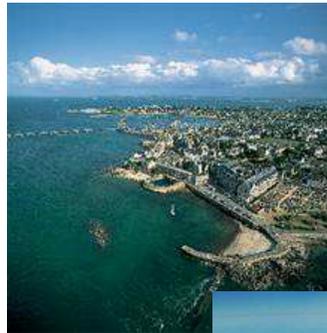
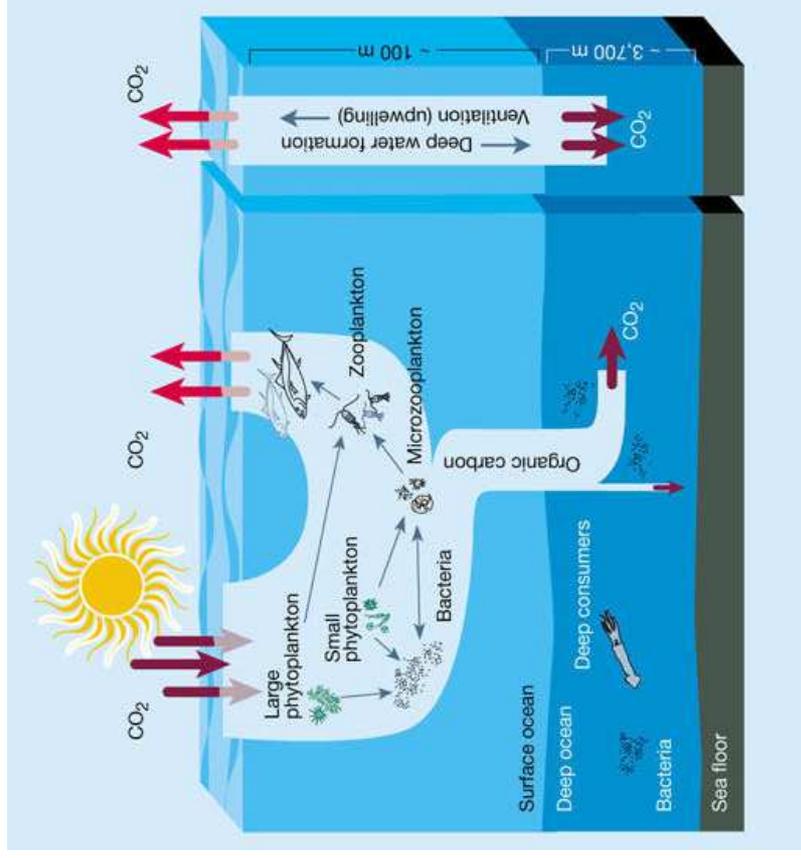
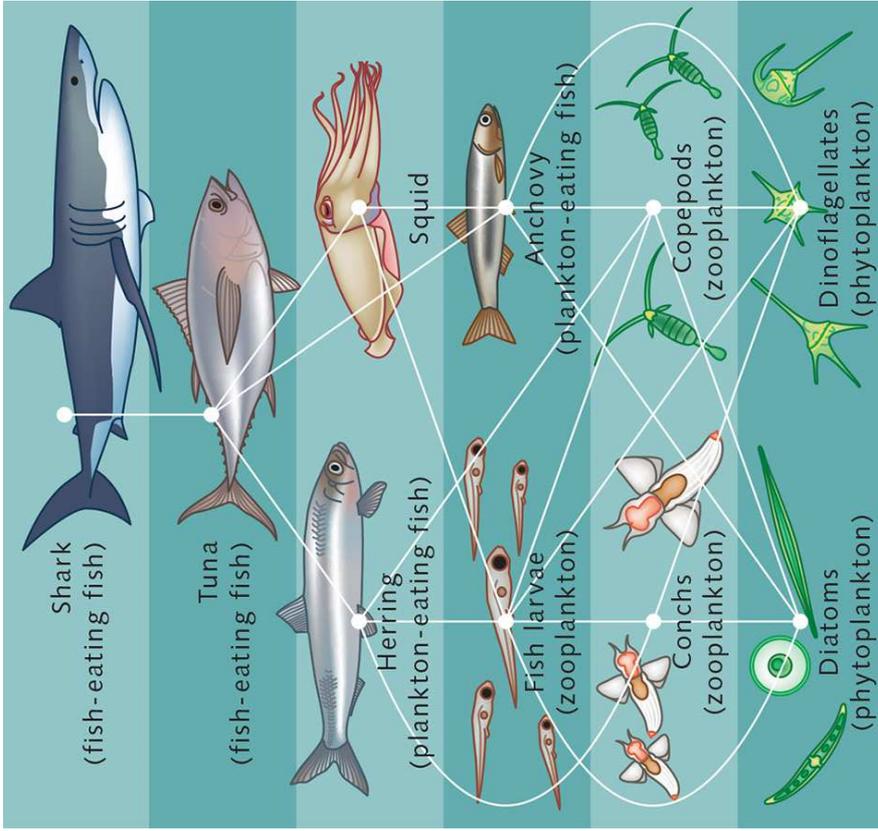
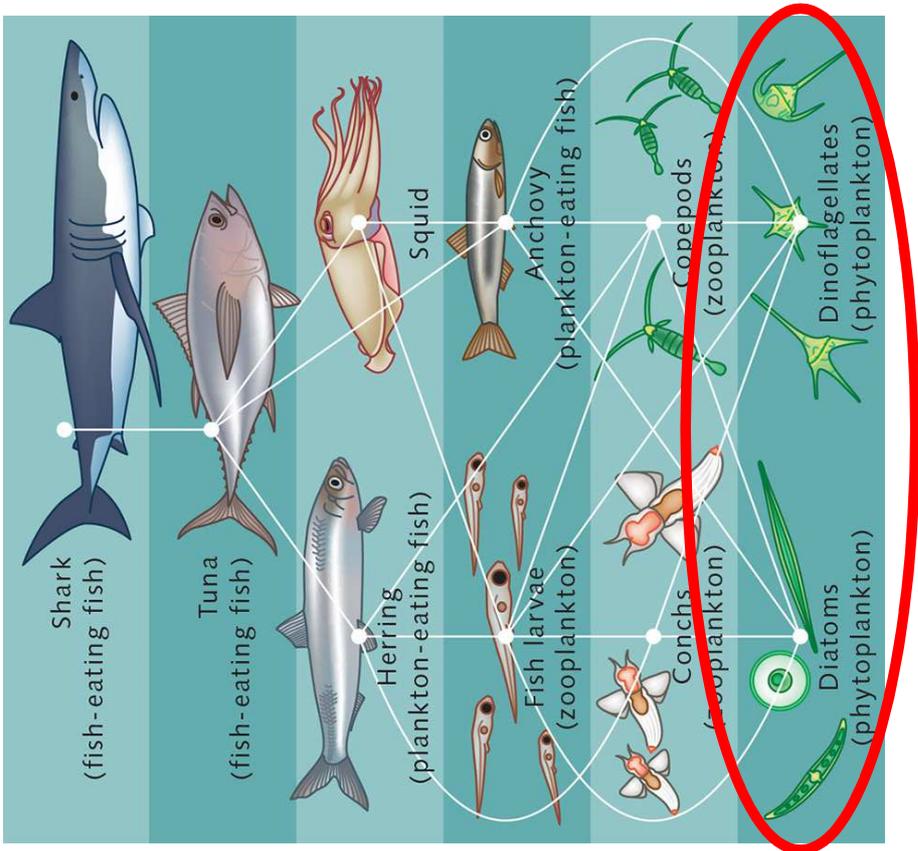
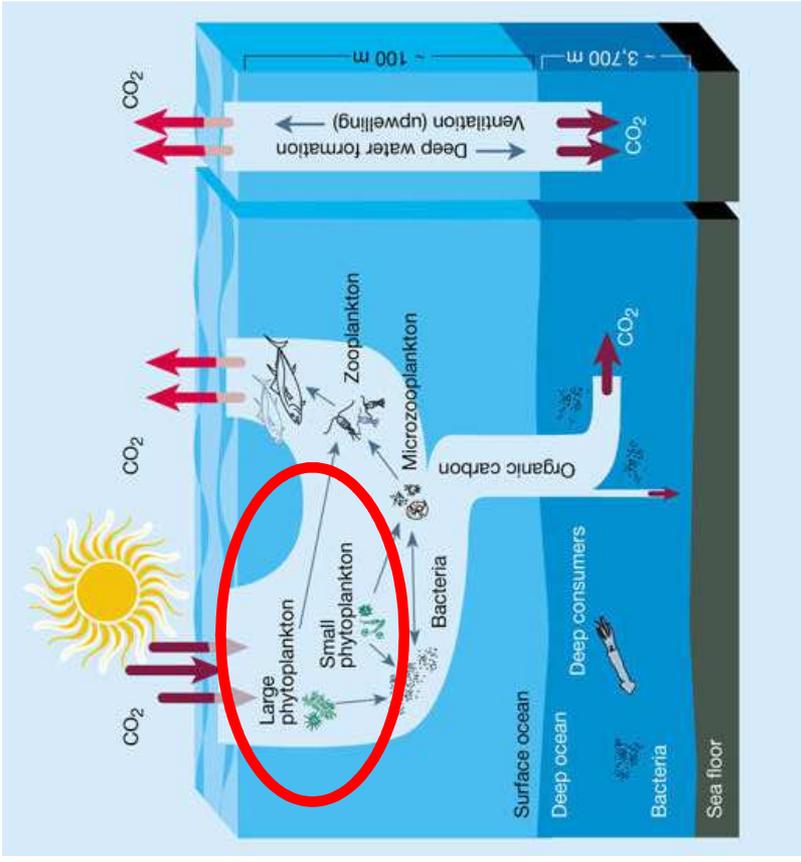


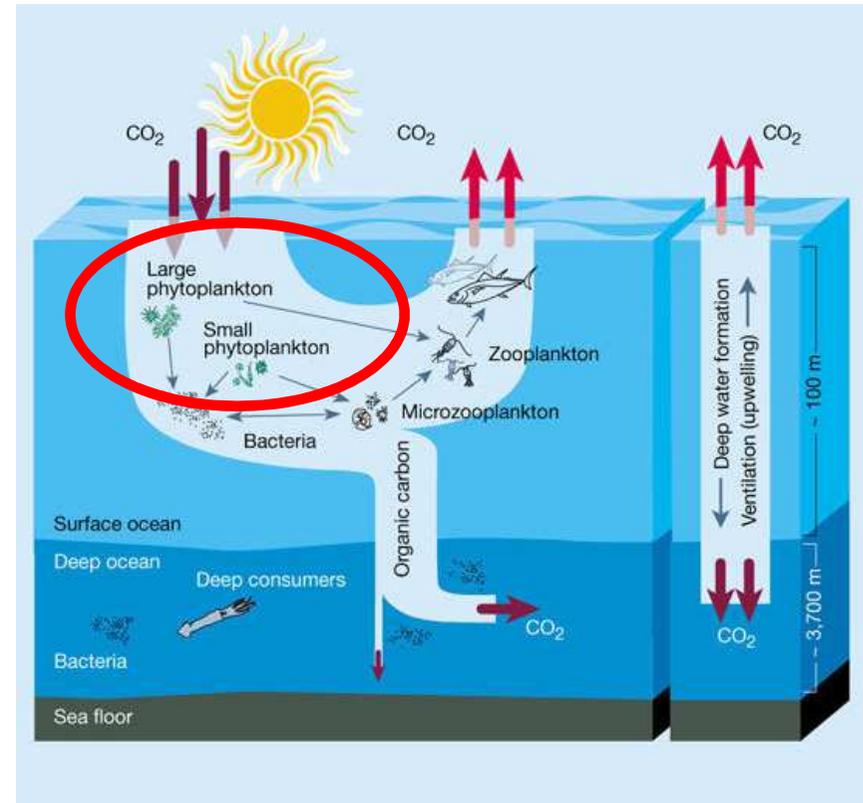
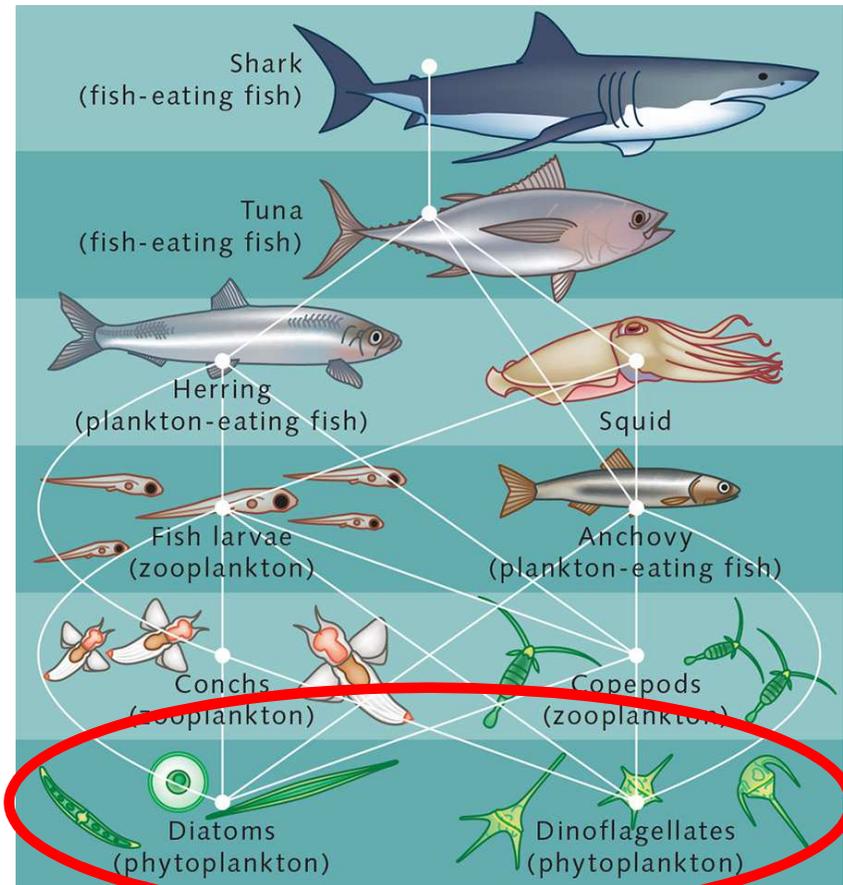
Evolution décennale du fonctionnement des écosystèmes côtiers : nutriments et biomasse chlorophyllienne

