

ECOLOGICAL ASSESSMENT OF MEDITERRANEAN PONDS (NORTH IBERIAN PLATEAU) USING MACROINVERTEBRATES

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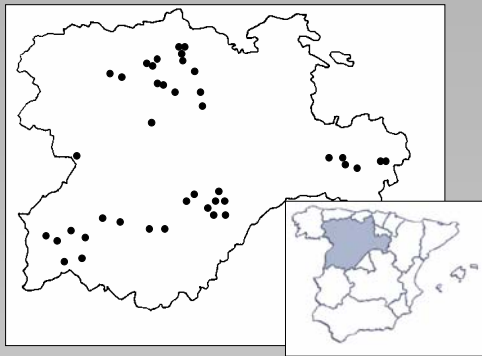


Figure 1: Location of the study ponds

CONCLUSIONS

•Overall, **Chironomidae** midges responded to pond condition, which resulted in three out of five measures in the final index related to Chironomidae (Table 1). This finding was somewhat expected as Chironomidae was the most abundant and most taxonomically diverse group in the study ponds. Chironomids have been often referred to as an effective tool for assessing the ecological status of lentic waters (Kashian & Burton 2000, King & Richardson 2002, Quinlan et al. 2002).

•None of the functional groups (e.g. % predators and % collector-gatherers) were sensitive to degradation (Fig. 1, Table 1), likely because many macroinvertebrates are omnivores (Norris 1995) difficult to allocate to defined functional traits (Rawer-Jost et al. 2000)

•Eutrophication resulted in declines of several richness and relative abundance measures (Table 2). Importantly, significant differences occurred between ponds with [TP] < 150 µL⁻¹ (classes 5 and 4) and ponds with [TP] > 600 µL⁻¹.

•The effect of habitat alteration, however, was less clear (Table 2) due likely to the vegetation shore belt of trees in sites in best available conditions leading to the simplification of the shore habitat and the disappearance of associated macroinvertebrate taxa.

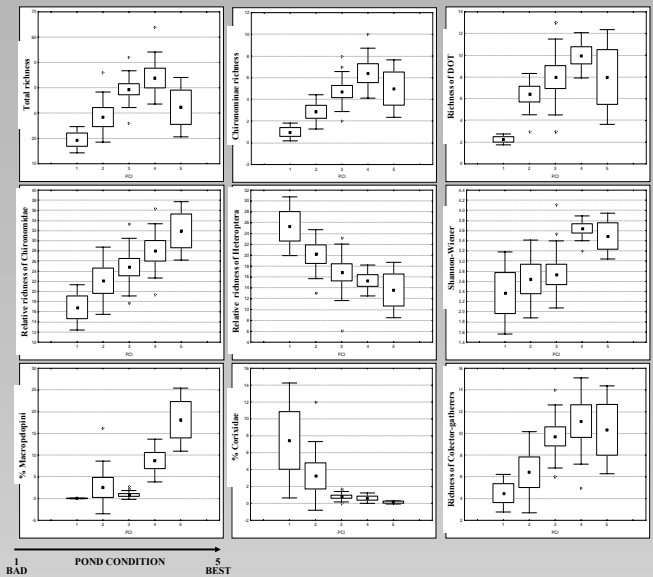


Figure 2: Box plots (Mean ±SE ±SD Outliers) of metric response to overall pond condition. 1) ponds in bad conditions; 2) poor conditions; 3) moderate conditions; 4) good conditions; and 5) best available conditions.

METHODS

•Macroinvertebrates samples were collected from 41 ponds (32 calibration + 9 validation) in July 2003 or June 2004 following a multihabitat approach (Briers and Biggs, 1995). Invertebrates were identified to genus and assigned to a functional group.

•55 community attributes were tested for their response along the five classes of pond condition (Fig. 1) using discrimination efficiency (% impaired sites below the 25th percentile of unperturbed sites for metrics increasing with pond condition and above 75th percentile of unperturbed sites for metrics increasing with degradation) and Mann Whitney U-test with Bonferroni adjustment (P<0.001).

