


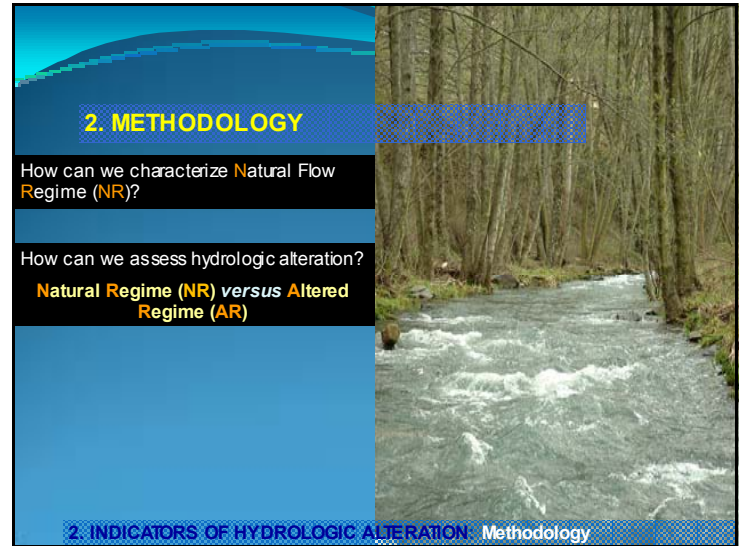
**INDICATORS OF HYDROLOGIC ALTERATION (IAH)**

1. Key concepts

2. METHODOLOGY

3. Application

4. Conclusions

**2. METHODOLOGY**

How can we characterize Natural Flow Regime (NR)?

How can we assess hydrologic alteration?

**Natural Regime (NR) versus Altered Regime (AR)**

**2. INDICATORS OF HYDROLOGIC ALTERATION: Methodology**



"Natural regime: a predictable diversity"

Fell et al., 1997

**2. INDICATORS OF HYDROLOGIC ALTERATION: Methodology**



**FAHRIS**

NEW SOFTWARE TO CHARACTERIZE FLOW REGIME AND TO ASSESS HYDROLOGIC ALTERATION

[http://www.enr.com/education/iaah/iaah\\_fahr.htm](http://www.enr.com/education/iaah/iaah_fahr.htm)

**IAHRIS** NEW SOFTWARE TO ASSESS HYDROLOGIC ALTERATION

*How can we evaluate our rivers' health?*

**IAHRIS** NEW SOFTWARE TO ASSESS HYDROLOGIC ALTERATION

*How can we evaluate our rivers' health?*

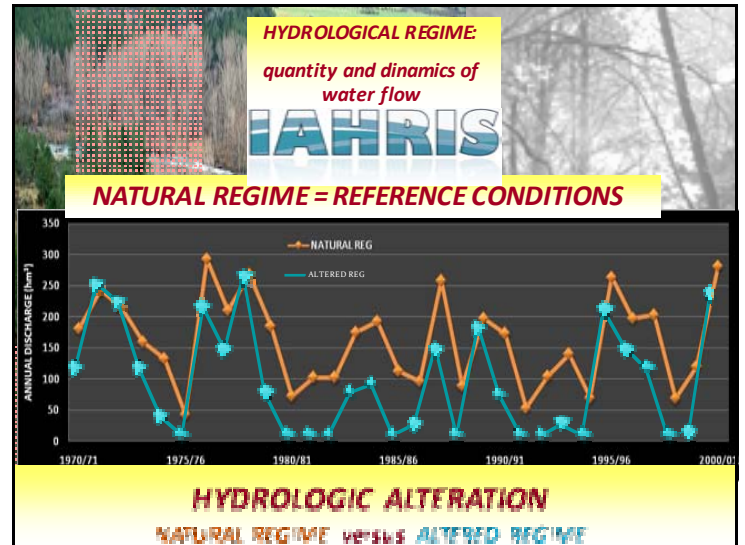
**Water Framework Directive** determines a set of components  
 ⇒ to assess ECOLOGICAL STATUS

