Saharan dust inputs stimulate Mediterranean zooplankton

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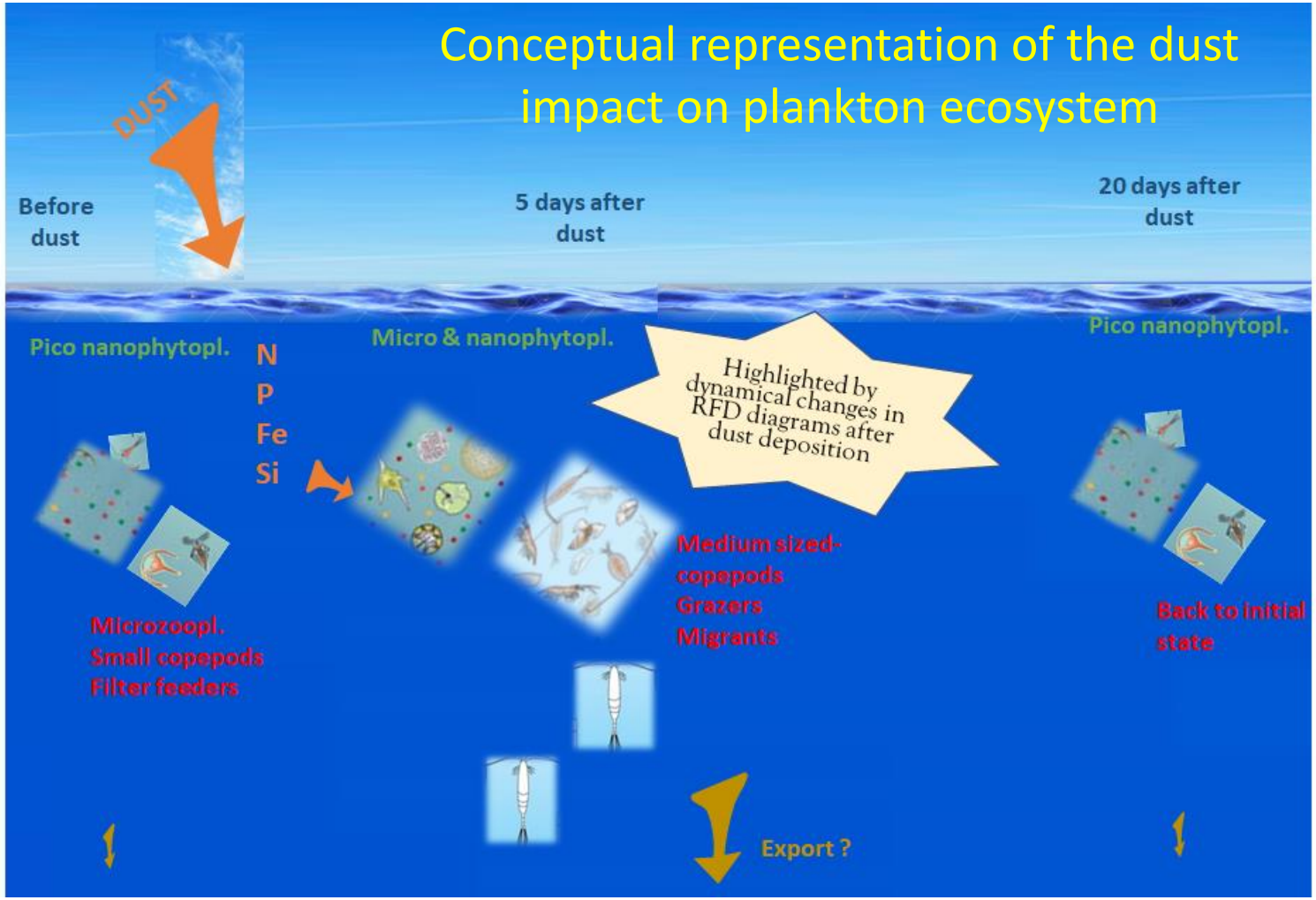
The PEACETIME-MERMEX cruise (May 12-June 8, 2017) aimed to observe the impacts of Saharan dust on the plankton ecosystem (PIs : C. Guieu & K. Desboeufs)

Our results suggest an immediate response of planktonic microautotrophs quickly transfered to zooplankton, creating a new trophic habitat,
attractive for certain functional groups (large migrant grazers, their predators), and *unappealing* for others (small particle filter-feeders).



