ALT EMPORDÀ SALT MARSHES

Gascón, S., Brucet, S., Badosa, A., Boix, D., Compte, J., Gesti, J., López-Flores, R., Sala, J., and Quintana, X.D.

Institut d'Ecologia Aquàtica, Universitat de Girona



ENVIRONMENTAL SYNTHESIS AND TYPIFICATION

TYPE OF LAGOON OR WETLAND: Coastal wetlands with permanent and temporary brackish systems. These coastal wetlands are included in a larger wetland ecosystem, Empordà wetlands, which encompasses a wide range of aquatic environments in a relatively reduced area (Trobajo et al. 2002), from isolated artesian freshwater springs (ullals) to hyperhaline systems, with a gradient of hydroperiod lengths from permanent to temporary waters. All aquatic environments are very shallow, with a medium depth of 60 cm, with the only exception of "la Massona", a meromictic coastal lagoon 8 m deep.

HYDROCHEMICS: Mean conductivity values range from 14 to 34 $mS \cdot cm^{-1}$ (Brucet et al. 2005, Gascón et al. 2005). Mean alkalinity values range from 5 to 8 $meq \cdot L^{-1}$ (Quintana et al. 1998). Finally, Cl^- and SO_4^- concentrations vary from 82 to 700, and from 16 to 81 $meq \cdot L^{-1}$, respectively (Comín et al. 1994).

TROPHIC STATE: The nutrient dynamics in water is principally determined by external supply of nitrogen and the release of the phosphorus accumulated in the sediment through water entry. Nitrogen diminishes after flooding due to organisms' consumption, infiltration to the aquifer and denitrification. Phosphorus accumulates in the sediment during the desiccation of the lagoons. This process has been named as differential confinement (Quintana et al. 1998).

The low total organic carbon concentration in sediments of Empordà coastal wetlands characterize them as mineral, since all samples analyzed had concentrations below 12% (Gascón et al. 2006)

MAIN IMPACTS: Hydrology in Empordà salt marshes is determined by sudden floodings, most of them caused by marine intrusions during sea storms, when waves came over the sand bar. Flooding periods are followed by long periods of confinement, when water level gradually decreases and salinity increases due to evaporation (Quintana 2002a, Quintana et al. 2004). Some studies pointed out the importance of this high hydrological variability for nutrient and organisms patterns (Quintana 2002b, Trobajo et al. 2004, Brucet et al. 2005, Gascón et al. 2005). Continuous freshwater supply caused by flux regulation in the freshwater channels has been described as the main cause of eutrophication (Quintana et al. 1998).

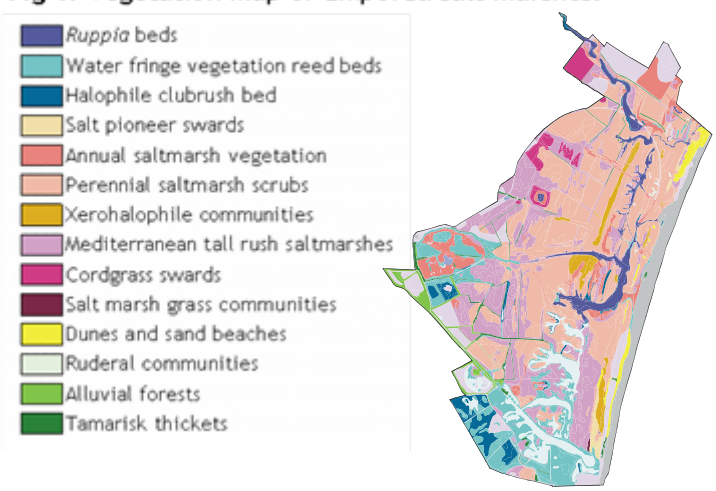
INTERESTING SPECIES AND HABITATS: 5 diatom assemblages were distinguished, each one with characteristic species (Trobajo et al. 2004): *Bacillaria paradoxa* was frequent in low confinement and high productivity situations, *Navicula perminuta* and *N. salinarium* were representative of flooding and low productivity situations, *Cocconeis placentula* dominated situations of maximum confinement and low productivity, but when maximum confinement was attained in basins with higher productivity situations *Nitzschia archibaldii* was also frequent.

