



Assessment of Morphological Quality of Surface Water Bodies in Western Sicily



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INTRODUCTION

According to the Water Framework Directive (WFD) (EUROPEAN COMMISSION, 2000), the good quality status for water bodies is determined by the assessment of both ecological and chemical status. The ecological status of surface water bodies is based on the evaluation of biological quality elements (phytoplankton, phytobenthos, benthic invertebrates, fish macrophytes) and supporting indicators as physico-chemical elements, and hydromorphological features of the water bodies.

For the hydromorphological assessment and analysis of streams, Rinaldi et al., (2011) introduced a new methodology, named IDRAIM (sistema IDRomorfologico di valutazione, Analisi e Monitoraggio dei corsi d'acqua) which provides the stream Morphological Quality Index (MQI) for the hydromorphological classification required by WFD.

In this work, the results of the application of IDRAIM to 47 surface water bodies in Western Sicily are presented.

STUDY AREA

BASIN	Area (km ²)	SWBs	Reaches
Arena	309	4	32
B. M. fra Lenzi e Birgi	90	1	5
Birgi	330	5	42
Finocchio	43	1	9
Forgia	61	1	8
Guidaloca	64	1	6
Lenzi	114	3	15
Mazaro	113	2	22
Modione	116	3	23
S. Bartolomeo	425	5	42

