

# Who is the master?!

## Trade-off between competitive ability and resistance to elevated pCO<sub>2</sub>

Giannina S.I. Hattich, Luisa Listmann, Birte Matthiessen

Geomar Helmholtz Centre for Ocean Research, Kiel

### Background

Ocean acidification (OA) negatively affects calcifying phytoplankton species, but studies show that evolutionary adaptation is possible. Under future conditions genotypes that are more resistant towards OA should thus have an advantage for this trait. Theory, however, states that “a jack in every trait is a master of none”. This suggests, highly OA-tolerant genotypes might be weaker in other traits as for example competition (Fig. 1).

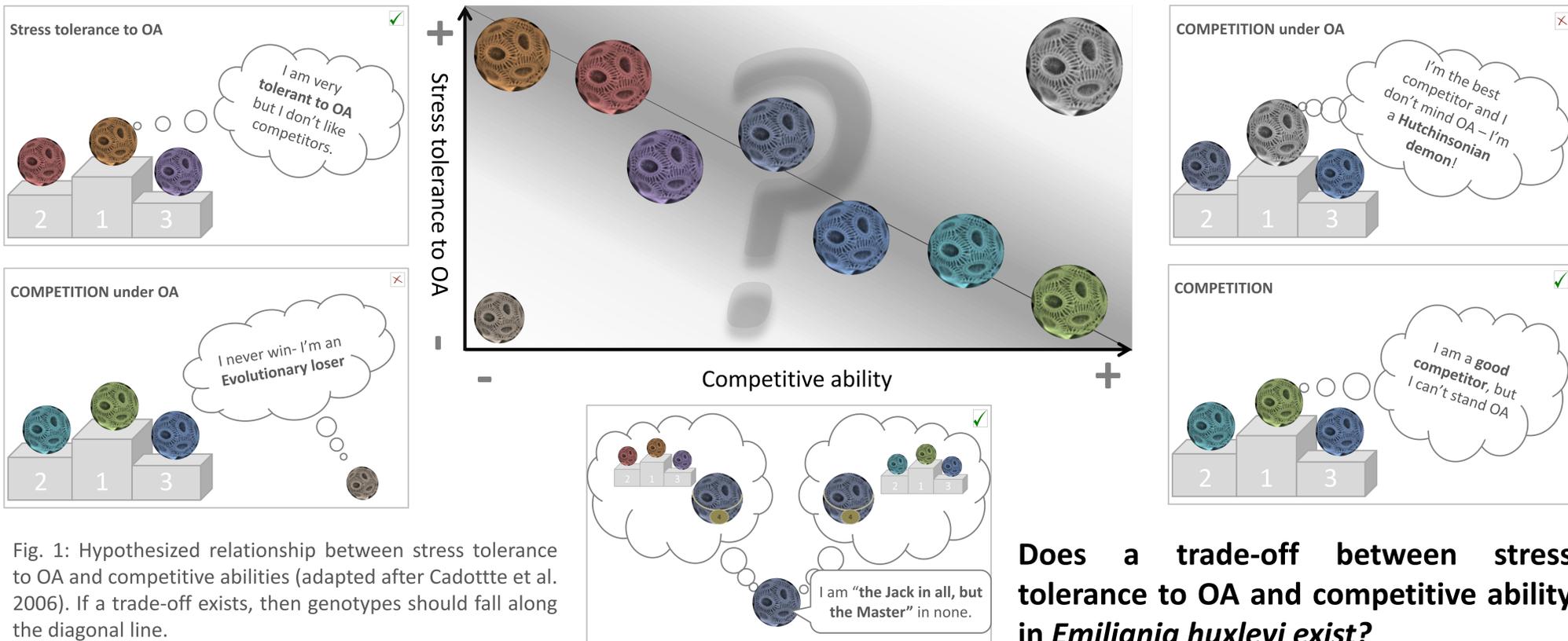


Fig. 1: Hypothesized relationship between stress tolerance to OA and competitive abilities (adapted after Cadotte et al. 2006). If a trade-off exists, then genotypes should fall along the diagonal line.