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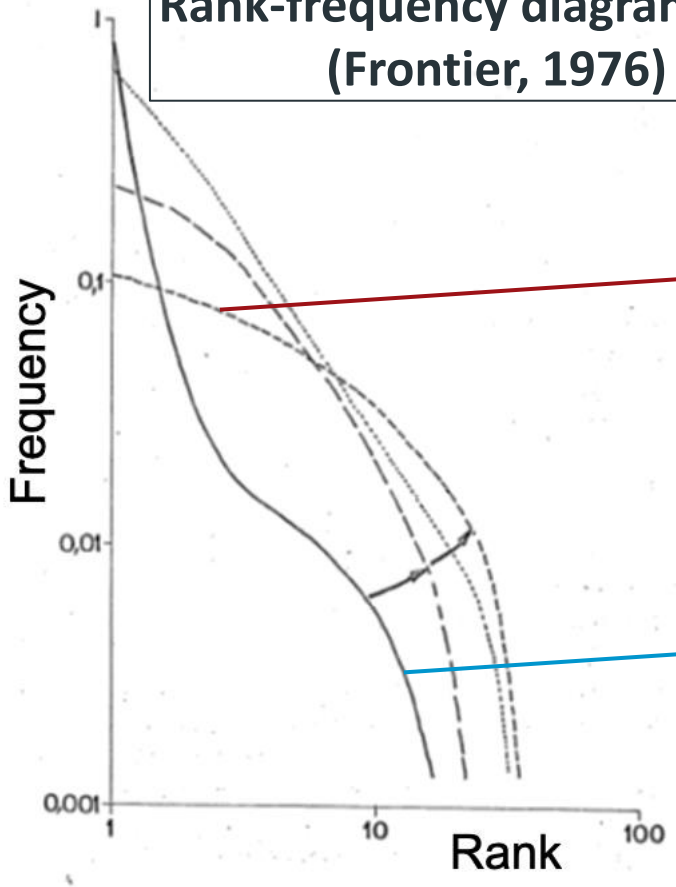
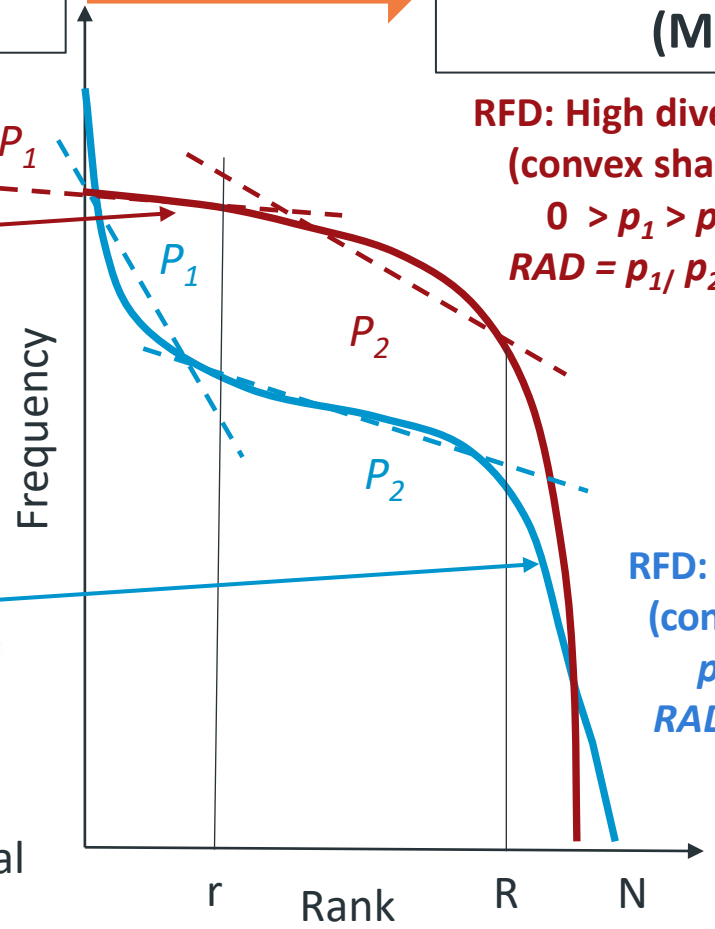
Rank-frequency diagram (RFD) (Frontier, 1976)



