River Basin Management Plans 2015 - 2021

An Approach to the Revoked Freshwater Fish Directive

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Water Framework Directive - An approach to the Revoked Freshwater Fish Directive

Summary

This document outlines what we have done about the Freshwater Fish Directive (FFD) which was revoked on 22 December 2013 as part of the Water Framework Directive (WFD). It is based on published WFD UKTAG (United Kingdom Technical Advisory Group) proposals[1] which explain the principles to be followed when developing the approach to revoked directives.

For the FFD, ecological status defined in the WFD will set the same protection to the protected areas for fish. UKTAG recommend that no action is needed for additional standards for this directive after 2013.

Principles

The following principles are proposed:

- a set of standards are established that deliver the same level of environmental protection as the UK's implementation of the old Directives
- Guideline Standards are dropped (except where confirmed by the administrations for use in regulatory decisions)
- Mandatory Standards not used to take past regulatory decisions are dropped
- Mandatory Standards whose function is covered by new standards under the Water Framework Directive are dropped provided the key aspects of taking decisions, and the geographical cover provided under the old Directive, are included under the Water Framework Directive
- The provisions in the Water Framework Directive for alternate objectives will not apply to any Mandatory Standards carried forward for use under the Water Framework Directive, but will be applied to any Guideline standards that are carried forward
- Standards expressed as "per cent of samples" are written as the corresponding percentiles
- Standards expressed as absolute limits are expressed as percentiles; by default as 95-percentiles
- Units are converted to those used for the standards for the Water Framework Directive.

[1] http://www.wfduk.org/sites/default/files/Media/Environmental%20standards/UKTAG%20%20approach%20to%20revoked%20directives_Draft_160210.pdf

The Freshwater Fish Directive

All waters designated under the Freshwater Fish Directive are included as or within water bodies under the Water Framework Directive. In setting up standards for the Water Framework Directive, the UKTAG anticipated the demise of the Freshwater Fish Directive and sought standards that would continue to achieve the purposes of the Freshwater Fish Directive. Table 1 makes proposals for standards. Appendix 1 contains supporting notes extracted from the UKTAG's papers on new standards for the Water Framework Directive. It is considered that all the river and lake water quality standards for the Freshwater Fish Directive are covered by the standards and procedures of the Water Framework Directive.

The stretches of water designated under the Freshwater Fish Directive have specific monitoring stations. These will be used for assessing compliance with the Freshwater Fish Directive, but from 2014 onwards, compliance with the requirements of the Freshwater Fish Directive will be subsumed within the issue of compliance of water bodies under the Water Framework Directive and will therefore not be reported separately.

Table 1: Proposals for the Freshwater Fish Directive

<table>
<tr><th colspan="4">Mandatory Standards for the Freshwater Fish Directive</th><th>Recommendations</th></tr>
<tr><td>Parameter</td><td>Salmonid</td><td>Cyprinid</td><td>Comments</td><td></td></tr>
<tr><td rowspan="3">Dissolved Oxygen (mg/l)</td><td>9</td><td>7</td><td>These standards were 50-percentiles in the Freshwater Fish Directive</td><td rowspan="3">For rivers:
The 50-percentiles are dropped. The units are changed from mg/l to per cent saturation.
The maxima are replaced with those for Good Status under the Water Framework Directive. Salmonid standards are those given to waters that are Upland and Low Alkalinity. This gives an annual 10-percentile of 75 per cent saturation. Cyprinid standards are taken from Lowland and High Alkalinity – an annual 10-percentile of 60 per cent saturation. Where a Lowland, High Alkalinity, Water is Salmonid under the Freshwater Fish Directive, the standards set for the Upland and Low Alkalinity will apply.
For lakes:
These standards are applied to mid-point profiles taken in July or August which should protect fish when thermal conditions in lakes are likely to produce the greatest impact.</td></tr>
<tr><td>6</td><td>4</td><td>These were 'maxima' under the Freshwater Fish Directive.</td></tr>
<tr><td colspan="3">The UKTAG noted that the standard for the Freshwater Fish Directive expressed as a 6 mg/l represents an annual 10-percentile of percentage saturation of 65 to 75. The value of 4 mg/l would be an annual 10-percentile of percentage saturation between 45 to 55.</td></tr>
<tr><td>pH</td><td>6-9</td><td>6-9</td><td>A derogation is allowed under the Freshwater Fish Directive for naturally acidic areas</td><td>These standards have passed into the definition of High Status for the Water Framework Directive.</td></tr>
</table>