Rodriguez S., Del Amo Y., David V., Bourasseau L., Bozec Y., Cariou T., Cordier M.A., Costes L., Ferreira S., Grossteffan E., L'Helguen S., Macé E., Rigaut-Jalabert F., Rimmelin-Maury P., Sauriau P.G. and Savoye N.







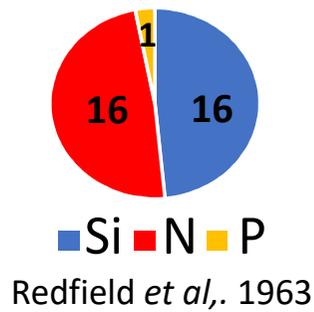


Nutriments

NO₃⁻, NO₂⁻

PO₄

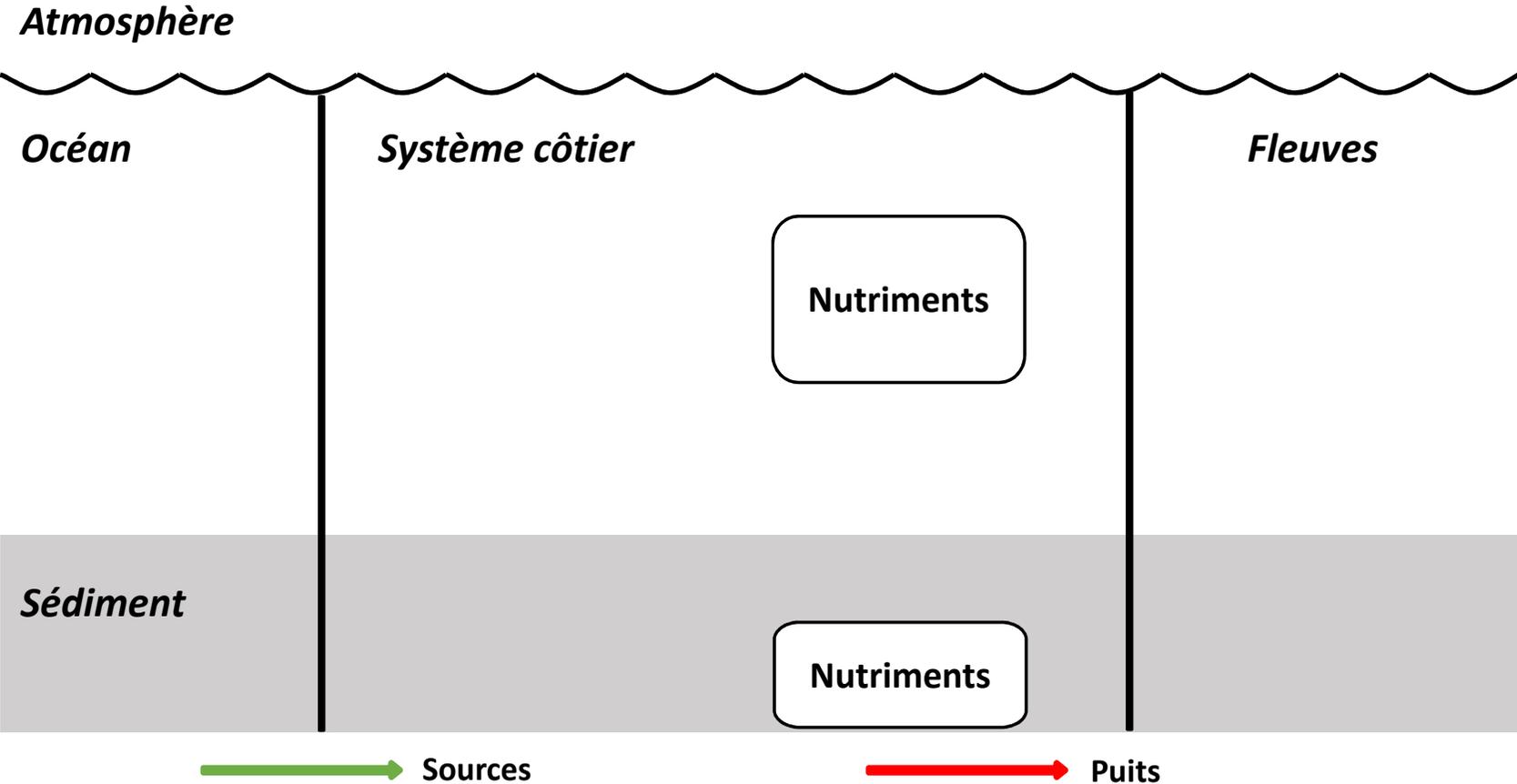
Si(OH)₄



