The EU Water Framework Directive
From great expectations to…

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Imperial College London embodies and delivers world class scholarship, education and research in science, engineering medicine and business, with particular regard to their application in industry, commerce and healthcare.

The Centre for Environmental Policy at Imperial provides a unique research interface between science and technology and the economic and policy context in which it is developed and applied.

The Environmental Quality Research Group focuses on the integrated scientific study of the environment with emphasis on waste, water and wastewater management. Complemented by the development and application of tools in sustainability analysis, multi-criteria optimisation and lifecycle assessment. Through a systems approach to understanding problems, we focus on environmental challenges, especially where science and engineering interface with public policy.
**GLOBAQUA** is a EU-funded project aiming to identify the prevalence of, and interaction between, stressors under water scarcity in order to improve knowledge of relationships between multiple stressors and to improve water management practices and policies.

**POLICY:** The ultimate goal of GLOBAQUA is to explore how to adapt management and policies to minimise the ecological, economical and societal consequences of water scarcity and ongoing global change. Scientific results from the project will be integrated with the demands of policymakers and national/EU environmental agencies to fill the communication gap in the Science–Policy Interface.
Ermmm no I hadn't be interesting to have a Brexitier slant on its's replacement. May be flawed but it was going in the right direction.
Taking over 10 years to develop, the new EU Water Framework Directive is the most significant legal instrument in the water field to emerge from Brussels for some time and will have a profound effect on how water is managed in Europe over the next 25 years.
An innovative approach

- Implementation through the **river basin management planning process**, requires the preparation, implementation and review of a **River Basin Management Plan (RBMP)** every six years for each RBD identified.

- The **harmonised transposition of the Integrated River Basin Paradigm**, the key to delivering **Good Ecological Status**.
New Paradigm in Water Management

- To maintain and improve the essential functions of our *water ecosystems*, we need to *manage them well*.

- The premise of *integrated river basin management* lies in treating the catchment as one interconnected system, with the development of *management responses* aimed towards improving water quality as a result of *improving ecosystem health* (system state).

- That means establishing a robust *understanding* of the essential *components* of the system (including pressures, impacts and economic analysis) and their *interactions*, to take appropriate *actions to reduce pressures and improve its overall state*. 
There is a consensus amongst EU water stakeholders that despite a lot of efforts invested by the Member States to implement and enforce the WFD, the outcomes of the 1st WFD planning cycle fell behind expectations.

Despite some good progress, nearly half of EU surface waters did not reach good ecological status in 2015, which has been a central objective of EU water legislation.

The results achieved implementing the WFD are not fully satisfactory: the planned measures in the first PoMs, which were predicted by MS to increase from 43 to 53% the number of water bodies in 'good status' in 2009-2015 have not been fully implemented.

Such delays and slow progress have led to the WFD’s scrutiny with many reviews emphasising the drawbacks and weaknesses of the Directive, questioning its overall effectiveness as a policy-tool.
What went wrong?
# Implementation issues

<table>
<thead>
<tr>
<th>Implementation progress</th>
<th>Number of Member States (27 in total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring and assessment</td>
<td></td>
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<tr>
<td>Gaps and delays in the implementation of monitoring and RBMPs</td>
<td>18</td>
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<tr>
<td>Improve methodologies for status assessments</td>
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<tr>
<td>Determine and finalise the reference conditions</td>
<td>8</td>
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<tr>
<td>Revise, improve and make transparent the designation process of the heavily modified and artificial water bodies</td>
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<tr>
<td>Pressures</td>
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<tr>
<td>Improve pressure analysis</td>
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<tr>
<td>Weak pressures and impacts analysis</td>
<td>11</td>
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<tr>
<td>Establishing clear links between pressures and measures (improving the pressures &amp; impact analysis for developing PoMs)</td>
<td>14</td>
</tr>
<tr>
<td>Apportion pressures to relevant sources and sectors and drivers (including the need for quantitative methods)</td>
<td>21</td>
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<tr>
<td>Integration of policies</td>
<td></td>
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<tr>
<td>Need for better integration of other EU Directives and other legislative drivers in implementing the WFD</td>
<td>15</td>
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<tr>
<td>Gap analysis</td>
<td></td>
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<tr>
<td>Assess the gaps and effectiveness of basic measures</td>
<td>9</td>
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<tr>
<td>Justify and set out clearly the need for supplementary measures</td>
<td>13</td>
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<tr>
<td>Improved gap analysis to inform the PoMs for the achievement of objectives</td>
<td>23</td>
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<tr>
<td>Providing more information regarding the scope of the measure (extent, cost and expected impact on water bodies)</td>
<td>9</td>
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<tr>
<td>Exemptions</td>
<td></td>
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<tr>
<td>Improve the approaches in the application of exemptions in RBMPs</td>
<td>9</td>
</tr>
<tr>
<td>Ensure that exemptions for not achieving objectives are adequately justified</td>
<td>20</td>
</tr>
</tbody>
</table>
Implementation problems

