



Precising target NO₃ concentrations to limit green algae blooms in Brittany

Patrick Durand, Sylvain Ballu, Francois Oehler, Pierre-Emmanuel Oms,
Thierry Perrot, Lea Sgro, Pavlo Georgakis, Jordy Salmon-Monviola

► To cite this version:

Patrick Durand, Sylvain Ballu, Francois Oehler, Pierre-Emmanuel Oms, Thierry Perrot, et al.. Precising target NO₃ concentrations to limit green algae blooms in Brittany. 8th Global Nitrogen Conference, May 2021, Berlin, Germany. hal-03340231

HAL Id: hal-03340231

<https://hal.inrae.fr/hal-03340231>

Submitted on 10 Sep 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

WELCOME TO INI2021



8th GLOBAL NITROGEN CONFERENCE

30 MAY – 3 JUNE 2021 | ONLINE

Nitrogen & The UN Sustainable Development Goals



Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety



Precising target NO₃ concentrations to limit green algae blooms in Brittany

Patrick Durand¹, Sylvain Ballu², Francois Oehler³, Pierre-Emmanuel Oms², Thierry Perrot², Lea Sgro¹, Pavlo Georgakis³, Jordy Salmon-Monviola¹

¹ UMR SAS, INRAE-Agrocampus Ouest, Rennes, France

² CEVA, Pleubian, France

³ SCHEME, LE Rheu, France

E-mail: patrick.durand@inrae.fr

Project funded by PLAV2 : 2nd remediation plan for green tides
(*Plan de Lutte contre les Algues Vertes*)

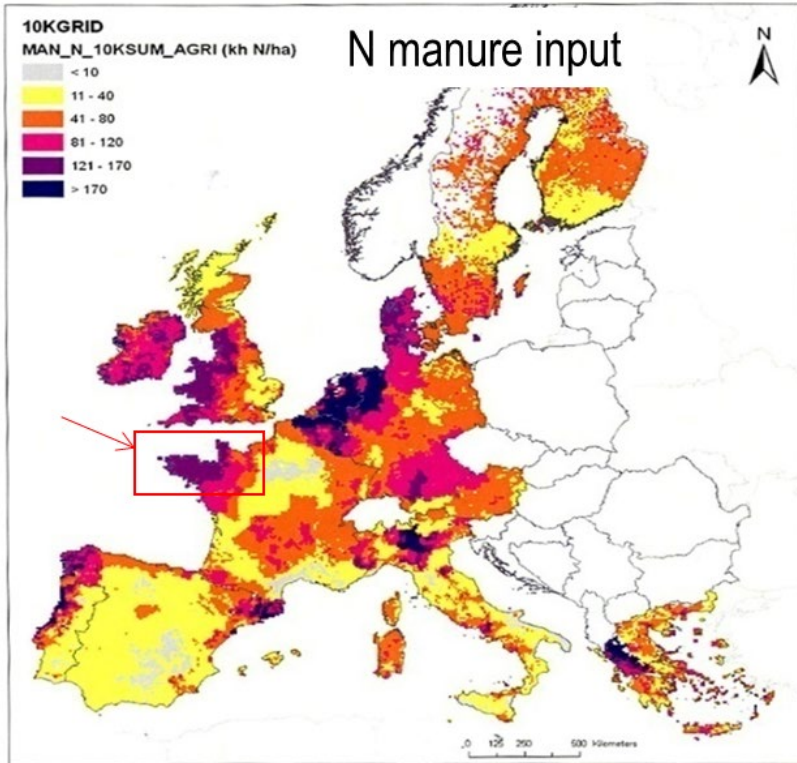
Introduction



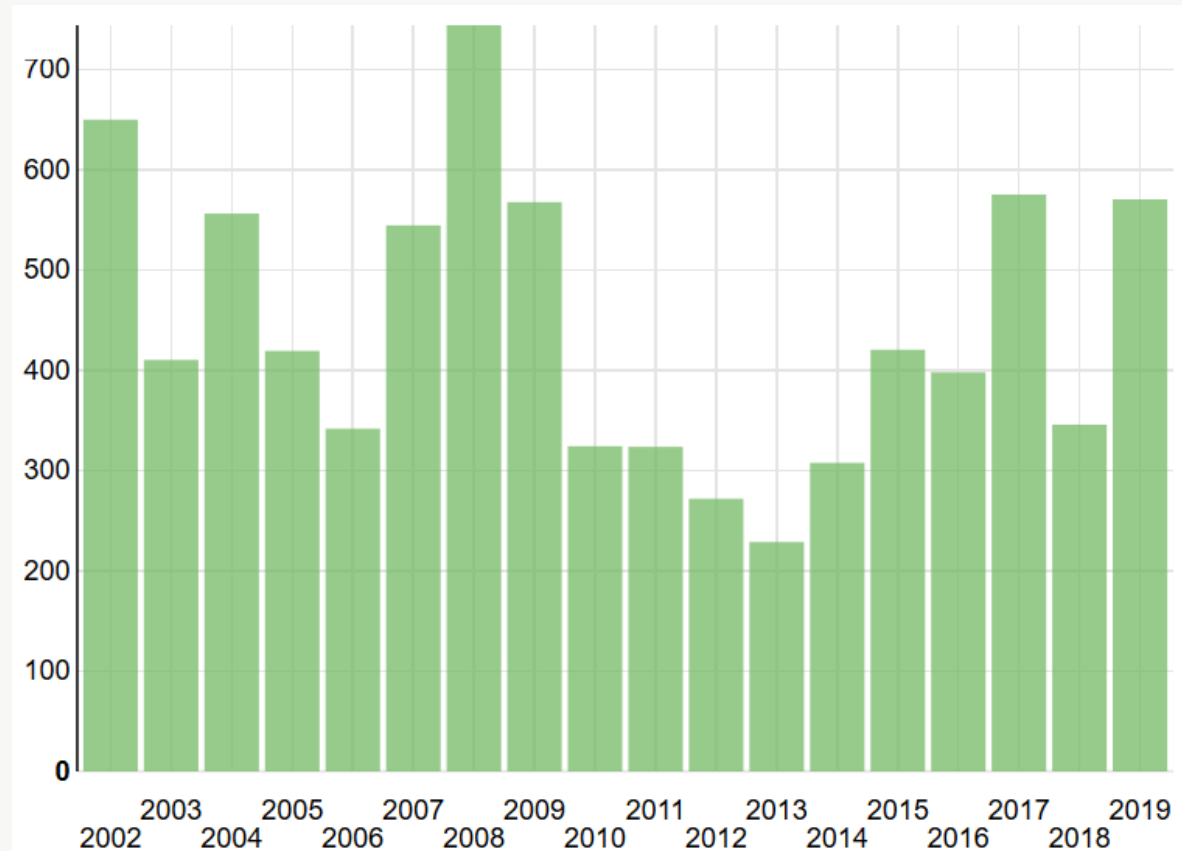
Green Tides (GT):
Macroalgal blooms (*Ulva* sp.)
Closed bays with shallow waters
enriched in N,P, usually from river
loads



