Oceanografía biológica: Algunos resultados de las campañas del Coriolis y Puerto Deseado

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CADIC

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G05
646
G06
650
G07
637
630
G08
621
G09
609
G10
Comodoro Rivadavia
Golfo San Jorge
Légende
Coriolis II
Pto. Deseado
Google Earth
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
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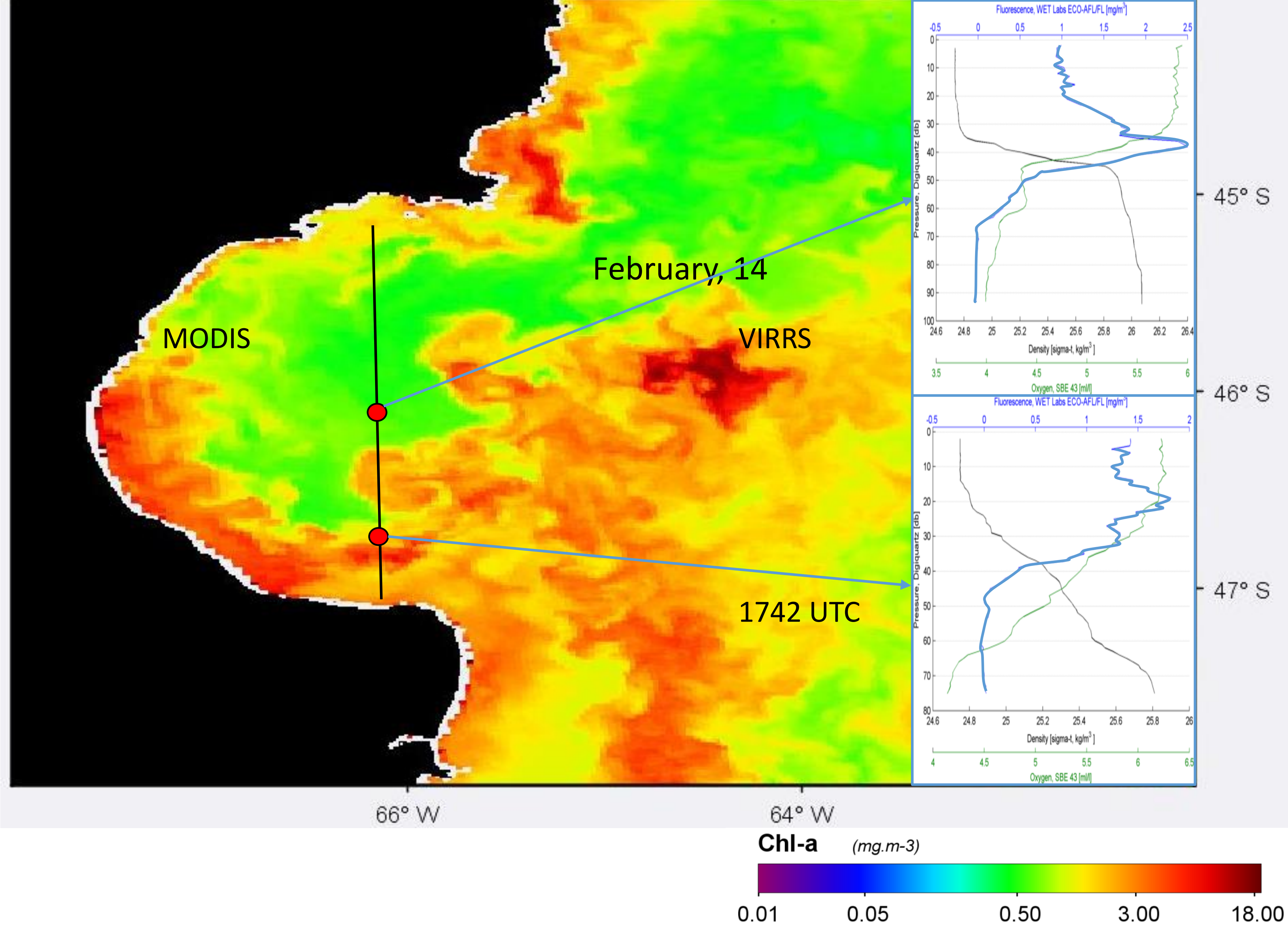
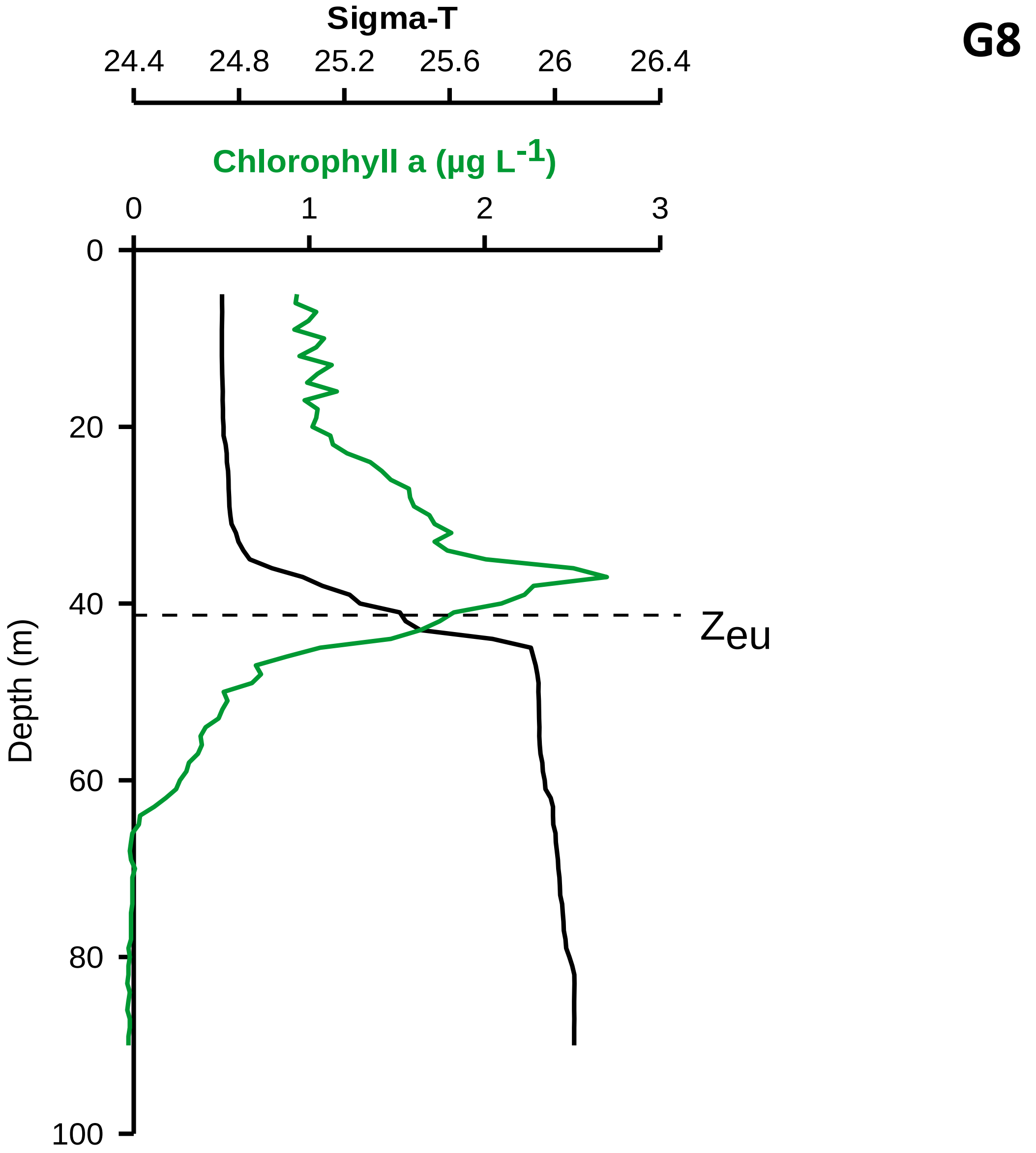
Image Landsat / Copernicus
100 km
N

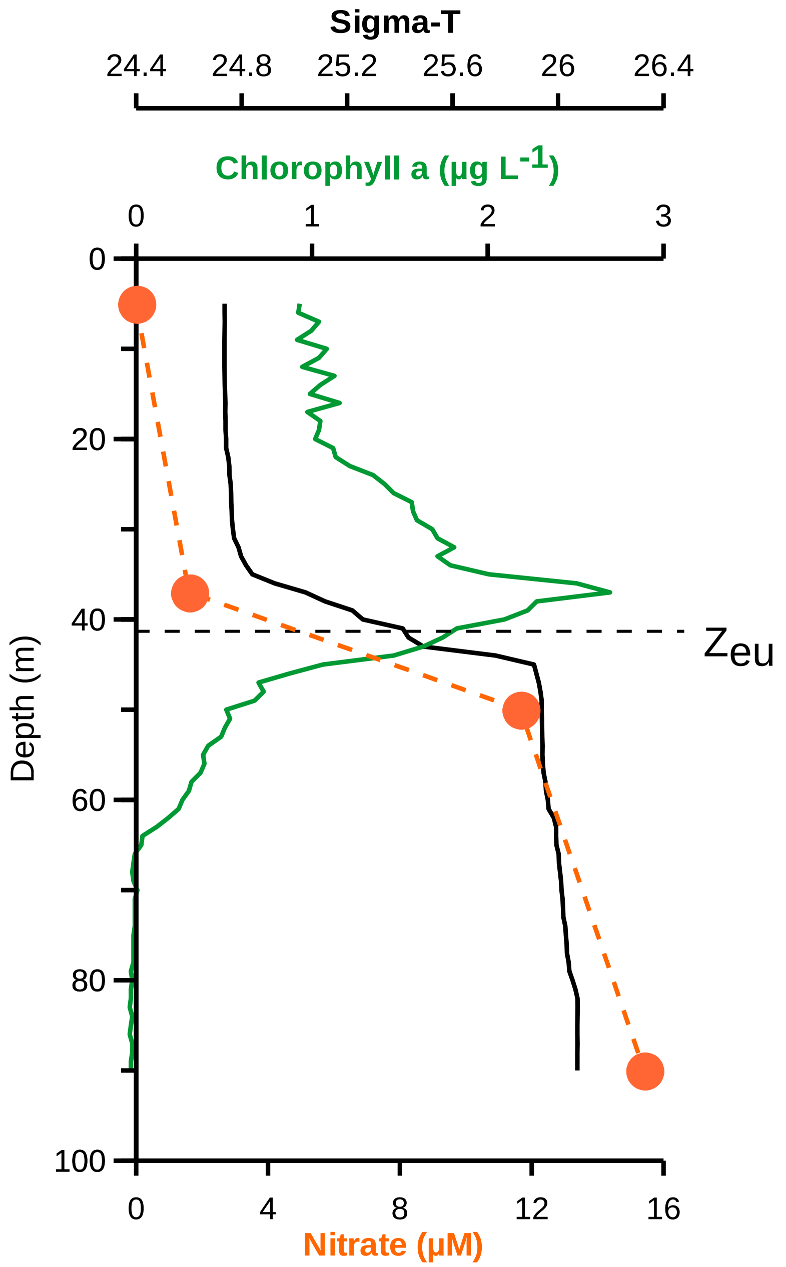
El fitoplancton



72 mg m^2

54 mg m^2


G8
Sigma-T
24.4
24.8
25.2
25.6
26
26.4
Chlorophyll a (µg L-1)
0
1
2
3
Depth (m)
0
20
40
60
80
100
Zeu