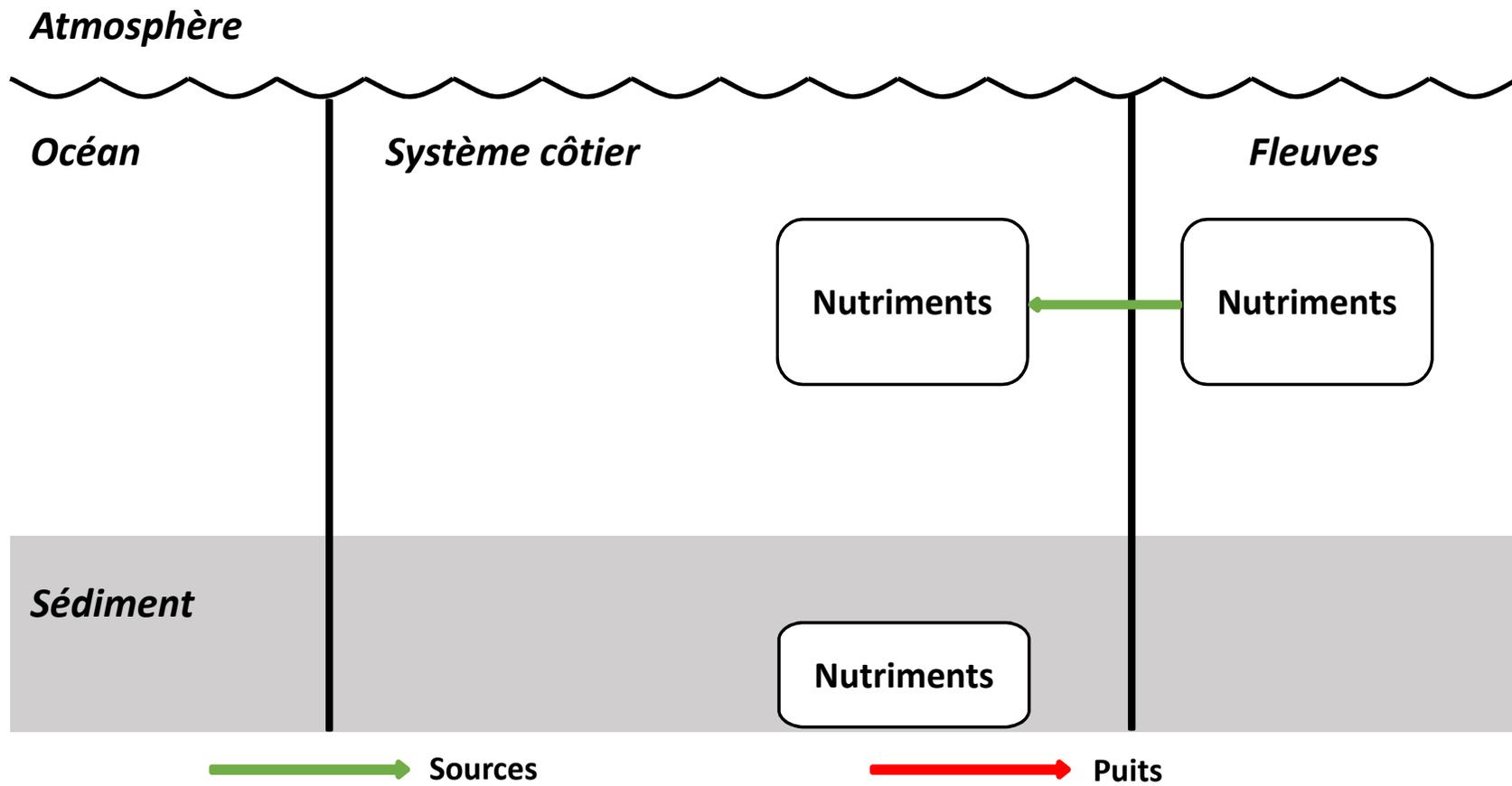
Limitation

Biomasse phytoplanktonique & Communautés phytoplanktoniques

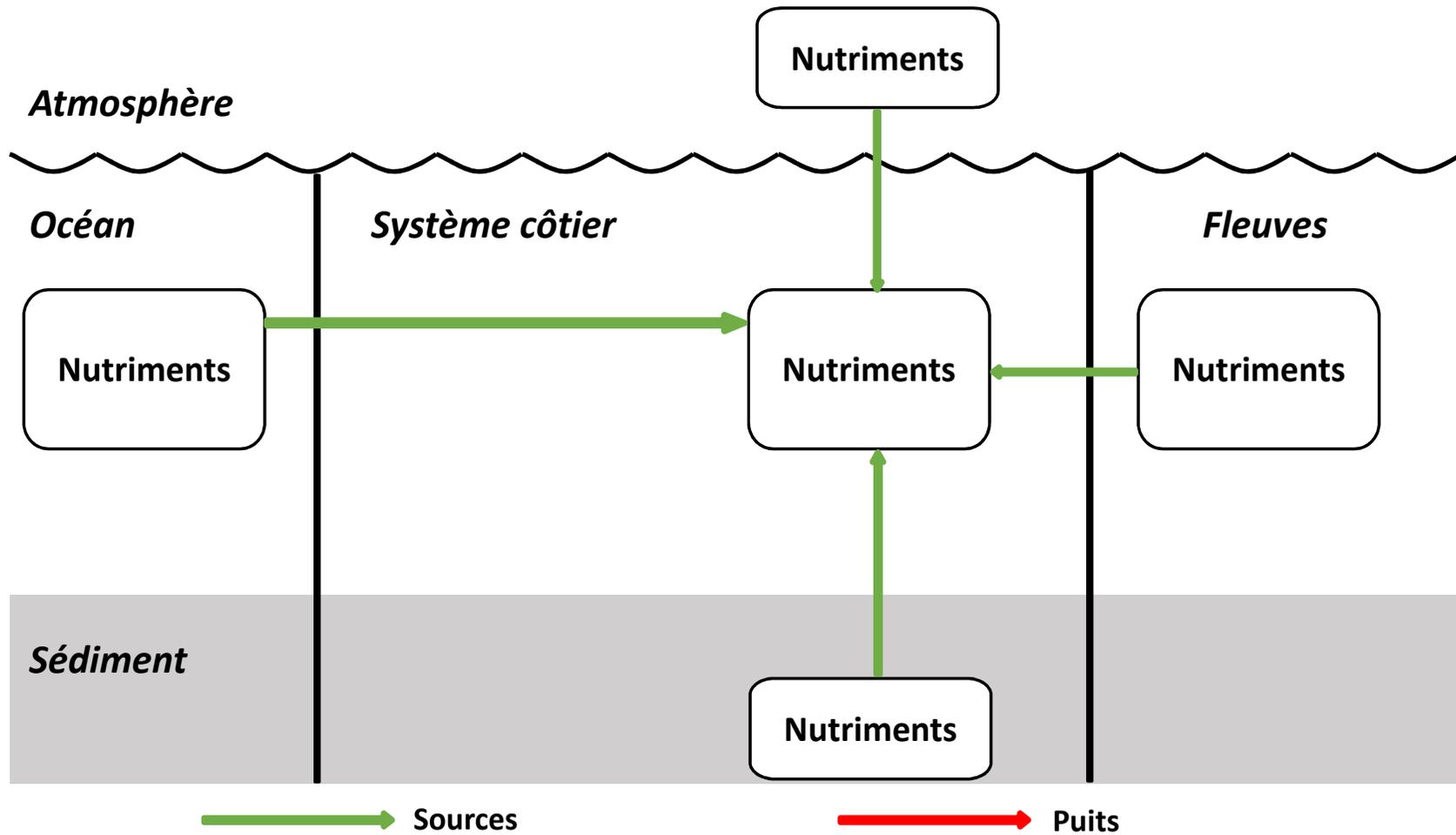
Les nutriments dans les systèmes côtiers



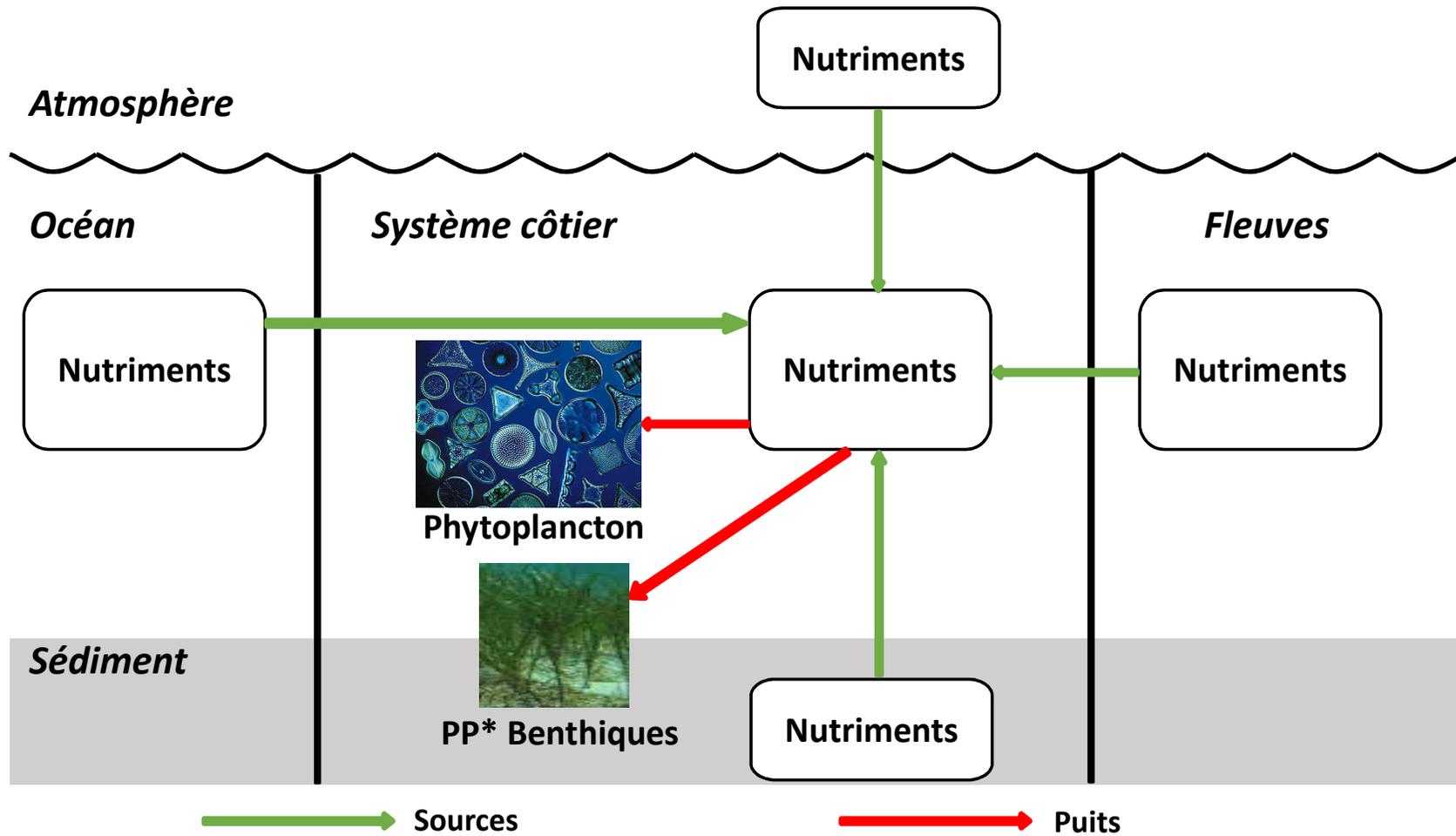
Les nutriments dans les systèmes côtiers



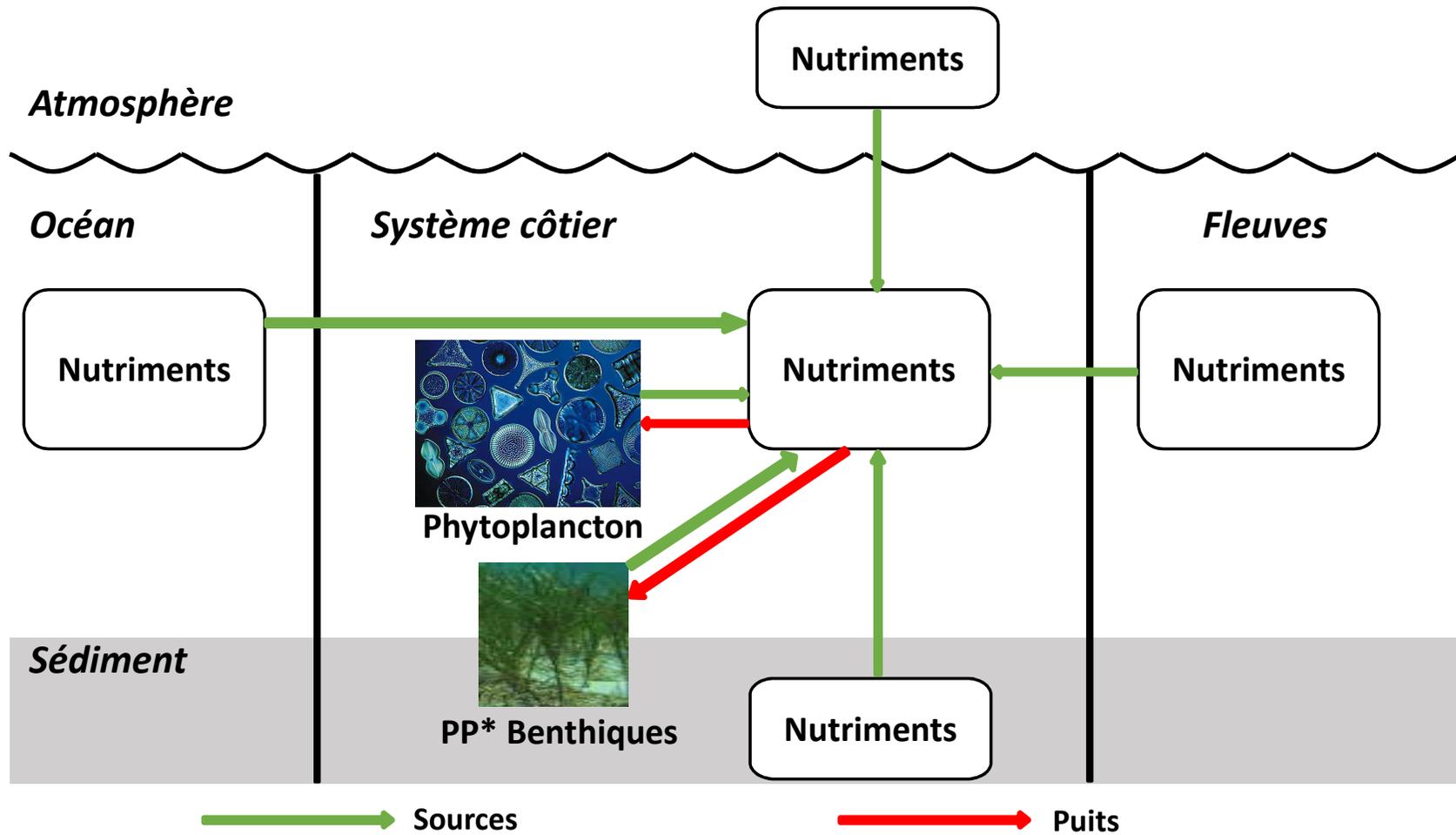
Les nutriments dans les systèmes côtiers