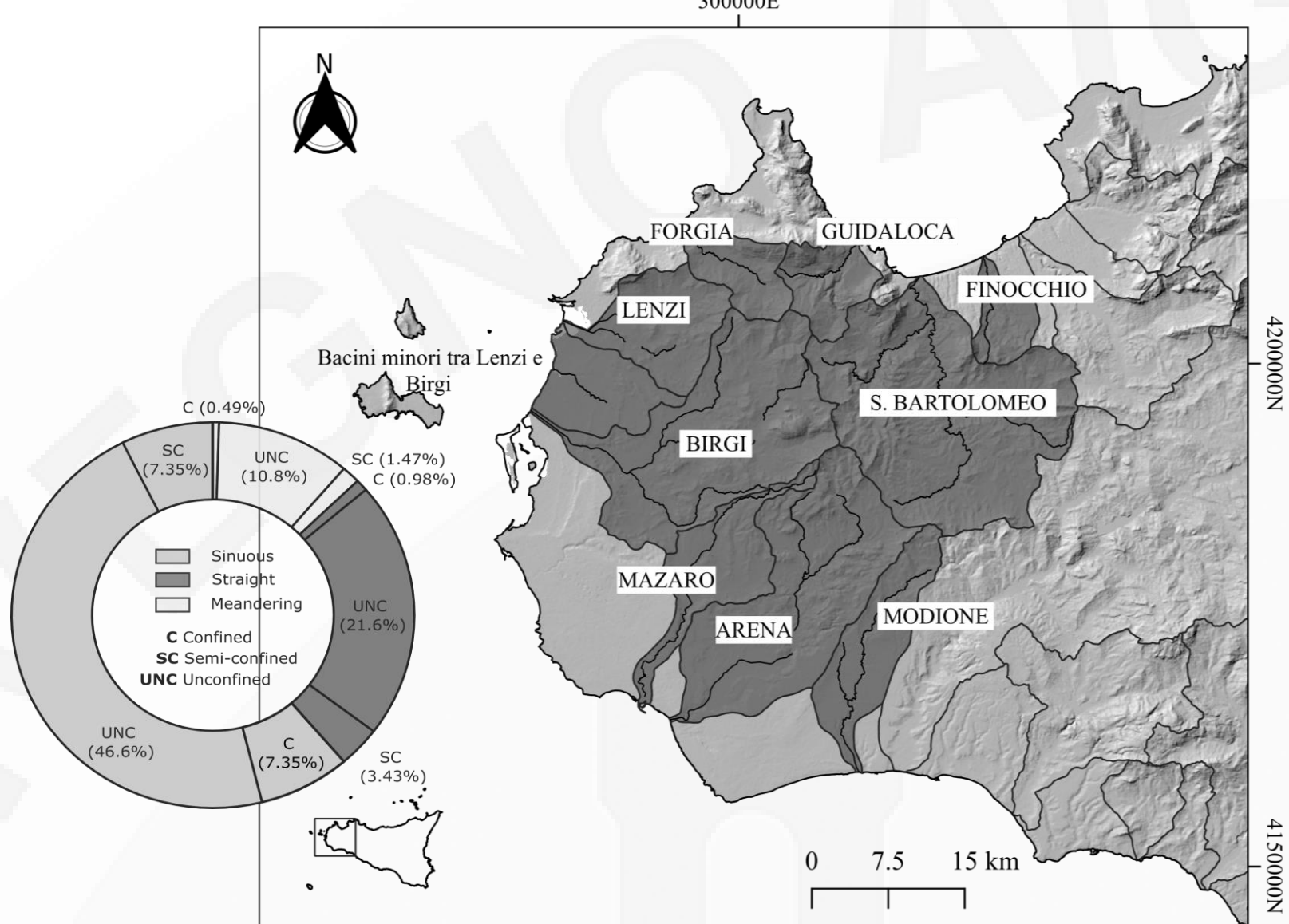


Figure 1 – Map of basins used for this analysis.

RESULTS AND DISCUSSION

A total of 205 reaches were analyzed, and a mean MQI value of 0.63 was obtained, indicating an overall moderate morphological quality for these reaches of the western sector.

In particular, the Guidaloca, Modione, Finocchio, S. Bartolomeo, Mazaro and Forgia surface water bodies showed average MQI values above 0.70, corresponding to good morphological status. The Arena catchment and Bacini minori tra Lenzi e Birgi showed moderate quality, with an average value of 0.6. Finally, the Birgi and Lenzi catchments revealed the most critical conditions.