Table 1: Proposals for the Freshwater Fish Directive				
Mandatory Standards for the Freshwater Fish Directive				**Recommendations**
Parameter	Salmonid	Cyprinid	Comments	
Un-ionised Ammonia (µgN/l)	21	21	In practice, actions are set by the standards for Total Ammonia. Un-ionised Ammonia would not drive action except for the most acidic of rivers.	This standard is dropped. The standards for Good Status required no physico-chemical standards for un-ionised ammonia. Any future standard for fish for un-ionised ammonia will come through as a Specific Pollutant.
Total Ammonia (mgN/l)	0.78	0.78	A derogation is allowed as a 95 percentile of 2.3 under the Freshwater Fish Directive where there is a healthy fish population.	The 95-percentile standards in the Freshwater Fish Directive are replaced with those for Good Status under the Water Framework Directive. Salmonid Waters are taken from Upland and Low Alkalinity –an annual 90-percentile of 0.3 mgN/l. Cyprinid Waters are taken from Lowland and High Alkalinity – an annual 90-percentile of 0.6 mgN/l. Where a Lowland, High Alkalinity water is a Salmonid, the standards for the Upland and Low Alkalinity will apply.
Temperature (degrees C)	21.5	28	These are 98-percentiles in the Freshwater Fish Directive. Member States may decide derogations, limited in geographical scope, if the competent authority can prove that there are no harmful consequences for the balanced development of the fish population. A key aspect of the standards for temperature under Freshwater Fish Directive is that they apply where there are thermal discharges; they are not used generally in assessing all waters.	These are replaced by the standards and modes of use proposed by the UKTAG. Good status for 'warm' water bodies matches the Imperative Standard for Cyprinid under the Freshwater Fish Directive. The boundaries for high and good for 'cool' water bodies span the Imperative Standard for Salmonid waters under the Freshwater Fish Directive.
Temperature (degrees C)			A 10^{o}C limit applies under the Freshwater Fish Directive to the breeding periods for species needing cold water for reproduction	UKTAG: the standard in the Freshwater Fish Directive, a maximum of 10^{o}C during the spawning season, should protect spawning of cool water species. No such limit should be applied to 'warm' waters. This maximum of 10^{o}C is not used in classification but, where appropriate, used to regulate the operation of thermal discharges

Table 1: Proposals for the Freshwater Fish Directive

Mandatory Standards for the Freshwater Fish Directive				**Recommendations**
Parameter	Salmonid	Cyprinid	Comments	
Temperature (degrees C)	1.5	3	This is the change in temperature downstream of a point of thermal discharge. These standards are the 98-percentile at the edge of the mixing zone	The UKTAG proposes that these sorts of values are not used for classification under the Water Framework Directive. They can be used to calculate the action needed to achieve a target class, and for day-to-day operational control of discharges and abstractions. A 3^{o}C uplift is to be used in this way except for waters of High Status where 2^{o}C is used.
Total Zinc (µg/l Zn)			A derogation is allowed under the Freshwater Fish Directive in areas of high mineralisation, natural enrichment or abandoned mines.	The UKTAG has proposed new standards for zinc for RBP2, see table 2 below. The annual means standards given below were for classification under the Water Framework Directive during RBP1.
Water Hardness (mg/l calcium carbonate as an annual mean)			The existing standards depend on the hardness of the water.	Water Hardness (mg/l calcium carbonate as an annual mean) / Salmonid: Annual Mean / Salmonid: 95-percentile / Cyprinid: Annual Mean / Cyprinid: 95-percentile
Up to 10	30	300	The standards for the Freshwater Fish Directive are 95-percentiles. They were supplanted later by standards expressed for zinc as a List II Dangerous Substances	Up to 50: 8 / 30 / 75 / 300
10 to 50	200	700		50 to100: 50 / 200 / 175 / 700
50 to 100	300	1000		100 to 250: 75 / 300 / 250 / 1000
More than 100	400	2000		More than 250: 125 / 500 / 500 / 2000
Total residual chlorine (mg/l HOCl)	0.005	0.005		This standard is dropped. The standards for Good Status required no physico-chemical standards for chlorine. Any future standard for fish for chlorine will come through as a Specific Pollutant.
Phenolic compounds	By taste			This standard is dropped. The standards for Good Status required no physico-chemical standards for phenols. Any future standards for fish for phenols will come through as Specific Pollutants.

