CYAnobacterial Platform
Optimised For Bioproduction

I carotenoidi nell'ambiente acquatico

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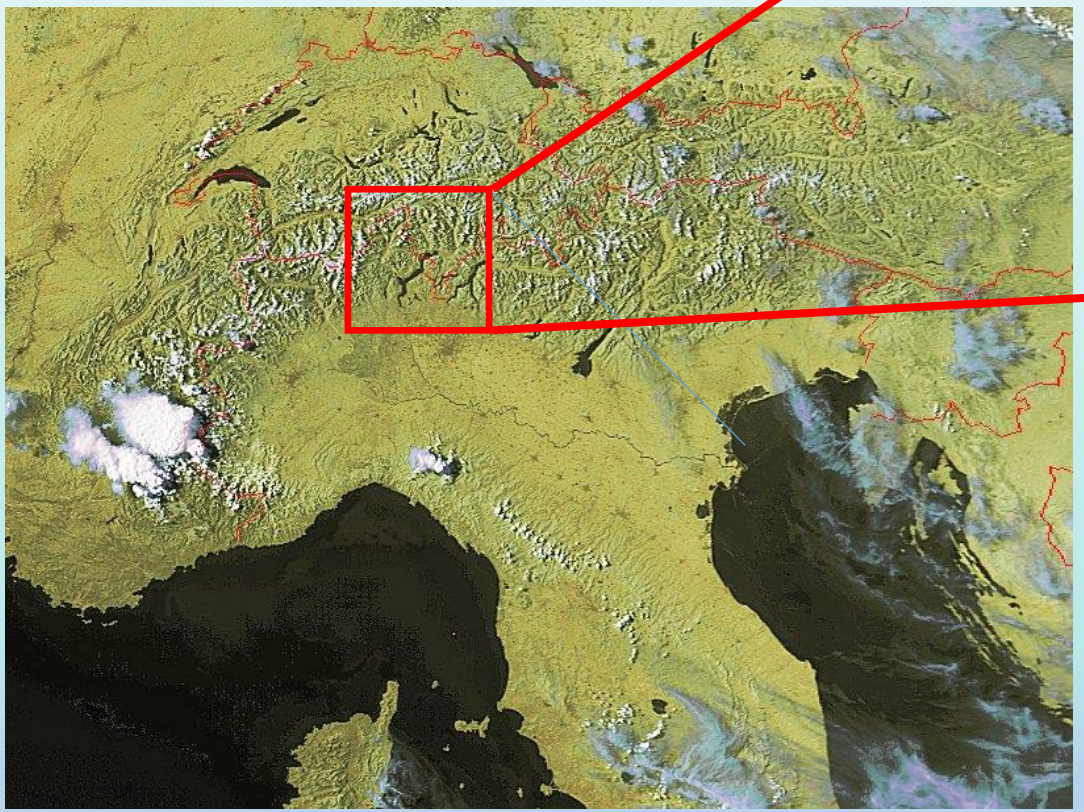
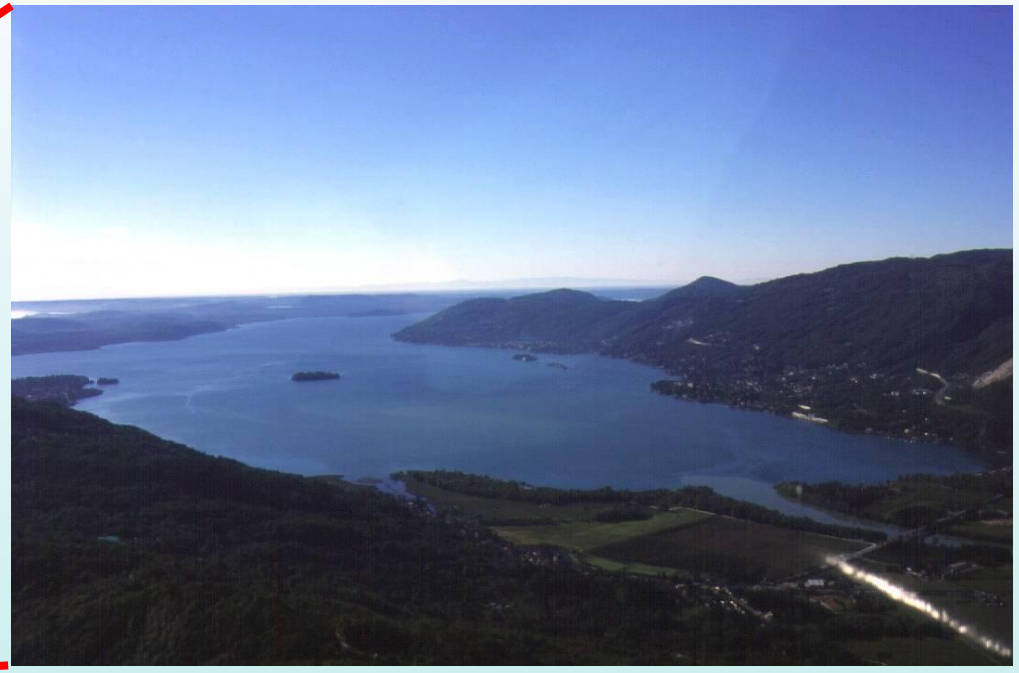
CNR – Istituto per lo Studio degli Ecosistemi, Verbania

outline

- CNR ISE presentation
- Algal pigment
  - structure
  - function
  - identification
- our role in the CYAO