Introduction (2)

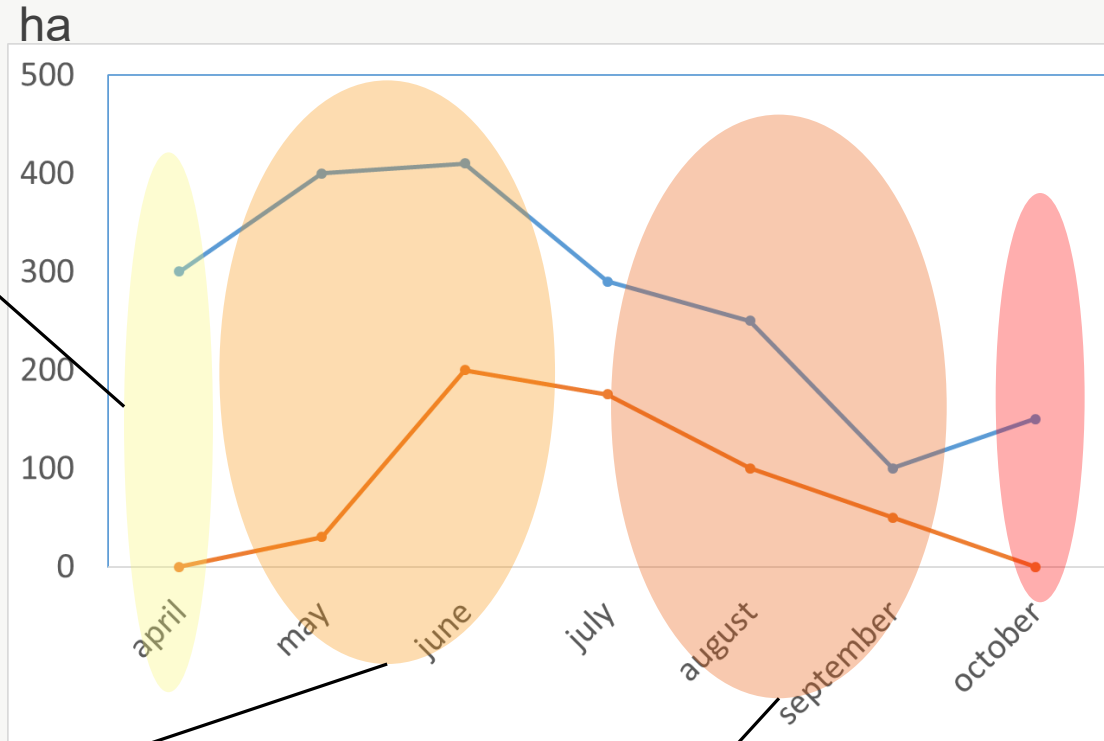


Western France suffers from GT since the 1970's, mainly due to intensive agriculture
Large variations of beached biomass since 2000



Introduction (3)

Beaching areas for 2 contrasting years



Initial pool:

Antecedent autumn pool,

Winter storms

Autumn residual pool

Light, temperature, storms

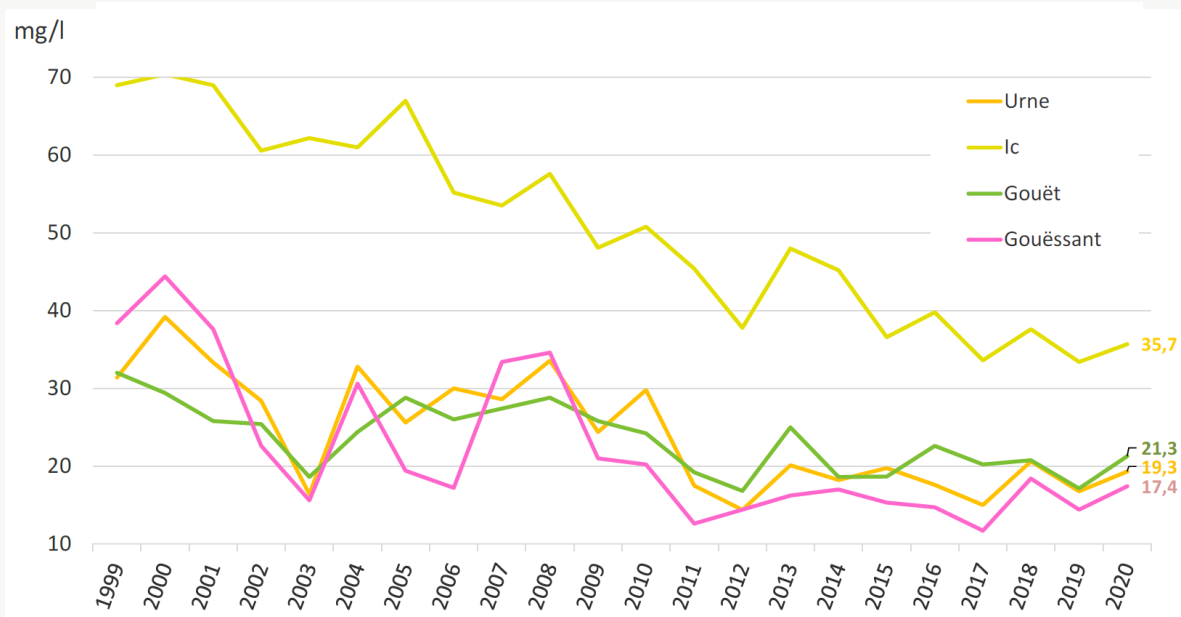
Spring growth:

