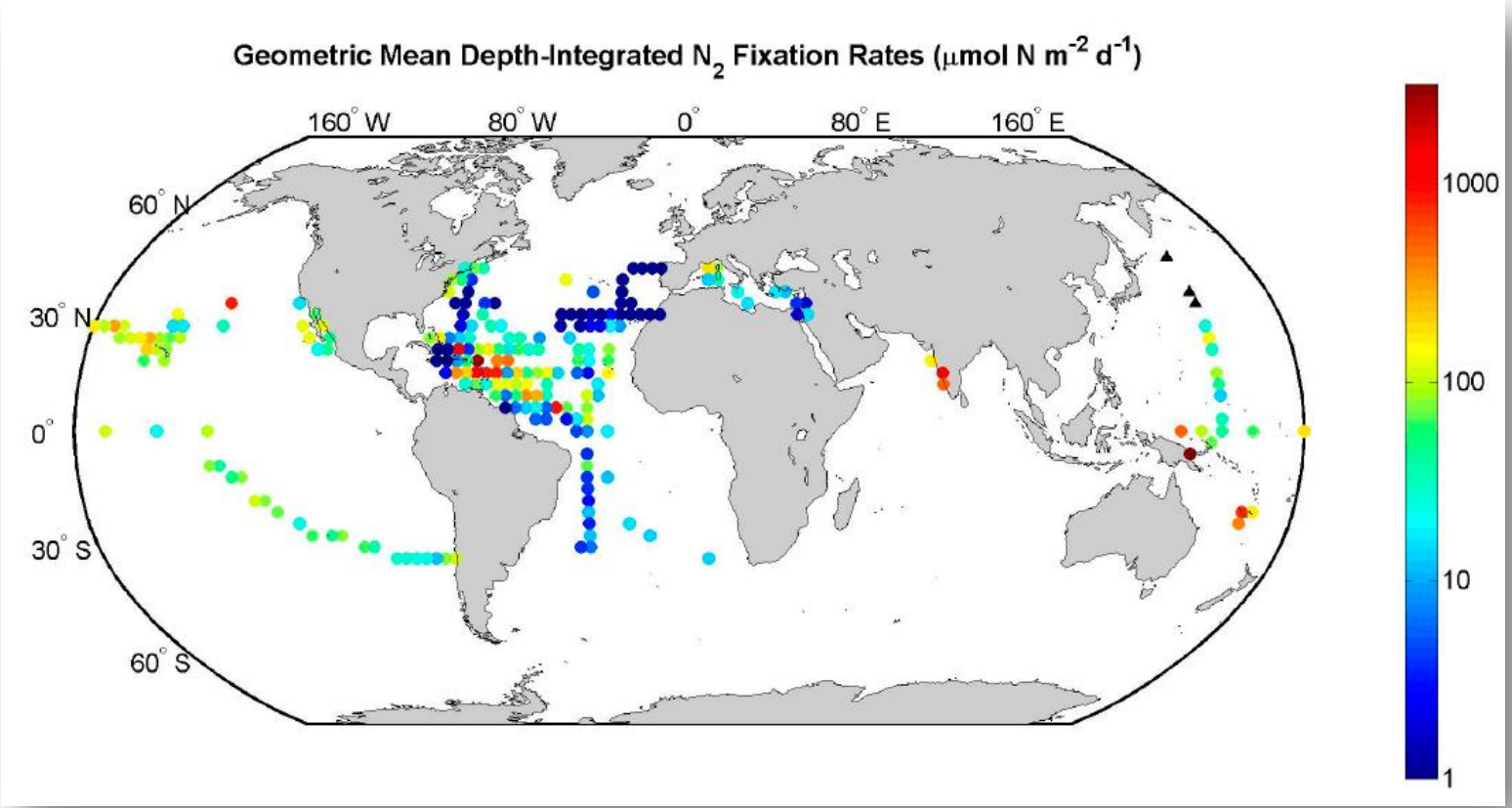
ICES/PICES 6th Zooplankton Production Symposium "New Challenges in a Changing Ocean"
9-13 May 2016, Bergen, Norway

Amino acid stable N isotope estimations reveal uniform diazotrophic contributions across zooplankton size fractions in the subtropical N Atlantic

Carmen Mompeán, **Antonio Bode**, Elizabeth Gier, Matthew D. McCarthy

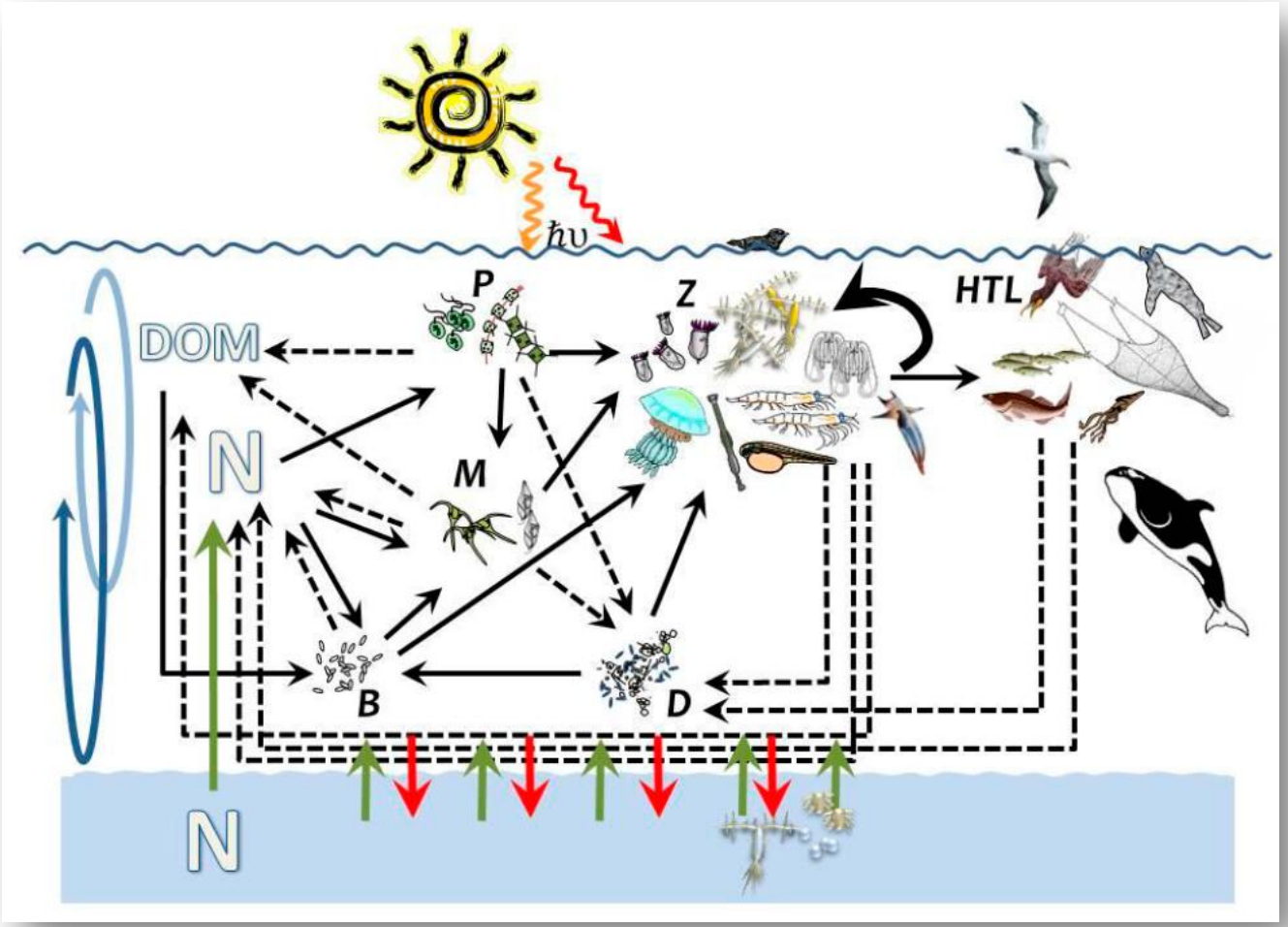
Introduction

Nitrogen fixation:



