Using ecological indicators in water-quality monitoring - a beginners guide

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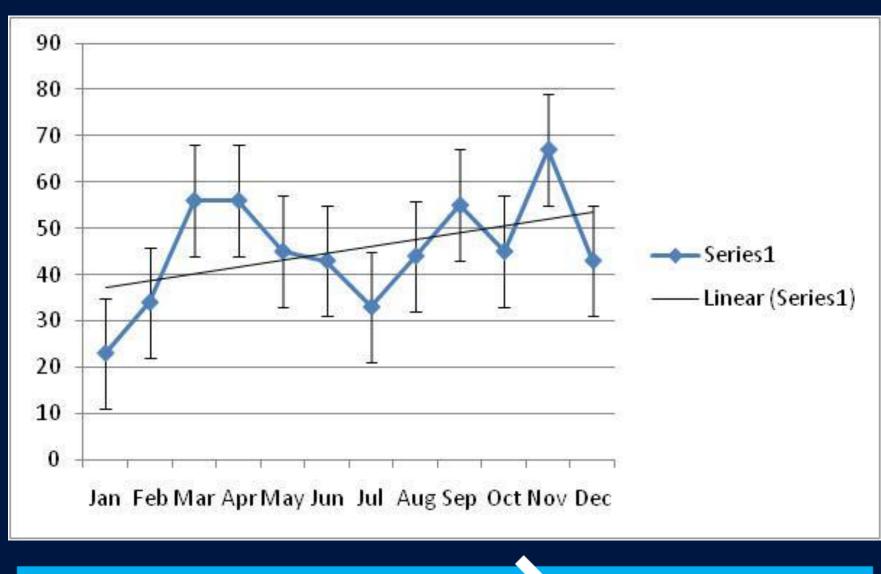
### Introduction

#### • Ecological Indicators:

- What are ecological indicators?
- Why are they used?
- Where (in what circumstances) are/can they be used?
- What is monitored?
- Examples



# How things have changed!



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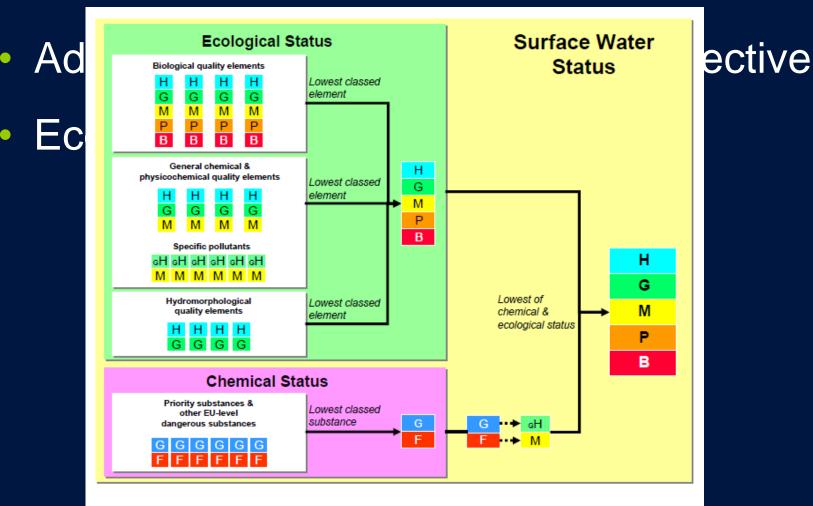


Figure 1b: Schematic representation of how results for different quality elements are combined to classify ecological status, chemical status and surface water status



# What are ecological indicators?

Score	Colour	Index Habitat integrity							
<=1.5	A	Unmodified, natural							
1.5-2.49	В	Largely natural with few modifications							
2.5-3.49	С	Moderately modified							
>=3.50	D	Largely modified							



