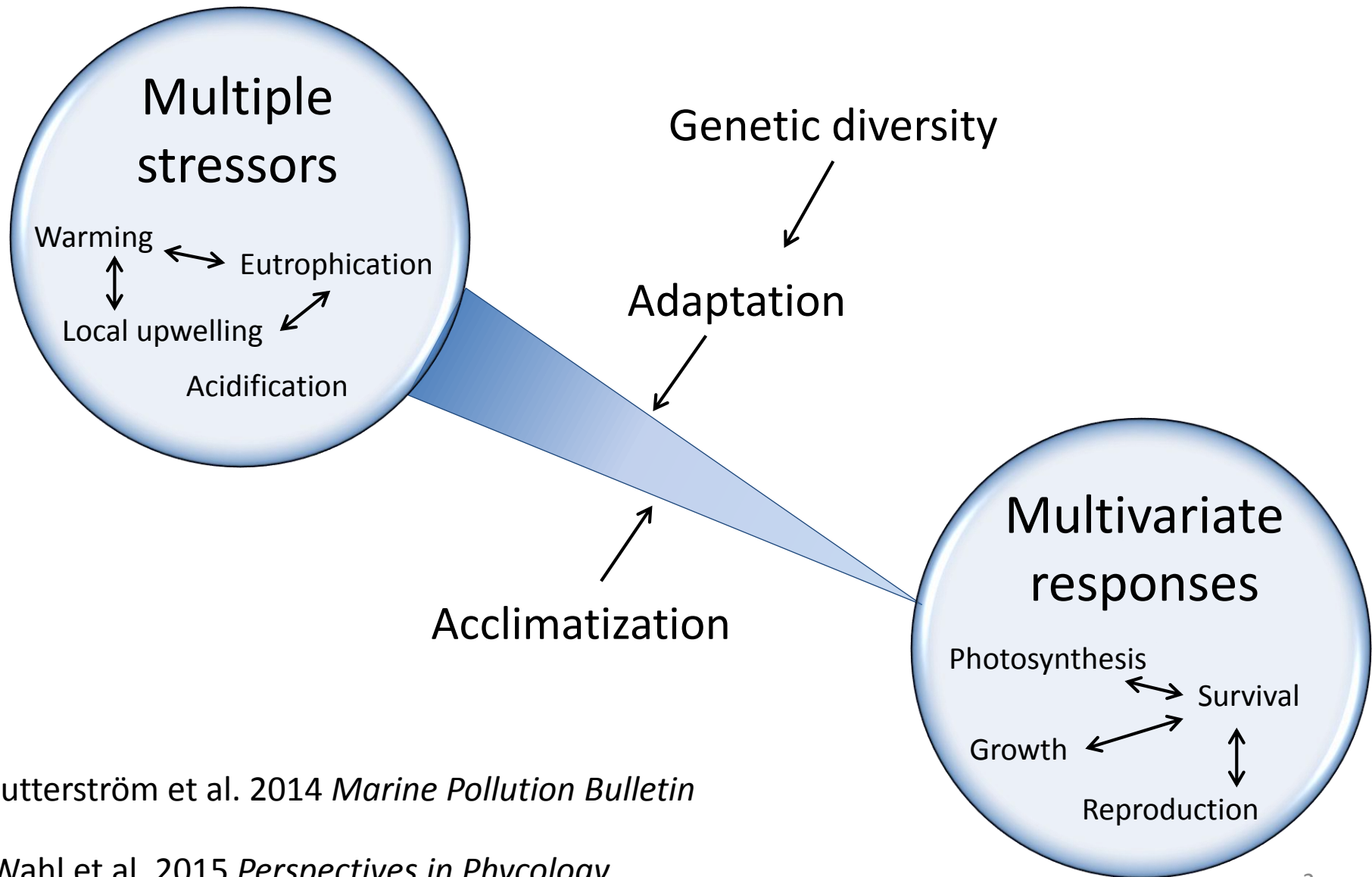


Correlated and anti-correlated sensitivities to global change factors will determine the fate of *Fucus vesiculosus*

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GEOMAR, Helmholtz Center for Ocean Research, Kiel, Germany





Jutterström et al. 2014 *Marine Pollution Bulletin*

Wahl et al. 2015 *Perspectives in Phycology*

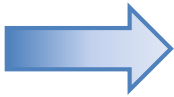
Collection of **fertile adult** *Fucus vesiculosus*