Table 1: Proposals for the Freshwater Fish Directive				
Mandatory Standards for the Freshwater Fish Directive				**Recommendations**
Parameter	Salmonid	Cyprinid	Comments	
Petroleum hydrocarbons	Visual or by taste			This standard is dropped. The standards for Good Status required no physico-chemical standards for petroleum hydrocarbons. Any future standards for fish for petroleum hydrocarbons will come through as Specific Pollutants

The standards are all 'equal or less than' or 'equal or more than', as appropriate. They are 95-percentiles except where stated otherwise. They are 'Annual' standards in the sense that compliance is assessed for complete periods of 12, 24 or 36 etc. continuous months.

Water Framework Directive standards for RBP2 for FFD elements

For the second River Basin Plan cycle starting in 2015, some WFD standards are changing whereas others are not. The relevant elements are discussed below.

Dissolved Oxygen and Ammonia

The Water Framework Directive standards for Dissolved Oxygen and Ammonia for the second River basin Plan period are not changing from RBP1. They can be found in:

http://www.wfduk.org/sites/default/files/Media/Environmental%20standards/Environmental%20standards%20phase%201_Finalv2_010408.pdf

Along with an explanation of typology for rivers (as the standards are based on it), they are as below:

Typology for water quality and rivers

The typology contains two factors – alkalinity and altitude. Alkalinity is expressed as five divisions of the concentration of calcium carbonate (which cover the range found in UK rivers). Altitude is split into two types – less than or greater than 80 metres. These two descriptors have been shown to play important roles in determining the biota of UK rivers.

This assessment agrees with the approach taken in the established way of reporting river quality for invertebrates – RIVPACS (River InVertebrate Prediction and Classification System [26]). River gradient also plays an important role, but this is associated with altitude. The typology is shown in Table 3.

Our present data have led us to a fairly broad-based typology for rivers. This may require refinement as it is applied it and we learn more about the relation between typology, ecology and water quality.

Table 3: Basic typology for rivers					
Site Altitude	*Alkalinity (as mg/l CaCO3)*				
	Less than 10	*10 to 50*	*50 to 100*	*100 to 200*	*Over 200*
Under 80 metres	*Type 1*	*Type 2*	*Type 3*	*Type 5*	*Type 7*
Over 80 metres			*Type 4*	*Type 6*	

Where the resulting standards for types turned out to be similar, we amalgamated types. In each case the standards for combined types were then produced by combining their sets of data and performing the analysis on the combined set. This process allowed us to simplify the typology into two types, as shown in Table 4 for dissolved oxygen and ammonia.

Table 4: Final typology for oxygen and ammonia for rivers	
Upland and low alkalinity	*Types: (1+2), 4 and 6*
Lowland and high alkalinity	*Types: 3, 5 and 7.*

Oxygenation and ammonia conditions for rivers

UKTAG propose standards for dissolved oxygen (DO), Biochemical Oxygen Demand (BOD) and ammonia. They have been developed following the same procedures and for the same typologies. They have been developed on the basis of conditions associated with macro-invertebrate communities.

Dissolved Oxygen and Biochemical Oxygen Demand

Oxygen in rivers is affected by complex interactions between ecological processes, and by anthropogenic pressures. Additions of organic matter such as discharges from sewage treatment works and storm overflows, and agricultural sources such as slurry and silage liquor, reduce dissolved oxygen due to the enhanced microbial respiration.

The standards are presented in Tables 5 and 6. The tables also show a comparison with standards from the environment agencies' present classification schemes. For comparison with existing standards, the following matches with the Freshwater Fish Directive (FWFD) are made:

- *Salmonid Waters (FWFD) - Upland and Low Alkalinity Type (2, 4 and 6)*
- *Cyprinid Water (FWFD) - Lowland and High Alkalinity Type (3, 5, and 7)*

Note: In Tables 5 and 6, and other tables in this report, "High" refers to the boundary between High and Good. To achieve High Status the standard must be bettered or equalled. Similarly Good refers to the boundary between Good and Moderate.