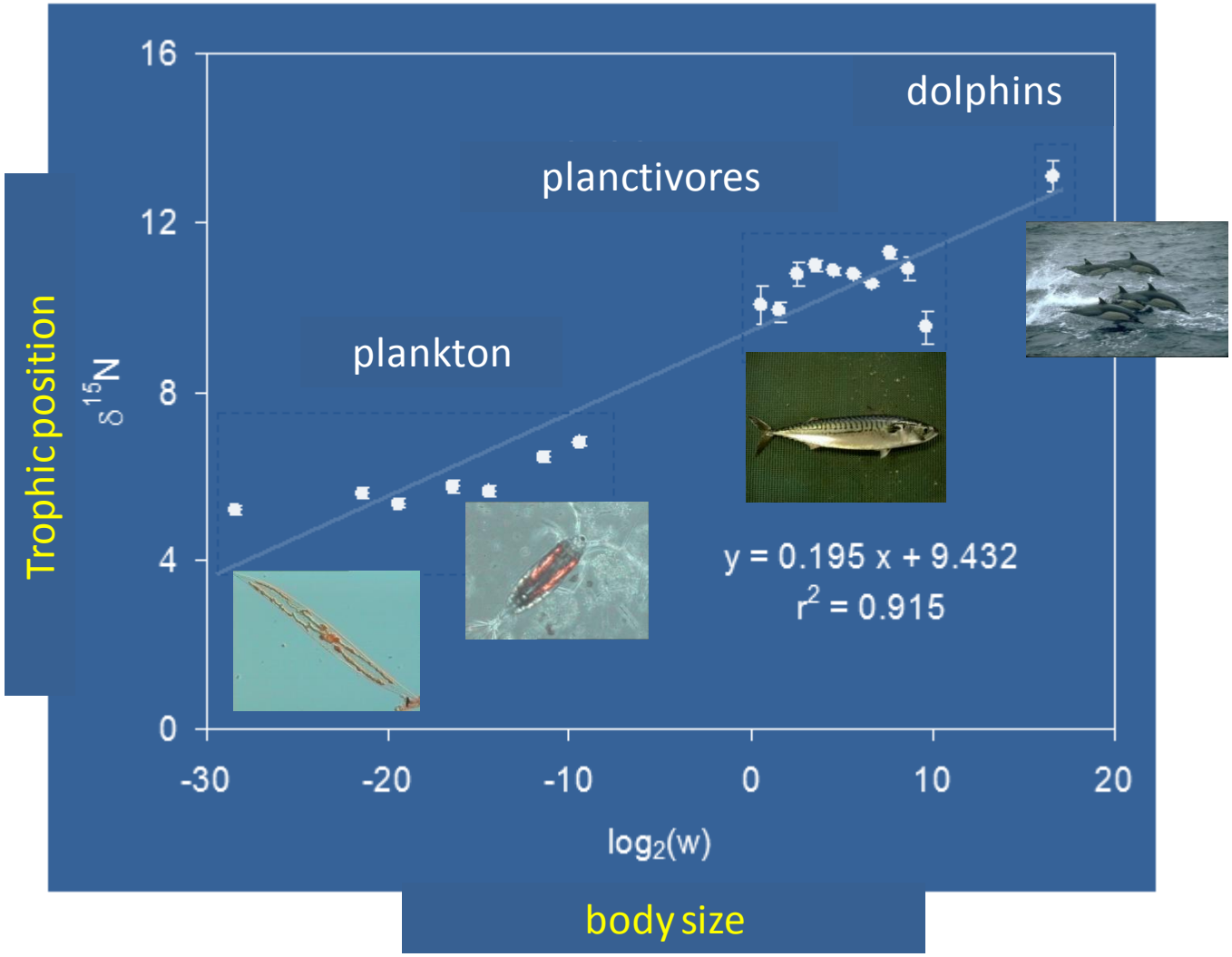
Luo et al. (2012) Earth Syst Sci Data 4: 47-73

Nitrogen transfer up the food web:



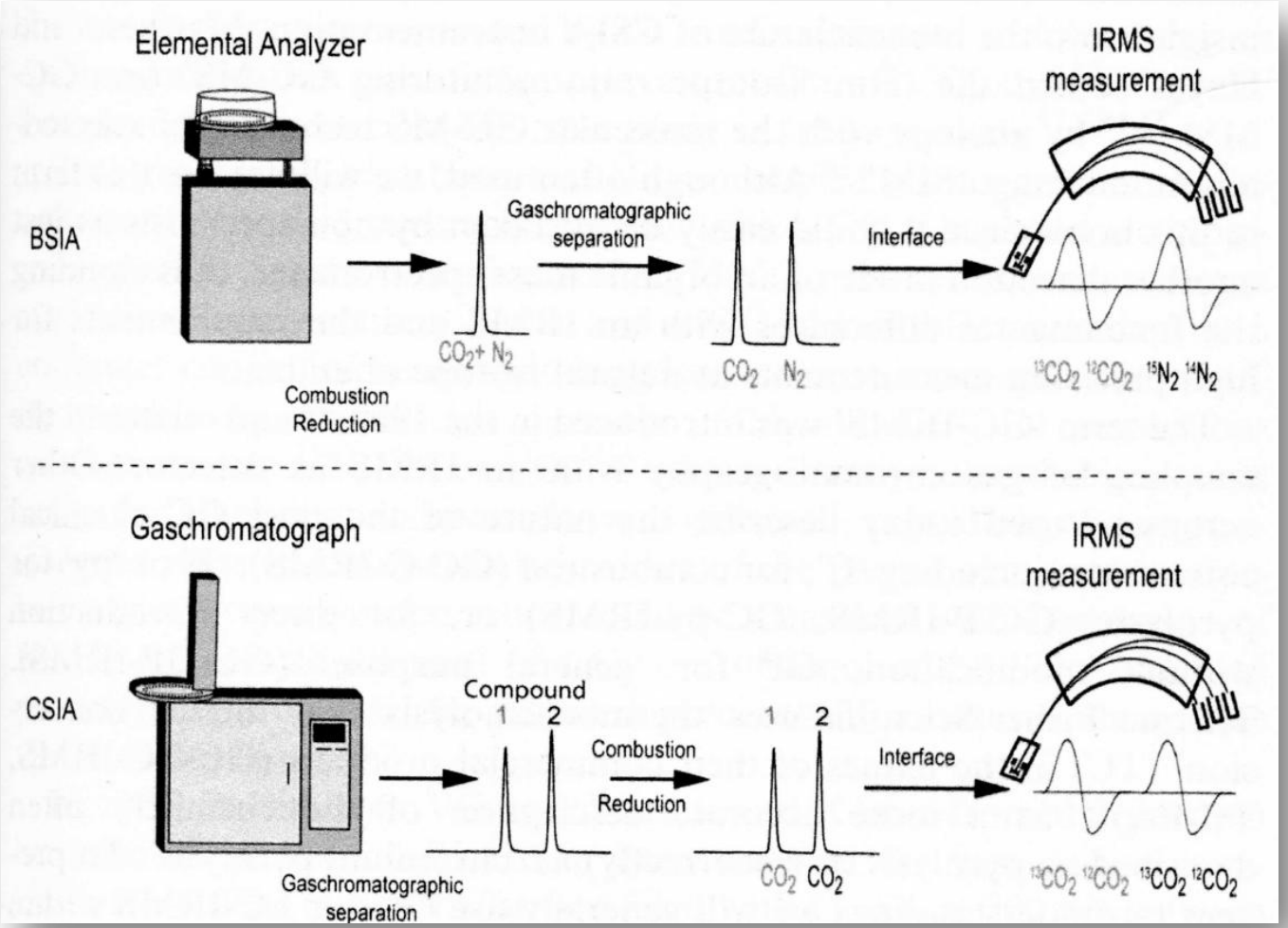
Mitra et al. (2014) Prog Oceanogr 129:176-199

