



INHABIT

Local hydro-morphology, habitat and RBMPs: new measures to improve ecological quality in South European rivers and lakes

**Invertebrati bentonici e variabilità di habitat:
incertezza nella classificazione o valutazione dello
stato ecologico?**

**Habitat control on Ecological Status: the example of
the lentic-lotic character in Sardinian streams**

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LIFE08 ENV/IT/00413 INHABIT



REGIONE AUTONOMA DELLA SARDEGNA





Use of Habitat information: the INHABIT approach

Habitat → combination of selected Hydro-morphological (*and physiochemical*) features

Habitat information crucial for:

- **Quantifying reference conditions e.g. to model REF values as a function of habitat diversity;**
- **Refining river typologies e.g. sub-types definition or accounting for expected seasonal and/or interannual variability;**
- **Interpreting biological data e.g. to discriminate between different sources of variation;**
- **Refining biological classification systems e.g. to select metrics, weights and habitat-specific approaches for stressor-specific**

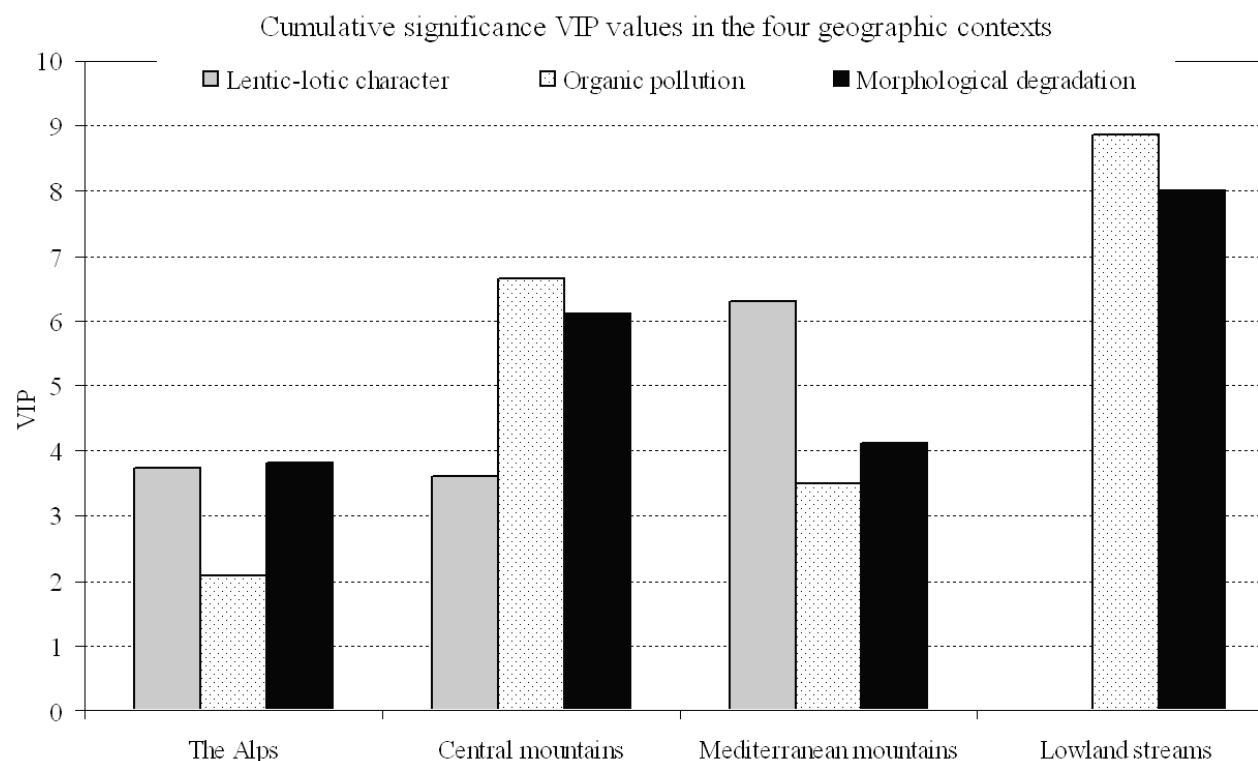
evaluations

11-16/12/2012

Habitat information for Ecological status: is that useful??

INHABIT: the main theme

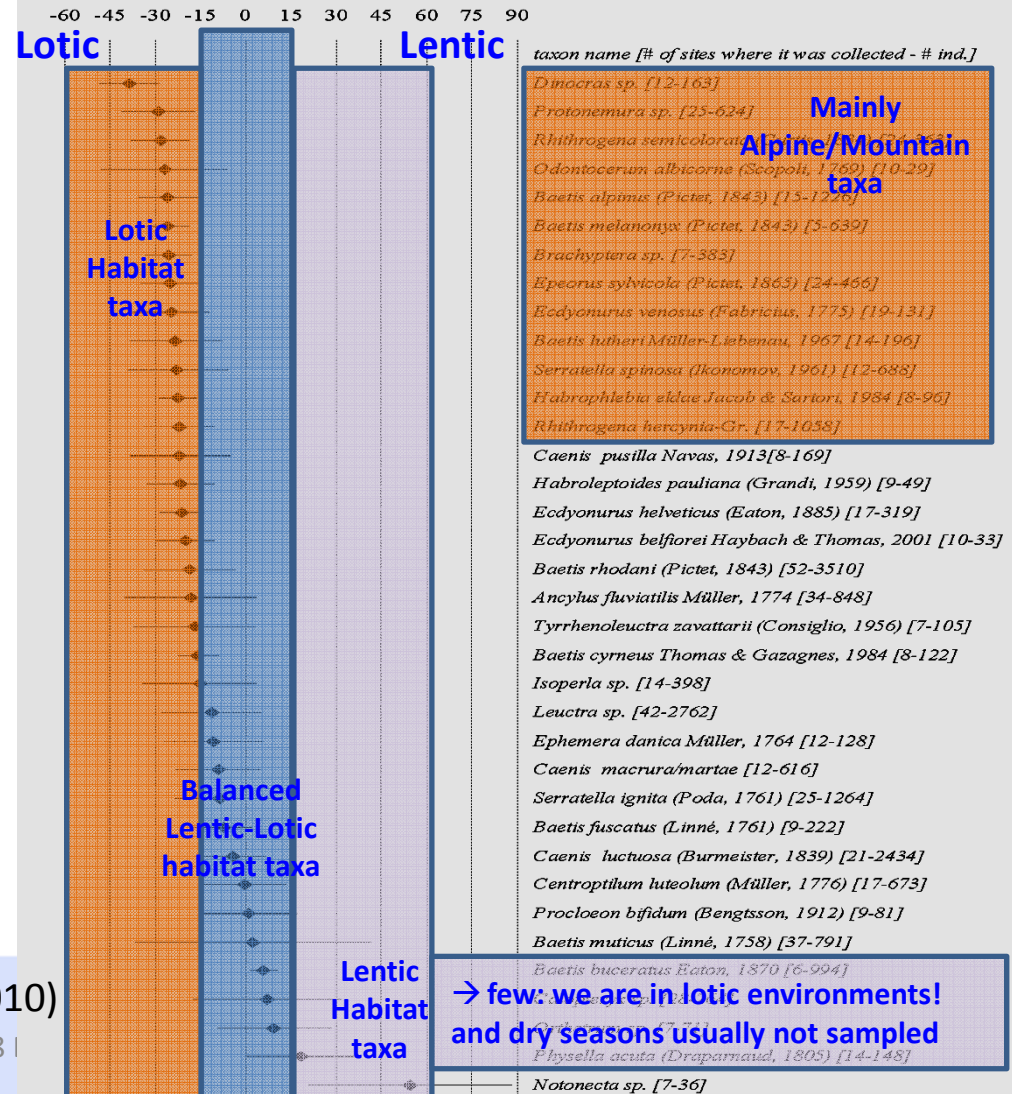
- Relative importance of different pressures (stressors) in European rivers
- HMS: Morphological degradation; OPD: Physiochemical pollution
- The contribution of the Lentic-lotic River Descriptor (LRD)