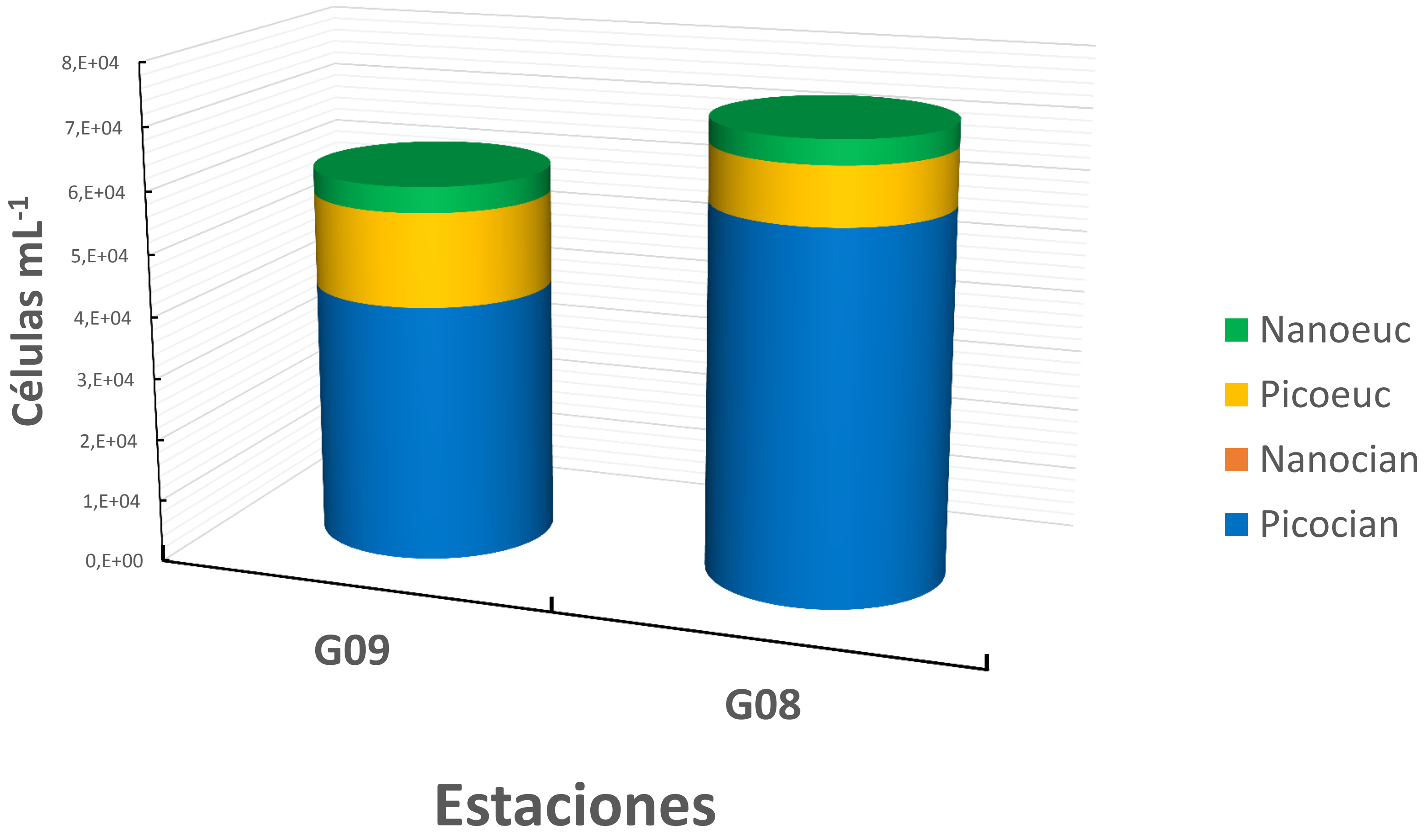


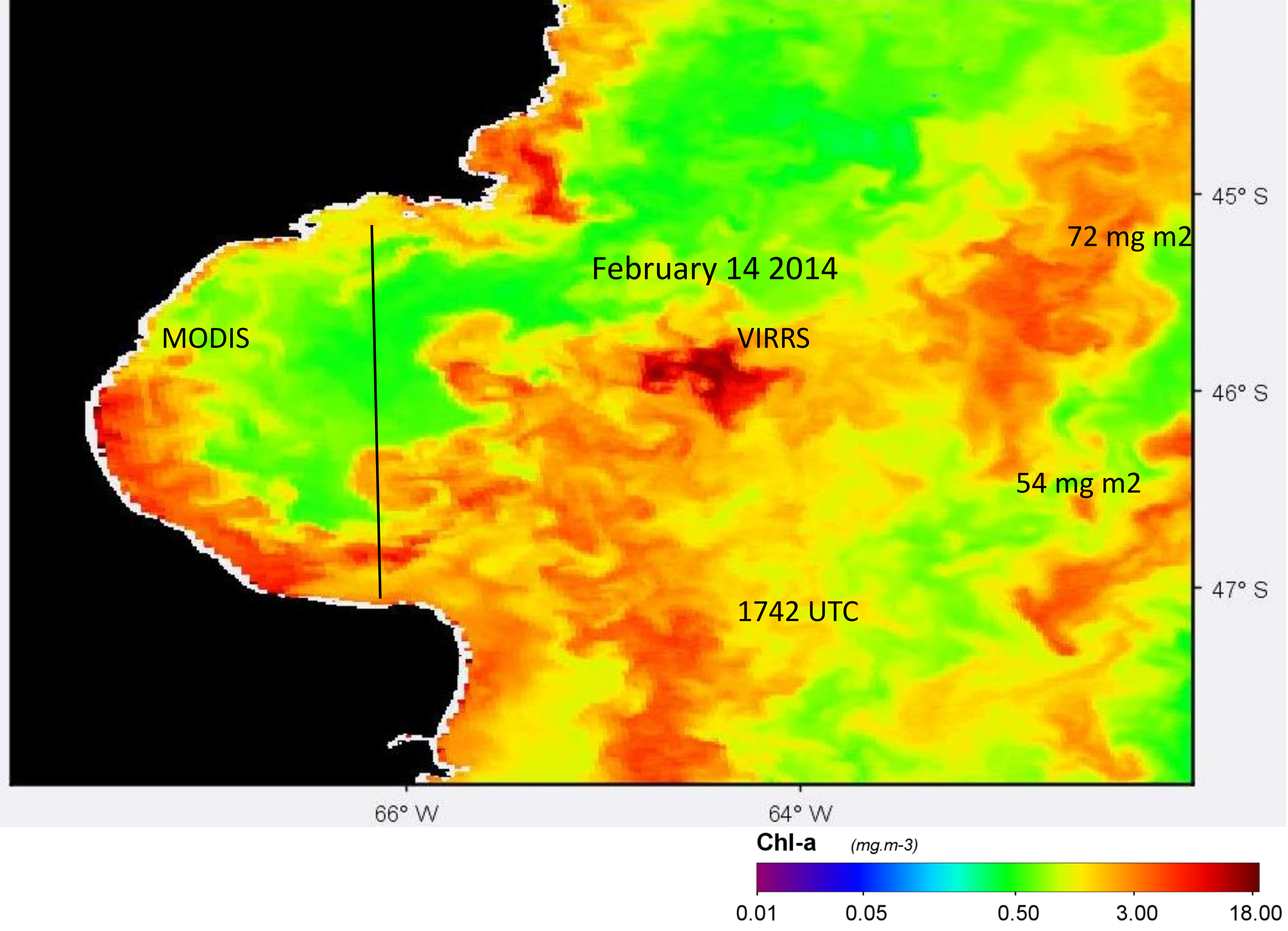
G8

$F_v/F_m = 0.31$

$F_v/F_m = 0.43$

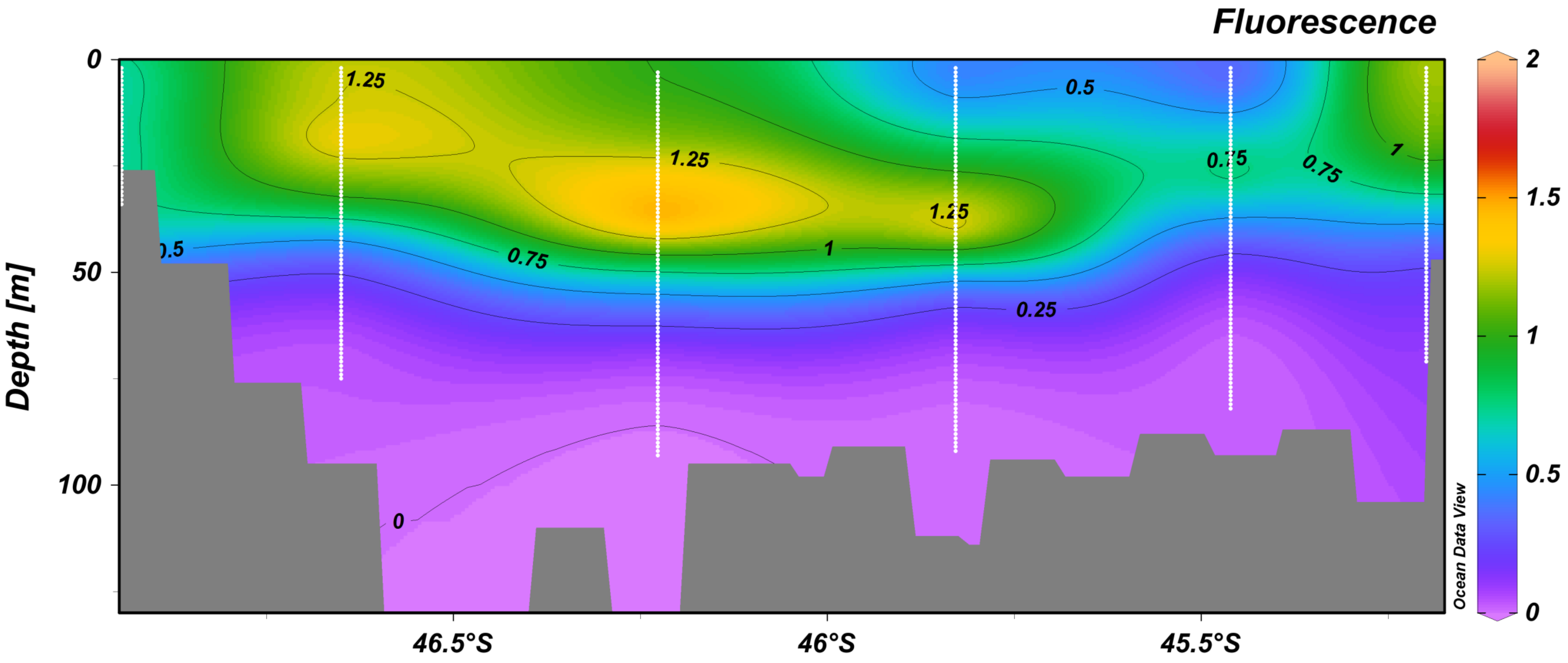
Fitoplancton



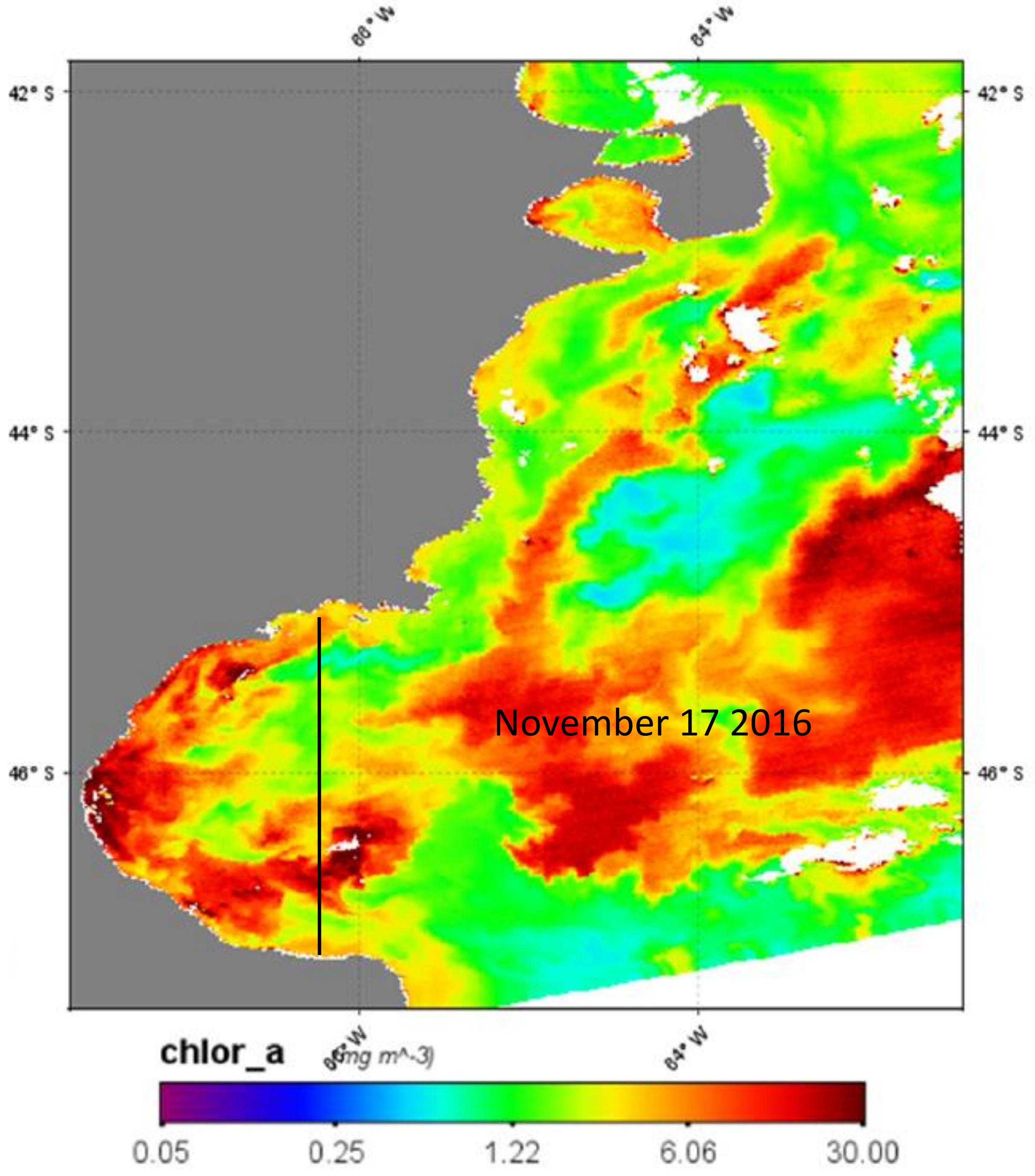


72 mg m2
February 14 2014
MODIS
VIRRS
54 mg m2
1742 UTC
45° S
46° S
47° S
66° W
64° W
Chl-a
(mg.m-3)
0.01
0.05
0.50
3.00
18.00

Coriolis II

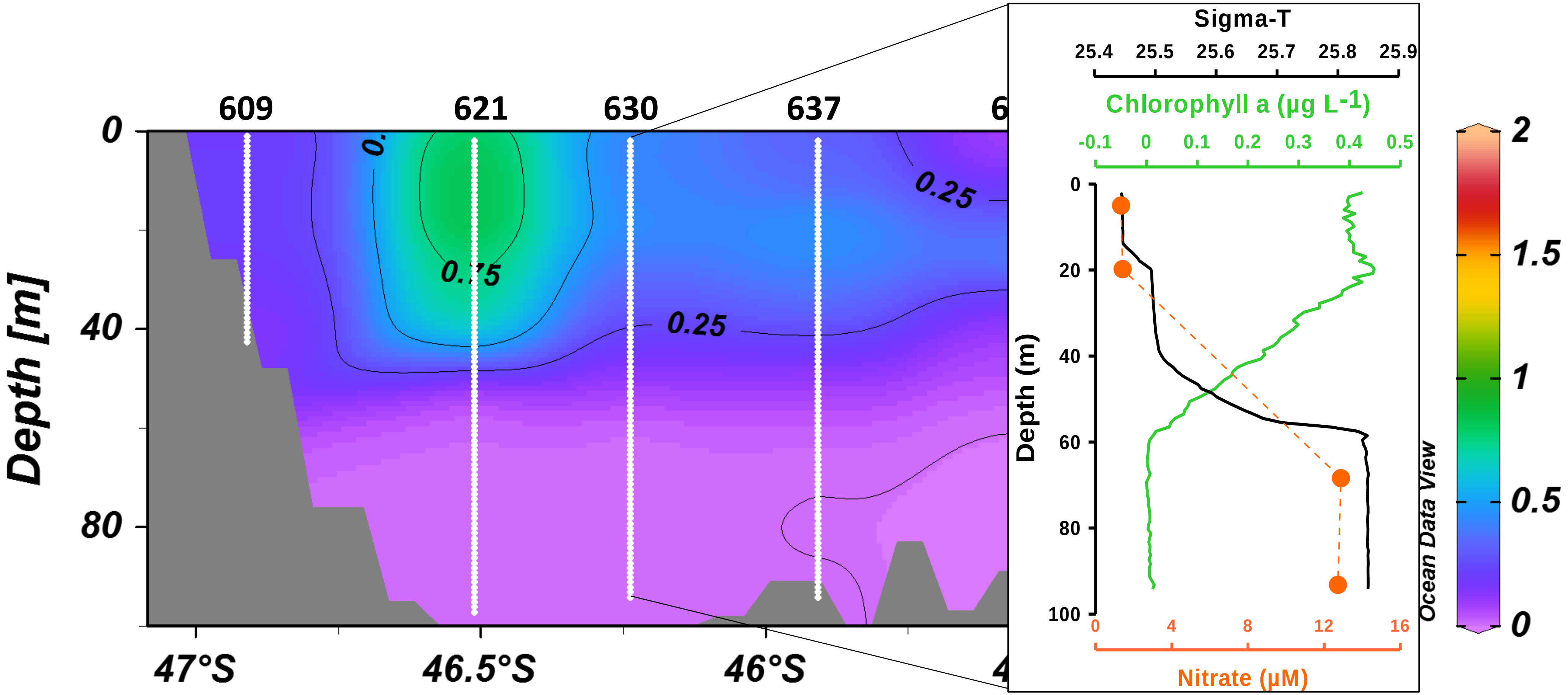


Fluorescence
Depth [m]
0
50
100
46.5°S
46°S
45.5°S
1.25
1.25
1.25
0.5
0.75
0.75
1
0.5
0.75
1
0.25
0
2
1.5
1
0.5
0
Ocean Data View



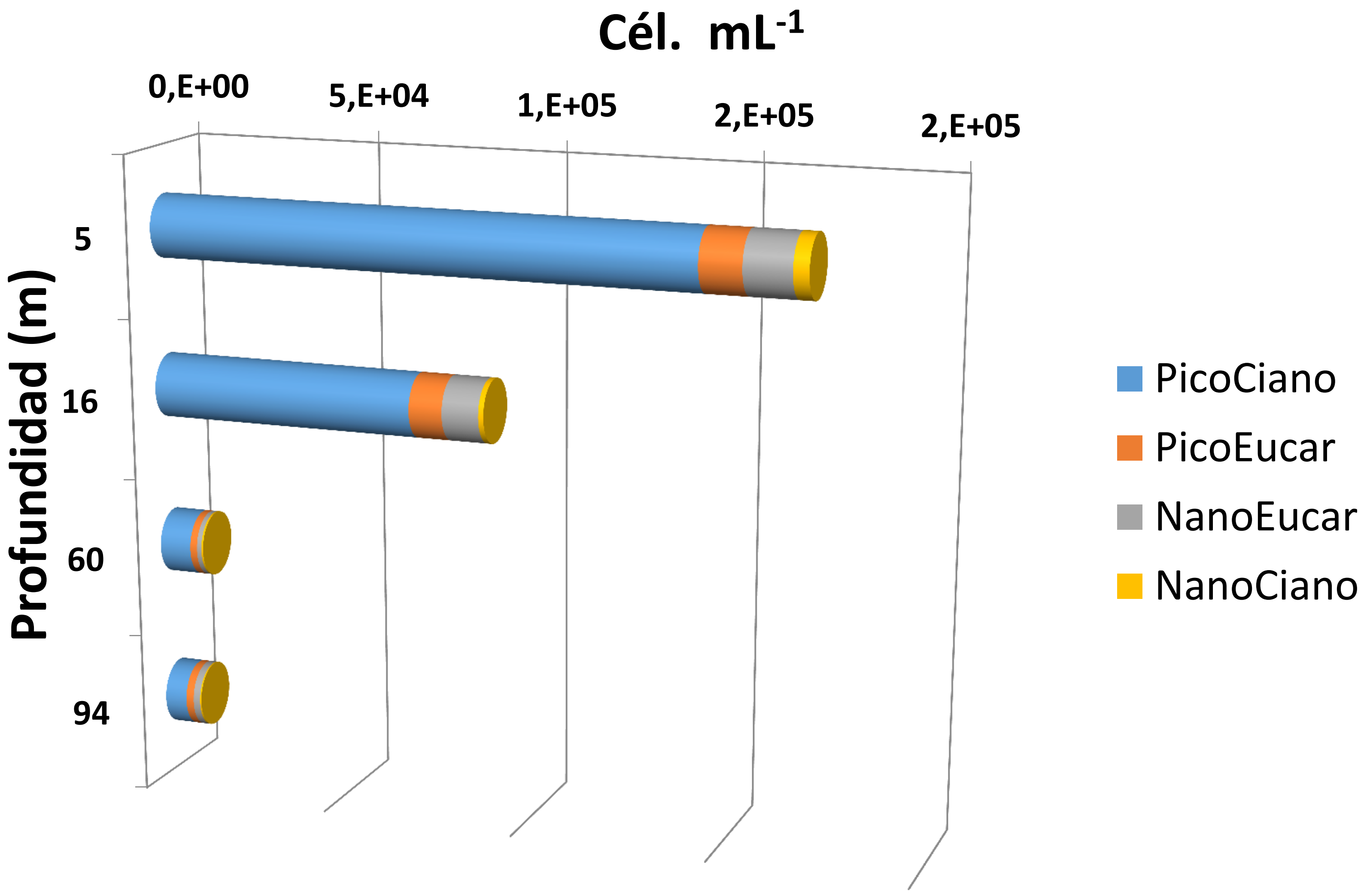
66° W
64° W
42° S
44° S
46° S
42° S
44° S
46° S
November 17 2016
66° W
64° W
chlor_a
(mg m^-3)
0.05
0.25
1.22
6.06
30.00

Pto. Deseado

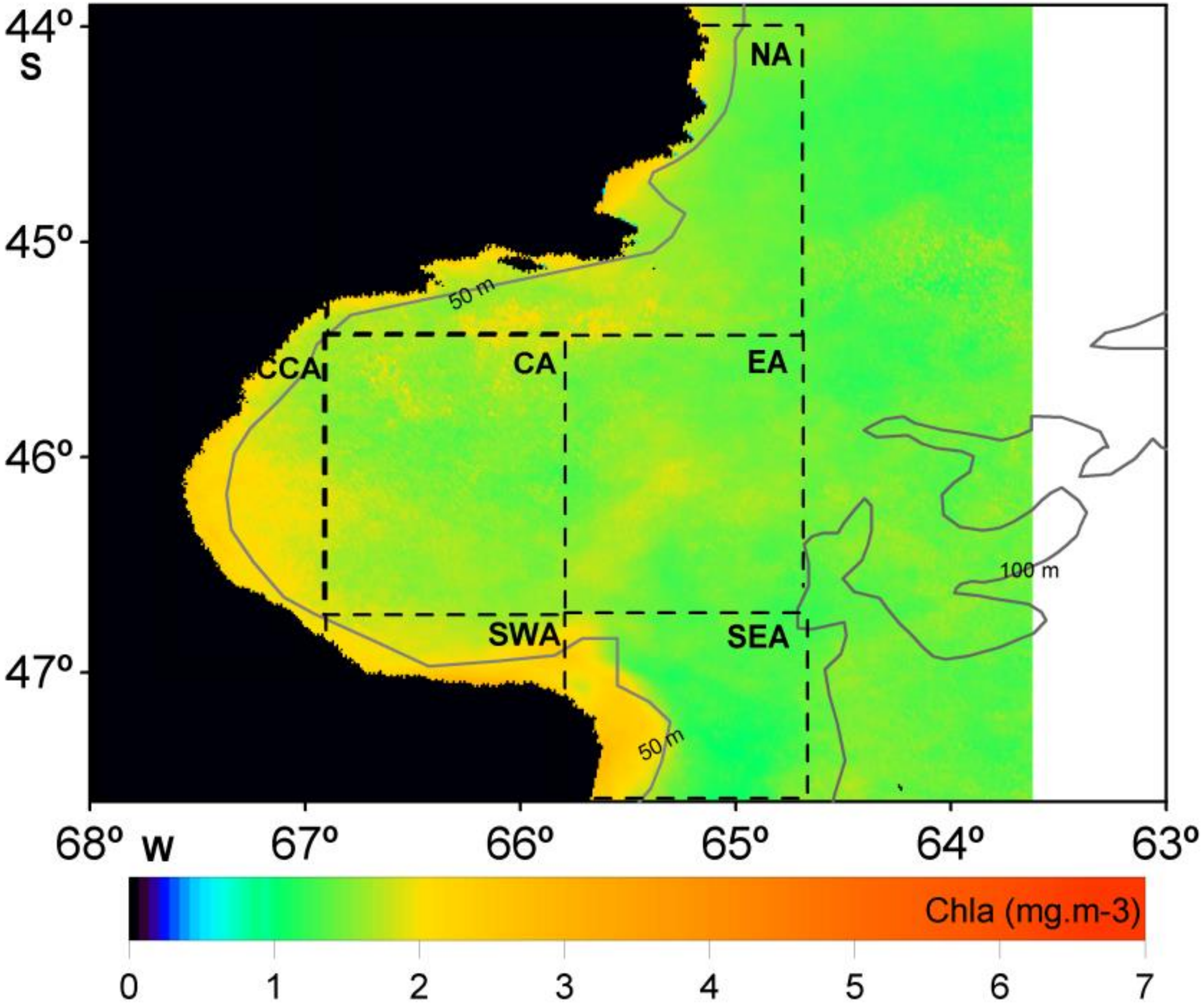


609
621
630
637
0
40
80
Depth [m]
0.25
0.75
0.25
47°S
46.5°S
46°S
Sigma-T
25.4
25.5
25.6
25.7
25.8
25.9
Chlorophyll a (µg L-1)
-0.1
0
0.1
0.2
0.3
0.4
0.5
Depth (m)
0
20
40
60
80
100
0
4
8
12
16
Nitrate (µM)
Ocean Data View
2
1.5
1
0.5
0