Similarly, several phases were identified in the temporal pattern of the zooplankton community (Quintana et al. 1998b, Brucet et al. 2005). The rotifer *Synchaeta* spp. dominates after intense floodings and is replaced by other zooplankton species during the confinement process (Cyclopoids→ Calanoids→ *Brachionus* sp.). However, under fish predation conditions, *Synchaeta* spp. persisted nearly all winter.

In contrast, benthic assemblages were determined by differences among habitats. Permanent waters had an assemblage characterized by a high density of individuals, total biomass and diversity, which was present in lagoons where more stable environmental conditions prevailed. Temporary waters had lower richness and diversity with little temporal variability due to their temporality. Temporary waters with altered hydrological regime had a high taxonomic singularity and a high temporal variability of species richness and diversity due to more unstable environmental conditions (Gascón et al. 2005)

STATE OF CONSERVATION: Alt Empordà salt marshes are highly protected, since are part of a Natural Park (Empordà Wetlands Natural Park)

Fig 1. Vegetation map of Empordà salt marshes.



REFERENCES:

SARGATAL, J. & FELIX, J. (eds.). 1989. Els Aiguamolls de l'Empordà. Aspectes ecològics, històrics i socials. Quaderns dels Indiketes nº 3. 376 pp.

GOSÁLBEZ, J., SERRA, J. & VELASCO, E. (eds). 1994. Els sistemes naturals dels Aiguamolls de l'Empordà. Treballs de la I.C.H.N., Barcelona, 13: 478 pp.

Other references see Institute of Aquatic Ecology (website; Limnology section): http://ciencies.udg.es/iea

CONTACTS:

Institute of Aquatic Ecology, section Limnology, Continental Aquatic Systems, Limnology of Mediterranean wetlands and ponds. Campus de Montilivi, E-17071-Girona, Catalunya, Espanya. Telf: 34 972 41 81 67 Fax: 34 972 41 81 50

Natural Park website;
http://mediambient.gencat.net/cat/el_medi/parcs_de_catalunya/aiguamolls

SUMMARIZING TABLE

Asterisk (*) corresponds to ranges of mean and coefficient of variation (CV) values of different water bodies

Name wetland/lagoon	Alt Empordà salt marshes
Coordinates UTM (x,y)	X: 509100; Y: 4674300
Type	Coastal wetlands
Surface (ha)	523
Medium depth (cm)	60
Main water inputs	Sea storms Intense rainfall
Type of river basin	Coastal salt marshes located between two river mouths (Muga river at north, and Fluvià river at south)
Extent river basin	Fluvià: 1124 km^2 ; Muga: 854 km^2
Predominant soil use	--
Cultural and economic values	Tourism Natural heritage
Protection status	Natural Park
Conductivity (mS· cm^{-1}) *	Mean; 3 to 31 CV; 34 to 140
Dissolved inorganic nitrogen (mg l^{-1}) *	Mean; 0.1 to 0.7 CV; 100 to 250
Total nitrogen (mg l^{-1}) *	Mean; 1.3 to 2.9 CV; 50 to 100
Soluble phosphorus (mg l^{-1}) *	Mean; 0.04 to 0.28 CV; 147 to 306
Total phosphorus (mg l^{-1}) *	Mean; 0.08 to 0.28 CV; 70 to 180
Chlorophyll a (mg l^{-1}) *	Mean; 0.01 to 0.03 CV; 100 to 120
Peculiarities (fauna, flora)	Endemic mediterranean amphipod (*Corophium orientale*) and endangered fish (*Aphanius iberus*)
Perilagoonal vegetation (helophytes and of the surface)	See fig.1
Submerged vegetation	See fig.1
Dominant phytoplankton	Dinoflagellates, Cyanophytes and Haptophytes
Dominant zooplankton	*Eurytemora velox* *Calanipeda aquaedulcis* *Brachionus plicatilis* *Synchaeta* spp. *Diacyclops bicuspidatus*
Macroinvertebrates	*Chironomus salinarius* *Gammarus aequicauda* *Corophium orientale*
Fish	*See Natural Park website*
Birds and other vertebrates	*See Natural Park website*

REDMARISMAS:

RedMarismas is the name of a nationwide Spanish scientific network founded in March 2005.
It assembles a great number of scientists and other specialists working with topics related to transitional waters (wetlands and coastal lagoons). More information is available at www.irta.es/redmarismas.