**Does a trade-off between stress tolerance to OA and competitive ability in *Emiliana huxleyi* exist?**

### Stress tolerance to OA

For the stress tolerance to OA, we ranked genotypes by the mean difference in growth rate under ambient and high CO<sub>2</sub> (400, 1200 ppm).

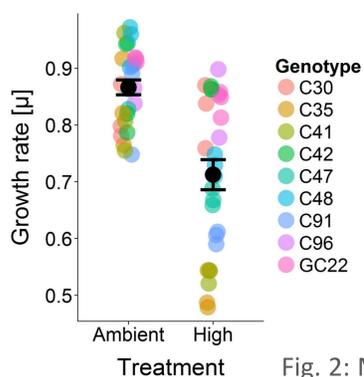


Fig. 2: Maximum growth rate of *E. huxleyi* under ambient and high CO<sub>2</sub>. Mean and 95% CI. (N=3).

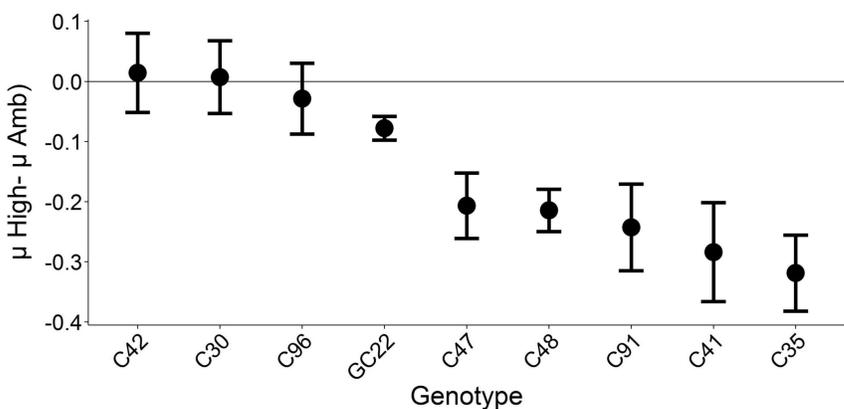


Fig. 3: Effect of OA on the growth rate of nine different genotypes of *E. huxleyi*. Mean and 95% CI (N=3).

### Competitive ability

Competitive ability will be ranked by the change in density of each genotype with competitor relative to densities reached without competition (Relative Yield; Carrara 2015)

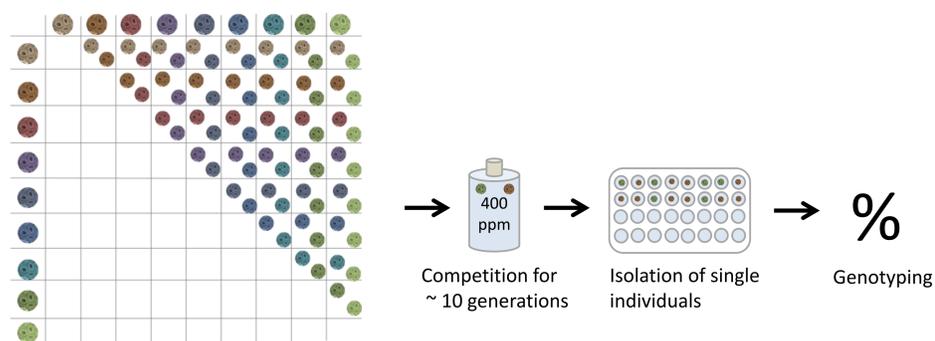


Fig. 4: Pairwise combination in which the competitive ability is assessed under ambient CO<sub>2</sub> and subsequent genetic analysis.

### Conclusion

- Existence of trade-off not certain
    - competitive ability not yet assessed
  - But:...
  - Strong difference in growth rate of genotypes in ambient and high CO<sub>2</sub> conditions
    - Cryptic genetic variation expressed at high CO<sub>2</sub>
    - Cost of similar growth rate under both CO<sub>2</sub> levels?
- Trade-off might exist