastern Australia (Clarke and Womersley 1981, King 1981).

The population that grows amongst the pneumatophores in the *Avicennia* mangrove communities of southern Botany Bay, Australia, has been described by King (1981). It appears to have been derived from adjacent populations on rocky shores. The characteristics that distinguish the thalli from those of rocky shore populations include the lack of holdfasts, the absence of sexual reproduction, and the compact and highly branched thallus form. Other features regarded as characteristic of unattached fucoids include dwarfed and twisted thalli often with yellowish tips (Norton and Mathieson 1983). King (1981) noted that small thalli were common in the free-living *Hormosira* but also noted that some plants were about four times larger than those found on rocky shores.

King (1981) undertook a survey of the biomass of *Hormosira* at a selected locality in Weeney Bay, in southern Botany Bay, with monthly sampling for twelve months commencing in August 1975. This survey involved the establishment of a permanent set of sites on a 20x20m marked grid and these sites can still be located on the basis of the position of the larger mangrove trees. In the present work the same sampling sites were revisited after an interval of 20 years to determine if there had been any major changes in biomass since the time of the original study.

Methods

The study site is located in Weeney Bay on the Towra Point peninsula in Botany Bay. The study site used by King (1981) was relocated and the same sampling procedures were adopted to estimate biomass so that the results are directly comparable. Sampling was done quarterly commencing July 1995.

The five 20m grid lines are horizontal to the shoreline and spaced five metres apart up the shoreline. Samples were taken at 5m intervals along each line. Line 1 is seaward of the *Hormosira* and line 5 is landward of it. At each collection point samples were taken from $0.25m^2$ quadrats and for each fresh weight determinations were made in the field. The thalli were then returned to the place from which they had been collected. Each three months ten samples were taken from outside of the

study area to determine a fresh to dry weight ratio. Samples were washed in freshwater, shaken and then dried until constant weight. The fresh weights were then converted to dry weight and results expressed as grams of dry weight per metre squared. Biomass was averaged over the grid lines 2-5 to obtain an overall average for the area. Data from grid line 1 were not used, to be consistent with the original study.

Results and discussion

Figure 1 shows the biomass values obtained in the present study alongside those from the earlier surveys. While the biomass of *Hormosira banksii* was generally lower than that recorded in the original study, they were no significant differences in the mean biomass between surveys. The same pattern of a summer maximum and winter minimum is evident. Data for three collections in spring 1992 are also shown. Differences in biomass in the present and the published study are within one standard deviation of the sample means of each other.

At the time of the original survey in 1975/76 the free-living *Hormosira* in Weeney Bay was well developed and more luxuriant than at any other location in NSW. Casual observations made over the next few years indicated that the population had declined markedly, especially following the oil spill from the ship 'World Encouragement' in September 1979. This oil spill was reported to have caused slight oiling in the area under study (Allaway 1982). Subsequently the population appeared to recover and measured biomass figures for Spring (August – September) 1992 (A. Schoeler, unpublished data) produced values that were slightly greater than in the original survey. The biomass for the three months in 1992 was recorded as fresh weight and the data have been converted to dry weight for comparison using the wet:dry ratio obtained from this study.

The highest biomass in summer 1975/76 was 638g dw m^{-2}, and the lowest (280g dw/m^{-2}) occurred in August. On the basis of the difference in these measures a conservative estimate of productivity of 360 g dw $m^{-2}y^{-1}$ was made. In the present study the equivalent value would be 200g dw $m^{-2}y^{-1}$ but the significance, if any, of this difference is unclear. Such productivity estimates only provide a crude estimate of the minimum value because they do not allow for loss and regrowth of algae that occurs throughout the year. There are no data for the loss of biomass due to grazing and the assumption is made that in the wave sheltered environment biomass is not exported from the mangrove community. There appears to be local movement of the *Hormosira* within the mangrove environment however. The average values for each grid line are shown in Figure 2. This figure emphasises that very little algae occurred at the outer limit of the mangrove pneumatophores (grid line 1) or at higher levels in the mangal (grid line 5). The bulk of the seaweed was found at the same position on the shore (grid line 2) with the exception of January 1996 when it was found further inshore. King (1981) also found the highest biomass at grid line 2 except in the final few months of his study.

