

# Water quality, feed intake and growth in European seabass (*Dicentrarchus labrax* L.) in relation to water renewal rate

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## Introduction

Off late, the use of oxygenation of the production water in intensive fish culture has increased. This enables the farmers to increase the production capacity and to economise with the water consumption. However, when the water flow is reduced, the accumulation of excretion products from the fish as ammonia, urea, carbon dioxide, suspended solids

and induced low pH may lead to reduced performance or health problems in fish. There are few studies on the effects of the combination of these parameters when water renewal is decreasing. Thus, we have conducted an experiment with groups of seabass which were exposed to five different flow rates.

## Materials and methods

The experiment was conducted at the Aquaculture station of Ifremer in Palavas-les-Flots (France) from December 2001 to April 2002. 15 circular tanks (1 m<sup>3</sup>) were used, each of them stocked with a biomass of 38 kg seabass (100-150 g). Five different flow rates (1520, 660, 380, 190, 125 l·h<sup>-1</sup>) in triplicates were chosen in order to obtain the different treatments of sea water renewal rates: 40 (control), 20, 10, 5 and 3.3 l·h<sup>-1</sup>·kg<sup>-1</sup> of fish biomass. Oxygen concentration was maintained at 100 % saturation and the temperature was 22 °C. Commercial feed (45% protein, 12% lipids, 10% ash and 10% water) was supplied *ad libitum* twice a day and feed intake was measured by using a particle trap. The experiment lasted for 84 days and the stocking density was maintained in a narrow range (38-44 kg·m<sup>-3</sup>) by removing fish regularly. Water quality parameters, feed intake, growth rate and some other selected physiological parameters were measured. ANOVA was used to statistically test between treatments (a probability level of p<0.05 was considered as significant).

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## Results and discussion

### Water quality

As the water renewal rates decreased, there were an increase in ammonia (TA-N), carbon dioxide (CO<sub>2</sub>), urea, phosphate (P-PO<sub>4</sub>), suspended solids (SS) concentrations (Fig. 1a, b, c, d and e) and the pH decreased (Fig 1f), indicating an accumulation of these metabolites in the water. However, the increase of these metabolites is not directly proportional to the reduction in water renewal rates. These results ( obtained in multiparametric varying conditions), compared to those obtained from previous experiments in monoparametric varying conditions, demonstrate that carbon dioxide is mainly responsible of the reduced performances in fish, as shown in the following table:

Calculated water parameters for a 10% breakdown in feed intake and growth from control fish		
	Multiparametric varying conditions	Monoparametric varying conditions
TA-N (mg·l <sup>-1</sup> )	1.9	8.8
CO <sub>2</sub> (mg·l <sup>-1</sup> )	36.5	37.7 (pH = 6.5)
pH	6.9	6 - 9.2