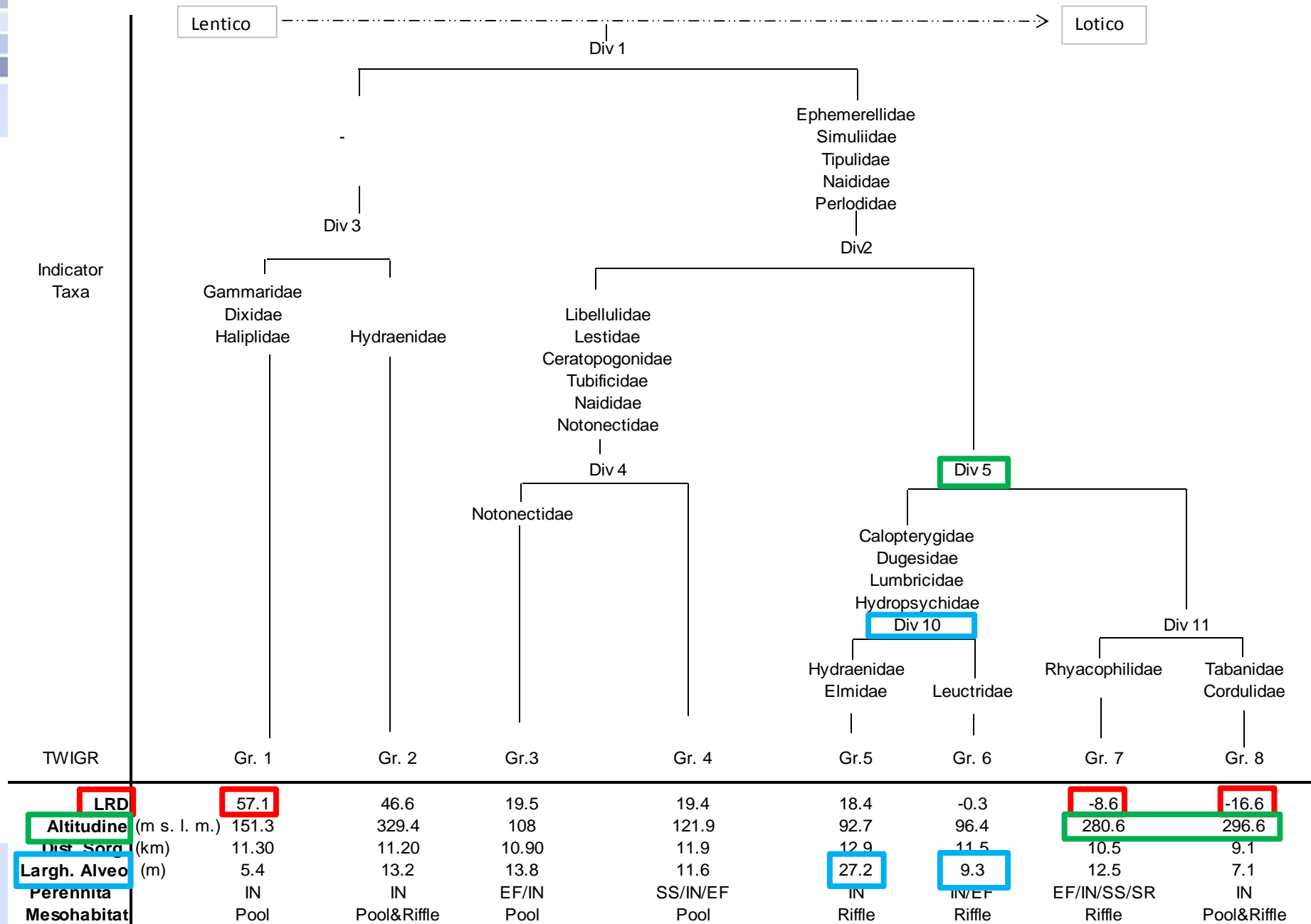
Buffagni A., Erba S. & Armanini D.G.
2010. The lentic–lotic character of
Mediterranean rivers and its
importance to aquatic invertebrate
communities *Aquatic sciences*.



Response of invertebrate taxa to the lentic-lotic character - LRD



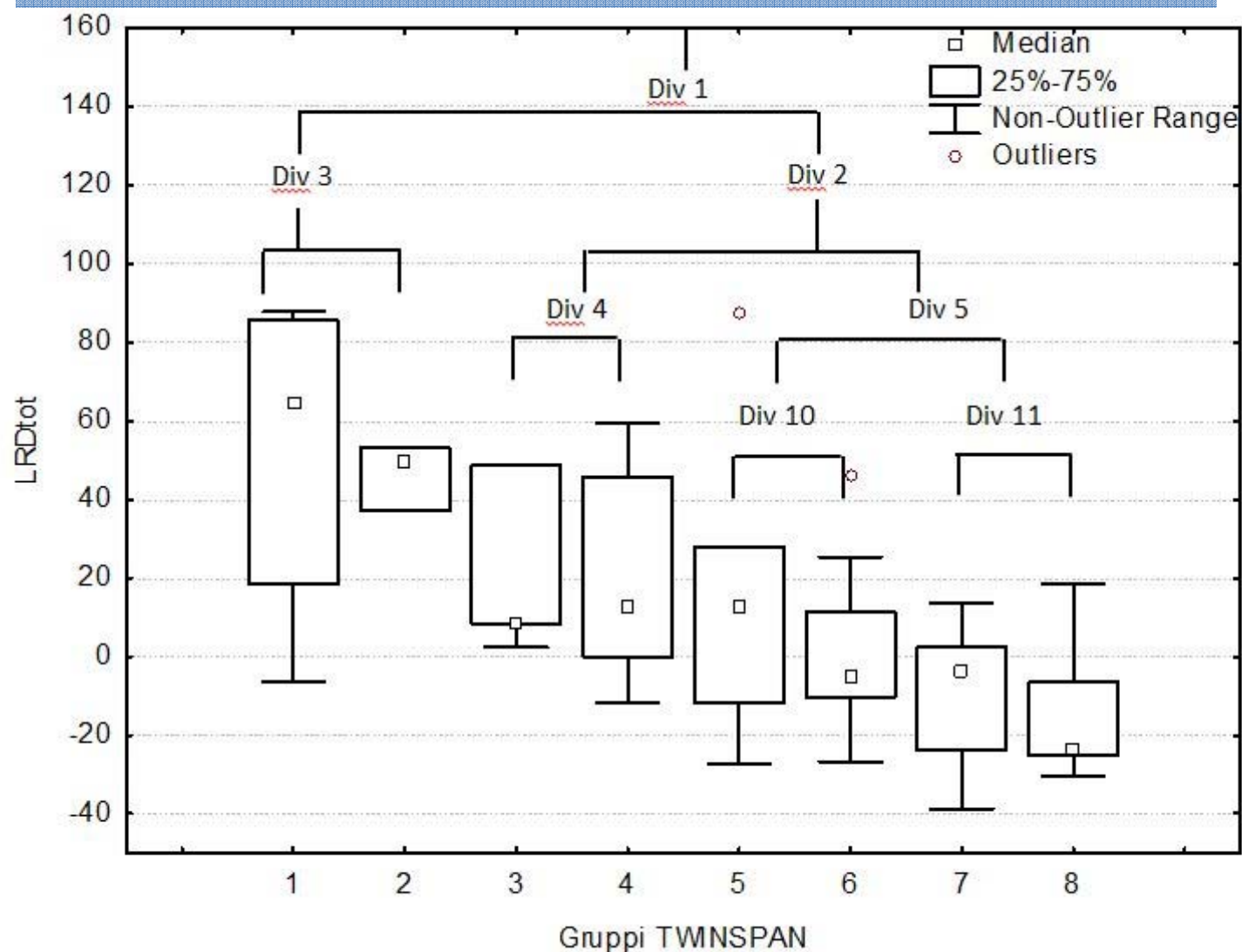
Natural variability: benthic bio-types in Sardinia