# Why do we use ecological indicators?





# Why do we use ecological indicators?



# Where/when are they used?

- Where a specific issue is suspected, e.g. intermittent pollution
- Where "traditional" forms of monitoring are expensive and/or difficult to implement
- Where there is a specific biodiversity issue



# Where/when are they used?

- Increasingly "as the norm" due to legislation – RSA reserve determination, EU WFD etc
- Where we want to be sure we are taking account of the whole system



#### Examples?

 The Southern African Scoring System (SASS) – *Dickens and Graham, 2002*



#### SASS

#### Requires sampling main habitats for a set time period





Aquatic Marginal veg. vegetation

Marginal veg. out of current Bedrock

#### SASS



Stones out of current

Stones in current

Gravel, Sand or Mud



### SASS

Date (dd:mm:yr):						(dd.dddd)				Biotopes Sampled (tick & rate)	Rating	Weigh	1		ne (min)		
Site Code:			Grid reference (dd mm ss.s) Lat:	S			#VA	LUE!	Stones In Current (SIC)		FALSE	r					
Collector/Sampler:			Long				/	LUE!	Stones Out Of Current (SOOC)		FALSE	•					
•					<u> </u>		# VA	LUE:			FALCE	<b>•</b>					
River:						Datum (WGS84/Cape):		<u> </u>				Bedrock		FALSE			
Level 1 Ecoregion:						Altitude (m):						Aquatic Veg		FALSE			
Quaternary Catchment:						Zonation:	_					MargVeg In Current		FALSE			
	Temp (°C):		Routine or Project? (circle one)		Flow:				MargVeg Out Of Current		FALSE						
Site Description:	pH:			Project Name:	Clarity	(cm):				Gravel		FALSE	ľ				
	DO (mg/	(L):					Turbidity:					Sand		FALSE			
	Cond (mS/m):					Colour:				Mud		FALSE					
	Riparian Disturbance:							colour.				Hand picking/Visual observation		I / LLOL		Cataman	•
												OVERALL BIOTOPE SUITABILITY		0.0	#####	Category #VALUE!	-
	Instream Disturbance:													0.0	_		
Taxon	QV	S	Veg	GSM	тот	Taxon	QV	S	Veg	GSM	тот	Taxon	QV	S	Veg	GSM	TOT
PORIFERA (Sponge)	5					HEMIPTERA (Bugs)						DIPTERA (Flies)					
COELENTERATA (Cnidaria)	1					Belostomatidae* (Giant water bugs)	3					Athericidae (Snipe flies)	10				
TURBELLARIA (Flatworms)	3			_		Corixidae (water boatmen)	3					Blepharoceridae (Mountain midges)	15		+		
ANNELIDA						Gerridae* (Pond skaters/Water striders)	5					Ceratopogonidae (Biting midges)	5		+		
Oligochaeta (Earthworms)	1					Hydronenender (Water met - rets)	l ü	$\prec$				Chironomidae (Midges)	2		+		
Hirudinea (Leeches)	3				(	Naucoridae* (Creeping water bugs)	7					Oulisidae* (Mosquitess)		1	$ \downarrow  \downarrow$		
CRUSTACEA						Nepidae* (Water scorpions)	0					Dixidae* (Dixid midge)	10				
Amphipoda (Scuds)	13					Notonectidae* (Backswimmers)	3					Empididae (Dance flies)	6				
Potamonautidae* (Crabs)	3					Pleidae* (Pygmy backswimmers)	4					Ephydridae (Shore flies)	3				
Atyidae (Freshwater Shrimps)	8					Veliidae/Mveliidae* (Ripple bugs)	5					Muscidae (House flies, Stable flies)	1				
Palaemonidae (Freshwater Prawns)	10					MEGALOPTERA (Fishflies, Dobsonflies &	1	s)				Psychodidae (Moth flies)	1				
