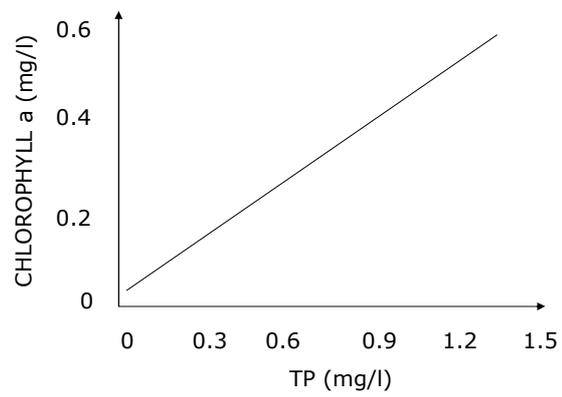
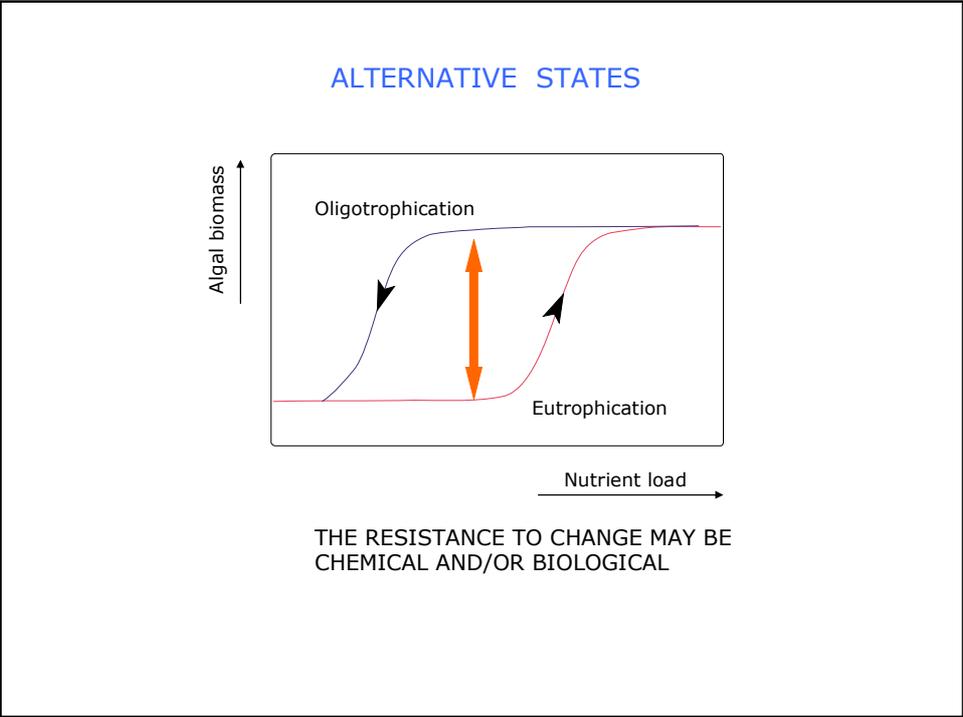
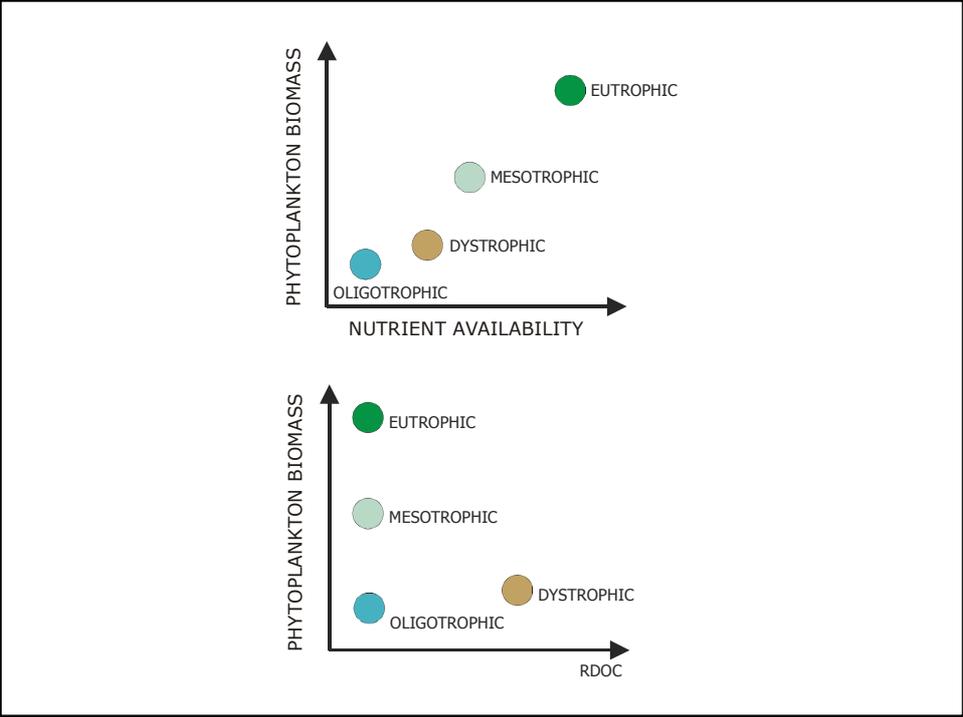