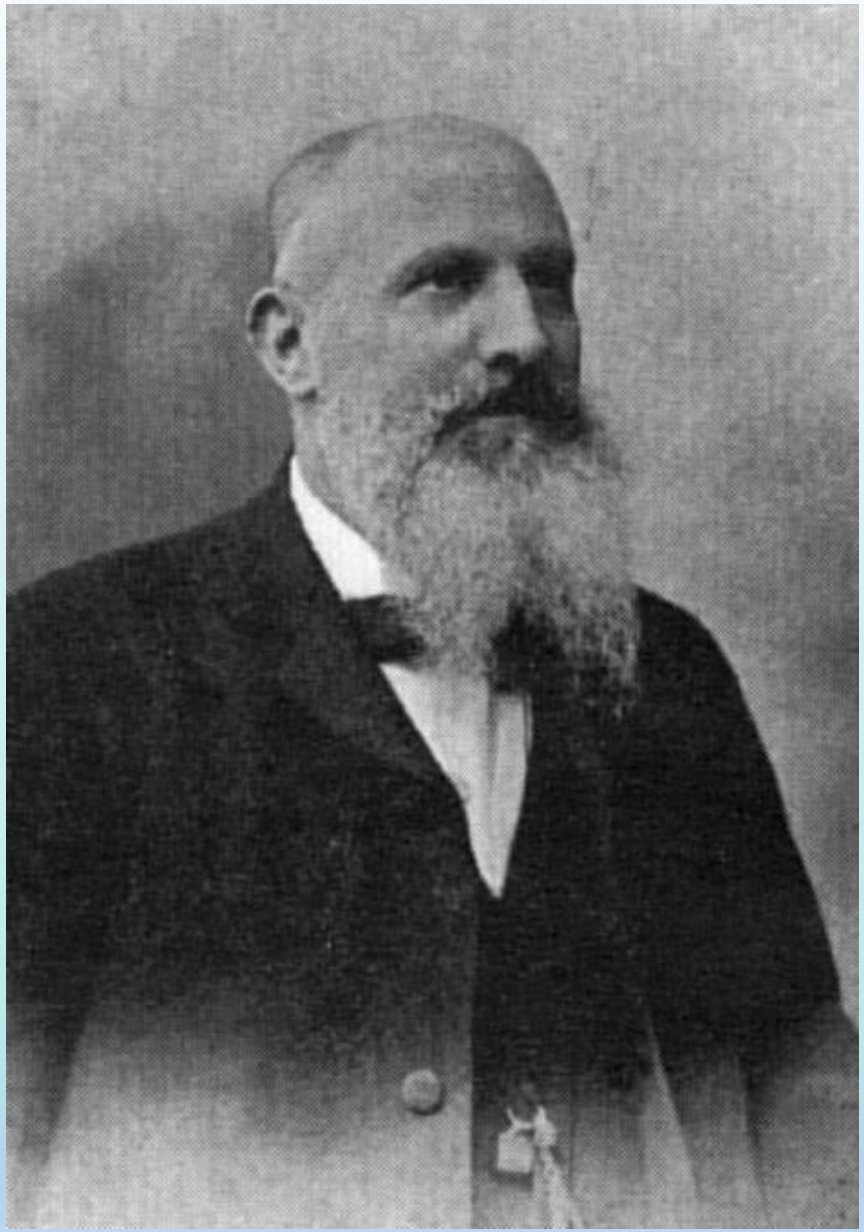
Istituto per lo Studio degli Ecosistemi - CNR (ISE-CNR)
Verbania, Italia





