



# Effects of iron addition and invasive crayfish on macrophyte growth

Anne Immers, Jessica van der Wal, Martijn Dorenbosch & Liesbeth Bakker

Department of Aquatic Ecology, Netherlands Institute of Ecology, The Netherlands



## BACKGROUND

- High nutrient loading and a subsequent increase in water turbidity due to phytoplankton surface blooms have led to a decrease in macrophyte abundance
- Water managers have tried to resolve this problem by adding iron (Fe), in the form of iron(III)chloride, to the lake as a natural P binding agent
- After application of iron, return of macrophytes was not apparent, even though recent lab studies (**BOX 1**) have shown that iron addition would not inhibit macrophyte establishment<sup>1</sup>

## RESEARCH QUESTIONS

Does iron addition hamper *in situ* macrophyte establishment?

Are invasive crayfish (*Procambarus clarkii*) responsible for macrophyte absence in the experimental ponds?

## METHODS

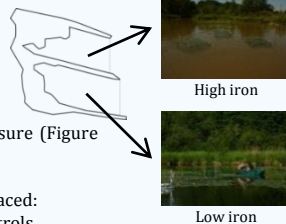
Herbivore enclosure cages (1 x 1 x 1 m) were placed in two closed off experimental ponds in Lake Terra Nova, Loenderveen

High iron pond: 1.6 mg Fe L<sup>-1</sup> (treated with iron(III)chloride)

Low iron pond: 0.2 mg Fe<sup>-1</sup> (not treated with iron(III)chloride)

Introduction of three different macrophyte species per enclosure (Figure 3)

Besides herbivore enclosures in the experimental ponds, we placed: crayfish enclosures, partial herbivore enclosures and open controls



## BOX 1

### Effects of iron addition on macrophyte growth

#### Methods

Slow addition of 0, 20 and 40 g Fe m<sup>-2</sup> over a time period of 5 - 12 weeks

#### Results

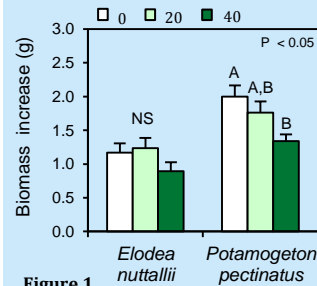


Figure 1

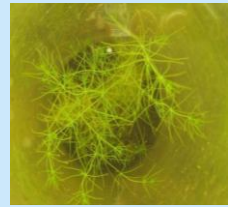
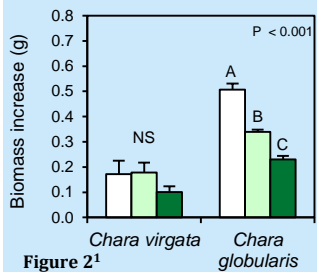


Figure 2<sup>1</sup>

## RESULTS

### Effects of iron addition on macrophyte establishment

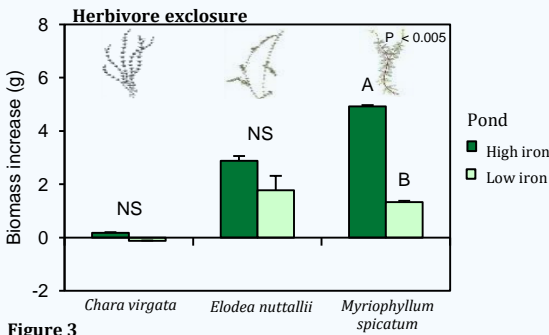


Figure 3

### Effects of crayfish presence on macrophyte establishment

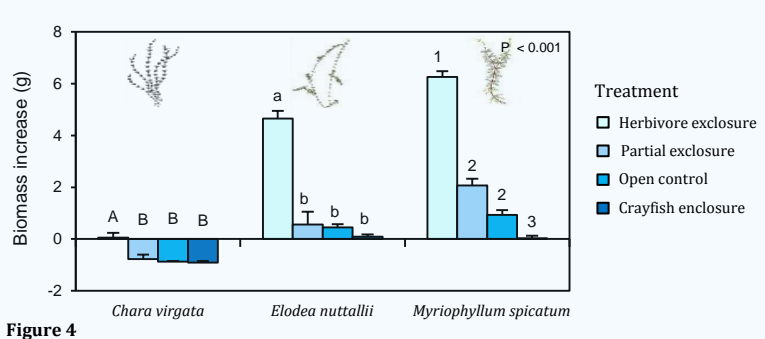


Figure 4

## CONCLUSIONS

- Biomass of all macrophyte species increased during lab experiments, even with high iron concentrations of 40 g Fe m<sup>-2</sup> (**BOX 1, Figure 1-2**)
- Iron addition does not reduce macrophyte growth in experimental ponds (**Figure 3**). *Chara virgata* and *Elodea nuttallii* growth was not affected by different iron concentrations in experimental ponds and *Myriophyllum spicatum* biomass was significantly higher in the high iron pond compared to the low iron pond
- The invasive crayfish *Procambarus clarkii* negatively affects macrophyte establishment in the experimental ponds (**Figure 4**)

<sup>1</sup> Immers et al., Hydrobiologia, 2012, DOI 10.1007/s10750-011-0995-7