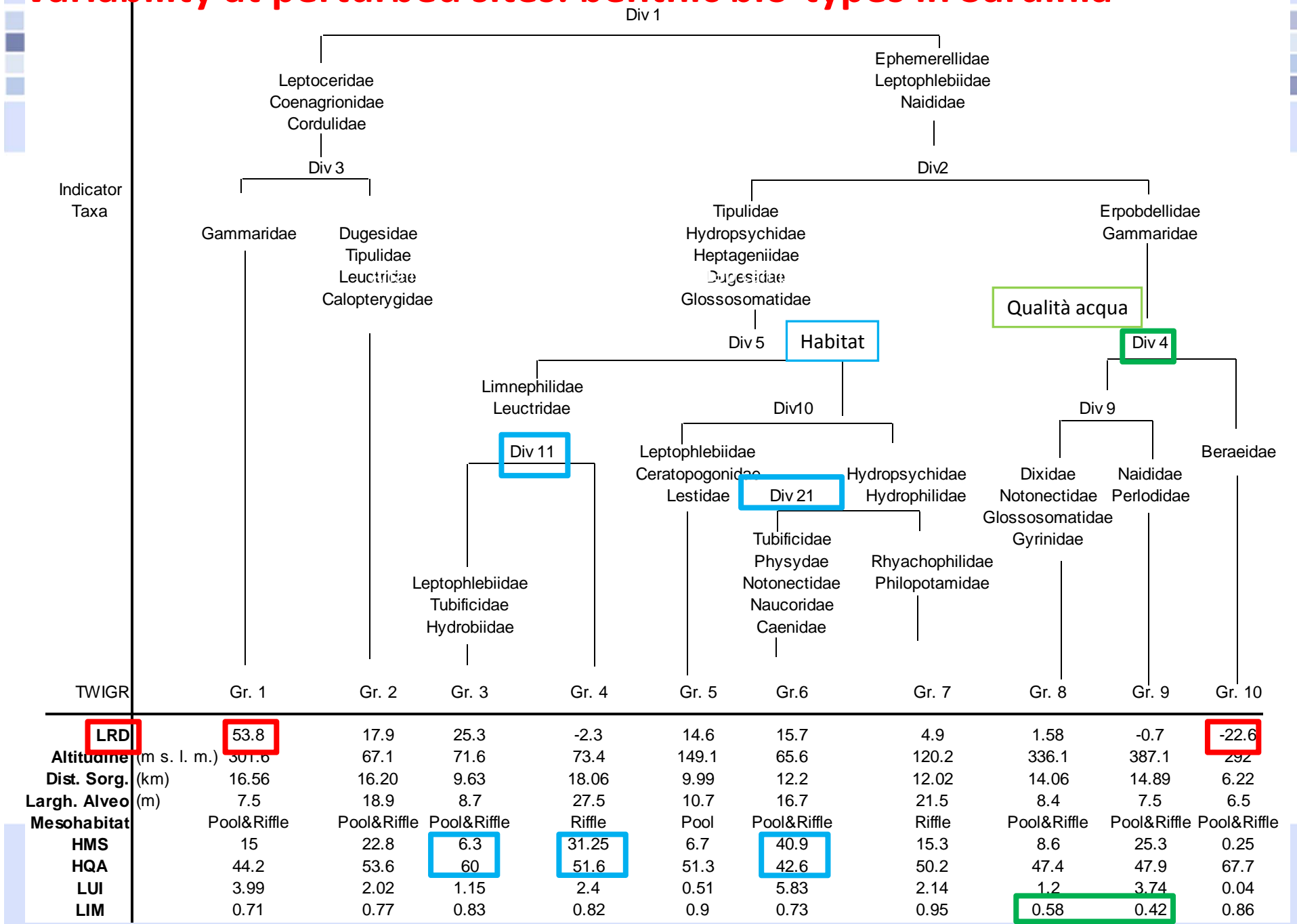
Natural variability: benthic bio-types in Sardinia

LRD vs TWINSPAN groups



Local hydro-morphology, habitat and RBMPs: new measures to improve ecological quality in

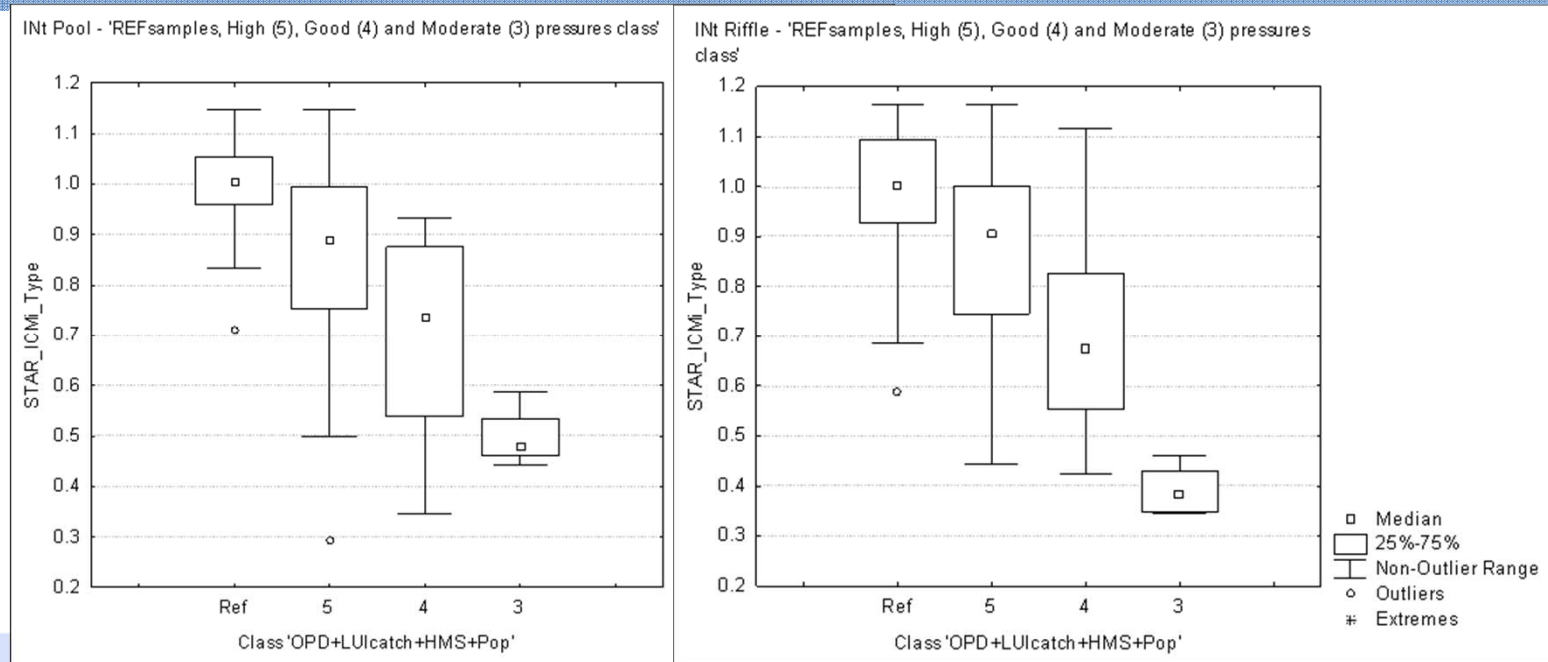
Variability at perturbed sites: benthic bio-types in Sardinia