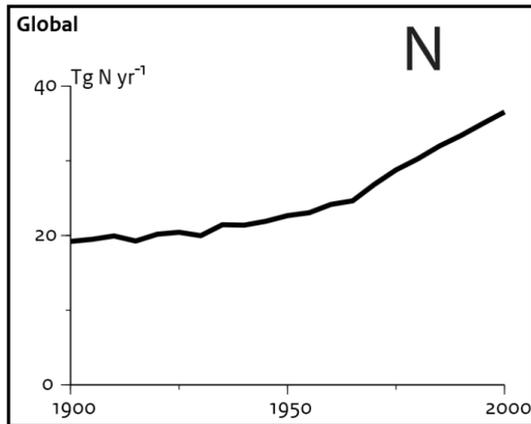


Les nutriments dans les systèmes côtiers

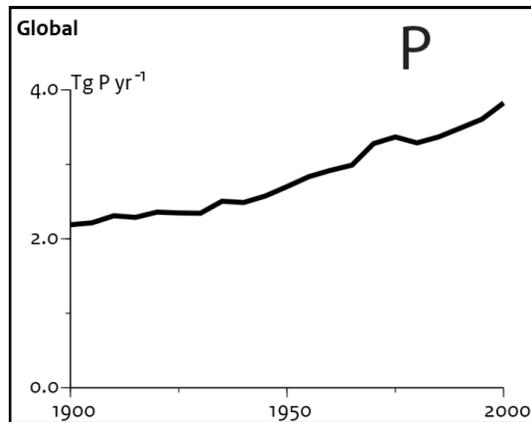


Les nutriments dans les systèmes côtiers



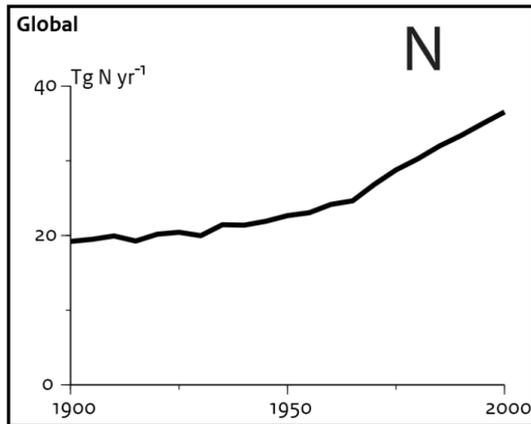


19 - 37 Tg.an⁻¹
 → + 90%

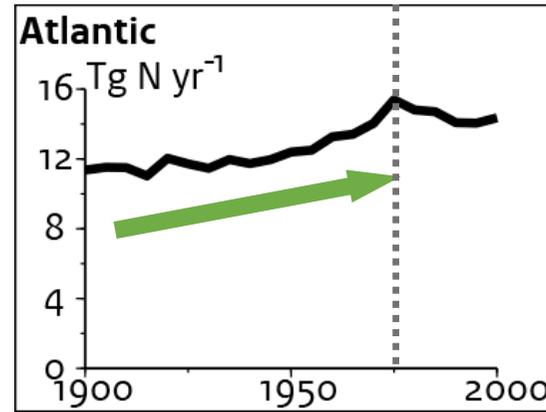


2 - 4 Tg.an⁻¹
 → + 75%

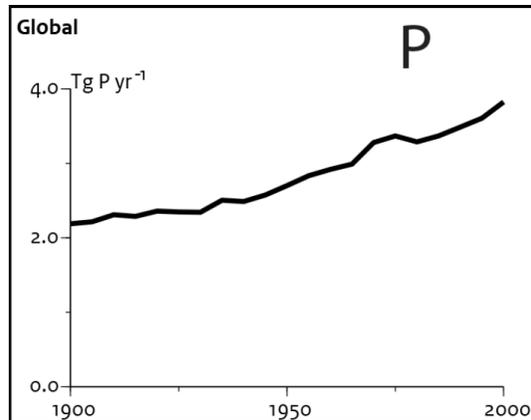
Beusen *et al.*, 2016



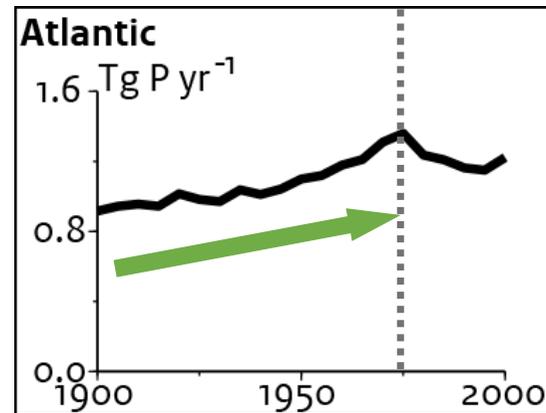
19 - 37 Tg.an⁻¹
 → + 90%



**Augmentation
 jusqu'aux années 1980**



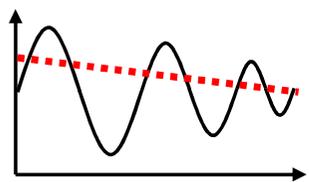
2 - 4 Tg.an⁻¹
 → + 75%



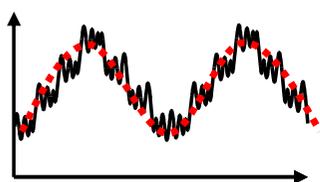
Beusen *et al.*, 2016

Objectifs

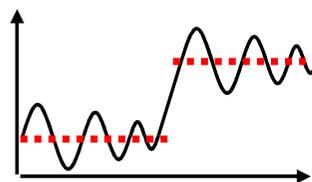
□ Evolution à long terme des nutriments



Tendances

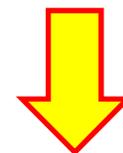


Cycles



Ruptures

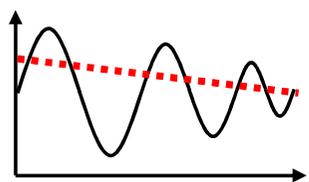
Concentrations
&
Rapports
N : P : Si



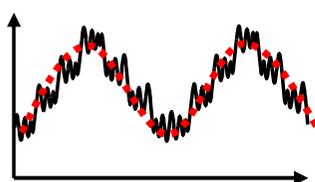
Objectifs

Facteurs de contrôle

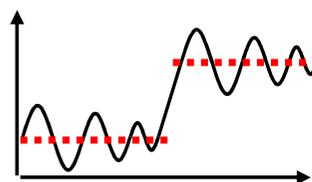
Evolution à long terme des nutriments



Tendances



Cycles



Ruptures



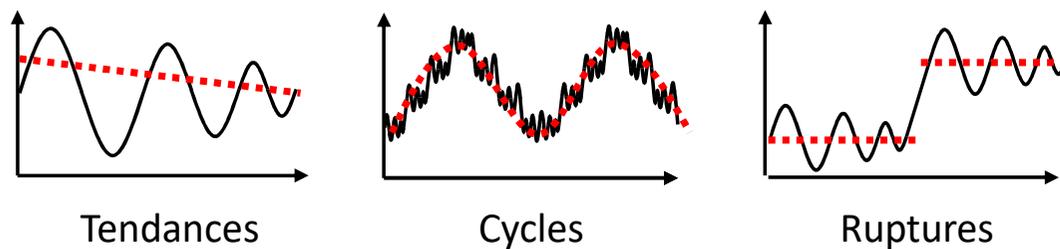
Concentrations
&
Rapports
N : P : Si



Objectifs

Facteurs de contrôle

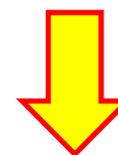
Evolution à long terme des nutriments



Conséquences sur la biomasse phytoplanctonique



Concentrations
&
Rapports
N : P : Si



Chlorophylle *a*

Statistiques

Données brutes

Régularisation
des données



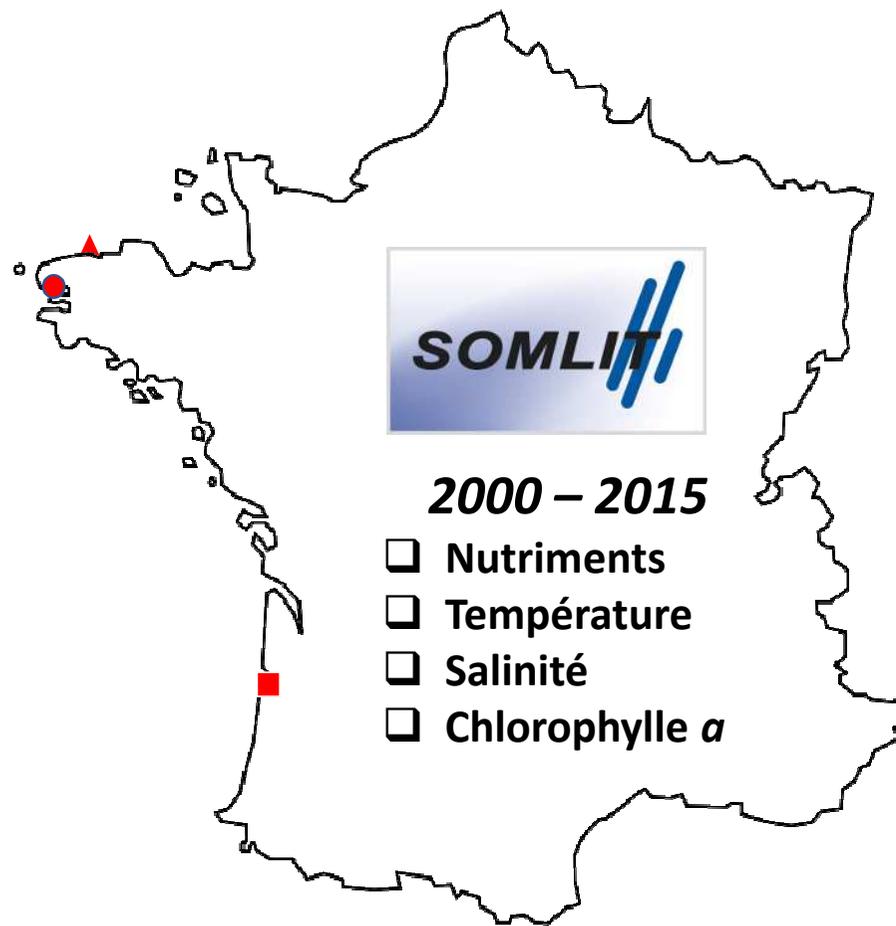
Moyenne Mobile



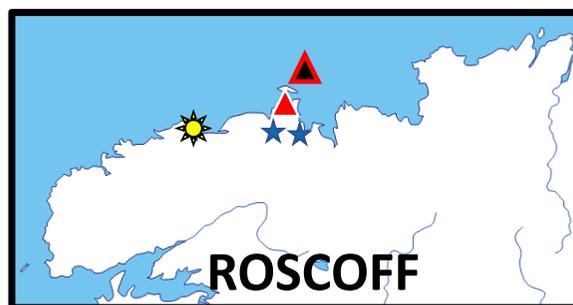
Test **Mann-Kendall** modifié

Zones d'étude

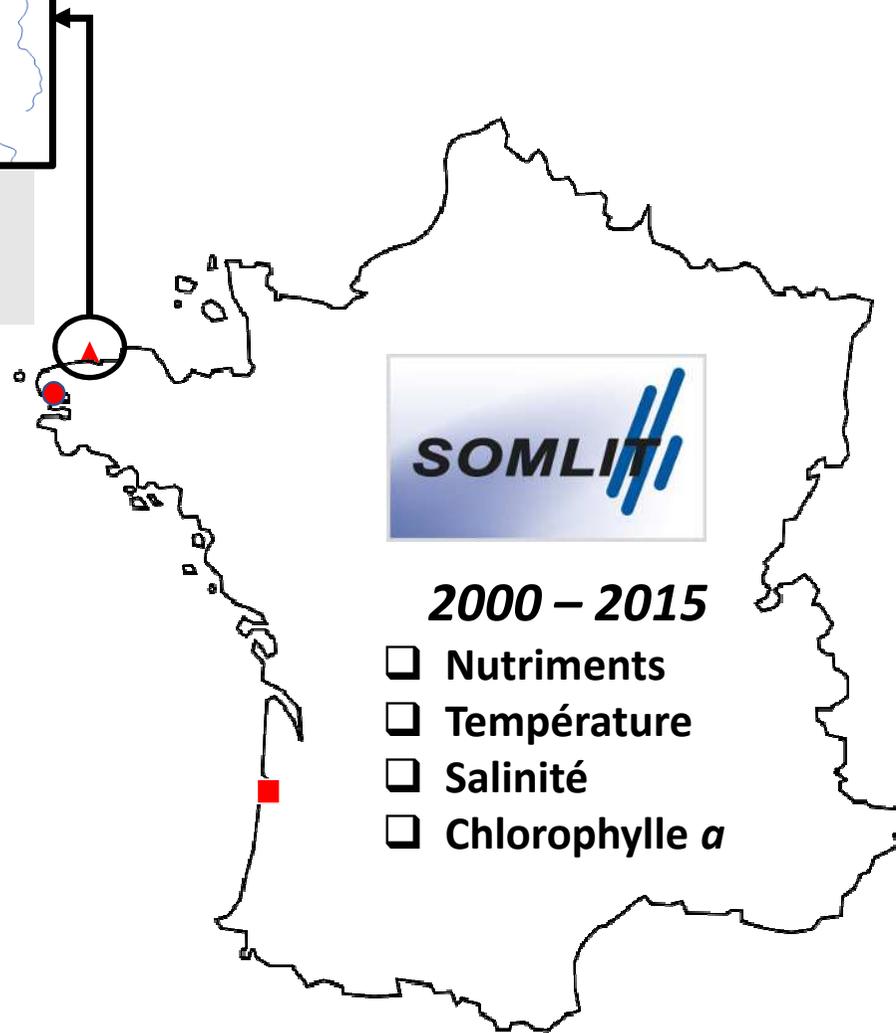
-  **Meteorologie**
(Météo-France)
-  **Hydrologie**
(ECOFLUX, Agences de l'eau, Banque Hydro)



Zones d'étude



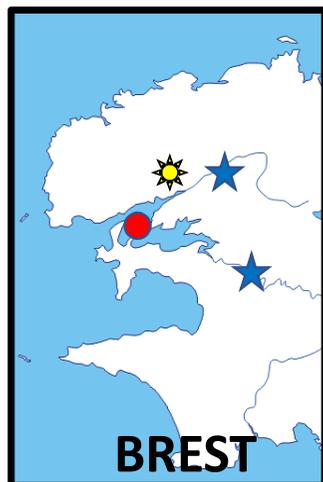
Fleuves ★ : Penzé & Guilhec
Profondeur : ▲ 60m / ▲ 3m
Salinité : $35,2 \pm 0,2$ / $35,2 \pm 0,2$