Sea temperature, light

Late summer growth
N supply

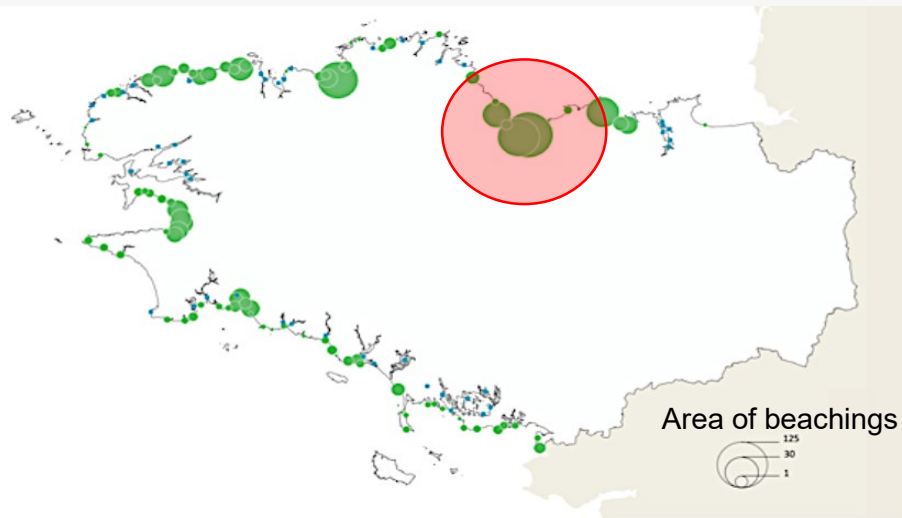
Agricultural practices
Spring rainfall

Hypotheses and questions



1. Does NO₃ decrease responsible for increasing variations of GT, or only climate variations?
2. Would further NO₃ decrease avoid large GT when other factors favorable for algal growth?
3. Would future climate scenarios increase or decrease the risk of GT?

Study site



Bay of St Brieuc : Largest GT in Brittany.