The contribution of Habitat-oriented methods (1) Quantifying pressures

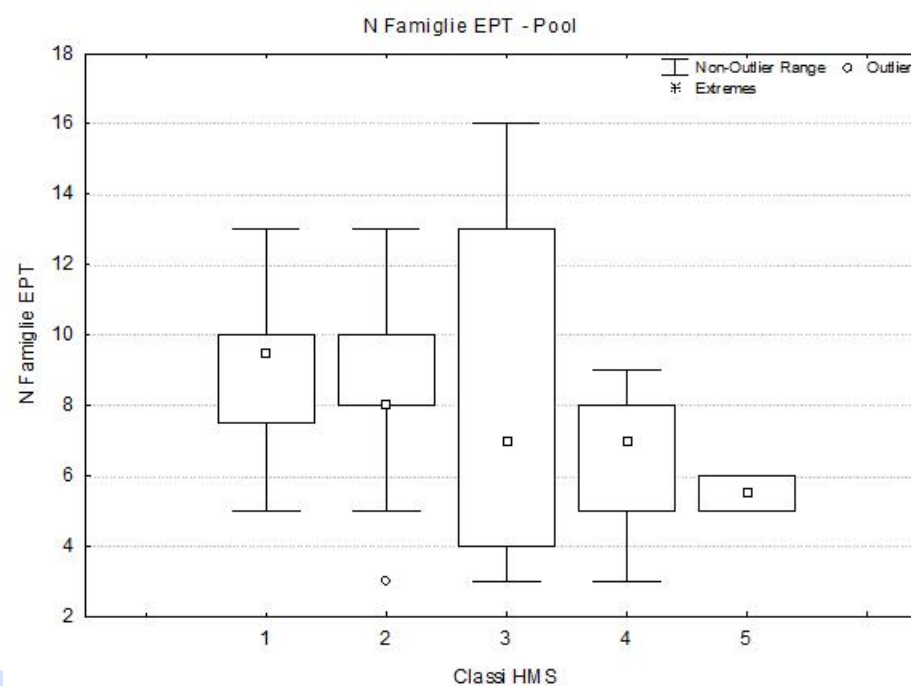
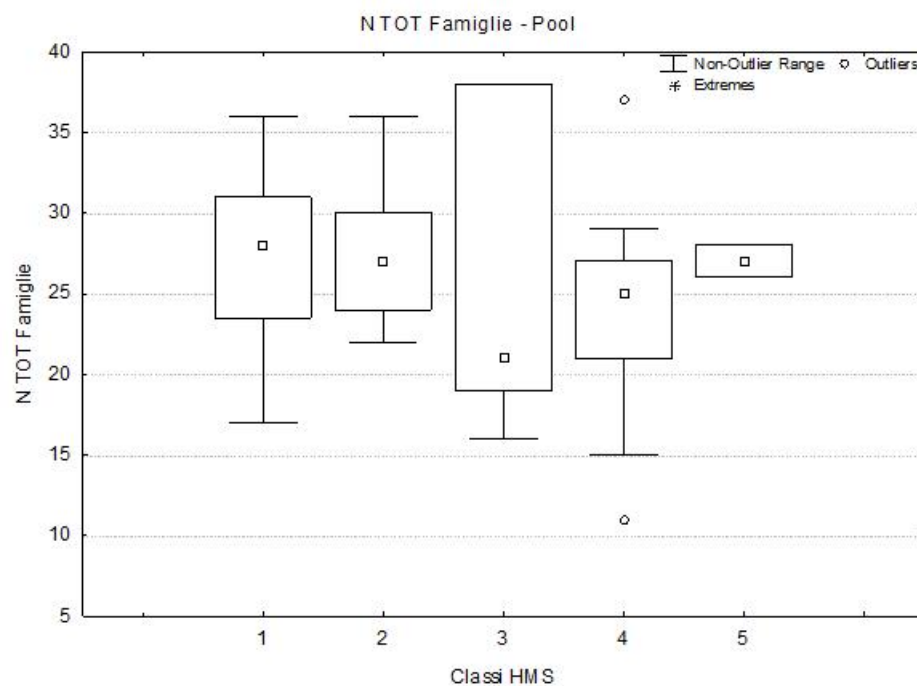


- Can we implement an ecological assessment system able to detect anthropogenic impact in a hydrological driven environment?
- CARAVAGGIO indices, catchment & water chemistry → Clear separation between pressure classes for STAR_ICMi in Intermittent river type, for both Pools and Riffles





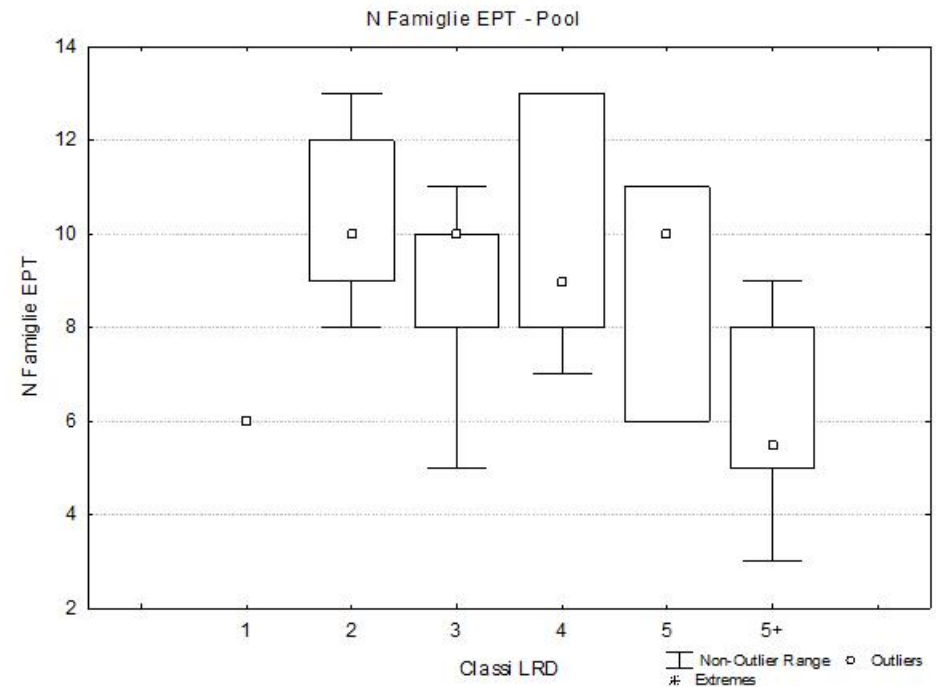
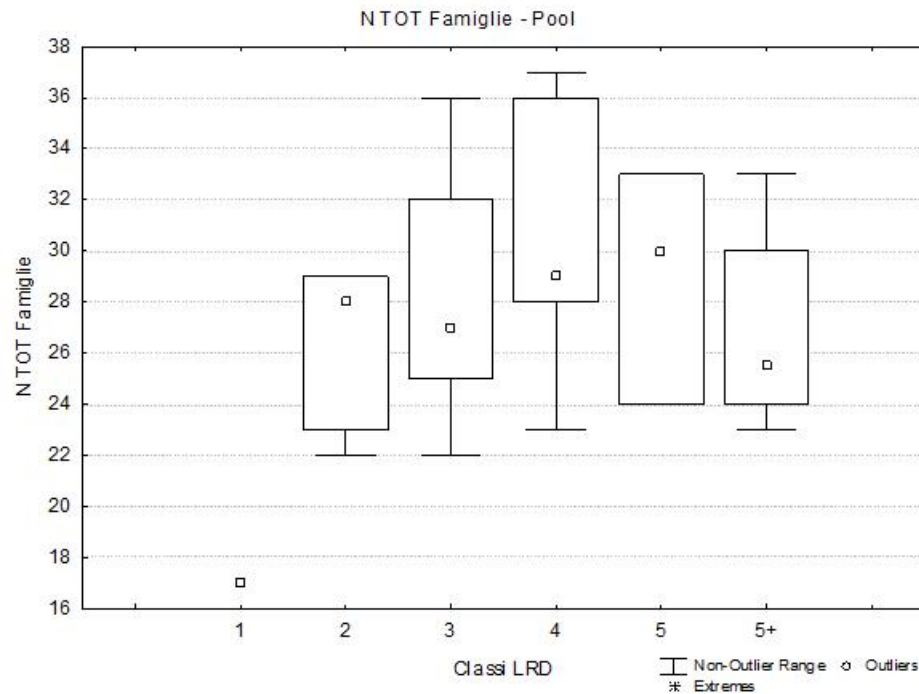
Assessment of variability in perturbed sites - single pressures vs benthic metrics Sardinia Med rivers

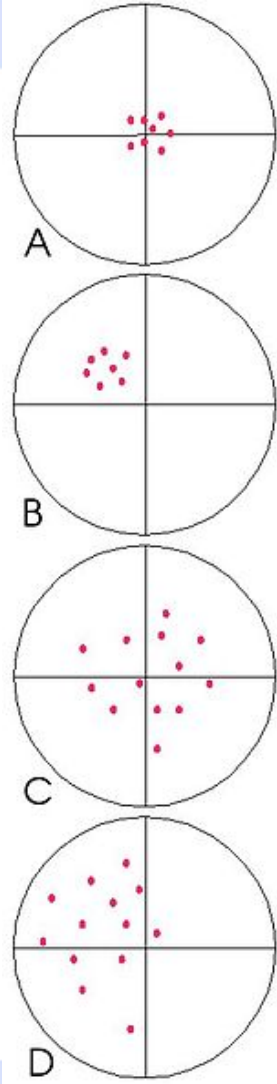




The contribution of Habitat-oriented methods (2) Quantifying natural variability

Assessment of natural variability (only REF/slightly perturbed sites), benthic metrics Sardinia Med rivers





