SDG Indicator 6.3.2
Caribbean Region
Target Values 26th May 2022

Proportion of bodies of water with good ambient water quality

Stuart Warner UNEP GEMS/Water

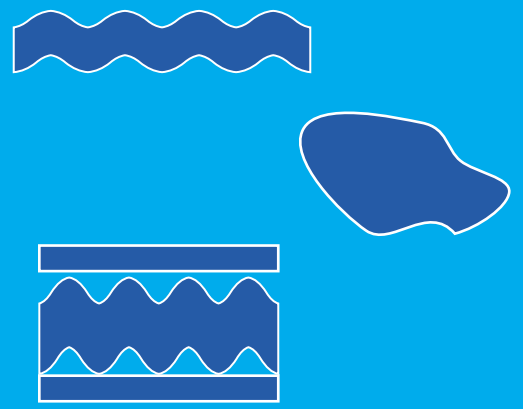
Methodology overview

Water bodies

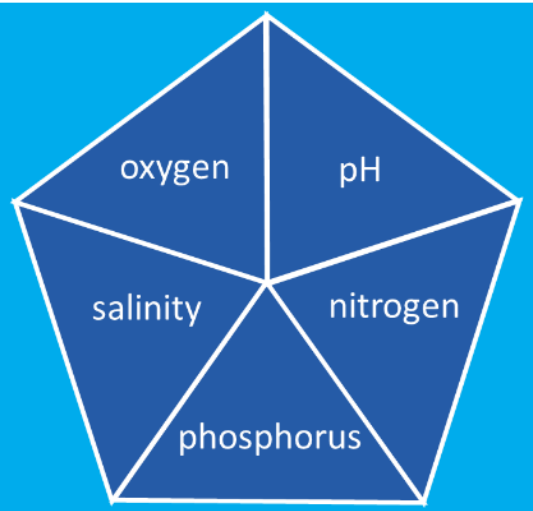
rivers,

lakes, and

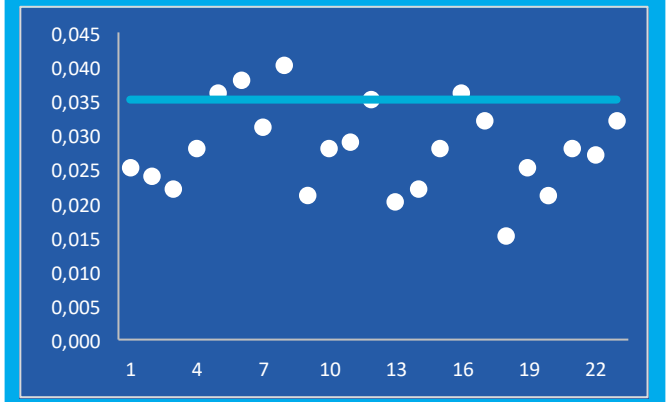
groundwaters



Water quality is classified by comparing measurements with **target values** for specific **parameters** from specific **parameter groups**



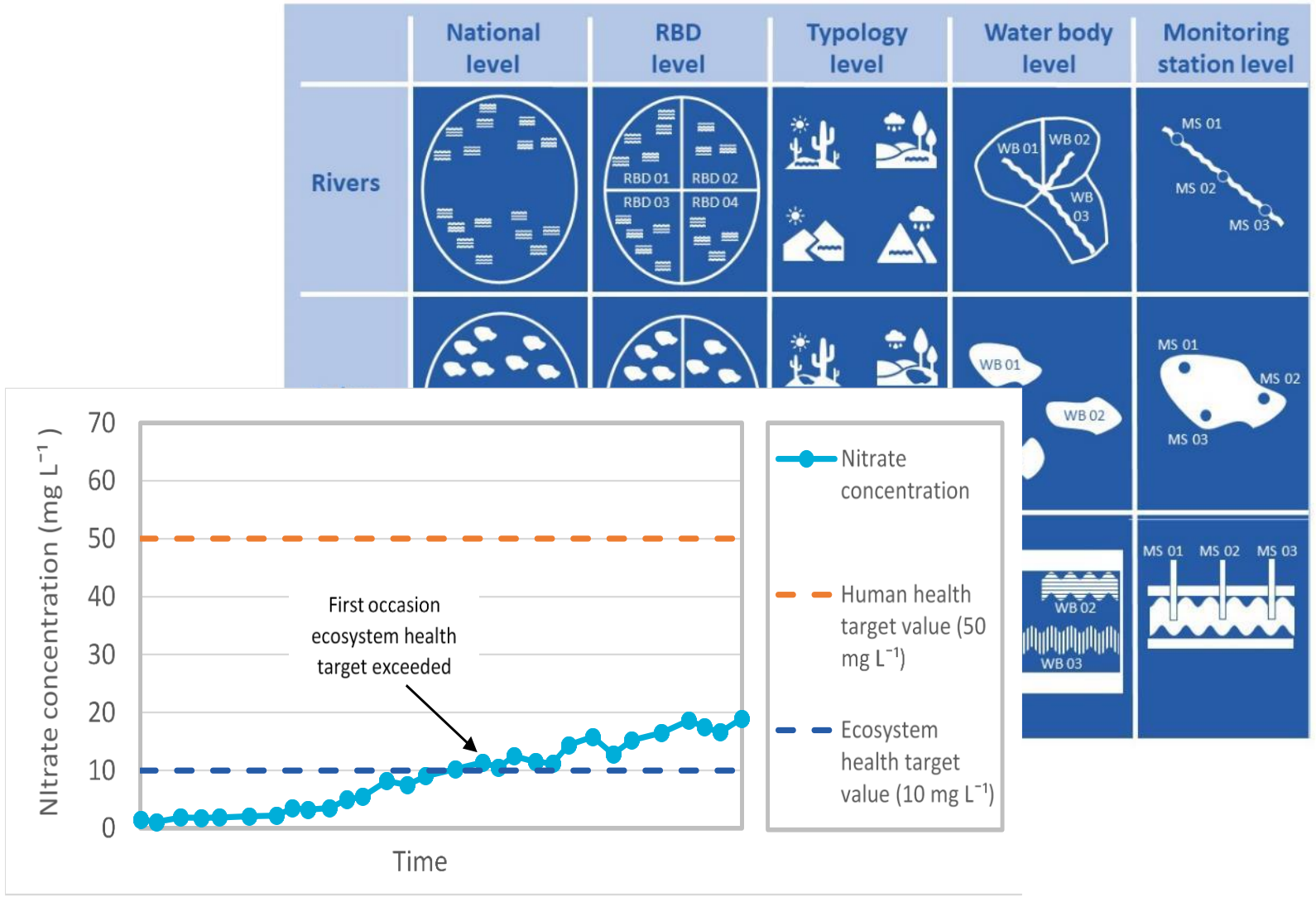
Good water quality represents at least **80%** compliance of measurements with target values



Target-based approach

Measured values are compared to numerical target values that represent “good ambient water quality”

These targets can be national, or more specific.



Introduction

This presentation is aimed at practitioners seeking further clarification on how to implement SDG indicator 6.3.2 in their own country.

This presentation:

- expands on the target value concept presented;
- outlines the challenges to setting meaningful target values;
- suggests approaches to setting and/or adapting existing target values from other jurisdictions for national use; and
- provides examples of targets used in different world regions.

Introduction

Indicator 6.3.2 uses a target-based approach to classify water quality.

Countries set their own target values.

Targets may be water quality standards that are defined by national legislation, or derived from knowledge of the natural or baseline status.

Targets should protect both ecosystem and human health.

Targets can be nation-wide values, or they can be water body or even site-specific.

What are target values?

Physico-chemical parameters of water, are compared to a numerical concentration limits that represent **water of good ambient quality.**

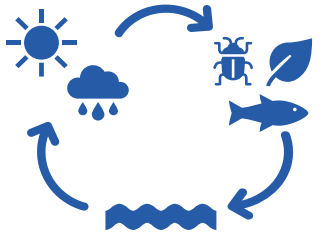
Target values represent concentrations that **preserve ecosystems** or to return them to their natural or near-natural condition.

The targets must also ensure that **human health** is not directly threatened by consumption or use of the water.

Establishing a **harmonised** approach, and applying a common strategy to setting targets, helps to ensure the global comparability of the indicator.

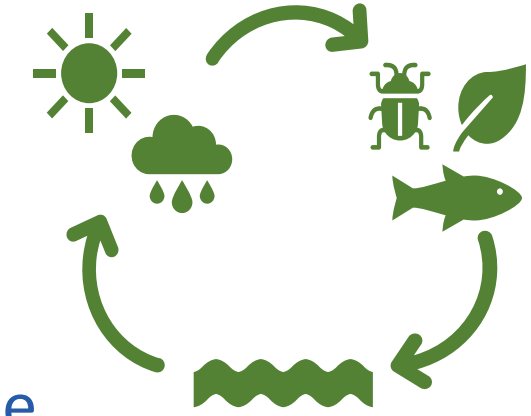
Target Value Essentials – Human or Ecosystem Health

The process to define target values for classification of water bodies should consider both **ecosystem** and **human** health.



Target Value Essentials – Human or Ecosystem Health

Aquatic ecosystems are adapted to the water quality at that location.



In certain cases, water quality in its natural state may be harmful and not suitable for human use without prior treatment.

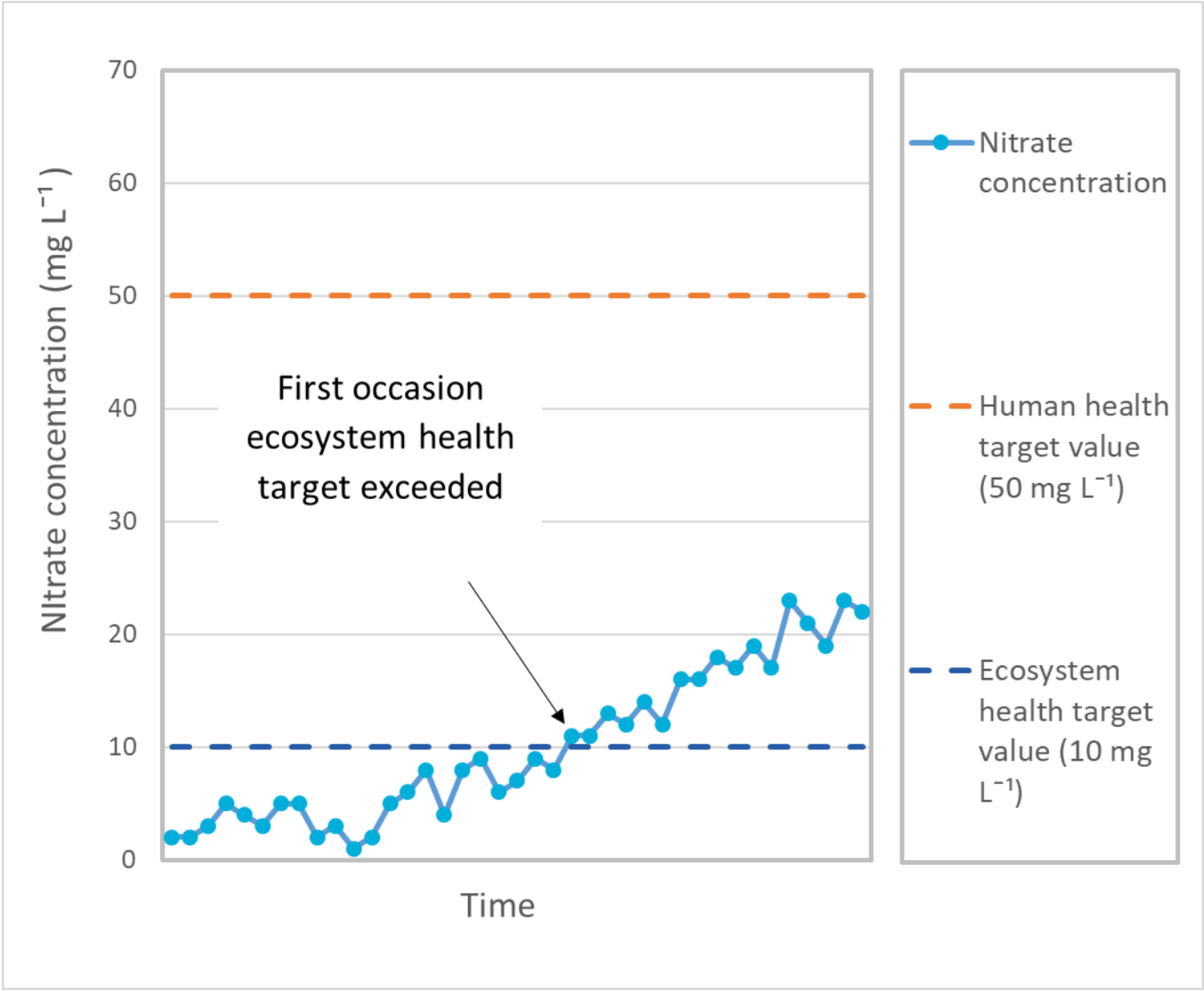
Nitrate concentrations can naturally exceed the 50 mg L^{-1} guideline recommended by the WHO for drinking water. Also, water can naturally have concentrations of arsenic and fluoride at toxic levels.

