Preliminary use of GlobColour Data Set in the Canarian LME to support halieutic stock management

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Outlines

- **Short presentation of the INRH**
- **Our missions and objectives**
- **Problematic of the Canary LME**
- **The resources management issue**
- **Application to New Primary Production (NPP) estimates by using GlobColour**

Institut National de Recherche Halieutique

MISSIONS AND RESEARCH PROGRAMS

Institut National de Recherche Halieutique

Created by law (Dahir)N° 1.96.98 in July 29,1996

MISSIONS

- Assess fisheries and assure the follow up of their exploitation
- Study marine and coastal ecosystems
- Monitor marine environment quality and health
- Perform tests on fishing techniques and products
- Contribute to developmemnt of coastal aquaculture

OBJECTIVES

- Sustainable management of resources
- Maintaining existing living biodiversity
- Preservation of marine system and protection of consumers of marine products
- Valorisation of resources in order to improve revenues and competitivness
- Promotion and developmement of aquaculture
- Education at large scale on research outcomes

ORGANISATION

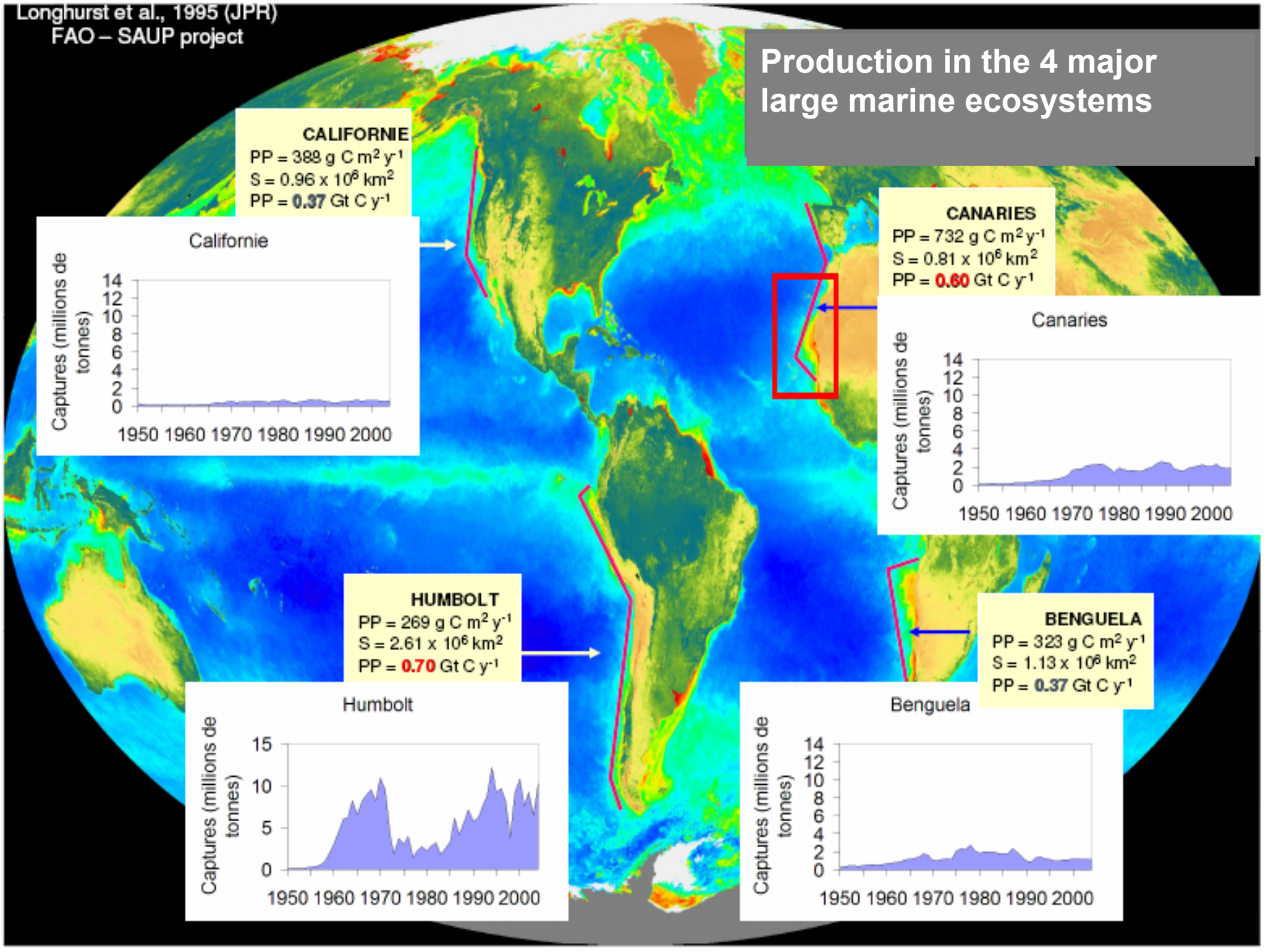
- 3 scientifics departments
- 1 Administrative and financial department
- 1 Documentation centre
- 1 Fishing economy unit
- 1 Information and Information system unit

ORGANISATION

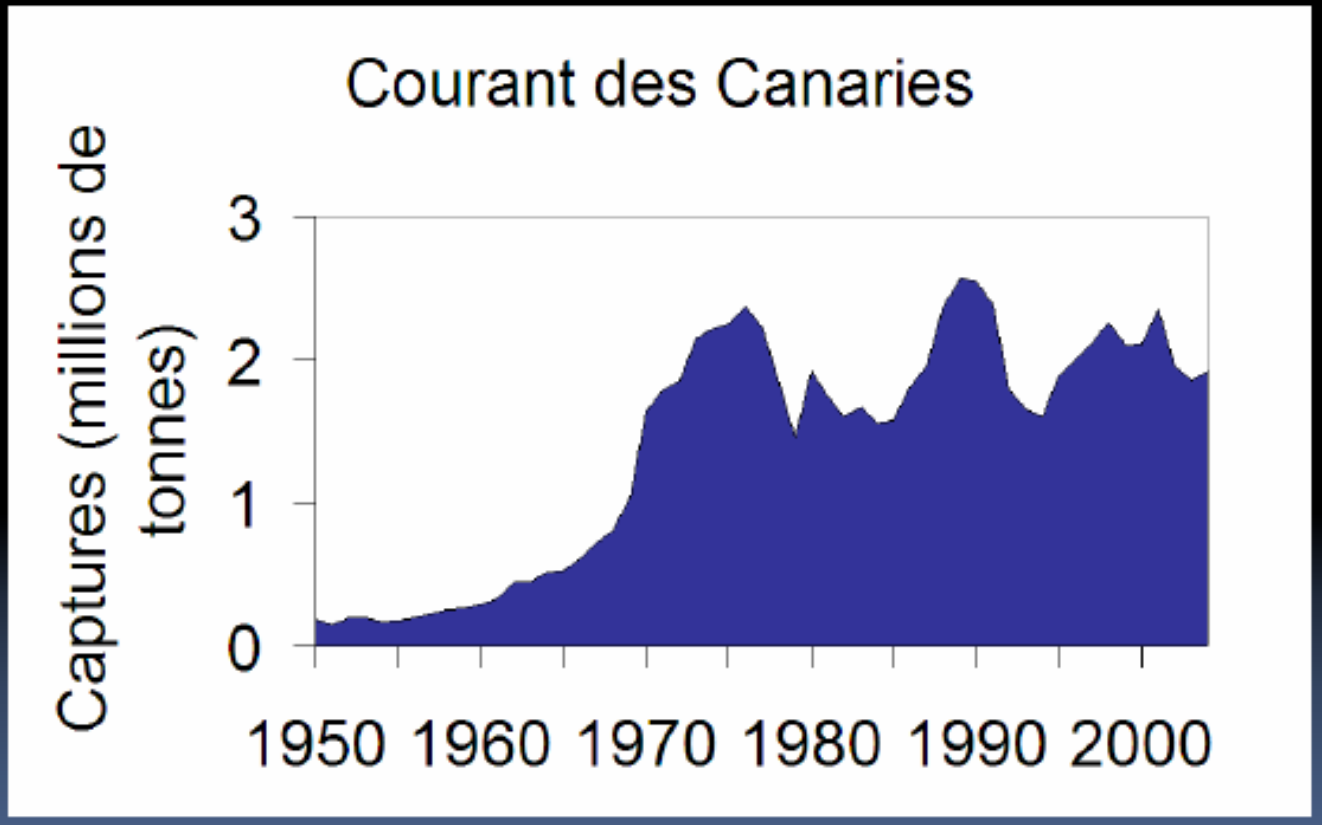
(cont'd)

- 5 Regional centres
- 3 Specialised centres
  - Centre Aquacole de M'Diq
  - Centre de Valorisation et de Technologies des Produits de la Mer
  - Centre de Technologie des Engins et des Bateaux de Pêche
- An Healthiness network for the coast
  - 3 stations in the Mediterranean (Nador, M'Diq et Tanger)
  - 5 on Atlantic facade (Casablanca, Oualidia, Agadir, Laayoune, Tan-Tan et Dakhla)