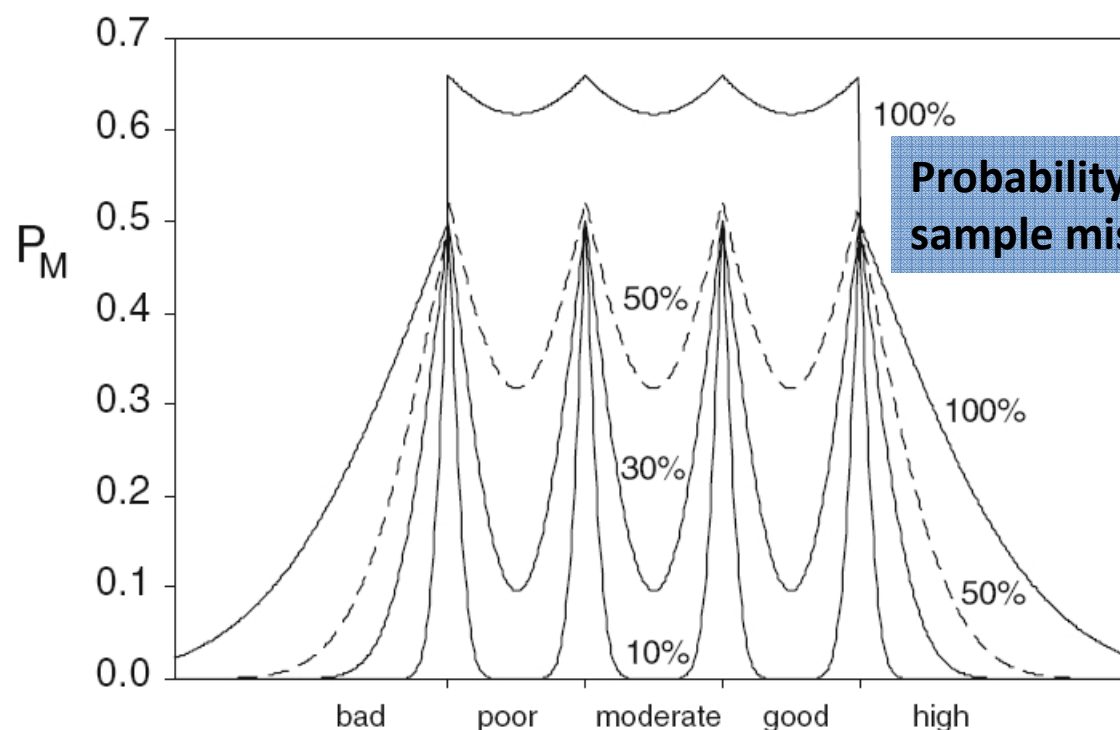
WFD: uncertainty in estimating Ecological Status: what is really relevant?

What about 'uncertainty' in defining reference conditions??

A conceptual example of accuracy and precision of a series of data (red dots).

- A- Precise and accurate
- B- Precise but not accurate
- C- Accurate but imprecise
- D- Not accurate nor precise

http://it.wikipedia.org/wiki/File:Accuracy_and_precision_example.jpg



Probability of sample misclassification

Clarke & Hering. 2006. Hydrobiologia 566:433–439

INHABIT –precision estimate
→ STARBUGS (Clarke)

06 SS XX - Classificazione: valori medi per sito

SITO	Stato Ecologico	%high	%good	%moderate	%poor	%bad	%HG	livello di rischio MI
1	BUONO	0.3	56.2	43.4	0.1	0	56.5	probabilmente a rischio
2	ELEVATO	58.8	41.2	0.1	0	0	100	non a rischio
3	BUONO	37.9	61.8	0.3	0	0	99.7	non a rischio
4	BUONO	34.7	64.8	0.5	0	0	99.5	non a rischio
5	BUONO	0.3	57.5	42.2	0.1	0	57.8	probabilmente a rischio

width W . Plots are shown for $\sigma = 10, 30, 50$ and 100% of W , where the broken line indicates the 50% plot.

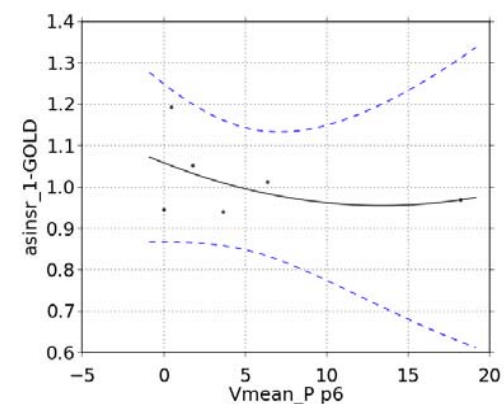
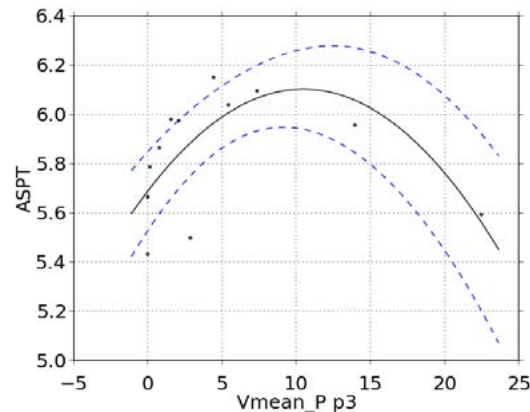
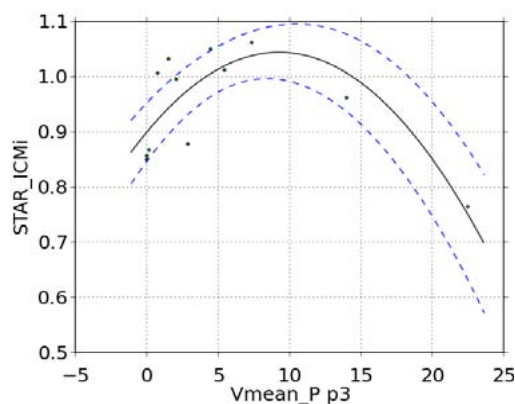




Influence of habitat on invertebrate metrics:

Water Velocity (local)

			STAR_ICMi	ASPT	n_FAM ²	n_EPT ²	1-GOLD ³	Shannon	log(SelEPTD+1)
			n samples/group=6						
'Pool' mesohabitat / Sardinia REF&slightly perturbed sites (REF RAS)	STAR_ICMi		0.126	0.259	0.675	0.342	0.790	0.151	0.757
			NS	NS	NS	NS	NS	NS	NS
			4.478	2.2	0.4	1.6	0.3	3.8	0.3
	all samples (n=36)		0.58	0.32	-0.28	0.19	-0.42	0.53	-0.38
			-2.9	-0.7	-0.1	0.4	-1.2	-1.7	0.7
			1.6	3.2	3.9	4.3	0.2	2.2	0.5
V_mean (Pool) mesohabitat	p	0.022	0.009	0.058	0.232	0.081	0.336	0.113	0.193
	sl	*	**	(*)	NS		NS	NS	NS
	F	4.3	8.3	4.0	1.7	3.4	1.2	2.8	2.0



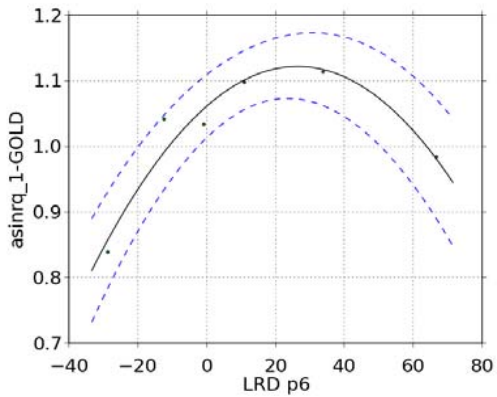
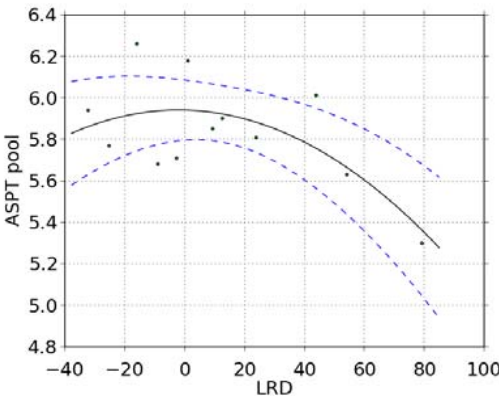
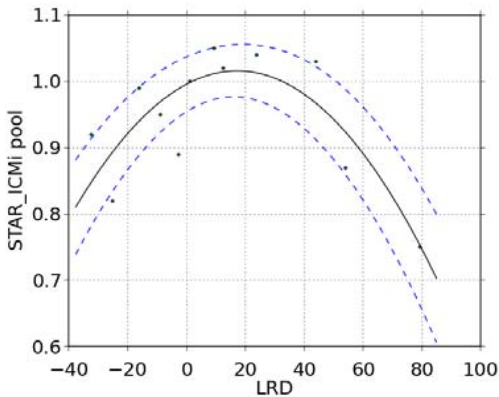
25	0.15
.5	1.2
.0	1.7