In these cases, the natural water quality may be perfectly suited to the ecosystem, but human health may be at risk.

Target Value Essentials – Human or Ecosystem Health

The opposite may also be true. Targets based on human health may overlook the requirements of ecosystem health! The WHO drinking water standard maybe safe for human consumption but may have consequences for ecosystem health!

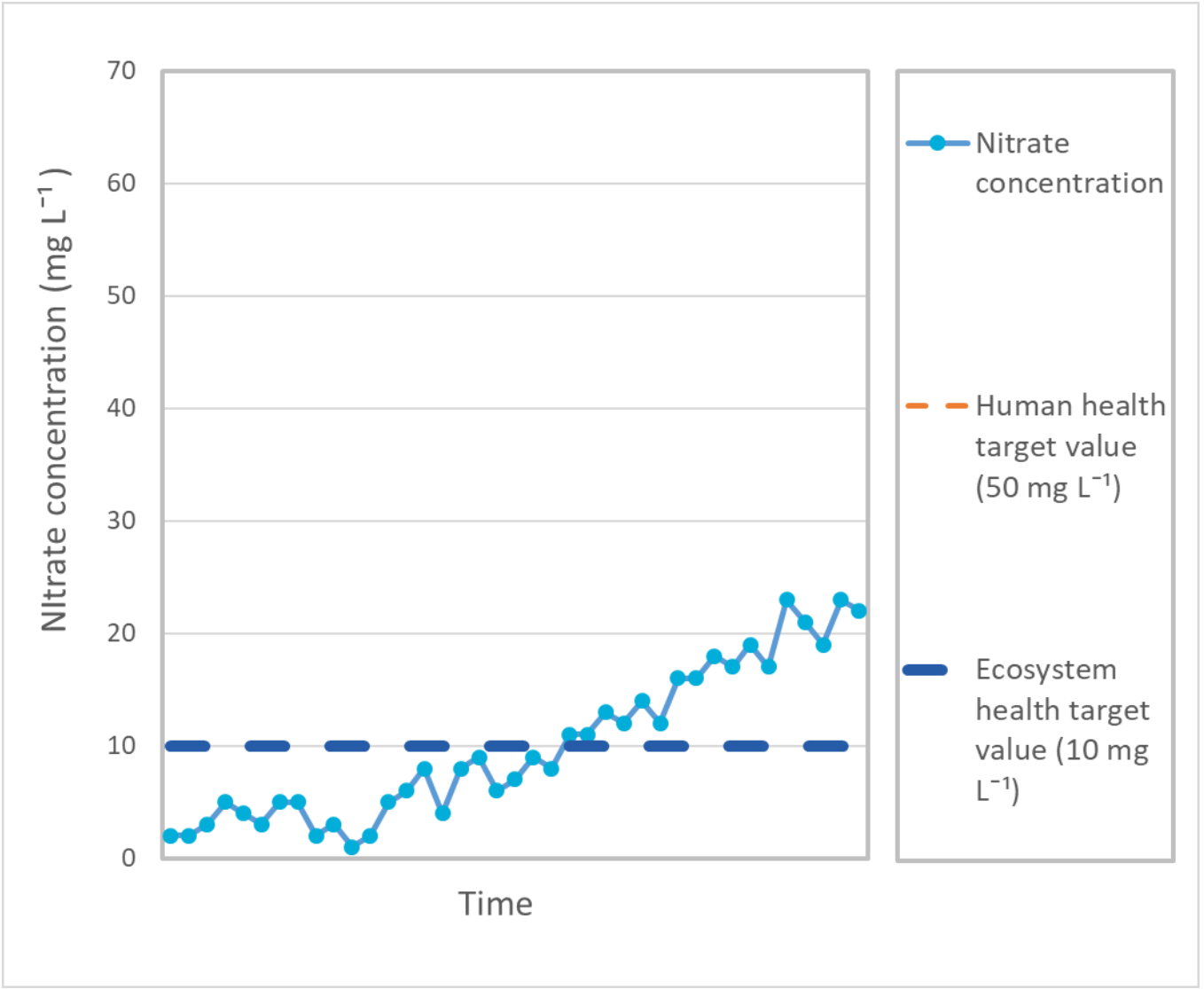
A much lower ecosystem-based target value that reflects the naturally low background nitrate level would be better.



Target Value Essentials – Human or Ecosystem Health

In situations where target values for both ecosystem and human health are relevant, **it is the most stringent that should be applied for indicator 6.3.2.**

There are some water bodies that may never achieve "good ambient water quality" classification because the natural water quality may not ever be suitable for human use without prior treatment.



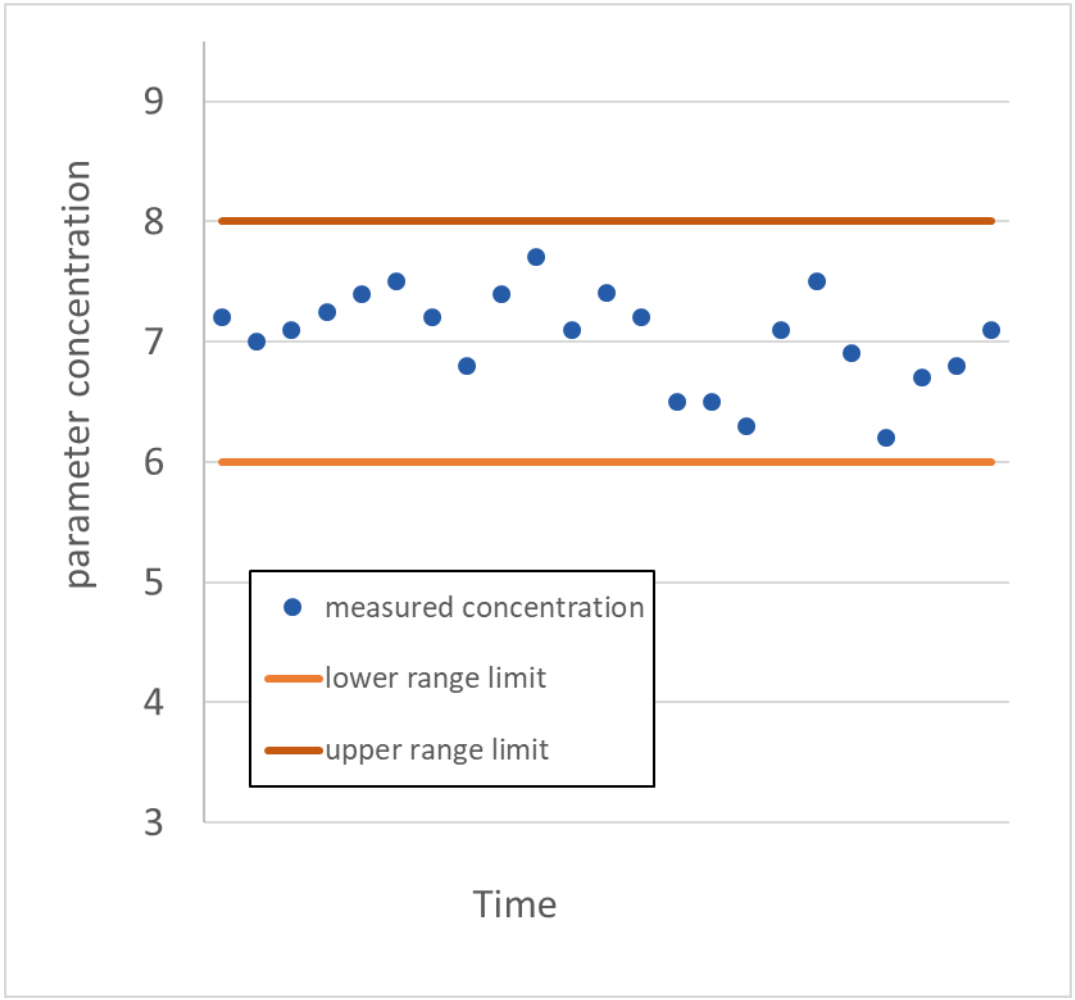
Target Value Essentials – Reference Conditions

Water quality measurements for water bodies in a natural or near natural condition, should fall within ranges that reflect **reference conditions**.

Some rivers may have:

- high dissolved oxygen concentration,
- low nutrients, and have
- pH and electrical conductivity values that are related to the geology and the proximity to the coast.

Measuring repeatedly over time will produce a **range** that can be defined statistically within which the majority of measurements should fall.