**IAHRIS** NEW SOFTWARE TO ASSESS HYDROLOGIC ALTERATION

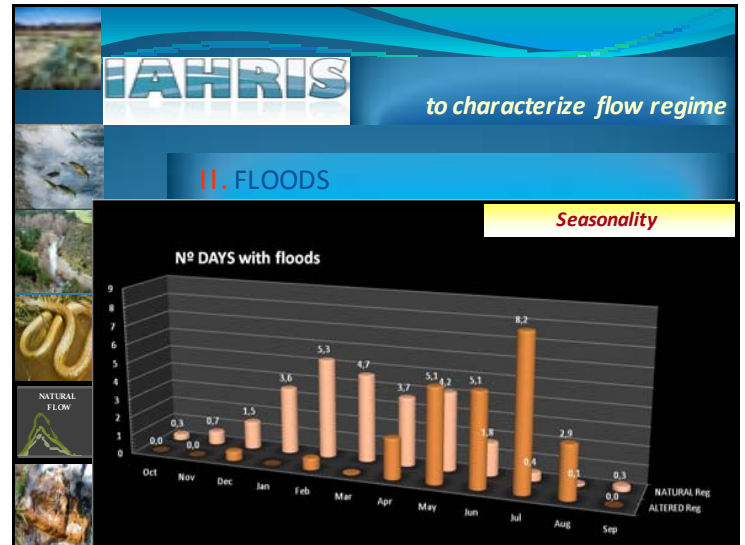
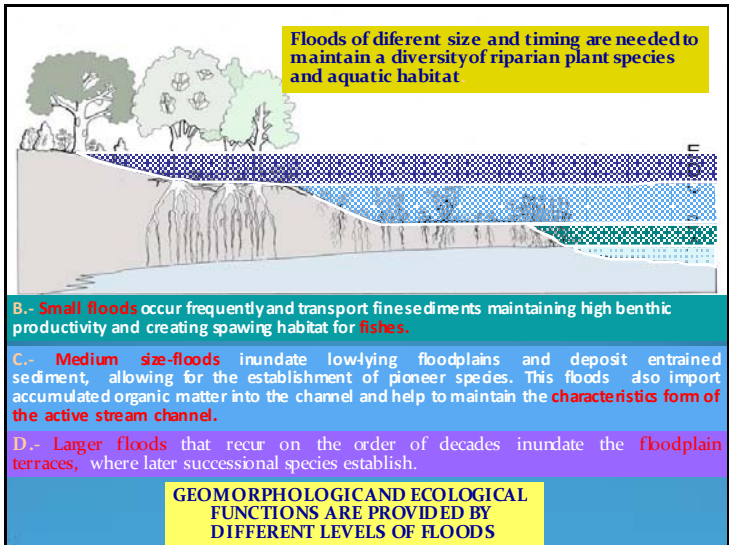
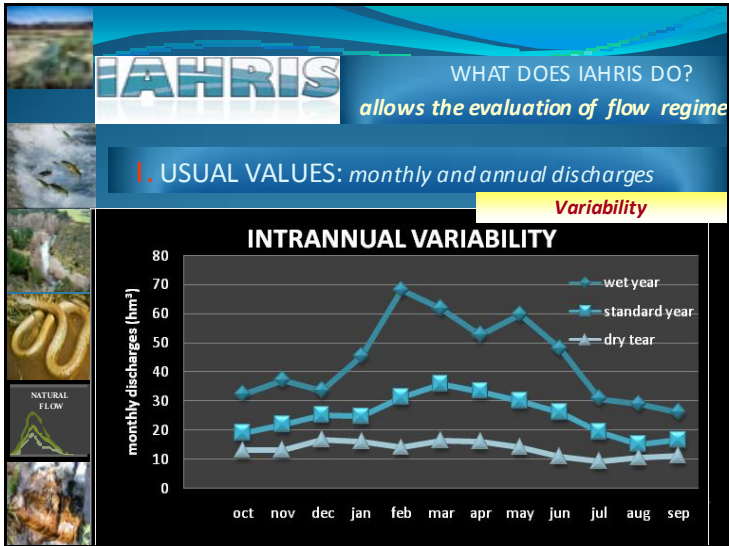
*How can we evaluate our rivers' health?*