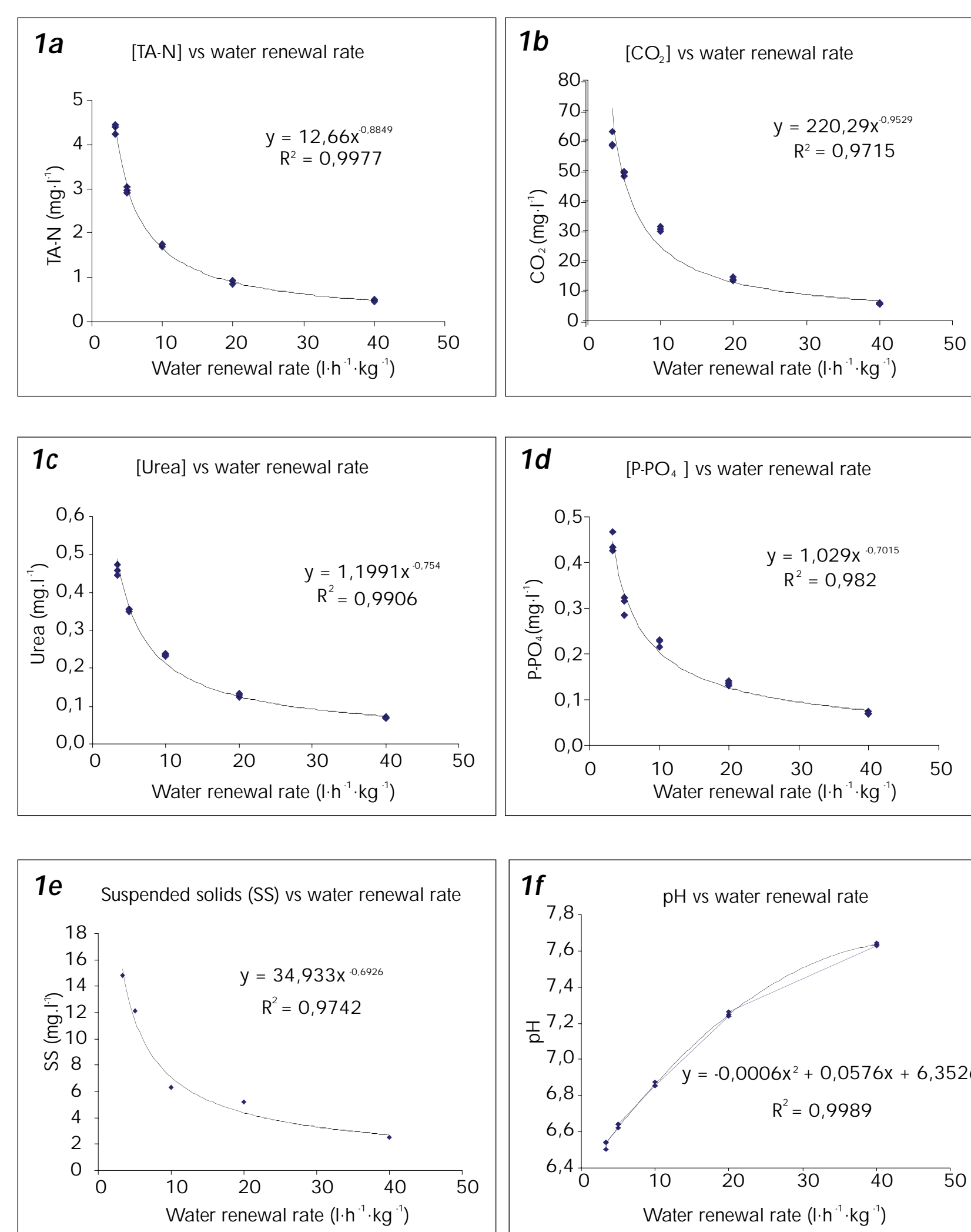


Figure 1a, b, c, d, and e. Accumulation of different metabolites in sea water depending on water renewal rate.

### Feeding and growth

The weight of the fish increased in all treatment groups during the course of the experiment, but fish subjected to the lowest renewal rates showed reduced growth, especially in the first period of the experiment (Fig. 2a).

The feed intake and growth of fish were significantly lower in treatment groups 10, 5 and 3.3 compared to the treatment groups 40 and 20, indicating that the reduction in water quality impaired the performances of seabass (Fig. 2b, c).