1. Misunderstandings with the definition and the role of ecological status

2. Issues with pressure-impact analysis and surveillance monitoring limited the potential of monitoring to capture the interactions between stressors

3. Problems with the use of elements in status assessment and “one out all out” principle

4. PoMs developed to improve element classifications rather than system state

5. PoMs that did not readily address significant pressures

Reductionist implementation of a systems Directive
Ecological status in the WFD is NOT

- “a biodiversity index”
- “a unifying concept for aiding the harmonization of results obtained in a variety of different countries/regions using a variety of their own ‘traditional’ assessment protocols” (as used in the intercalibration exercise*)
- “an integrative evaluation of aquatic ecosystem health, designed to reflect changes in community structure and ecosystem functioning in response to anthropogenic pressures” or “a synthetic judgement that represents the condition of water bodies” (as used by the JRC in the European Pressures assessment)

Questions about the legitimacy of interpretative elements found in CIS guidance

*which purpose was not to harmonise assessment systems, but only their results (Prichard and Makuch, 2012), to ensure common understanding of ‘good ecological status’, in accordance to differing methods of assessment employed by Member States (Josefsson, 2015).
Good ecological status in the WFD

- Defined as the **state of the system** in the **absence of any anthropogenic pressures**, or a **slight biological deviation** from what would be expected under undisturbed/reference conditions.

- This is because of **ecological variability** and in recognition that different water may be characterised by distinct definitions of quality, good ecological status **cannot be defined** across Europe using absolute standards.

- **Ecological status** is an “expression of the quality of the structure and functioning of surface water ecosystems” - a reflection of multiple, diverse and distributed (scalar) causes: multiple pressures that affect both their structure and function.

- **Ecological status** is, in other words, an **indicator** that shows the **need for action**, the **deviation of the current system from its state under undisturbed/ reference conditions**, and **not an absolute value of ecosystem quality**.
Fever as an indicator

Definitions of fever vary, but generally a temperature above 37.8-38°C is usually considered abnormal.

A fever may be classified as mild (or 'low grade') if it's between 37.8°C and 38.5°C; or high (or 'high-grade') above 38.5°C.

When we are infected with a bacteria, a virus or another germ, the body releases chemicals known as pyrogens that stimulate the hypothalamus. This causes physiological changes in our body which result in a fever or 'pyrexia'.

Fever itself isn't a disease but a symptom of an underlying condition. So when doctors examine a patient who has a fever, they are looking for the disease that is causing it. Your doctor will usually take a history and do a physical examination. Tests may be ordered to try to find the source of the infection.
The WFD adopts the DPSIR Framework

The European DPSIR framework (after Gabrielsen & Bosch, 2003).

