Growth of the mangrove *Avicennia marina* at different salinity

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Introduction

Avicennia marina is one of the most widespread mangroves. It settles not only the northern and southern limits of the extension of mangroves but also in the areas of highest salinity within the mangrove vegetation.
Plants show a typical correlation between salinity and growth. In extreme habitats the growth of *Avicennia marina* is reduced to a shrubby shape.

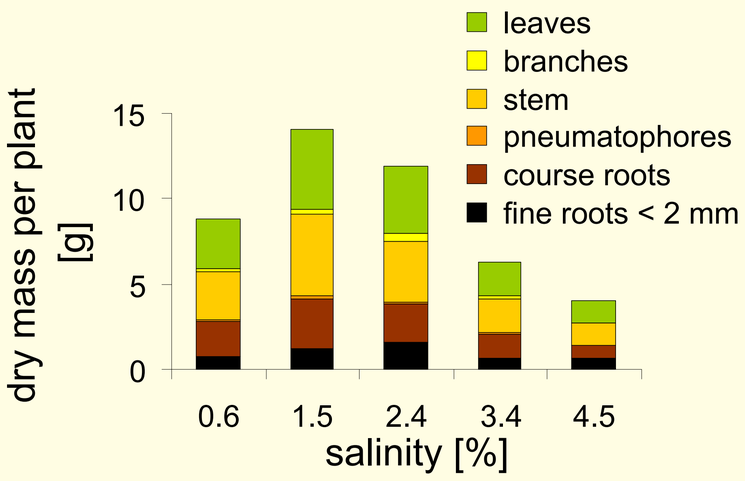

Fig. 2: Mean total dry mass in plant organs at different salinity levels. The ratio between root and shoot dry mass varied not significantly.

Method

Propagules of *Avicennia marina*, collected in the U.A.E. were germinated in a greenhouse under controlled environmental conditions (T_{air}: 20-25°C, *VPD:* ~1.4 kPa, PPFD: 500 µmol m^{-2} $s^{-1,}$ daylenght: 12 hours). They were grown in special plant breeding boxes where the tide was simulated (Fig. 1). During the first three months the salinity level was 1.5% NaCl. After this time the seedlings were divided up into five homogeneous groups and cultivated at five different salinity levels (0.6 %, 1.5%, 2.4%, 3.4% and 4.5% NaCl).
Primary growth values (height, stem diameter, leaf area and number of leaves) were

Fig. 1: Growing of *Avicennia marina* in plant breeding boxes with simulation of tides. Small picture on the top: roots of *A. marina*, small picture at the bottom: plant breeding box at the installation.

continuously measured over a period of twelve months. Final dry mass was determined by harvest. Structural parameters (root/shoot ratio, LMA, leaf succulence) were calculated from the results of the final harvest.

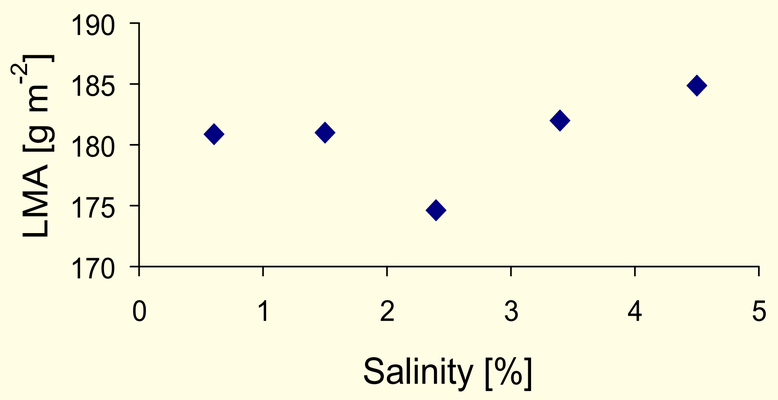

Fig. 4: The leaf mass area increases significant at higher salinity.