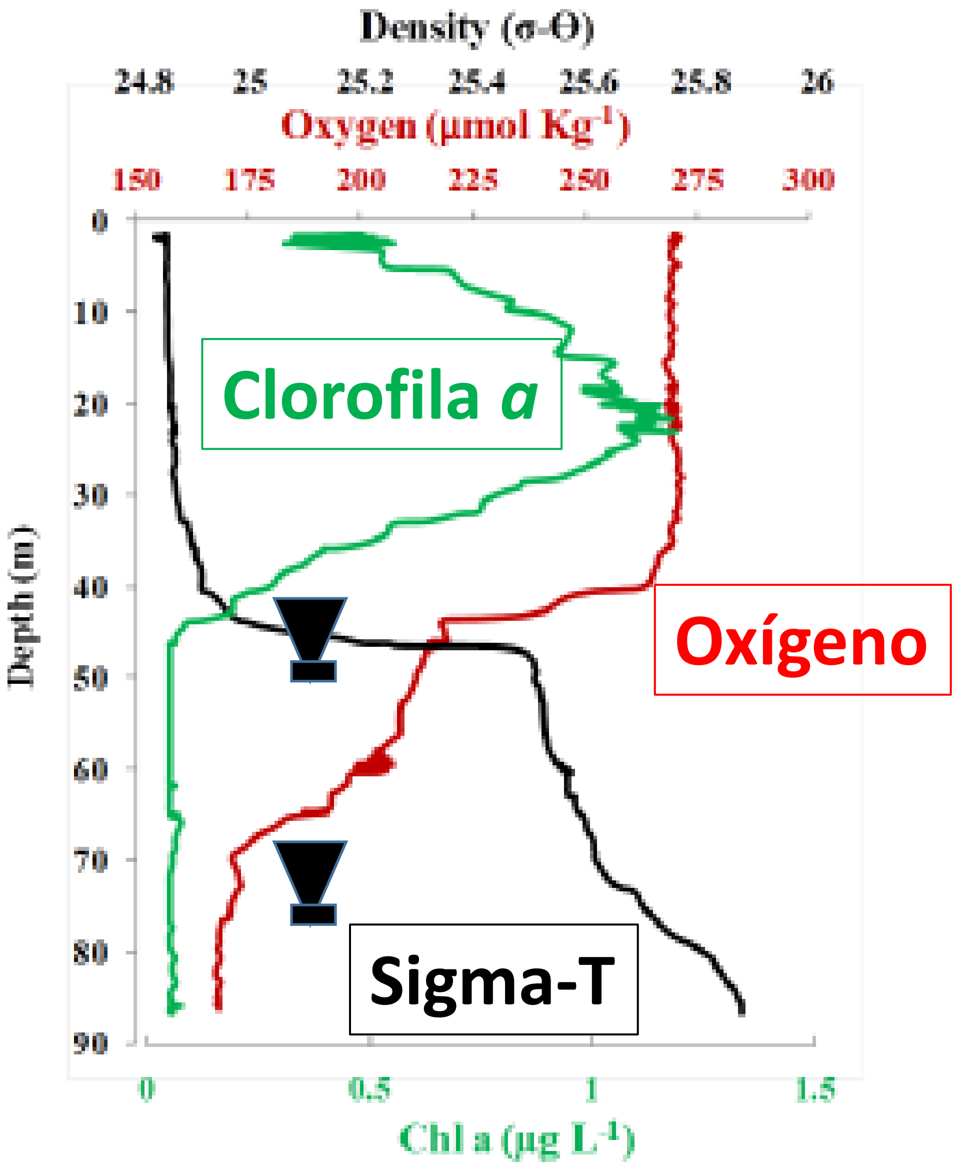
Fitoplancton



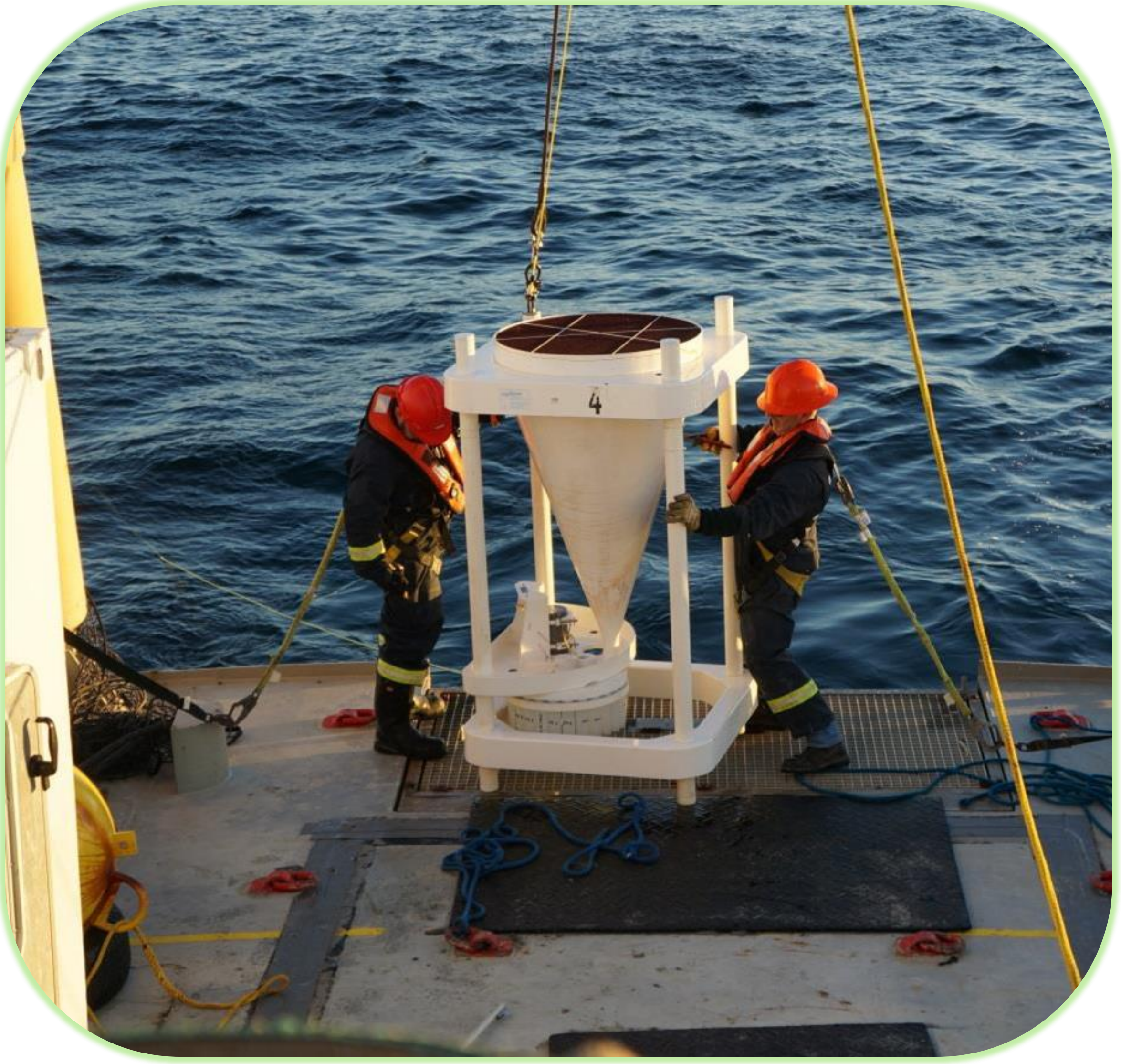
Chla SeaWiFS Serie temporal (2000-2006) MODIS (2004-2012) OC4v4
O`Reilly, 2000

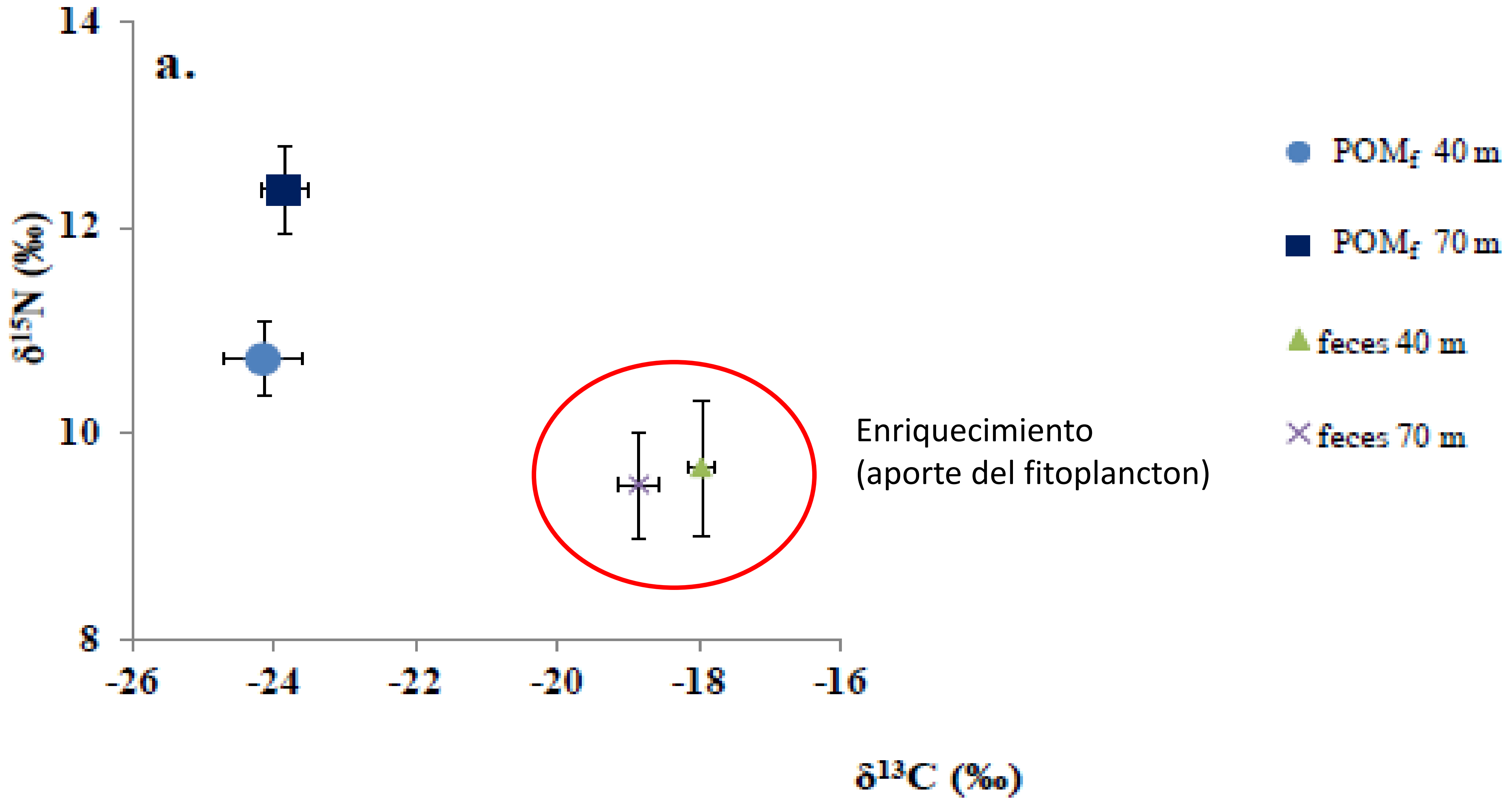


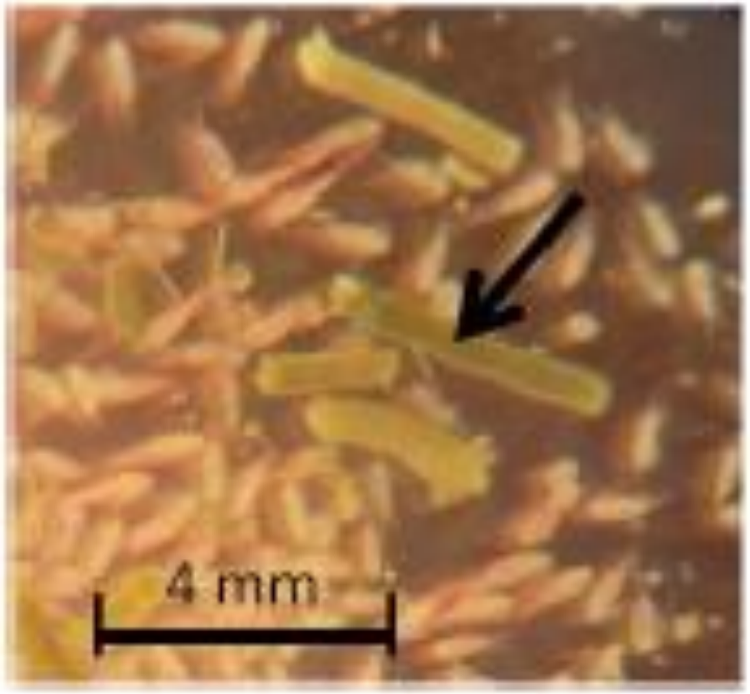
La exportación de materia orgánica

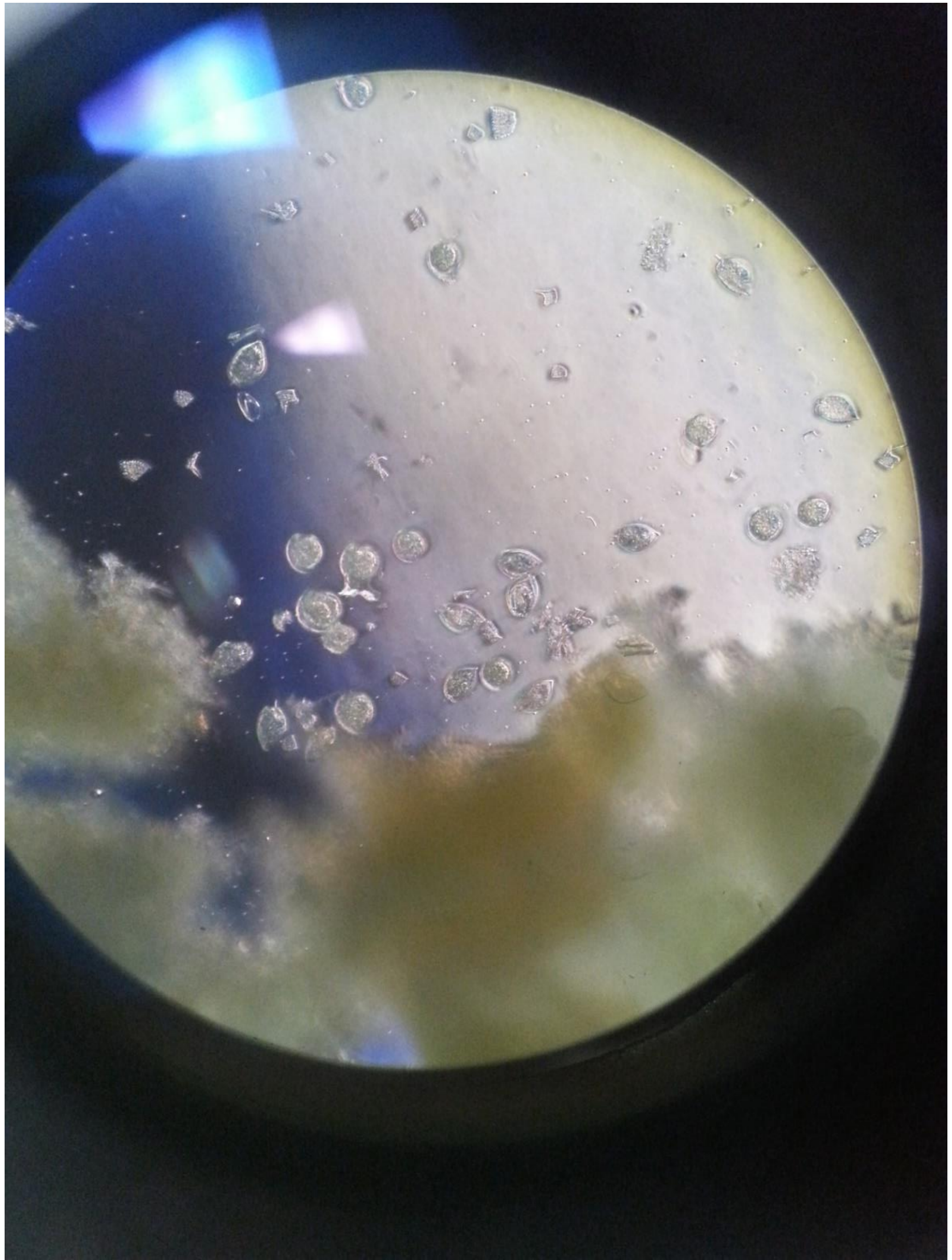


Density (σ-Θ)
24.8
25
25.2
25.4
25.6
25.8
26
Oxygen (µmol Kg-1)
150
175
200
225
250
275
300
0
10
20
30
40
50
60
70
80
90
Depth (m)
Clorofila a
Oxígeno
Sigma-T
0
0.5
1
1.5
Chl a (µg L-1)