Indicators and information linking DPSIR elements

- ‘What is happening to the environment and to humans?’ (Type A or Descriptive Indicators)
- ‘Does it matter?’ (Type B or Performance indicators)
- ‘Are we improving?’ (Type C or Efficiency indicators)
- ‘Are we on the whole better off?’ (Type D or Total Welfare indicators)
**WFD: a “systems” directive**

**System:** River Basin (Catchment)
**System State:** expression of structure and function

**Ecological Status**
Performance indicator for classification of water bodies

**GOOD ECOLOGICAL STATUS:**
The state of the system in the absence of any anthropogenic pressures*, or a slight biological deviation from what would be expected under natural/undisturbed conditions

**Monitoring Ecological Status**
for operational monitoring provides the evidence:
- to determine the need for action
- to monitor the effectiveness of measures

**Quality elements:**
Selected during surveillance monitoring their value is indicative of the distance from the optimal performance conditions.

**Most sensitive to pressure:**
Operational monitoring is about elements more sensitive to pressure*

**Management**
Measures (PoMs) manage anthropogenic pressures to reduce their impacts*, to improve system state

*Informed by pressures and impact assessments:
To deliver a systemic understanding the cause-effect relationships between the environment and various anthropogenic activities taking into account the essential features of the system of interest.

Requires deep understanding of catchments and human-nature interdependencies
To assess compliance with the WFD objective of preventing deterioration, 2015 classifications results (based on data up to the end of 2014) using the standards and classification tools used in 2009, were compared with the 2009 classification baseline.

Between 2009 and 2015, out of 34,320 monitored surface water elements:

- 1,658 (4.8%) elements have a lower status
- 27,481 (80.1%) elements maintained their status
- 4,142 (12.1%) elements improved their status
- 1,039 (3%) elements moved from High to Good status

They represent a 7.24% net improvement (2.06% net improvement at >75% certainty) in the status of surface water body elements but a 4% reduction of water bodies at good or better status.

### Water bodies that have deteriorated (at >75% confidence)

<table>
<thead>
<tr>
<th>Water bodies</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface water ecological status</td>
<td>143</td>
<td>2%</td>
</tr>
<tr>
<td>Surface water chemical status</td>
<td>9</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Groundwater quantitative status</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Groundwater chemical status</td>
<td>0</td>
<td>0%</td>
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</tbody>
</table>

### Comparison of 2009 baseline with 2015 predicted and actual results (using the water body network, standards and classification tools used in 2009)

<table>
<thead>
<tr>
<th>Water bodies</th>
<th>2009</th>
<th>2015 predicted</th>
<th>2015 actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface water ecological status</td>
<td>26%</td>
<td>30%</td>
<td>21%</td>
</tr>
<tr>
<td>Surface water chemical status</td>
<td>8%</td>
<td>9%</td>
<td>14%</td>
</tr>
<tr>
<td>Groundwater quantitative status</td>
<td>61%</td>
<td>61%</td>
<td>72%</td>
</tr>
<tr>
<td>Groundwater chemical status</td>
<td>58%</td>
<td>59%</td>
<td>53%</td>
</tr>
<tr>
<td>Overall status</td>
<td>26%</td>
<td>30%</td>
<td>22%</td>
</tr>
</tbody>
</table>
Anglian RBD: Ecological Status of waterbodies in 2009 and 2015
Changes in Ecological Status over 1st cycle (2009-2015)

• Overall net significant deterioration.

• Data indicates 27 less waterbodies at Good or High status.

• PoMs have not resulted in overall net improvements in ecological status of waterbodies.
### Pressures and PoMs in the Anglian RBD

**PoMs:**

- 644 listed cycle 1 measures within Anglian RBD, 255 being “Supplementary measures”

- Many “Locally Derived Measures”, being specific to catchments or waterbodies.

- Focus on indicator improvement rather than reducing pressures – e.g. “eel management plan”.