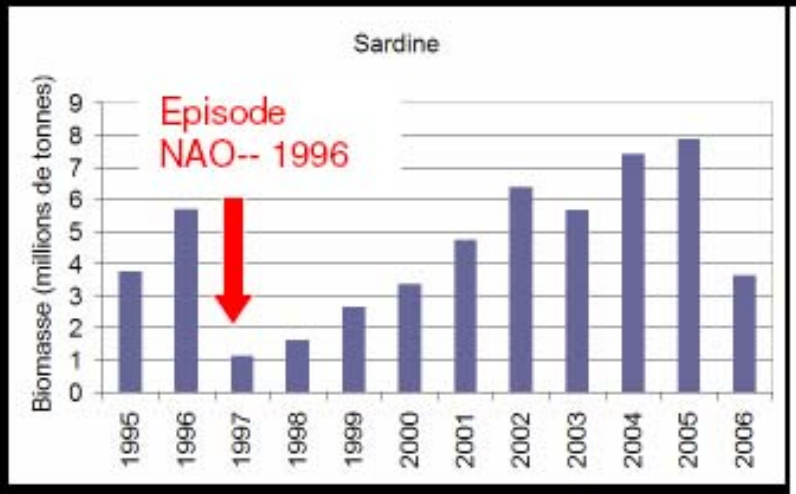
Geographical implantation

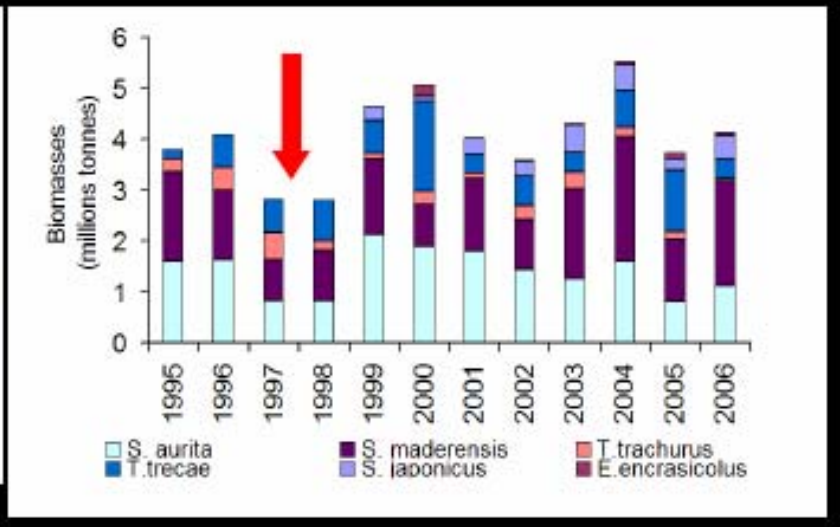

Longhurst et al., 1995 (JPR)
FAO – SAUP project
Production in the 4 major large marine ecosystems
CALIFORNIE
PP = 388 g C m² y⁻¹
S = 0.96 x 10⁶ km²
PP = 0.37 Gt C y⁻¹
Californie
Captures (millions de tonnes)
0 2 4 6 8 10 12 14
1950 1960 1970 1980 1990 2000
CANARIES
PP = 732 g C m² y⁻¹
S = 0.81 x 10⁶ km²
PP = 0.60 Gt C y⁻¹
Canaries
Captures (millions de tonnes)
0 2 4 6 8 10 12 14
1950 1960 1970 1980 1990 2000
HUMBOLT
PP = 269 g C m² y⁻¹
S = 2.61 x 10⁶ km²
PP = 0.70 Gt C y⁻¹
Humbolt
Captures (millions de tonnes)
0 5 10 15
1950 1960 1970 1980 1990 2000
BENGUELA
PP = 323 g C m² y⁻¹
S = 1.13 x 10⁶ km²
PP = 0.37 Gt C y⁻¹
Benguela
Captures (millions de tonnes)
0 2 4 6 8 10 12 14
1950 1960 1970 1980 1990 2000

Global production (FAO)

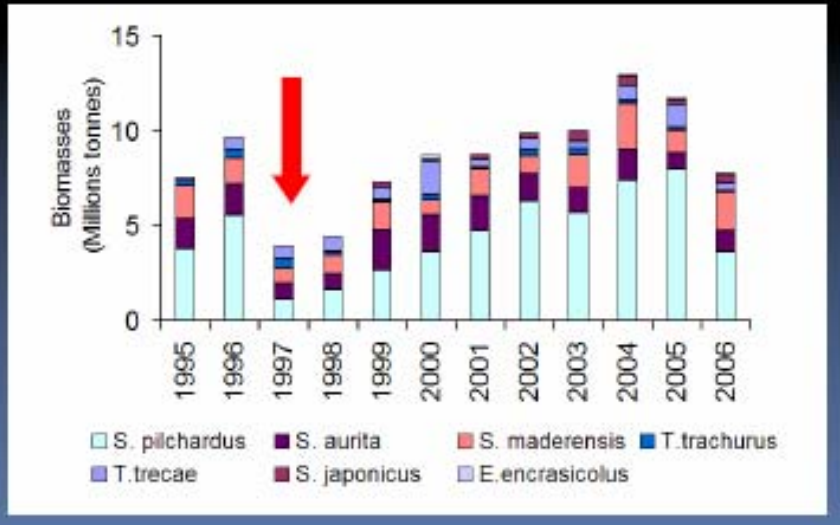


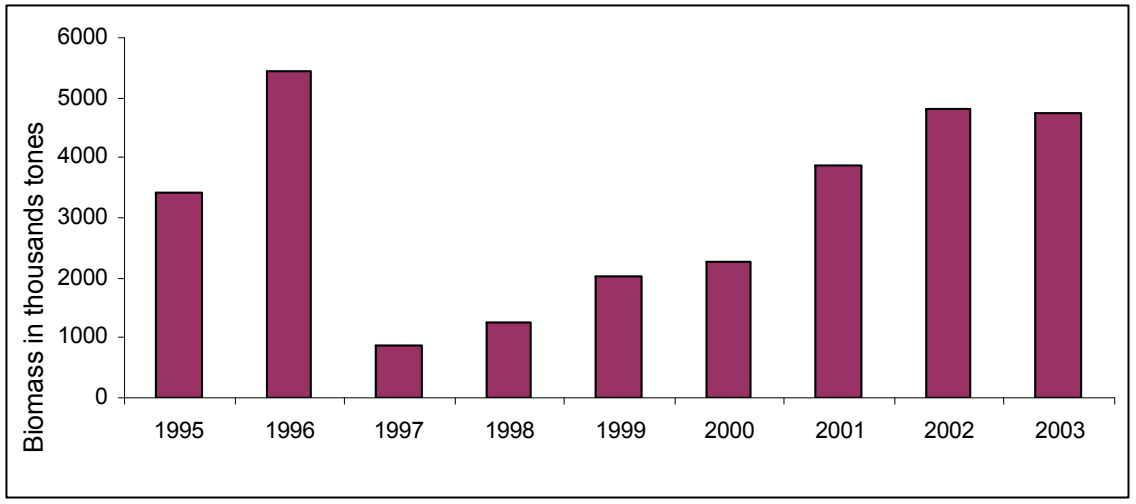
Interannual variablity of biomasses and climatological anomalies



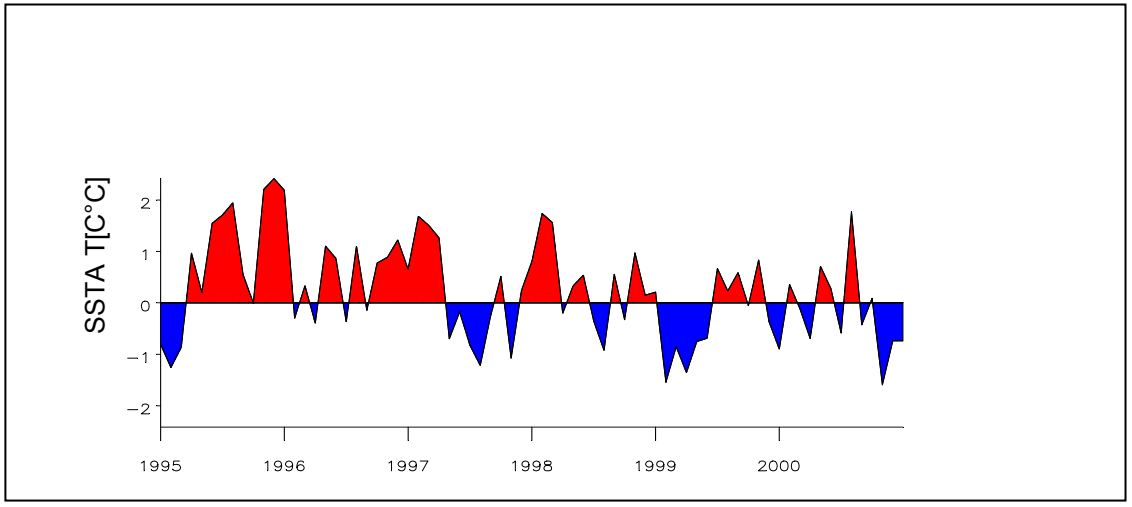


Estimations N/R Dr F. Nansen

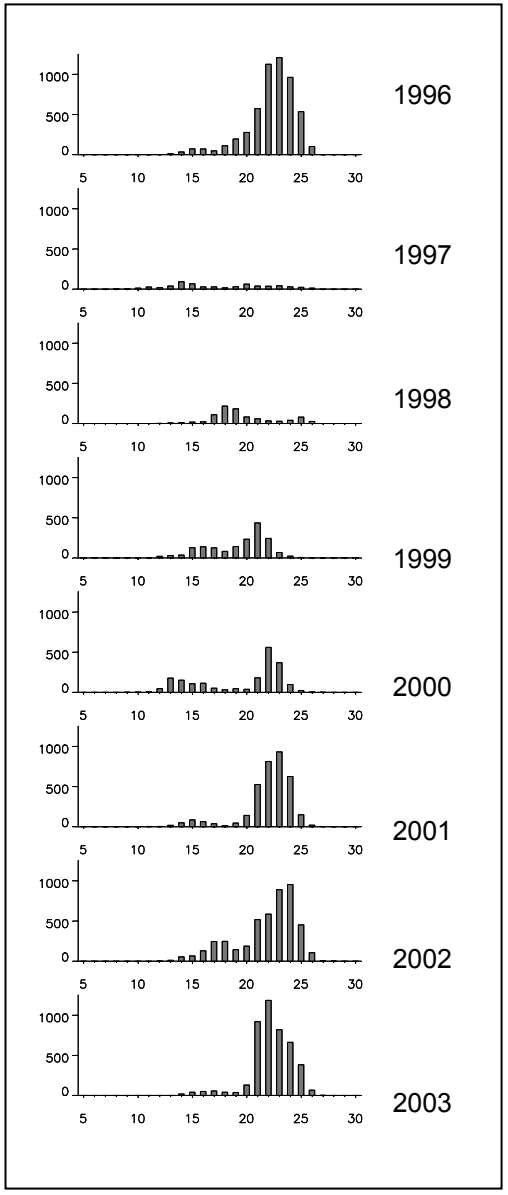




The biomass estimates of Sardine between 16° and 29°N from acoustic surveys with R/V Dr. Fridtjof Nansen during November 1995-2003.