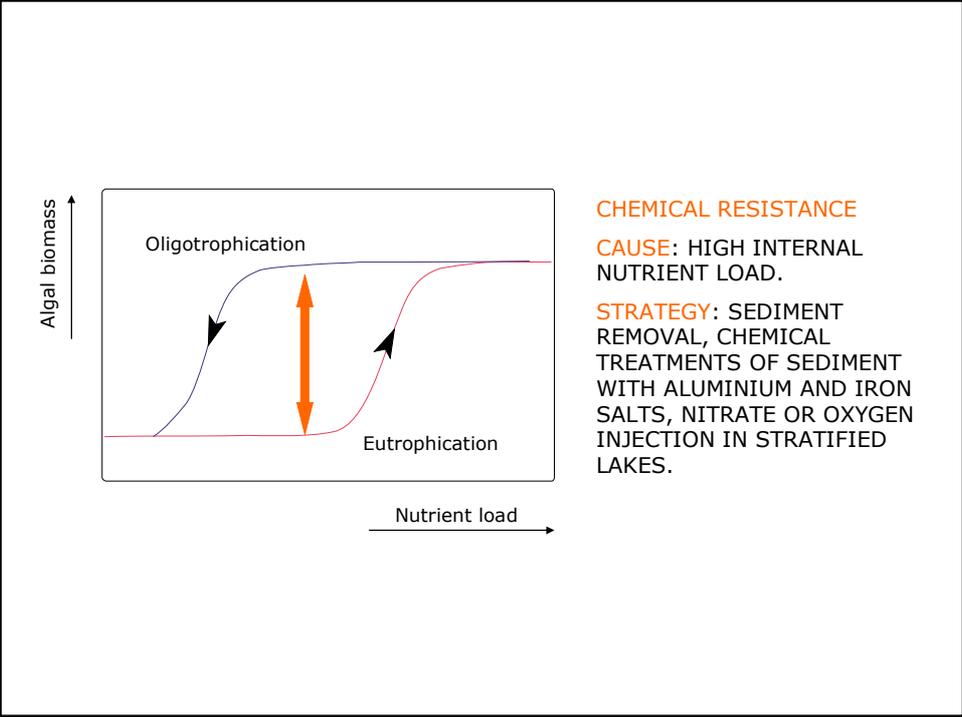
NEW PERSPECTIVES IN ECOLOGY OF SHALLOW  
LAKES: THE (SUB)TROPICAL POINT OF VIEW



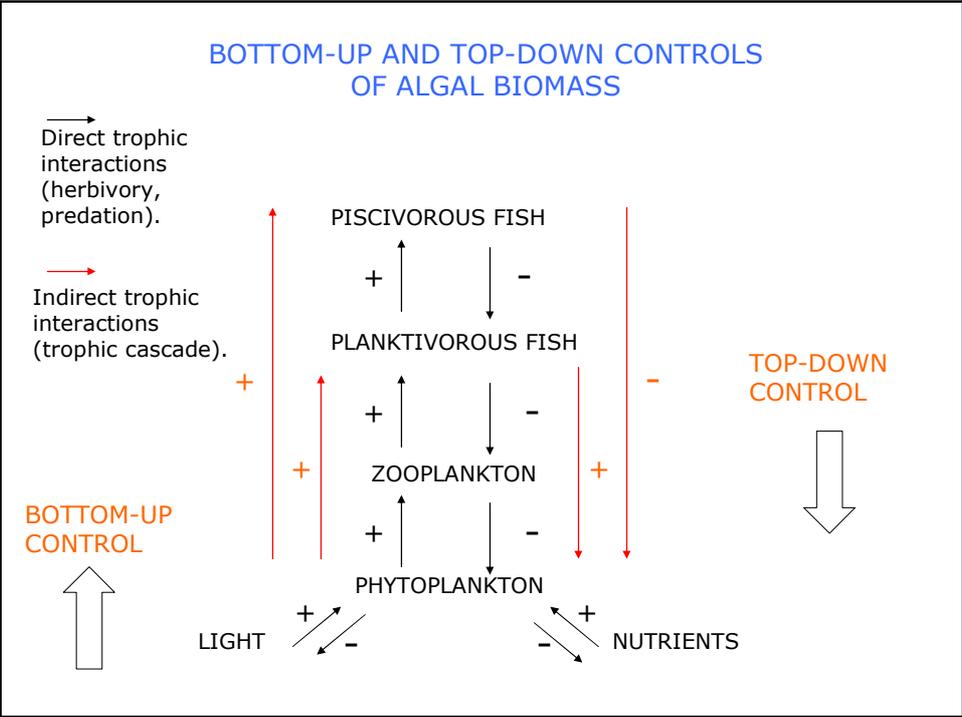
Néstor Mazzeo  
Departamento de Ecología  
Facultad de Ciencias UDELAR  
Montevideo, Uruguay  
email: nmazzeo@fcien.edu.uy







**CHEMICAL RESISTANCE**  
**CAUSE:** HIGH INTERNAL NUTRIENT LOAD.  
**STRATEGY:** SEDIMENT REMOVAL, CHEMICAL TREATMENTS OF SEDIMENT WITH ALUMINIUM AND IRON SALTS, NITRATE OR OXYGEN INJECTION IN STRATIFIED LAKES.



## BOTTOM-UP AND TOP-DOWN CONTROLS OF ALGAL BIOMASS

### NET PRIMARY PRODUCTION/HERBIVORY RATE

- FRESHWATER ECOSYSTEMS UP TO 80%.
- WETLANDS BETWEEN 30-50%.
- TERRESTRIAL ECOSYSTEMS, AVERAGE 25%.



## TOP-DOWN CONTROL IN SUBTROPICAL AND TROPICAL AREAS

### BASIC TOPICS

- Higher fish specific richness with partial niche overlap. Probably there is a higher impact of predation control on preys.
- The fish stocks in tropical and subtropical lakes are often dominated by omnivorous species that feed on zooplankton, but also consume phytoplankton, periphyton, benthic invertebrates and detritus. It is reasonable to expect a higher carrying capacity of fish than with obligated zooplanktivores.
- Our communities present fewer large strict piscivores, and more small-sized carnivores and sit-and-wait predators in comparison with North American and European fish communities.