Induction of **gamete release**

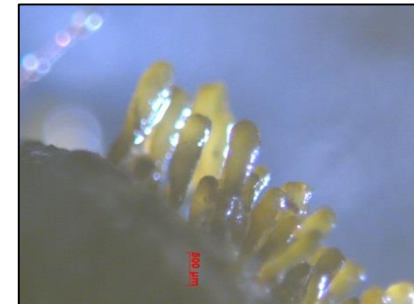
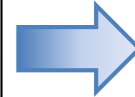
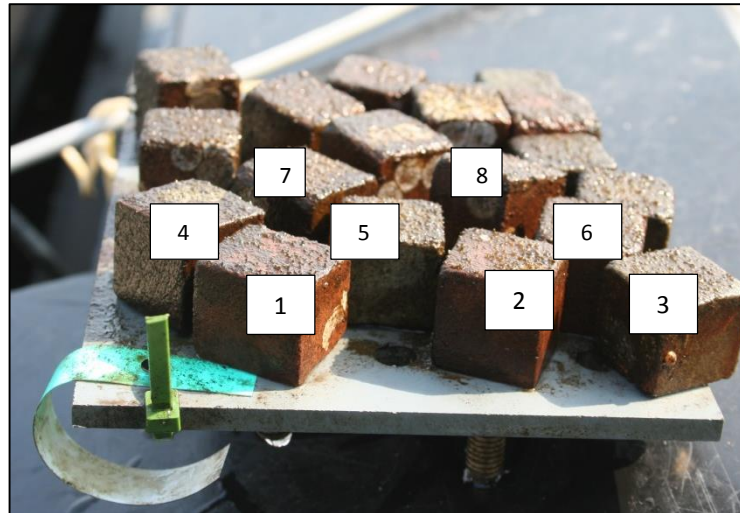
Settling of germlings on sandstone cubes: edge length 2 cm.



1x ♂ ♀

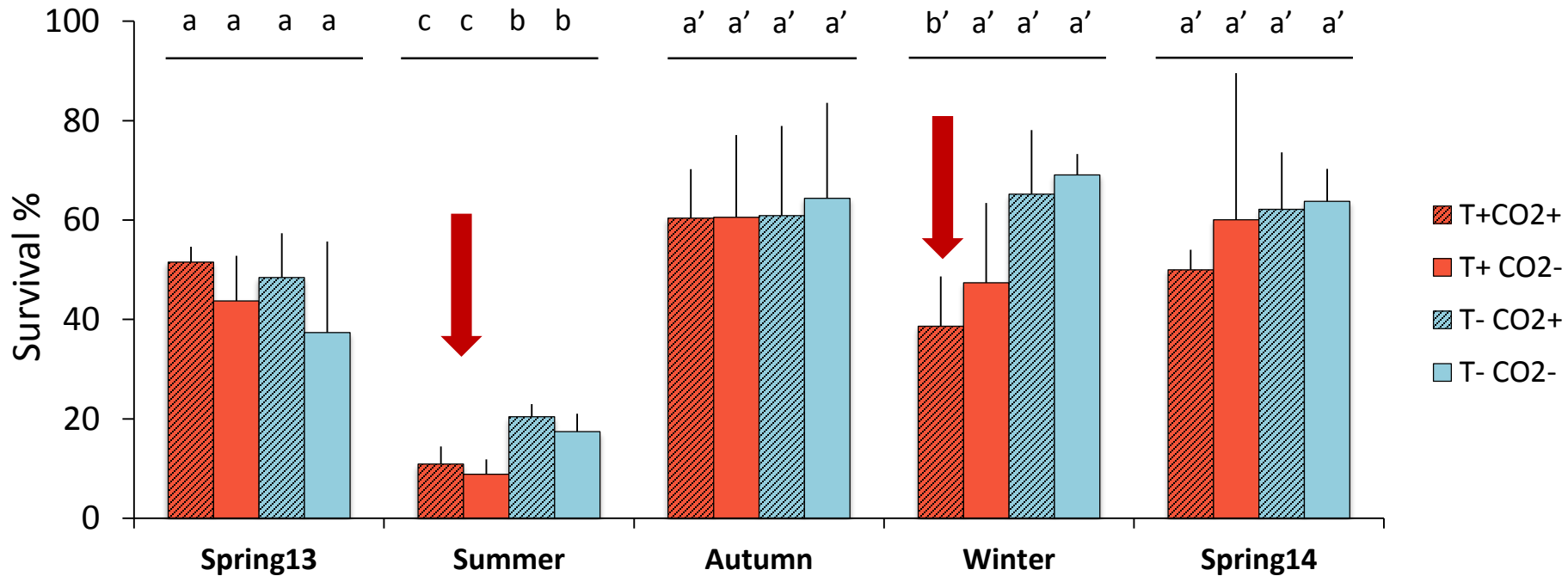


8 sibling groups





| | | |
|----------------------|--|--------------|
| 1. Experiment | Temperature x pCO₂ x Season | n = 3 |
| 2. Experiment | [Temperature x pCO₂] x Nutrients | n = 3 |
| 3. Experiment | + Final upwelling event | n = 3 |



Seasonal differences between spring and summer (p-value < 0.05)