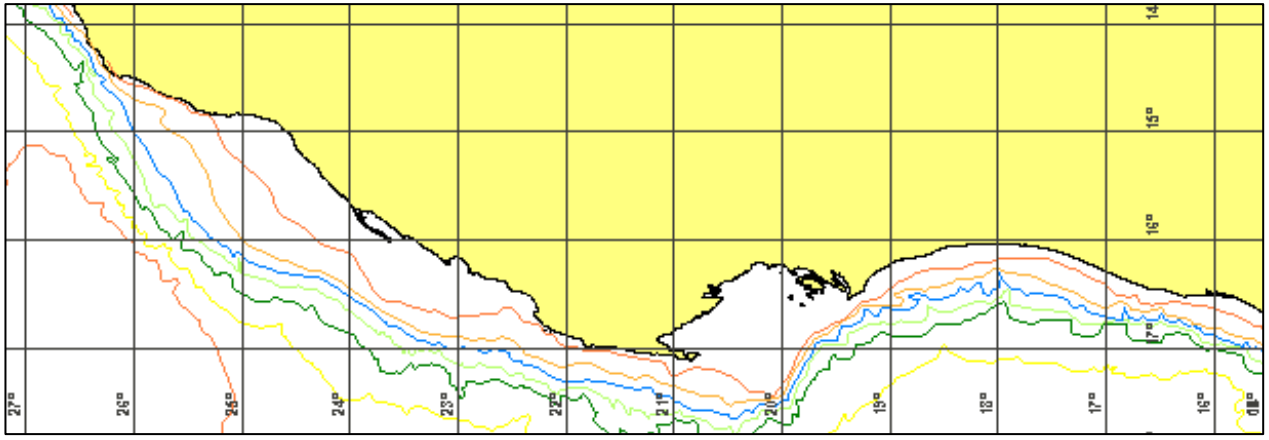


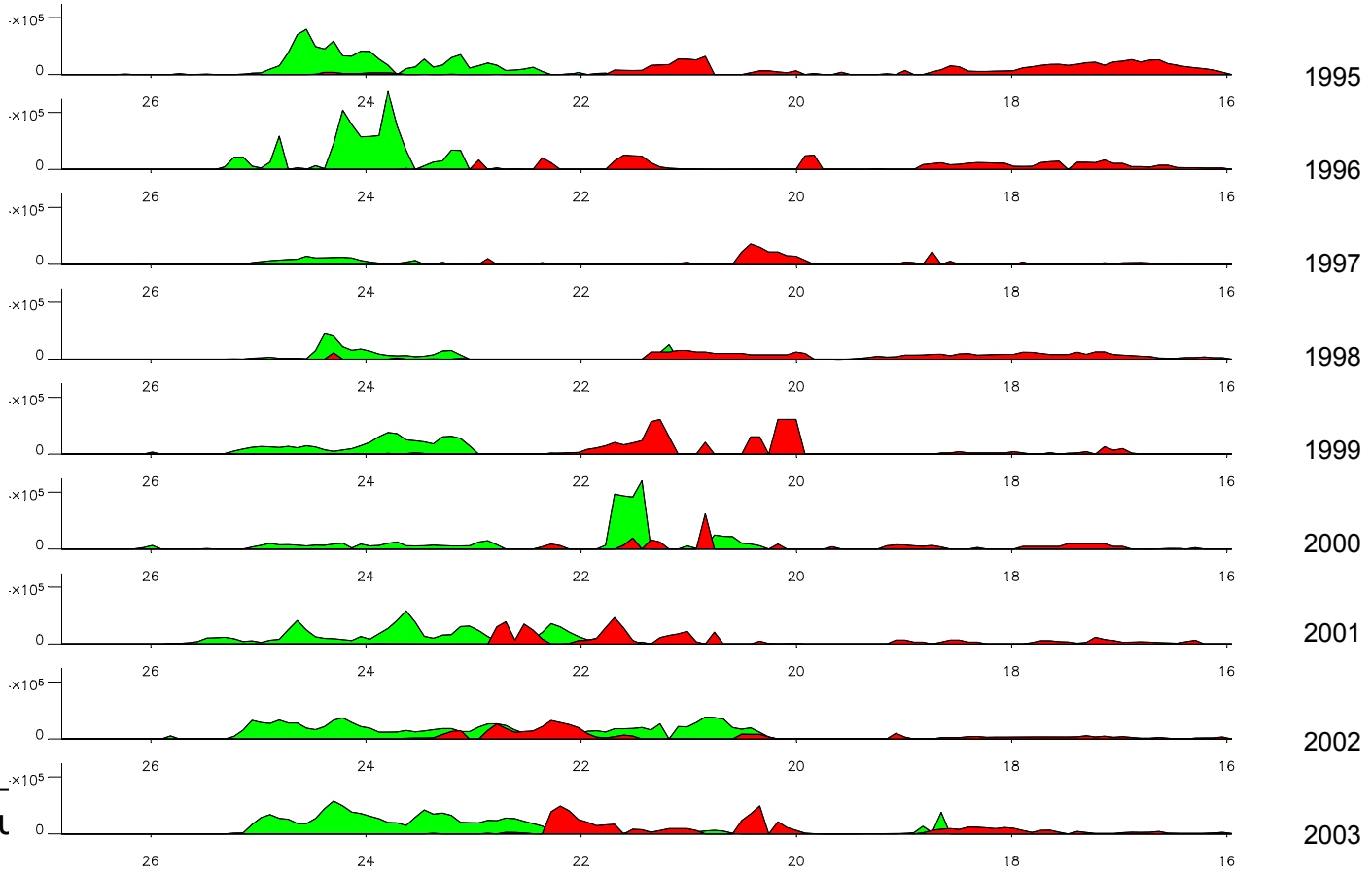
The evolution of SST anomaly off Cape Blanc (20°50'N, 17°30W), 1995-2000



Biomass of sardine by length classes
(Length in centimeters)

Meridional distribution of biomass of sardine (green) and sardinellas (red) 1995-2003





User Consu

So what about … exploitation of Earth Observation at INRH

Recent developments

•Exploitation of SST to monitor the upwelling system (early 2000)

•Comparisons and complementarity analysis with Chla (from 2006)

Present developments

•Take advantage of the continuity/consistency of the 10 years GlobColour time series

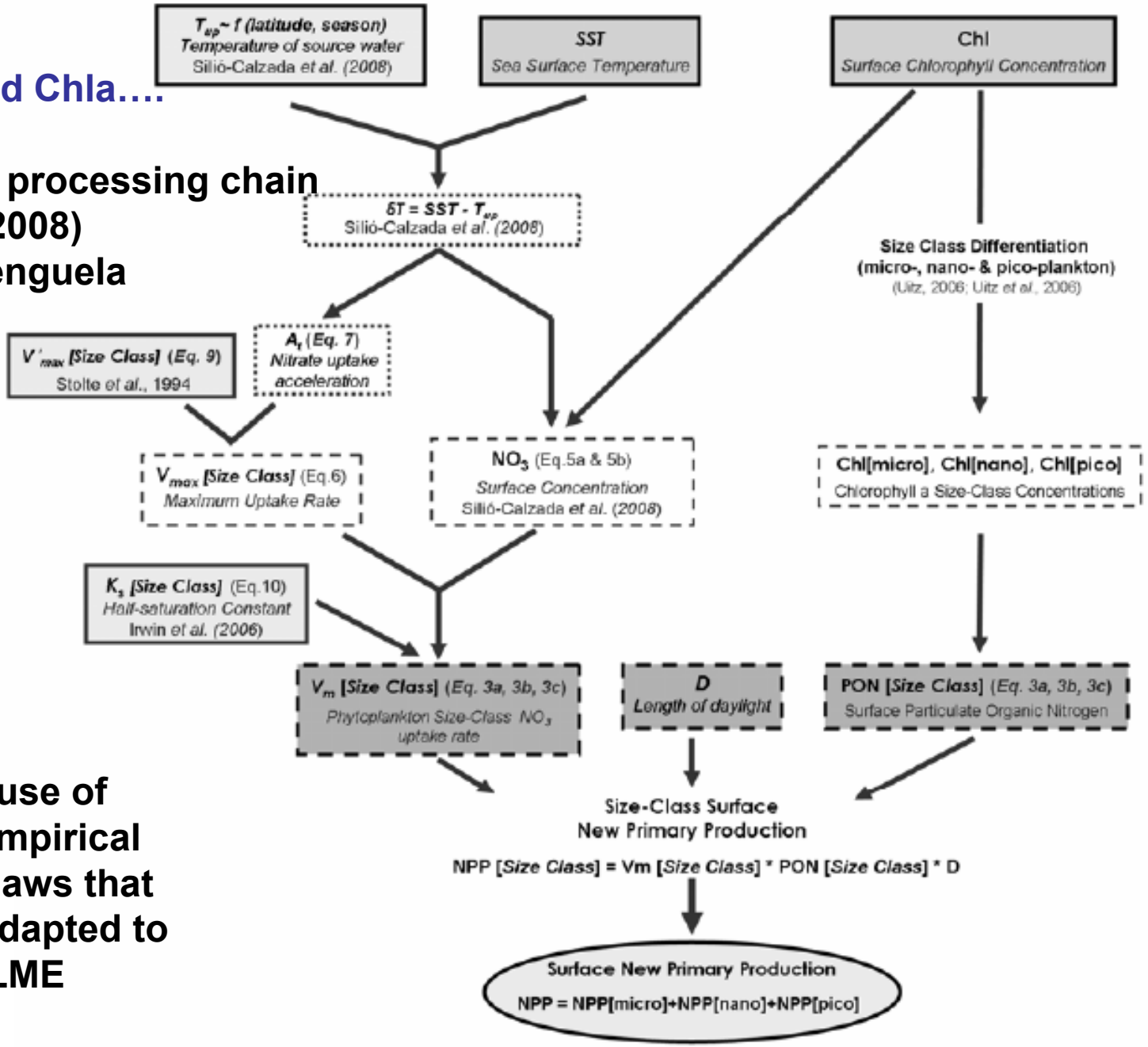
•Make use of the latest works on:

- •Phytoplancton size classes classification (Uitz et al. 2006 and after)
- •New Primary Production assessment (Ana Silió-Calzada's Phd 2008)

First attempt to apply the Silio'method (derived for Benguela LME) to the Canary LME

From SST and Chla….