Villa Marco de Marchi

http://www.cyaoproject.org

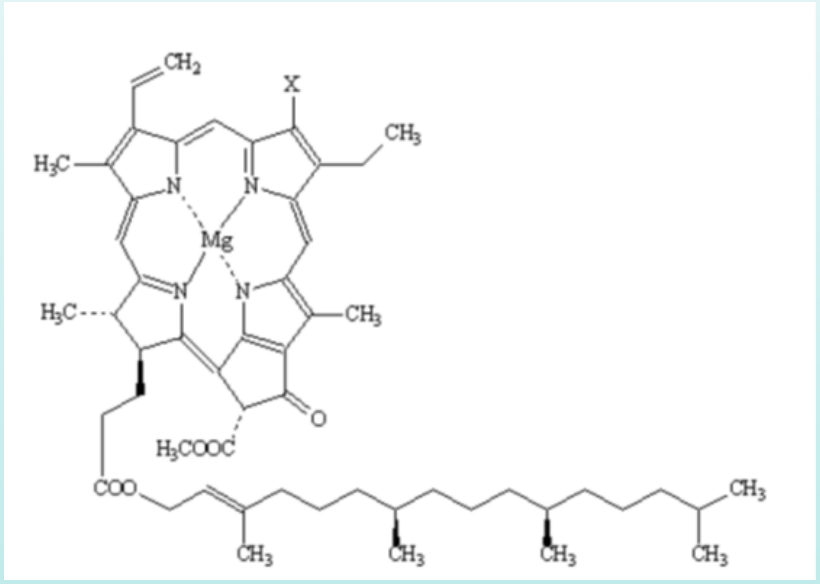


Pietro Pavesi

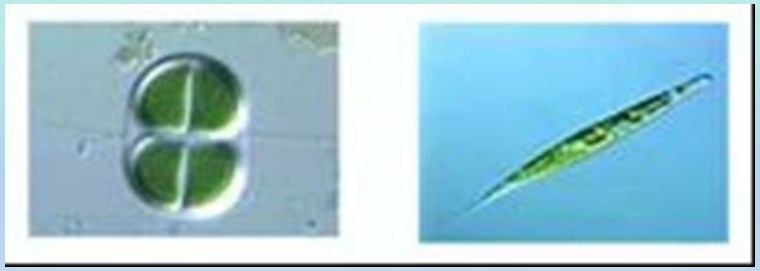
Rina Monti

Phytoplankton biomarkers: photosynthetic pigment

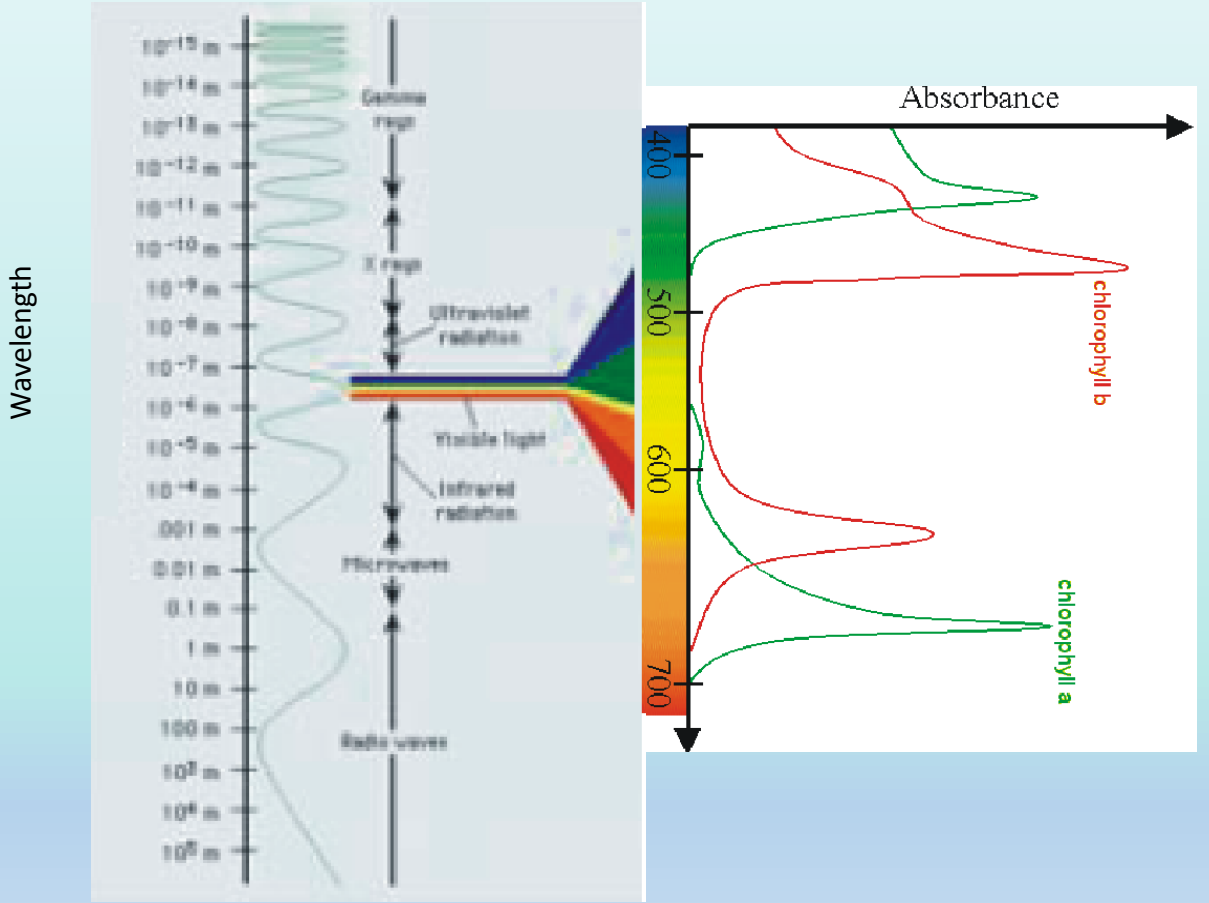
Chlorophyll



Algae are green due to chlorophyll



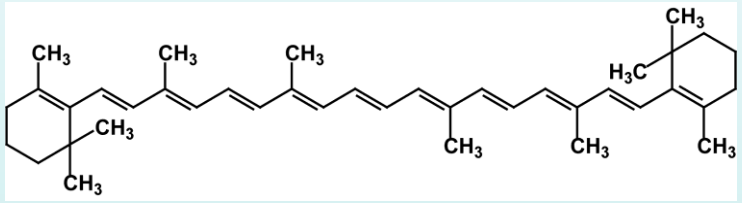
Why more than one chlorophyll?



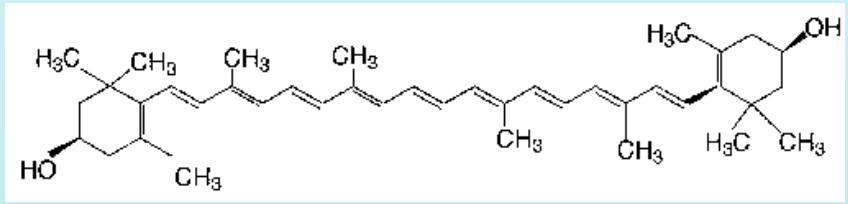