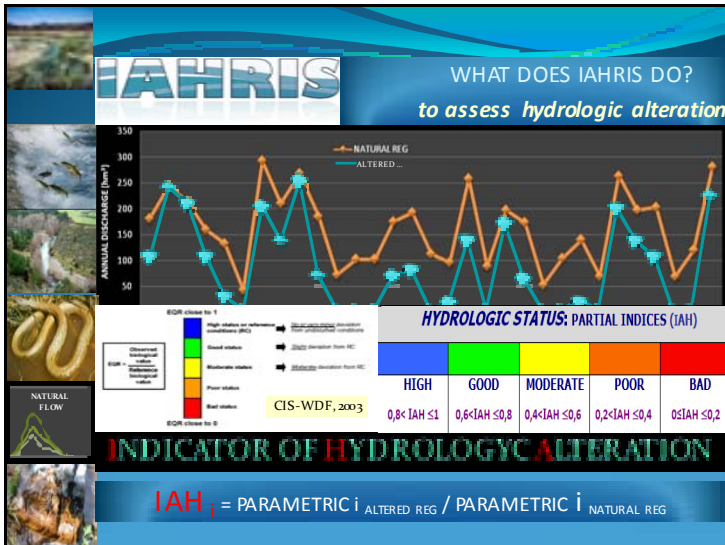
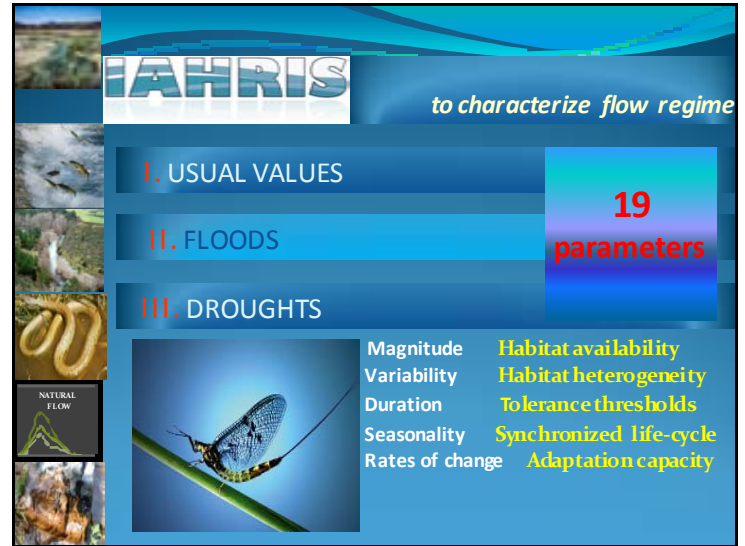
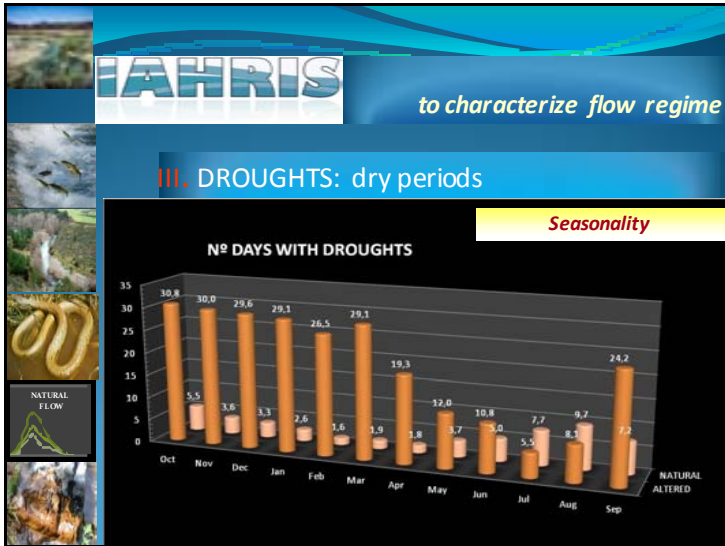
**Water Framework Directive**