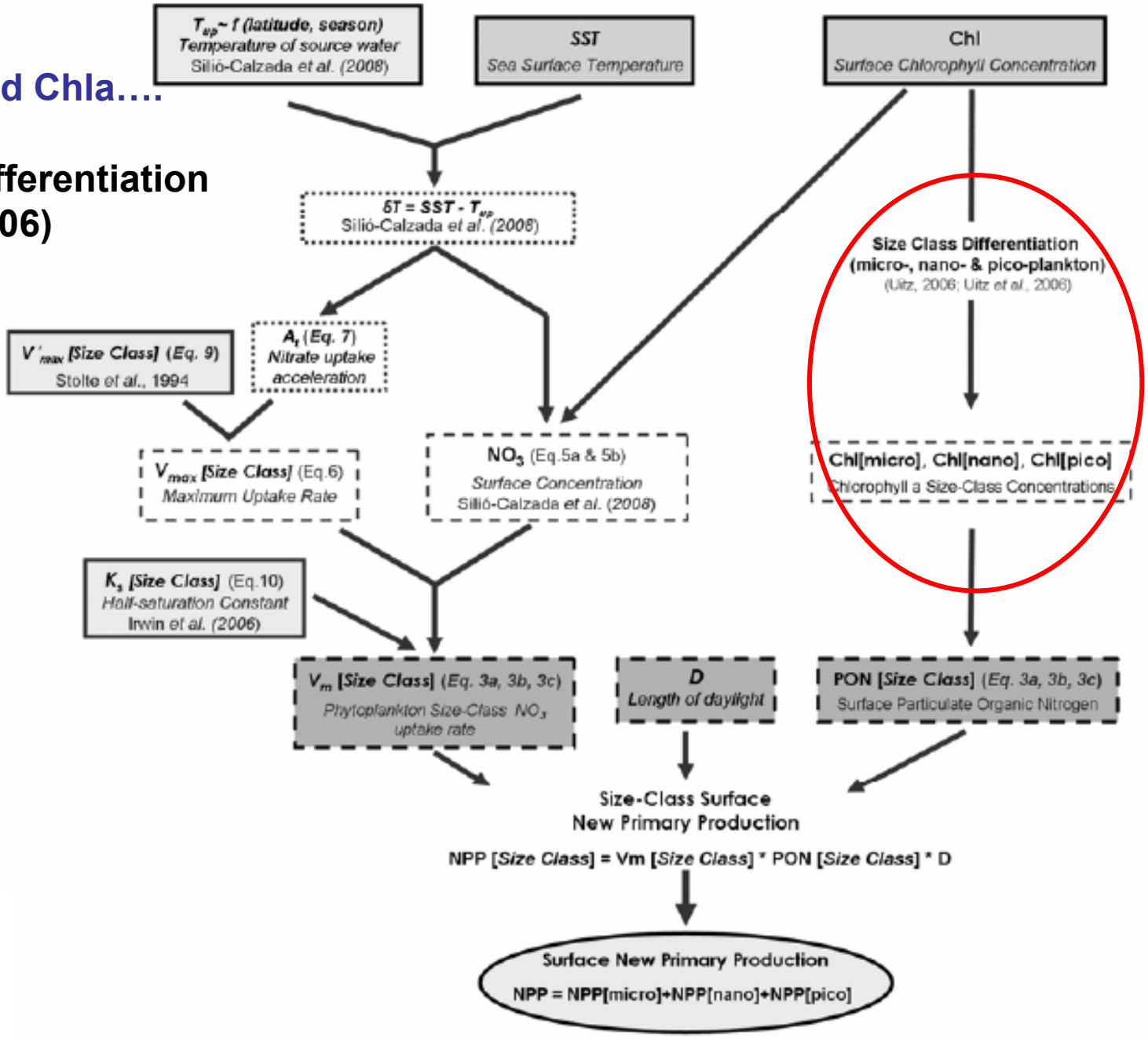
the scheme / processing chain (from Silvio 2008) applied to Benguela



This makes use of number of empirical adjustment/laws that have to be adapted to the Canary LME

From SST and Chla….

Size class differentiation
Uitz et al. (2006)



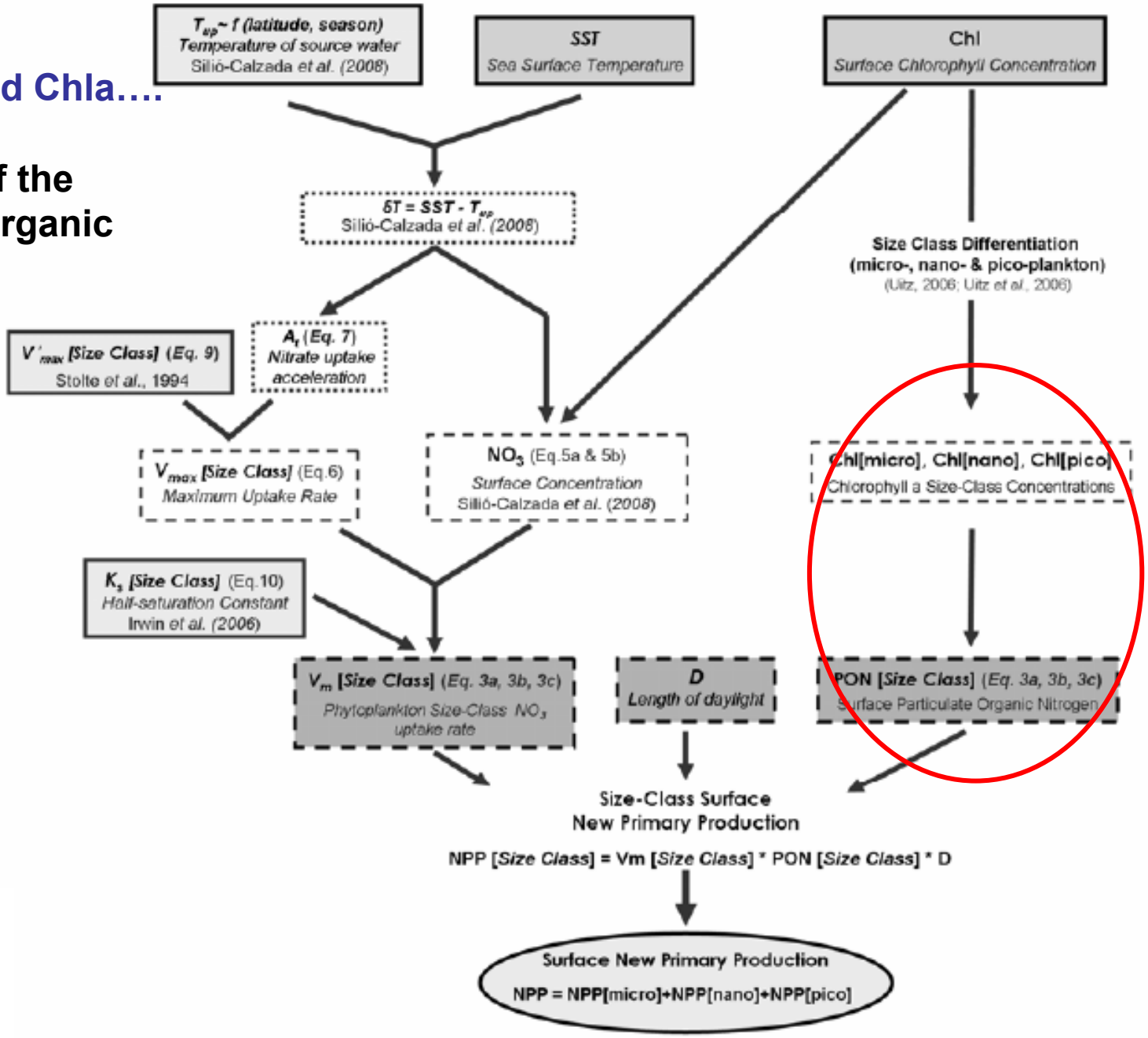
Consideration of the role played by Phytoplankton size structure

- Phytoplankton size is one of the parameters influencing the physiological variables associated to nitrate uptake, and therefore in the new primary production.
- **Uitz *et al*. (2006)** approach allows the estimation of the **contributions of the phytoplanktonic size** classes to the total biomass.

We take into account the **phytoplankton size classes** (***micro****phytoplankton* (20-200 µm), ***nano****phytoplankton* (2-20 µm), ***pico****phytoplankton* (0.2-2 µm)).

From SST and Chla….

