

AGE SPECIFIC PATTERNS OF LEAF GROWTH: THEIR DETERMINATION AND IMPORTANCE FOR
EPIPHYTIC COLONIZATION IN *POSIDONIA OCEANICA* (L.) DELILE.

by

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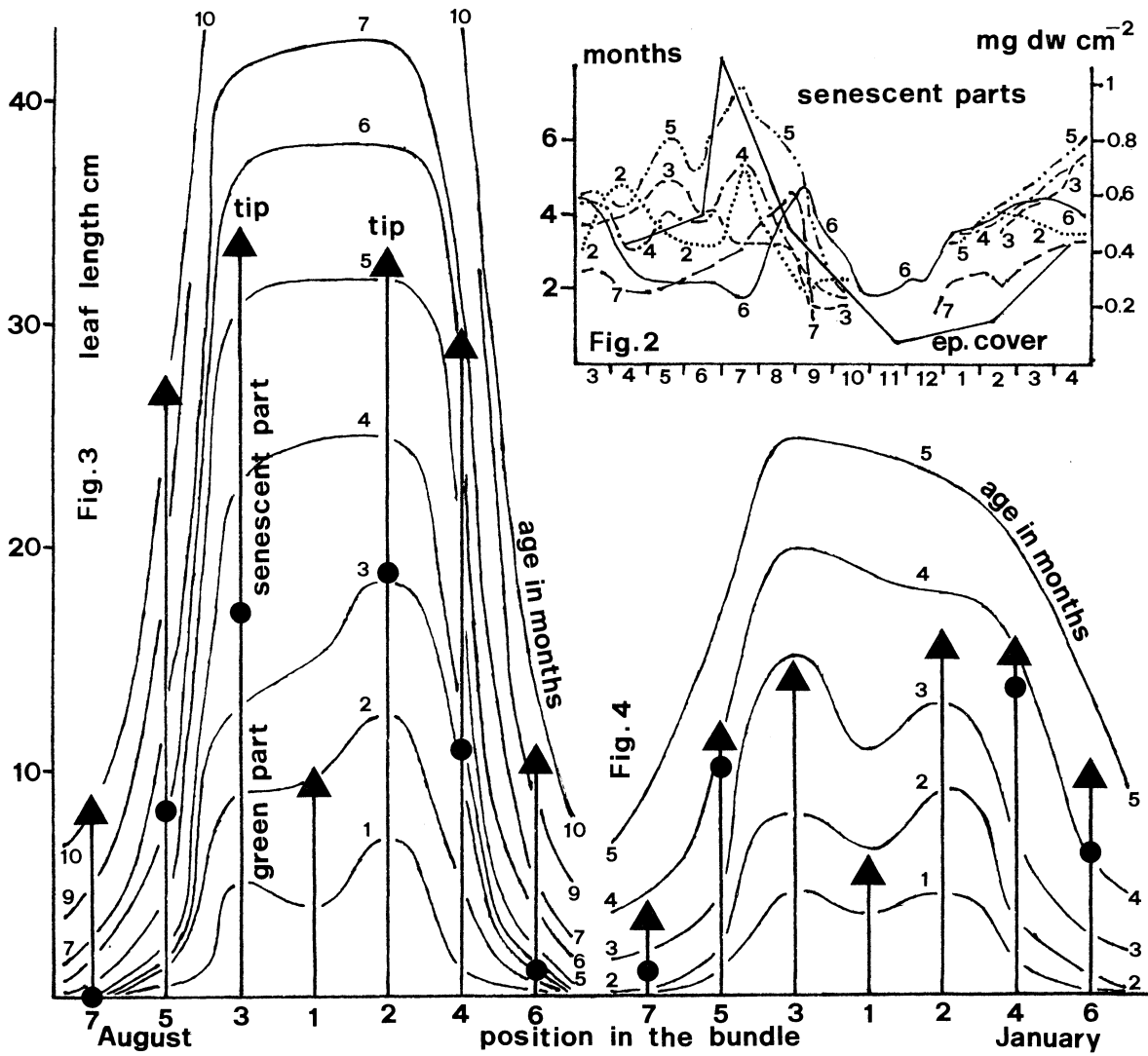
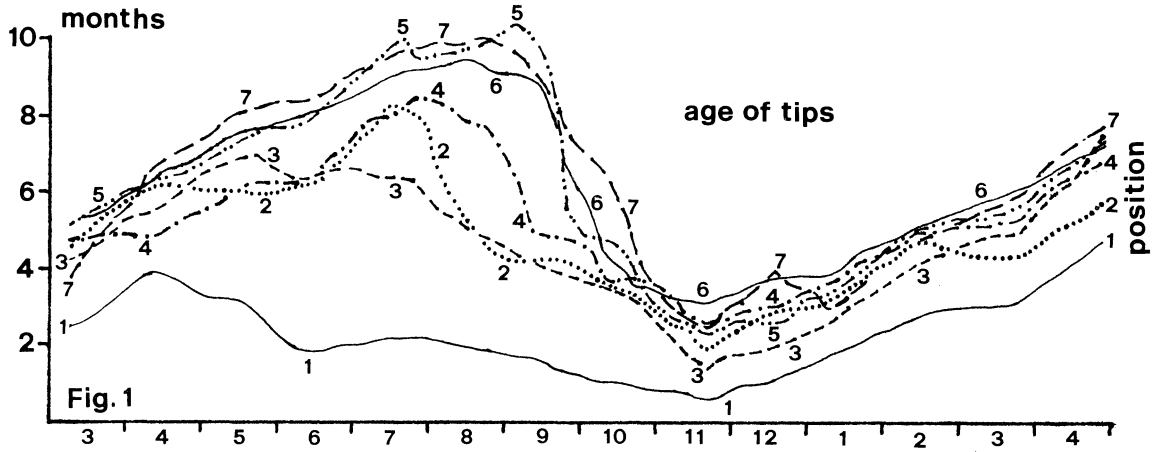
Resumé. Les données obtenus au cours d'une recherche expérimentale in situ sur l'accroissement de *Posidonia oceanica* forment la base pour un model de simulation sur ordinateur qui permet de calculer l'age d'une feuille étant donnée sa position à l'intérieur d'un faisceau et le saison. Ce model montre que l'age des pointes et des parties senescentes des feuilles présente une saisonnalité définie qui suggère l'existence d'une stratégie d'accroissement - détérioration permettant la plante de se libérer d'un recouvrement excessif d'épiphytes.