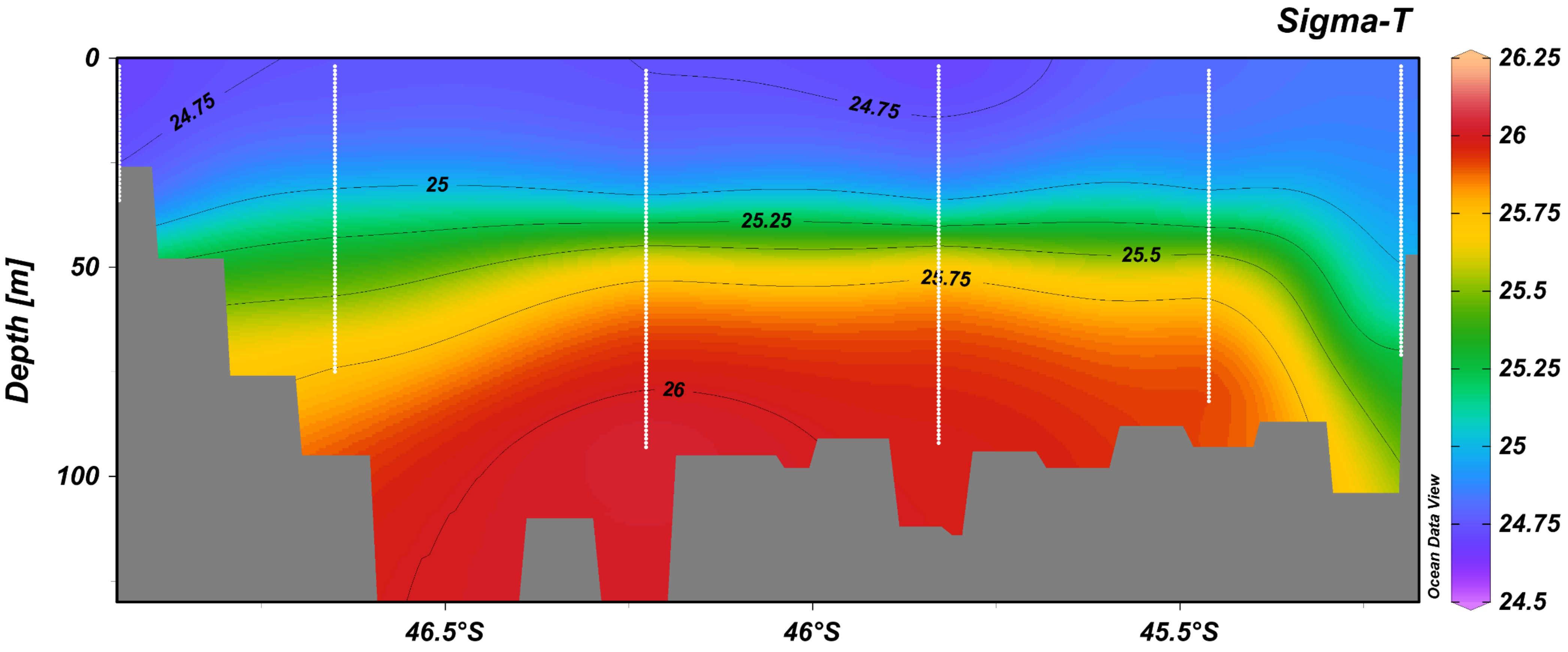

a.
14
12
10
8
-26
-24
-22
-20
-18
-16
δ15N (‰)
δ13C (‰)
POMf 40 m
POMf 70 m
feces 40 m
feces 70 m
Enriquecimiento
(aporte del fitoplancton)


4 mm

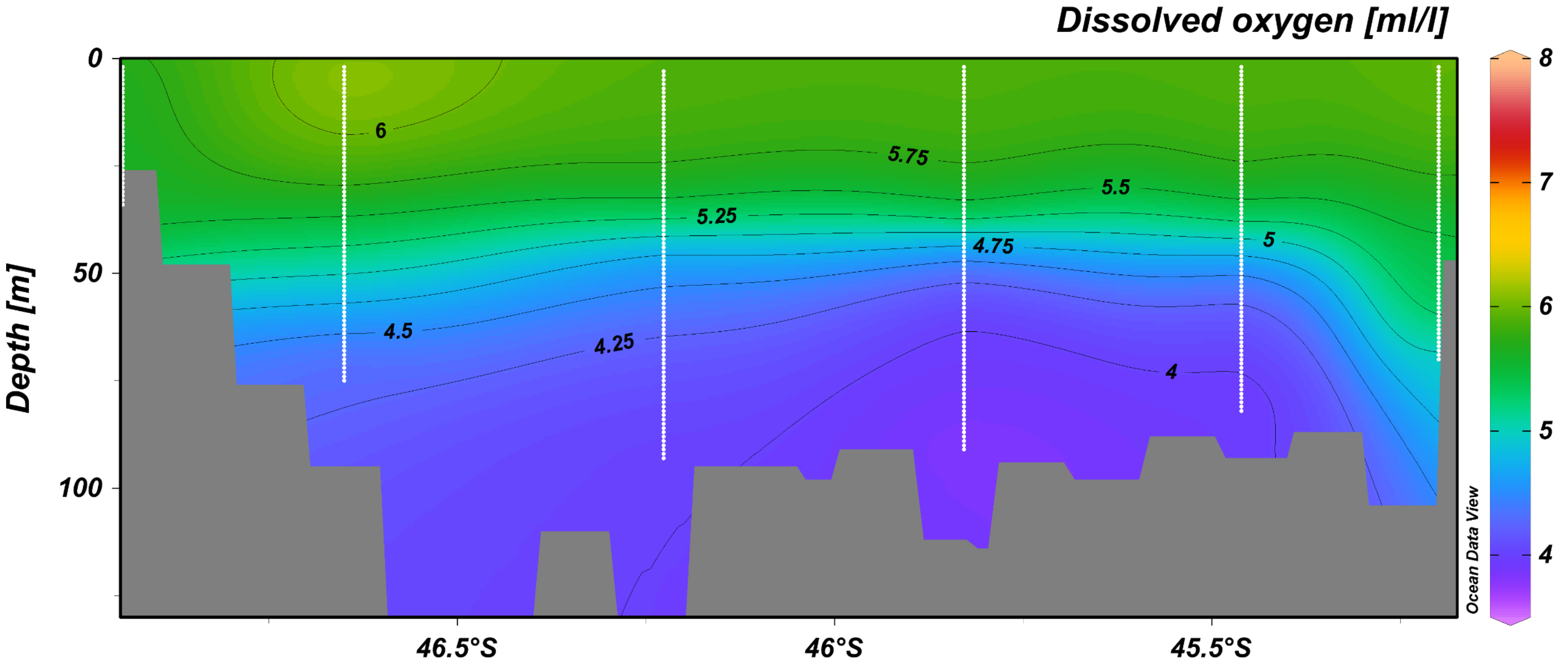


El metabolismo en la columna de agua

Coriolis II

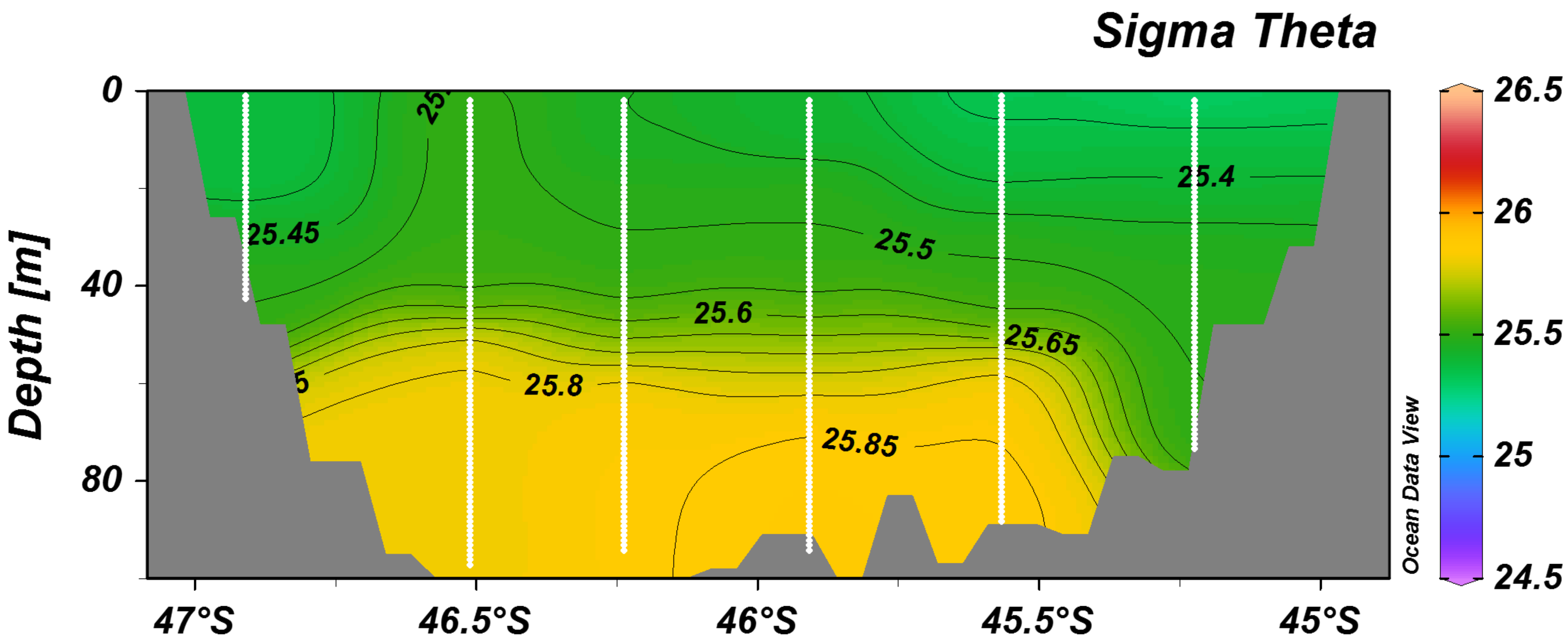

Sigma-T
0
50
100
Depth [m]
24.75
24.75
25
25.25
25.5
25.75
26
46.5°S
46°S
45.5°S
Ocean Data View
26.25
26
25.75
25.5
25.25
25
24.75
24.5

Coriolis II



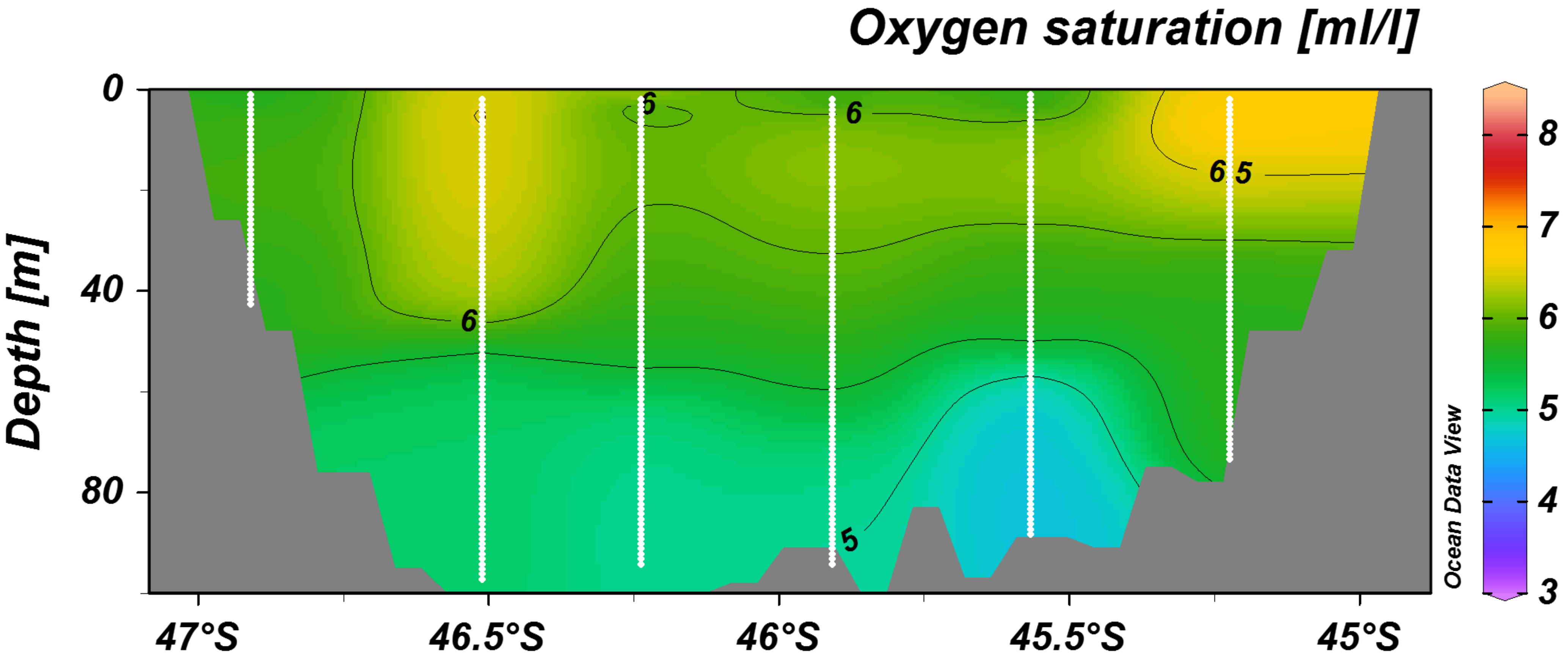
Dissolved oxygen [ml/l]
Depth [m]
0
50
100
6
5.75
5.5
5.25
5
4.75
4.5
4.25
4
46.5°S
46°S
45.5°S
8
7
6
5
4
Ocean Data View

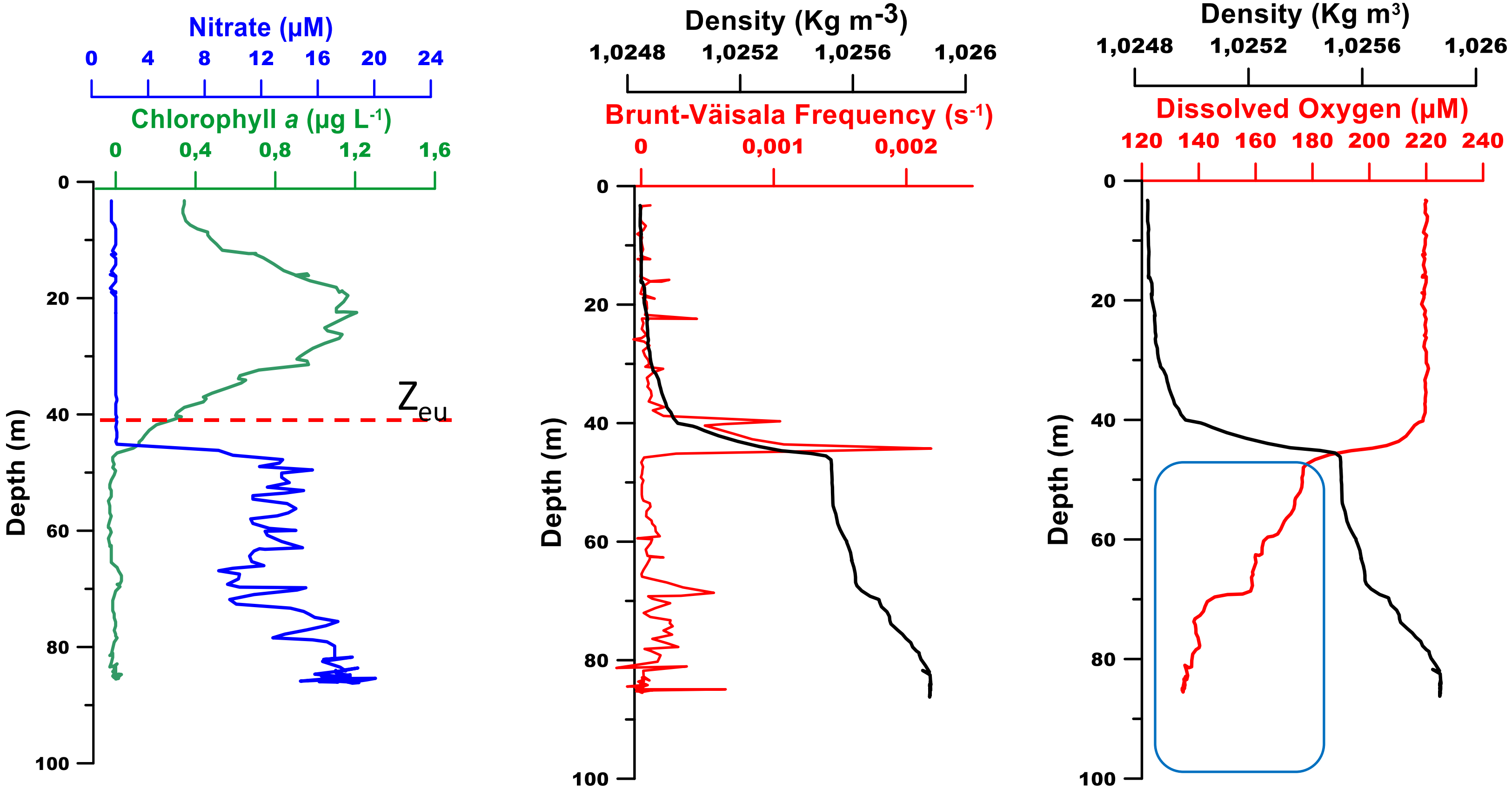
Pto. Deseado



Sigma Theta
Depth [m]
0
40
80
47°S
46.5°S
46°S
45.5°S
45°S
25.45
25.4
25.5
25.6
25.65
25.8
25.85
26.5
26
25.5
25
24.5
Ocean Data View