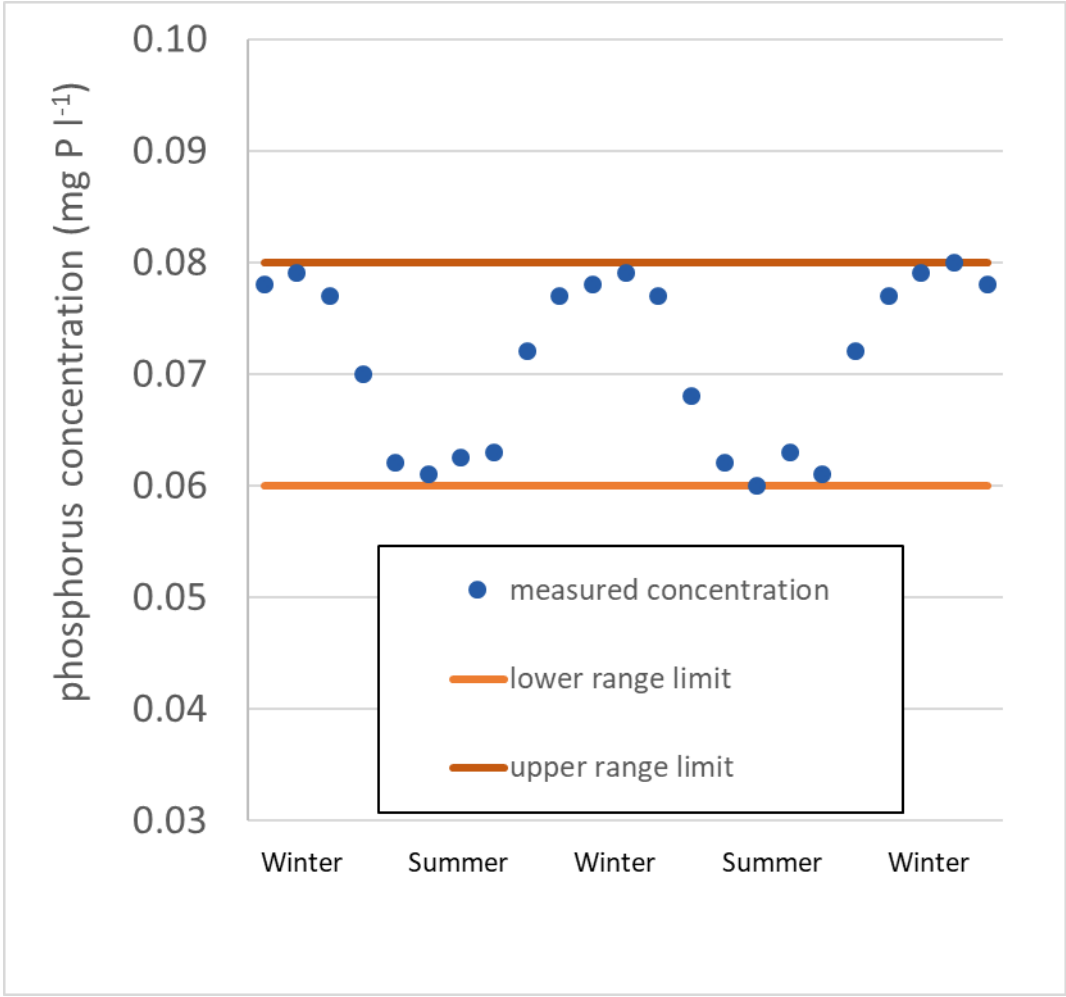


Target Value Essentials – Reference Conditions

There could also be diurnal or seasonal patterns but there should not be any upward or downward trend over time.

Target values are not the same as reference conditions, but they are closely linked.

A target value may be derived from a known or estimated reference condition, assuming that a slight deviation from the reference condition does not harm ecosystem function.



Target Value Essentials – Reference Conditions

Each water body is unique and differs by certain natural characteristic. These characteristics influence natural water quality.

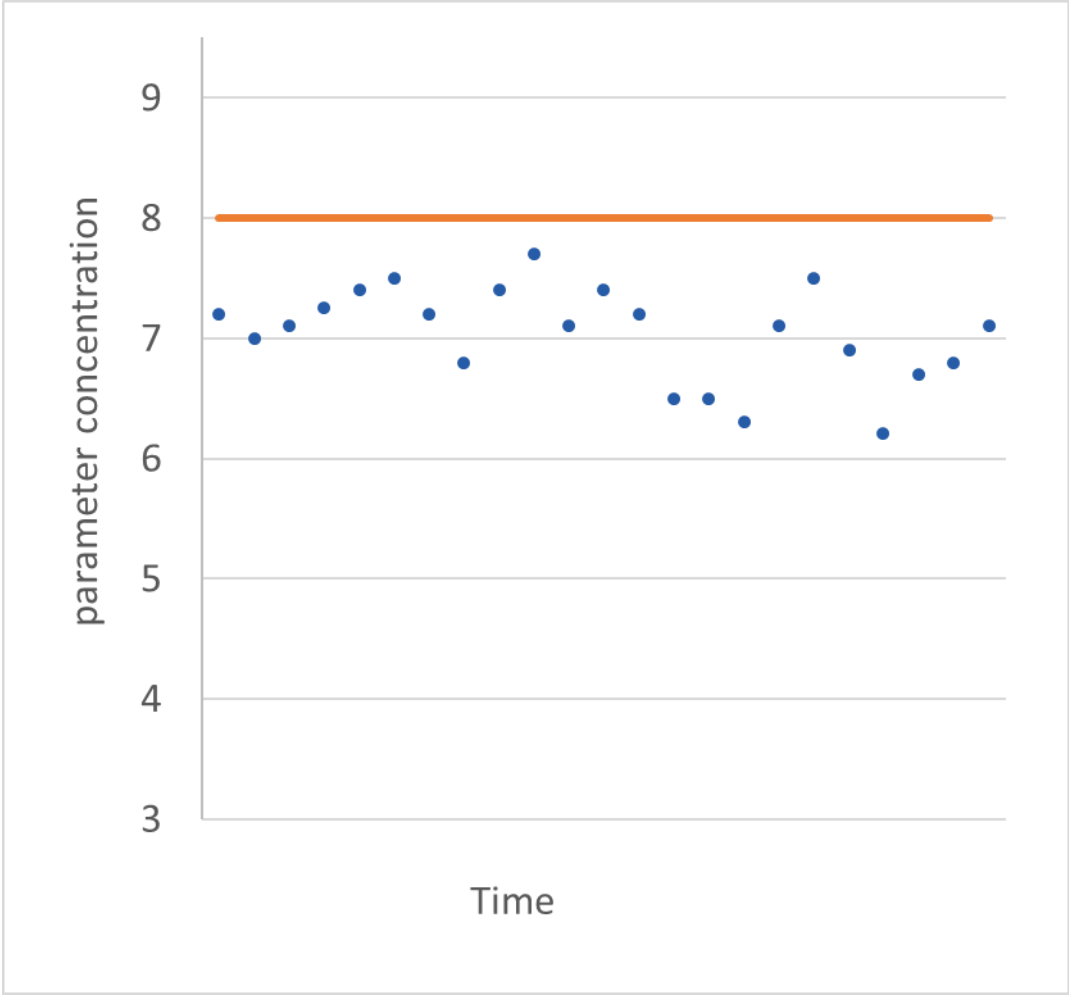
Characteristic	Description	Example of mechanism for influence
Location	latitude/longitude; elevation; depth below ground (for groundwaters) and proximity to coast	Latitude: defines seasonality with differences observed between tropical and temperate surface waters.
Geology	the structure and lithology of rock matrix underlying the catchment area	Chemical weathering: underlying geology with high solubility may lead to surface and groundwaters with higher concentrations of dissolved compounds compared with less soluble lithologies.
Climate	the long-term trends of precipitation, temperature, wind and humidity of an area	Temperature: the solubility of gases in water decreases with increasing temperature. This is especially relevant for dissolved oxygen which is required by aquatic animals and plants for respiration.
Topography	the arrangement and shape of the physical landscape	Gradient and length of slope: determines velocity of river flow. Higher velocity water also has higher concentrations of dissolved oxygen, due to turbulence at the surface.
Biology	the ecosystems within the catchment area and the biological interactions within the water body	Wetlands: these ecosystems can directly affect water quality by trapping sediment, uptake of nutrients, reducing velocity of water flow and release of dissolved organic carbon downstream.

Target Value Essentials – Upper, Lower or Range Values

Target values can be of three types depending on the parameter being measured.

Some parameters will have **upper** target values meaning the value should not be exceeded.

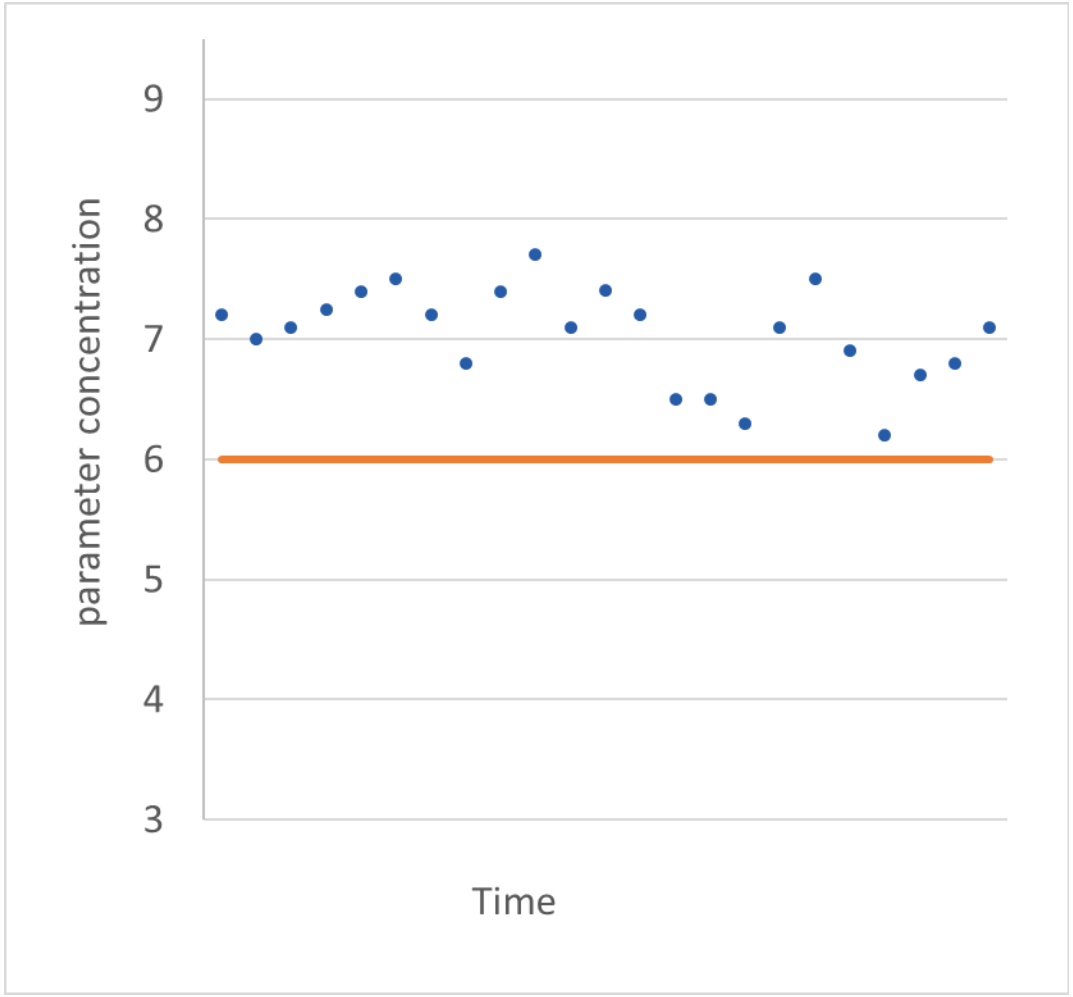
For example, measurements of nutrients should not exceed their targets.