The structure and dynamics of the epiphytic community are an important aspect in the study of the *Posidonia oceanica* ecosystem. Because of their seasonality of growth, the leaves of this plant represent a highly dynamic substratum for epiphyte settling. It is expected, therefore, that the dynamics *per se*, in combination with climatic and other biotic factors, are critical in determining colonization patterns and rates on the leaf substratum.

According to Ott (1979), the basic seasonality of growth of *Posidonia* is to a large extent an intrinsic characteristic of the plant because the typical growth pattern occurs also in absence of seasonal variations in illumination and temperature. The new leaves appear in the middle of each bundle, which has a characteristic symmetry, with the young leaves in the center, and the old ones, usually brown and heavily eroded, in the extreme lateral positions. This leaf organisation allows one to number leaves in order of appearance, from position 1 to 7. The realized length of leaves is the result of the interaction of growth and erosion processes. The latter occurring at the leaf tips which are senescent and covered with epiphytes.

Growth was determined using marking methods described by Ott (in press), at monthly intervals from March 1979 to April 1980 in a superficial (4m) dense stand of *Posidonia* in waters around the island of Ischia (Gulf of Naples). Leaves were found to grow at a rate up to 3.7 mm/leaf/day, depending on their position in the bundle and on the season, with maxima in spring and autumn. Mean leaf numbers per bundle varied from 4.1 in September to 5.3 in November. A bundle produced on the average 6.7 new leaves per year, in which the majority (4.1) appeared during the period September to November. A general leaf fall of old leaves occurred from the end of September to October.

In order to determine the age of a given part, of a given leaf, in given position and at given season, a computer program was generated. The program



uses for each season appearance of new leaves, growth rates at given position in the bundle, length of leaves, and position of brown parts as data inputs. The program simulates the appearance of new leaves and shifts their position relative to the others as they grow. Changes in leaf length are simulated by integrating growth rates in time steps of one day. The same growth pattern was used for extrapolation back to the preceding growth season (1978).

The results are given in Figs. 1 to 4. The spatial heterogeneity of different parts of leaves in terms of age difference per unit length increased from leaf no. 2 to 7. For example, in August, near the end of the growth season, the tip of leaf 2 was 5 months old with a total leaf length of 33 cm, whilst the tip of leaf 6 was 9.5 months with a length of 11 cm (Fig. 3). The differences are less pronounced in January when all leaves are younger than 5 months (Fig. 4). In all seasons, the age of the tips increased from leaf 1 to 7 (Fig. 1). This is a consequence of displacement of their position within the bundle and of moderate erosion. From November to April, the tips of leaves 2 to 7 do not differ in age by more than two months. This indicates not only highly regular growth patterns, but also indicates regular erosion patterns (Fig. 1). In summer there were high age differences between the tips. This is contributed to low growth and high decay rates occurring simultaneously with heavy epiphytic cover (in mg dw ep. / cm² expressed as overall average per bundle: Fig. 2). Erosion at tips (in terms of cm/day) is much reduced in leaves 5 to 7 compared with leaves 2 to 4 which grow faster. This is due to the fact that in leaves 5 to 7 a second type of decay takes place: The aged leaves break off at their basis at a preformed line, the *lunula* when the leaves are still a few cm long (for these leaves a few cm correspond to ages of up to 10 months). It may be also of importance that hydrodynamic forces harm long, young leaves much more than short, old ones.

The location of the lower limits of the senescent (visualized as brown tissue) parts of leaves is given in Fig. 2. As described in leaf tips, the age of senescent tissue increased from leaf 2 to 5. In contrast, the oldest leaves (no. 6 and 7) became brown in much younger portions. This and the highly regular age patterns indicate that position of tips as well as brown parts are under the control of an intrinsic growth - decay strategy of the plant. In this way *Posidonia oceanica* likely avoids being too heavily covered by epiphytes. The results of this study demonstrate the importance of leaf ages for epiphyte settlement and survival.

REFERENCES

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