- BIOLOGICAL ELEMENTS
- HYDROLOGICAL REGIME: quantity and dynamics of water flow
- CHEMICAL AND PHYSICO-CHEMICAL ELEMENTS









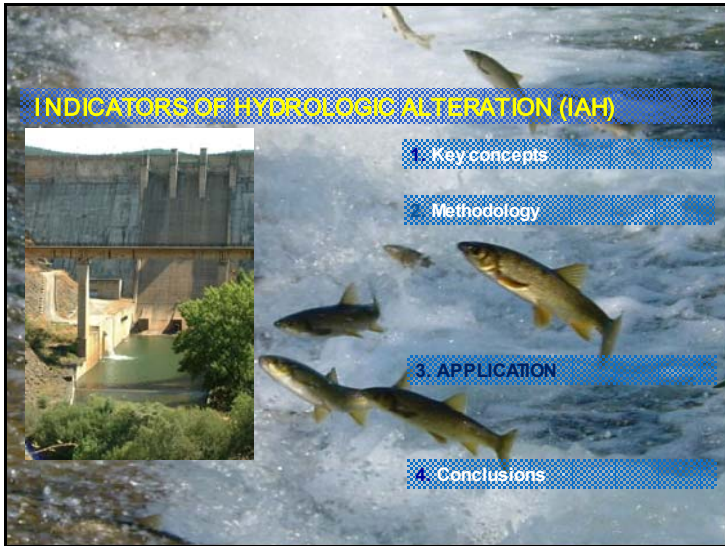
ASPECT	INDICES OF HYDROLOGIC ALTERATION (IAH)			HIGH	GOOD	MODERATE	POOR	BAD
	VALUE	CODE	DEMONINATION	0,8 < IAH ≤ 1	0,6 < IAH ≤ 0,8	0,4 < IAH ≤ 0,6	0,2 < IAH ≤ 0,4	0 ≤ IAH ≤ 0,2
HABITAT DATA	magnitude	0,62-0,78	IAH01					
	variability	0,17-0,27	IAH02					
	seasonality	0,27-0,37	IAH03					
FLOODS	magnitude	0,25-0,35	IAH04					
	variability	0,27-0,37	IAH05					
	duration	0,32-0,42	IAH06					
	seasonality	0,37-0,47	IAH07					
DROUGHTS	magnitude	0,07-0,17	IAH08					
	variability	0,22-0,32	IAH09					
	duration	0,07-0,17	IAH10					
	seasonality	0,17-0,27	IAH11					
<b>INDICES OF GLOBAL ALTERATION</b>				HIGH	GOOD	MODERATE	POOR	BAD
ASPECT	VALUE	CODE		0,44 < IAH ≤ 0,6	0,30 < IAH ≤ 0,44	0,16 < IAH ≤ 0,30	0,02 < IAH ≤ 0,16	0 ≤ IAH ≤ 0,02
HABITAT DATA	0,83	IAH01-03						
FLOODS	0,47	IAH04-07						
DROUGHTS	0,80	IAH08-11						