HYDRACARINA (Mites)	8					Corydalidae (Fishflies & Dobsonflies)	8					Simulidae (Blackflies)	5				
PLECOPTERA (Stoneflies)						Sialidae (Alderflies)	6					Syrphidae* (Rat tailed maggots)	1				
Notonemouridae	14					TRICHOPTERA (Caddisflies)						Tabanidae (Horse liles)	5				
Perlidae	12					Dipseudopsidae	10					Tipulidae (Crane flies)	5				
EPHEMEROPTERA (Mayflies)						Ecnomidae	8					GASTROPODA (Snails)					
Baetidae 1sp	4					Hydropsychidae 1 sp	4					Ancylidae (Limpets)	6				
Baetidae 2 sp	6					Hydropsychidae 2 sp	6					Bulininae*	3				
Baetidae > 2 sp	12					Hydropsychidae > 2 sp	12					Hydrobiidae*	3				
Caenidae (Squaregills/Cainfles)	б					Philopotamidae	10					Lymnaeidae* (Pond snails)	3				
Ephemeridae	15					Polycentropodidae	12					Physidae* (Pouch snails)	3				
Heptageniidae (Flatheaded mayflies)	13					Psychomyiidae/Xiphocentronidae	8					Planorbinae* (Orb snails)	3				
Leptopniebiidae (Prongills)	9					Cased caddis:						Thiaridae* (=Melanidae)	3				
Oligoneuridae (Brushlegged mayflies)	15					Barbarochthonidae SWC	13					Viviparidae* ST	5				
Polymitarcyluae (Pale Dunowere)	10					Calamoceratidae ST	11					PELECYPODA (Bivalvles)					
Prosopistomatidae (Water specs)	15					Glossosomatidae SWC	11					Corbiculidae (Clams)	5				
Teloganodidae SWC (Spiny Grawlers)	12					Hydroptilidae	6					Sphaeriidae (Pill clams)	3				
Tricorythidae (Stout Crawlers)	9					Hydrosalpingidae SWC	15	I				Unionidae (Perly mussels)	6	1			
ODONATA (Dragonflies & Damselflies)						Lepidostomatidae	10					SASS Score					
Calopterygidae ST,T (Demoiselles)	10					Leptoceridae	6					No. of Taxa					
Chlorocyphidae (Jewels)	10					Petrothrincidae SWC	11	I				ASPT	l		$\vdash$		ļ
Synlestidae (Chlorolestidae)(Sylphs)	8					Pisuliidae	10	ļ		L	L	Other biota:					
Coenagrionidae (Sprites and blues)	4					Sericostomatidae SWC	13	L				Į					
Lestidae (Emerald Damselflies/Spreadwings)	8					COLEOPTERA (Beetles)						Į					
Platycnemidae (Stream Damselflies)	10					Dytiscidae/Noteridae* (Diving beetles)	5	I				Į					
Protoneuridae (Threadwings)	8					Elmidae/Dryopidae* (Riffle beetles)	8	l									
Aeshnidae (Hawkers & Emperors)	8					Gyrinidae* (Whirligig beetles)	5	I				Comments/Observations:					
Corduliidae (Cruisers)	8					Haliplidae* (Crawling water beetles)	5	ļ		L	L	4					
Gomphidae (Clubtails)	6					Helodidae (Marsh beetles)	12	L				4					
Libellulidae (Darters/Skimmers)	4					Hydraenidae* (Minute moss beetles)	8					1					
LEPIDOPTERA (Aquatic Caterpillars/Moths)						Hydrophilidae* (Water scavenger beetles)	5					1					
Crambidae (Pyralidae)	12					Limnichidae (Marsh-Loving Beetles)	10					1					
						Psephenidae (Water Pennies)	10										

### Examples?

- miniSASS Graham, Dickens and J Taylor (2010)
- Namibian Scoring System (NASS) Palmer and E Taylor (2004)
- Proportion of Sediment-sensitive Invertebrates (PSI) – Extence et al (2011)

#### Examples?

- Diatoms
- Fish
- Macrophytes
- Habitat
- Single species





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