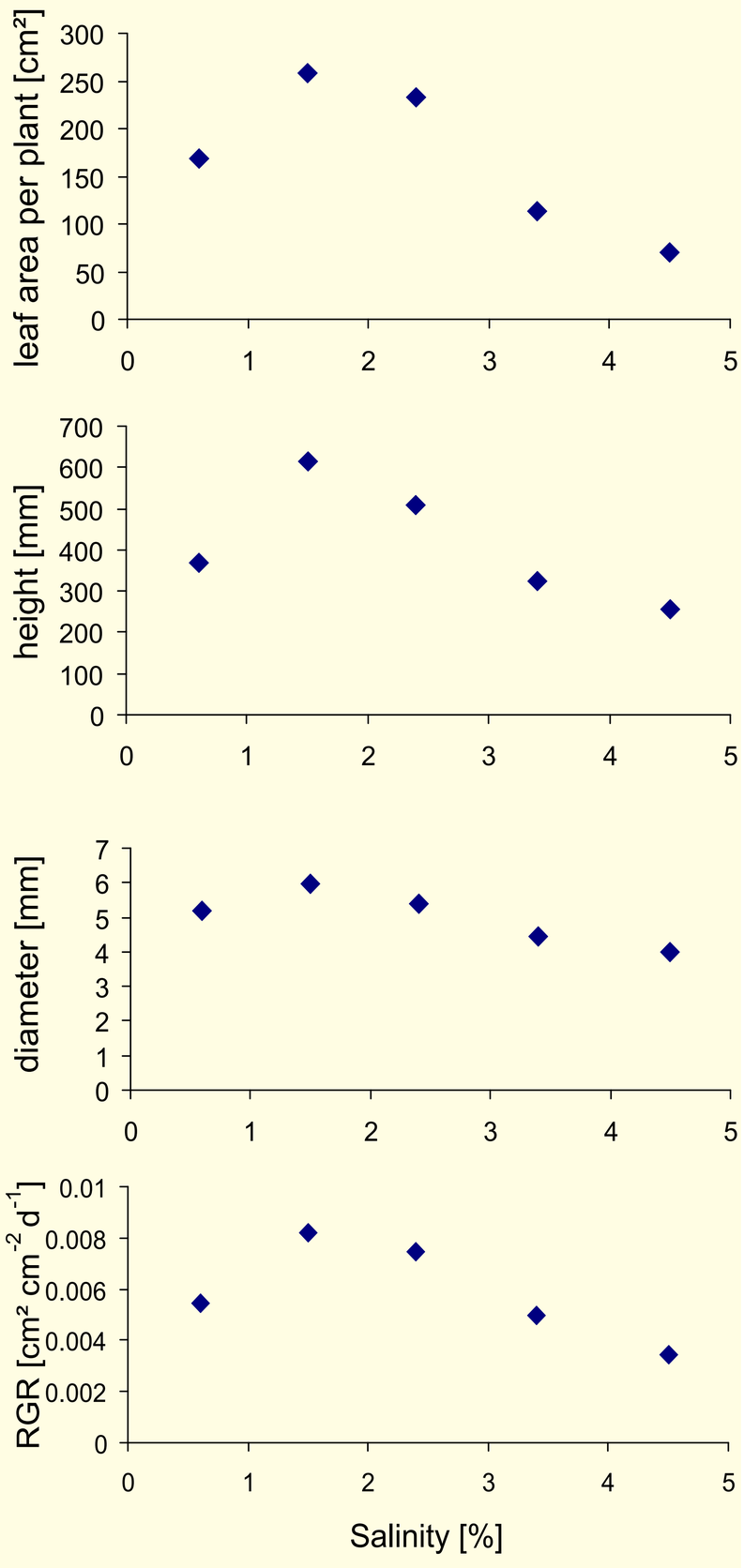

Fig. 3: Mean values of growth parameters (leaf area, stem height and diameter, relative growth $rate_{leaf\ area}$ (RGR)) of *Avicennia marina* at different salinity levels.

Results and Discussion

The plants showed optimum growth at a salinity of 1.5% and minimum growth at 4.5%. A significant decrease in dry mass was found at 0.6% and 4.5% NaCl (Fig.2). It corresponded with a decline in height, stem diameter, leaf area and relative growth $rate_{(leaf\ area\ and\ height)}$ (Fig.3). While structural leaf properties like LMA showed an increase at higher salinity (Fig.4) leaf succulence was hardly affected.
The root/shoot-ratio showed no significant differences between the treatments.
Apart from changes in LMA which could be related with a higher leaf salt content at elevated salinity, it is shown, that the growth of *A. marina* responds to salinity by changes in growth-rate.
Further investigations need to clarify whether the decrease in productivity at higher salinity levels are a response to changes in the physiology of photosynthesis.

Tab. 1: Mean values of measured parameters with standard deviation (SD).

	units	0.6%	SD	1.5%	SD	2.4%	SD	3.4%	SD	4.5%	SD
dry mass	g	8.79	9.48	14.13	9.43	11.92	10.32	6.06	8.57	3.93	2.74
hight	mm	370	201	614	234	509	274	323	203	255	137
diameter	mm	5.2	1.2	6.0	1.2	5.4	1.3	4.4	1.3	4.0	0.9
leaf area	cm^2	169	173	258	157	232	183	113	134	70	54
leaf mass area	g m^{-2}	180.9	18.8	181.0	20.8	174.6	13.1	182.0	17.7	184.9	18.6
root/shoot		0.31	0.15	0.36	0.14	0.35	0.18	0.25	0.16	0.27	0.11
succulence	g_{H20} dm^2	2.04	0.22	2.16	0.26	2.08	0.16	1.97	0.21	2.07	0.22
relative growth rate (height)	mm mm^{-1} d^{-1}	$4.7*10^{-3}$	$3.4*10^{-3}$	$7.0*10^{-3}$	$2.6*10^{-3}$	$7.0*10^{-3}$	$1.7*10^{-3}$	$4.0*10^{-3}$	$1.4*10^{-3}$	$3.2*10^{-3}$	$1.0*10^{-3}$
relative growth rate (leaf area)	cm^2 cm^{-2} d^{-1}	$5.4*10^{-3}$	$0.3*10^{-3}$	$7.5*10^{-3}$	$0.3*10^{-3}$	$7.5*10^{-3}$	$0.4*10^{-3}$	$5.0*10^{-3}$	$0.6*10^{-3}$	$3.4*10^{-3}$	$0.5*10^{-3}$