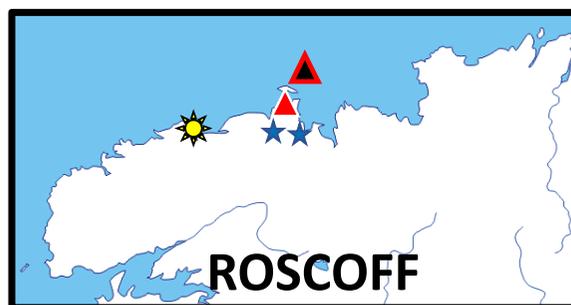
☀ *Meteorologie*
(Météo-France)

★ *Hydrologie*
(ECOFLUX, Agences de l'eau, Banque Hydro)

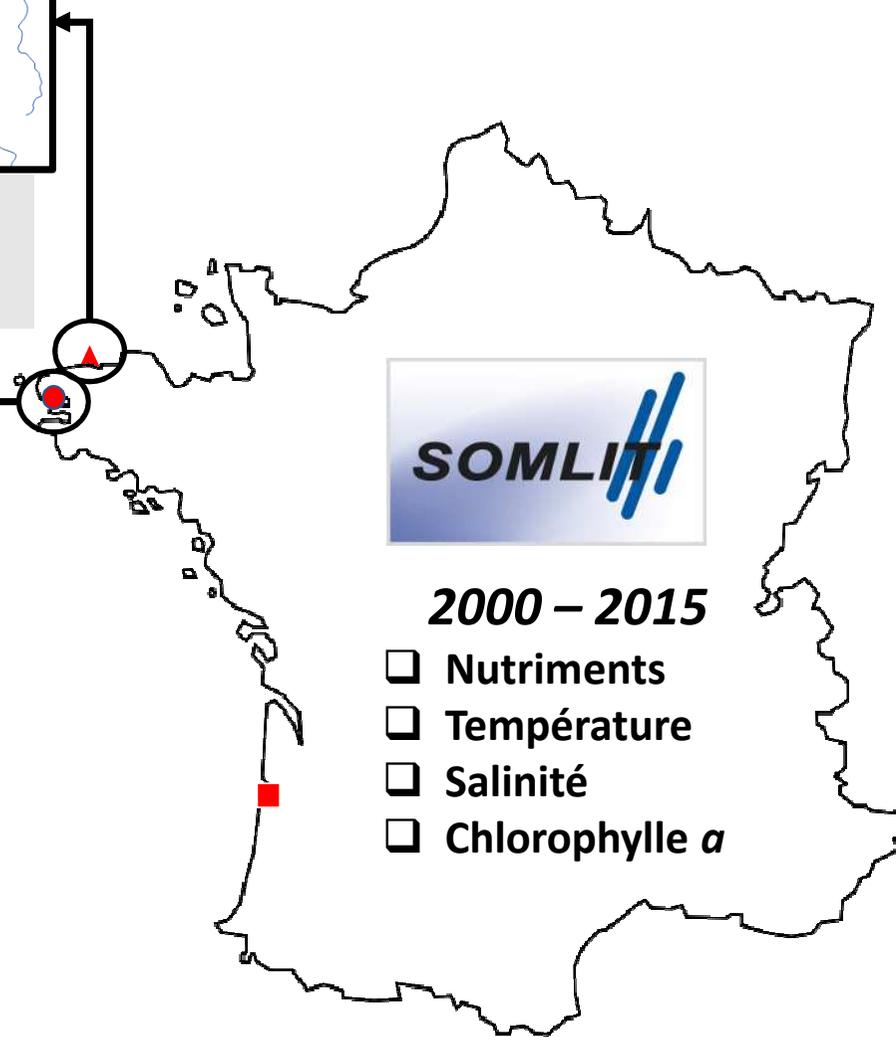
Zones d'étude



Fleuves ★ : Aulne & Elorn
Profondeur : ● 10m
Salinité : $34,6 \pm 0,6$



Fleuves ★ : Penzé & Guilhec
Profondeur : ▲ 60m / ▲ 3m
Salinité : $35,2 \pm 0,2$ / $35,2 \pm 0,2$

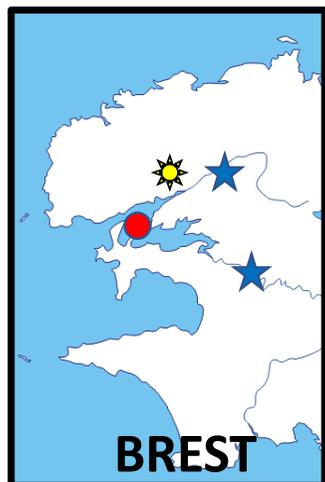


*Meteorologie
(Météo-France)*

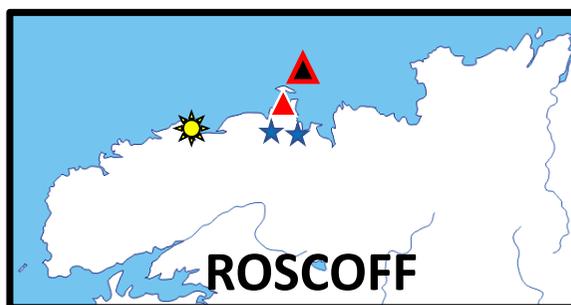


*Hydrologie
(ECOFLUX, Agences de l'eau, Banque Hydro)*

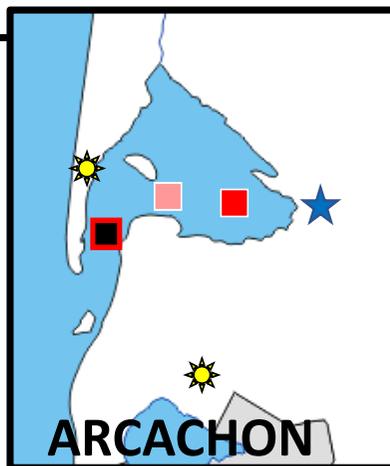
Zones d'étude



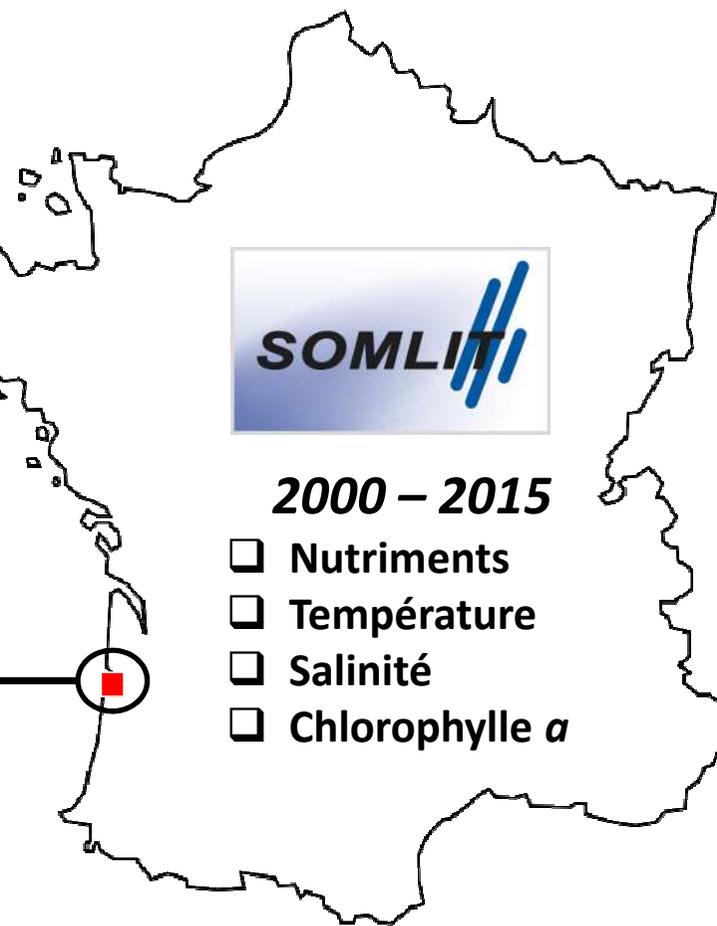
Fleuves ★ : Aulne & Elorn
 Profondeur : ● 10m
 Salinité : $34,6 \pm 0,6$



Fleuves ★ : Penzé & Guilhec
 Profondeur : ▲ 60m / ▲ 3m
 Salinité : $35,2 \pm 0,2$ / $35,2 \pm 0,2$



Fleuve ★ : Leyre
 Profondeur : ■ 25m / ■ 8m / ■ 6m
 Salinité : $34,4 \pm 0,8$ / $32,6 \pm 1,8$ / $31,4 \pm 2,6$



2000 – 2015

- ☐ Nutriments
- ☐ Température
- ☐ Salinité
- ☐ Chlorophylle *a*

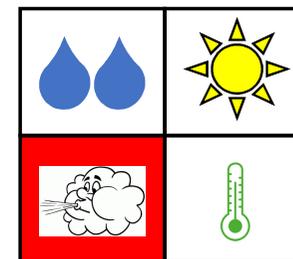
☀ *Meteorologie*
 (Météo-France)

★ *Hydrologie*
 (ECOFLUX, Agences de l'eau, Banque Hydro)

Roscoff

	Tendance positive
	Tendance négative
	Données inutilisables
	Non - significatif

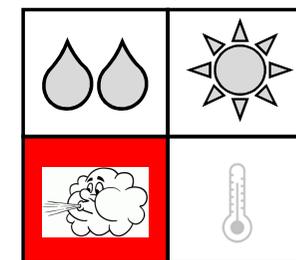
	NOx	NH ₄ ⁺	PO ₄ ³⁻	Si(OH) ₄	N/P	Si/P	Si/N	CHLA	Temp	Sal
Astan										
Estacade										
Fleuves										



Roscoff

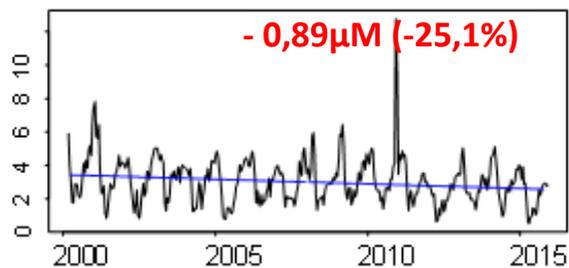
	Tendance positive
	Tendance négative
	Données inutilisables
	Non - significatif

	NO ₃ ⁻	NO ₂ ⁻	PO ₄ ³⁻	Si(OH) ₄	NH ₄ ⁺	NO ₂	NO ₃	SiO ₄	CHL _a	Temp	Sal
Astan											
Estacade											
Fleuves											

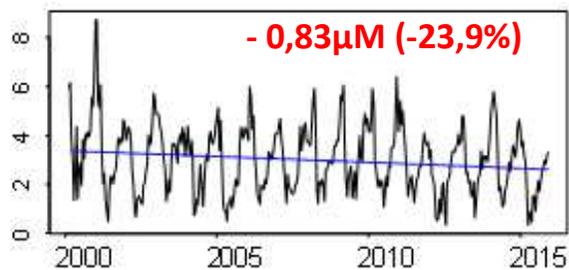


Si(OH)₄ (μM)

ASTAN (60m)



Estacade (3m)

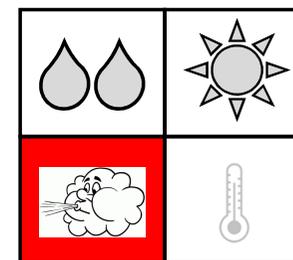


Si(OH)₄

Roscoff

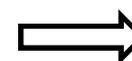
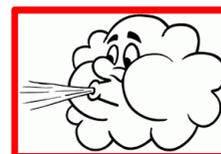
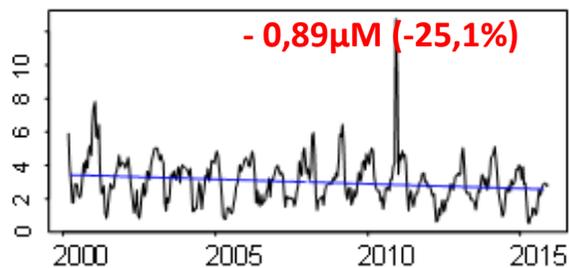
	Tendance positive
	Tendance négative
	Données inutilisables
	Non - significatif