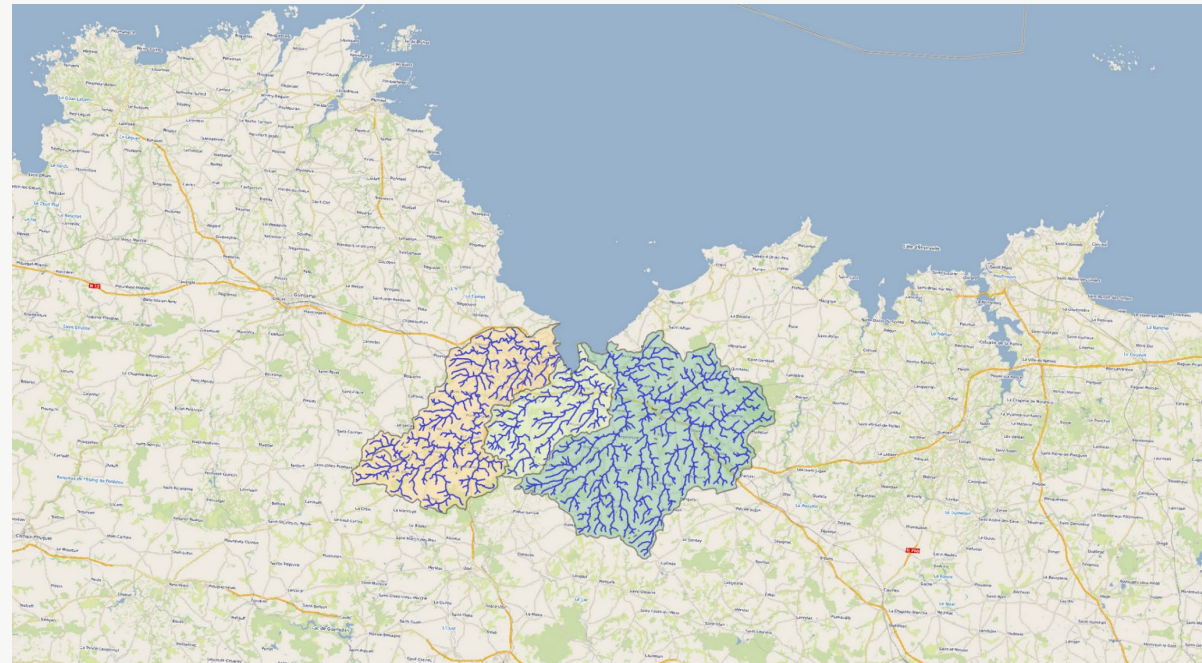
Contributing catchments: 825 km²

Climate: oceanic temperate

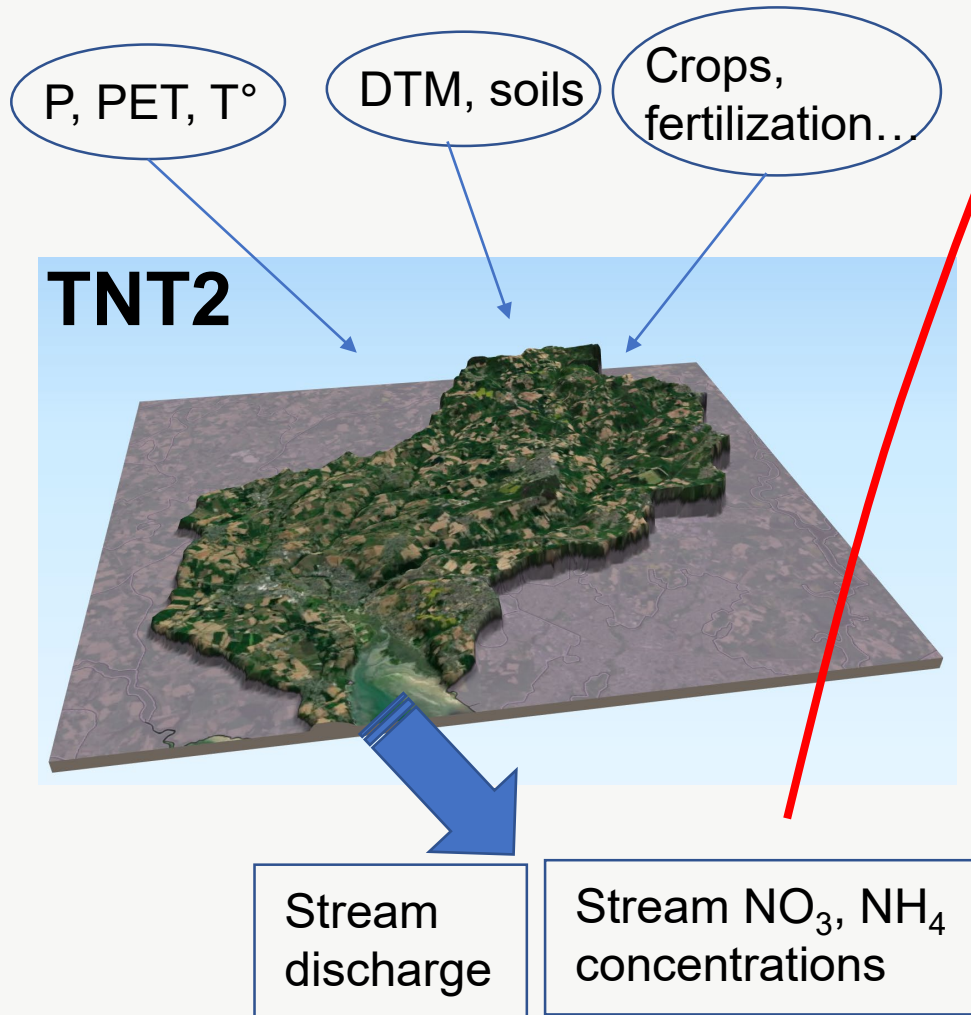
Rainfall: 800 mm/year

Mean temperature: 9°C

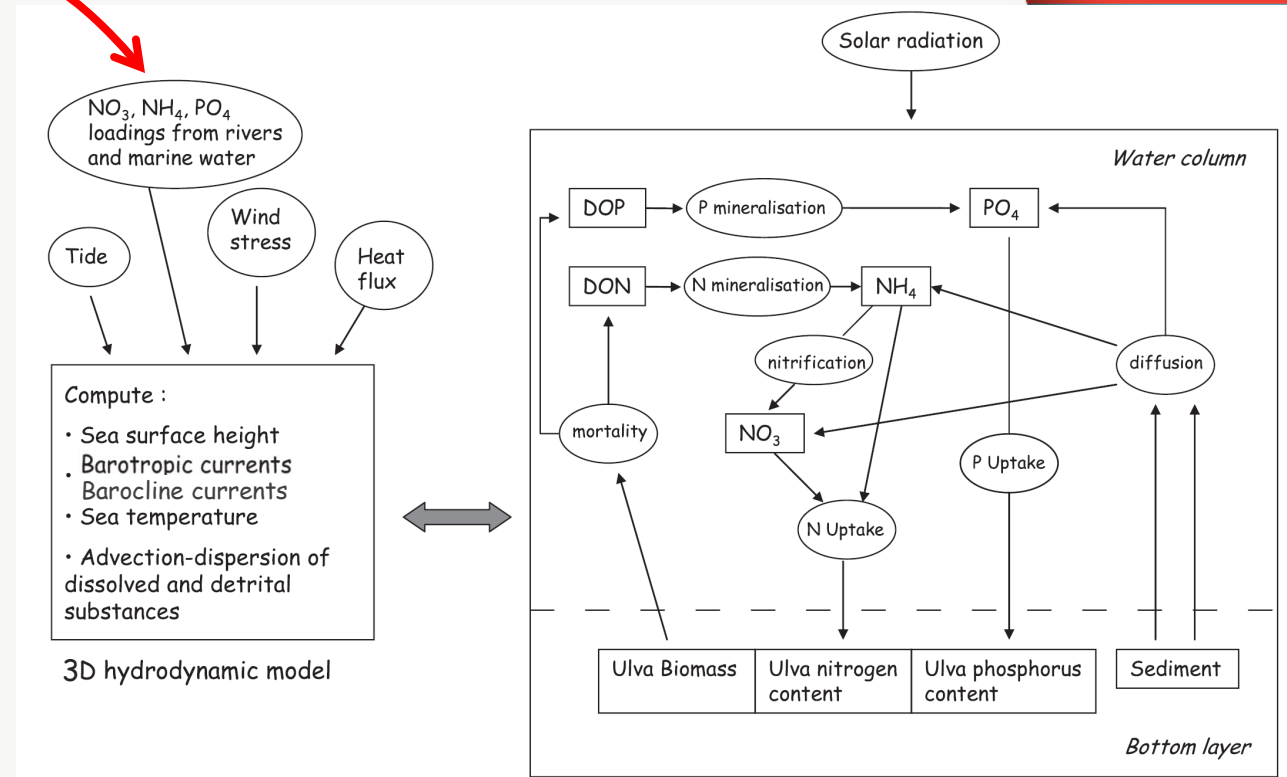
Mean N-NO₃ ~ 6mg/L



Methods (1)



ECO-MARS-ULVES



Methods (2)