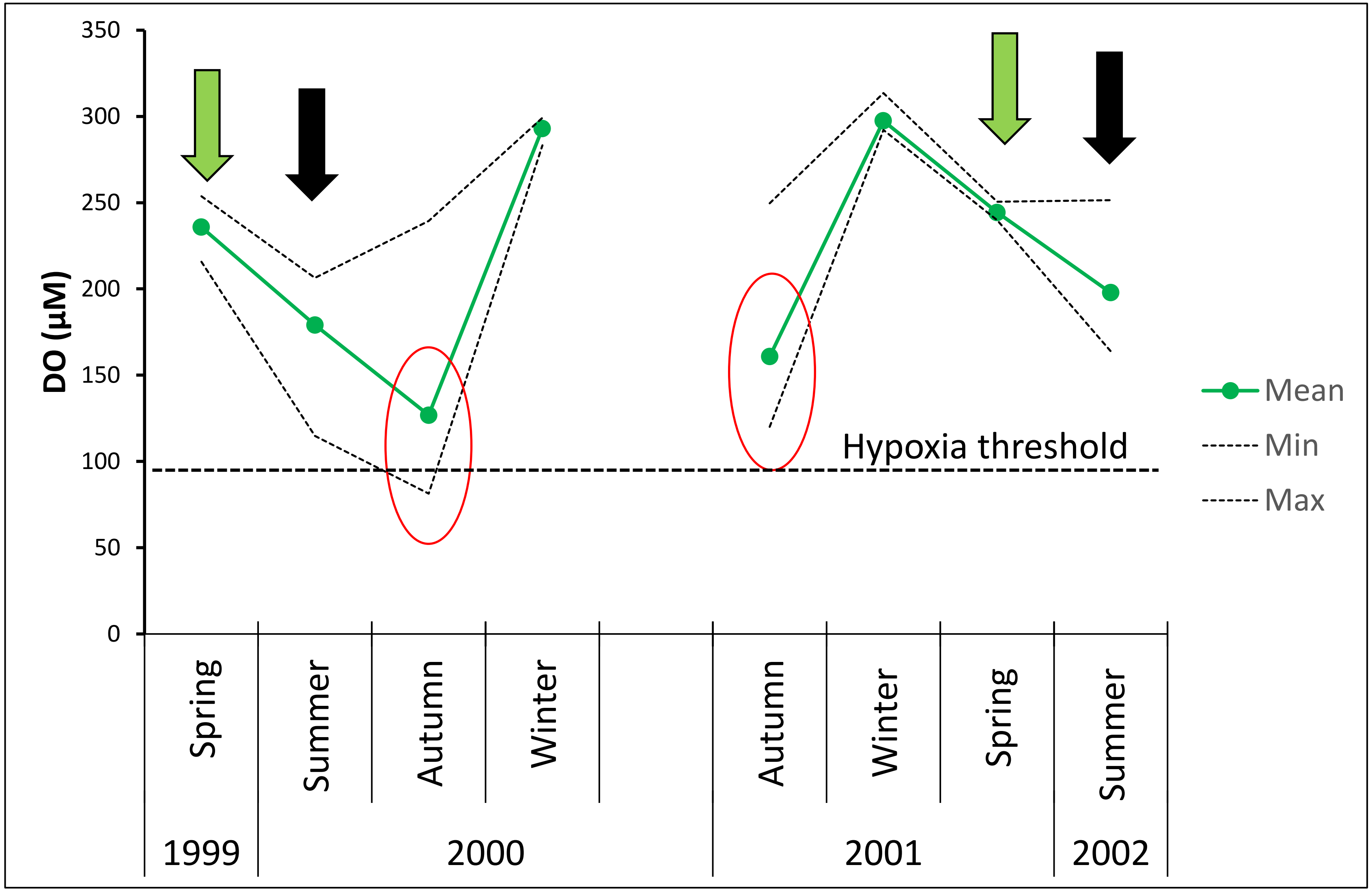
Pto. Deseado


Oxygen saturation [ml/l]
Depth [m]
0
40
80
47°S
46.5°S
46°S
45.5°S
45°S
6
6
6
6.5
5
8
7
6
5
4
3
Ocean Data View

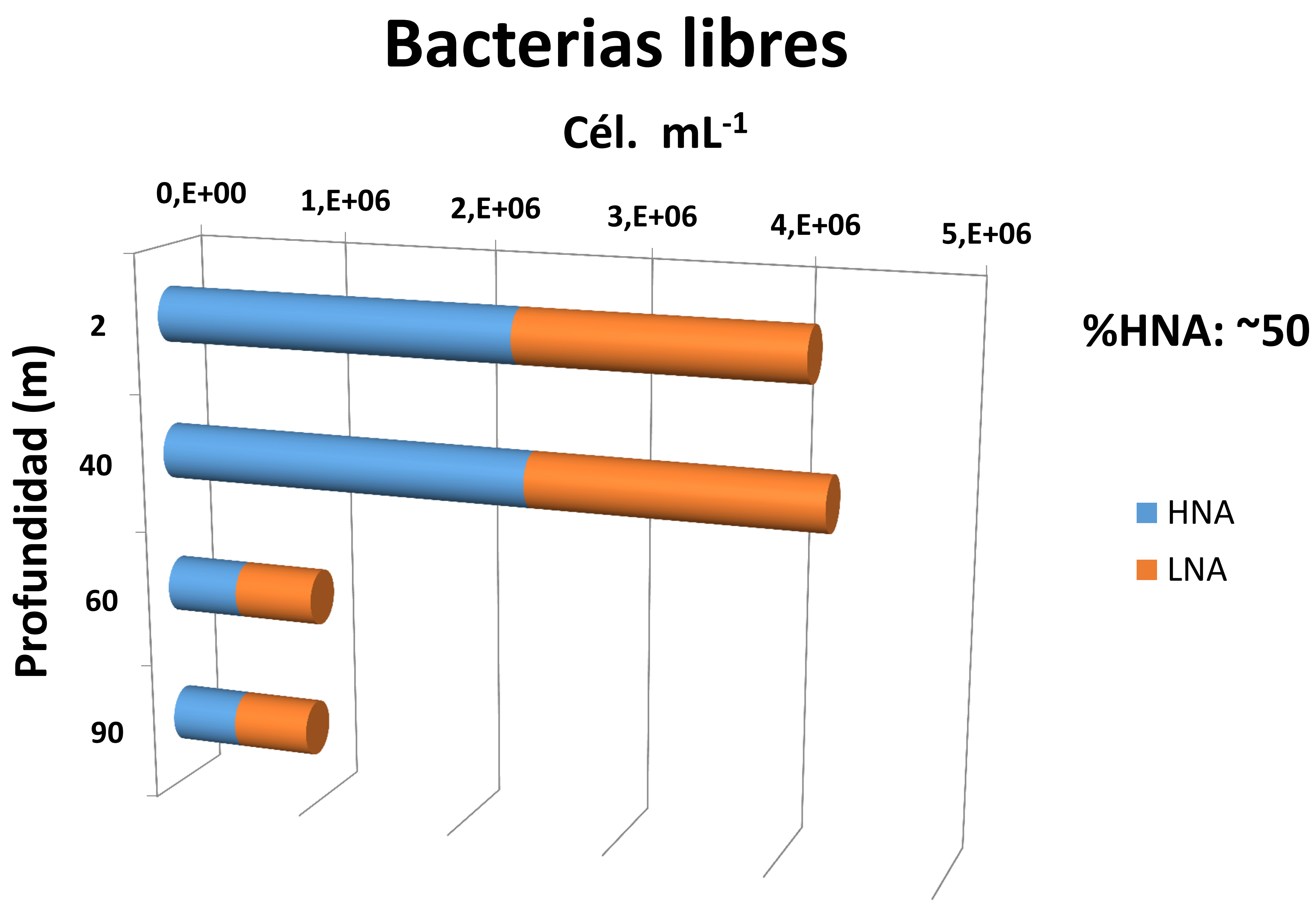


Nitrate (µM)
0 4 8 12 16 20 24
Chlorophyll a (µg L-1)
0 0,4 0,8 1,2 1,6
Depth (m)
0 20 40 60 80 100
Zeu
Density (Kg m-3)
1,0248 1,0252 1,0256 1,026
Brunt-Väisala Frequency (s-1)
0 0,001 0,002
Depth (m)
0 20 40 60 80 100
Density (Kg m3)
1,0248 1,0252 1,0256 1,026
Dissolved Oxygen (µM)
120 140 160 180 200 220 240
Depth (m)
0 20 40 60 80 100

The interannual perspective

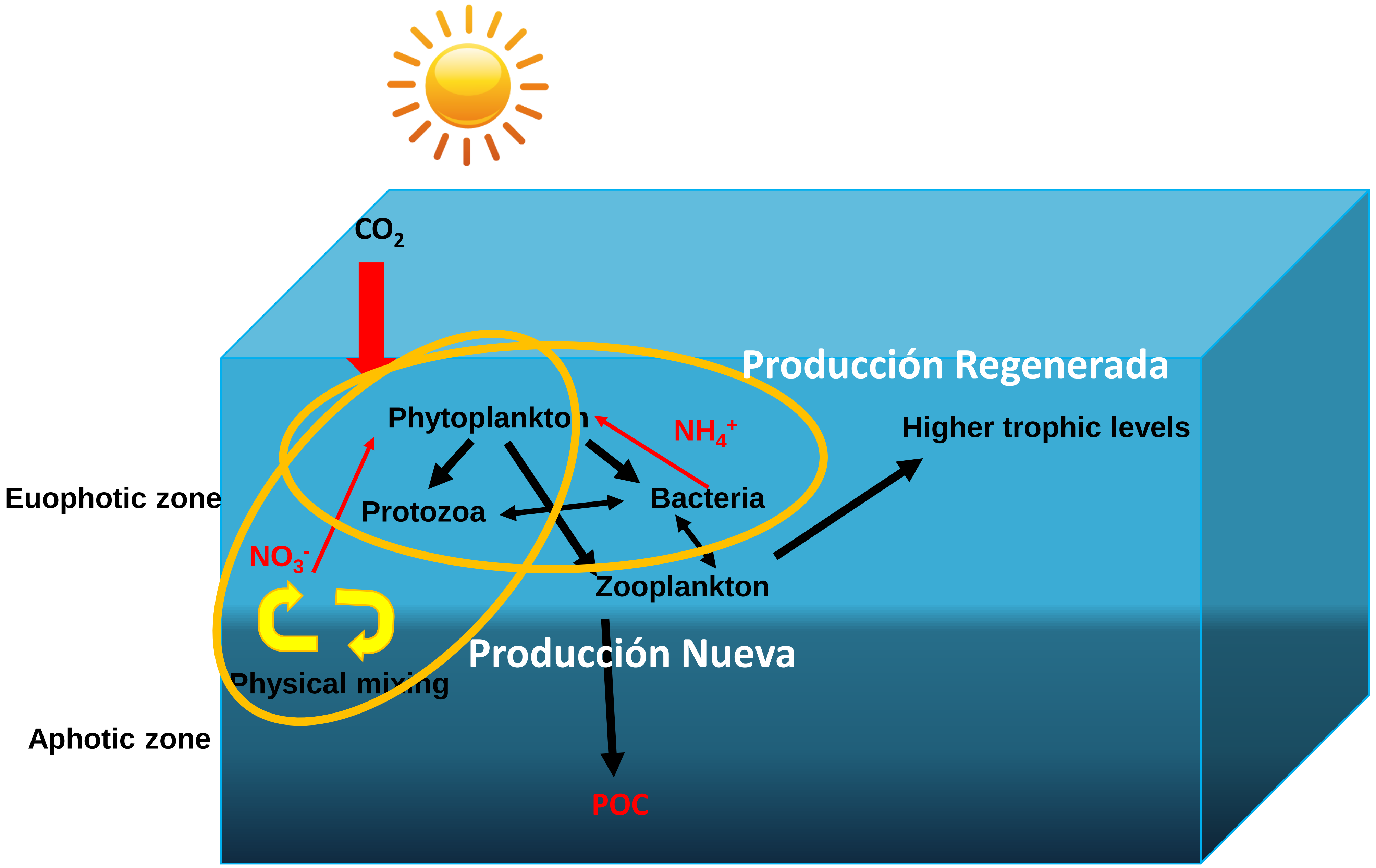


Fernandez 2006

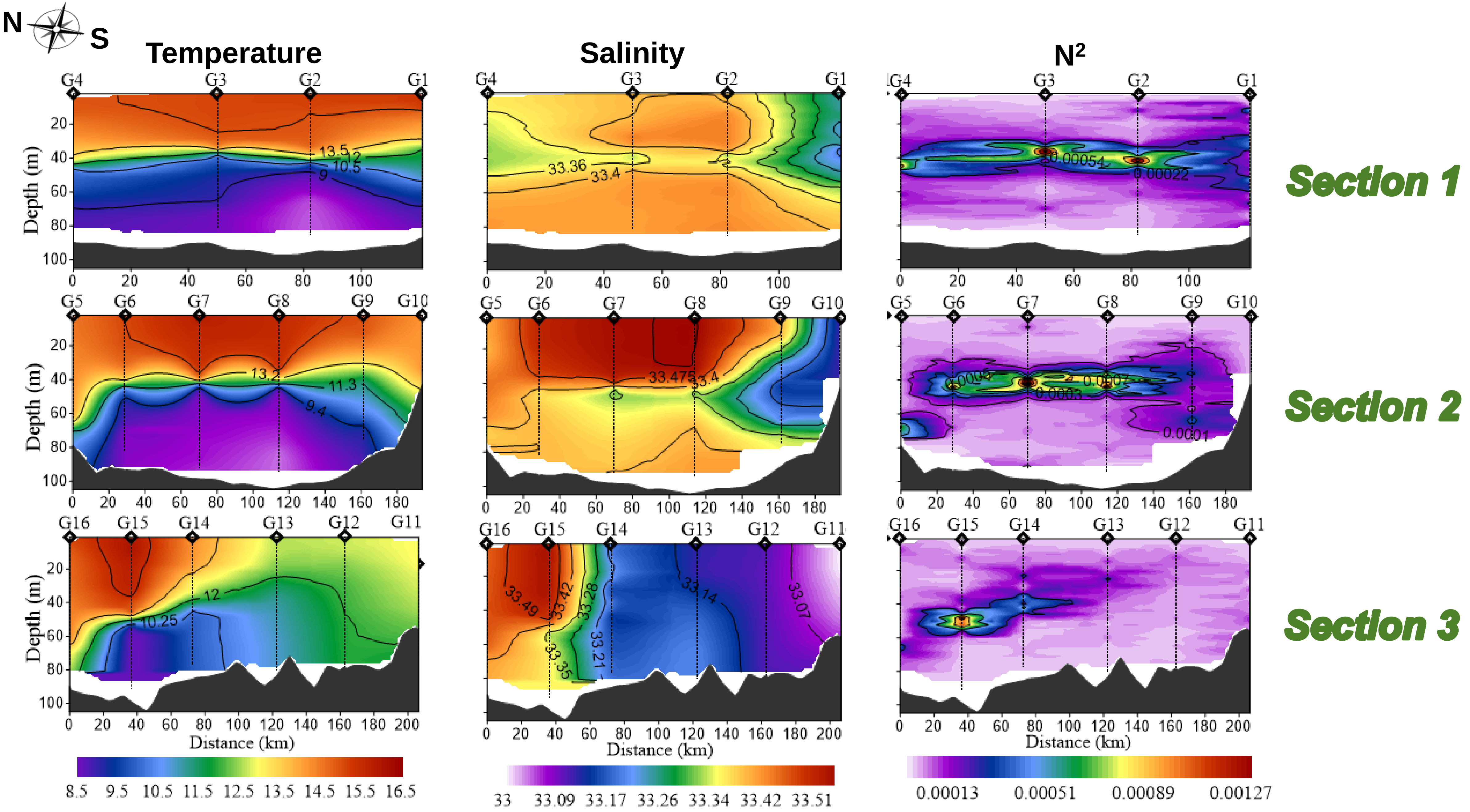

Bacterias libres
Cél. mL-1
0,E+00
1,E+06
2,E+06
3,E+06
4,E+06
5,E+06
Profundidad (m)
2
40
60
90
%HNA: ~50
HNA
LNA

Cómo se pueden sostener los niveles de exportación de carbono y de biomasa observados?