Trophic structure:



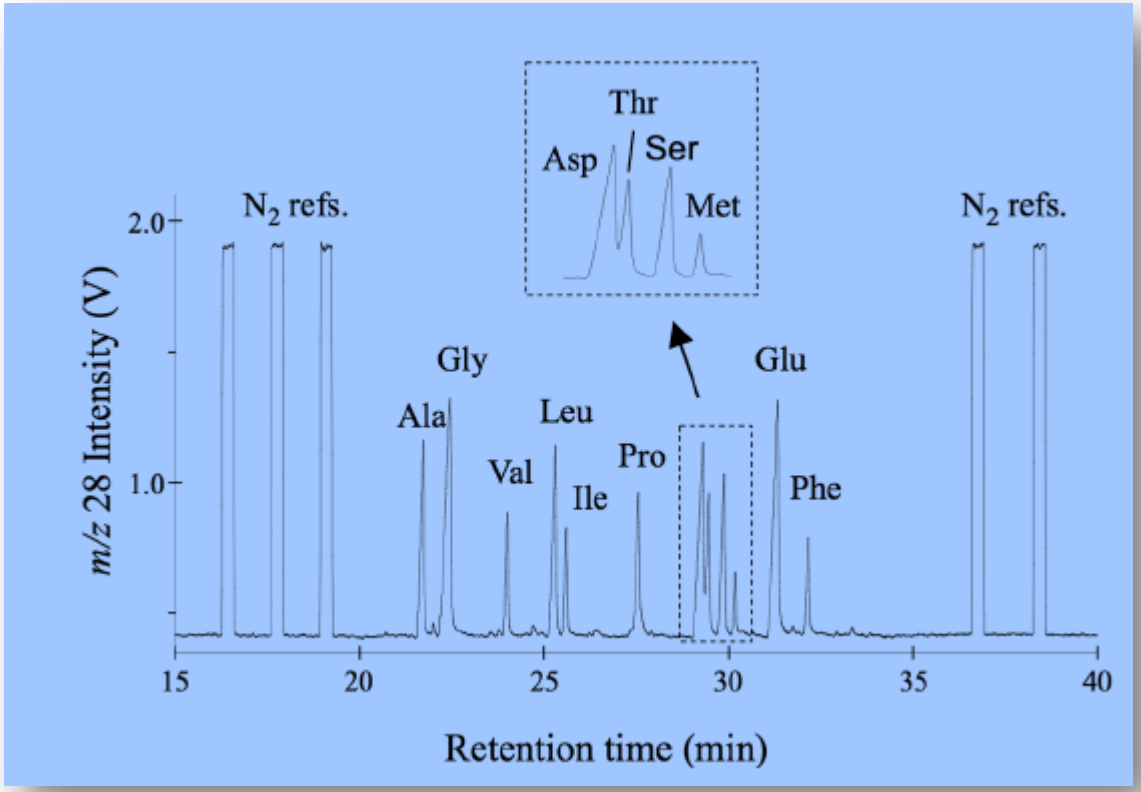
Bode et al. (2003) ICES J Mar Sci 60:11-22

Bulk Stable Isotope Analysis (BSIA) vs. Compound Specific Isotope Analysis (CSIA):



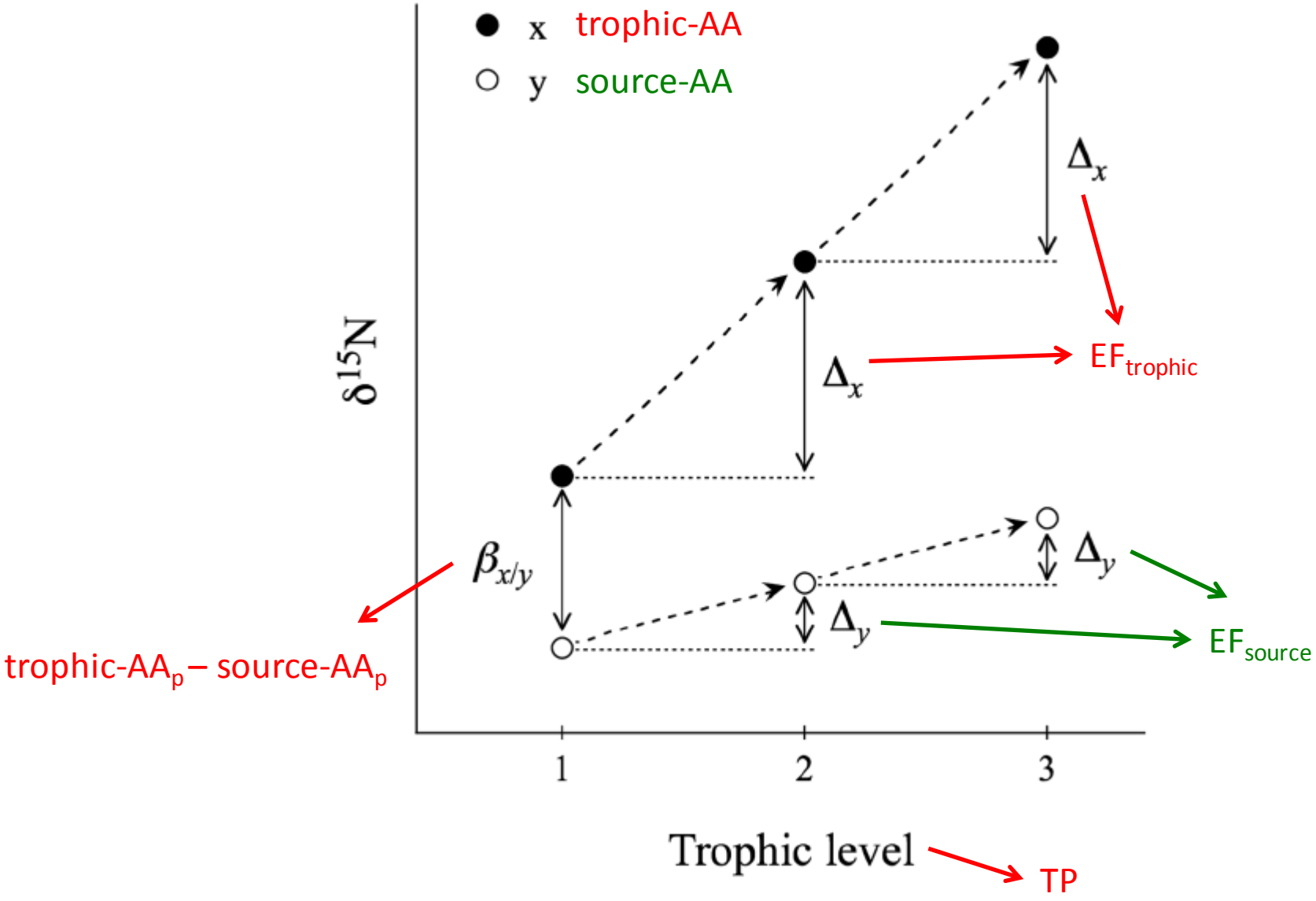
Jochmann & Schmidt (2012)