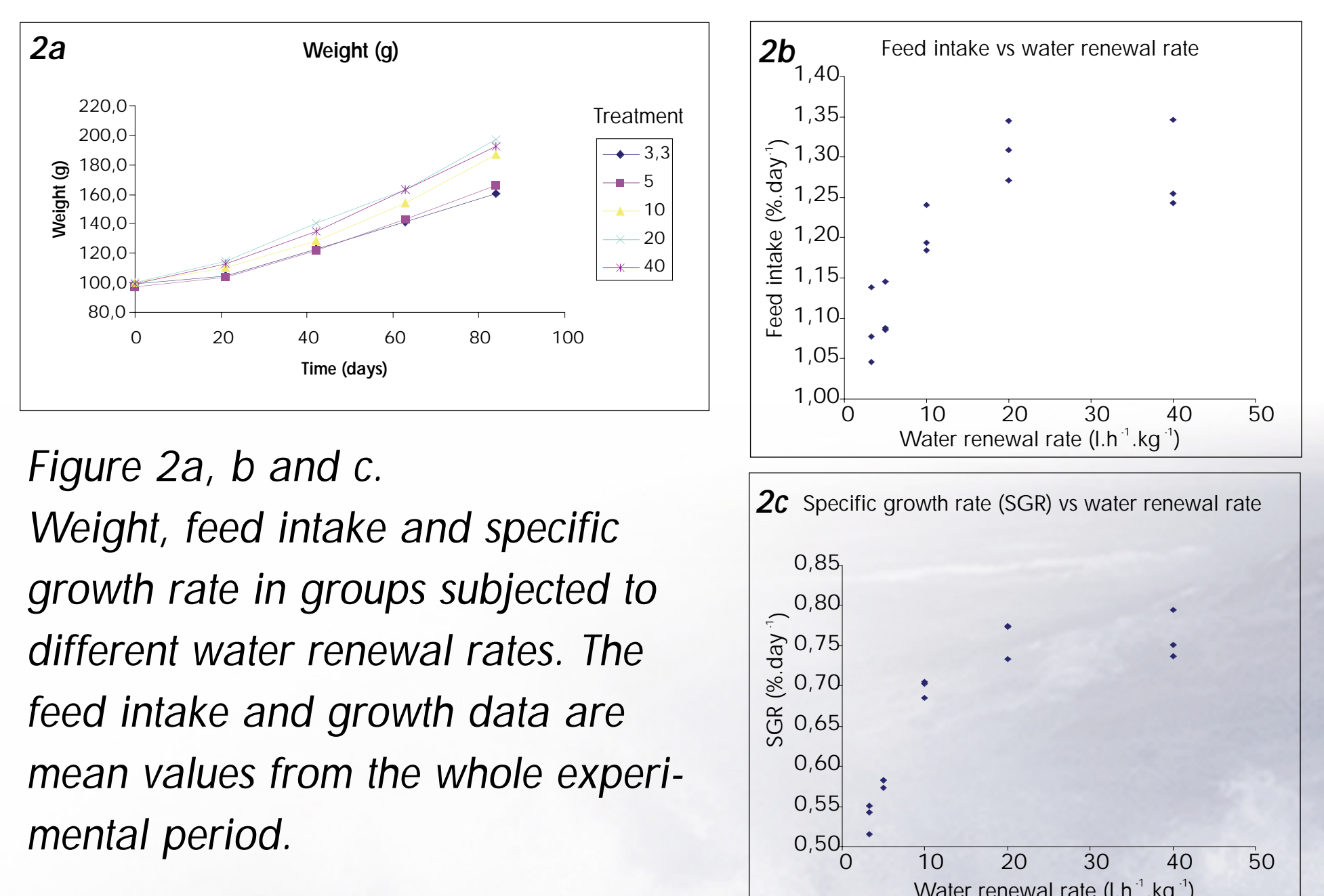


Figure 2a, b and c. Weight, feed intake and specific growth rate in groups subjected to different water renewal rates. The feed intake and growth data are mean values from the whole experimental period.

## Conclusions

- The accumulation of excretion products, when the water flow is reduced, leads to decreased performance in seabass when water renewal rate is below 20 l·h<sup>-1</sup>·kg<sup>-1</sup> or when the feed intake is above 27 g·m<sup>-3</sup> of renewal seawater. A 10% breakdown in feed intake and growth from control fish is observed when water renewal rate is 8.15 l·h<sup>-1</sup>·kg<sup>-1</sup> or when the feed intake is 59 g·m<sup>-3</sup> of renewal seawater.
- Carbon dioxide is mainly responsible of the reduced performances in fish.

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