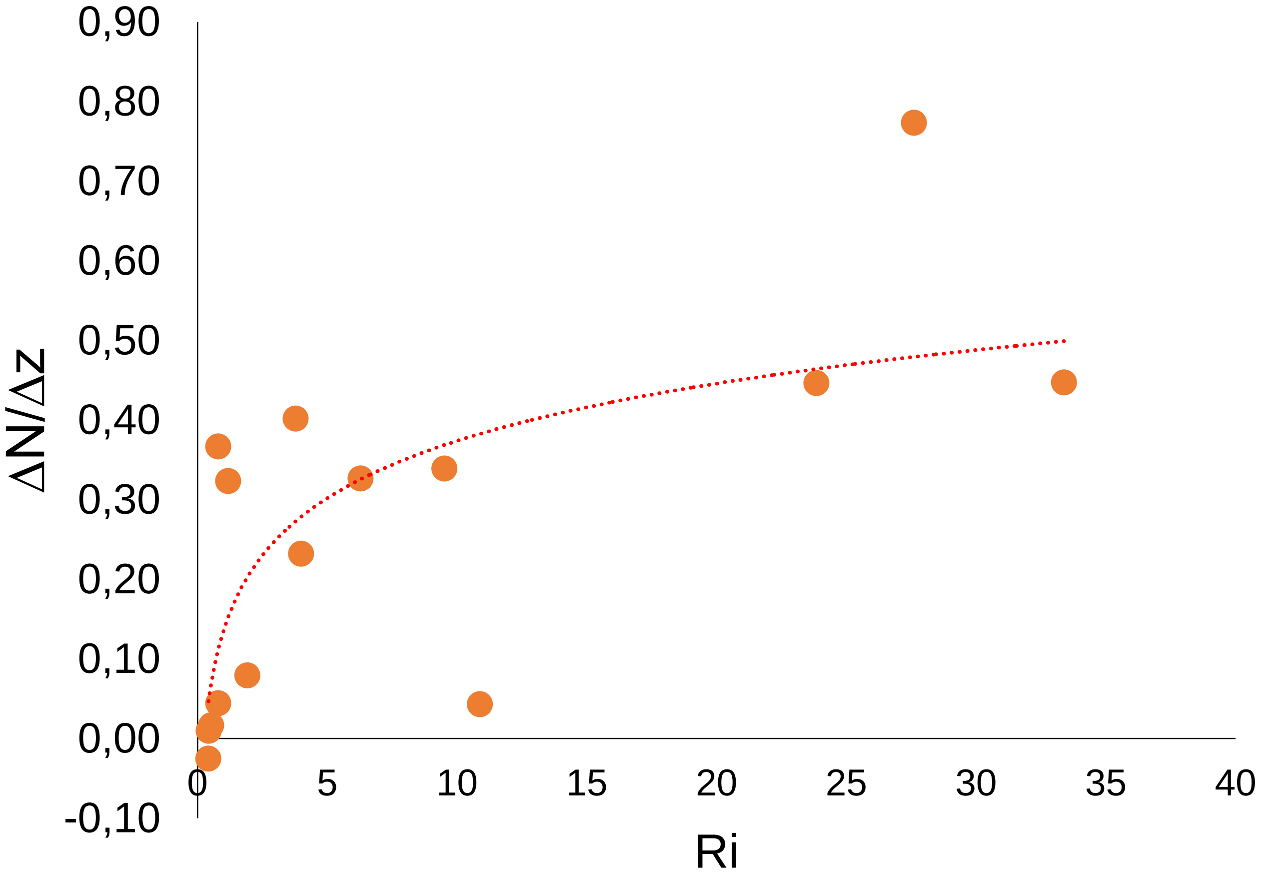
Zona central del GSJ



Maité Latorre 2017

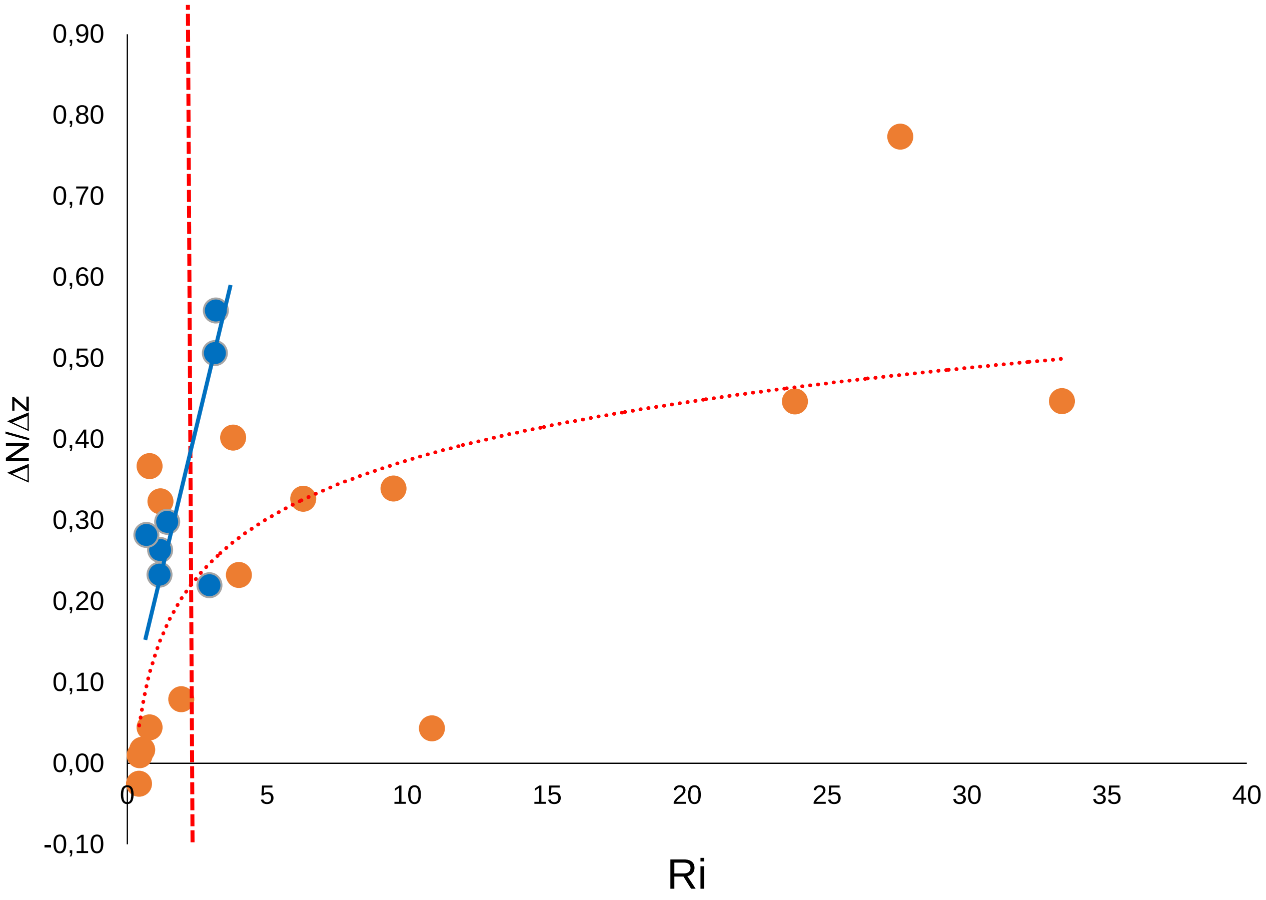

N
S
Temperature
Salinity
N²
Section 1
Section 2
Section 3
G4
G3
G2
G1
G5
G6
G7
G8
G9
G10
G16
G15
G14
G13
G12
G11
Depth (m)
Distance (km)
8.5 9.5 10.5 11.5 12.5 13.5 14.5 15.5 16.5
33 33.09 33.17 33.26 33.34 33.42 33.51
0.00013 0.00051 0.00089 0.00127

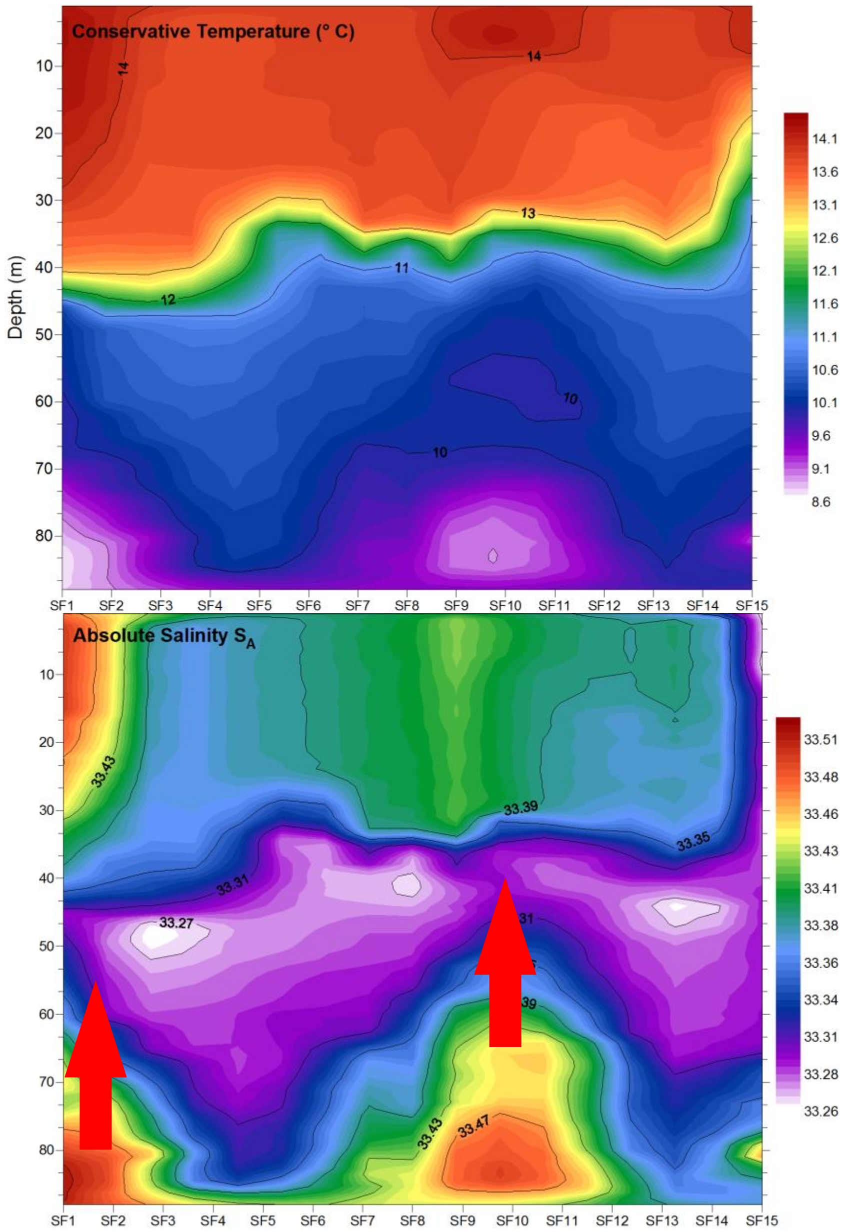
Ri at the SFix



Maité Latorre 2017

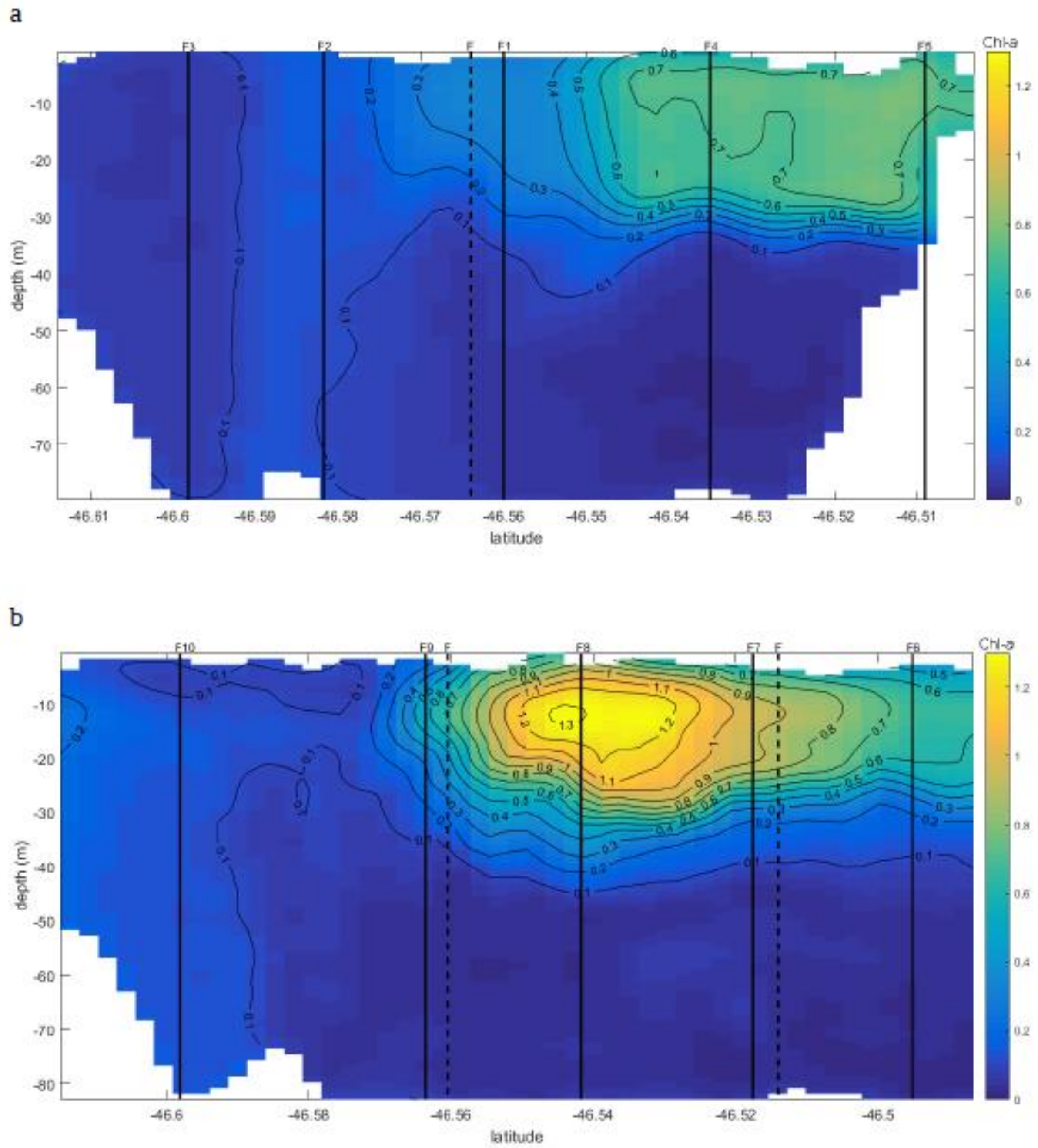
Ri at the SFix





Maité Latorre 2017

Frente sur



Sisigia

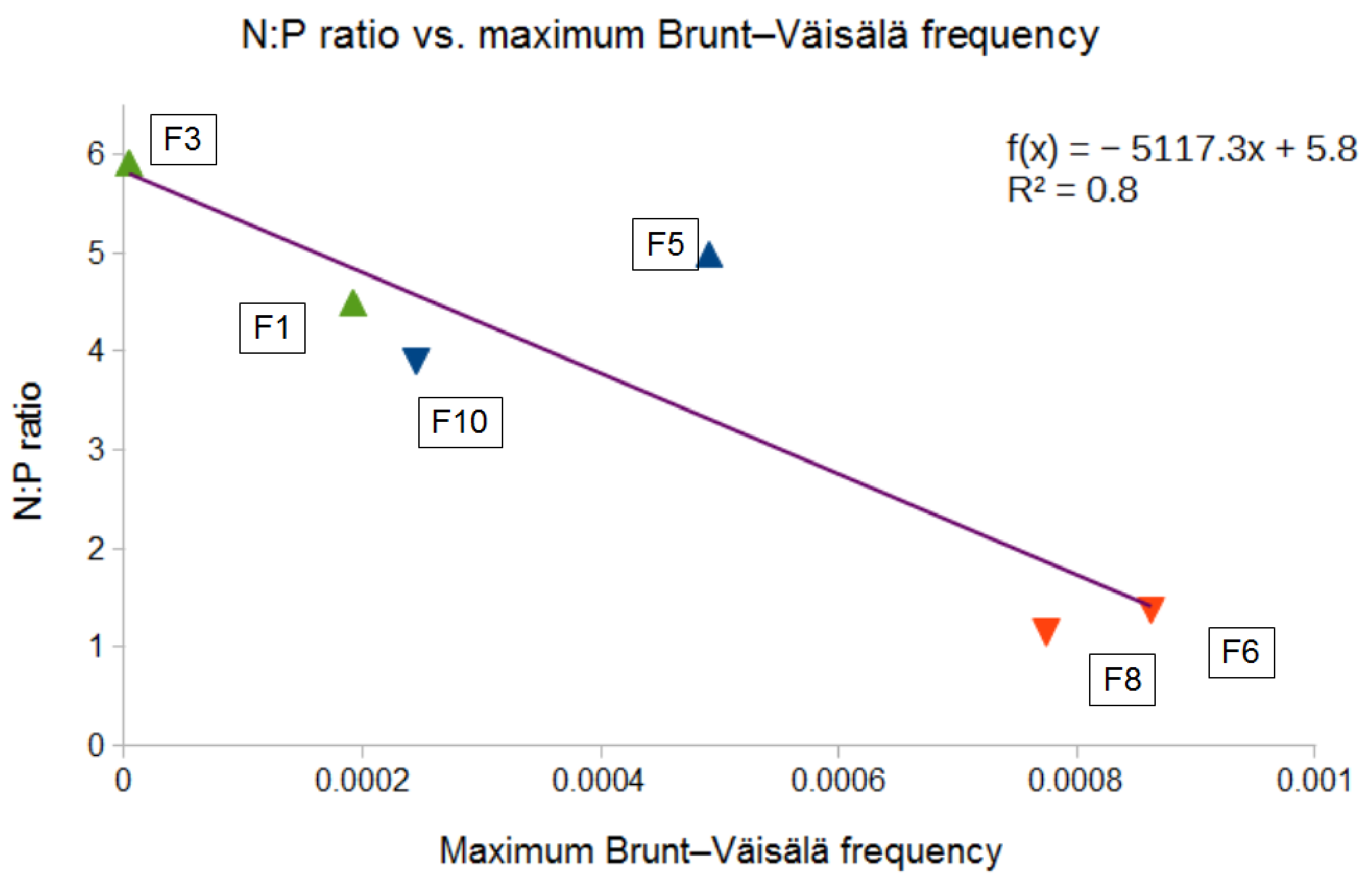
Cuadratura

Ximena Flores Melo

	Ushant Front	Georges Bank	SJG Front
Lm (m)	4000	5000	4000
D (m)	20	20	40
C (mg m^{-3})	2	2	3.65
Tm (s)	15	27	15
Qm (mg m^{-1} s^{-1})	0.12	0,26	**0,45**