Target Value Essentials – Upper, Lower or Range Values

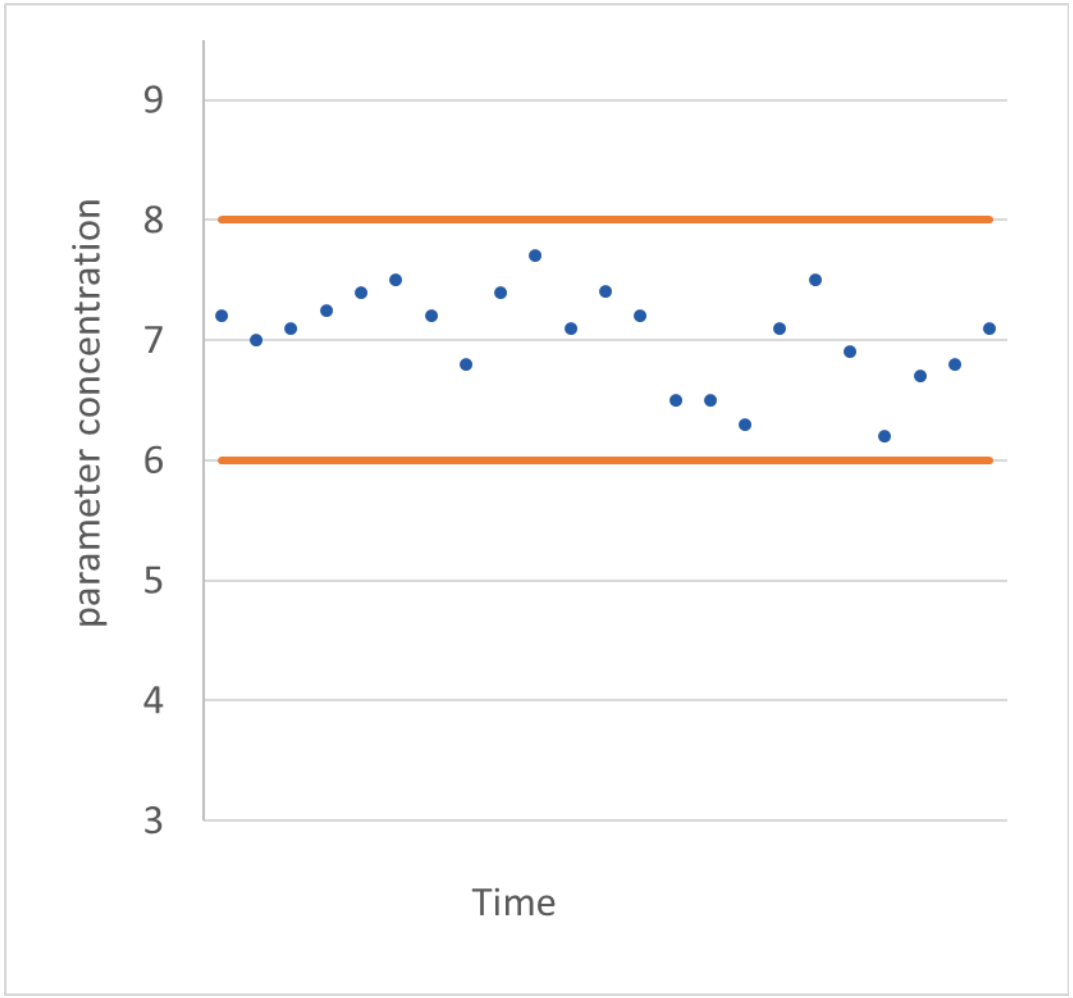
Some will be **lower** target values, meaning the measured value should not be below the target.

For example, a target value of 80 per cent saturation may be applied to dissolved oxygen in rivers, and all measured values should be above this.



Target Value Essentials – Upper, Lower or Range Values

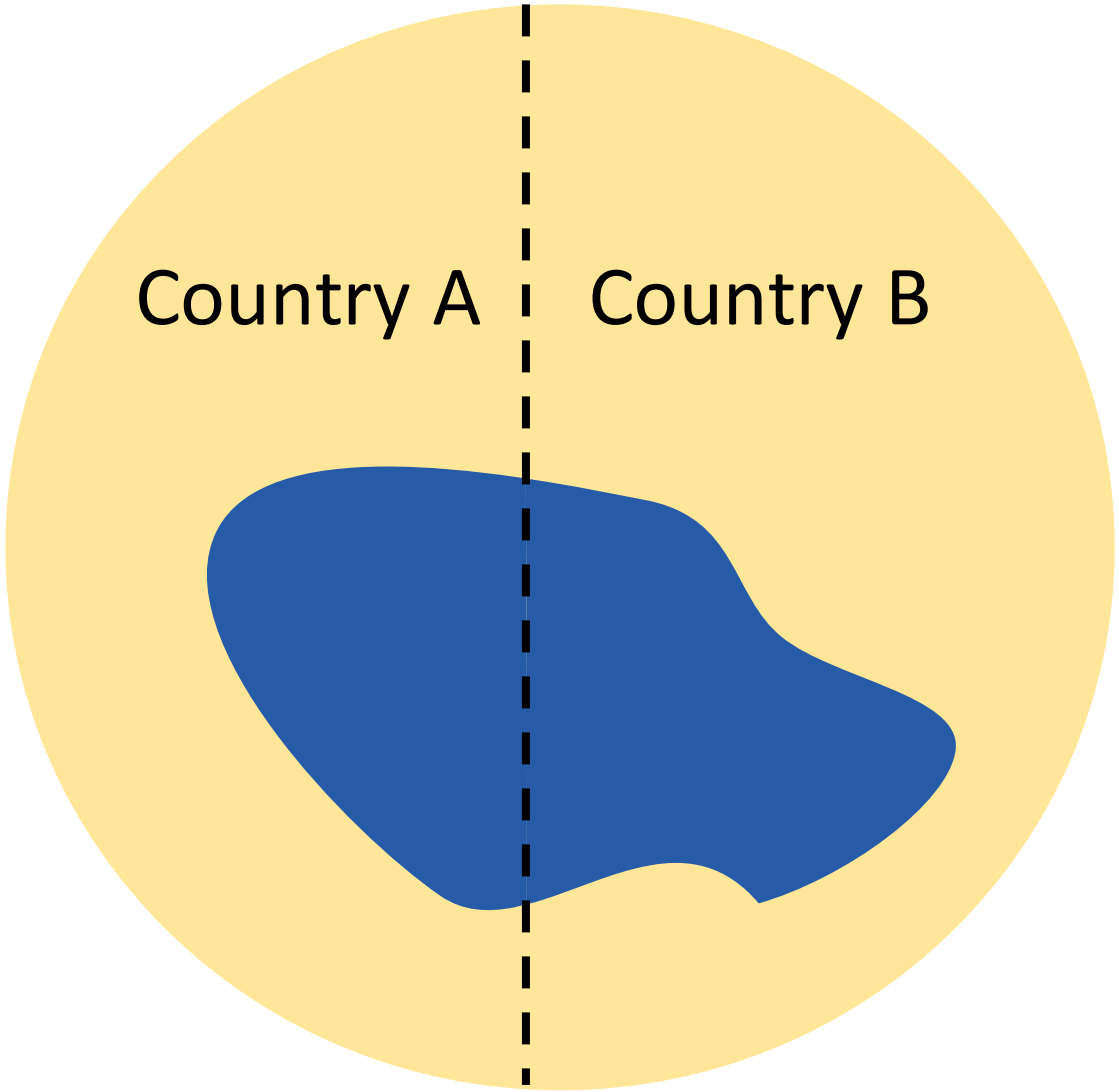
Some parameters will have a target **range** which represents the normal acceptable upper and lower measurement limits.



Target Value Essentials – Transboundary Target Values

Countries that share transboundary waters are encouraged to collaborate to set target values.

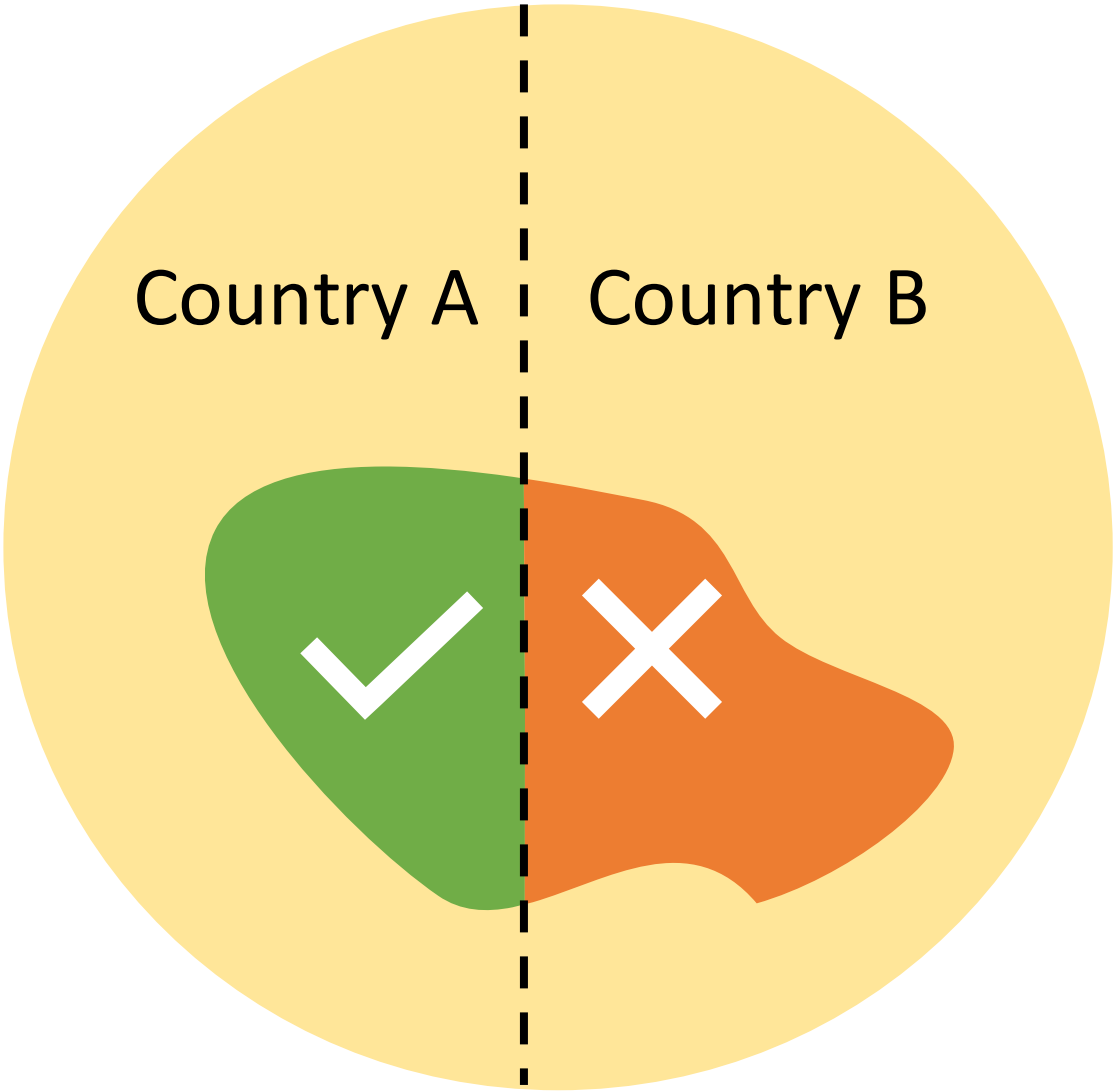
Different target values in neighbouring countries may lead to different classifications of the same water body.