•Core metrics were transformed into unitless values using O-125th/ R75th - 125th where, O = observed value, 125th = 25th percentile of impaired sites and R75th = 75th percentile of slightly degraded sites.

•All possible combinations were analysed and the final index with the highest discrimination efficiency was selected.

•Finally, the relative response of each metric to eutrophication and habitat alteration was evaluated.

Table 1: Discrimination efficiency for the calibration (DE cal.) and validation (DE val.) sites and threshold values between acceptable (best and good) and unacceptable (moderate, poor and bad) conditions. Selected combination is in bold.

Metric combination	DE cal.	DE val.	Thresholds
1 % <i>Ablabesmyia</i> + <i>Tanytarsus</i> , S Chironominae, S DOT, %S Chironomidae, H'	90.9	71.4	0.53
2 % <i>Ablabesmyia</i> + <i>Tanytarsus</i> , S Chironominae, S DOT, %S Chironomidae, λ	81.8	57.1	0.55
3 % <i>Ablabesmyia</i> + <i>Tanytarsus</i> S Chironominae, S DOT, %S Chironomidae, % dominant taxon	90.9	71.4	0.55
4 % <i>Macropelopiini</i>, S Chironominae, S DOT, %S Chironomidae, H'	95.5	85.7	0.61
5 % <i>Macropelopiini</i> , S Chironominae, S DOT, %S Chironomidae, λ	95.5	71.4	0.64
6 % <i>Macropelopiini</i> , S Chironominae, S DOT, %S Chironomidae, % dominant taxon	95.5	71.4	0.64

S = richness; DOT = Dytiscidae + Odonata + Tanytarsidae; %S = relative richness; H' = Shannon - Wiener index; λ = Simpson's index.

Table 2: Effects of eutrophication and habitat degradation on several metrics. Significant F-values of one-way ANOVA are given. Post-hoc comparisons were conducted with Tukey-Kramer HSD test.

		Eutrophication			Habitat condition		
		Response	F	post-hoc	Response	F	post-hoc
Taxonomic Richness	S Insecta	-	2.76	5-1	ns	ns	ns
	S Diptera	-	3.16	5-1	ns	ns	ns
	S Chironomidae	-	5.57	5-1 & 2; 3-1	ns	ns	ns
	S Chironominae	-	6.80	5-1* & 2; 1-4 & 3	ns	ns	ns
	S Chironomidae + Coleoptera S DOT	ns	ns	ns	-	3.13	4-1
Relative taxonomic richness	% S Diptera	-	3.14		ns	ns	ns
	% S Chironomidae	-	5.48	5-1 & 2; 3-2	ns	ns	ns
	% S Chironominae	-	6.32*	5-1; 5-2	ns	ns	ns
Relative abundance	% <i>Macropelopiini</i>	-	3.42	ns	-	7.72*	5-1, 3 & 2; 4-2
	% <i>Ablabesmyia</i> + <i>Tanytarsus</i>	-	3.52	ns	-	12.83*	5-1, 2*, 3* & 4;
	% <i>Cricotopus</i>	ns	ns	ns	+	3.10	-
Richness of functional traits	% <i>Chaoborus</i> + <i>Cricotopus</i>	ns	ns	ns	+	3.59	3-2
	S multivoltines	-	5.45	5-1 & 2	ns	ns	ns
	S collector-gatherers	-	5.58	1-2, 3 & 5*	ns	ns	ns
Relative richness of functional traits	% S multivoltines	-	2.89		ns	ns	ns
	% S collector-gatherers	-	4.92	5-2	ns	ns	ns

Values marked with * were still significant after Bonferroni adjustment (p < 0.001). Metric response to eutrophication and habitat degradation was positive (+), increasing with perturbation, or negative (-), decreasing with perturbation. S = richness; % S = relative richness; DOT = Dytiscidae + Odonata + Tanytarsidae.

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