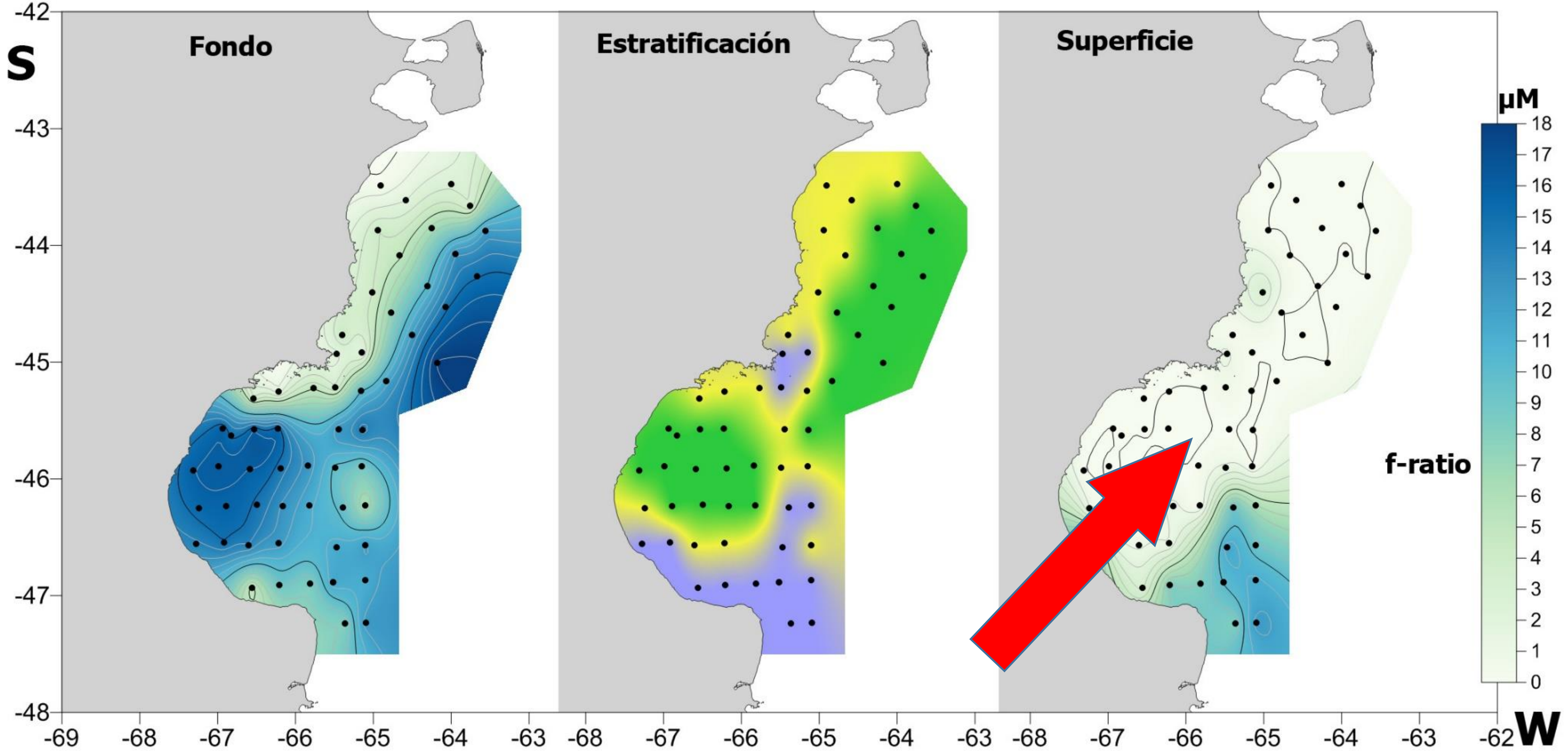
Tabla 1: Results of the model of Loder & Platt (1985) comparing nutrient fluxes at three tidal frontal zones. Lm: displacement of the front between spring and neap tide (m); D: pycnocline depth; C: Nutrients concentration in the upper mixed layer during spring tide on the mixed side; Tm: tidal cycle; Qm: nutrient flux.

Ximena Flores Melo



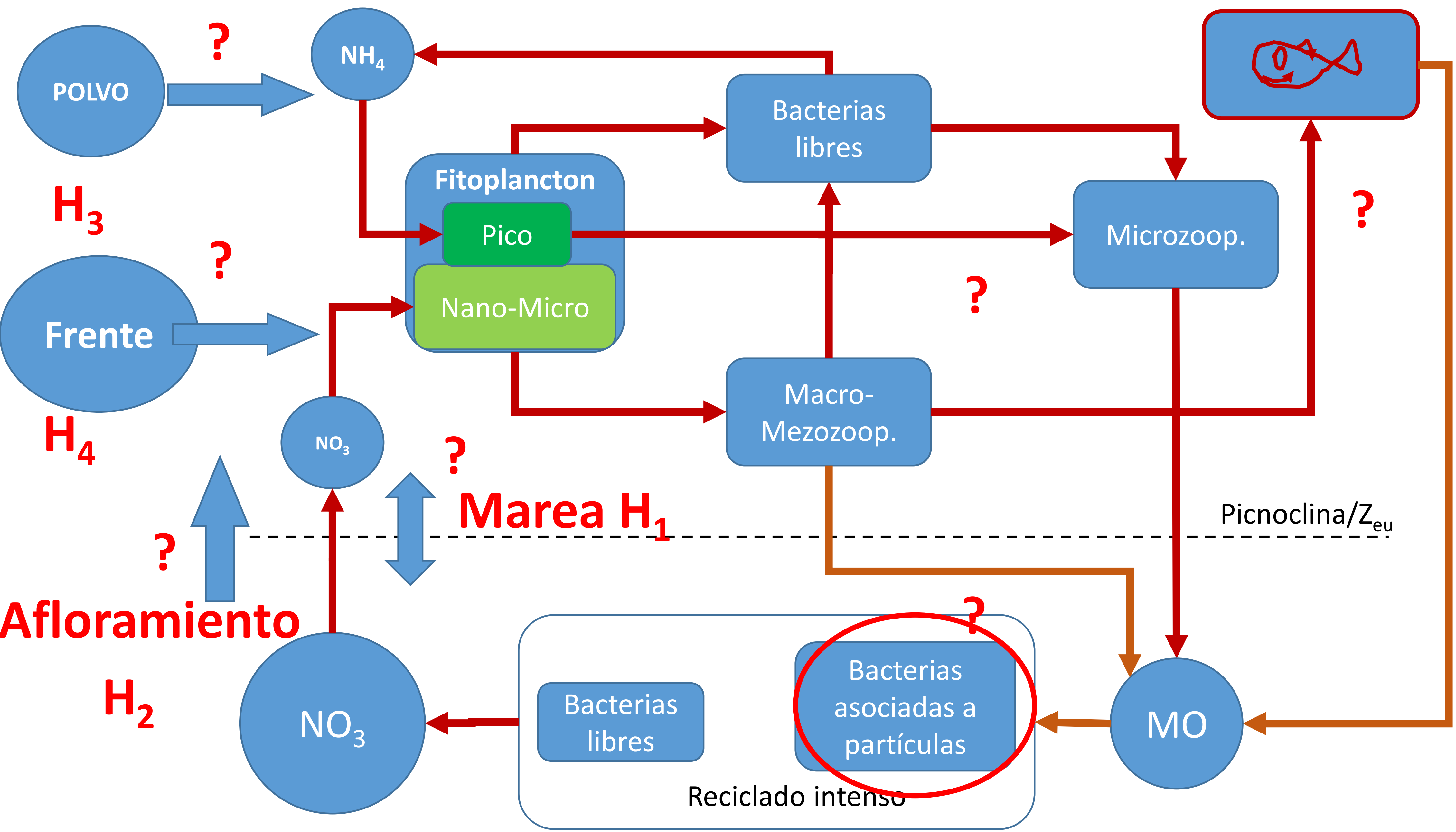
N:P ratio vs. maximum Brunt–Väisälä frequency
f(x) = − 5117.3x + 5.8
R² = 0.8
F3
F5
F1
F10
F8
F6
N:P ratio
0
1
2
3
4
5
6
0
0.0002
0.0004
0.0006
0.0008
0.001
Maximum Brunt–Väisälä frequency

NO_3



S
Fondo
Estratificación
Superficie
-42
-43
-44
-45
-46
-47
-48
-69
-68
-67
-66
-65
-64
-63
-62
W
µM
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
f-ratio

Acoplamiento Producción primaria – Pastoreo



Conclusiones

- La elevada biomasa y exportación en el GSJ durante la primavera y el verano esta sostenida por productividad primaria constante

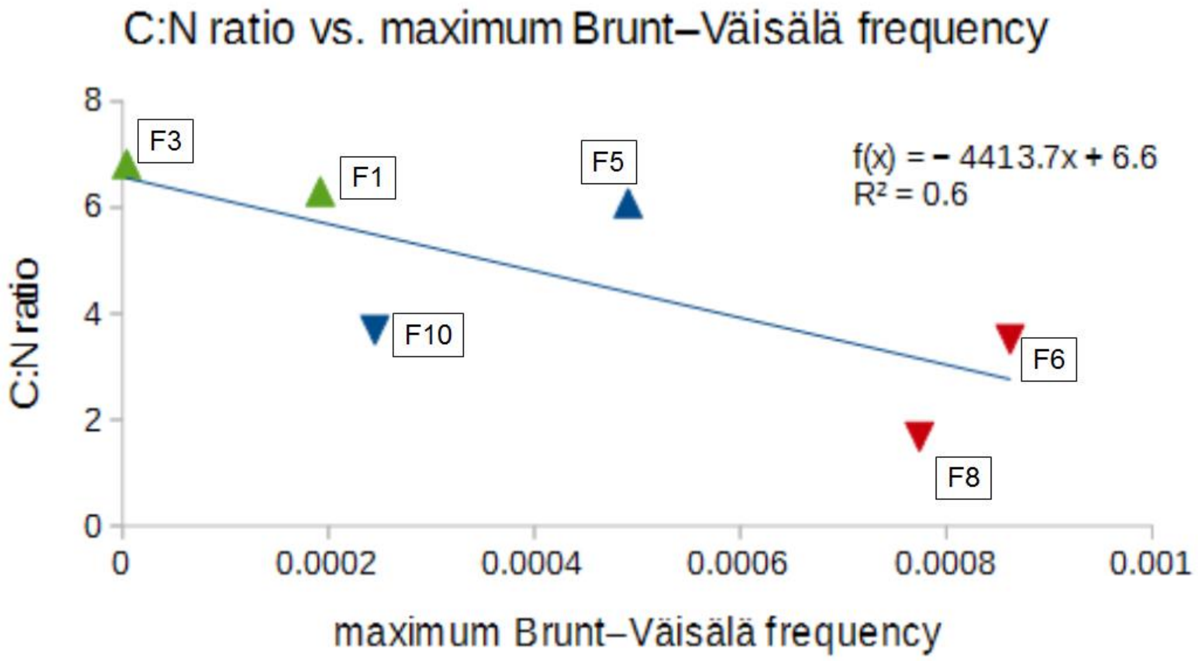
- Fueling de la PP:
  - ✓ H_1: Bombeo de nutrientes, producción nueva
  - ✓ H_2: Afloramiento
  - ✓ H_3: Polvo atmosférico
  - ✓ H_4: Transporte lateral frente

  - Baja acumulación de biomasa de fitoplancton ➔ acoplamiento entre PP y pastoreo (alta tasa de renovación de la biomasa)

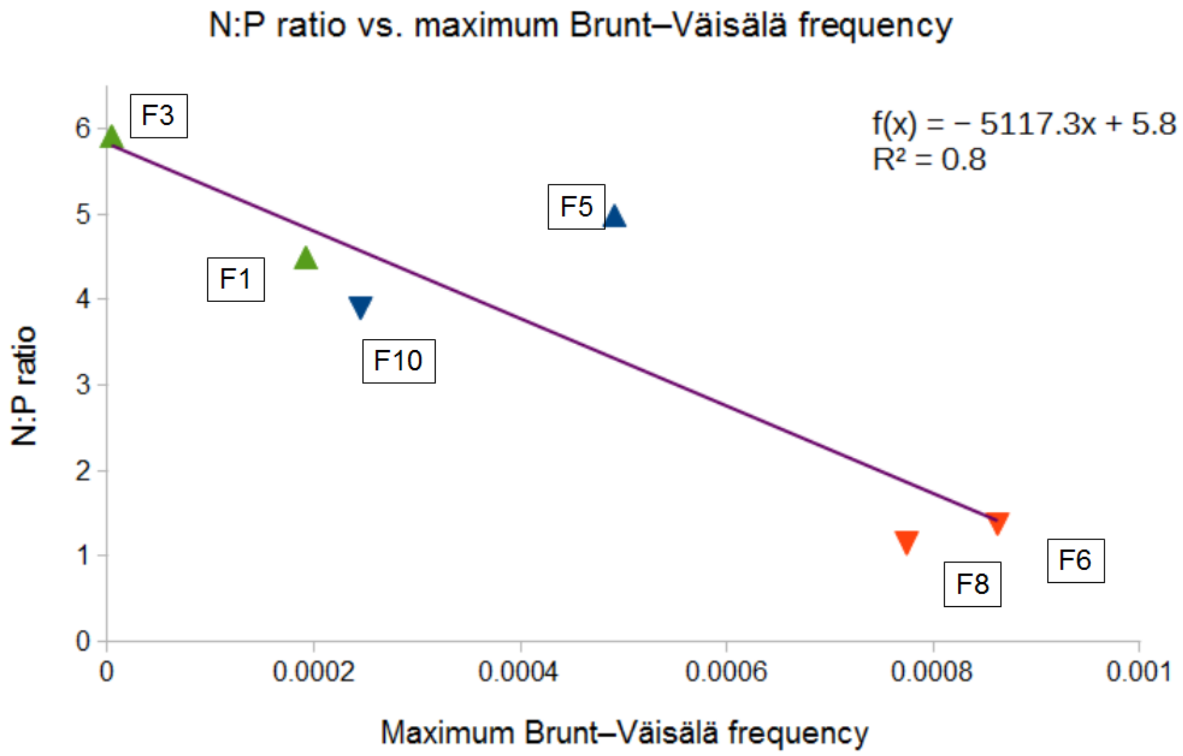
- Primavera-verano-otoño ➔ Bomba Biológica eficiente

Muchas gracias

- 0,5 m/s
- 1,4 km/h
- 8,6 km en 6 h



C:N ratio vs. maximum Brunt–Väisälä frequency
f(x) = − 4413.7x + 6.6
R² = 0.6
F3
F1
F5
F10
F6
F8
C:N ratio
maximum Brunt–Väisälä frequency

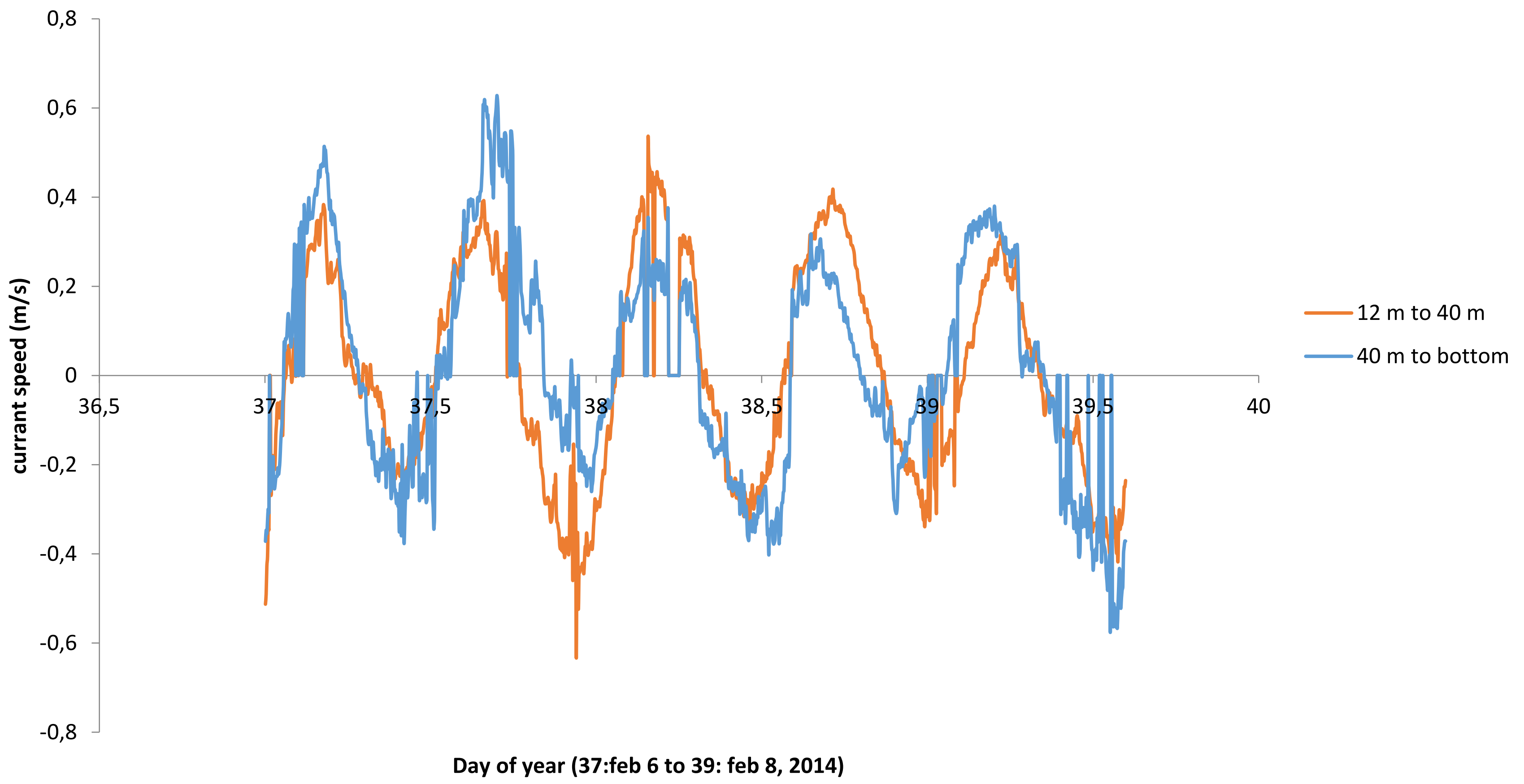


N:P ratio vs. maximum Brunt–Väisälä frequency
f(x) = − 5117.3x + 5.8
R² = 0.8
F3
F5
F1
F10
F8
F6
N:P ratio
Maximum Brunt–Väisälä frequency