Generally, UKTAG proposed standards should be used in the same way as the existing standards. We suggest that the standard for dissolved oxygen is used for assessing and reporting compliance of rivers, and that the standard for BOD is used for deciding action to meet the standard for dissolved oxygen in the river. This is because the levels of BOD can be misleading in clean rivers, and because the link between BOD and dissolved oxygen is a complex and uncertain issue if dealt with on a site-by-site basis.

Table 5: Standards for oxygen in rivers		
Dissolved Oxygen (per cent saturation)		
(10-percentile)		
Type	*High*	*Good*
Upland and low alkalinity	*80*	*75*
Lowland and high alkalinity	*70*	*60*

Existing standards		
Dissolved Oxygen (per cent saturation)		
(10-percentile)		*(5-percentile)*
High	*Good*	
Existing classification schemes (note 1)		*Freshwater Fish Directive (note 2)*
80	*70*	*65 - 75 Salmonid*
		45 55 Cyprinid

Note:

1. *The existing values are those for River Quality Objectives, RE1 and RE2 for England and Wales and for the best two classes of the schemes used in all countries.*
2. *The values from the Freshwater Fish Directive as 6 mg/l would typically represent a 10-percentile of percentage saturation of approximately 65 to 75%. The value of 4 mg/l would represent a 10-percentile of percentage saturation between 45 to 55%.*

Where a lowland, high alkalinity water body is a salmonid river, the standards for the upland, low alkalinity type will apply. This is because in these conditions the standards required by fish are tighter than those required by invertebrates.

Table 6: Standards for oxygen conditions (BOD)		
Biochemical Oxygen Demand (mg/l)		
(90-percentile)		
Type	*High*	*Good*
Upland and low alkalinity	*3*	*4*
Lowland and high alkalinity (note 2)	*4*	*5*

Existing standards (note 1)	
Biochemical Oxygen Demand (mg/l)	
(90-percentile)	
High	*Good*
2.5	*4*

Note:

1. *The existing values are the thresholds for the River Quality Objectives, RE1 and RE2 for England and Wales, and for the best two classes of the schemes used in all countries.*

2. *Where a lowland, high alkalinity water body is a salmonid river then the standards for the upland, low alkalinity type will apply.*

The standards have been developed on the basis of oxygen conditions associated with macro-invertebrate communities as these are most sensitive biota to this pressure [1]. Invertebrate communities at Reference Condition[2] in these river types require higher oxygen levels than fish.

The approach is in broad alignment with the scientific literature describing the relationship between macro-invertebrates and dissolved oxygen and we have demonstrated compliance with the Directive's class definitions [2].

Ammonia

Ammonia is hazardous due to its toxic and sub-lethal impacts on fish and macro-invertebrates. It is a decay product of nitrogenous organic wastes and of the breakdown of animal and vegetable wastes. Sewage effluent from treatment works is a major source of ammonia in rivers. Agricultural diffuse sources of ammonia are also important. Our draft standards for ammonia are in Table 7.

[2] The term used by the Directive to define conditions that are close to pristine.

Table 7: Standards for ammonia		
Total Ammonia (mg/l)		
(90-percentile)		
Type	*High*	*Good*
Upland and low alkalinity	*0.2*	*0.3*
Lowland and high alkalinity	*0.3*	*0.6*

Existing standards	
Total Ammonia (mg/l)	
(90-percentile)	
High	*Good*
Existing classification schemes (note 1)	
0.25	*0.6*

1. *The existing values are the thresholds used for the River Quality Objectives, RE1 and RE2, for England and Wales, and for Class A and B of the General Quality Assessment.*

The standards have been developed on the basis of ammonia conditions associated with macro-invertebrate communities at High and Good Status. Further work will be done during the first cycle of River Basin Management Plans to confirm that the proposed values also protect communities of freshwater fish, though this seems likely from the comparison with present standards.

The approach is in broad alignment with the relationship between macro-invertebrates and ammonia described in the literature, and we have demonstrated compliance with the Directive's class definitions [2].

Temperature

Similarly to DO and Ammonia, WFD temperature standards are not changing between RBP1 and RBP2. From the same document referenced above they are as follows:

The proposed standards for the Water Framework Directive are intended to supersede the standards in the Directives on Freshwater Fish and Shellfish Waters when these directives are repealed in 2013.

As noted above, two types have been distinguished: cool-water and warm-water.

While the salmonid and cyprinid groupings for the Freshwater Fish Directive match these types, the new standards encompass, in principle, all types of freshwater, estuarine and marine fish.