Estimation of the Particulate Organic Nitrogen

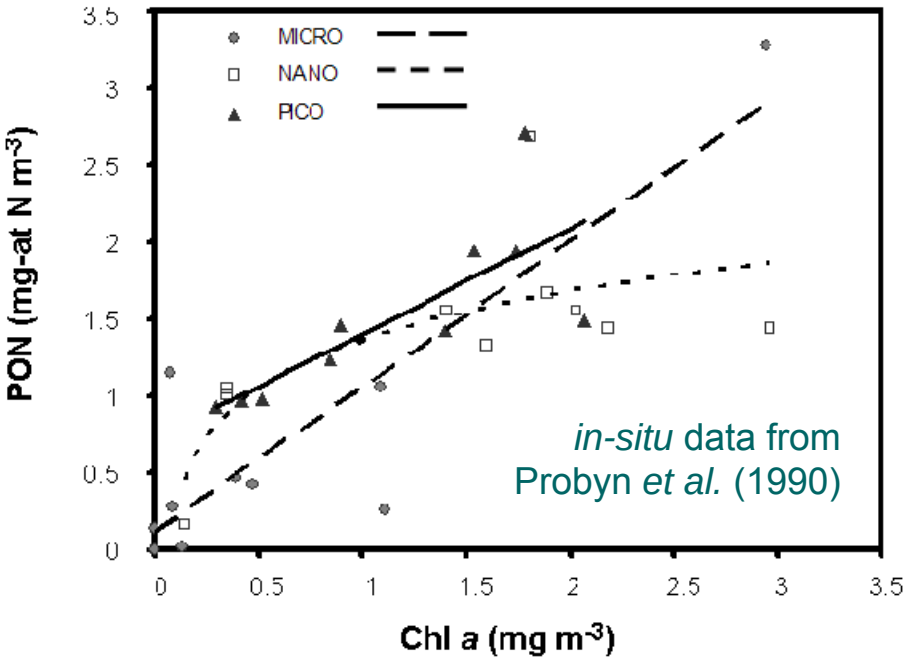


From Chlorophyll Concentration to Particulate Organic Nitrogen:

Global Relationship:

Kudela and Chavez (2000):
[PON (mg-at N m^{-3})] = [Chl (mg m^{-3})]

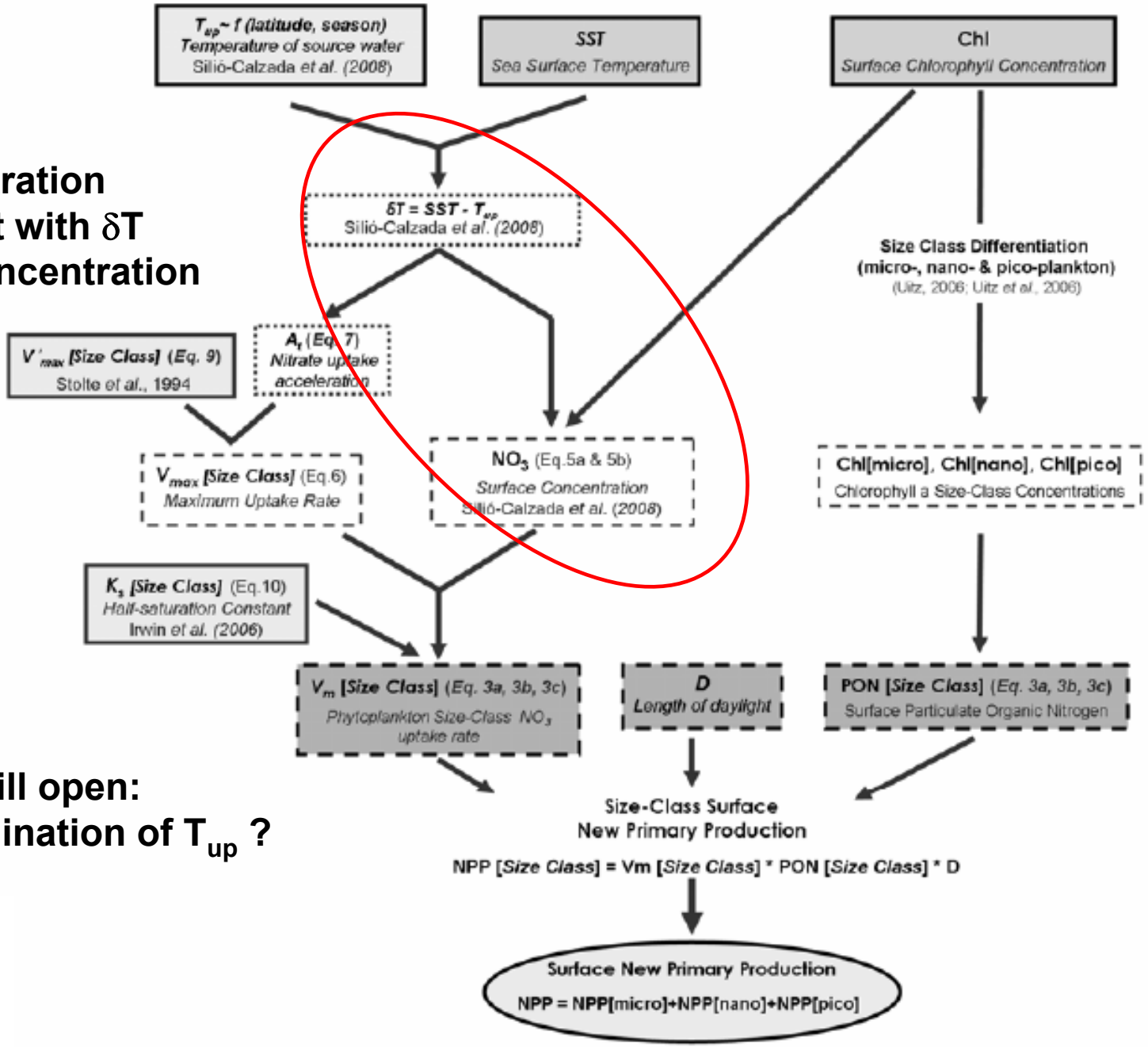
Estimation of the Size-Class Specific Particulate Organic Nitrogen, PON:



Microphytoplankton:	PON [*micro*] = 0.9488 * Chl [*micro*] + 0.1133	R^2=0.77
Nanophytoplankton:	PON [*nano*] = 0.461 * ln(Chl [*nano*]) + 1.366	R^2=0.56
Picophytoplankton:	PON [*pico*] = 0.6794 * Chl [*pico*] + 0.7287	R^2=0.59

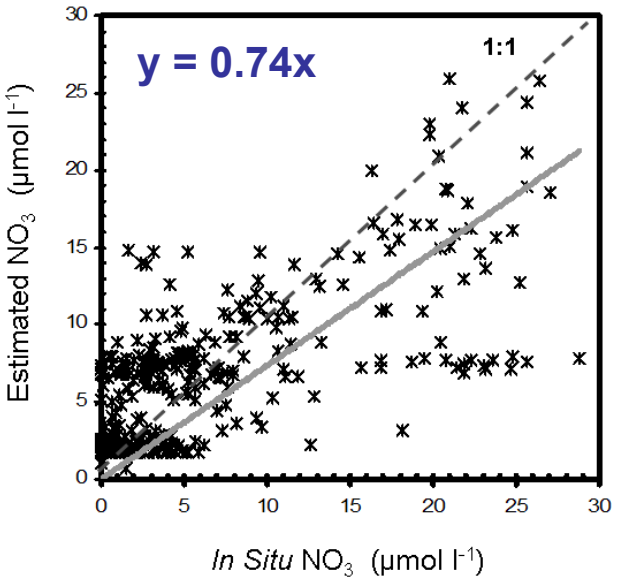
SST branch

NO3 concentration assessement with δT and Chl-a concentration



Question still open:
Fine determination of T_{up} ?

NO3 ~ *f* (SST)

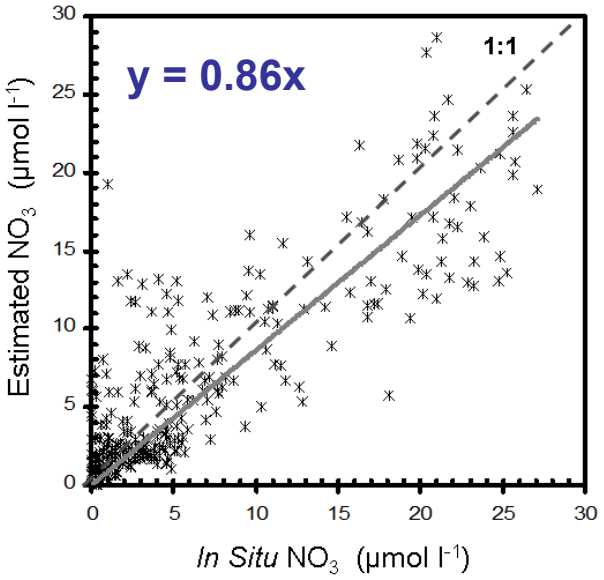


R^2 = 0.285

RMSE = 4.79 µmol l^{-1}

NO3 ~ *f* (SST, Chl a)

(Appr. Goes *et al.*, 1999)

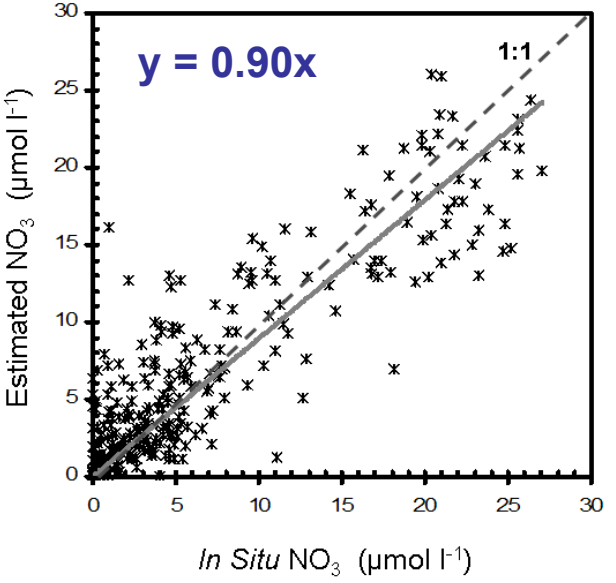


R^2 = 0.754

RMSE = 3.70 µmol l^{-1}

NO3 ~ *f* (δT, Chl a)

(Silió-Calzada *et al.*, 2008)