Target Value Essentials – Transboundary Target Values

Countries that share transboundary waters are encouraged to collaborate to set target values.

Different target values in neighbouring countries may lead to different classifications of the same water body.



Target Value Essentials – Specificity of Target Values

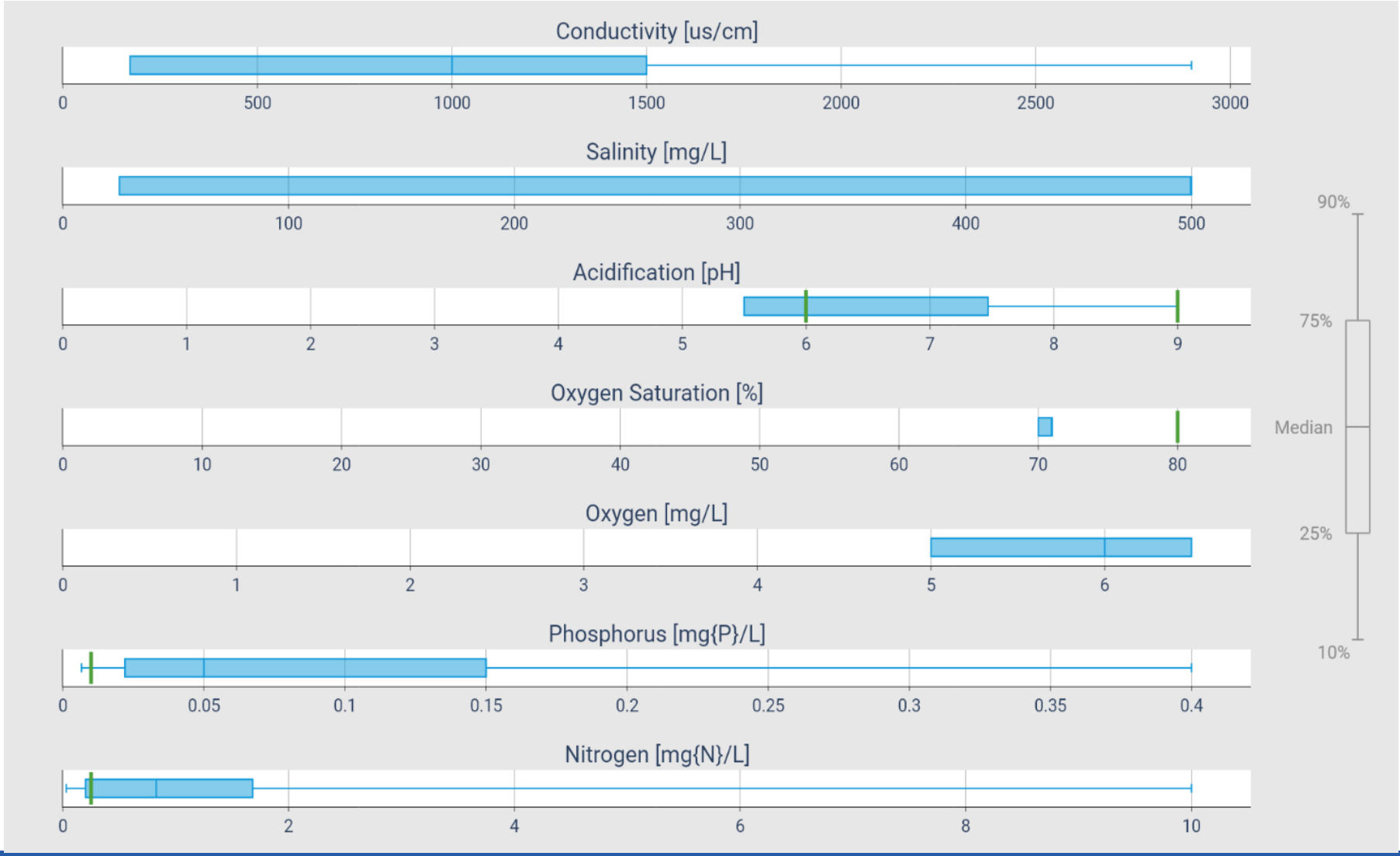
Many countries apply national level targets.

This approach is more straightforward to apply and can be useful for certain parameters, such as dissolved oxygen or pH.

However, such broad targets do not take account of the natural diversity of water bodies and, therefore, may fail to protect water quality.

Countries are encouraged to generate specific targets where resources and information to do so are available.

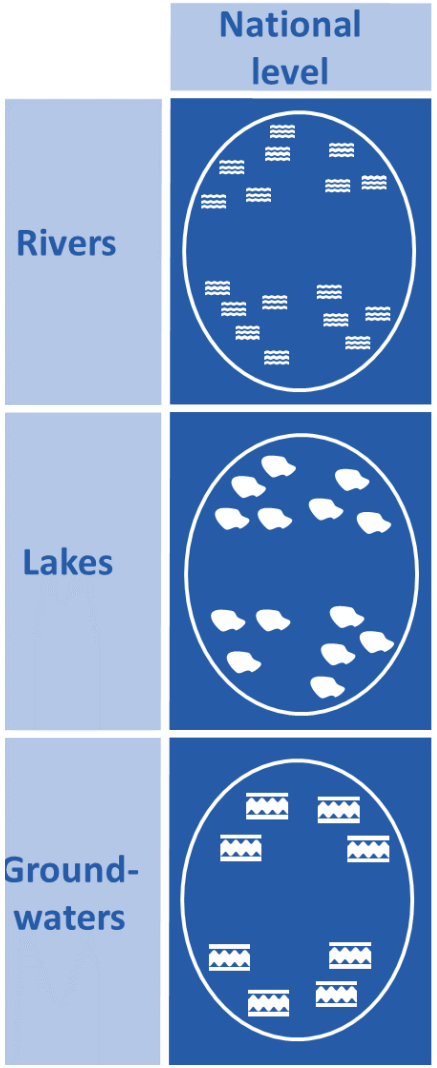
Summary of Targets reported in 2020

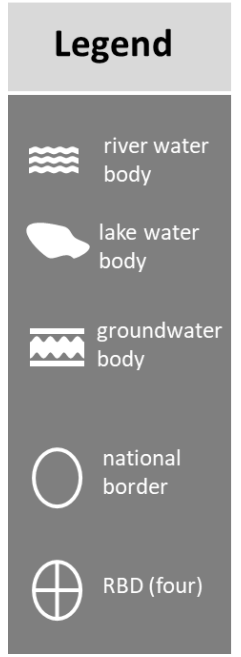


Target Value Essentials – Specificity of Target Values

The national level
A single numerical value (or range) for each waterbody type.

For example, a single value for rivers, another for lakes and a third for groundwaters, for each parameter.

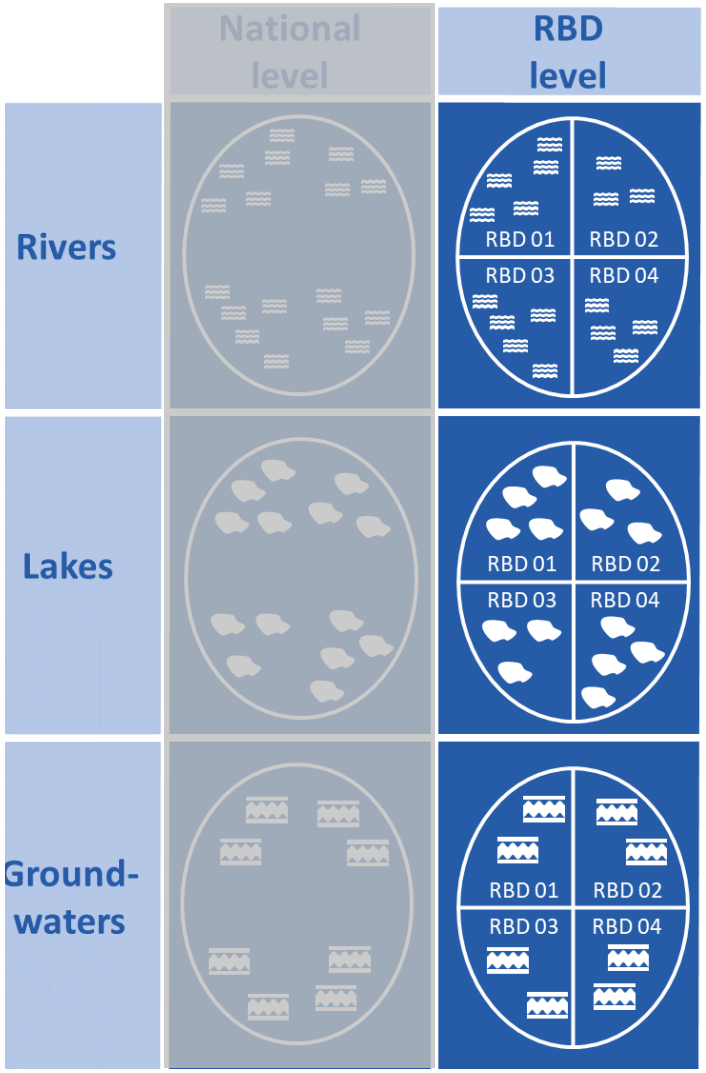




Target Value Essentials – Specificity of Target Values

The RBD level
a set of targets defined specifically for each RBD.