	NO ₃ ⁻	NO ₂ ⁻	PO ₄ ³⁻	Si(OH) ₄	SiO ₂	SiO ₃ ²⁻	SiO ₄ ²⁻	SiO ₂ (particulaire)	Température	Salinité
Astan										
Estacade										
Fleuves										



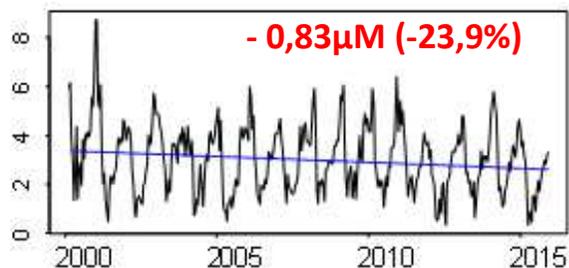
Si(OH)₄ (μM)

ASTAN (60m)



Si(OH)₄

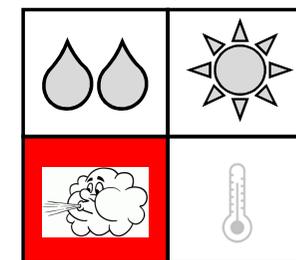
Estacade (3m)



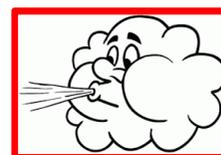
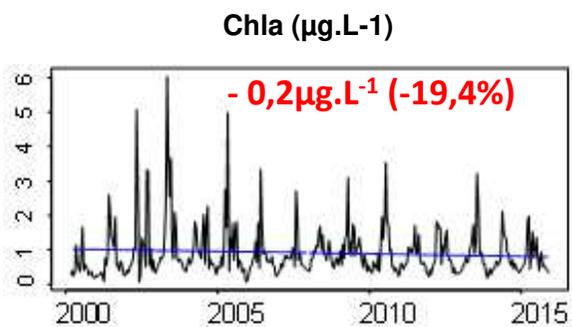
Roscoff

	Tendance positive
	Tendance négative
	Données inutilisables
	Non - significatif

	N/P	Si/P	Si/N	CHLA
Astan				
Estacade				
Fleuves				



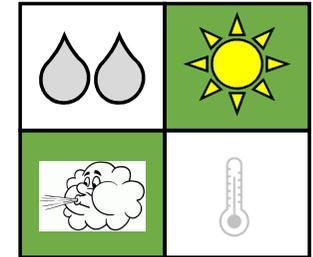
ASTAN (60m)



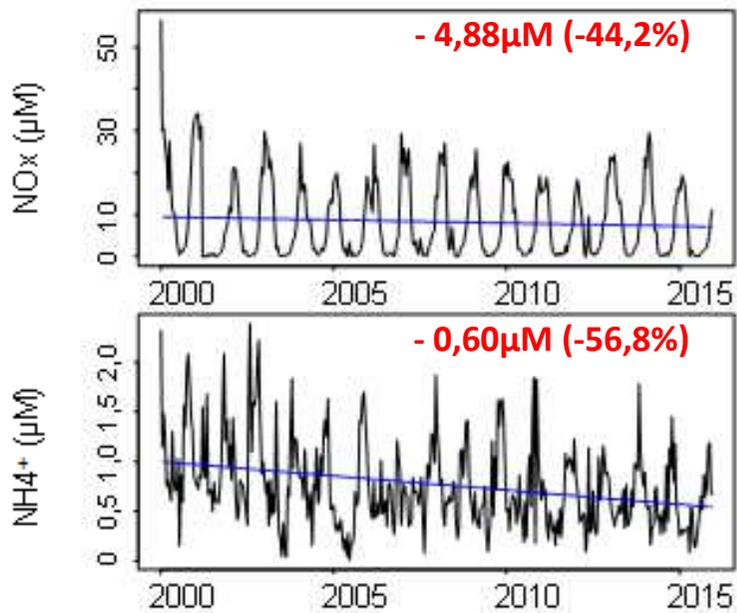
Brest

	Tendance positive
	Tendance négative
	Données inutilisables
	Non - significatif

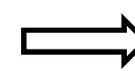
	NOx	NH ₄ ⁺	PO ₄ ³⁻	Silicium	NAP	Si/P	Si/N	PO4/N	PO4/Si
Portzic									
Fleuves									



Portzic



Fleuves

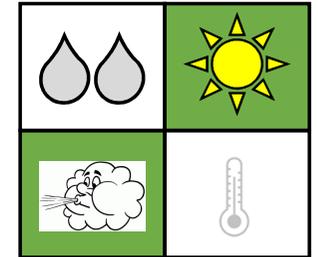


Azote

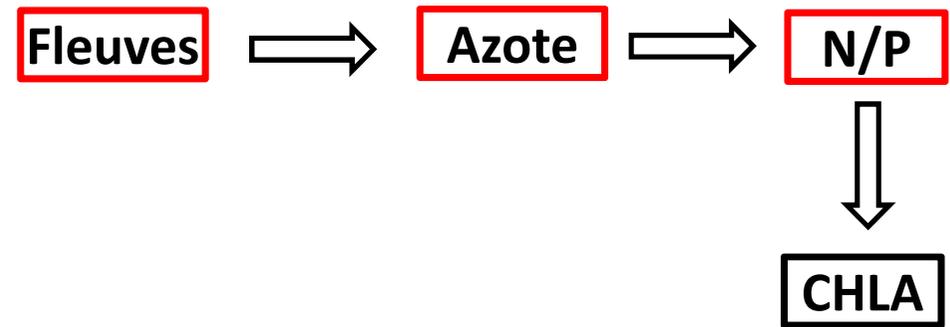
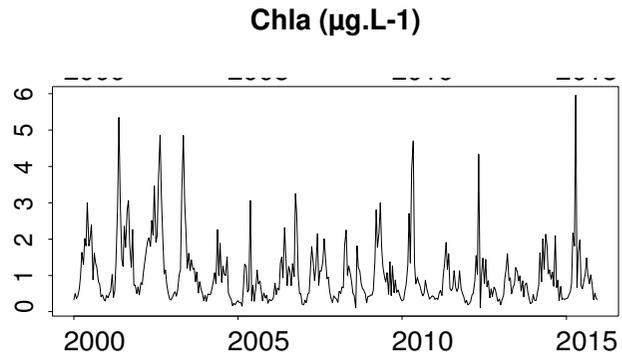
Brest

	Tendance positive
	Tendance négative
	Données inutilisables
	Non - significatif

	NO _x	NH ₃	PO ₄ ³⁻	Si(OH) ₄	N/P	Si/P	Si/N	CHLA	Temp	Sal
Portzic										
Fleuves										



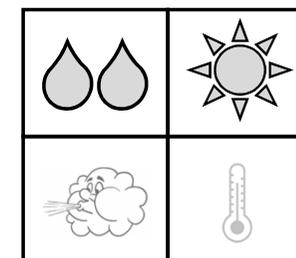
Portzic



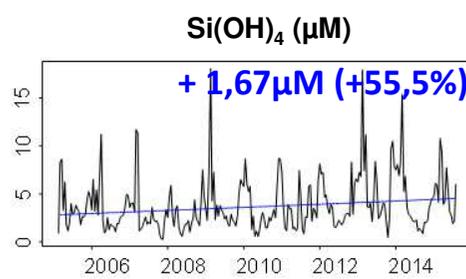
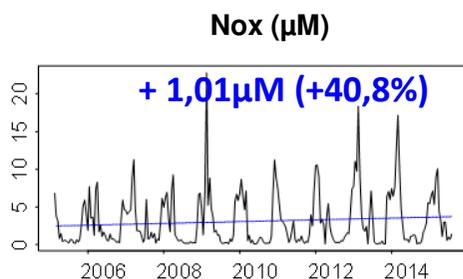
Arcachon

	Tendance positive
	Tendance négative
	Données inutilisables
	Non - significatif

	NOx	NH ₄ ⁺	PO ₄ ³⁻	Si(OH) ₄	N/P	S/P	Si/N	CHL	Temp	Sal
Bouee13										
Eyrac										
Comprian										
Flueves										



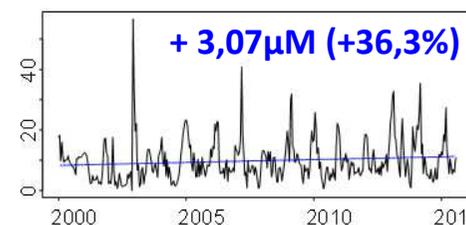
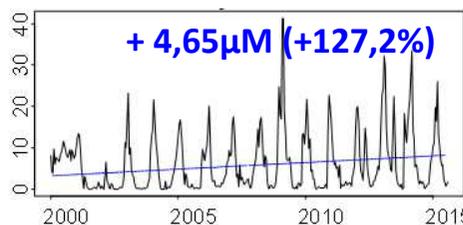
B13 (25m)



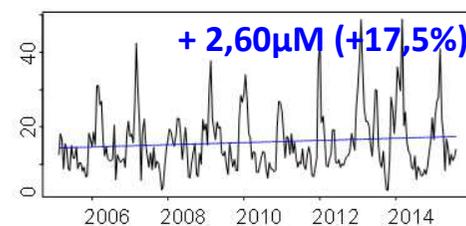
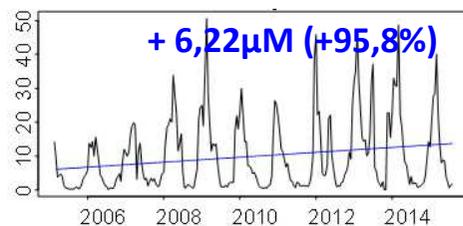
NOx

Si(OH)₄

EYRAC (8m)



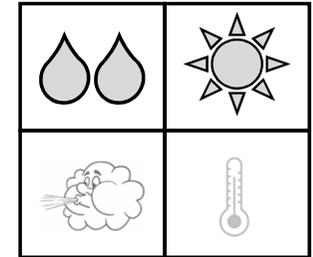
COMPRIAN (6m)



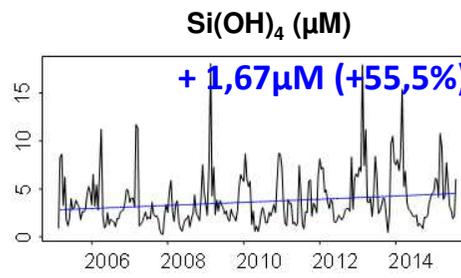
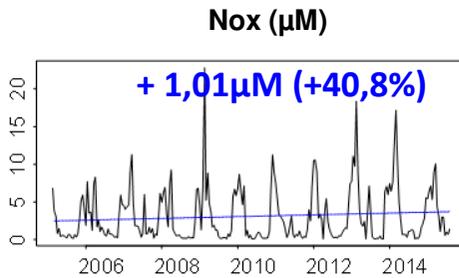
Arcachon

- Tendance positive
- Tendance négative
- Données inutilisables
- Non - significatif

	NO _x	NH ₄ ⁺	PO ₄ ³⁻	Si(OH) ₄	N/P	Si/P	Si/N	CHLA	Temp	Sal
Bouee13										
Eyrac										
Comprian										
Fleuves										



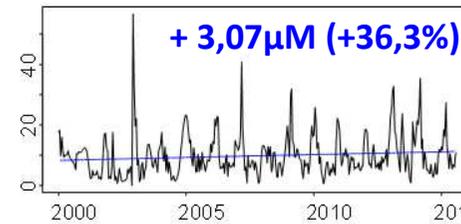
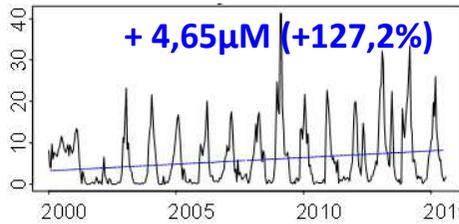
B13 (25m)