R^2 = 0.805

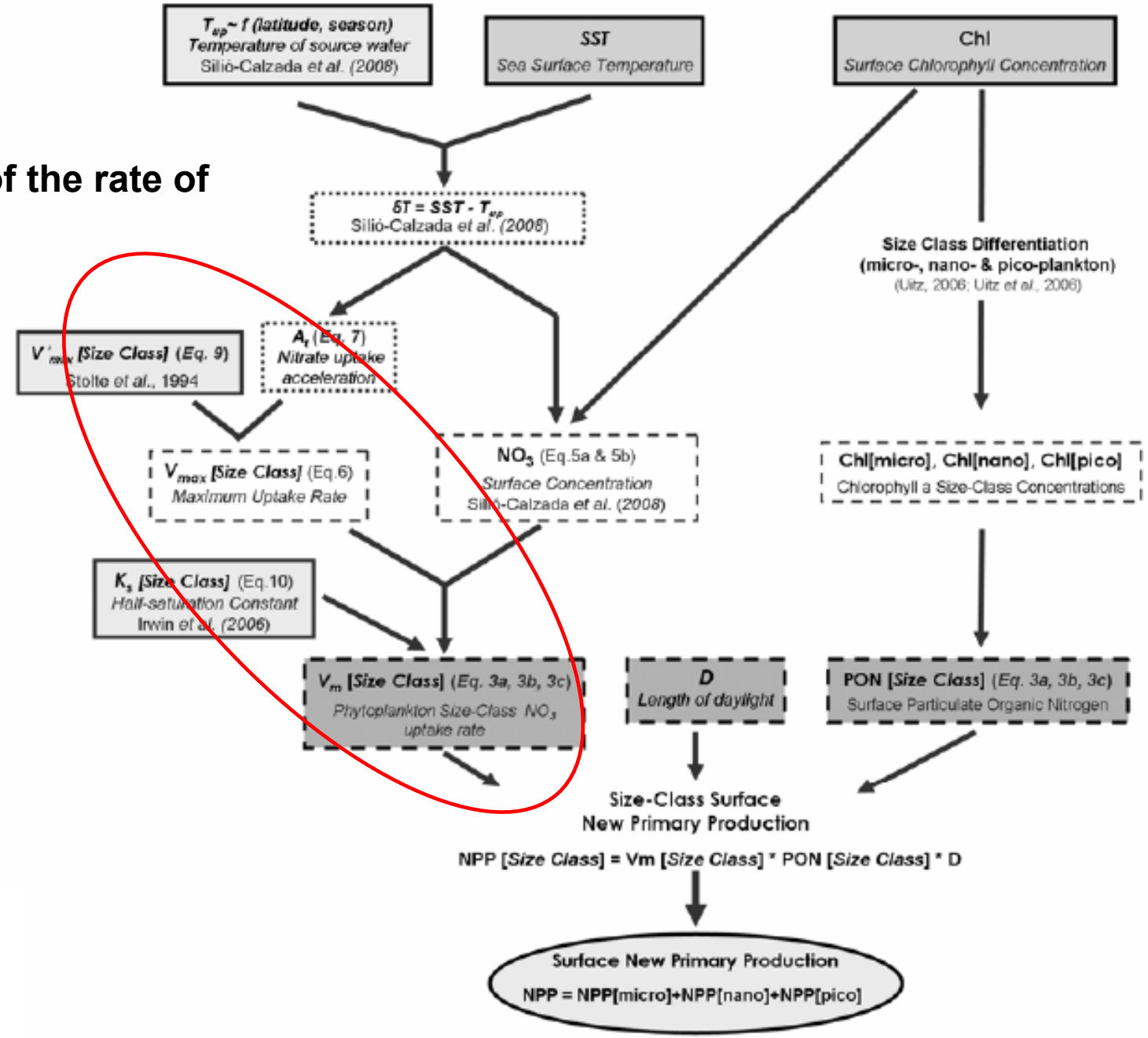
RMSE = 3.29 µmol l^{-1}

- **The estimation of NO3 ~ *f* (δT, Chl a) leads to:**
  - The **increase of R^2**
  - The **decrease of the RMSE**
  - **Slope** of the regression line **closer to 1**.

→ **Algorithms more robust compared to other approaches.**

SST branch

Estimation of the rate of NO3 uptake



Modeled Uptake Rate, dependent on the *nutrient concentration* and *phytoplankton kinetics*:

Maximum Nitrate Uptake Rate

Nitrate Surface Concentration

$$V_m = \frac{V_{\max} \times [NO_3^-]}{K_s + [NO_3^-]}$$

Nitrate Half-Saturation Constant

Variables

Kudela and Chavez (2000)

Maximum Nitrate Uptake Rate:

V'_{max} (h^{-1})

$V_{max} = V'_{max} \times A_t$

$V'_{max} = 0.094$

K_s (mg-at N m^{-3})

K_s = 1.0 ($[NO_3^-] > 1$ µmol l^{-1})

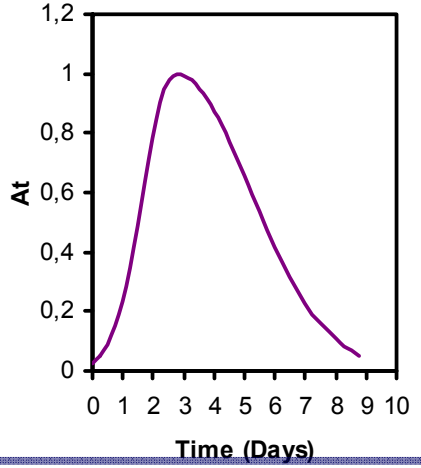
K_s = 0.1 ($[NO_3^-] < 1$ µmol l^{-1})

Maximum Nitrate Uptake Rate

New Approach

Nitrate Uptake Time Dependency

Silio-Calzada *et al.* (JGR, *in press*)



e) Stolte *et al.* (1994)

074 and **0.180**
nicrophytoplankton,
ively

e) Irwin *et al.* (2006)

) and **15.7**
nicrophytoplankton,
ively.

New primary production
(Kudela and Dugdale, 1996):

$$NPP = V_m \times D \times PON$$

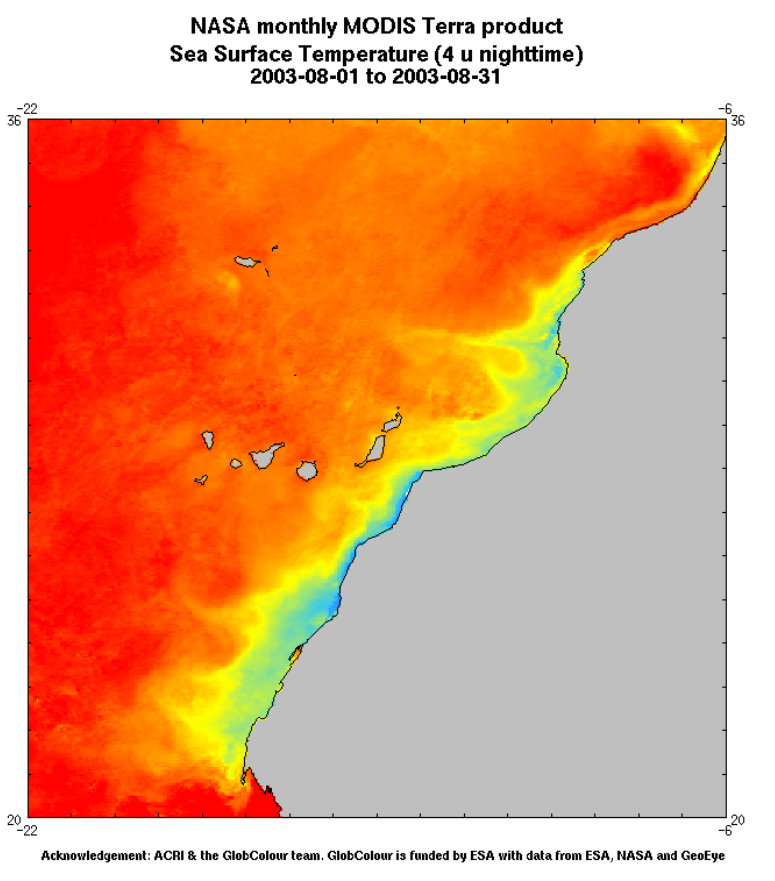
V_m [Size class] PON [Size class]

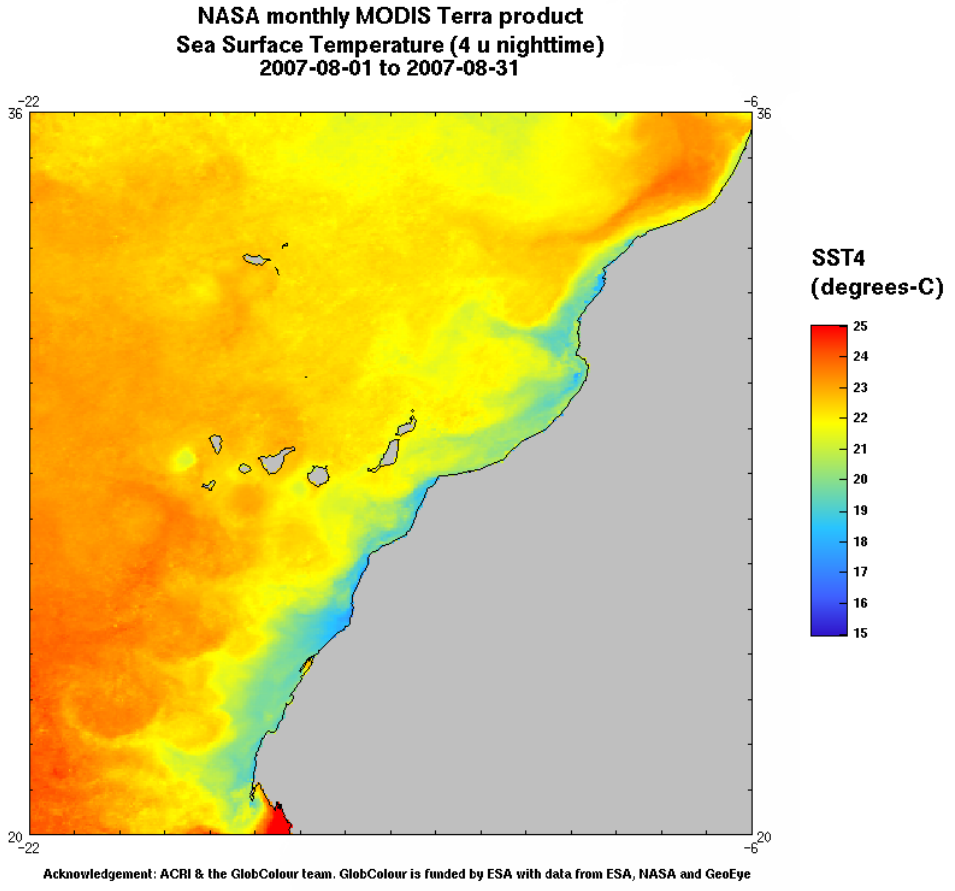
Adaptations

New primary production
(Silió-Calzada *et al.*, JGR, *in press*):