Phytoplankton biomarkers: photosynthetic pigment

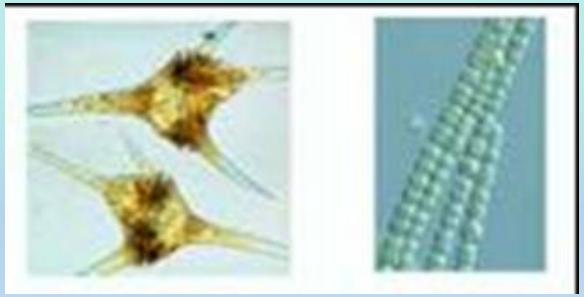
Carotenoids

Carotenes



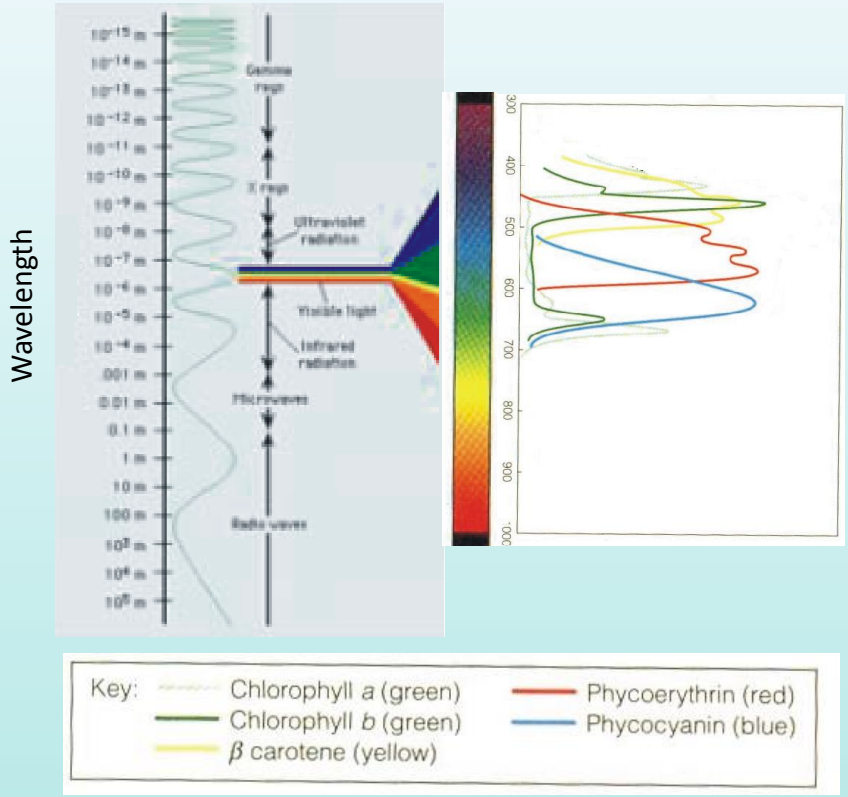
Xanthophylls





Some algae are orange or brownish

Some are blue-green in color



Occurrence: Universally distributed in all photosynthetic organisms

Function: Accessory pigments, antioxidants

Structure: Many different structures (>100 identified to date)

