EFFECTS OF SUBMERGED AND EMERGENT MACROPHYTES AND PREDATION RISK ON THE DIEL DISTRIBUTION OF CLADOCERANS IN SUBTROPICAL LAKE BLANCA (URUGUAY, SOUTH AMERICA)

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- The spatial distribution of animals is a compromise between costs and benefits (avoidance of predation and optimal consumption).

- Aquatic plants play a relevant role in the structuring of freshwater communities and their spatial distribution.

- Submerged macrophytes provide spatial refuge for Daphnia from fish predation during daytime.

- However, many juvenile fish often use the littoral zone as daytime refuges against predatory fish, which eliminate the refuge capacity of macrophytes for zooplankton.
In the tropics and subtropics, the effects of macrophytes on trophic interactions are more complex:

- All life forms (emergent, submerged, floating-leaved and large free-floating species) can be extremely prominent.
- Fish, particularly the smallest species and individuals, aggregate in high numbers in the vegetation (Meerhoff et al. 2003, Jeppesen et al. 2005).
- Chaoborus seems to be more abundant in tropical lakes.
- A strong predation pressure on zooplankton by shrimps (i.e. Palaemonetes argentinus or Macrobrachium borelli) can occur.

Emergent plant zone (EP2)  Submerged plant zone  Emergent plant zone (EP1)

(Schoenoplectus californicus and floating mats dominated by Typha latifolia)

Only S. californicus  Egeria densa and Ceratophyllum demersum
• A.- Does horizontal migration of zooplankton occur in the scenario of high abundance of vertebrate and invertebrate predators?
• B.- What is the influence of small omnivorous fish, shrimps and Chaoborus on the daily pattern of horizontal migrations of zooplankton?
• C.- What is the role of physical and chemical environment modifications by the aquatic communities on the zooplankton horizontal migrations and fish spatial distribution?
• D.- Which are the main factors that determine the spatial distribution of fish during the day and the night?

We selected by random 5 sampling points per strata, emergent plants (EP), submerged plants (SP) and the pelagic area (OW). The maps and the random selection were performed for each season (winter, spring, summer and autumn).
• Lake Blanca is a warm polymictic system, temperature range registered: 11.3 °C (winter) to 26.3 °C (summer).
• Annual average of conductivity and alkalinity were 179 µs cm⁻¹ and 71 meq l⁻¹, respectively.
• All year round, the pH was basic (close to 8).
• Oxygen saturation conditions occurred during autumn and spring, and subsaturation in winter (86.3%) and summer (88.2%).
• The euphotic zone comprised the whole water column.
• The nutrient content was moderate to high, the range of TN was 600 (summer) to 1281 µg l⁻¹ (spring), and the TP was 15 (spring) to 155 µg l⁻¹ (autumn).
• Finally, the algal biomass presented also moderate to high levels according to water nutrient content, 19.7 in summer and 52.8 µg l⁻¹ in autumn.

• SP and EP showed higher temperatures than OW, during the midday the differences between SP and OW reached 0.8 °C in spring and 2 °C in summer.
• The differences of dissolved oxygen between day and night were always statistically significant and more remarkable in sites with submerged plants, when the subsaturation conditions reached up to 44% in summer during the night.
• The plant sites were more clear in all seasons except spring, but the differences were only significant during summer. The water transparency of SP was 46% higher than OW.
• Finally, the sites with plants showed bigger Chl a, TN and TP than OW
Cyclopoid copepods: Mesocyclops longisetis and Metacyclops mendocinus.
Calanoids: Notodiaptomus incompressus
Cladocerans: Bosmina longirostris, Diaphanosoma birgei, Moina micrura, Moina reticulata, Chydorus sphaericus and Alona spp.
• Cyclopoids presented higher abundances in the SP stands ($F_{(2,117)} = 12.9$, $p<0.001$), while *N. incompositus* and the rotifers were homogeneously distributed among the analyzed compartments in all seasons.

• The cladocerans were analyzed species by species because their particular distribution.
The inverse correlation between *J. multidentata* and shrimps indicate a differential spatial use, in general shrimp were collected in higher abundances in OW and SP.
• Horizontal migration of zooplankton occurs in the scenario of high abundance of small omnivorous-planktivorous fish and *Chaoborus*, but the horizontal pattern varied according to the season.

• The direction was the opposite that we expected, two cladocerans species (*B. longirostris* and *D. birgei*) refuges in plant mats by night.

• The invertebrate *Chaoborus* seems to be the trigger of the daily pattern of horizontal migrations. The influence of small omnivorous fish and shrimps seems to be secondary in comparison with *Chaoborus*.

• Despite the physical and chemical differences among sites, there were no evidence of influence on the zooplankton horizontal migrations and fish spatial distribution.

• The absence of piscivores determine that the distribution of *J. multidentata*, specially the females, is conditioned by food availability and reduction of predation risk by birds. *P. argentinus* seems to be affected by *J. multidentata*, and occupy other compartments showing segregated distributions.