$$NPP\ [Size\ class] = V_m\ [Size\ class] \times D \times PON\ [Size\ class]$$

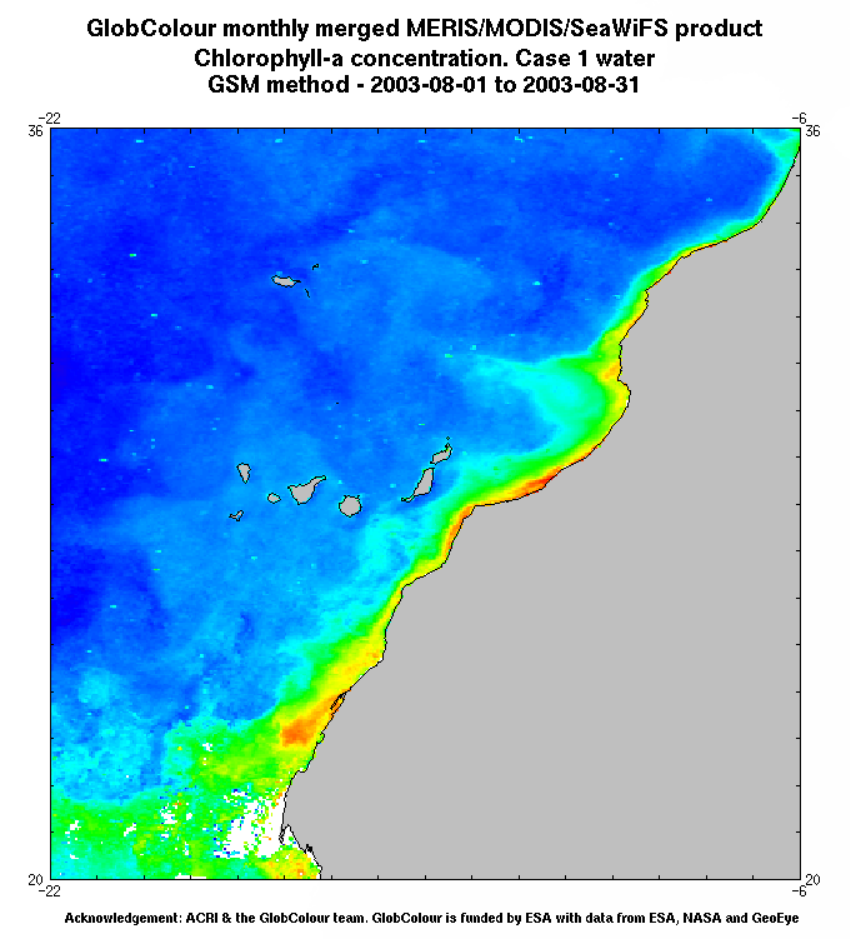
The new primary production is calculated as the **sum of the individual new primary productions** due to each of the phytoplankton size classes