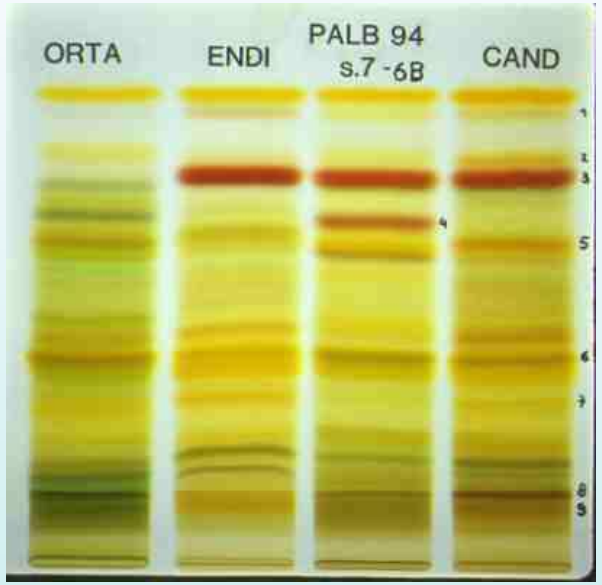
Function of pigments in photosynthetic organisms

chlorophyll a:

- light absorption (“Light harvesting complexes”)
- electron donor and acceptor in reactive centres

Carotenoids:

- light absorption
- quenching “ of Chl photoinduced triplet
- scavengers of other reactive oxygen species