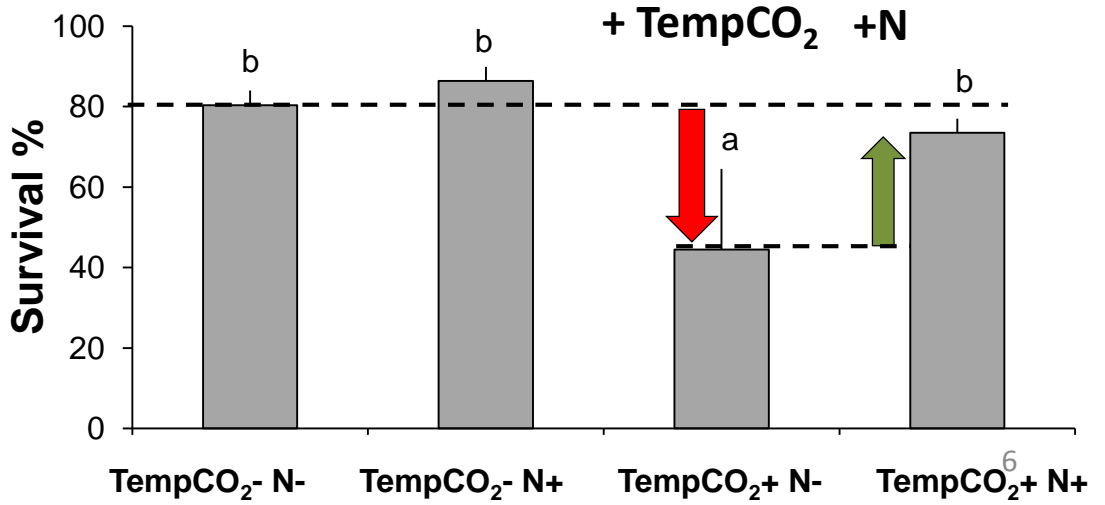
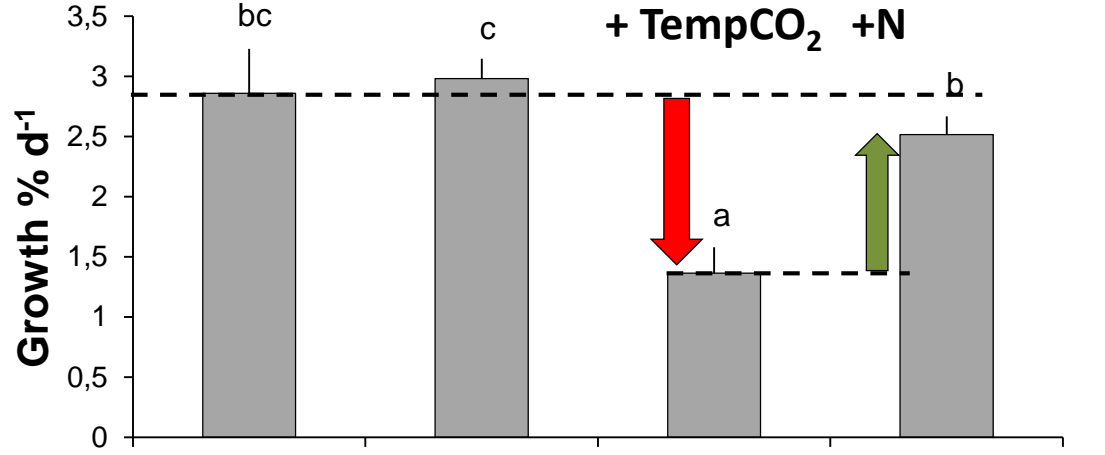
Warming decreases survival in **summer** and also in **winter** (p-value < 0.05)