Deformation of RFD's along an ecological succession of plankton communities

Relative Abundance Diversity Index (RAD) (Mouillot & Leprêtre, 2000)



RFD: High diversity (convex shape)

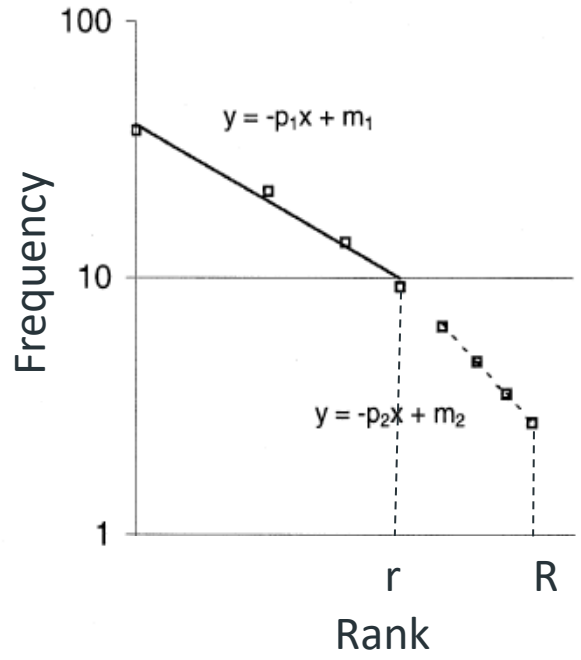
$0 > p_1 > p_2$

$RAD = p_1 / p_2 < 1$

RFD: Low diversity (concave shape)

$p_1 < p_2 < 0$

$RAD = p_1 / p_2 > 1$



RFD is described using two linear regressions, the first for the r first species and the second for the following R-r species.

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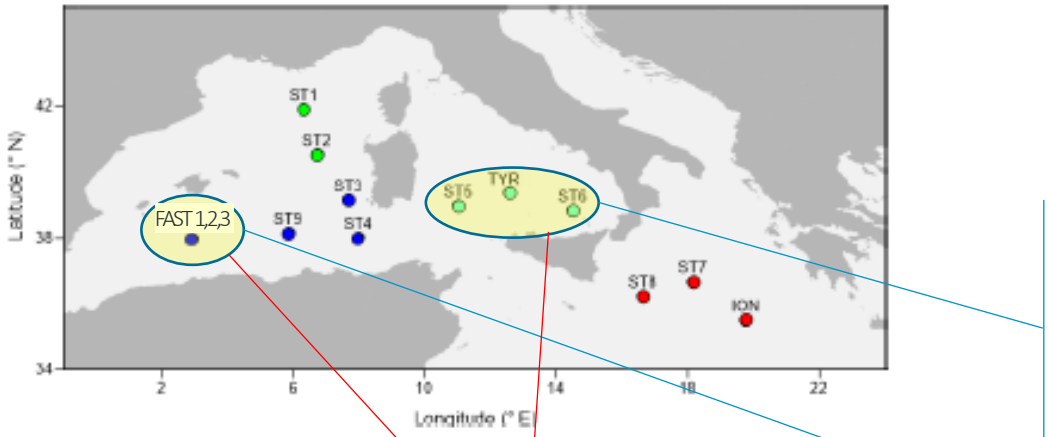
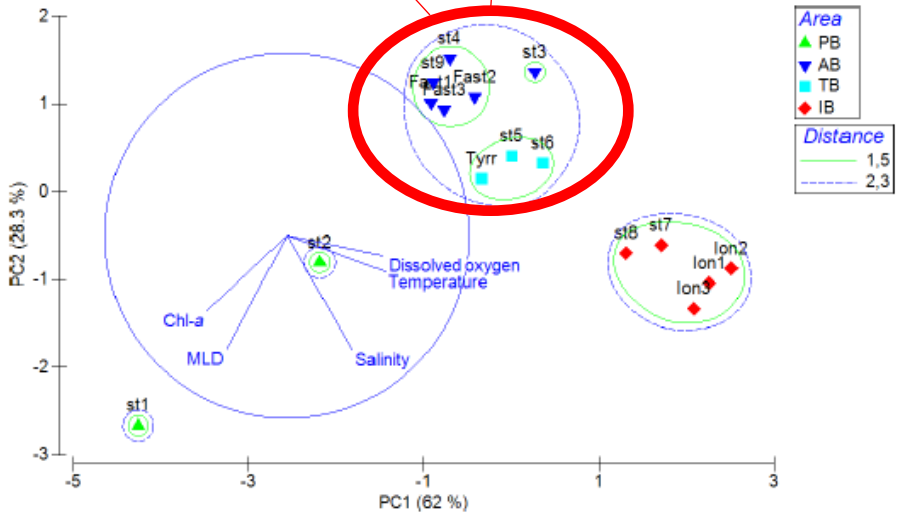
From PEACETIME cruise