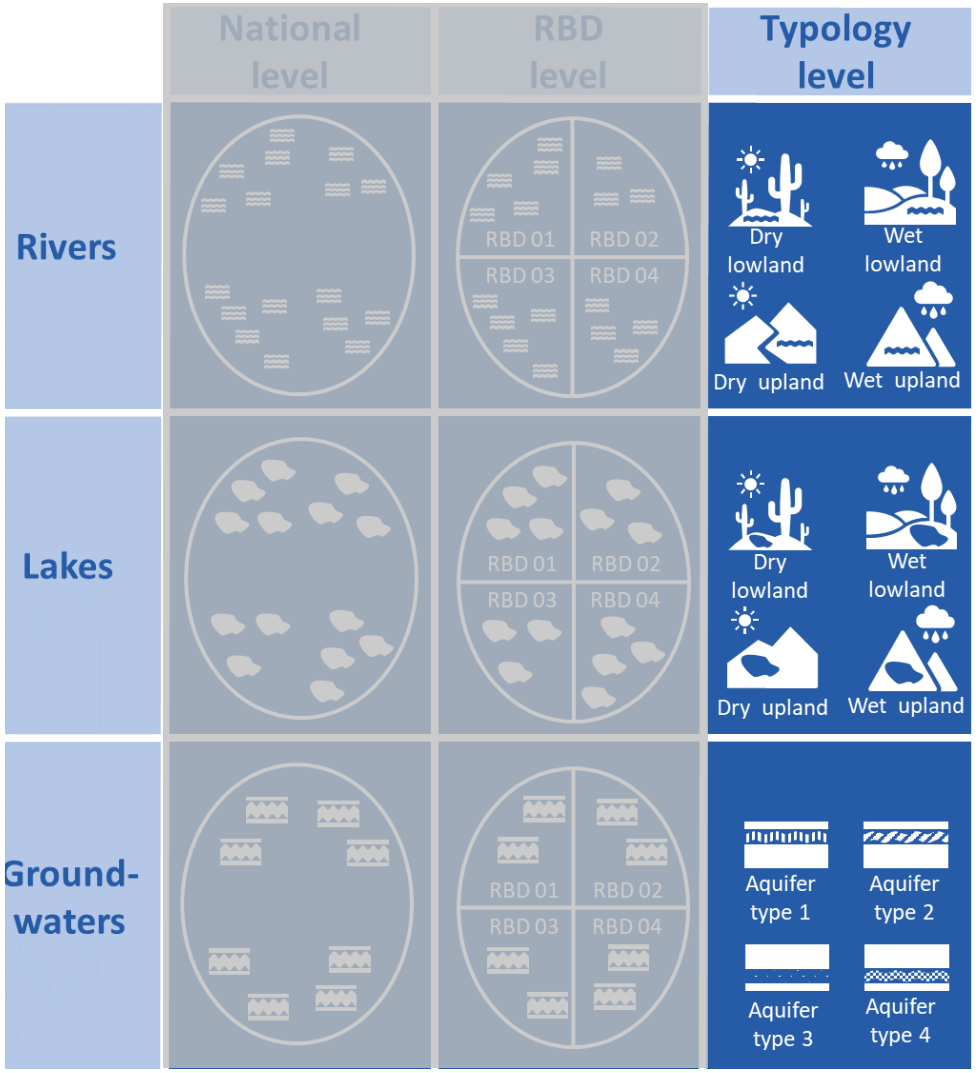
A country may decide that RBDs are sufficiently different to warrant their own target values.

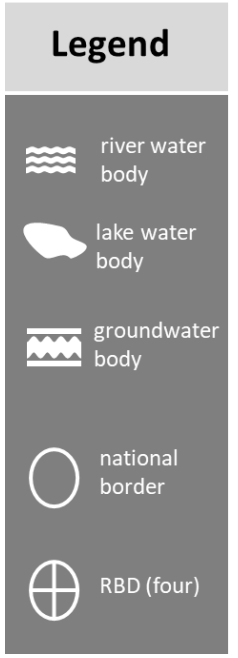


Target Value Essentials – Specificity of Target Values

The typology level
A set of targets for each type of water body identified in the country.

For example, an upland river in an area of high annual rainfall, or an aquifer of a particular lithology.

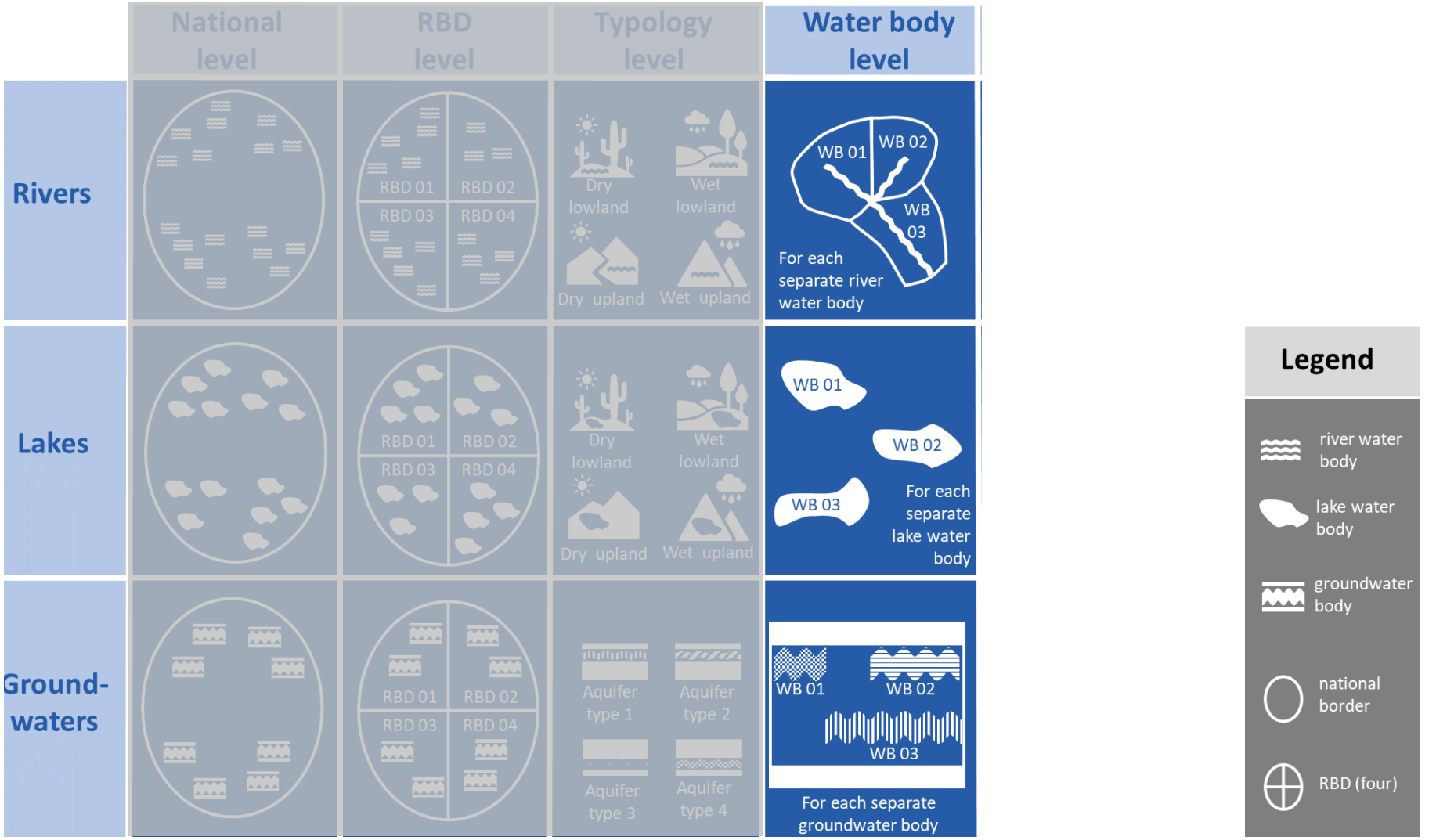




Target Value Essentials – Specificity of Target Values

The water body level
A set of targets for each specific water body.

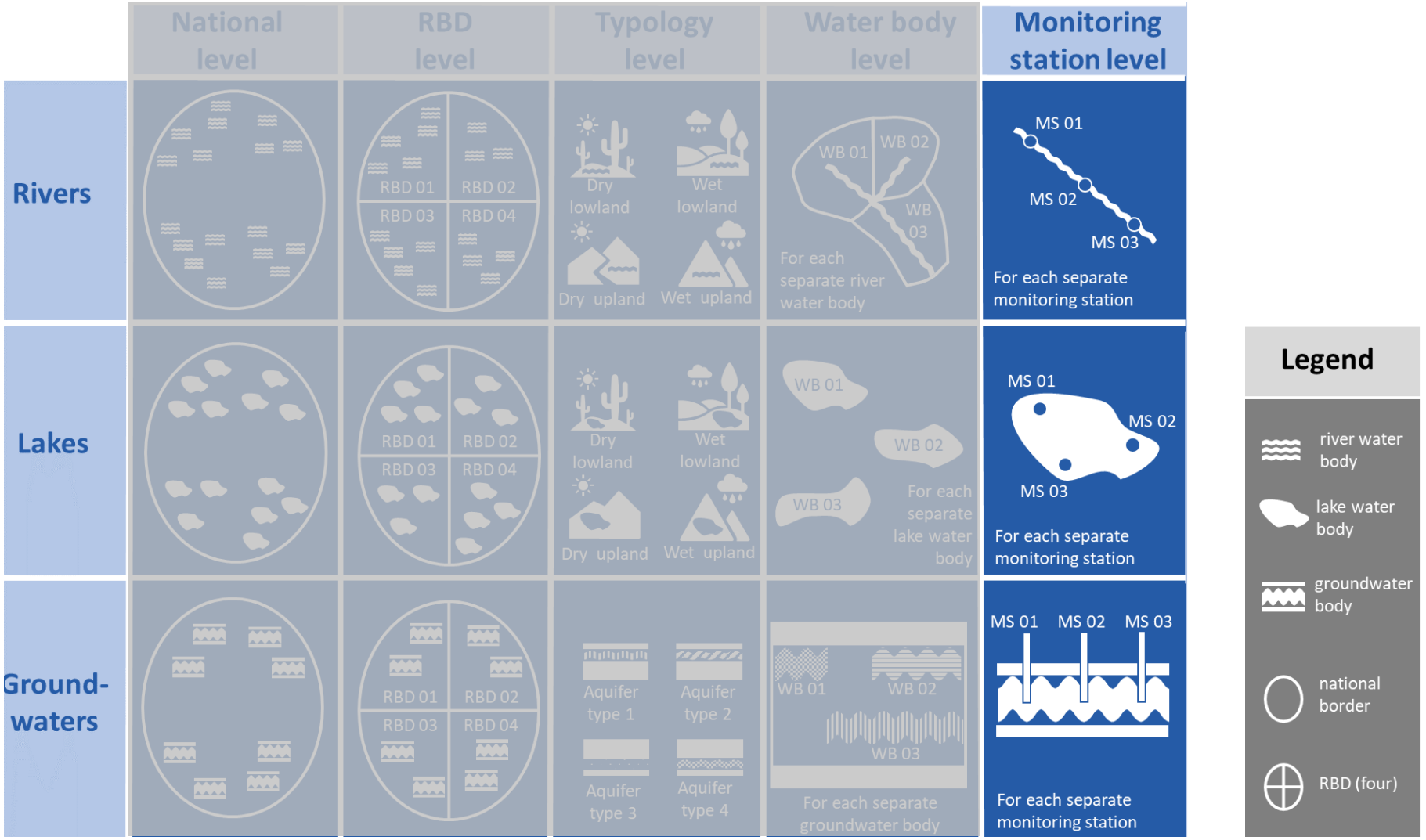
For example, this approach might be needed t align with neighbouring countries for a specific transboundary water body.



Target Value Essentials – Specificity of Target Values

The national level
Specific target values for monitoring stations.