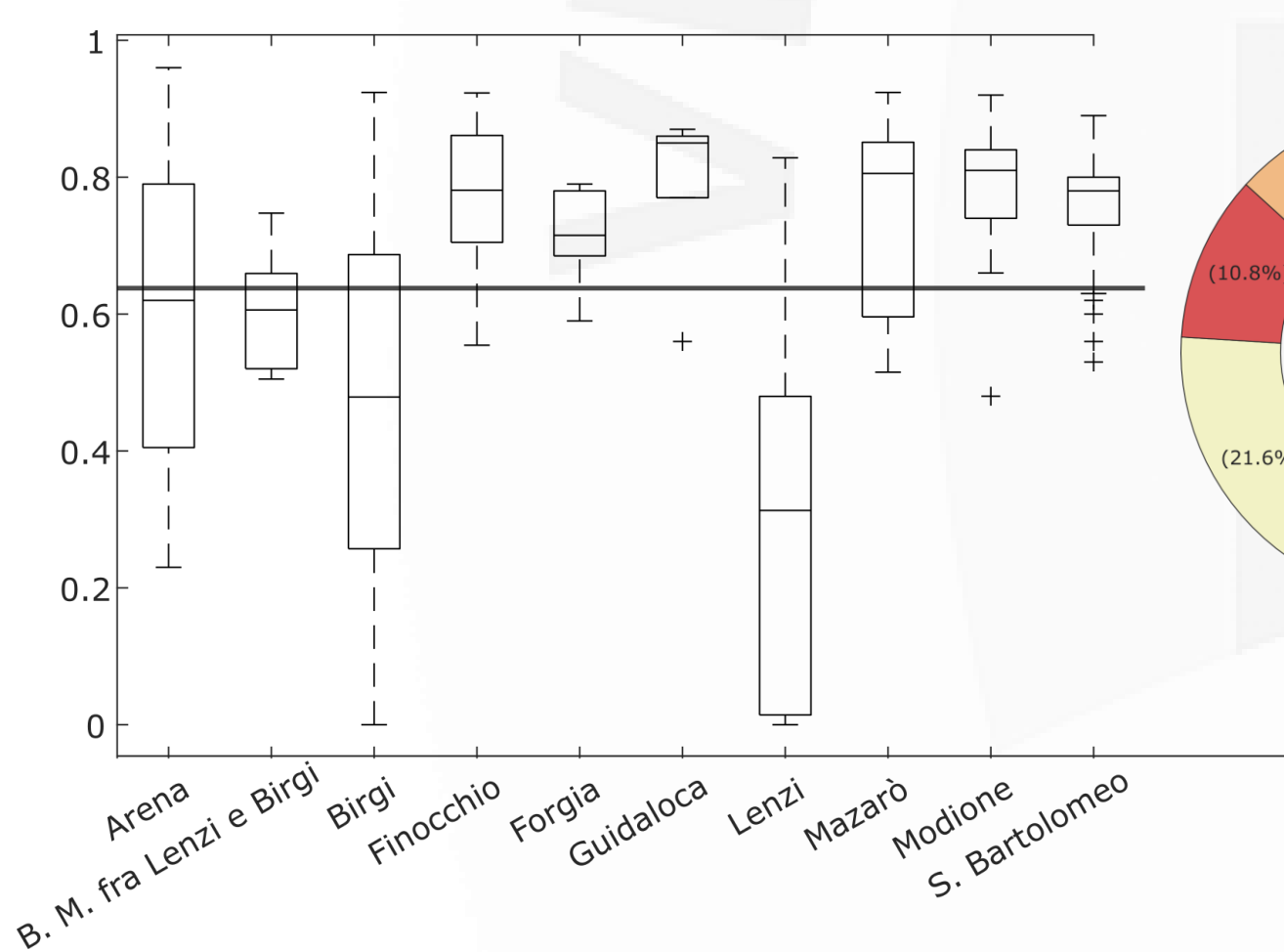


Figure 4 – Average MQI for all analyzed SWBs

Good	
FINOCCHIO	0.77
IT19RW04401	0.77
S. BARTOLOMEO	
IT19RW04501	0.68
IT19RW04502	0.8
IT19RW04503	0.72
IT19RW04504	0.78
IT19RW04505	0.79
GUIDALOCA	
IT19RW04601	0.79
FORGIA	
IT19RW04801	0.72
MAZARO	
IT19RW05301	0.72
IT19RW05302	0.76
MODIONE	
IT19RW05601	0.81
IT19RW05602	0.76
IT19RW05603	0.73
Moderate	
B.M. fra Lenzi e Birgi	
IT19RW05001	0.6
ARENA	
IT19RW05401	0.34
IT19RW05402	0.75
IT19RW05403	0.45
IT19RW05404	0.74
Poor	
BIRGI	
IT19RW05101	0.55
IT19RW05102	0.14
IT19RW05103	0.38
IT19RW05104	0.64
IT19RW05105	0.48
Very Poor	
LENZI	
IT19RW0491	0.31
IT19RW0492	0.09
IT19RW0493	0.62



This example illustrates that long reaches containing artificial discontinuities can greatly lower the overall score, as the MQI is computed as a length-weighted average of the reach values.

	Mean F	Mean A	Mean V	Mean MQI	Length (m)
IT19RW04902	0.08	0	0.04	0.09	9320
1	0.15	0	0.06	0.06	1775
2	0.15	0.29	0.06	0.51	425
3	0.02	0	0.03	0	475
4	0.02	0	0.03	0	1650
5	0.07	0	0.03	0	2350
6	0.1	0	0.06	0	2645

Table 1 - Mean F, A, V, and MQI scores vs. reach length.