Introduction



Chikaraishi et al. (2009) Limnol Oceanogr Methods 7:740-750

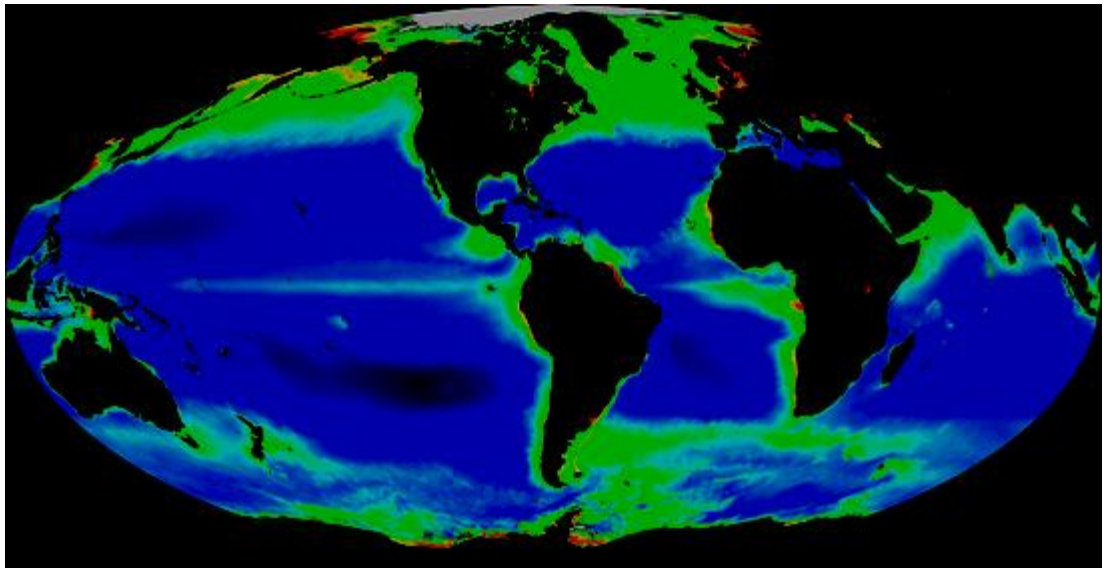
Differences in $\delta^{15}N$ AA-enrichment



Chikaraishi et al. (2009) Limnol Oceanogr Methods 7:740-750

Objectives

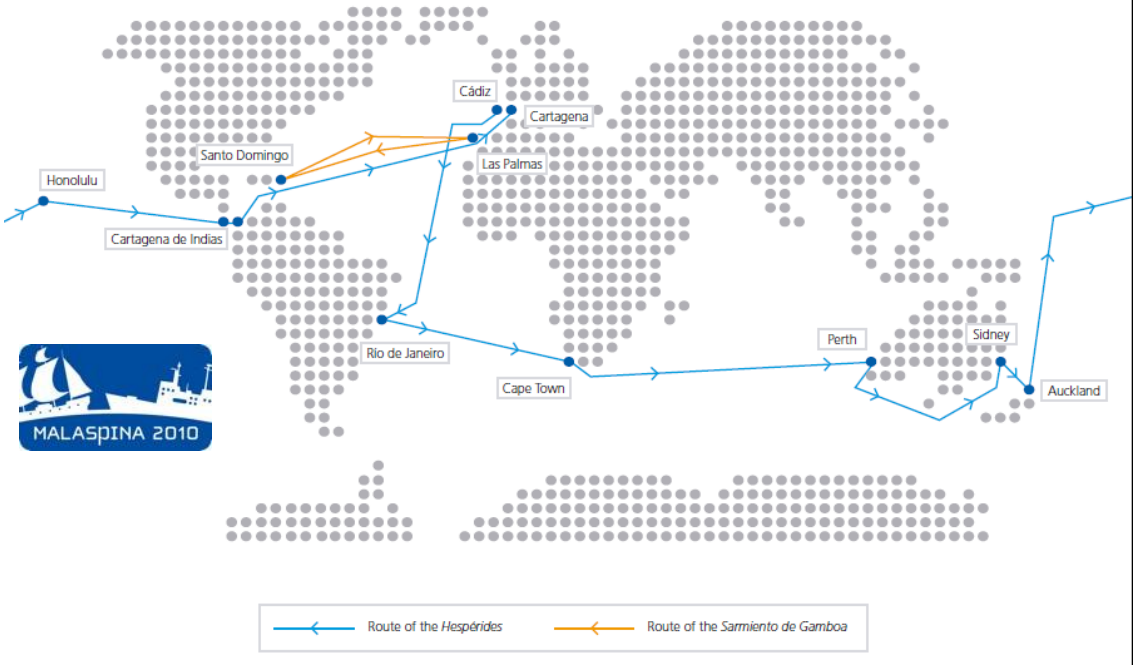
1. estimate of trophic position in size-fractions of plankton based on $\delta^{15}N_{AA}$
2. estimate diazotrophic N contribution across plankton size-fractions, and compare these results with more common $\delta^{15}N_{bulk}$ approaches