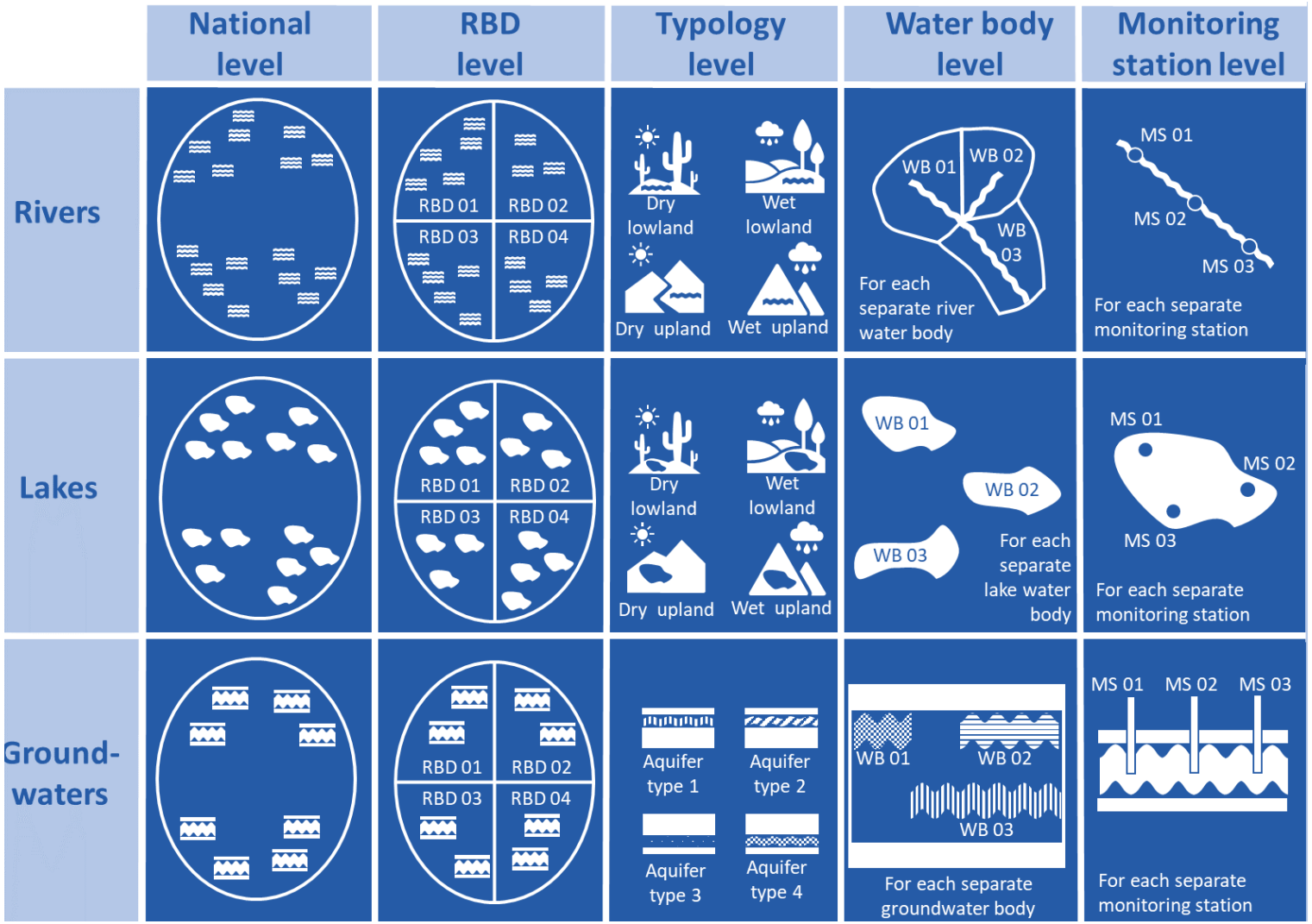
This would only be necessary in cases where the natural water quality is highly spatially variable.



Target Value Essentials – Specificity of Target Values

Countries are encouraged to generate specific targets where resources and information to do so are available.

National targets may be suitable for oxygen and pH, whereas more specific targets may be needed for N, P and salinity.



Target Value Essentials – Specificity of Target Values

This example from Australian and New Zealand Environment and Conservation Council is an extract from the water quality guidelines produced in 2000.

Broad geographical regions were defined which were then sub-divided based on climatic zones and administrative areas.

Ecosystem type	TP ($\mu g\ L^{-1}$)	TN ($\mu g\ L^{-1}$)	DO (% saturation)		pH		EC ($\mu S\ cm^{-1}$)	
			lower limit	upper limit	lower limit	upper limit	lower limit	upper limit
Upland river (>150 m)	20	250	90	110	6.5	7.5	30[a]	350[a]
Lowland river	50	500	85	110	6.5	8.0	125[b]	2200[b]
Lakes and reservoirs	10	350	80	110	7	8.5	20[c]	30[c]

Target Value Essentials – Specificity of Target Values

The **natural trophic status** of surface waters is another important consideration.

Natural eutrophication takes centuries in leading to a change in the productivity, biomass and sediment (different from artificial or cultural eutrophication!).

This table lists the ranges of total phosphorus associated with each trophic state in Canadian lakes and rivers.

Trophic Status	Total phosphorus (µg P L^{-1})
Ultra-oligotrophic	< 4
Oligotrophic	4-10
Mesotrophic	10-20
Meso-eutrophic	20-35
Eutrophic	35-100
Hyper-eutrophic	> 100

Optional Target Values

In response to requests, guidance for global target values for each of the core parameter groups is now available.

Defining numerical values that reflect good water quality at the global are unlikely to be the most appropriate and may fail to protect ecosystem health at national or local levels.

Countries that currently do not have targets in place, can adopt these values in the short-term until sufficient data are available to generate more relevant, and therefore more appropriate targets.

Optional Target Values

This table lists the various targets for the core parameter groups for each of the water body types. The following slides describe how these were derived.

Parameter Group	Parameter	Target type	Rivers	Lakes	Groundwaters
Oxygen	Dissolved oxygen	range	80 – 120 (% sat)	80 – 120 (% sat)	-
Salinity	Electrical conductivity*	upper	500 µS cm^{-1}	500 µS cm^{-1}	500 µS cm^{-1}
Nitrogen	Total Nitrogen	upper	700 µg N l^{-1}	500 µg N l^{-1}	-
	Oxidised nitrogen	upper	250 µg N l^{-1}	250 µg N l^{-1}	250 µg N l^{-1}
Phosphorus	Total phosphorus	upper	20 µg P l^{-1}	10 µg P l^{-1}	-
	Soluble reactive phosphorus	upper	10 µg P l^{-1}	5 µg P l^{-1}	-
Acidification	pH	range	6 – 9	6 – 9	6 – 9

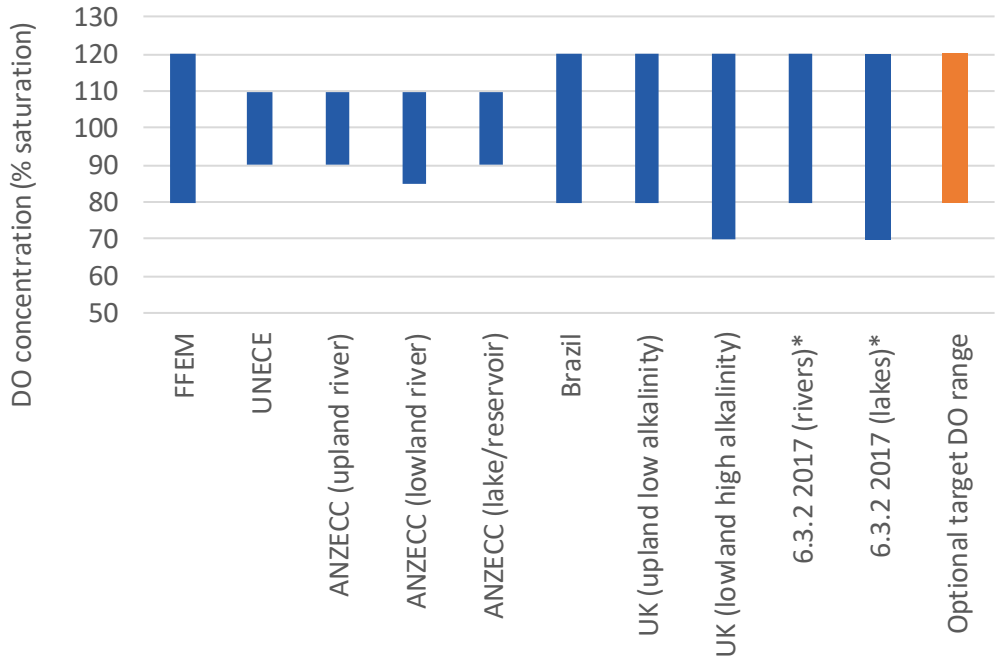
* For electrical conductivity the

Optional Target Values – Oxygen

The optional target range for dissolved oxygen is between **80 and 120 per cent saturation**.

Per cent saturation rather than concentration is suggested. Using a concentration of dissolved oxygen (such as 9 mg L^{-1}) is not recommended because of the influence of temperature on oxygen saturation.

The measured DO concentration of 6.8 mg L^{-1} in water at 25 °C equates to 82.4 per cent saturation, whereas in colder water of 10 °C, this same concentration would equate to a saturation of 60.3 per cent.



*median lower limit and occasionally upper limit not always reported

	Rivers	Lakes	Groundwaters
Oxygen	80 – 120 (% sat)	80 – 120 (% sat)	-

Optional Target Values – Salinity

Naturally, freshwater EC concentrations can vary between 10 and 1000 µS cm^{-1}.

The lithology of the catchment's underlying bedrock and the proximity to the coast are the primary determinants of EC.

An optional target value of **500 µS cm^{-1}** is proposed

This value is lower than the majority of those reported during the 2017 data drive (median target for surface water RBDs was 800 µS cm^{-1}) but, in the absence of better information on the water body reference conditions, it can be used as an interim target value.

In the absence of sufficient data, a target of below **500 µS cm^{-1}** for electrical conductivity is suggested.

It is preferable and recommended that more specific targets are defined using a range between the 10th and 90th percentiles from a reference monitoring period or location.

Optional Target Values – Nitrogen

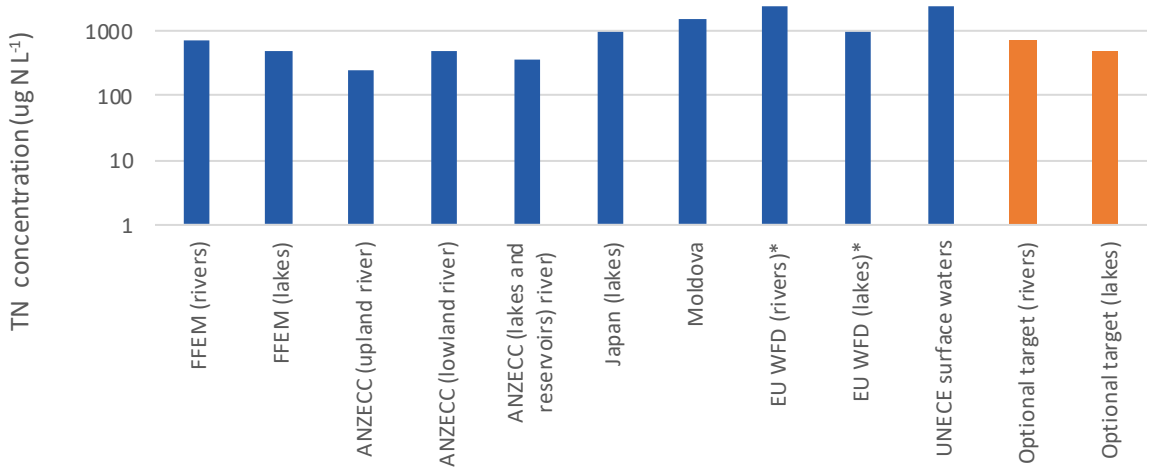
Countries can choose to report any form of nitrogen that exist in freshwaters.