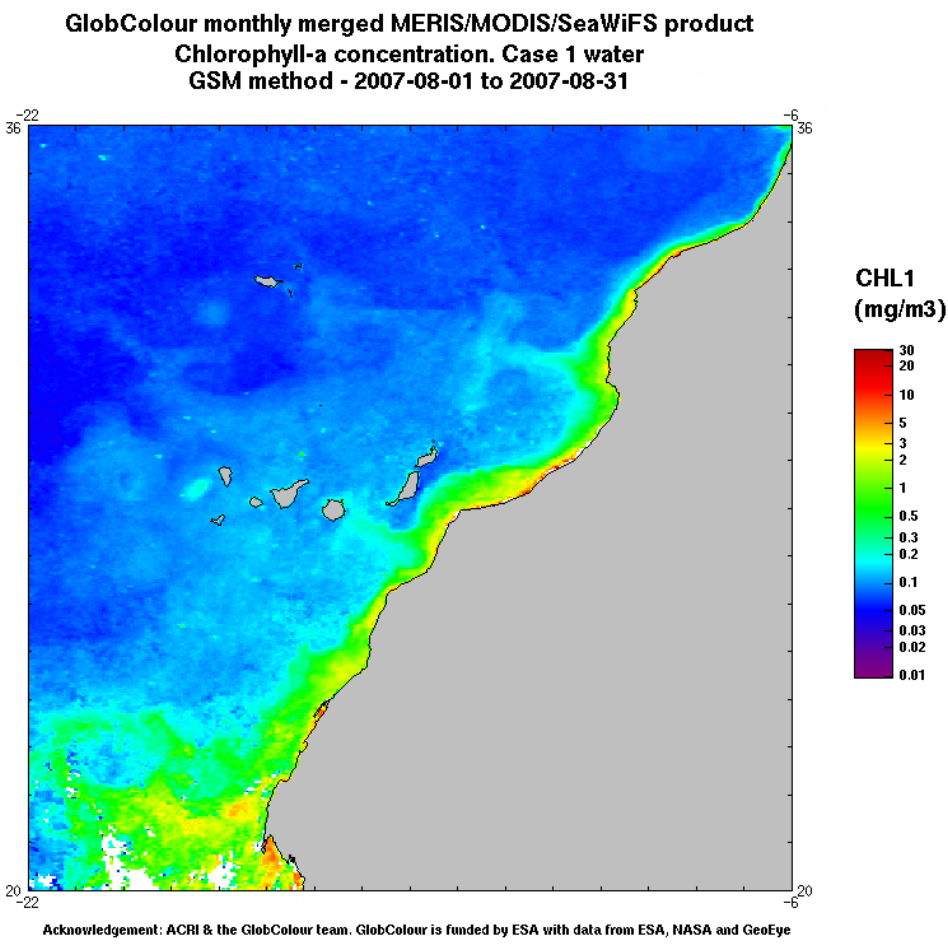




2003 **SST** **2007**

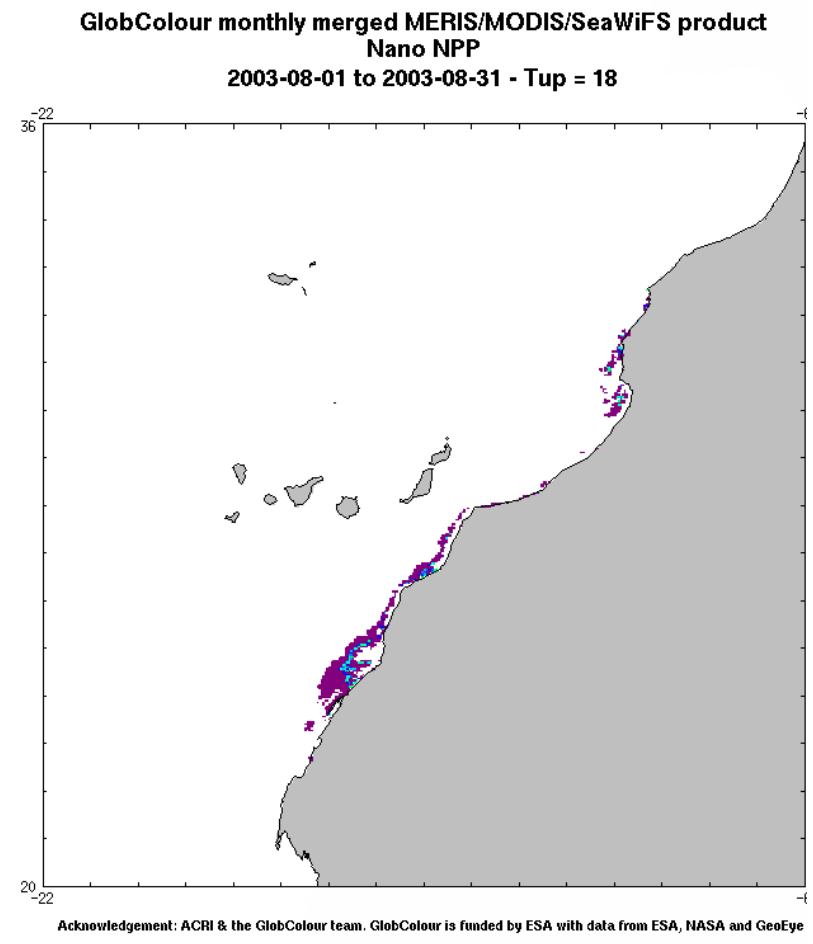
Preliminary results

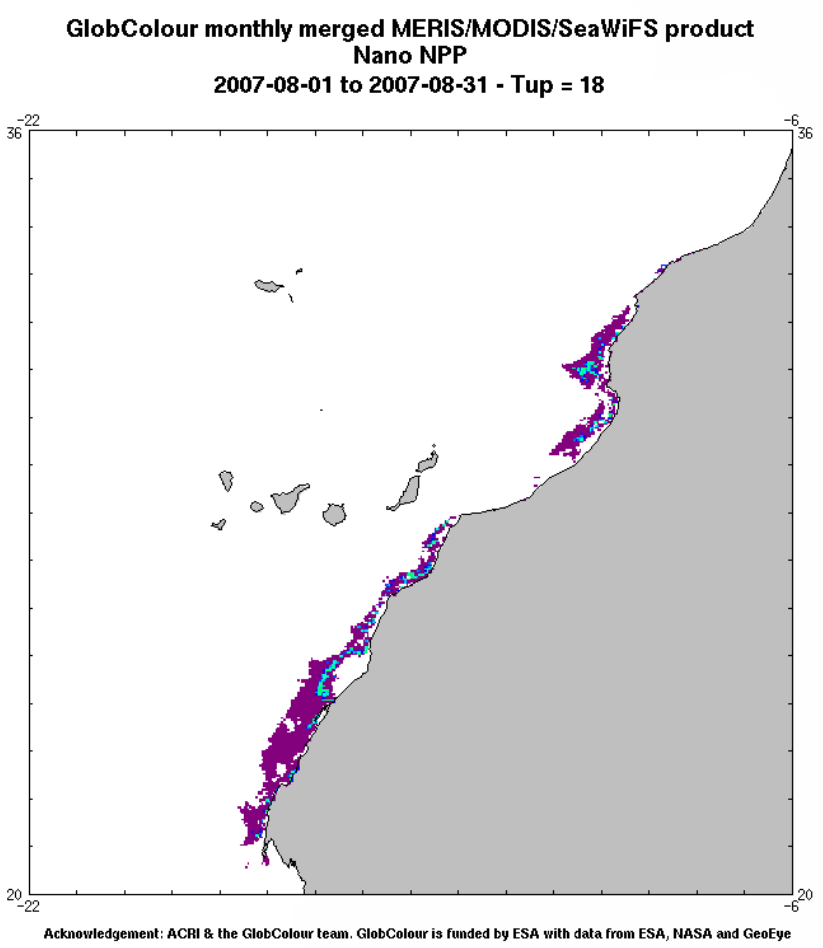


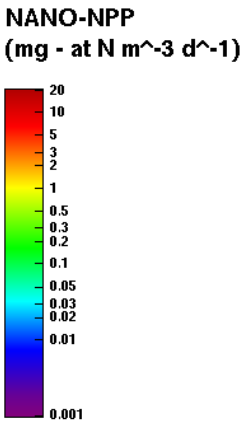


2003 **Chl-a** **2007**

Preliminary results





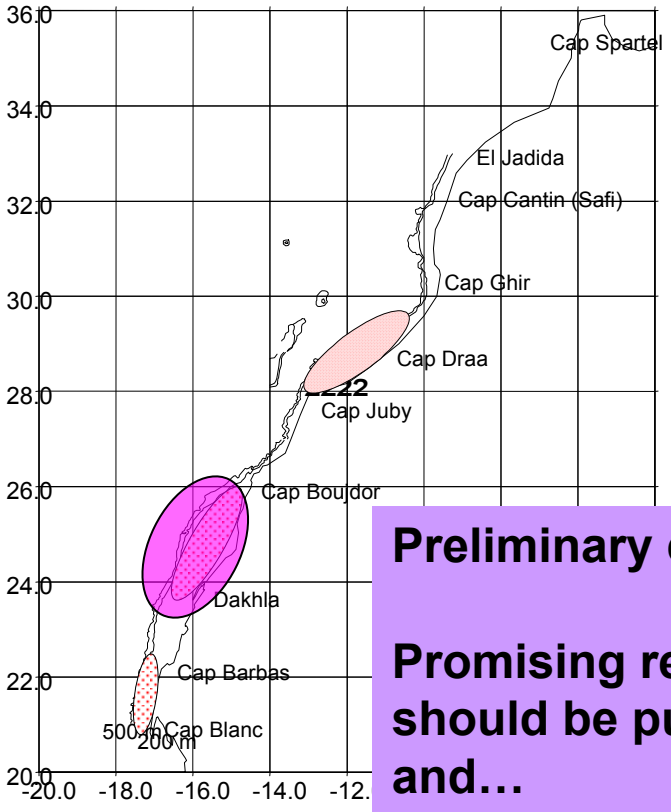


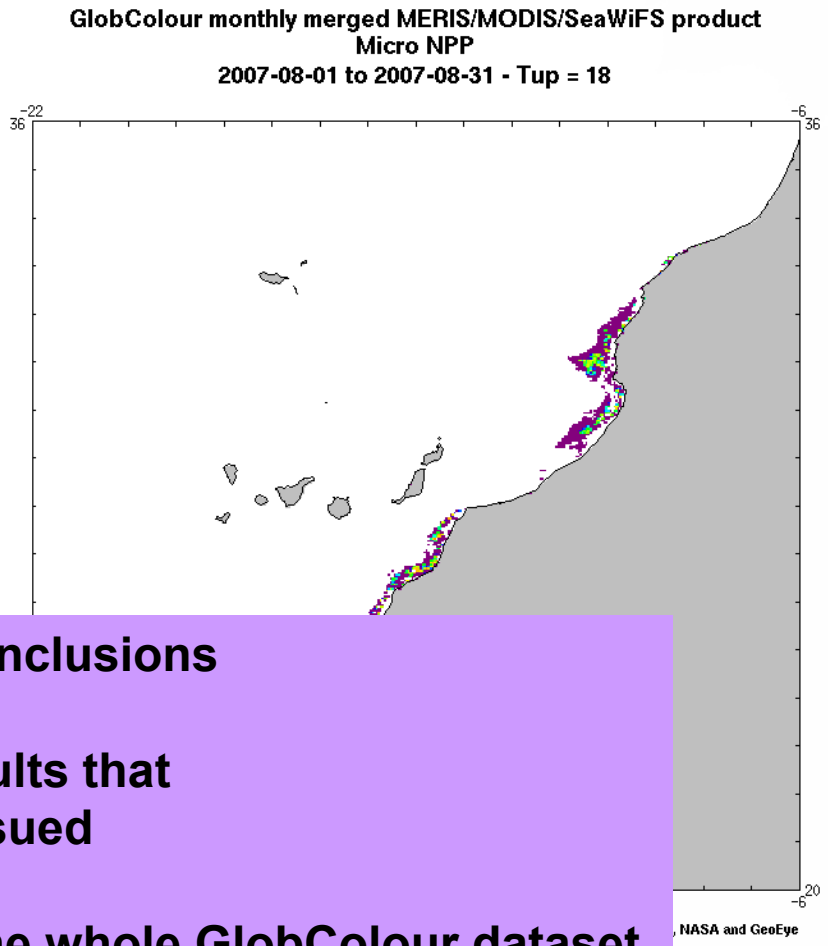
2003 **2007**

New Primary Production
Assessment of the contribution to nano-phytoplancton

Preliminary results

Main spawning areas



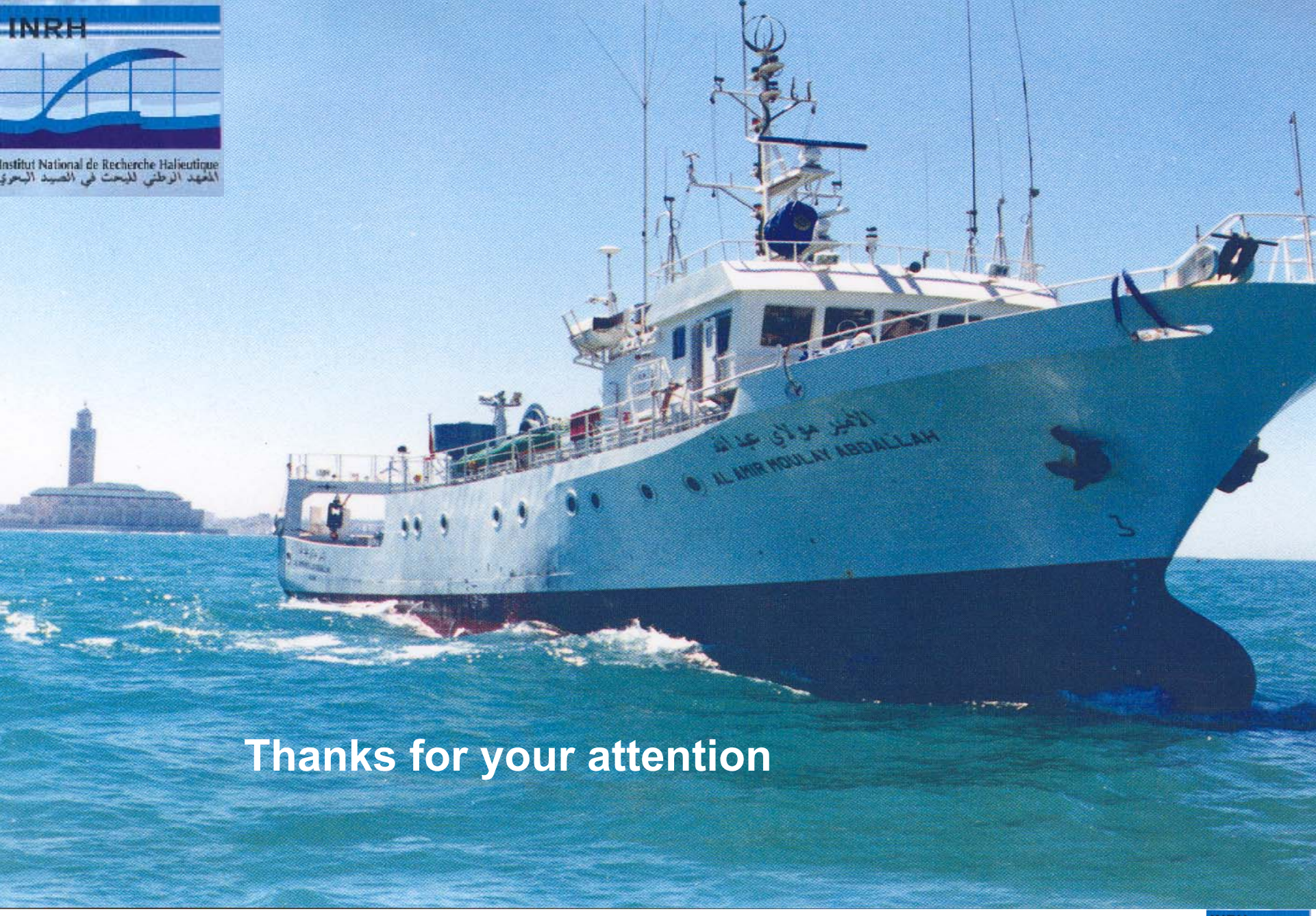


Preliminary conclusions

Promising results that should be pursued and…
expanded to the whole GlobColour dataset

Cas des principales espèces pélagiques sud Marocaine

Sardine, Maquereau, chinchards et anchois



Thanks for your attention