Influence of habitat on invertebrate metrics:

LRD (river stretch)

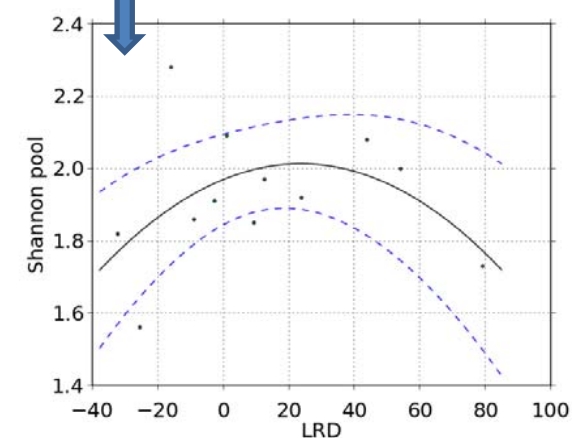
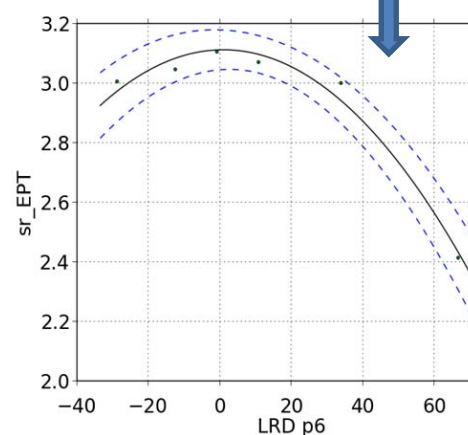
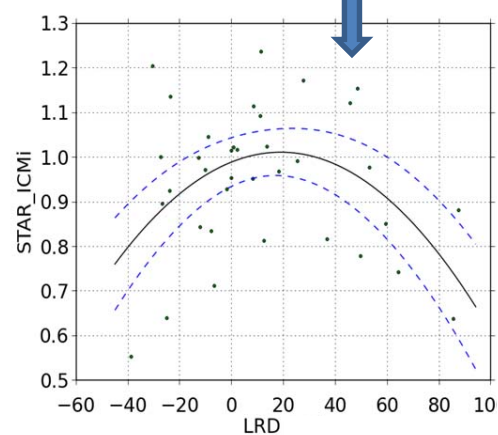
		STAR_ICMi	n samples/group=6							
'Pool' mesohabitat / Sardinia REF&slightly perturbed sites (REF RAS)			0.048	0.017	0.045	0.003	0.020	0.342	0.060	
			*	*	*	***	*	NS	(*)	
			9.9	20.9	10.3	71.6	19.1	1.6	8.3	
		all samples (n=36)	0.78	0.89	0.79	0.97	0.88	0.18	0.74	
			-3.2	-2.4	-1.1	-2.9	-3.6	-1.1	-1.5	
			3.1	8.7	9.2	24.5	5.3	1.5	5.6	
LRD ¹ (Reach scale, 500 m)	p	0.025	0.006	0.066	0.002	0.006	0.223	0.319	0.222	
	sl	*	**	(*)	***	**	NS	NS	NS	
		4.1	9.8	2.7	14.3	2.8	1.8	1.8		
								1.3	1.8	
									1.05	0.12
									0.4	-0.1
								3.5	29.9	



Local hydro-morphology, habitat and RBMPs: new measures to improve ecological quality in Habitat control on biota: Lentic-Lotic character - Summary



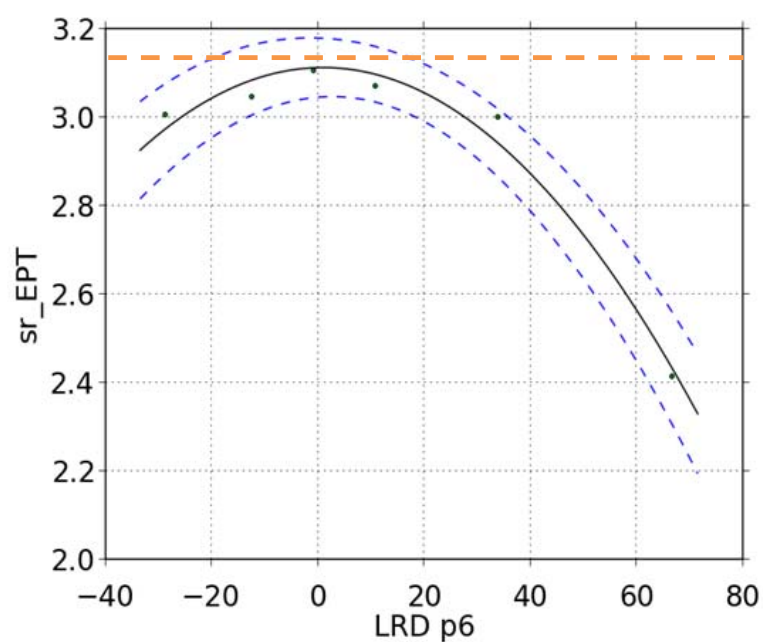
'Pool' mesohabitat / Sardinia REF&slightly perturbed sites		STAR_ICMi	STAR_ICMi	ASPT	sr_FAM	sr_EPT	arcsinsr_1-GOLD	Shannon	log(SeI EPTD+1)
		all samples	NS						
LRD	p	0.025	0.006	0.017	0.002	0.003	0.020	0.319	0.060
(Reach	sl	*	**	*	***	***	*	NS	(*)
scale,	F	4.1	9.8	20.9	14.3	71.6	19.1	1.3	8.3
500 m)	R-sq adj	0.15	0.61	0.89	0.71	0.97	0.88	0.05	0.74
	AIC	-0.9	-2.6	-2.4	-0.7	-2.9	-3.6	-0.4	-1.5
	F/ass_AIC	4.8	3.8	8.7	19.4	24.5	5.3	3.5	5.6





What about accuracy in Ecological Status classification ??

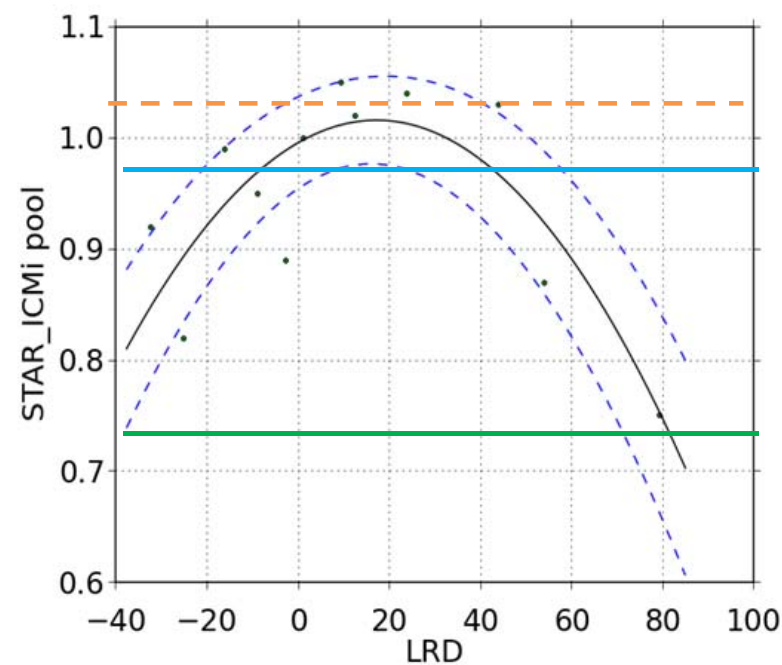
REF value
EPT: 10 (3.16^2)
STAR_ICMi: 1.019