Beta carotene

echinenon

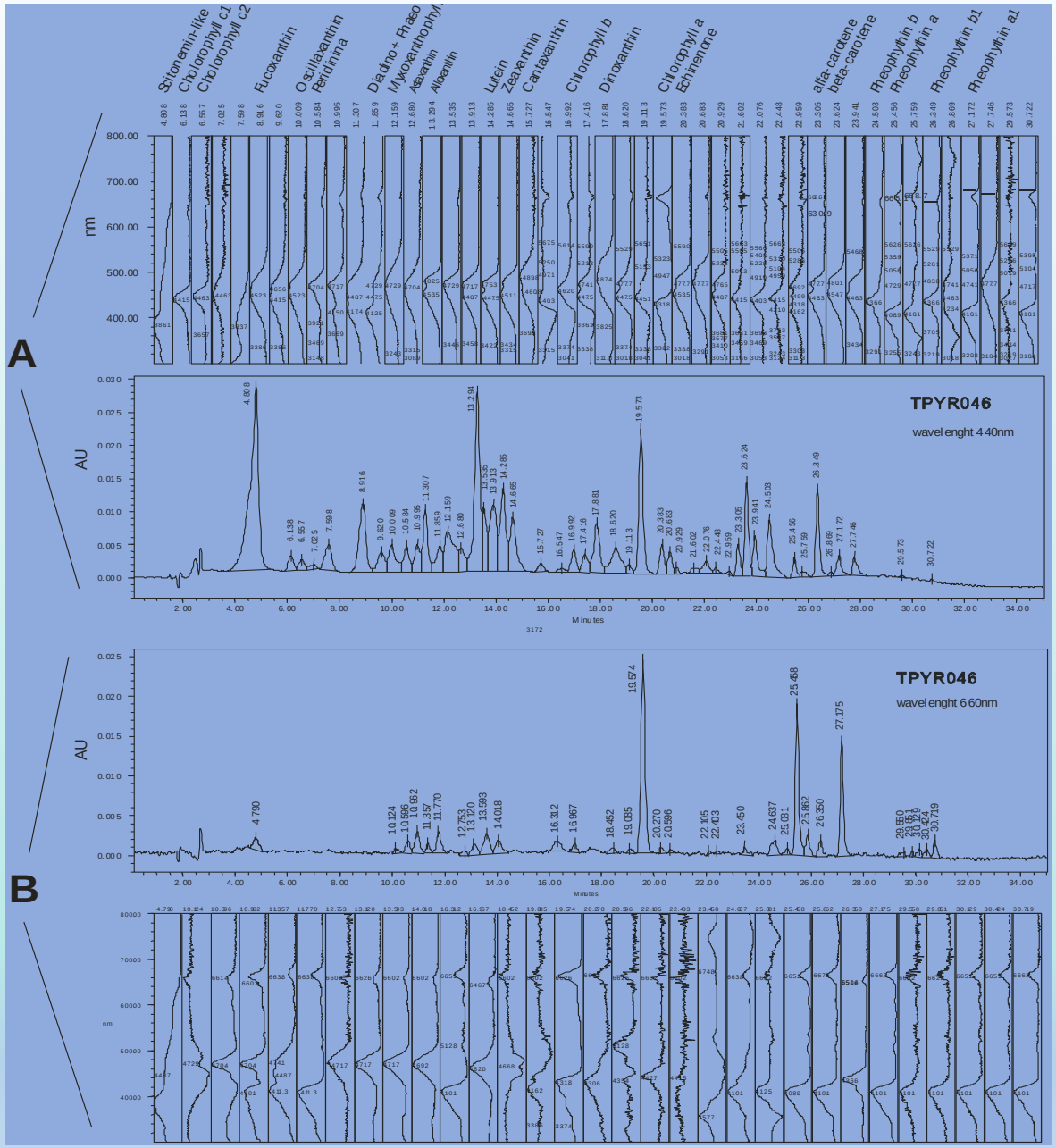
okenone

canthaxanthin

lutein

myxoxanthophyll

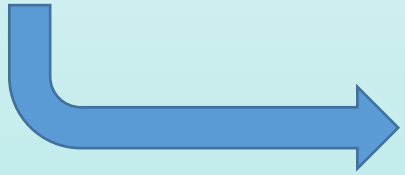
oscillaxanthin



CNR ISE contribution to the CYAO project

WP6: Carotenoid profiling of cyanobacteria, trout aquaculture trial and characterisation of fish flesh.

Task 6.1 Evaluation of the photosynthetic pigments and natural antioxidants in parental and engineered cyanobacterial strains.



WP2: Production of Synechocystis and Synechococcus strains synthesising Chlorophyll *d*

Task 6.2 Fish trials. Body growth performance test of rainbow trout fed with traditional feed and with pellet enriched with Asx extracted from the engineered cyanobacterial strains.

6.1 Evaluation of the photosynthetic pigments and natural antioxidants in wild type and engineered cyanobacterial strains. Characterization of the Asx enriched fish feed and fish flesh.

- Pigments composition by HPLC with DAD: detailed profile of chlorophylls, primary and secondary carotenoids
  - Characterization of starting strain
  - Characterization of engineered strain
  - Photosynthetic pigments and process optimization: “batch” and “large scale PBR”

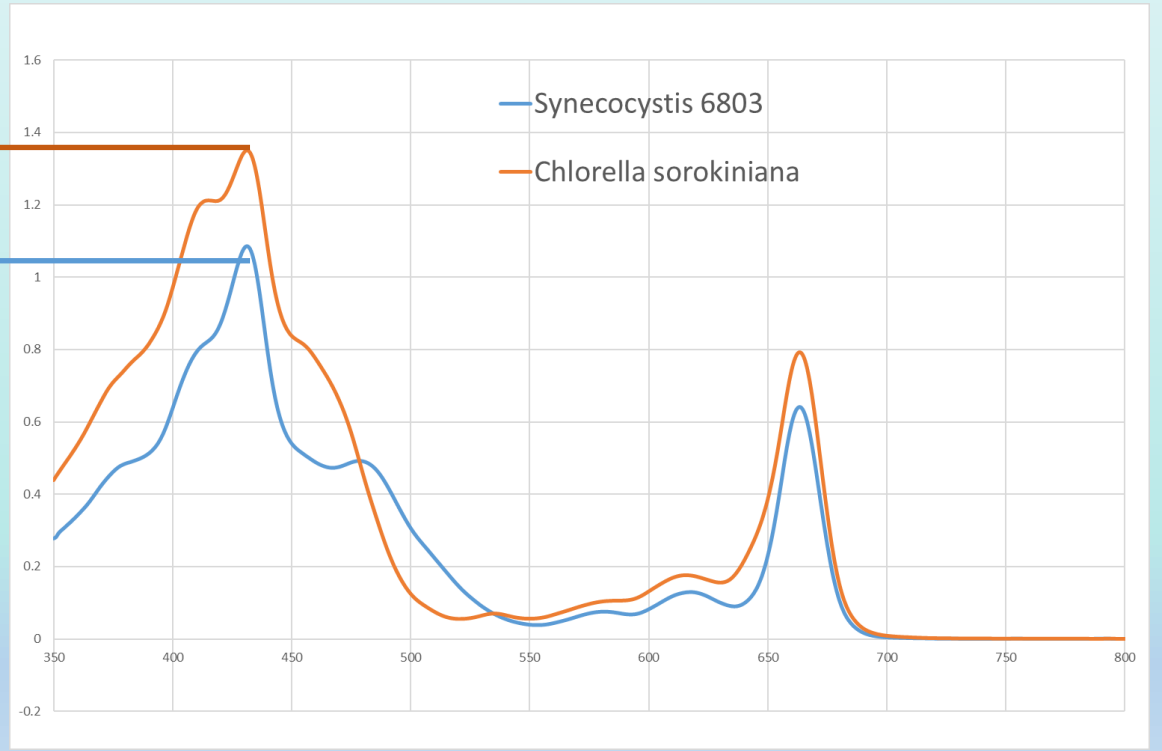
- Characterization of natural antioxidants in the test cultures and Asx enriched fraction for CYAO pellet