The most commonly reported forms are **total nitrogen** and **total oxidised nitrogen** (nitrate plus nitrite).

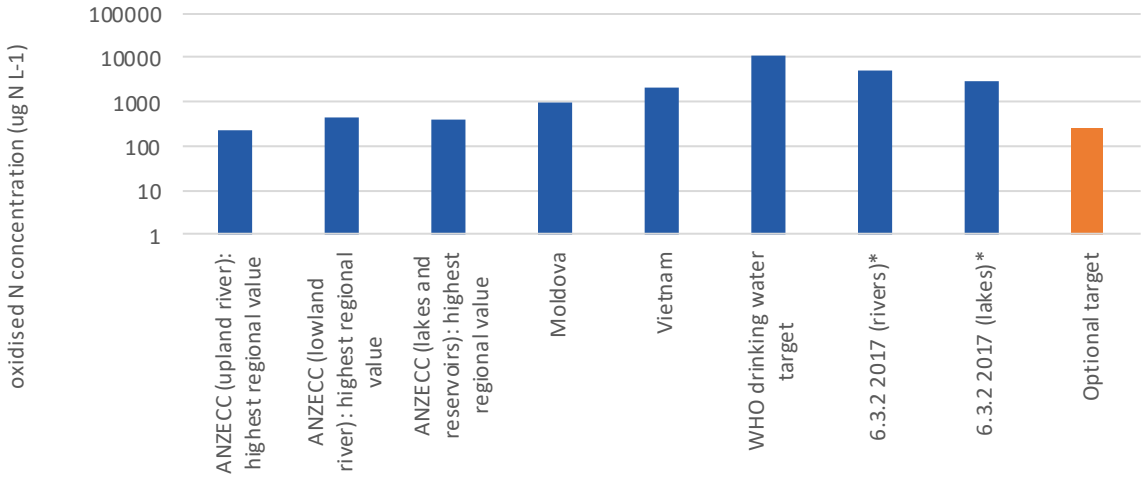
Shown here are target values applied in various jurisdictions for surface waters.

Based on these values, the optional target values are shown in this table.

	Rivers	Lakes	Groundwaters
Total Nitrogen	**700 µg N l^{-1}**	**500 µg N l^{-1}**	**-**
Oxidised nitrogen	**250 µg N l^{-1}**	**250 µg N l^{-1}**	**250 µg N l^{-1}**



**median of good/moderate boundary*



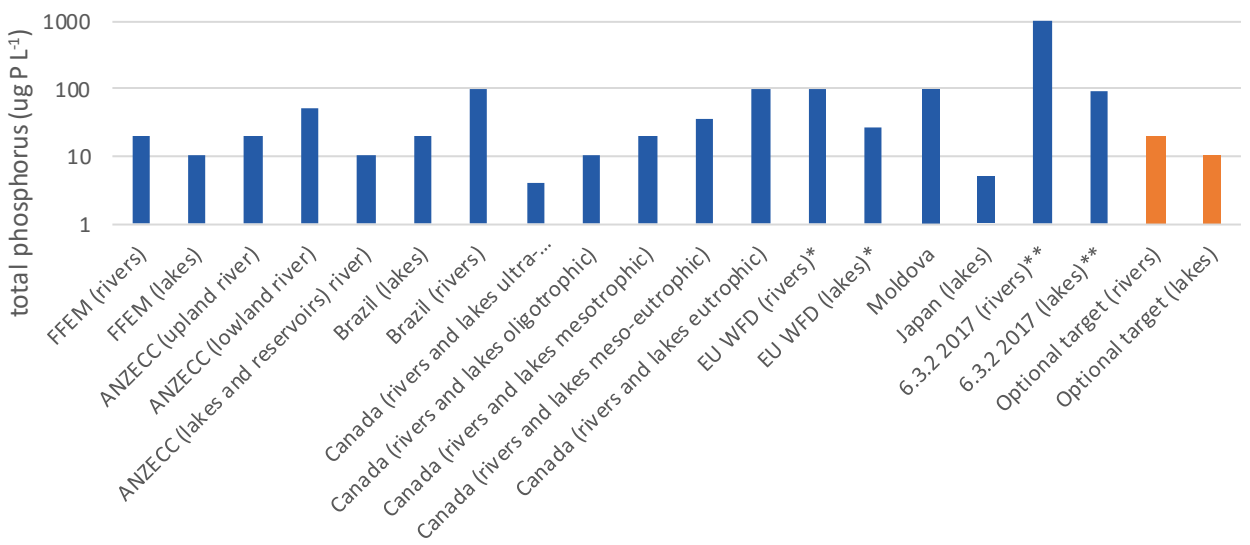
Optional Target Values – Phosphorus

Orthophosphate (OP) is the most straightforward form of phosphorus to measure.

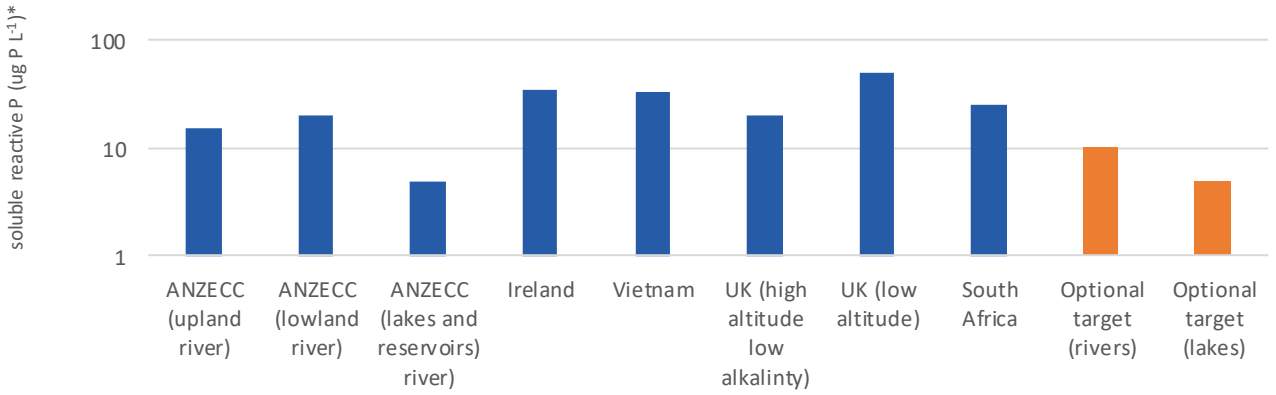
Total Phosphorus includes all forms of phosphorus that are present in a sample. It can indicate the potential for long-term impacts from phosphorus bound to particulate matter, and then serve as a phosphorus source if remobilised in the future.

The optional targets for phosphorus are shown in this table.

Parameter	Rivers	Lakes
Total phosphorus	20 µg P l^{-1}	10 µg P l^{-1}
Soluble reactive phosphorus	10 µg P l^{-1}	5 µg P l^{-1}



*median of good/moderate boundary
**median



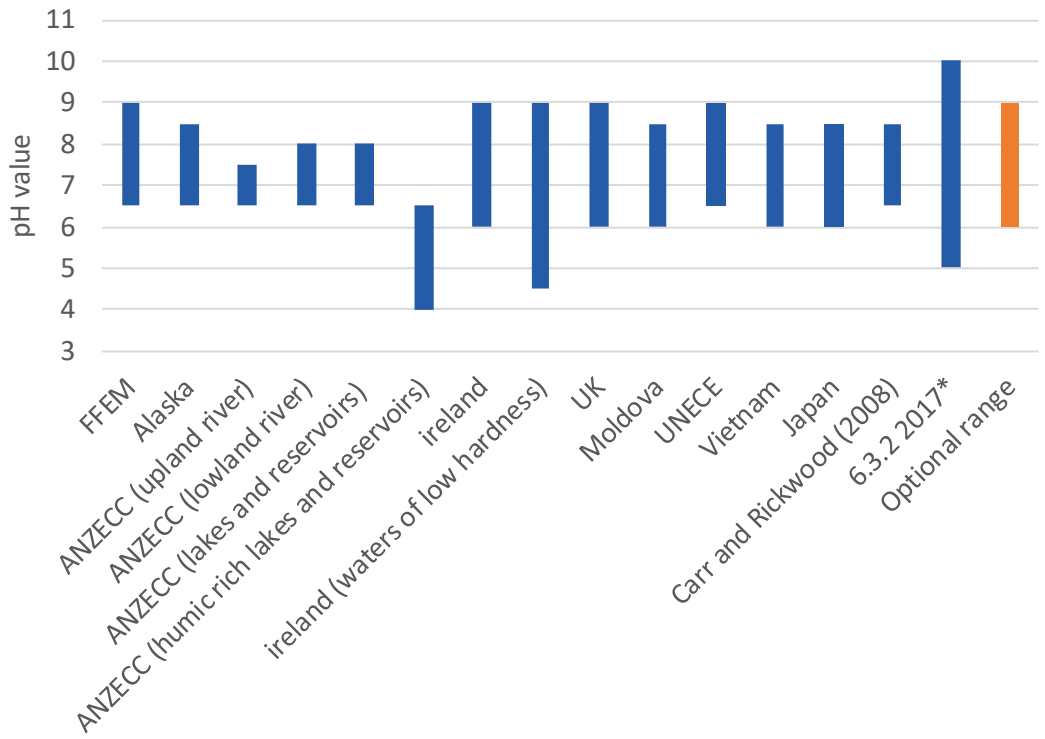
Optional Target Values – Acidification

The acidification parameter group is most commonly reported using the parameter **pH**.

The majority of freshwaters are naturally near neutral (pH 7) but they can naturally be acidic, or slightly alkaline.

Shown here are various target pH ranges used in jurisdictions designed for the protection of ecosystems and aquatic life.

The optional target range for pH is between 6 and 9.



**the 6.3.2 2017 values include the maximum and minimum of all values reported*

	All freshwaters
pH	6 – 9 pH units

Summary

Target values are central to the SDG indicator methodology, which provide a straightforward method of water body classification.

One limitation of the approach is that the classification assigned is very sensitive to the choice of target value used. The indicator score reported could be either more positive or negative than the reality.

The optional target values suggested here provide a starting point for countries looking to develop new targets and a benchmark against which to compare existing targets.

Efforts to set more specific target values will lead, in time, to a more robust classification of water bodies and, subsequently, to more efficient allocation of resources to improve water quality.

It will provide clearer and more reliable understanding of which water bodies are under threat.

Challenges faced

- Data gaps (information on baseline conditions)
- Monitoring activities are limited
- Capacity gaps (technical and institutional)
- Lack of ambient water quality standards (often use-based used)
- Lack of legislation

Positives

- Awareness increasing (relevance of ambient WQ monitoring)
- More countries are engaging
- Consideration given to ecosystem health for first time
- Several countries developing national WQ standards for first time

Thank you

Indicator 6.3.2 Support Platform

https://communities.unep.org/display/sdg632/SDG+6.3.2+Home

Helpdesk

SDG632@un.org
stuart.warner@un.org
daiana.martindelgado@un.org

Please follow us:
Twitter:

- @GemsWaterCDC
- @UN_WWQA
- @UN_Water

Twitter tag: #SDG632