Means +SD
n=3

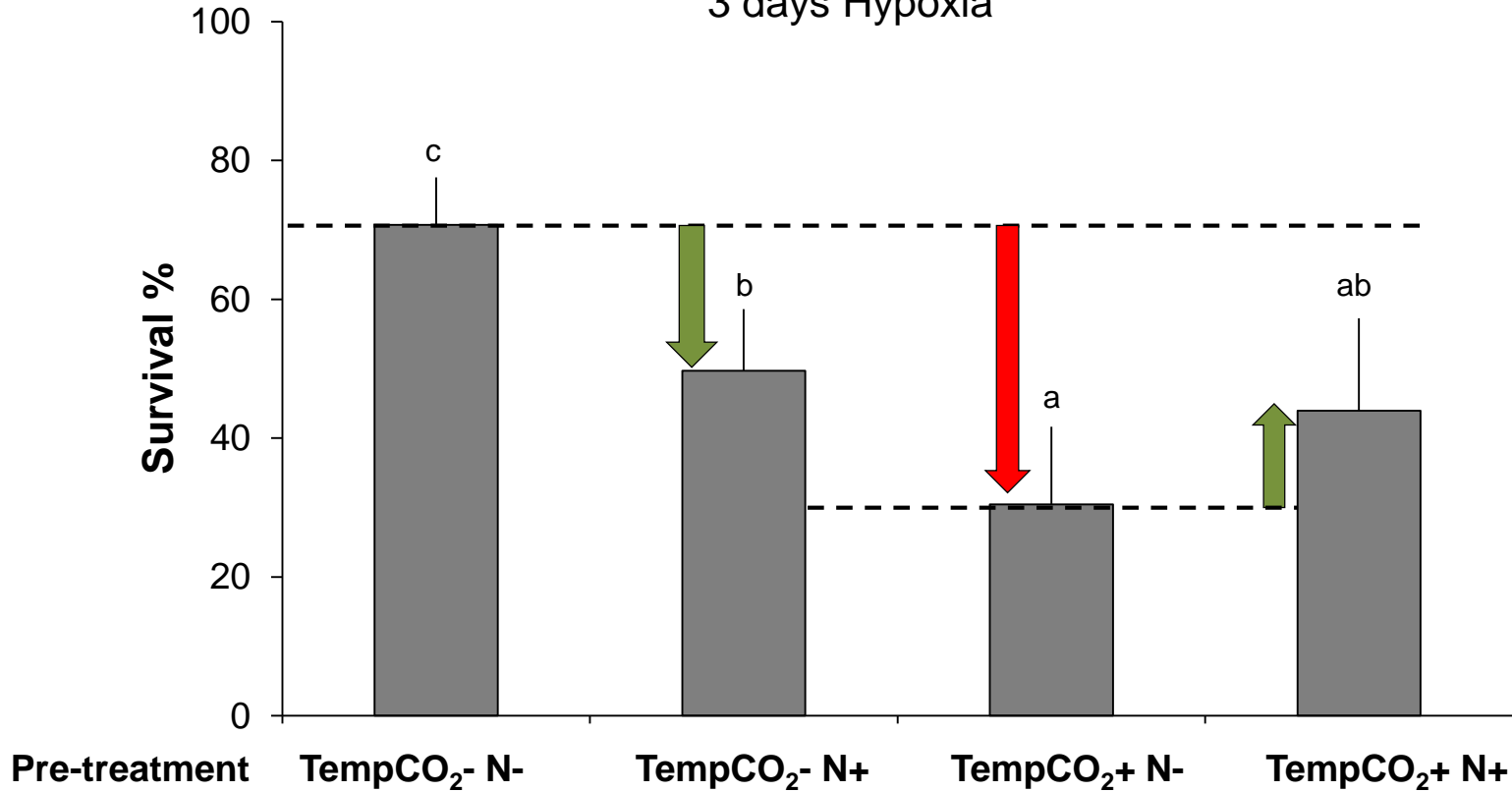
Nutrient enrichment mitigates heat wave stress

Warming during a heat wave decreased survival and growth significantly ($p < 0.0001$)

Nutrient enrichment attenuates the high mortality and growth reduction ($p < 0.0001$)