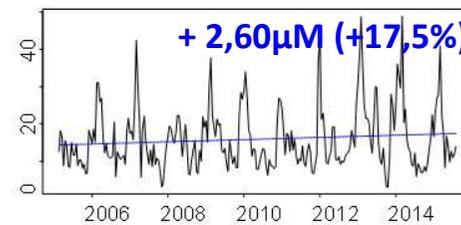
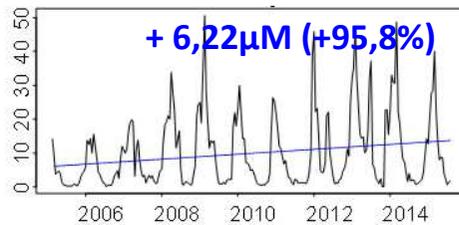
NO_x

Si(OH)₄

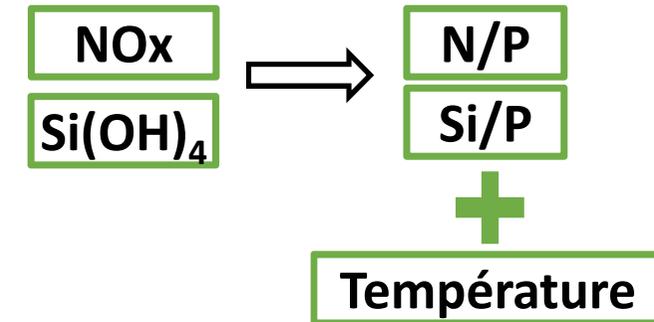
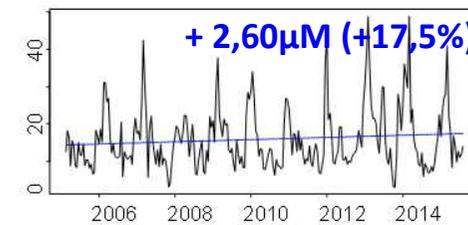
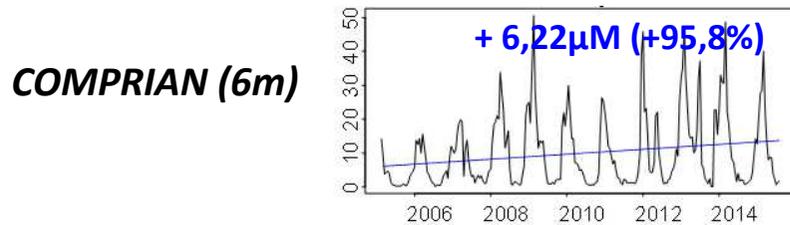
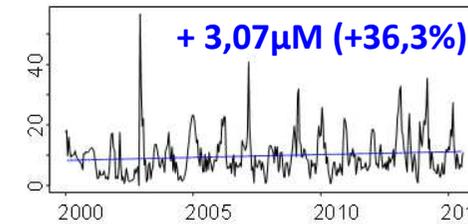
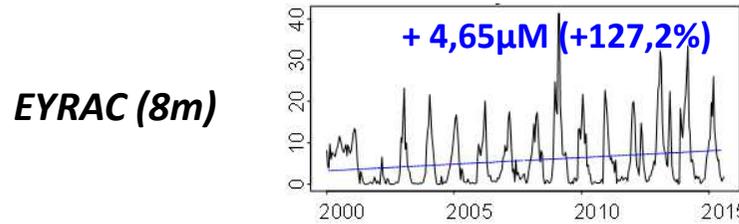
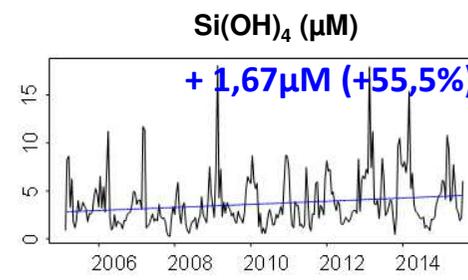
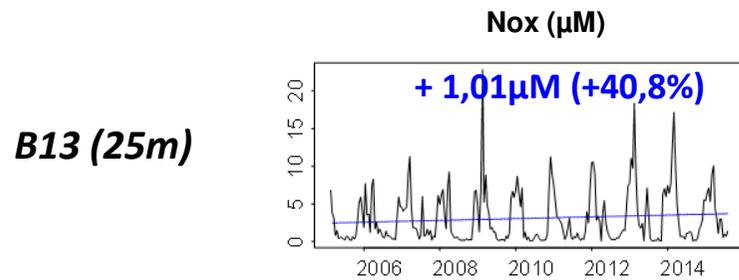
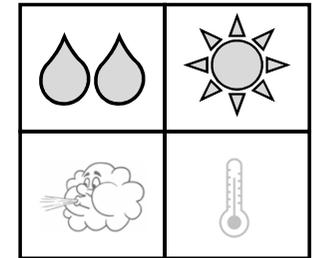
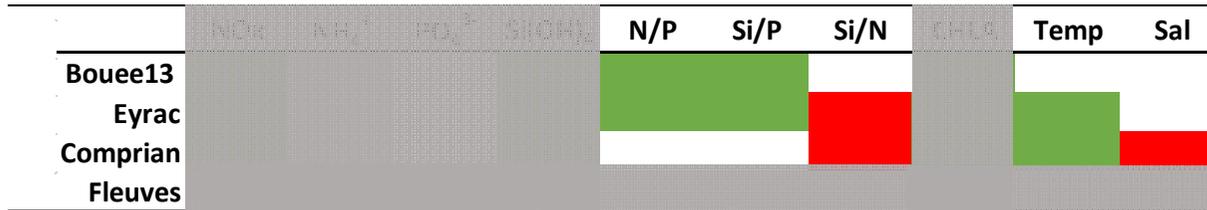
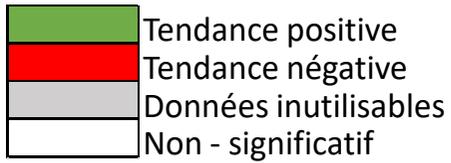
EYRAC (8m)



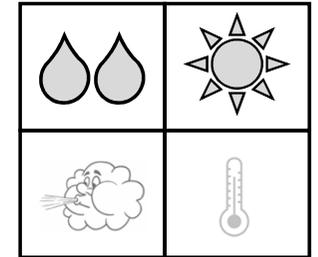
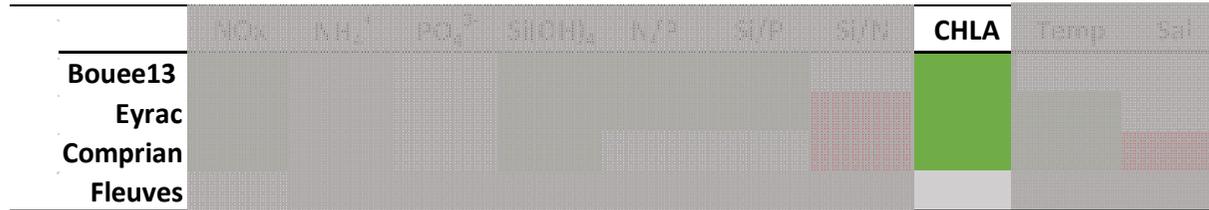
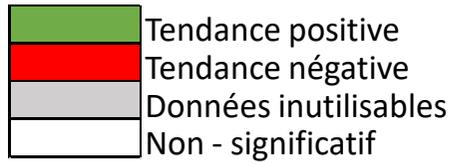
COMPRIAN (6m)



Arcachon

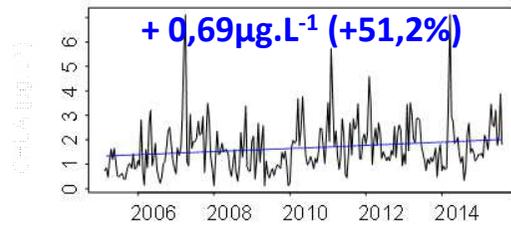


Arcachon

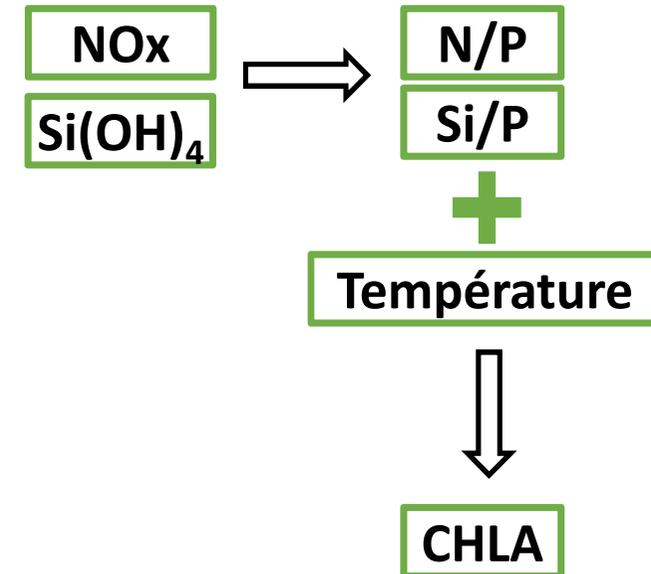
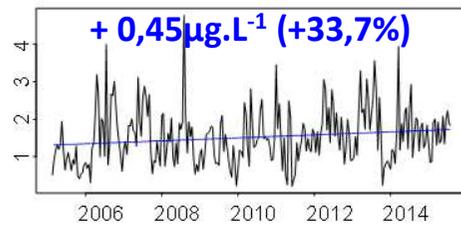


Chla (µg.L-1)

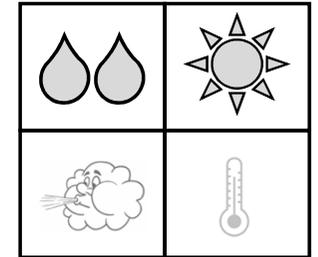
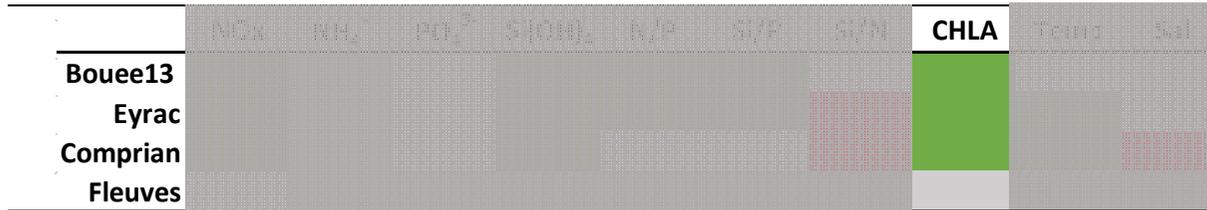
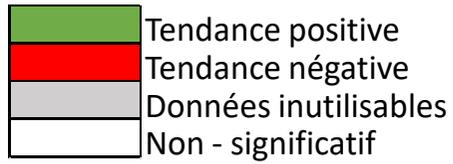
B13 (25m)



COMPRIAN (6m)

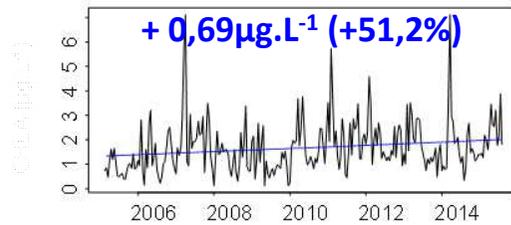


Arcachon

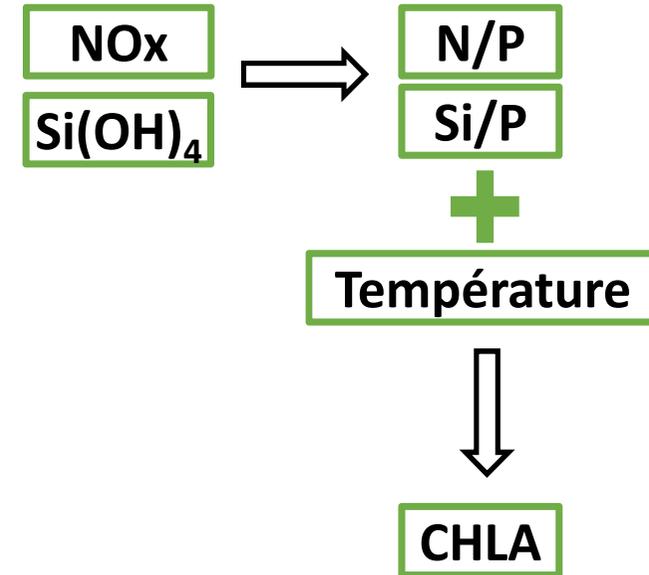


Chla (µg.L-1)