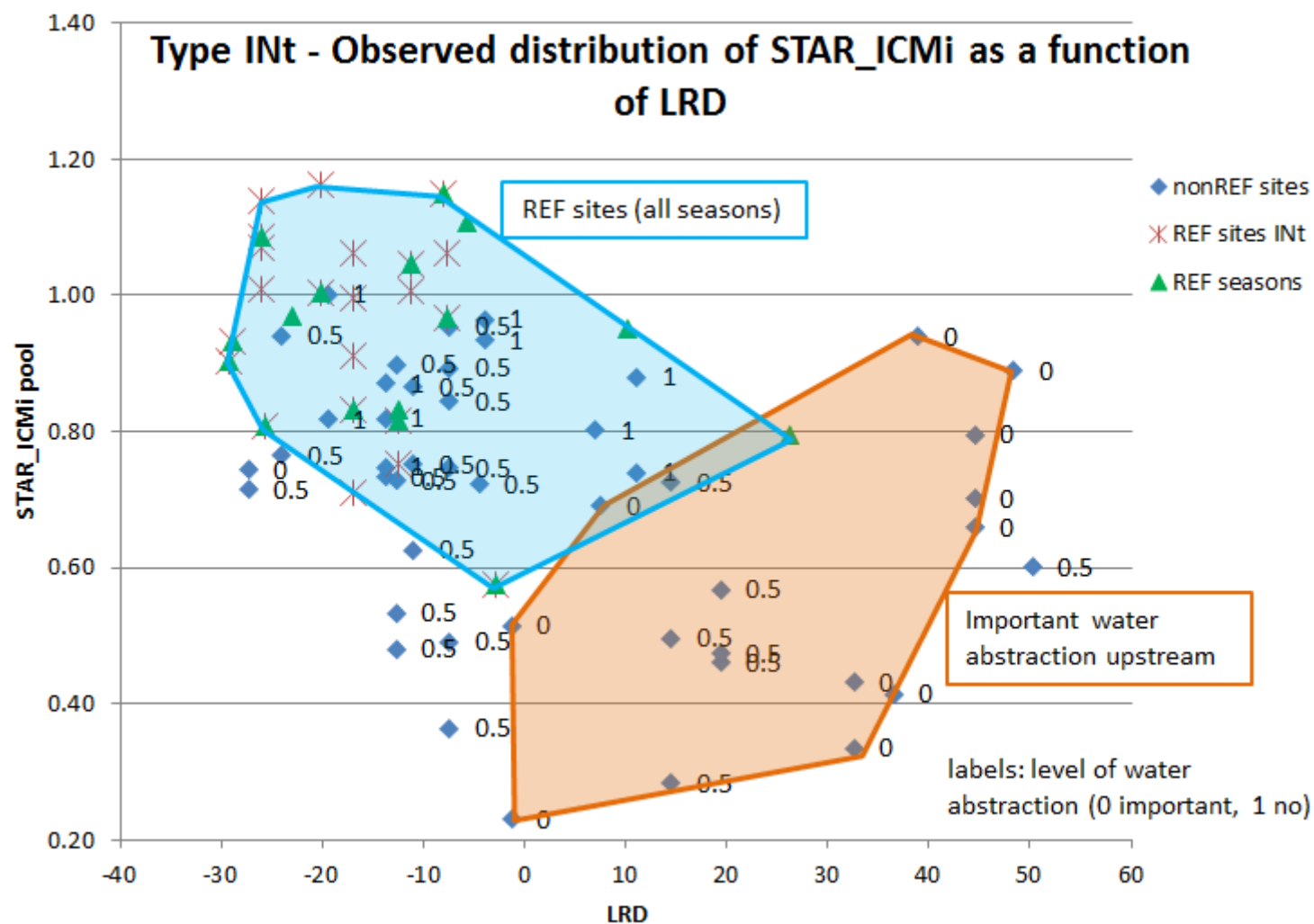


Class boundaries (Italy – R-M5)