Step 1: Simulation of observed period : 2008-2018

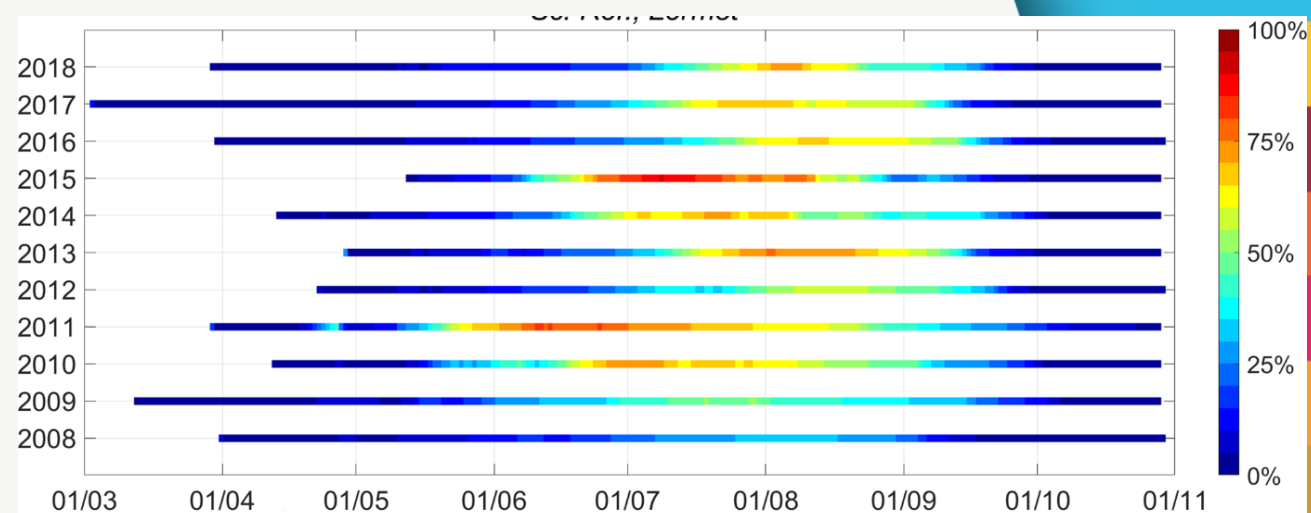
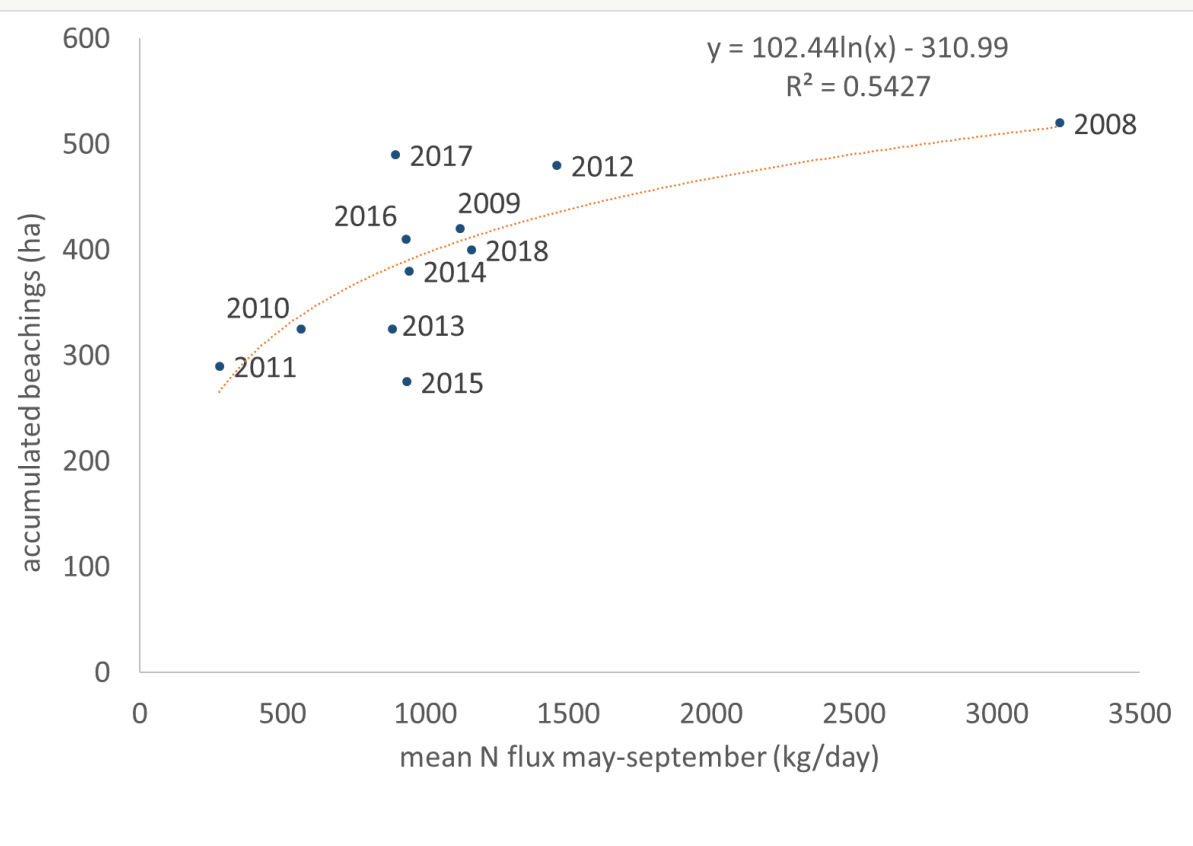
Step 2: Simulation of reduced N loads with same climate