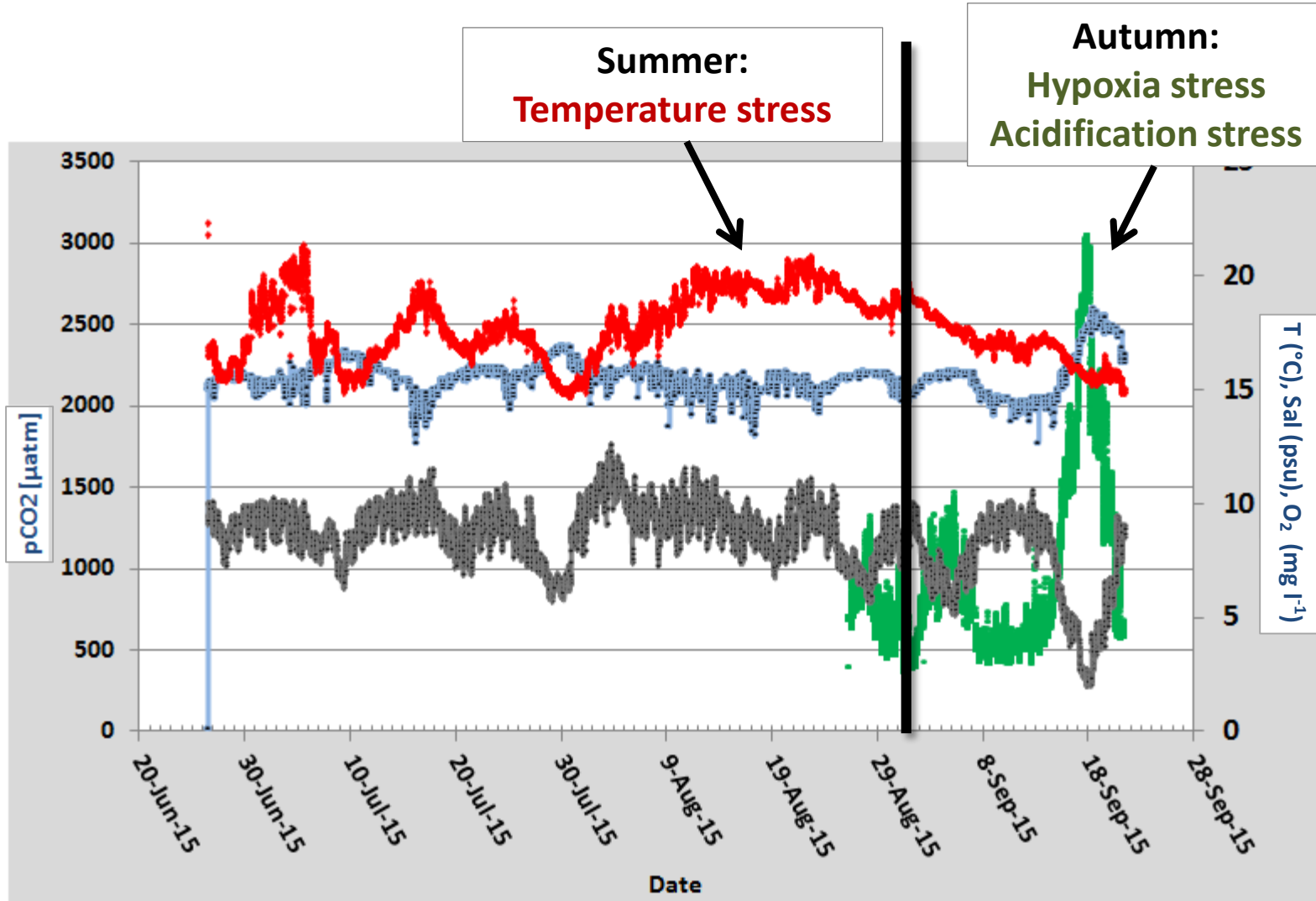


3 days Hypoxia



Survival of *F. vesiculosus* germlings is **strongly decreased under hypoxia** in all groups of pre-treatments

Previous exposure to **warming and acidification decreased the tolerance** to hypoxia stress ($p < 0.001$)