Temperature preferences were represented by the concept of a "niche" – fish spend two thirds of their time within 2^{o}C of a preferred temperature. The proposed boundary between high and good status for rivers is the upper limit of the niche in which most fish will spend two-thirds of their time (±2ºC of the preferred temperature). Similarly the boundary between

good and moderate status is the upper limit of the niche in which most fish will spend all of their time (±5ºC of the preferred temperature).

The standards for the Water Framework Directive are expressed as boundaries between high, good, moderate, poor and bad (Table 8)

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The boundary between moderate and poor status is the lower limit of the range in estimates of lethal temperatures for species. The proposed standards are values at the edge of the mixing zone1 that must be achieved for 98 per cent of the time.

The UKTAG proposes that these standards are used in the classification of rivers receiving thermal discharges and in calculating the action needed to achieve a target class for rivers. It is proposed that the values are not used for the classification of lakes, estuaries and coastal waters; but are to be used for these waters to calculate the action needed to achieve a target class, or for day-to-day operational control of discharges and abstractions. In the regulation of thermal discharges more specific locally derived background reference conditions may be required if the thresholds below are not appropriate.

Table 8: Proposed boundaries for temperature				
	Temperature (ºC)			
	High-Good	***Good-Moderate***	***Moderate-Poor***	***Poor-Bad***
Cold water	*20*	*23*	*28*	*30*
Warm water	*25*	*28*	*30*	*32*

pH

For pH, revised standards are proposed for RBP2. The standards for RBP1, again from the same document referenced above were as follows:

Acid conditions for rivers

The effects of anthropogenic acidification are complex and include toxic effects on biota. The UKTAG tried to develop new standards across the UK but the level of resolution at which most invertebrate analysis is undertaken by the environment agencies prevented this. In addition discussions indicated that a standard based on Acid Neutralising Capacity would be better than pH. As a consequence of these factors we propose to retain the existing standards for the first cycle of River Basin Management Plans.

Table 8: Standards for acid conditions in rivers			
pH – all river types in England, Wales and Northern Ireland			
High	*Good*	*Moderate*	*Poor*
(5 and 95 percentile)		*10 percentile*	*10 percentile*
>=6 to <=9		*4.7*	*4.2*
pH – all river types in Scotland			
High	*Good*	*Moderate*	*Poor*
(5 and 95 percentile)	*10 percentile*	*10 percentile*	*10 percentile*
>=6 to <=9	*5.2*	*4.7*	*4.2*

The proposals for RBP2 are contained in the following UKTAG document:

http://www.wfduk.org/resources/phase-3-review-environmental-standards-201213

and are as follows:

Anthropogenic acidification is caused by emissions to the atmosphere of sulphur dioxide and oxides of nitrogen. These are released as a result of the combustion of fossil fuels. The gases undergo oxidation to form sulphuric acid and nitric acid, respectively. The acids are then deposited, either in rain or snow, or when particles or gases stick to the ground, plants or other surfaces.

Base cations[3] in soils, such as calcium, potassium and manganese, act as a natural buffer against acidity. The acidification of rivers and lakes occurs in areas which have limited buffering capacity, such as land with thin soils that overlay granite rock. Forests can enhance the deposition of acid pollutants from the atmosphere because of the greater air turbulence caused by their rough canopies. The way forests are planned, designed and managed influences the risk of them contributing to acidification.
Action taken under a series of treaties dating from the 1980s and 1990s has led to significant reductions in emissions of acid pollutants from power stations and industry. Despite this, acidification remains an issue, particularly in upland western parts of Scotland and Wales, where rainfall is high, soils are generally base poor, and significant conifer plantations exist.
The UKTAG has developed recommendations on standards for acidification in rivers.
The standards are for pH and a parameter called the Acid Neutralising Capacity (ANC)[4]. The first of these acts as a surrogate for "labile aluminium", which is believed to provide the toxicity which shapes biological communities at low pH. The ANC is a direct measure of longer-term anthropogenic acidification.

Dissolved Organic Carbon (DOC) plays an important role in determining the damage to waters prone to acidification. A value of 10mg/l of DOC is used as a threshold to distinguish "clear" and "humic" waters[5] in the biological method that is used to describe the impact of

[3] 1Base cations are the most prevalent, exchangeable and weak acid cations in the soil.
[4] As calculated by the Cantrell method
[5] 3Humic material provides the brown staining of water in peat catchments and is derived from the oxidation of peat.

acid pressures in rivers [2]. The UKTAG recommends that this value is used as a threshold to develop separate standards for each type of water.