INDICE OF GLOBAL ALTERATION IN HABITAT VALUES

INDICE OF GLOBAL ALTERATION IN FLOODS


INDICE OF GLOBAL ALTERATION IN DROUGHTS

## INDICATORS OF HYDROLOGIC ALTERATION (IAH)




1. Key concepts
2. Methodology
3. APPLICATION
4. Conclusions

## 1 EXAMPLE





To quantify the hydrological alteration caused by water regulation

## 1 EXAMPLE



To quantify the hydrological alteration caused by water regulation

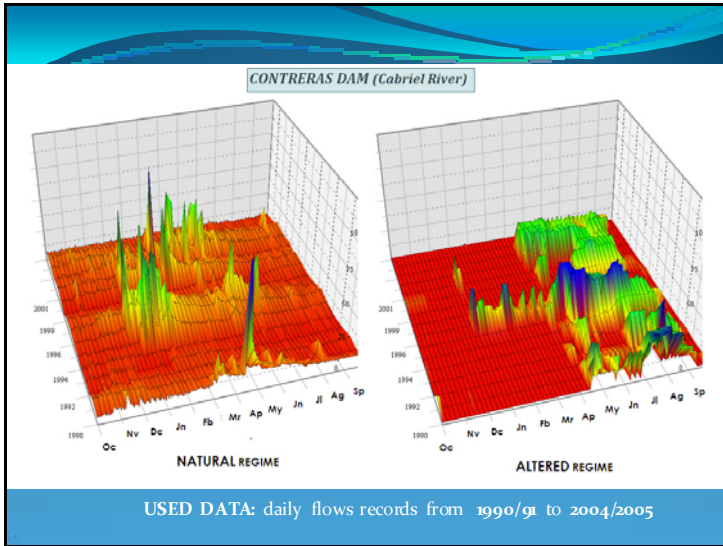
TECHNICAL DATA		
Construction year	1974	
Basin area	3266 km <sup>2</sup>	
Annual natural input	Average	345 hm <sup>3</sup>
	Min	95 hm <sup>3</sup>
Reservoir volume	Max	773 hm <sup>3</sup>
		874 hm <sup>3</sup>

CONTRERAS DAM (Cabriel River, Spain)

## CONTRERAS DAM





# ÍNDICES DE ALTERACIÓN HIDROLÓGICA EN RÍOS

# IAHRIS

## IAHRIS

**USER'S MANUAL**

**METHODOLOGY REFERENCE MANUAL**

About IAHRIS

CONTRERAS\_COETANEO.xls [Modo de compatibilidad] - Microsoft Excel

Versión 1.0  
Enero 2008

**IAHRIS**

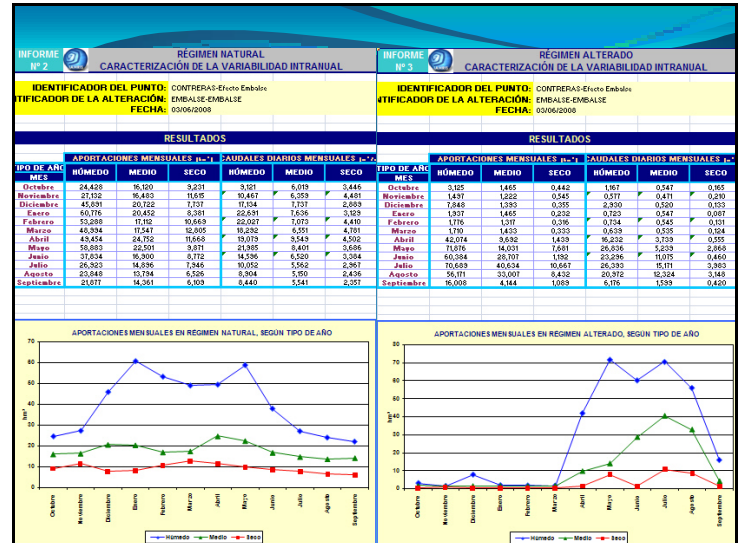
**IDENTIFICADOR DEL PUNTO:** CONTRERAS-Erroto Embalse  
**IDENTIFICADOR DE LA ALTERACIÓN:** EMBALSE-EMBALSE  
**FECHA:** 03/06/2008