Step 3 : Simulation of past (higher) N loads with same climate

Step 4: simulation of present and reduced N loads with climate projections

Results

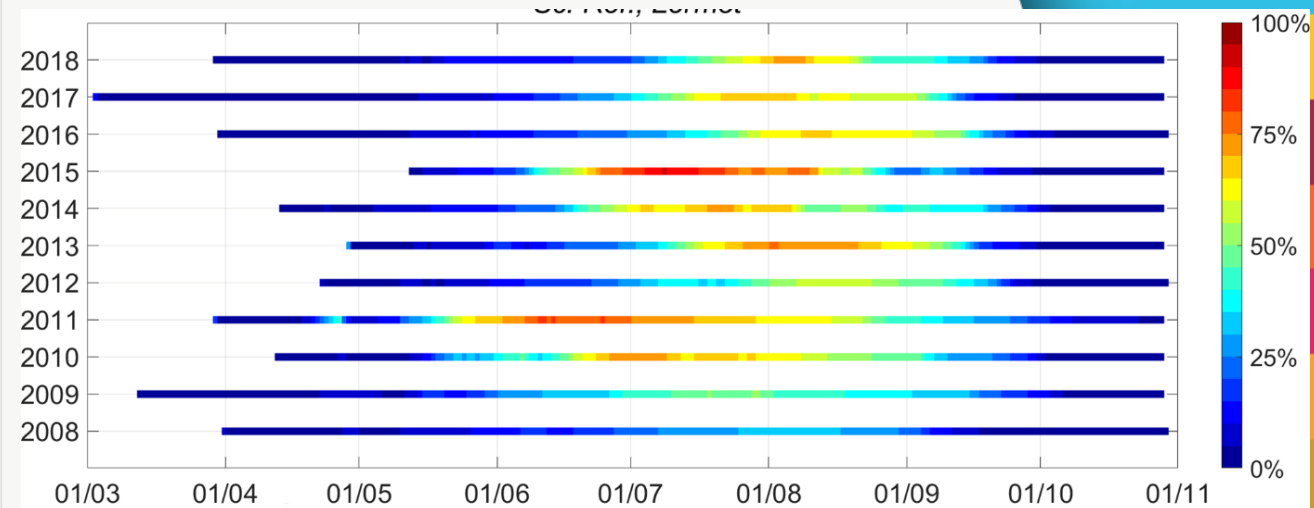
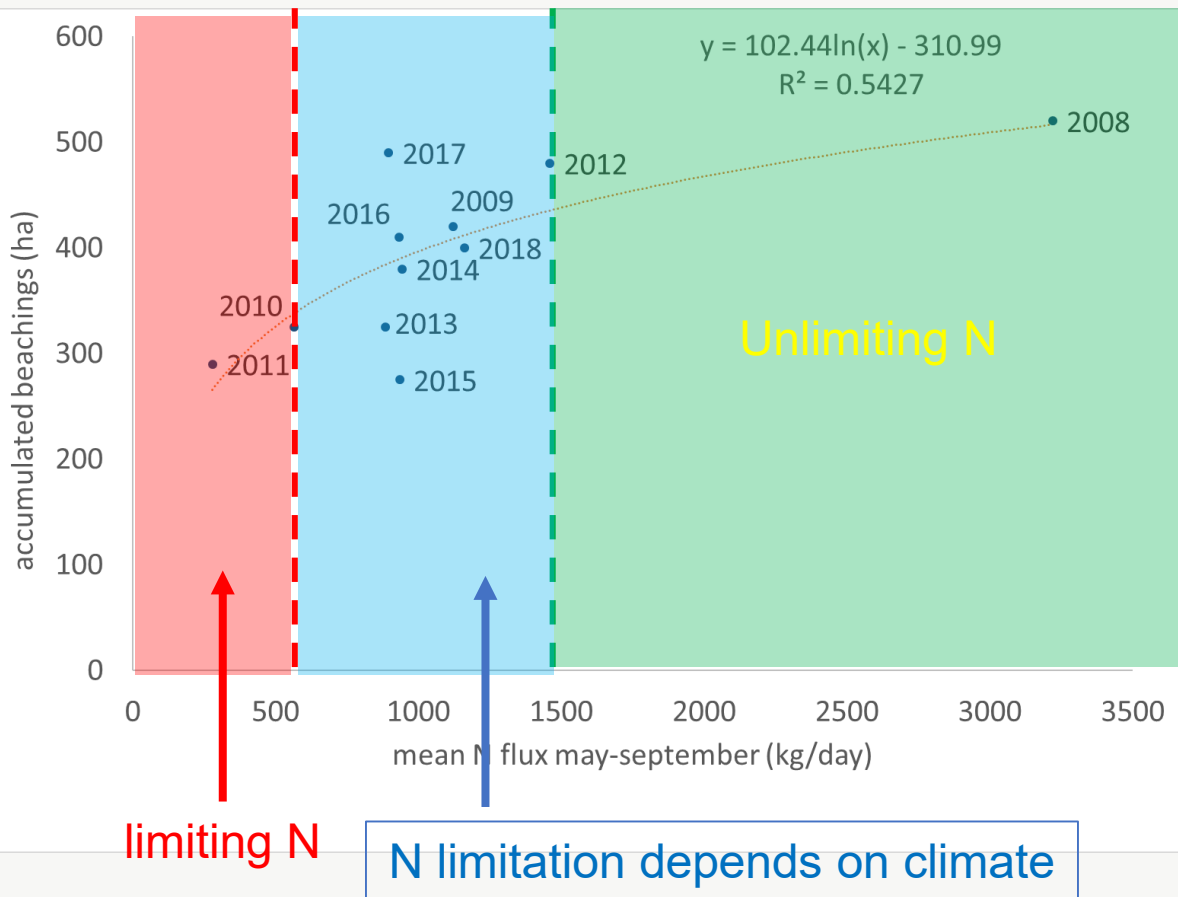
N fluxes vs. area of beach covered by algae