- Quality control of fish pellets, quantification of Asx in control feed and CYAO pellet

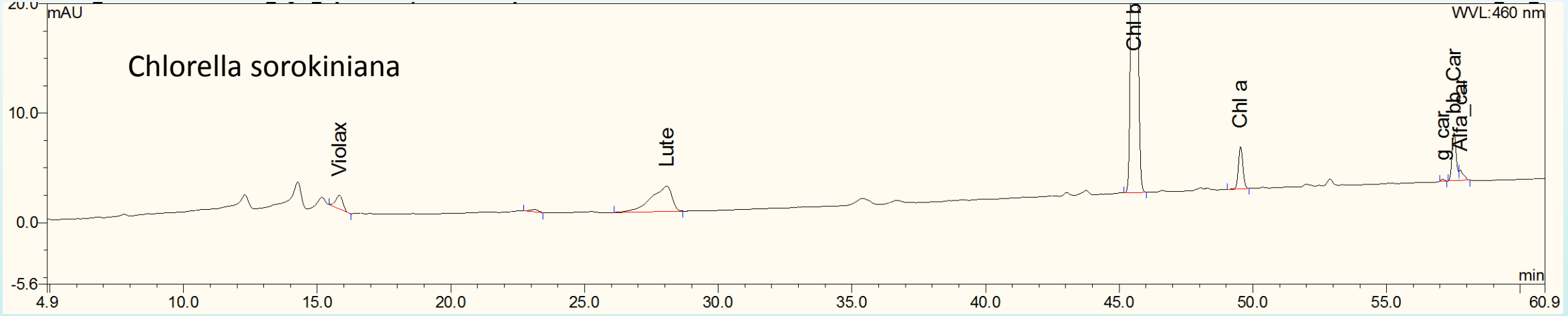
- Quantification of Asx in trout flesh to estimate the efficiency of carotenoid transfer from feed

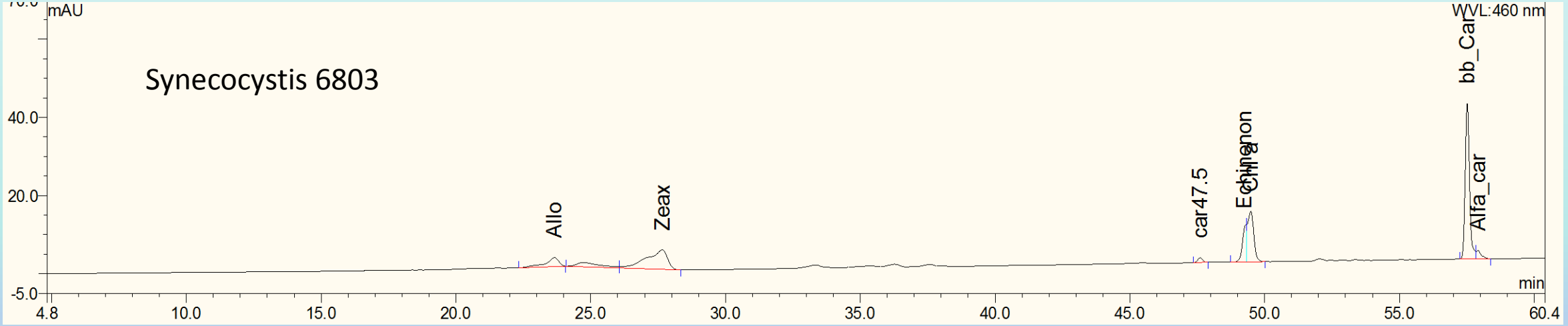
- Nutritional quality of CYAO-fed-trout: proteins, lipids, carotenoids, antioxidants

Characterization of starting strain : comparison of VIS spectra from two algal acetone extract