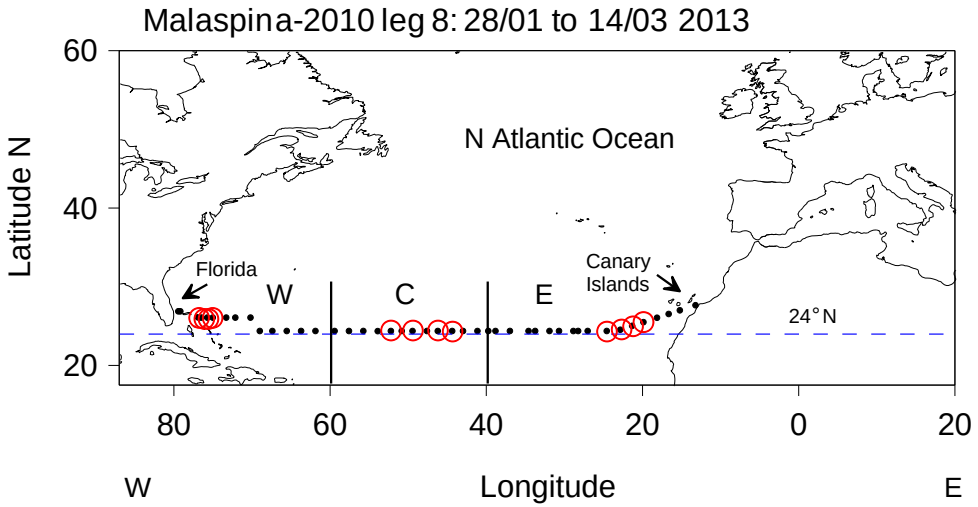


NASA SeaWifs

Methods

Sampling



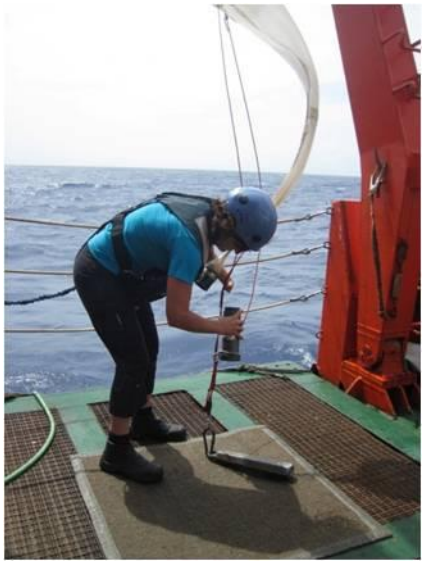


Circunnavigation Expedition Malaspina 2010: Global Change and Biodiversity Exploration of the Global Ocean (MALASPINA 2010). Project CSD 2008-00077

Methods

Sample processing:

WP2 nets
40 & 200µm mesh
0-200m



Separation in size-fractions

Size-fractions:
40-200µm
200-500µm
500-1000µm
1000-2000µm
2000-5000µm

SINAR
(mass-spectrometry)

$\delta^{15}N$ (‰)

… and plankton abundance and biomass determinations

Methods

Estimating TP using $\delta^{15}N$ Glu & Phe:

$$TL_{Glu/Phe} = (\delta^{15}N_{Glu} - \delta^{15}N_{Phe} - 3.4)/7.6 + 1$$

Chikaraishi et al. (2009) Limnol Oceanogr Methods 7:740-750

trophic-AA_p – source-AA_p

$EF_{trophic}$ - EF_{source}

Estimating diazotrophic N:

nitrate 5‰

atmospheric N_2 0‰

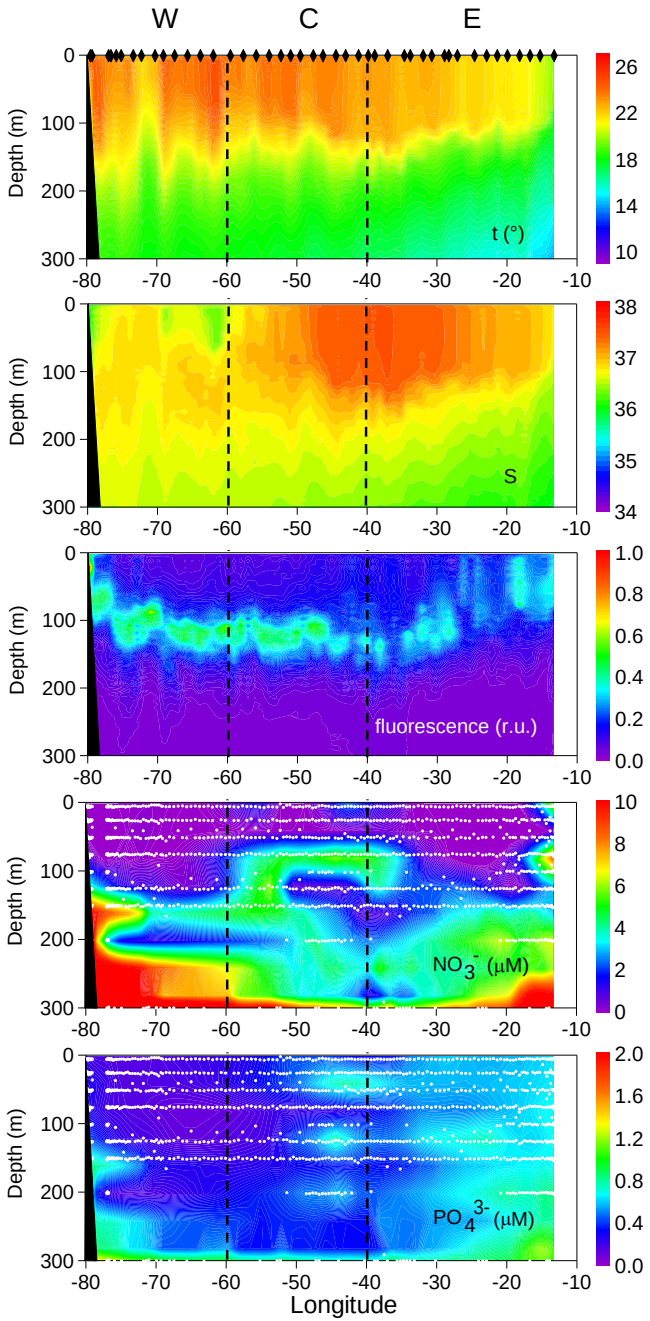
nitrate 5‰

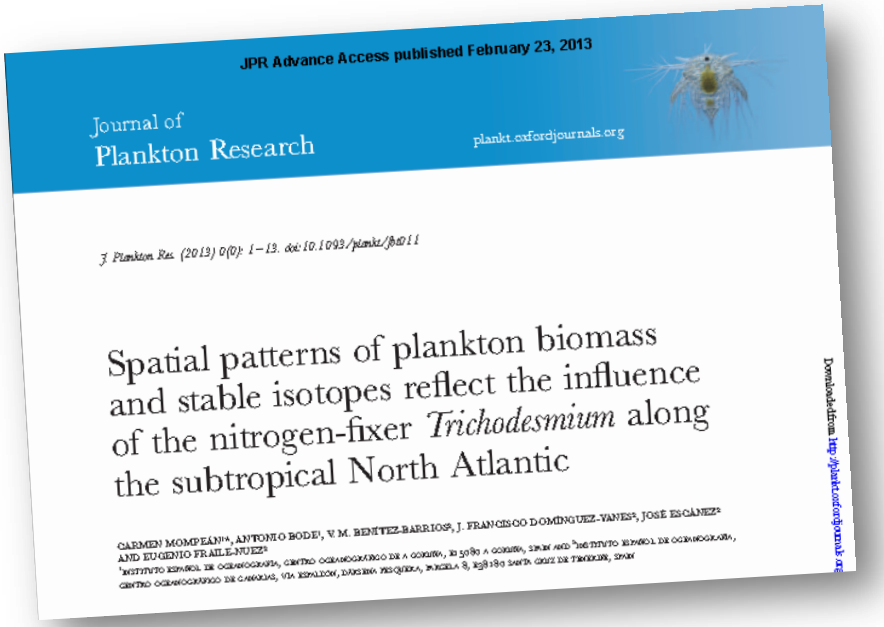
$$\%N_{fix} = 100\ (\delta^{15}N_{bulk} - \delta^{15}N_{ref}) / (\delta^{15}N_{diazo} - \delta^{15}N_{ref})$$