There are difficulties in determining long term trends in biomass data. For example, the variability in abundance of free-living *Hormosira banksii* in Botany Bay leads to difficulties in designing an adequate sampling program. In this case biomass is generally lower than in the previous survey, but the high variability between samples means that no significant differences in mean biomass were found. On rocky shores intertidal algae can be

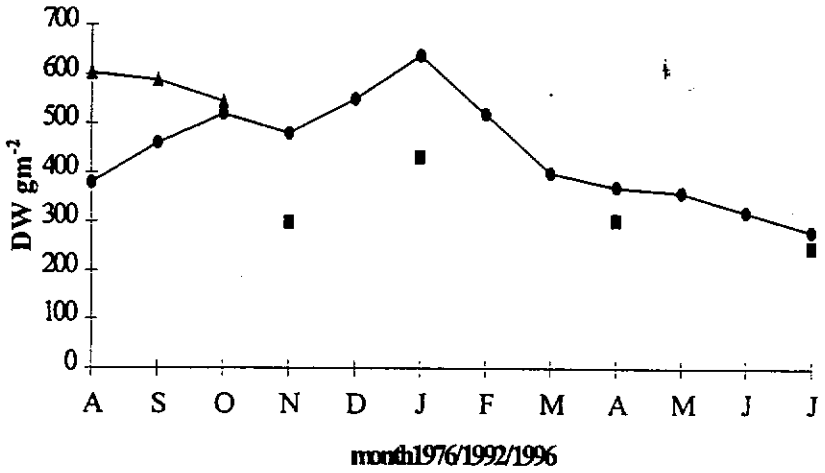

Figure 1 Seasonal average biomass of *Hormosira banksii* for 1976 (circles), 1992 (triangles) and 1996 (squares) averaged for gridlines 2-5.

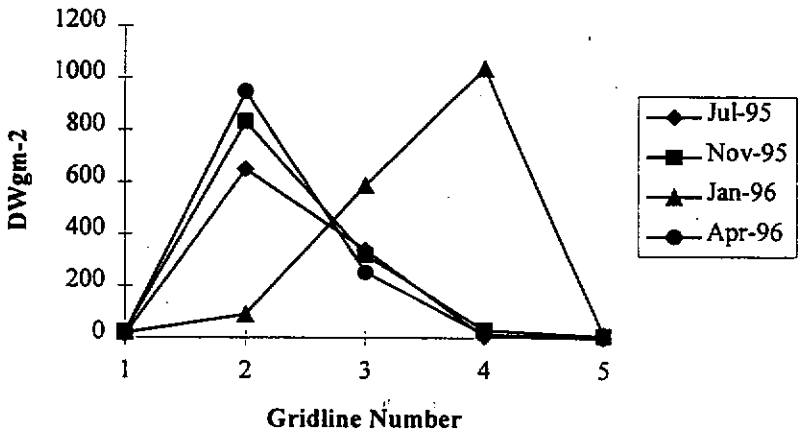

Figure 2 Average biomass of *Hormosira banksii*. A comparison between site gridlines.

erratic in their abundance and distribution (May 1981) and long term records of the biomass of seagrass in coastal saline lagoons also point to great variation from year to year (King and Hodgson 1986). In the absence of data on variation over the long-term it is not possible to make any definitive statement regarding the status of the population of *Hormosira* in Botany Bay: however the range in the values and the highest average biomass recorded in the grid are similar to the values recorded some 20 years ago. On this basis we conclude that the biomass data presented here provide no evidence of a long term decline in the population in Weeney Bay.

Acknowledgements
We acknowledge the work of Arne Schoeler who undertook the 1992 survey. In addition we would like to thank Chris Laursen and Joan Brooks for their assistance with the field work.

References

Allaway, W.G. (1982) Mangrove die-back in Botany Bay. *Wetlands (Aust)* **2**:2-7.

Bergquist, P.L. (1957) A statistical approach to the ecology of *Hormosira banksii*. *Botanica Marina* **1**:22-53.

Clarke, S.M. and Womersley, H.B.S. (1981) Cross-fertilisation and hybrid development of forms of the brown alga *Hormosira banksii* (Turner) Decaisne. *Australian Journal of Botany* **29**:497-505.

King, R.J. (1981) The free-living *Hormosira banksii* (Turner) Decaisne associated with mangroves in temperate eastern Australia. *Botanica Marina* **24**:569-576.

King, R.J. and Hodgson, B.R. (1986) Aquatic angiosperms in coastal saline lagoons of New South Wales. IV. Long term changes. *Proceedings of the Linnean Society of New South Wales* **109**:51-60.

May, V. (1981) Long-term variation in algal intertidal floras. *Australian Journal of Ecology* **6**:329-343.

Moore, L.B. (1950) A "loose-lying" form of the brown alga *Hormosira*. *Transactions of the Royal Society of New Zealand* **78**:48-53.

Norton, T.A. and Mathieson, A.C. (1983) The biology of unattached seaweeds. *Progress in Phycological Research* **2**:333-386.