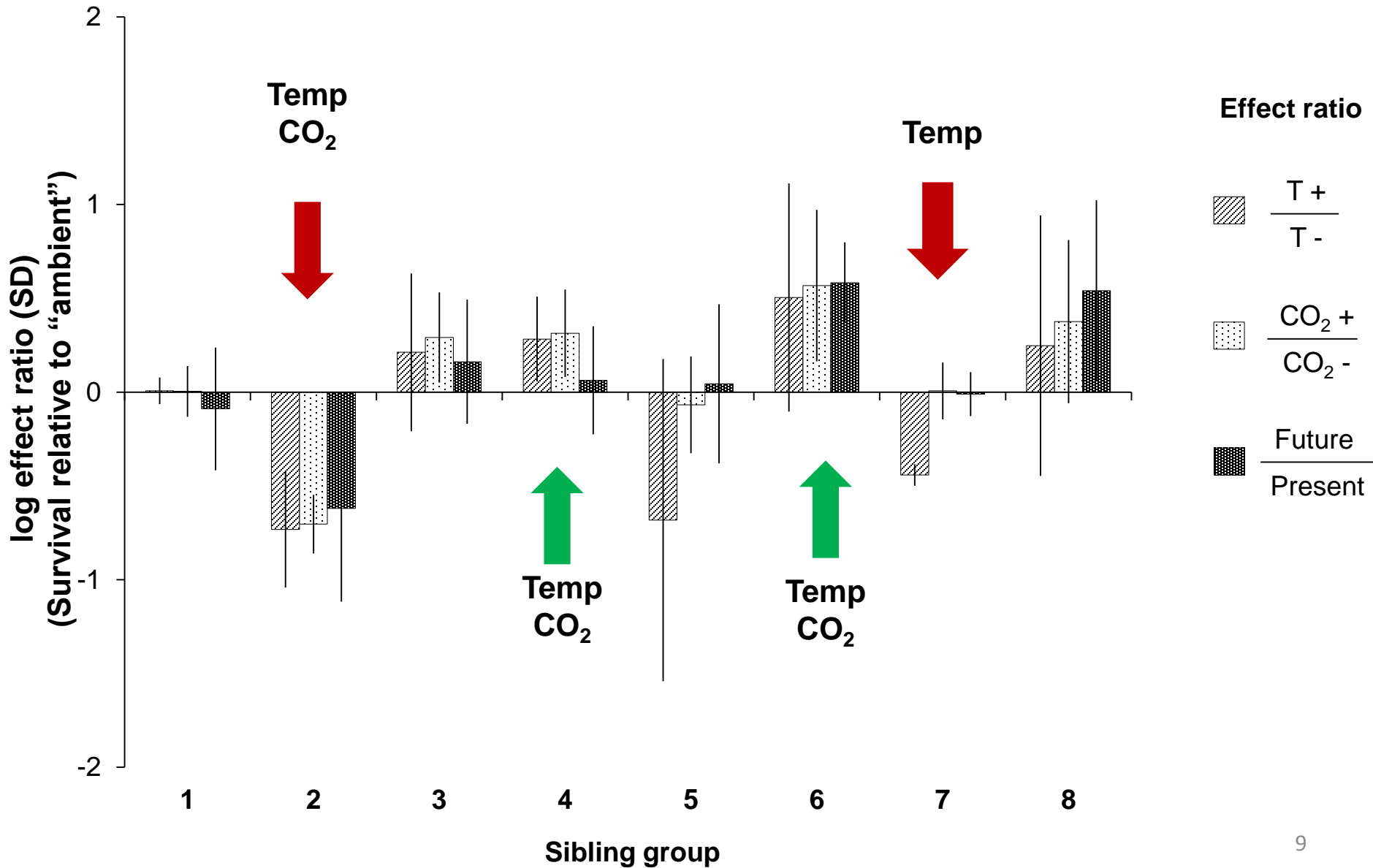
● Temperature

● Salinity

● O₂

● pCO₂

Siblings vary in their response to warming and acidification



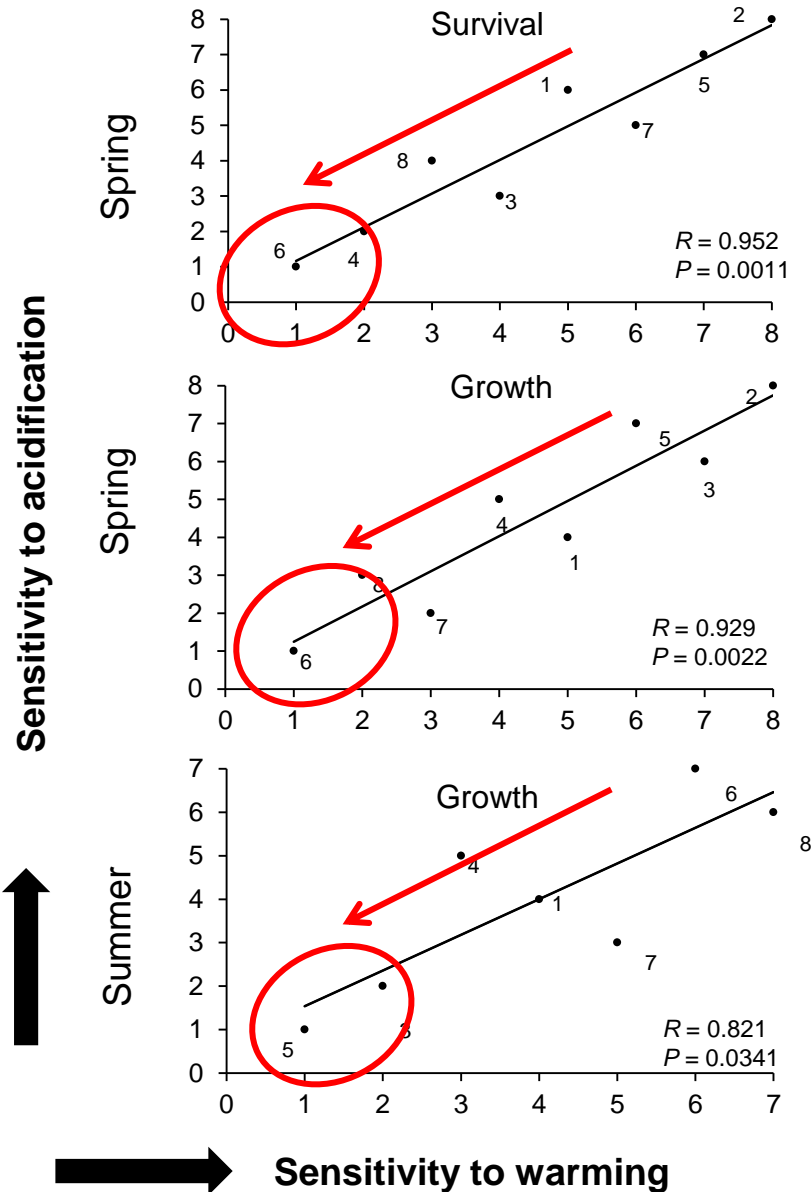
Correlations of sibling groups' sensitivities to warming and OA

Sensitivity to acidification



Sensitivity to warming

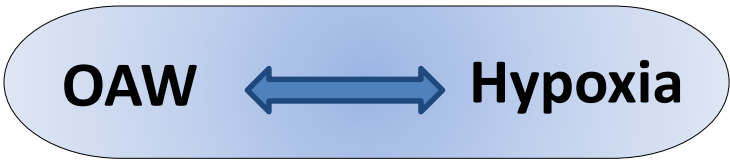
Correlations of sibling groups' sensitivities to warming and OA



Sensitivity to warming and acidification is **positively correlated** ($p < 0.05$)

Direction of selection goes towards the more tolerant genotypes to warming and acidification