PCA environment



Overview of the dust events and associated measurements

Stations impacted by dust and cruise visit duration	Cruise strategy with regard to dust events	Characteristics of the dust events	Zooplankton sampling Date
Tyrrhenian Sea 16 to 22May 2017	Model predicted a dust event 6 days before the arrival	10 to 12 May Whole southern Tyrrhenian sea Predicted flux: >1 g m^{-2} Flux in sediment traps: 153 mg m^{-2}	ST5: 16 May TYR: 19 May ST6: 22 May
Wet dust event FAST 02 to 08 June 2017	Scheduled on board according to metereological event	4 to 5 June Betwen Baleares and Algerian coast Predicted flux: 0.5 g m^{-2} Dust deposition observations: 0.012 g m^{-2} Fluxes in sediment traps: 50 mg m^{-2}	FAST1: 4 June FAST2: 6June FAST3: 8 June
References of the data	Dulac (pers.com) Desboeufs et al. (in prep) Guieu et al. (accepted) .	Desboeufs et al. (in prep) Guieu et al. (accepted) Bressac et al. (in prep) Tovar-Sánchez et al. (2020) van Wambeke et al. (in prep)	

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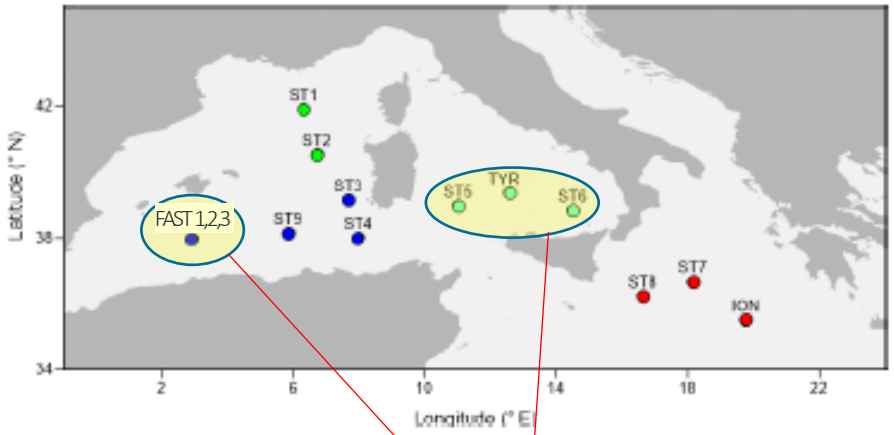
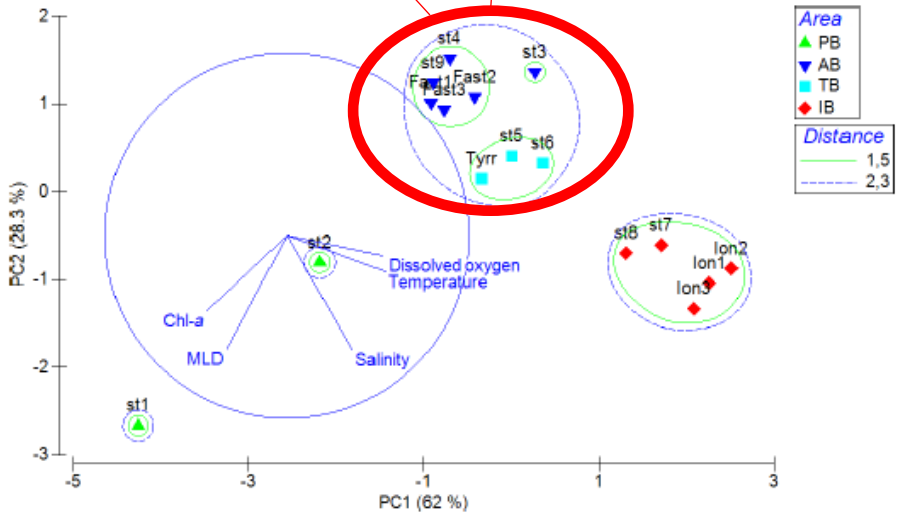
From PEACETIME cruise