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**Figure G.3: Pressures affecting the water environment**

<table>
<thead>
<tr>
<th>WFD PRESSURES</th>
<th>Specific pressures considered</th>
</tr>
</thead>
</table>
| **Point source pollution** | - Organic pollution - including ammonia and biochemical oxygen demand  
- Chemicals - including priority hazardous substances, priority pollutants, specific pollutants  
- Other Pollutants - faecal indicator organisms  
- Acidification  
- Nutrients - nitrate, phosphorus  
- Mines and minewaters |

| **Diffuse source pollution** | - Organic pollution - including ammonia and biochemical oxygen demand  
- Other Pollutants - faecal indicator organisms  
- Acidification  
- Nutrients - nitrate, phosphorus  
- Mines and minewaters |

| **Pressures on the quantitative status of water** | - Abstraction and other artificial flow pressures  
- Physical modification - morphology |

| **Other impacts on the status of water** | - Physical modification - morphology  
- Invasive non-native species  
- Biological pressures - including fish stocking, biota removal  
- Sediments  
- “Emerging” substances such as endocrine disrupters  
- Urban and transport pressures  
- Recreation (e.g. boating, fishing)  
- Saline Intrusion into groundwater bodies (resulting from abstraction pressures) |
Criticism

- Its application tends to inflate Type I errors in the classification results and thus a water body could be classified as below “good” status, even if it is not (Borja and Rodriguez, 2010).

- For example, in a study by Prato et al. (2014), results from an integrated assessment of the ecological status in two coastal lakes in Italy were compared to their WFD classifications. Deviation interpreted as supporting the need to shift away from the one out-all out principle.

Misunderstanding

- The difference down to the selection of quality elements in the planning phase – often not done correctly.

- In depth understanding of catchment as a system needed for the appropriate selection of quality elements.

- They should be derived from the pressures and impact analysis and validated by surveillance monitoring, processes often compromised by the tendency for their application to follow traditional approaches in management (European Commission, 2015a).
Reflecting on Implementation

- MSs continued with traditional water management practices, implementing the WFD like any other Directive
- Flexible and experimentalist nature perceived as *ambiguous ambitions*
- Compliance driven implementation that did not trigger a paradigm shift

As the elements serve as indicators of ecological status, this approach implies that measures target symptoms rather than the causes of water degradation.

Capacity building, reporting requirements, meeting deadlines, using exceptions and harmonising the transposition of the WFD paradigm, diverted from the paradigm shift the WFD aimed to trigger.
THE SYSTEM

Catchment

THE SYSTEM

Catchment

Catchments are fundamentally different from each other (both in socio-political and natural conditions)

Pressures

✓ Pressures and associated impacts cause a deviation in system states
✓ Their assessment aims to understand the sources of potential degradation and the degree of risk of failing to achieve the default good status objectives
✗ Insufficient pressure and impact assessment
✗ Treating elements as system components

LEGEND
✓ Required systems thinking for implementing the WFD
✗ Conflict with WFD intentions or lack of systems thinking

Programme of Measures (PoMs)
aim to manage the impacts of anthropogenic pressures
✗ PoMs are often focusing on improving element classifications or are only basic measures without contributing to WFD objectives

Current State

Ecological Status

✓ Ecological Status: performance indicator that compares system state (actual conditions) with good ecological status (a specific set of reference conditions.)
✓ Measures the ‘distance(s)’ between the current environmental state and the desired state
✗ Misunderstandings of role of ecological status

Desired State

Good Status

✓ The state of the system in the absence of any anthropogenic pressures, or a slight biological deviation from what would be expected under natural/undisturbed (reference) conditions.
Implementing the WFD like any other directive is not going to work. Need to allow the WFD to deliver its systemic intent to reach its full potential.

- The WFD requires **in depth catchment understanding** - treat the **catchment as a system** composed of human-nature interdependencies

- **Ecological status** should be used as a tool to inform IRBM and evaluate the **system’s overall performance** and the **effectiveness of PoMs**.

- Clear **links between pressures and measures** should be developed by understanding catchment interdependencies

- **Interdisciplinary research and knowledge integration** – through collaborative participatory approaches – are needed

- The nature of the **Ecosystem Services** as both a concept and as potential **indicator of ecosystem state** signifies an emerging trend that could facilitate WFD implementation and provide the right conditions to effectively achieve the broader objectives of the Directive.
Thanks to Theo Giakoumis and Aiken Besley for their help with this presentation