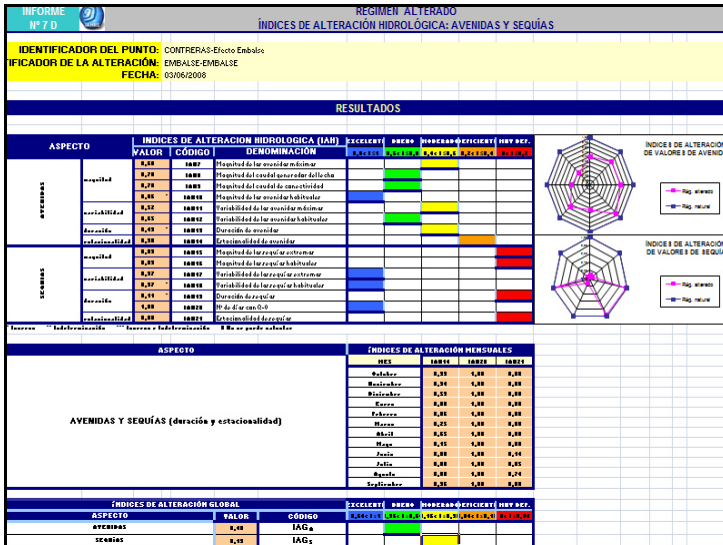
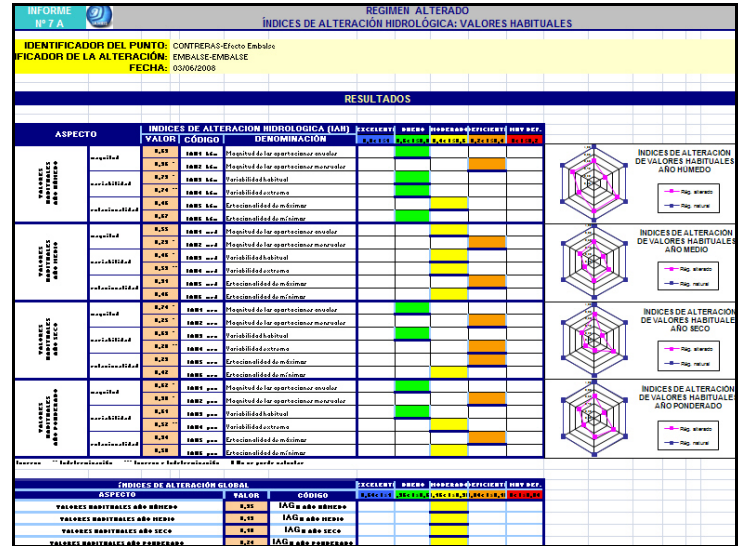
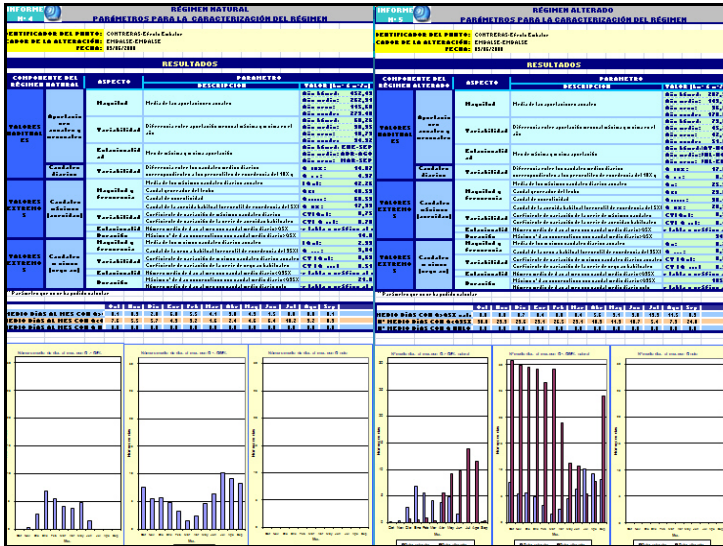
**INFORMES REALIZADOS:**