PCA environment



A virtual time series of zooplankton response to dust impact

	FAST1	FAST2	FAST3	ST5	TYR	ST6
Timing after dust fall	Day 0	Day 2	Day 5	Day 6	Day 9	Day 12

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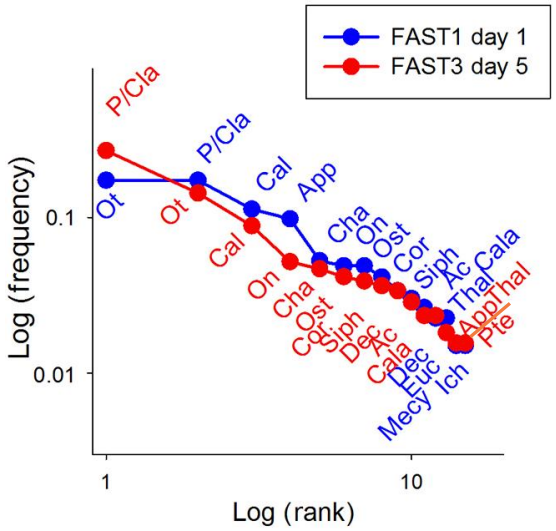
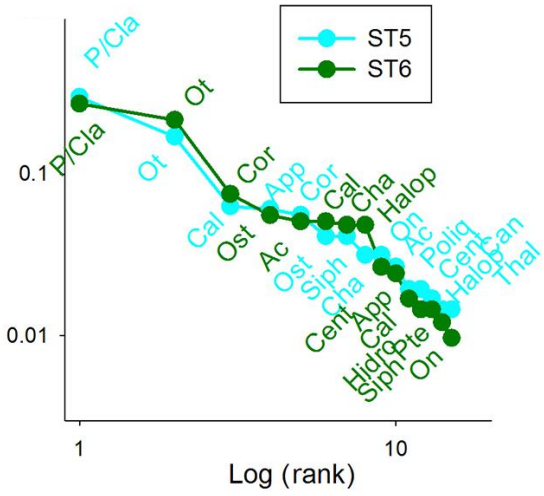
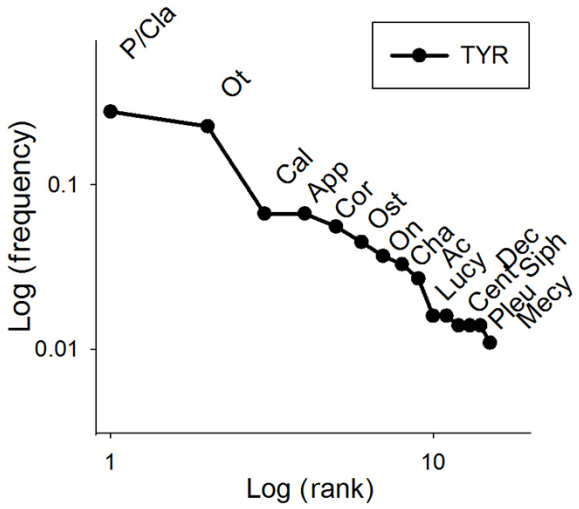
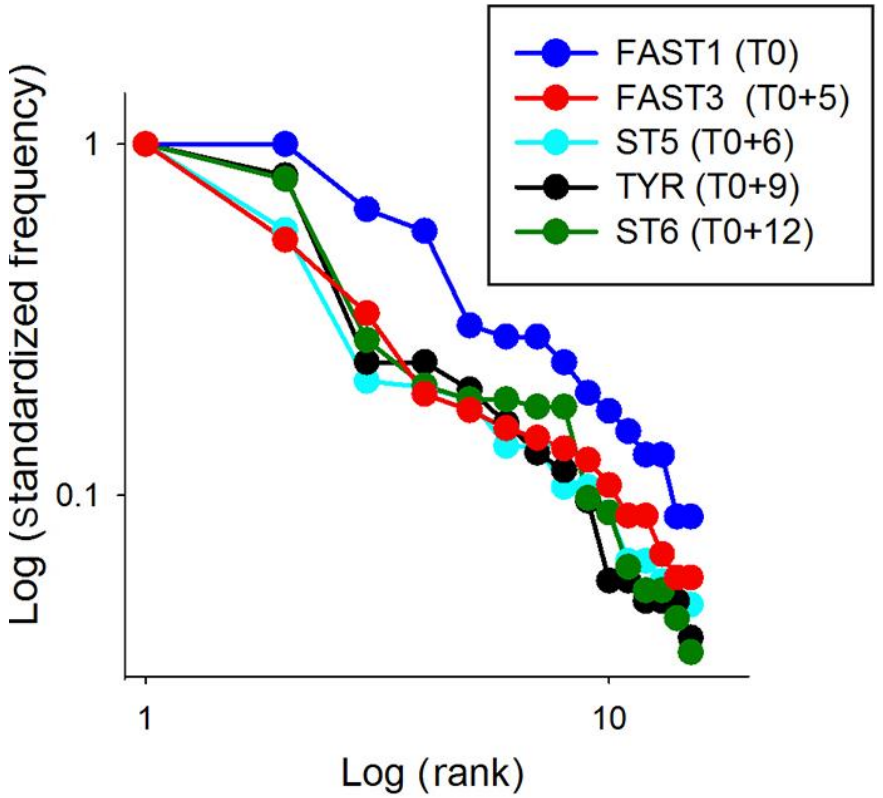