% of growth limitation by N

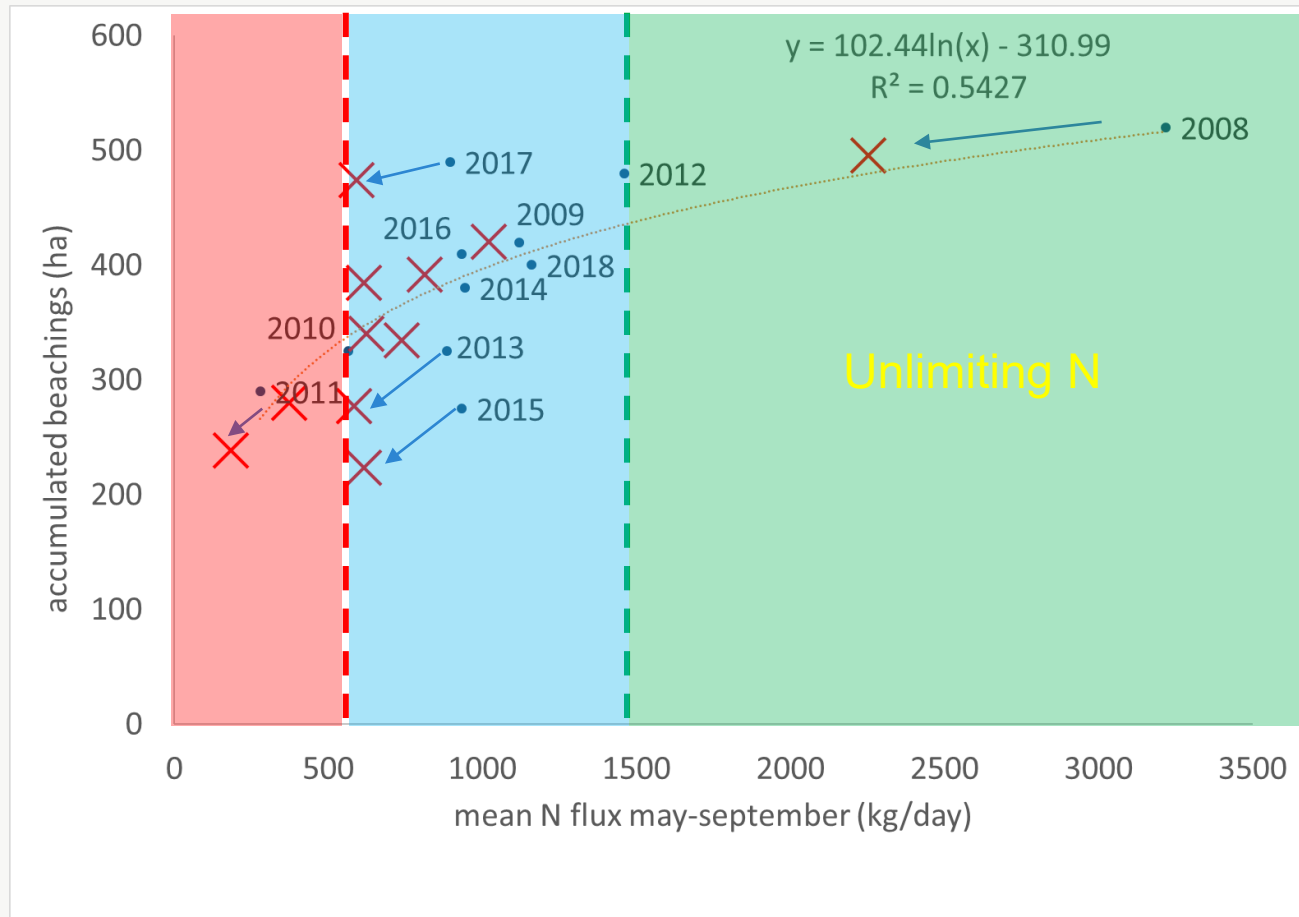
Results

N fluxes vs. area of beach covered by algae



% of growth limitation by N

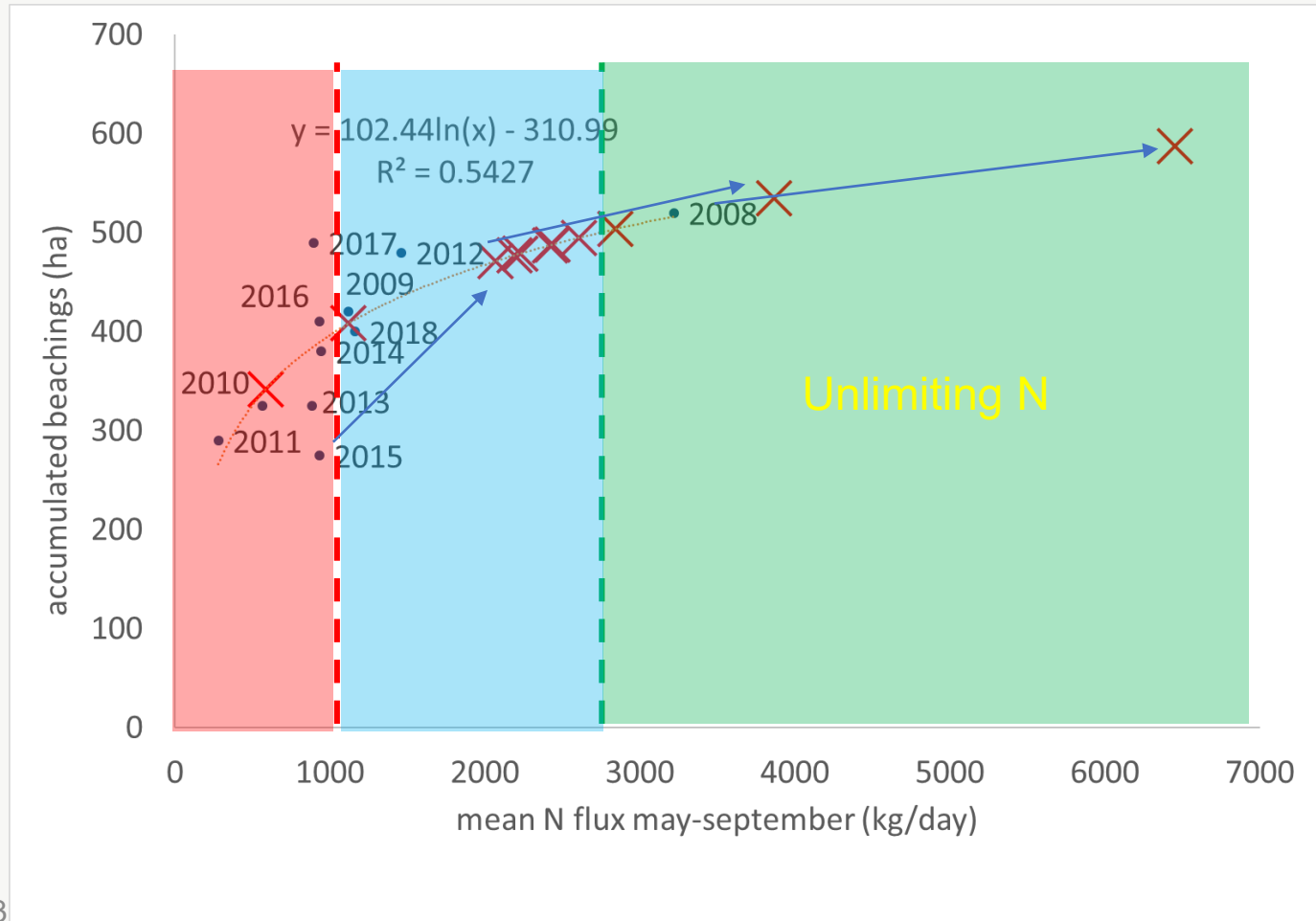
Impact of 30% N flux reduction



Only 10% biomass reduction :

Bad years would remain bad years...

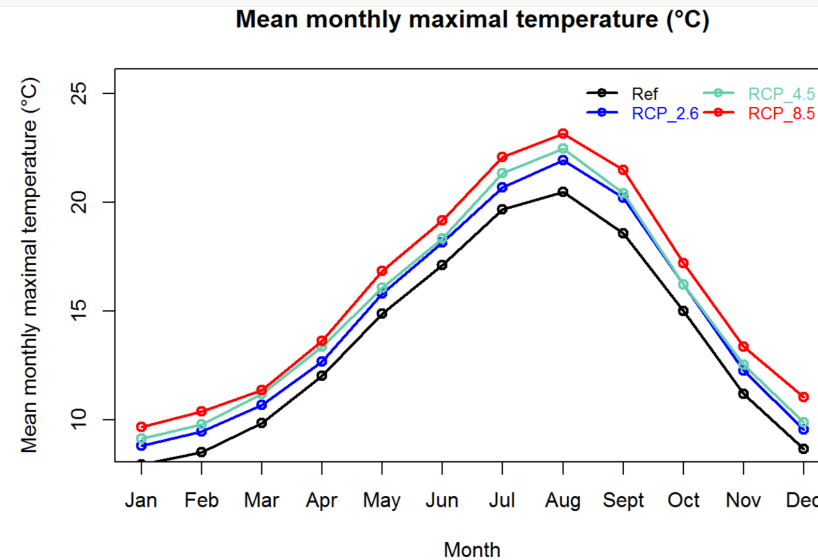
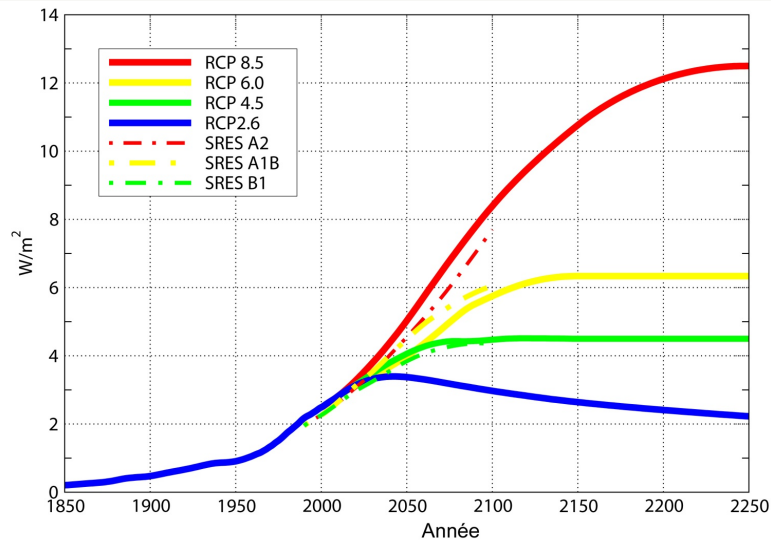
What if N03 directive and national regulations had not existed?