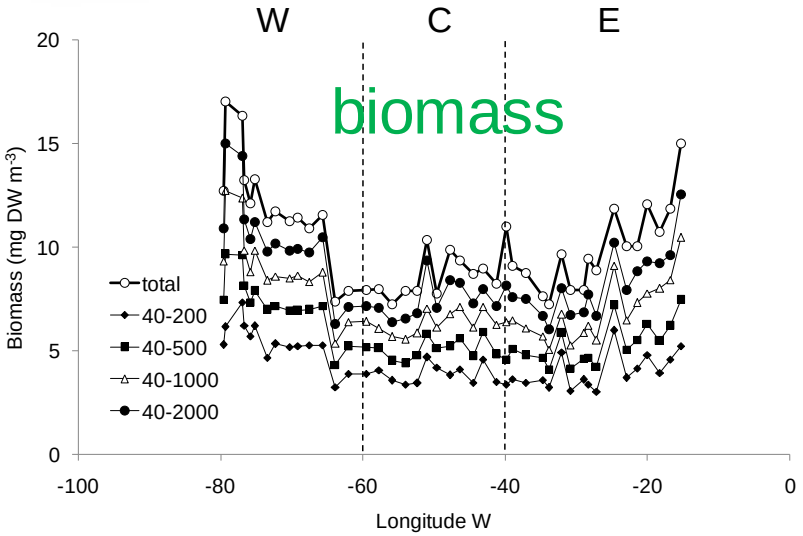
Montoya et al. 2002, Limnol. Ocanogr. 47: 1617-1628

$$\delta^{15}N_{bulk} = \delta^{15}N_{Phe} + \beta_{Phe}$$

Results



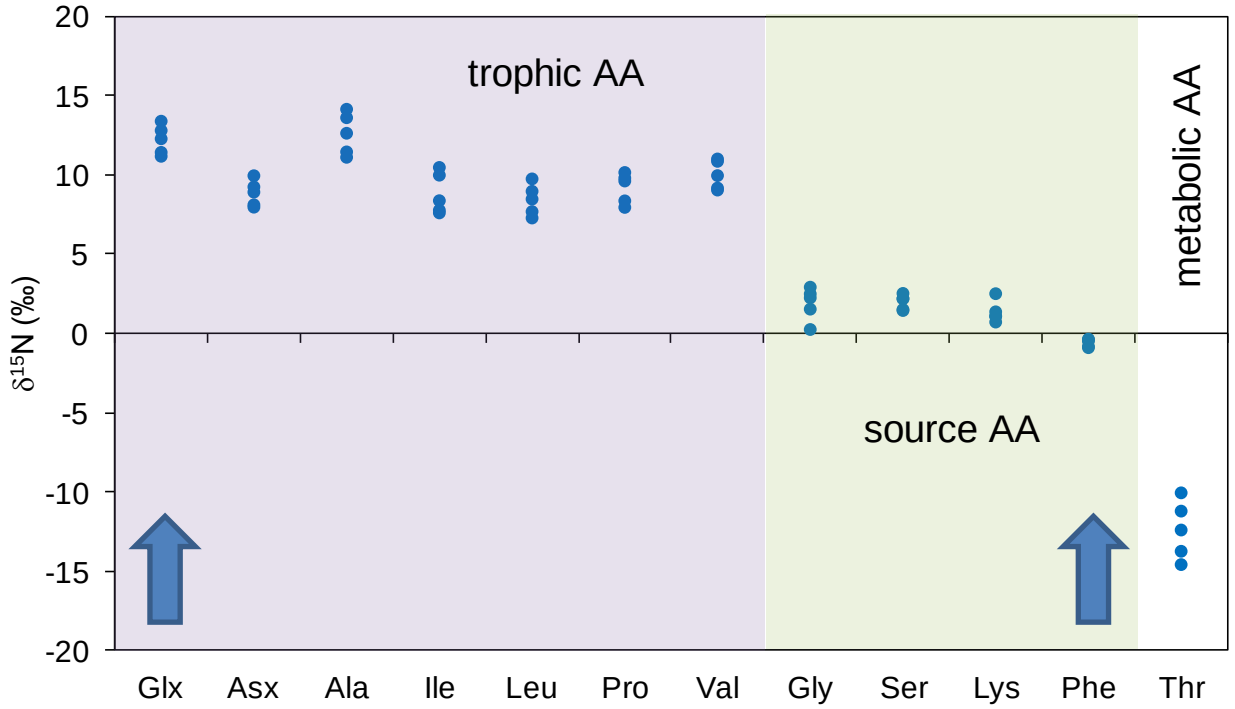




© Mompeán et al., J. Plankton Res. 2013, doi:10.1093/plankt/fbt011

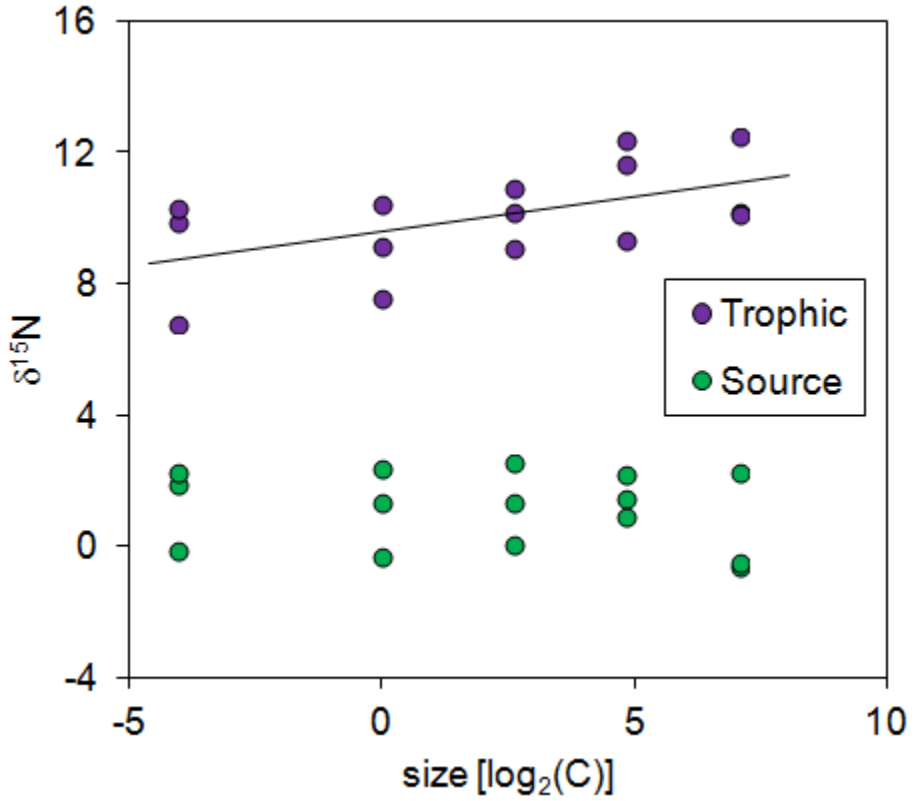
Results

Overall CSI-AA patterns:



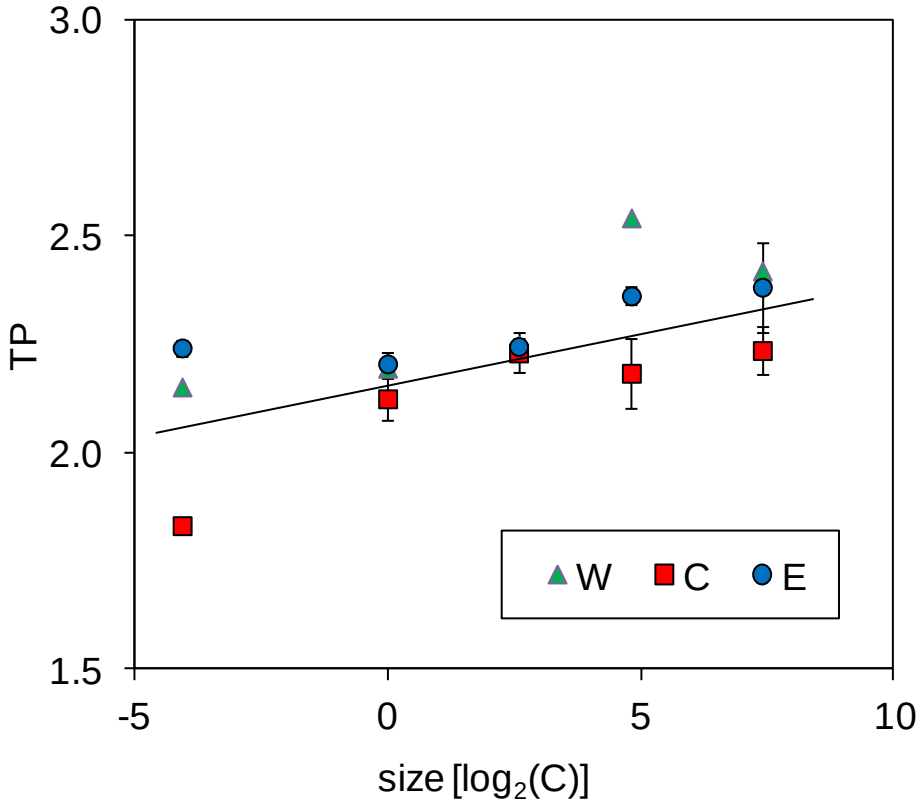
Results

Covariation of δ^{15}N-AA with size:



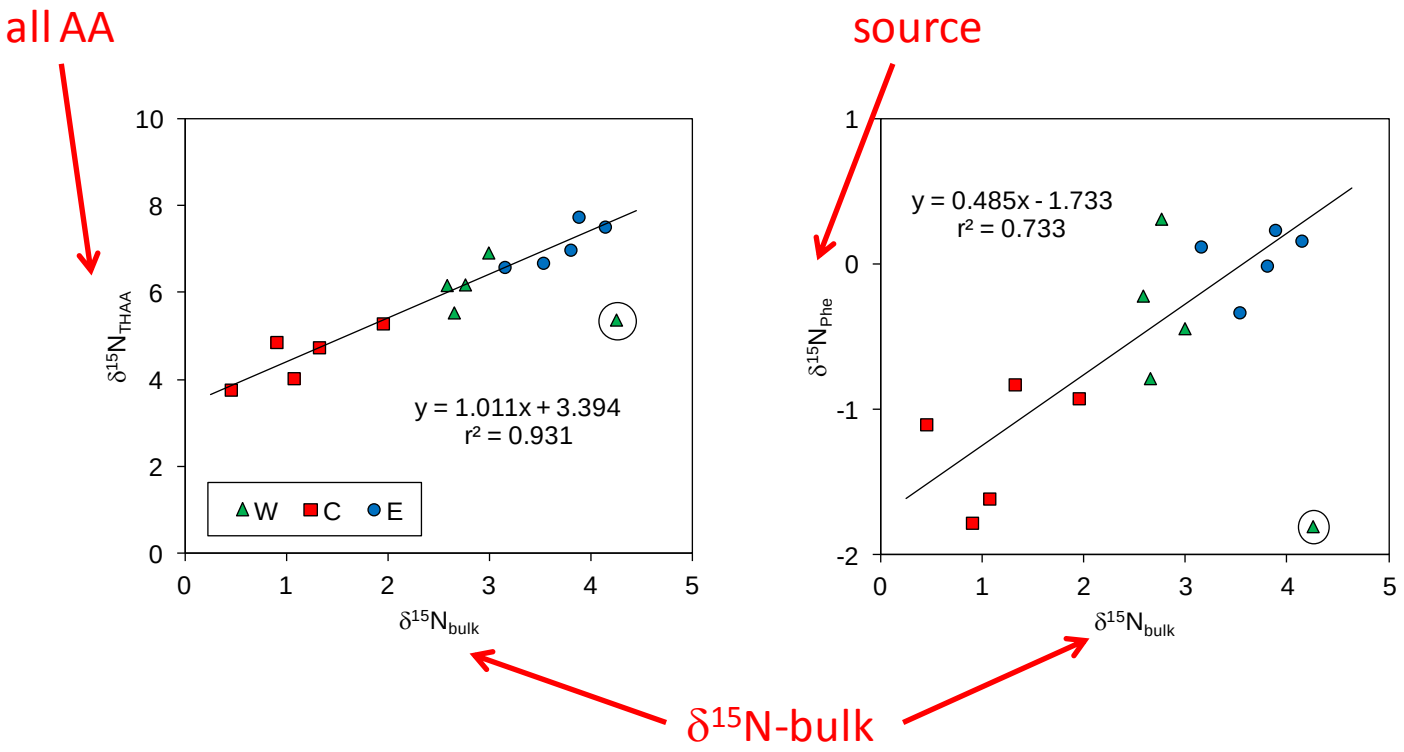
Results

Covariation of TP with size:



Results

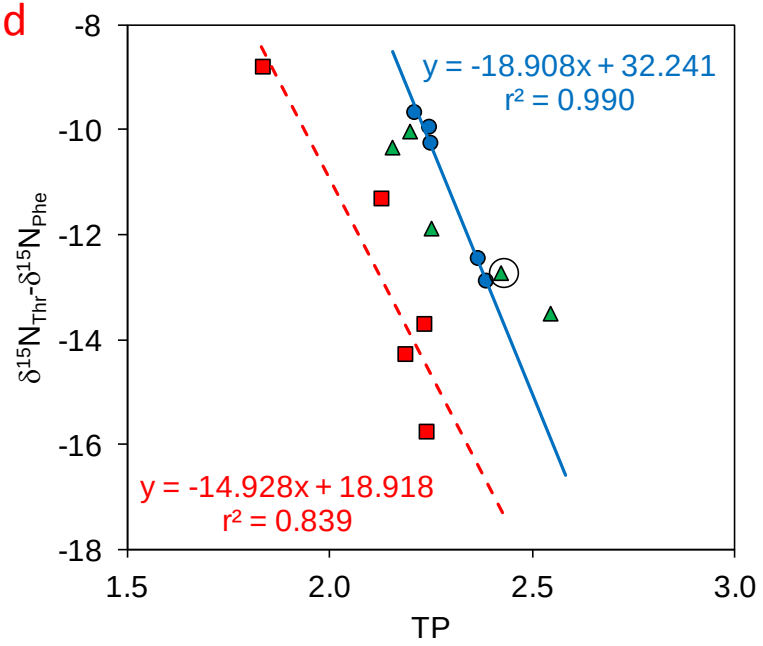
δ^{15}N-AA explain δ^{15}N-bulk patterns:



Results

TP affects Thr $\delta^{15}N$ patterns:

source corrected

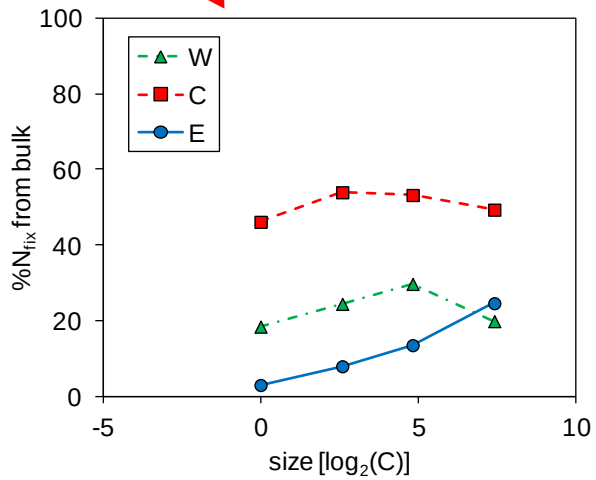


a new trophic marker?

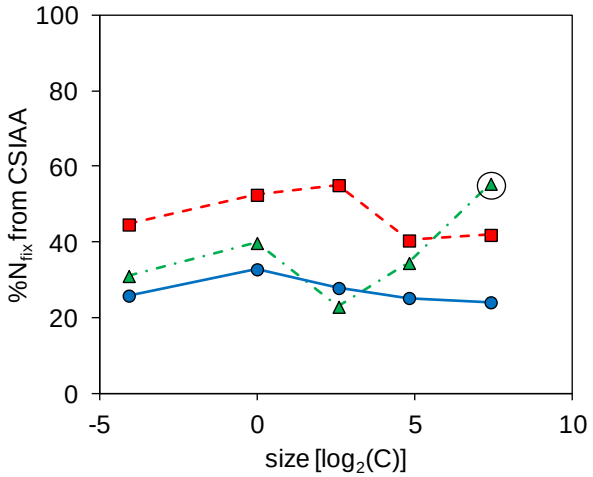
Results

Diazotrophic N impact vs. size:

bulk estimates



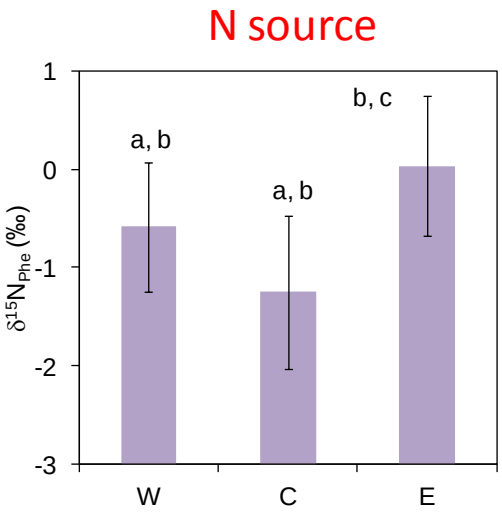
AA estimates

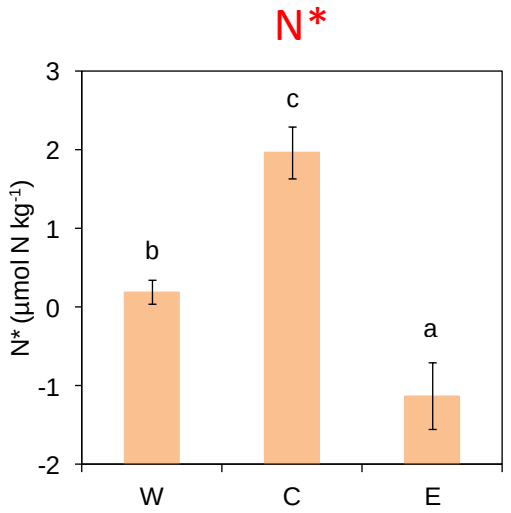


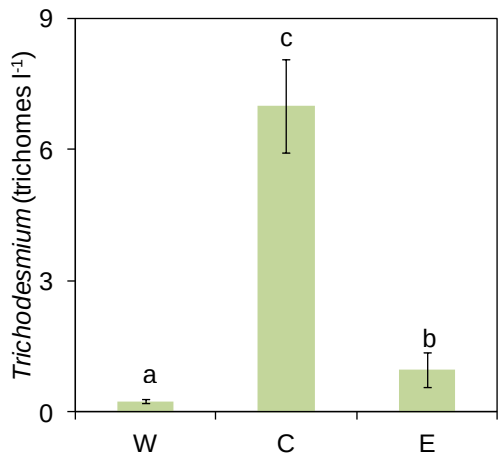
constant impact across sizes

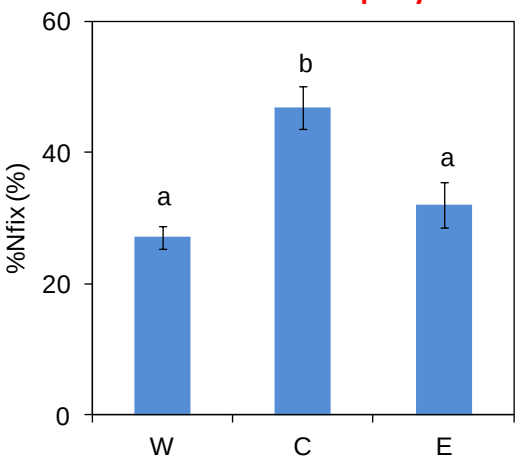
Results

Diazotrophy and *Trichodesmium*:









… and other Nfixers

Conclusions

δ^{15}N-AA in plankton size-classes:

- high impact of diazotrophy in the central subtropical Atlantic
- low variability in the impact of diazotrophic nitrogen across plankton size fractions
- greater importance of diazotrophic N than suggested by $\delta^{15}N_{bulk}$, abundance of *Trichodesmium* or nitrogen fixation rate measurements
- $\delta^{15}N_{Thr}$ = new parameter to compare trophic structure


CORREOS
0,50€ España
BIODIVERSIDAD Y OCEANOGRAFÍA
EXPEDICIÓN MALASPINA 2010
MALASPINA
MICROPLANCTON> 20µm
Formol 4%
RCM-FNMT 2011
ESTUDIO JESUS SANCHEZ