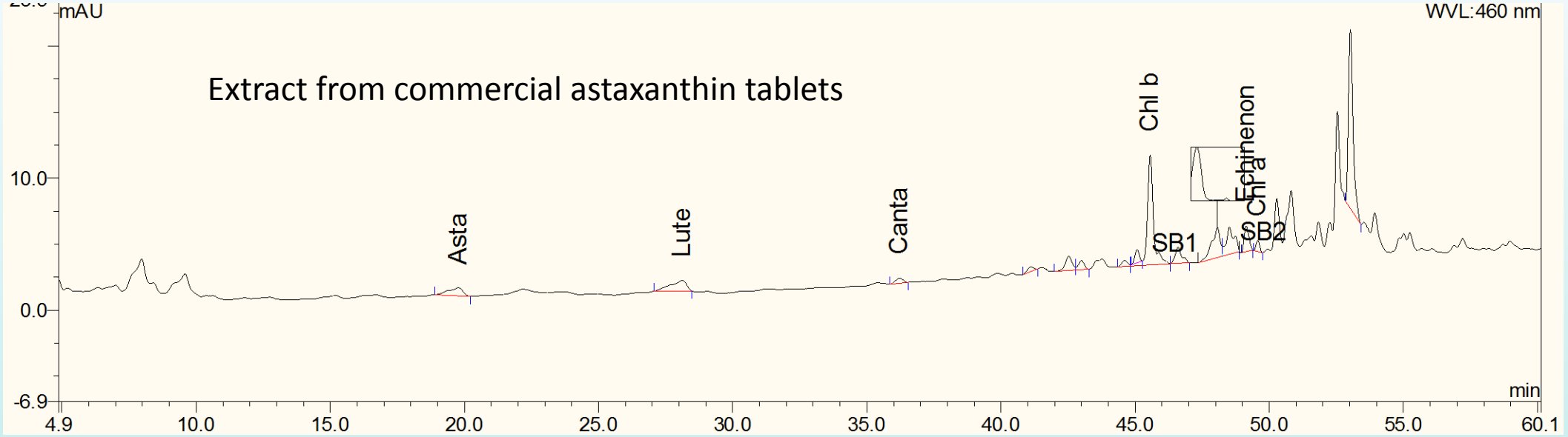
Characterization of starting strain : comparison of two algal spectra

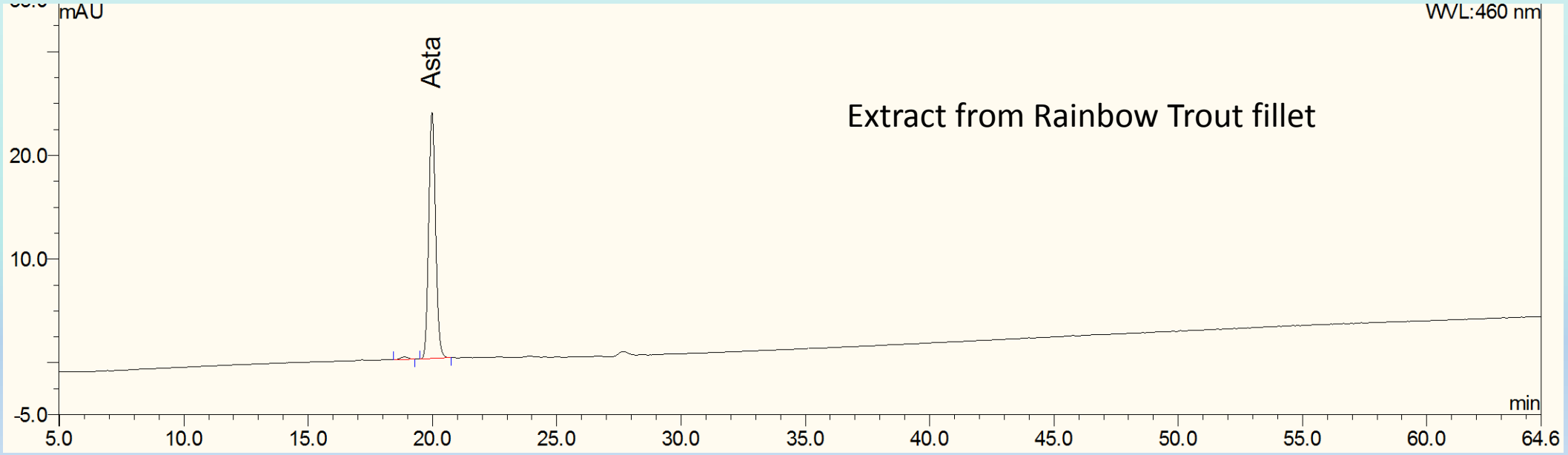




6.2 Fish trials. Body growth performance test of rainbow trout fed with traditional feed and with pellet enriched with Asx extracted from the engineered cyanobacterial strains.

- Rainbow trout (size 20cm, 1 year old) adaptation
- Feeding experiments: control 40 fishes, feed trial
- Trout identification and biometric parameters (total length and fork length) and weight
- Environmental parameters and biological variables analysis
- Model of fish-growth parameters between treated and control fishes


mAU
WVL:460 nm
Extract from commercial astaxanthin tablets
Asta
Lute
Canta
Chl b
Echinenon
Chl a
SB1
SB2
10.0
0.0
-6.9
min
4.9
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.1


mAU
WVL:460 nm
Asta
Extract from Rainbow Trout fillet
20.0
10.0
-5.0
min
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
64.6