KEY CHARACTERISTICS OF IDRAIM

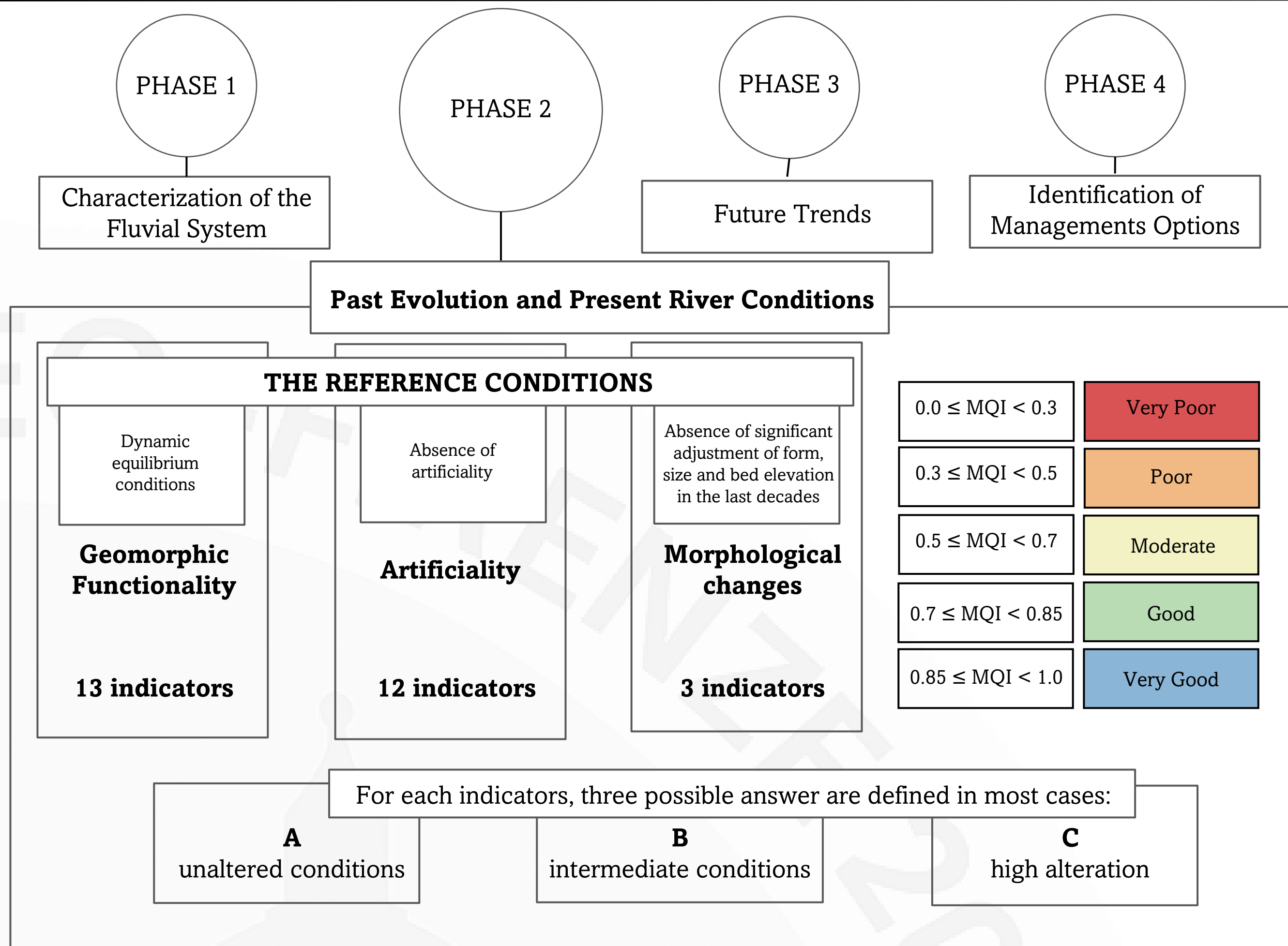


Figure 2 – Overview of IDRAIM structure

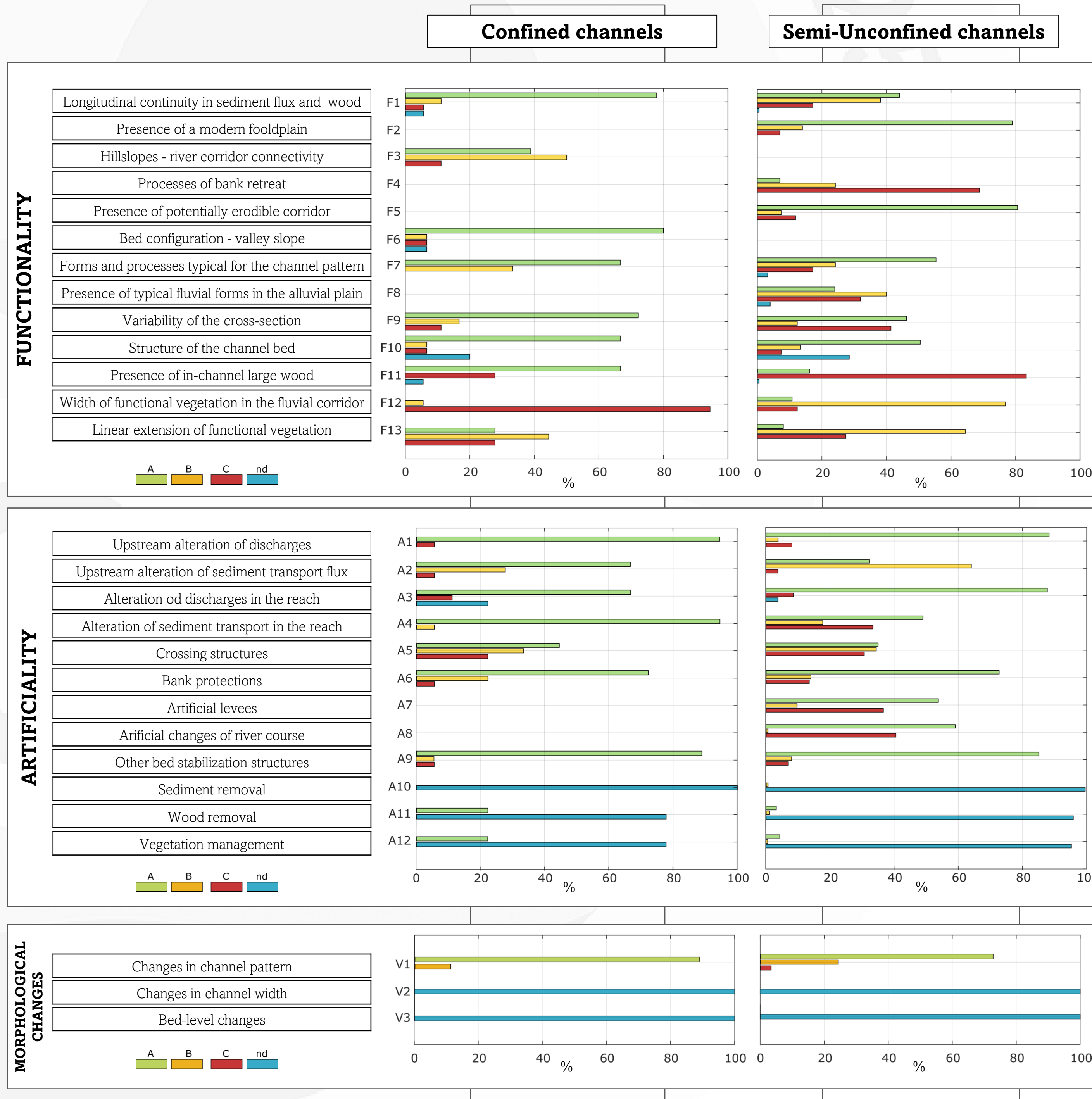


Figure 5 – Percentage of classes A, B, and C for the respective indicators assessed using the two-evaluation protocols for Confined and Semi-Unconfined reaches.

As shown in Fig. 5, for functionality in confined reaches, the indicator with the highest number of classes C is F12, reflecting limited functional vegetation width. In the other reach type, class C occurs most frequently in indicators related to the absence of retreating banks and large wood. For artificiality, class C is most common for A7, A5, and A4 related to longitudinal and lateral discontinuities, as well as A8, concerning alterations to channel morphology or substrate. Indicators A10, A11, and A12, as well as V2 and V3 were least frequently assessed due to insufficient data availability.

CONCLUSIONS

- The analysis conducted highlighted significant variability in the morphological quality of water bodies in western Sicily, with average MQI values ranging mainly between "good" and "poor".
- The low MQI values in the Western Sicilian basins are attributed to a high degree of artificiality.
- A sensitivity analysis conducted on a representative surface water body demonstrated that improving the MQI of a single reach—particularly if it is spatially long—can result in significant changes in the overall water body MQI.