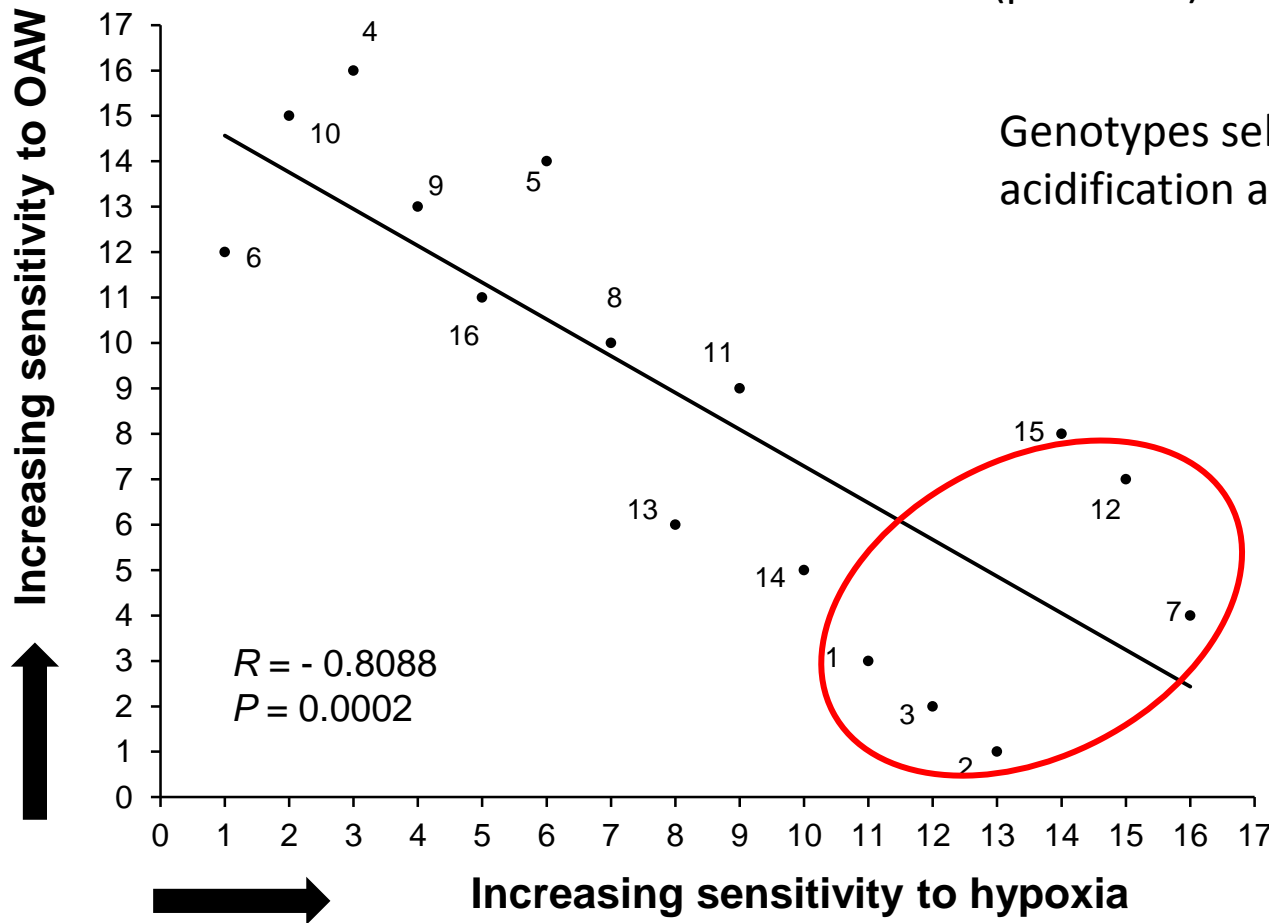
Accelerated rate of adaptation towards genotypes tolerant to warming and acidification

