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Seasonal Lamina Growth in two Age Groups of *Laminaria saccharina* (L.) Lamour. in Western Norway

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Abstract

In this study of *Laminaria saccharina* the length-to-width ratio of newly grown lamina tissue was observed to vary throughout the year. The ratio was at its lowest during the period of slow growth and at its highest during the period of rapid growth. An increase in both length and width growth took place at mid-winter simultaneously with a decrease in carbon content of the lamina, indicating consumption of stored carbohydrates. Long laminae were more prone to distal erosion than short ones during the autumn. The distribution of more growth in the width direction during summer and autumn may therefore maximize the lamina area during autumn and winter and thus increase the amount of stored carbon available for the plants at this time. It may be interpreted as a morphological adaptation to a period of slow growth. A period of rapid lamina growth during late winter and spring was observed. Both length and width growth declined early in the summer, probably due to nitrate limitation. At the end of the investigation the plants were harvested and their age determined. The lamina elongation was found to be generally lower in third-year plants than in second-year ones, while width growth was similar in the two groups. This means a decreased length-to-width ratio of the new tissue produced with increasing age. Depopulation of the tagged plants was at its highest during the period of slow growth.

Introduction

Seasonal growth in European *Laminaria saccharina* (L.) Lamour. has been investigated in Great Britain (Parke 1948, Conolly and Drew 1985) and in Helgoland (Lüning 1979). A general growth pattern of maximum growth during late winter and spring and minimum growth during the summer and autumn has been demonstrated. However, in some *Laminaria* species geographical variations in the seasonal growth pattern due to environmental factors such as temperature (Sundene 1964) or nitrate availability (Gagné *et al.* 1982) have been demonstrated. Information on seasonal growth in *L. saccharina* from northern Europe is therefore of general interest.

Much work has been done in order to find the factors affecting seasonal growth in *Laminaria* spp. (see for example Chapman and Craigie 1977, Gagné *et al.* 1982, Lüning 1986, Lüning 1988). Ecological aspects related to fitness have been given less attention in studies of seasonal growth patterns. For example, growth in the various parts of the thallus in kelp species has been little studied. *Laminaria* spp. have thalli which are divided into holdfast, stipe and lamina. Lamina may have genetically fixed features such as splits or bullations. The morphology of *Laminaria* species may also show considerable phenotypical variation. Several species of *Laminaria* develop narrower lamina at wave-exposed localities than at sheltered ones. Gerard (1987) demonstrated that mechanical stress caused *L. saccharina* to grow more in the length and less in the width direction. In addition, lamina width of *L. saccharina* varies during the year (Parke 1948). The ecological implications of this morphological plasticity in *Laminaria* spp. are not well known. Gerard and Mann (1979) found that *L. longi-*