HG: 0.97

GM: 0.73



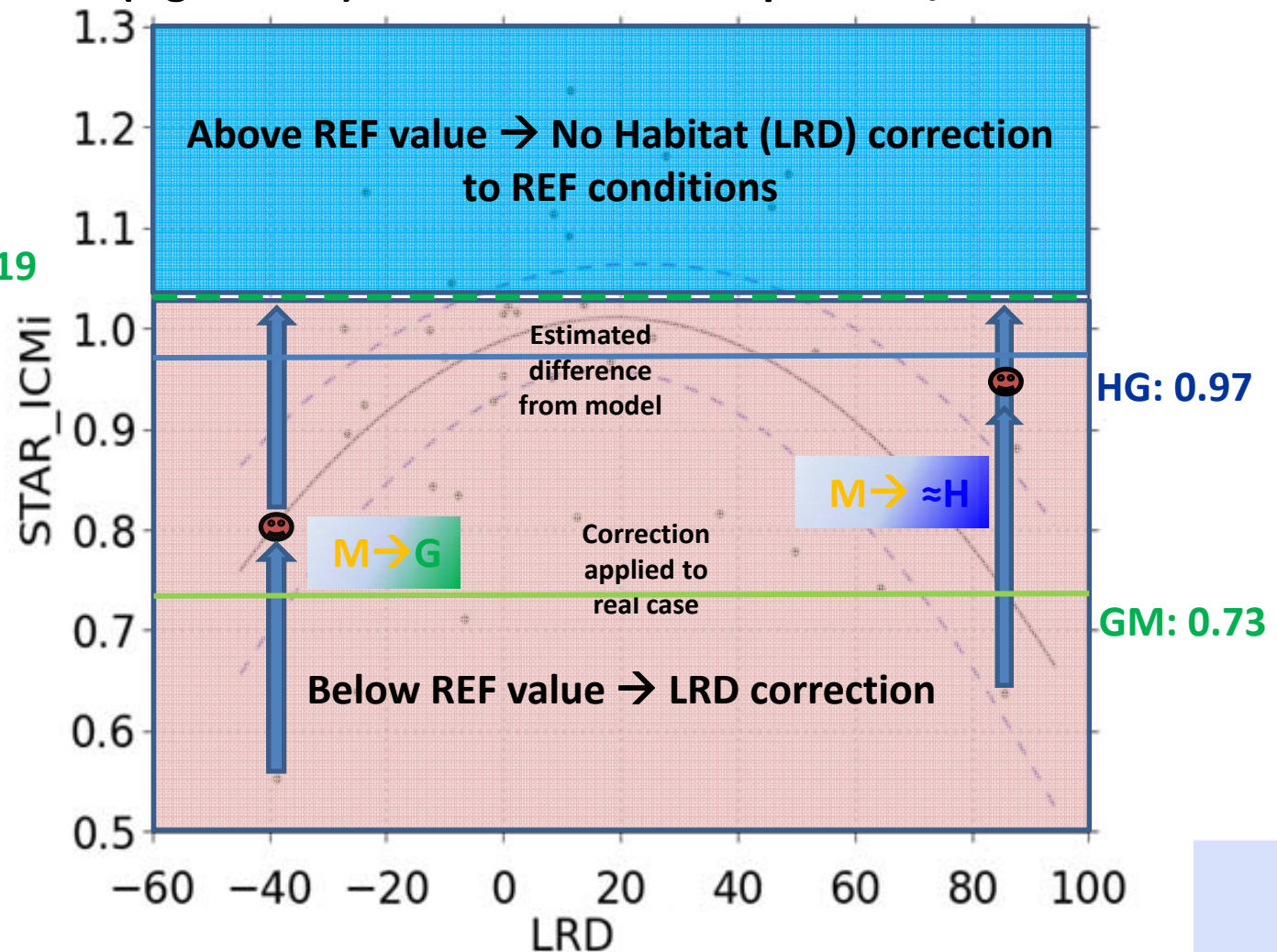




Direct use of Habitat information Case 1a – Modeling reference conditions

No (significant) water abstraction upstream/flow increase

REF value
STAR_ICMi: 1.019



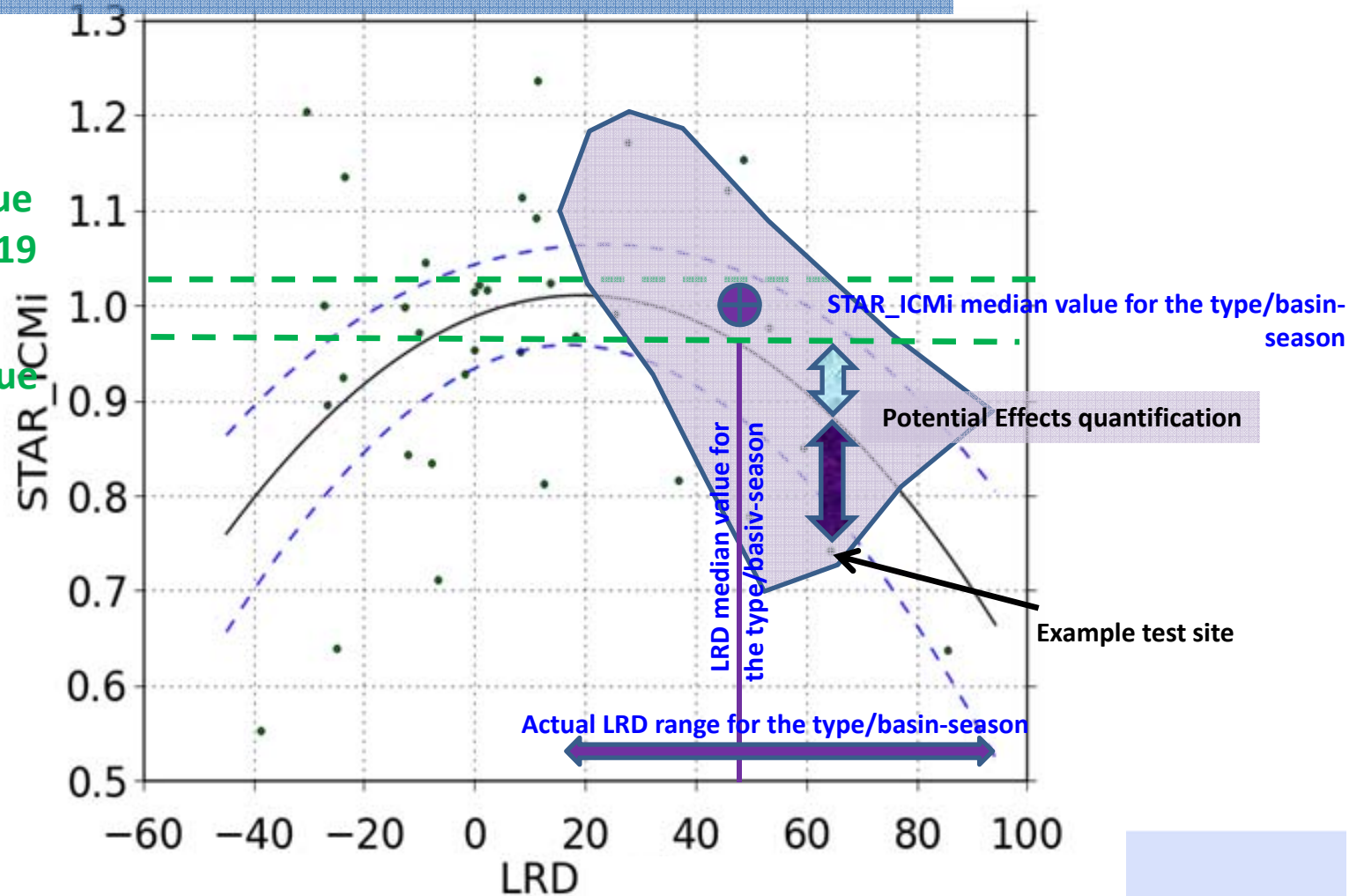
e.g. different sites in the same area, type, season, year

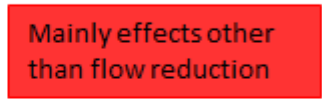


Direct use of Habitat information Case 1b – Refining Reference conditions (type/season/site adjusted) & Assessing Impacts

Overall REF value
STAR_ICMi: 1.019

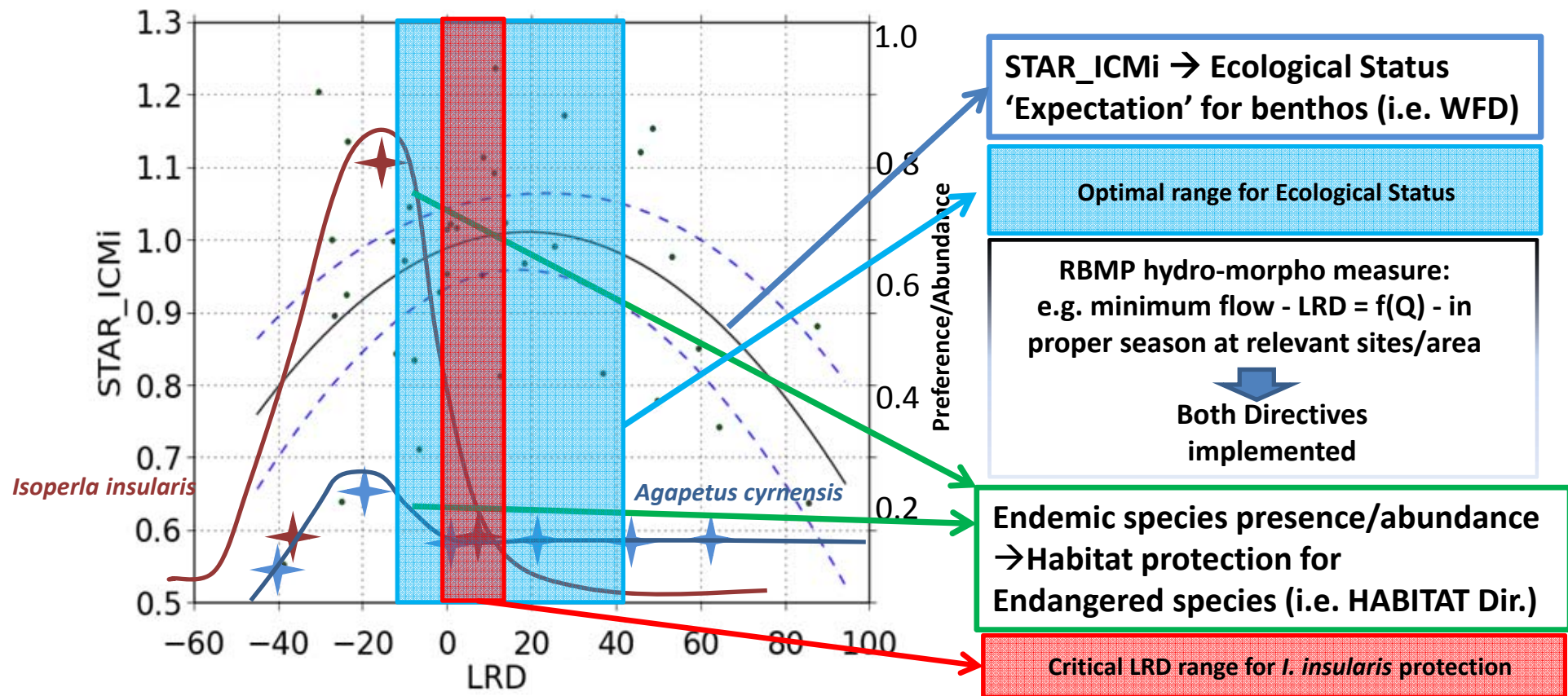
Refined REF value
STAR_ICMi:
e.g. 0.970

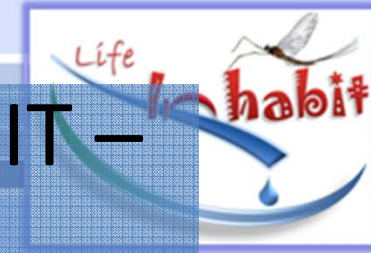






Direct use of Habitat information Case 2 – Habitat is a bridge between the WFD and the Habitat Directive..





Alcune conclusioni di INHABIT – aspetti Habitat/biota

- Tipizzazione in area mediterranea può essere debole.
- Importante influenza delle caratteristiche di habitat sulle comunità.
- Il carattere lentico-lotico è direttamente correlato alla variabilità delle metriche biologiche e influenza gli indici biologici utilizzati nella classificazione.
- L'accuratezza dei metodi di classificazione in uso può essere scarsa.
- È necessaria una correzione nei sistemi di classificazione sulla base delle caratteristiche di habitat.
- È possibile definire semplici relazioni tra LRD e metriche biologiche.
- Le caratteristiche di habitat saranno da considerare per la ridefinizione delle condizioni di riferimento.
- I modelli sviluppati possono supportare la quantificazione dell'alterazione legata ai prelievi idrici.
- Habitat è un ponte tra WFD e Direttiva HABITAT.

→ Relazioni con idrologia: da definire meglio

Grazie per l'attenzione!!



Cagliari, 11-12 Dicembre 2012