1. INFORME DE VARIABILIDAD INTERANUAL REGIMEN NATURAL
2. INFORME DE VARIABILIDAD INTERANUAL REGIMEN ALTERADO
3. INFORME DE VARIABILIDAD INTRANUAL REGIMEN NATURAL
4. INFORME DE VARIABILIDAD INTRANUAL REGIMEN ALTERADO
5. INFORME DE PARÁMETROS REGIMEN NATURAL
6. INFORME DE PARÁMETROS REGIMEN ALTERADO
7. INFORME DE CURVAS ANUALES REGIMENES NATURAL Y ALTERADO
8. INFORME DE REGIMEN ALTERADO INDICES DE VALORES HABITUALES
9. INFORME DE REGIMEN ALTERADO INDICES DE EXTREMOS Y TENDENCIAS

**DATOS DISPONIBLES Y DATOS UTILIZADOS PARA LA REALIZACIÓN DE LOS INFORMES:**

Año	DATOS MENSUALES				DATOS DIARIOS			
	Regimen natural		Regimen alterado		Regimen natural		Regimen alterado	
	Completo	Utilizado	Completo	Utilizado	Completo	Utilizado	Completo	Utilizado
1944-45	X							
1945-46	X							
1946-47	X							
1947-48	X							
1948-49	X							
1949-50	X							
1950-51	X							
1951-52	X							
1952-53	X							
1953-54	X							
1954-55	X							
1955-56	X							
1956-57	X							
1957-58	X							
1958-59	X							
1959-60	X							
1960-61	X							

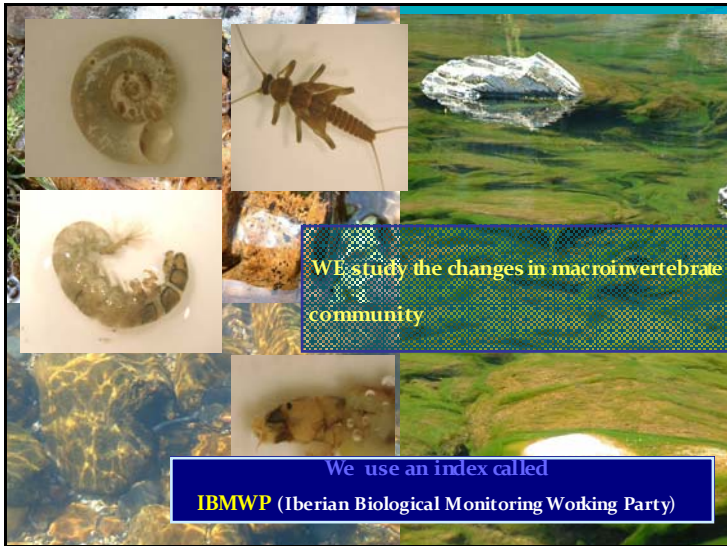




### Alteration in droughts: ecological significance

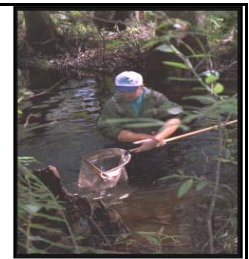
- Limiting the quality and quantity of habitat
- Physiological stress leading to reduced plant growth rate, morphological change or mortality
- Reduction or elimination of plant cover
- Changes in aquatic plant
- CHANGES in INVERTEBRATE COMMUNITY STRUCTURE
- Mortality of fish trapped in off channel habitats
- Mortality of fish due to deteriorating water quality conditions, limited food and lack of shelter from predatory fish and birds.





