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## The Relationships Between Weight, Length, Age and Intensity of Photosynthesis and Organotrophy of Macrophytes in the Barents Sea

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For *Ascophyllum nodosum*, *Fucus vesiculosus*, *Fucus inflatus* and *Rhodymenia palmata* in the Barents Sea a quantitative description is given of the relationship between length ( $L$ ) and weight ( $W$ ) of the thallus, and for *A. nodosum* also between weight ( $W$ ) and age ( $T$ ). The weight of the thallus has also been related to the intensity of two physiological functions – photosynthesis ( $P_i$ ) and the consumption of organic substances ( $P_o$ ) dissolved in the water. According to the value of linear growth per unit of weight and the intensity of  $P_i$ , the different species form the series: *Rhodymenia palmata* > *Fucus inflatus* > *Fucus vesiculosus* > *Ascophyllum nodosum*. From the  $W$ - $T$  relationship a lag phase ("early youth"), a logarithmic phase ("youth"), and the beginning of a stationary phase ("maturity") have been disclosed in the ontogenesis of *A. nodosum*. It has been shown that the photosynthesis and organotrophy of the thallus diminish with the increase of its weight. This dependence is approximated by a power equation, which parameters have been determined. In two species *A. nodosum* and *F. vesiculosus* the weight ( $W$ ) ratios of tissues of different age ( $t$ ) have been determined. On the basis of these data, stages of youth, maturity and senescence of tissues have been determined in *A. nodosum*. The comparison of the  $w$ - $t$  curves of *A. nodosum* and *F. vesiculosus* shows that a different strategy of thallus formation is inherent in them.

The knowledge of functional morphology of higher organisms – especially animals – has developed very purposefully and successfully. At the same time the functional morphology of marine plants has been represented by investigations which, even if numerous, are uncoordinated, and no purposeful development of such research has been observed as yet. Marine macrophytes, however, with their perennial, usually very ramified thalli and strongly expressed basic function (photosynthesis) could doubtlessly provide a wealth of data for the comparison of form and function. In our opinion one of the main causes for the lagging of functional morphology of marine macrophytes depends on the absence of a quantitative approach, a systematic measurement of at least the principal morphological parameters of the thallus – length and weight. If such measurements were paralleled by simultaneous measurements of physiological functions, primarily photosynthesis, the functional morphology of marine plants would be given the necessary foundation.

An analysis of the literature devoted to marine macrophytes shows that even for the best studied species of the northern seas, as *A. nodosum*, (Baardseth 1970), despite a relatively great variety of information, very little quantitative data are available on growth and relationship of morphological and physiological characters. The aim of

this work is to make a morpho-physiological analysis of the thalli of two species of macrophytes occurring in masses – *Ascophyllum nodosum* and *Fucus vesiculosus*. We have less data on the third species studied – *Fucus inflatus*.

### Materials and Methods

The work was carried out in February, 1975 on the shore of the Barents Sea in the neighbourhood of the Dalniye Zelentsy settlement (Murmansk Marine Biological Institute of the USSR Academy of Sciences). The following characters were determined: maximum length of freshly collected thalli ( $L$ ), their age ( $T$ ) and absolute dry weight ( $W$ ). One stratum of air bladders is formed every year in *A. nodosum* and *F. vesiculosus* older than three years. This character is usually used to determine the age of fucoids (Tikhovskaya 1955; Baardseth 1970) by the formula:

$$T = n + 2$$

where  $n$  is the number of air bladders. The part of the thallus which is below the first stratum of bladders is three years old. Dissecting the bush transversally over the air bladders, we were able to differentiate the yearly