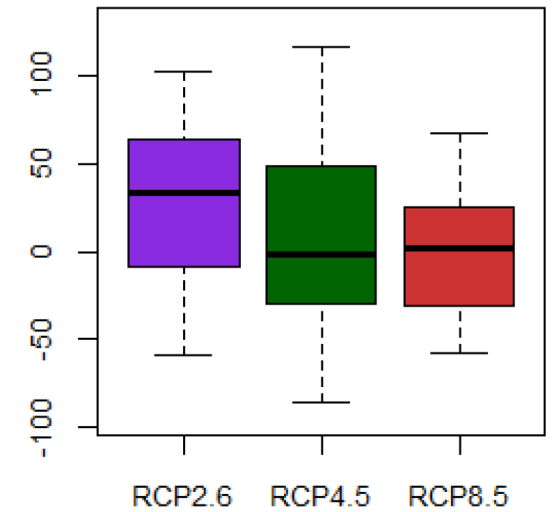
Probably only one
« good » year in the
decade

most « good » years would
have been bad years...

Climate scenarios



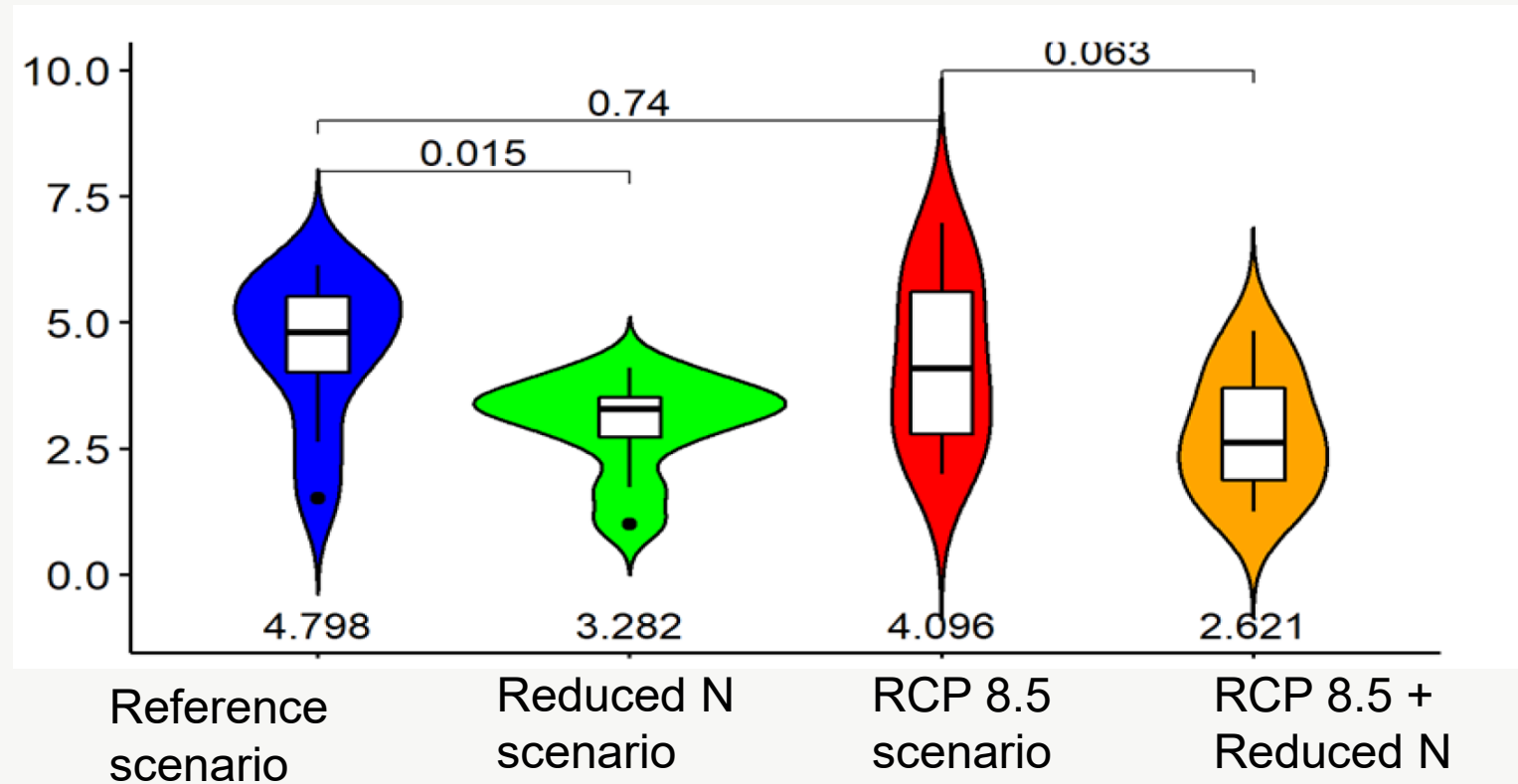
Precipitation MJJ change 2030-2060 (%)



Selected scenario: RCP 8.5 for 2030-2060

Impact of climate scenarios

Summer N flux (kg/ha)



Eco-MARS : very limited >0 impact of increased water temperature

Conclusions

Results need consolidation :

- ✓ The simulation of (uncertain) low flow/concentration data by hydrological model is difficult
- ✓ Ecological model overestimated biomass in late summer-autumn -> *underestimation of impact of reduced N scenario?*
- ✓ Simulation of 7 other bays in progress.

Main messages :

- ✓ Limited N reduction will not improve « bad » years green tides *other solutions to reduce initial pools and spring growth?*
- ✓ No significant impact of climate change in the next decades (probably more impact of other anthropogenic changes)