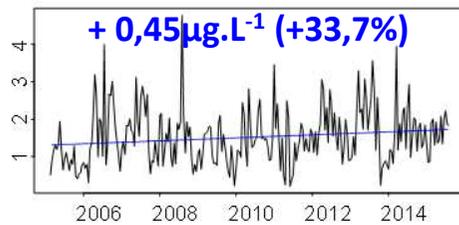
B13 (25m)



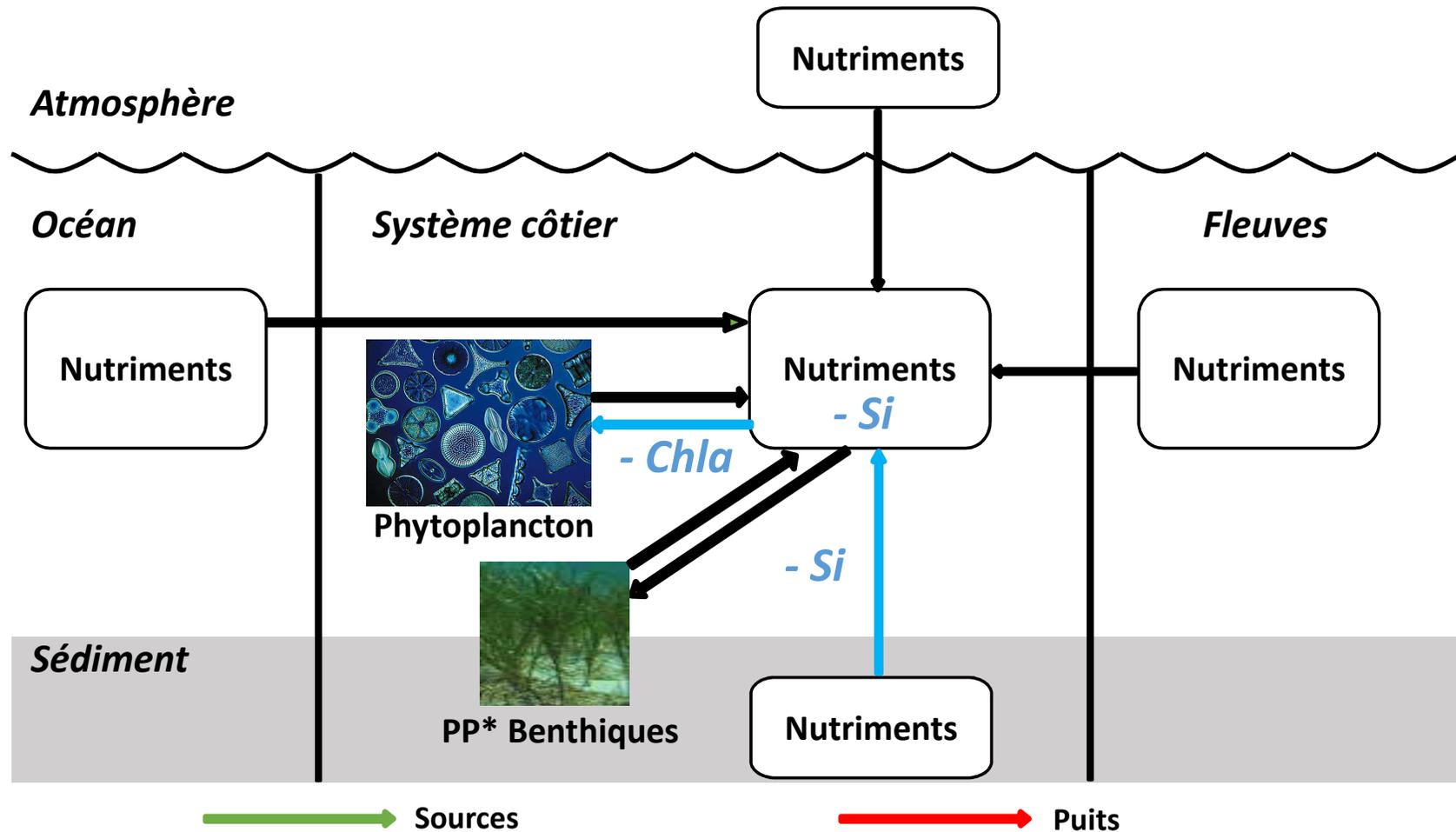
Zostera spp.



COMPRIAN (6m)

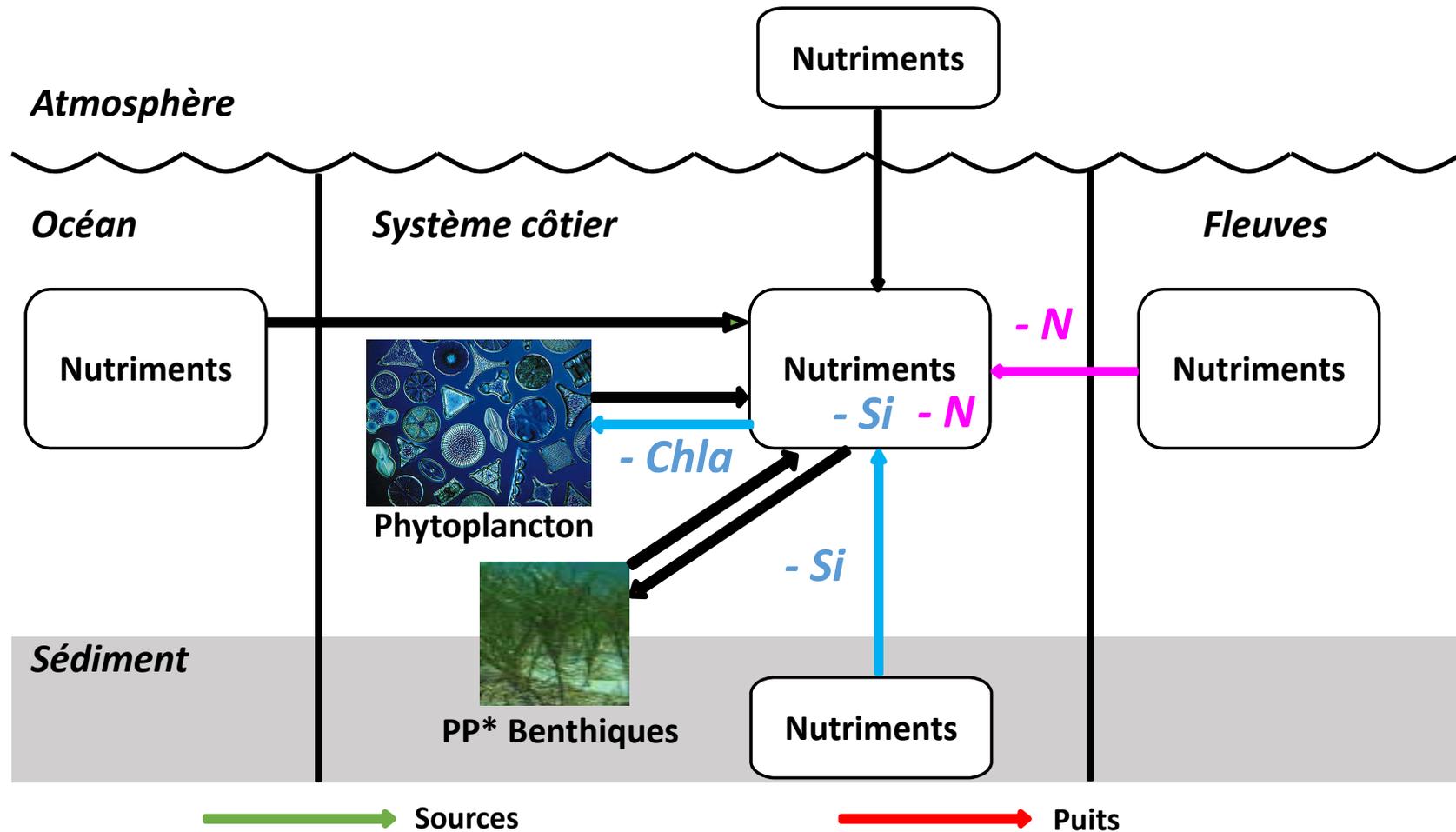


3 systèmes = 3 fonctionnements et évolutions



Roscoff

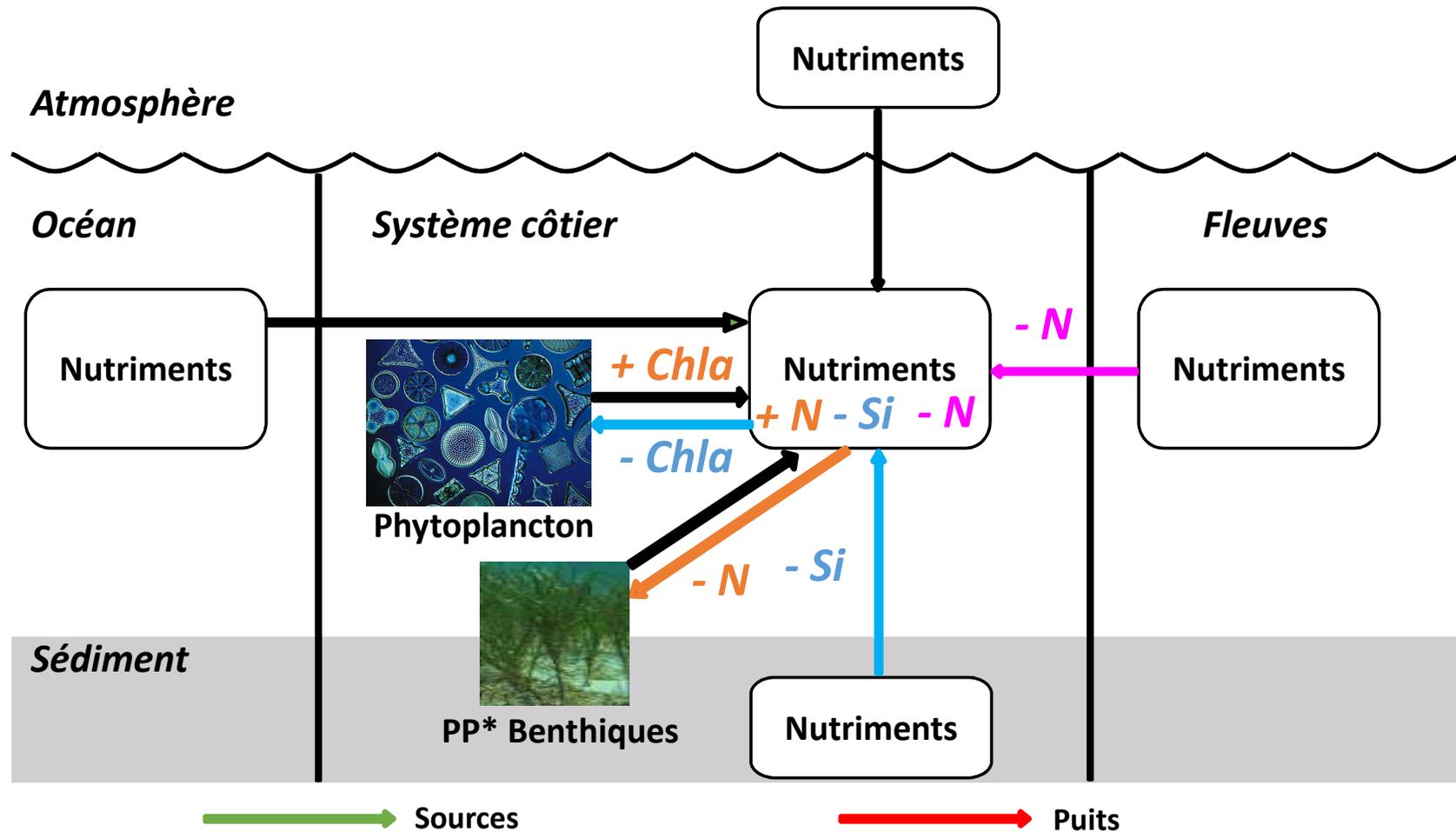
3 systèmes = 3 fonctionnements et évolutions



Roscoff
Brest

3 systèmes = 3 fonctionnements et évolutions

Systemes littoraux complexes



Roscoff
Brest
Arcachon