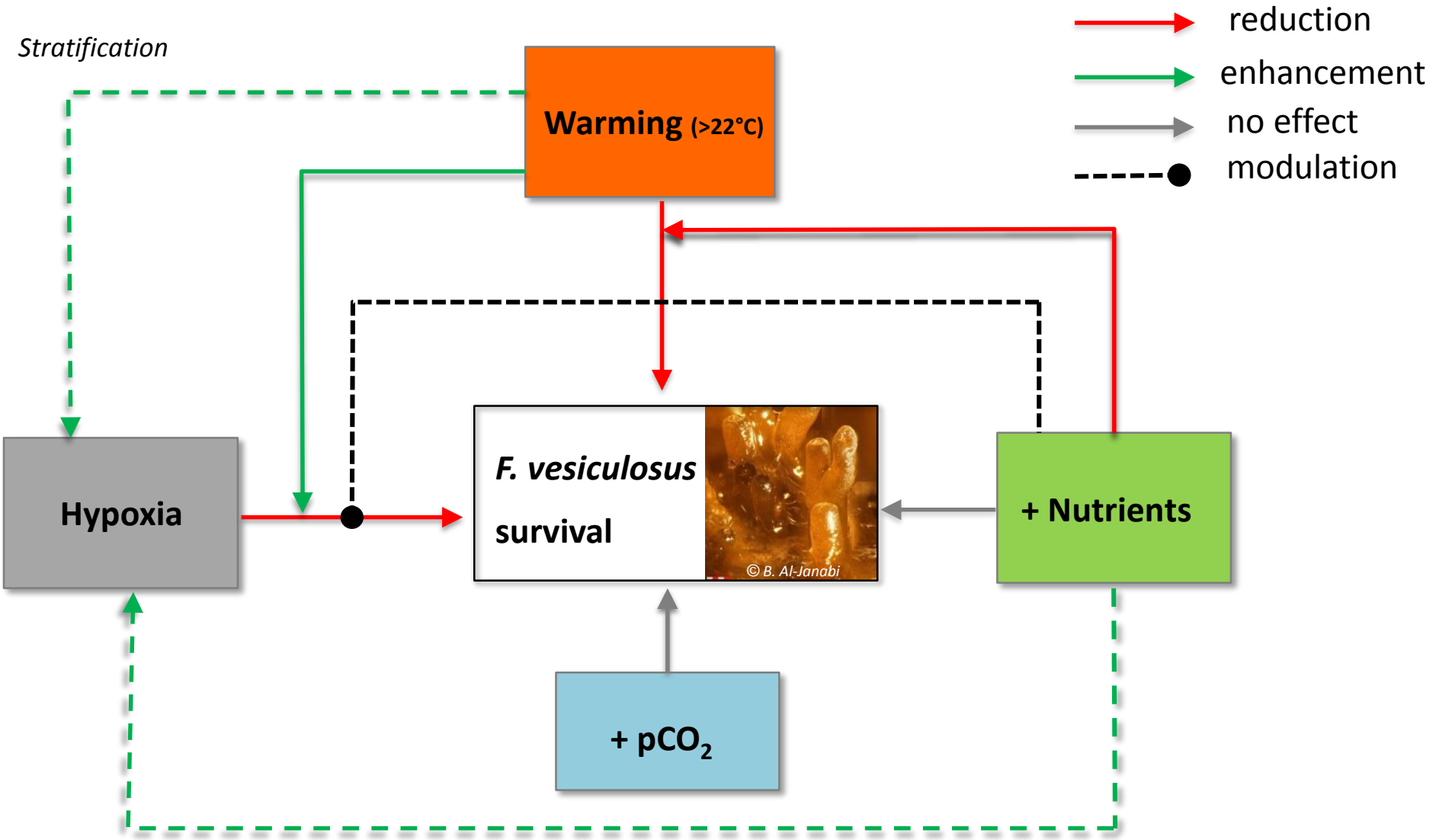


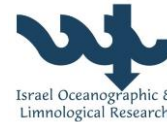
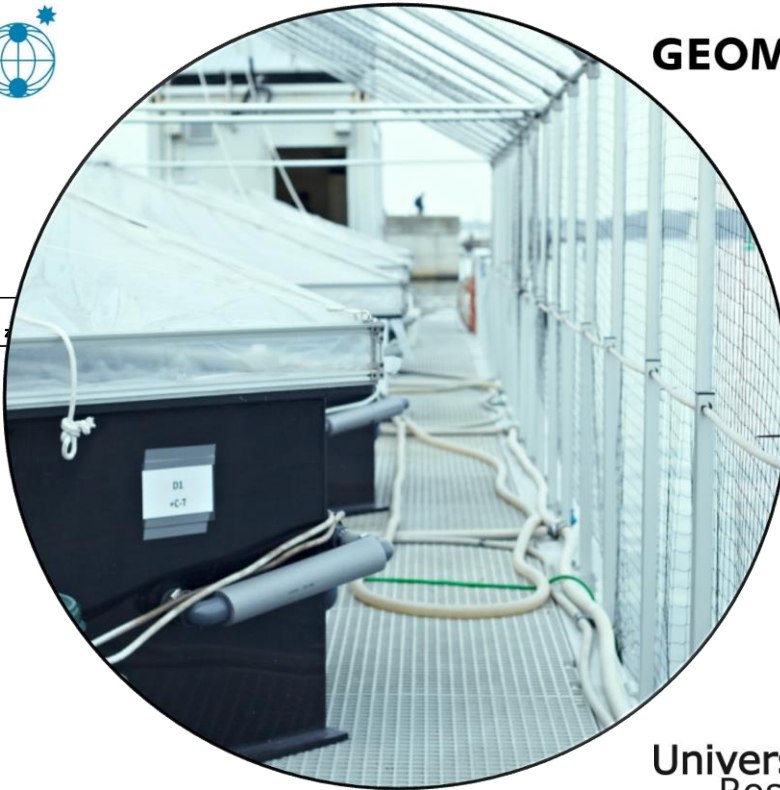
Correlations of sensitivities to OAW and hypoxia

Sensitivity towards warming+acidification and hypoxia is **negatively correlated** ($p < 0.001$)

Genotypes selected under warming and acidification are **most sensitive to hypoxia**







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Thank you for your attention!