The UKTAG's existing recommendations on standards for pH are set as the annual 5 or 10-percentile for acidification, and the annual 95-percentile for alkalinity. The studies that underpin this review have demonstrated strong correlations between the annual mean and the biological data. Consequently, it is recommended that the new standards are defined as annual mean values.

The pH boundary for good and moderate is placed at the start of increases in concentrations of labile aluminium – a point at which significant damage starts to be observed in biological communities. For ANC, the boundary between high and good is set above the point at which concentrations of labile aluminium begin to elevate. The other boundaries are positioned at appropriate places on the gradient of labile aluminium. The poor-bad boundary is placed just below maximum concentrations of labile aluminium[6].

Under most instances, the recommended standards provide the same class as the class suggested by the biological data. Where there is disagreement it is most commonly by only one class. There is a slight bias towards a lower class for biology. This might be expected because the biological data provides an integrated record, and the chemical records describe the conditions at the times of sampling – the biology may be shaped by extreme events not picked up in chemical samples that were taken.

As noted above, the ANC and pH fulfil different roles in describing the impact of acidification. ANC provides an indication of buffering capacity that is useful in the context of national and international management of acid deposition; it forms the basis of approaches based on critical loads, forestry plantings and the modelling of scenarios for the impact of acid deposition. The pH is a measure of overall acidity and is strongly correlated with the concentrations of labile aluminium. However, it does not help distinguish between natural and anthropogenic acidification.

Comparison of current and recommended standards for acidification
To help with the comparison, the current percentile standards have also been shown in Table 24 as estimates of the corresponding annual means[7]. The new standards are tighter for clear waters but laxer for humic waters.

Comparison of current and recommended standards for pH and ANC						
Class	*Current Standards[8]*		*Recommended standards*			
	All waters		*Clear waters*		*Humic waters*	
	pH		*pH*	*ANC*	*pH*	*ANC*
		(typical mean)	*(annual mean)*			
High	*6.0 (5%ile)*	*5.79*	*6.60*	*80*	*5.10*	*80*
Good	*5.2 (10%ile)*	*5.37*	*5.95*	*40*	*4.55*	*50*
Moderate	*4.7 (10%ile)*	*4.91*	*5.44*	*15*	*4.22*	*10*
Poor	*4.2 (10%ile)*	*4.43*	*4.89*	*10*	*4.03*	*5*

[6] Covering most concentrations of dissolved organic carbon.

[7] Using data on typical values of the standard deviation and assuming a normal distribution and a coefficient of variation of 0.075, the average for Welsh rivers

[8] The current standards for high status also include a test set to protect against elevated pH – an annual 95-percentile of 9. No change is proposed for this.

At present NIEA has only a limited amount of DOC data so for the initial part of RBP2 will continue to use the RBP1 standards for classification updates. When we have sufficient DOC data we will most likely adopt the proposed pH standards.

Zinc

Similarly to pH, the zinc standards are changing for RBP2. The standards are described in the following UKTAG document from which the extracts below are taken:

http://www.wfduk.org/sites/default/files/Media/Environmental%20standards/UKTAG%20Environmental%20Standards%20Phase%203%20Final%20Report%20041120133.pdf

Zinc is a naturally occurring substance and is ubiquitous in aquatic environments where it tends to occur at higher concentrations than most metals. Therefore to best assess compliance with the environmental quality standard (EQS) we need to take account of ambient background concentrations (ABCs); the EQS applies only to the additional contribution over and above the ambient background level (i.e. the value at which toxic effects occur, ignoring contributions from background concentrations).

Ambient background concentrations in freshwater
ABCs have been derived by assessing a dataset of around 150000 data points and using a low percentile1 to ensure significant anthropogenic influences are excluded. Where there are sufficient data, ABCs have been defined for a catchment or group of catchments. Where there are insufficient data, data are subject to uncertainty because many measured concentrations are reported as 'less than' concentrations or where there are minimal differences between catchments, a default value based on pooled data is used.

For Northern Ireland, an ABC of 1.0ug/l has been proposed for freshwaters. The zinc standards are as follows:

Water	Exposure	Annual statistic	New standard
Fresh	Long-term	Mean	10.9 bioavailable plus ABC (ug/l) dissolved