Some emerging points

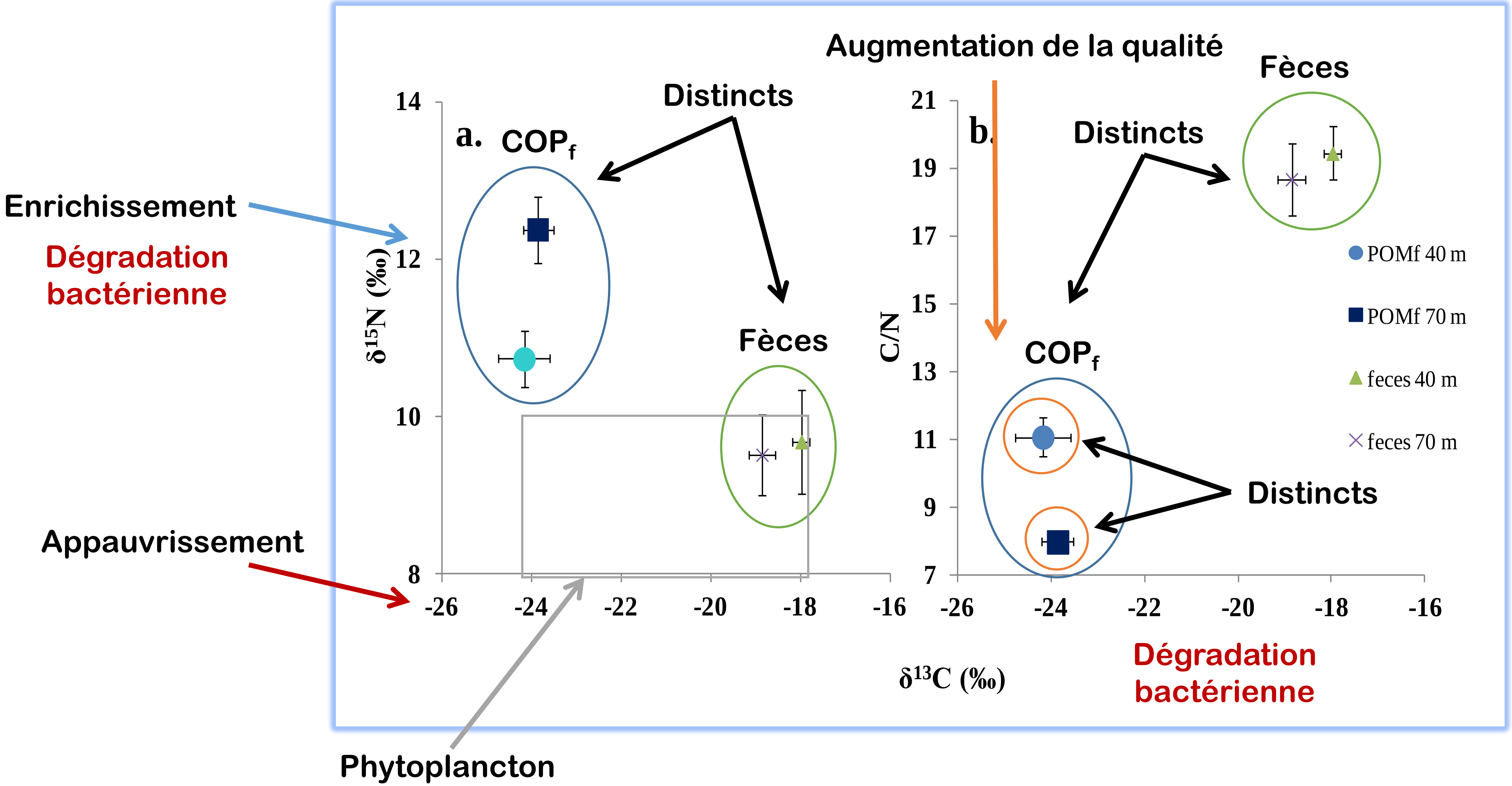
- Marine snow in deep waters = are low DO and pH related to the metabolism in the water column?
- Biological pump = Intensity or efficiency?
- Vertical fluxes of carbon = phytoplankton-zooplankton coupling?
- Fate of carbon = Effects of export on benthic and pelagic systems and transfer to higher trophic levels?
- Nutrients: how phytoplankton copes with the observed low concentrations?
- Frontal zones: physical-biological coupling and dynamics of contaminants?

Average currant speed and orientation

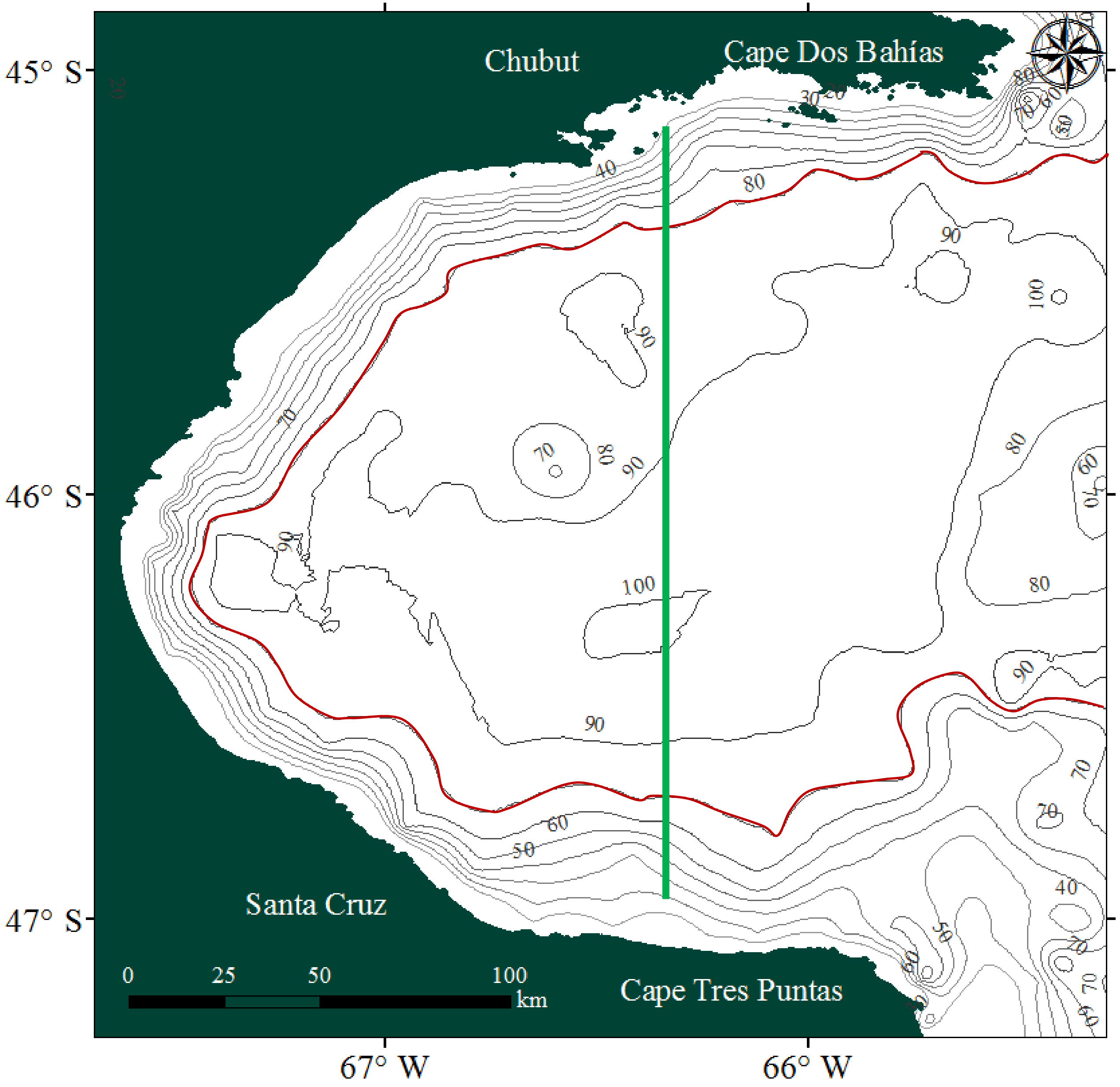


Source et qualité de la MO

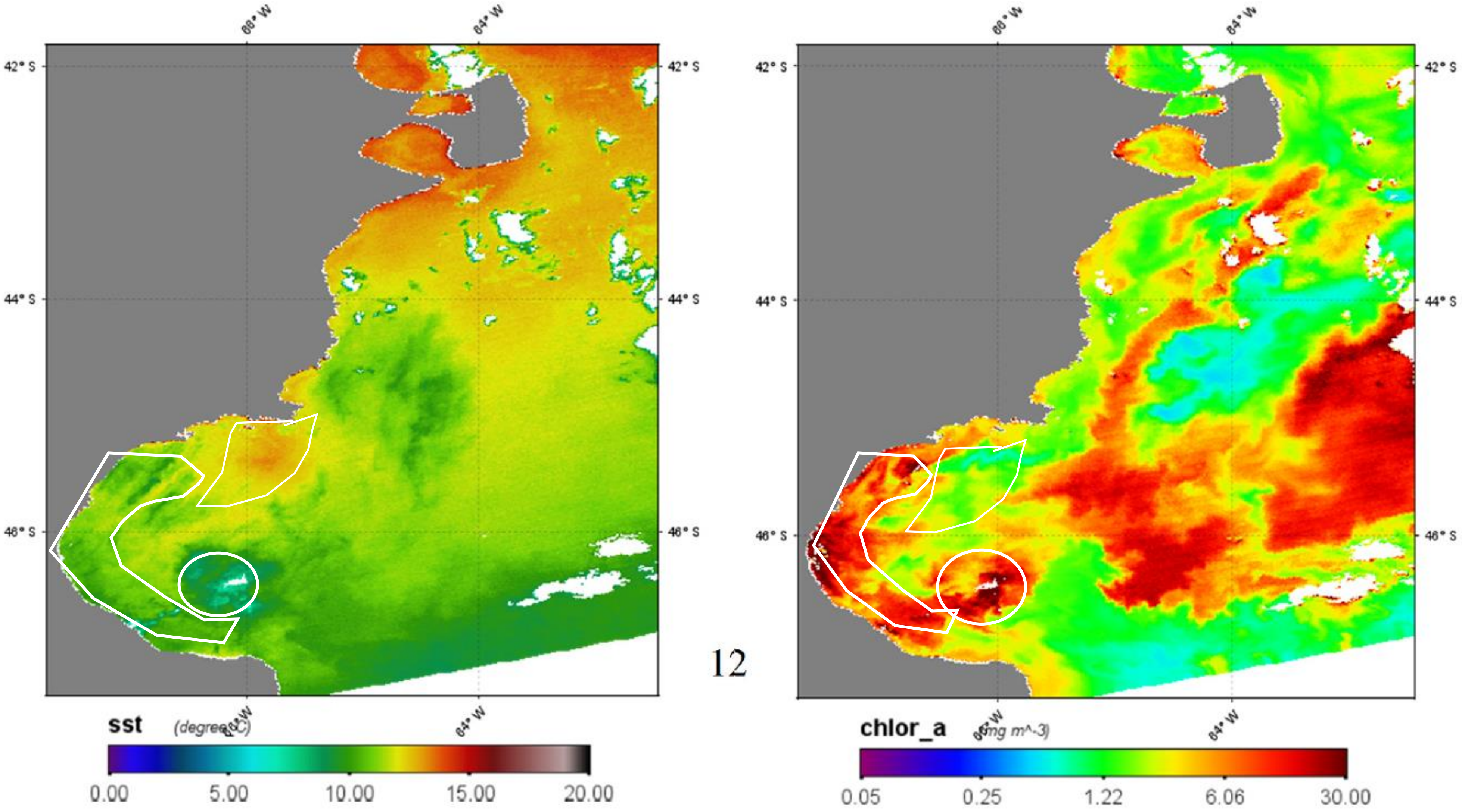
- La qualité de la matière organique augmente avec la profondeur



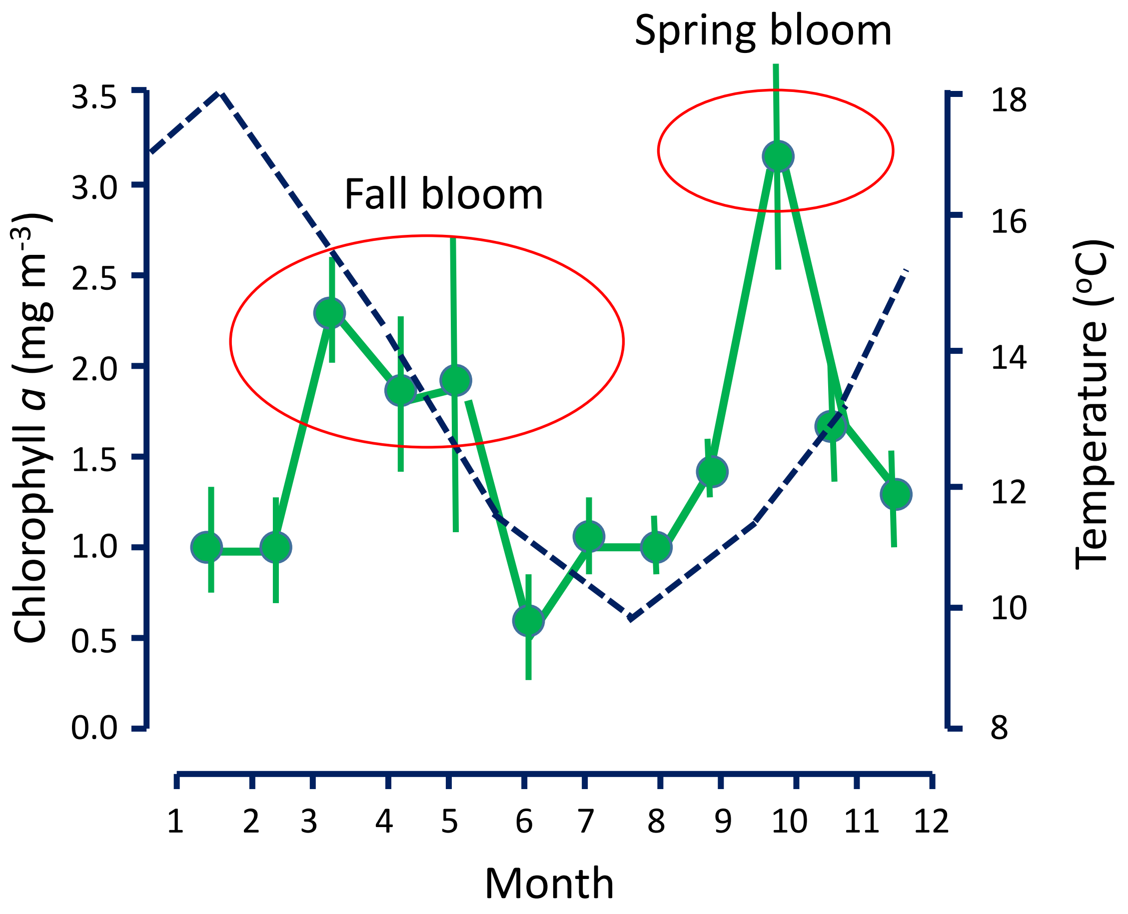
Fry, 2006



45° S
46° S
47° S
67° W
66° W
Chubut
Cape Dos Bahías
Santa Cruz
Cape Tres Puntas
0
25
50
100
km


68° W
64° W
42° S
44° S
46° S
sst
(degrees C)
0.00
5.00
10.00
15.00
20.00
chlor_a
(mg m^-3)
0.05
0.25
1.22
6.06
30.00

The seasonal perspective



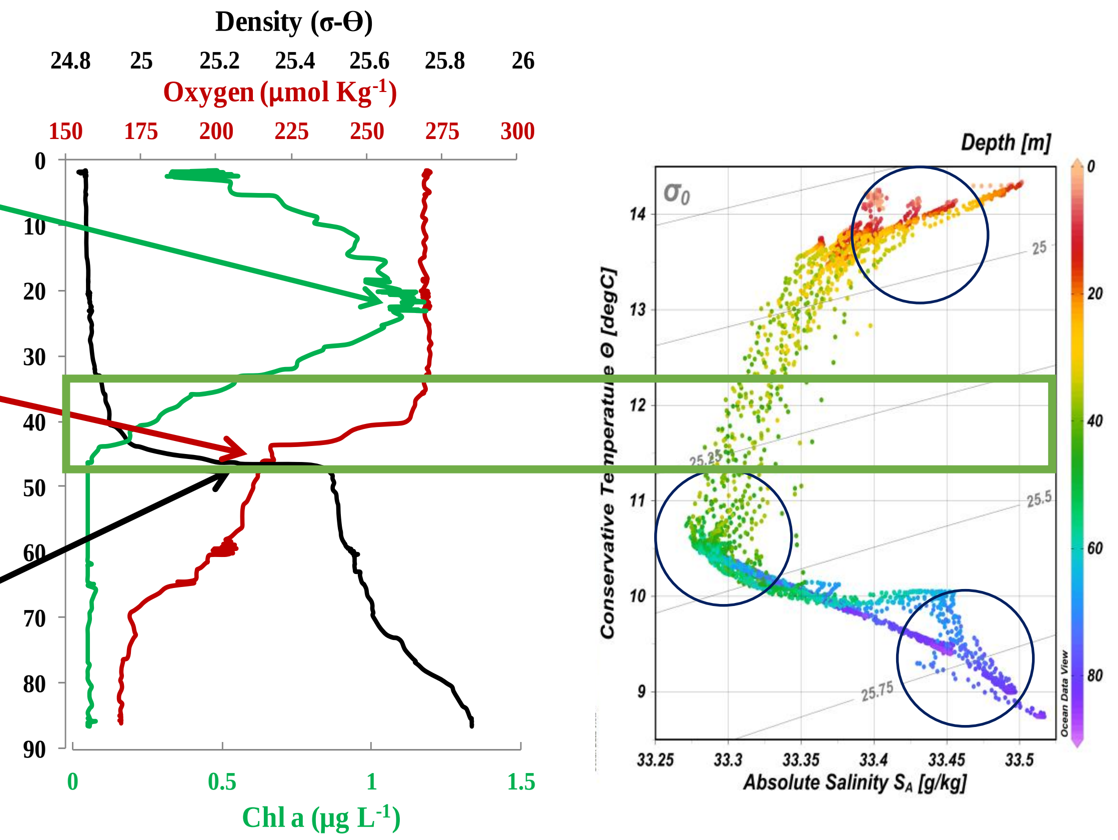
Glembocki et al. 2015

La colonne d’eau

Max Chl *a*

Baisse d’oxygène

Changement de densité marqué



3 masses d’eau

Pycnocline: zone clé