## TOP-DOWN CONTROL IN SUBTROPICAL AND TROPICAL AREAS

### FACTORS THAT COULD PREVENT THE SUCCESS OF BIOMANIPULATION

- The fish density, but not necessarily biomass, is substantially higher (maybe 1-2 orders of magnitude) in subtropical and tropical lakes in South America than in comparable north temperate lakes.
- Fish reproduction, which in temperate freshwaters takes place once a year, occurs throughout the year in many subtropical and tropical species.
- The dominance of small fish in such high numbers leads to a higher predation pressure than in temperate lakes, since small fish are usually zooplanktivorous and have a much higher energy demand per unit of biomass than large fish.



## TOP-DOWN CONTROL IN SUBTROPICAL AND TROPICAL AREAS

### FACTORS THAT COULD PREVENT THE SUCCESS OF BIOMANIPULATION

- Macroinvertebrate predators (e.g. *Chaoborus* and shrimps) are more abundant and occur all year round in subtropical and tropical areas.



## TOP-DOWN CONTROL IN SUBTROPICAL AND TROPICAL AREAS

**Hypothesis:** The meso and macrozooplankton herbivores are very limited in tropical and subtropical areas because of the stronger top-down control in comparison with temperate zones.

**Hypothesis:** Traditional biomanipulation has no cascading effects on phytoplankton (at least in tropical regions).



## ENHANCEMENT OF TOP-DOWN CONTROL: LIMITATIONS AND PERSPECTIVES IN SUBTROPICAL AND TROPICAL AREAS

### APPLIED TOPICS

- New aquaculture strategies are absolutely necessary to maximize grazing on phytoplankton and reduce the nutrient transport from the sediments to the water column.



## ENHANCEMENT OF TOP-DOWN CONTROL: LIMITATIONS AND PERSPECTIVES IN SUBTROPICAL AND TROPICAL AREAS

### APPLIED TOPICS

- The absence of native piscivorous fish culture systems in many tropical countries precludes the application of biomanipulation.
- There is a huge richness of fish species potentially useful for mass production, and biomanipulation has not been considered yet.
- Generally, aquaculture has focused so far on exotic species (e.g. common carp and grass carp) that have negative effects on water quality and biodiversity.



## ROLE OF SUBMERGED AND FREE-FLOATING PLANTS

Limitations of our knowledge, and the direct and indirect possibilities of changing bottom-up and top-down controls through the manipulation of aquatic plants

### Direct competition with phytoplankton by:

Light

Nutrient

Allelopathic compounds

### Other effects:

Increase algal sedimentation rates

Reduce sediment resuspension

Offer daytime refuge for zooplankton against fish predation

Reduce the cannibalism in populations of piscivores



## ROLE OF SUBMERGED AND FREE-FLOATING PLANTS

Limitations of our knowledge, and the direct and indirect possibilities of changing bottom-up and top-down controls through the manipulation of aquatic plants



### Direct competition with phytoplankton by:

Light

Nutrient

Allelopathic compounds?

### Other effects:

Reduce algal biomass by filtration of the root systems

Reduce sediment resuspension

Offer daytime refuge for zooplankton against fish predation?

The life cycle of some species is completely connected to free-floating plants. Do piscivores prefer this habitat?

## ROLE OF SUBMERGED AND FREE-FLOATING PLANTS

Limitations of our knowledge, and the direct and indirect possibilities of changing bottom-up and top-down controls through the manipulation of aquatic plants

- Some subtropical and tropical systems show simultaneously submerged and free-floating plants. What are the habitat preference of zooplankton and fish in this situation?
- Do the culture and removal of free-floating plants present any effects on pelagic trophic web? Can that lead to an increase in phytoplankton grazing?
- Is it possible to develop new mechanical systems to maximise the direct and indirect effects of aquatic plants? Is it feasible to produce such equipments in our countries and reduce the economic costs?