Functional zooplankton groups from imagery analysis with ZOOSCAN



A virtual time series of zooplankton RFD



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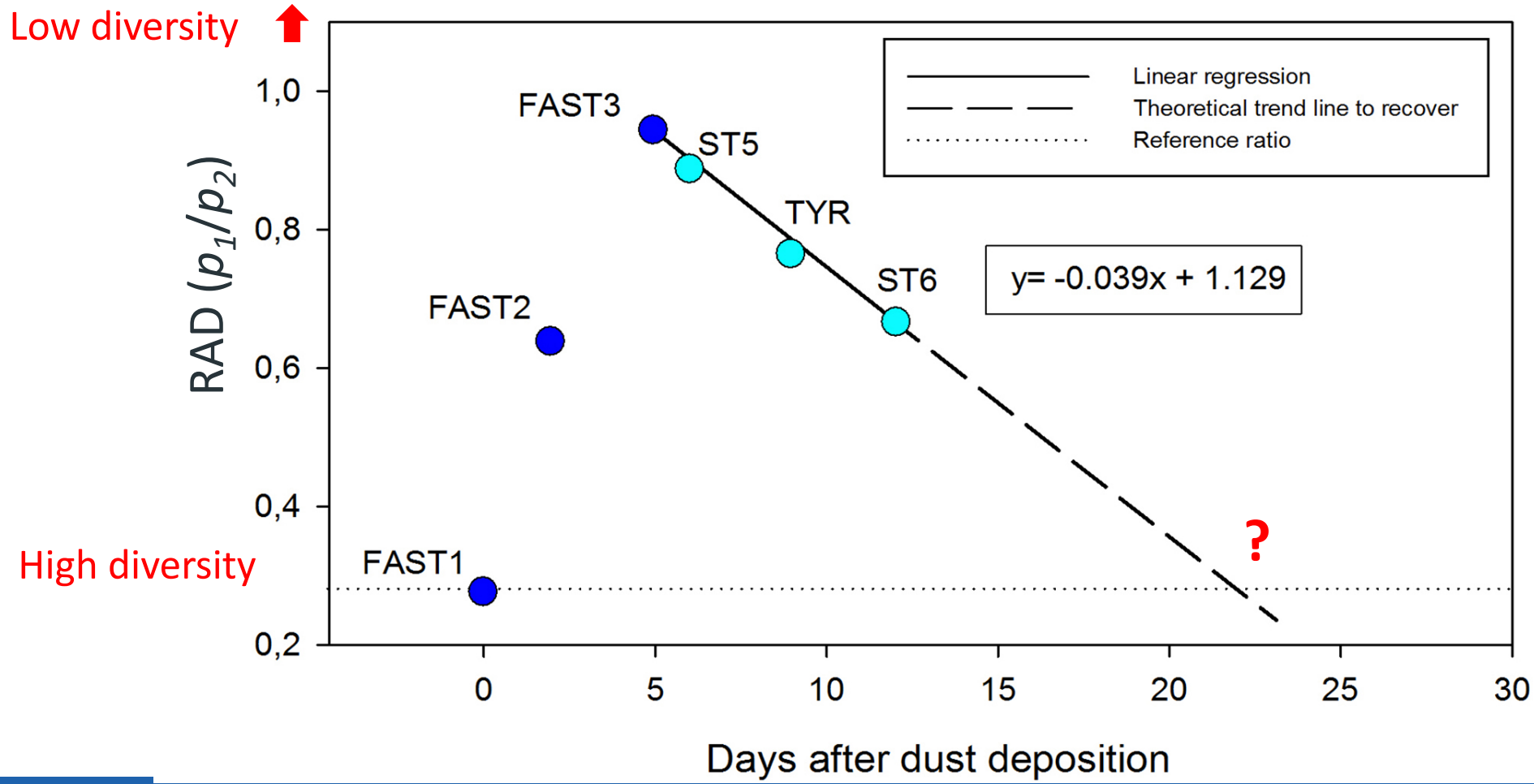
RAD time series of zooplankton as response to dust impact



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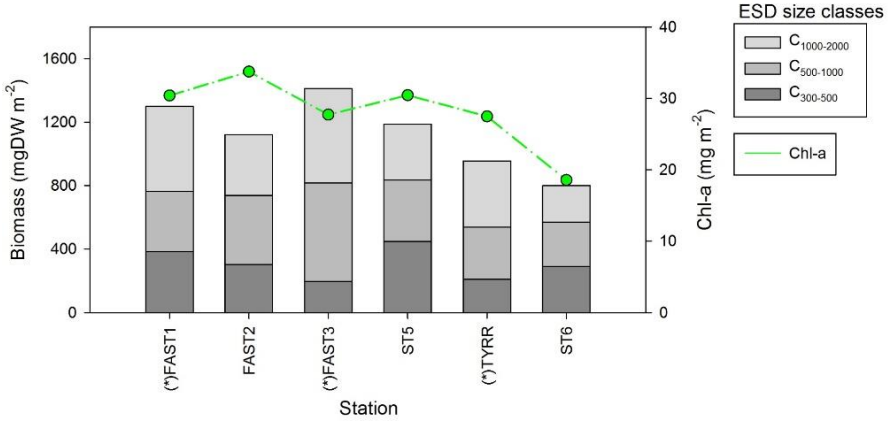
Conclusion and perspectives

- The PEACETIME campaign allowed to observe a quick reactivity of Mediterranean zooplankton to Saharan dust inputs (by association of 2 events) in terms of change in diversity (RAD)
- This change in diversity appears to be a more relevant indicator than changes in biomass and abundance (no clear trend)



These results are available in Biogeosciences, 17, 1–25, 2020
https://doi.org/10.5194/bg-17-1-2020

- Finer dedicated observations are requested to test our hypothesis about the creation of a new trophic habitat after dust input and to better sample the productive layer at high frequency (several tows within 24 hours) to test the attraction of large migrant grazers and their predators, and the decrease of small particle filter-feeders.
- The impact on fluxes remains to be demonstrated (buoyant drifting sediment trap below the productive layer, metabolic rate measurements)
- The frequency of Saharan events could be a key factor for the productivity of the southern Mediterranean basins and the export of material.