Kicknet

2.- Toma de muestras



D-frame Dipnet



Rectangular Dipnet

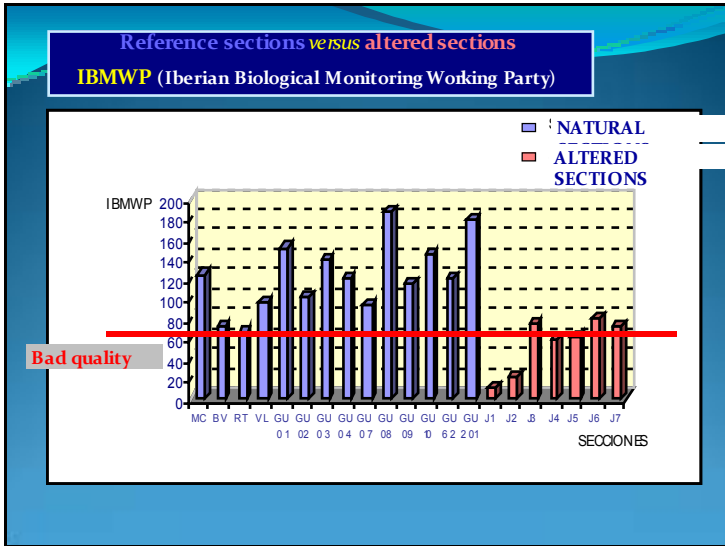


Hess sampler









2. EXAMPLE **IAHRIS** AS A TOOL OF HYDROLOGIC DECISION MAKING

OJA River (La Rioja, Spain)

IUCN Red List of Threatened Species

Scientific Name	Family	Order	Class	Phylum	Kingdom	Common Name(s)
<i>Mustela lutreola</i>	MUSTELIDAE	CARNIVORA	MAMMALIA	CHORDATA	AMPHIBIA	EUROPEAN MINK/OTTER

We studied different scenarios of management

We selected the best one applying IAHRIS

INDICES DE ALTERACION DE VALORES DE AVENIDA

INDICES DE ALTERACION DE VALORES DE SEQUIA

The components and functions of the ecosystem which are linked to Flow regime

Will not be seriously affected

SEÑALES	INDICES DE ALTERACION HIDROLOGICA (IAH)		REPERTE	SERVA	SUSPENDIDA	RECONSTRUIDA	NOB. SER.
	VALOR	CÓDIGO					
magnitud	1.00	IAH01	Magnitud de las regadas extremas				
variabilidad	1.00	IAH06	Magnitud de las regadas habituales				
	1.00	IAH07	variabilidad de las regadas extremas				
	1.00	IAH08	variabilidad de las regadas habituales				
duración	1.00	IAH09	Duración de sequías				
extinción	1.00	IAH20	TP de desaparición				
	1.00	IAH21	extinción de especies				



**summary**

## INDICATORS OF HYDROLOGIC ALTERATION (IAH)

**FLOW REGIME**

Availability  
Diversity  
Tolerance  
Synchrony

**TO ASSESS HYDROLOGIC ALTERATION AND ITS ENVIRONMENTAL CONSEQUENCES**

Variability  
Duration  
Seasonality  
Rate of change

**FULL RANGE OF VARIABILITY**

Inter and intrannual

- 1 Key concepts
- 2 Methodology
- 3 IAH: its application
- 4 CONCLUSIONS

STATA HIDROLÓGICA PARTIAL ALTERATION (IAH)				
1	2	3	4	5
HIGH 0.06 ± 0.01	GOOD 0.07 ± 0.03	MODERATE 0.44 ± 0.05	POOR 0.23 ± 0.04	BAD 0.02 ± 0.01

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Now, we know how to assess on the degree of hydrological alteration

The next question may be ...

**HOW MUCH WATER DOES A RIVER NEED to sustain its biodiversity?**

Sorry about my english

Thank you very much