WATER QUALITY IN 2017

An Indicators Report

Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

ENVIRONMENTAL PROTECTION AGENCY
The Environmental Protection Agency (EPA) is responsible for protecting and improving the environment as a valuable asset for the people of Ireland. We are committed to protecting people and the environment from the harmful effects of radiation and pollution.

The work of the EPA can be divided into three main areas:

Regulation: *We implement effective regulation and environmental compliance systems to deliver good environmental outcomes and target those who don't comply.*

Knowledge: *We provide high quality, targeted and timely environmental data, information and assessment to inform decision making at all levels.*

Advocacy: *We work with others to advocate for a clean, productive and well protected environment and for sustainable environmental behaviour.*

Our Responsibilities

Licensing
We regulate the following activities so that they do not endanger human health or harm the environment:
- waste facilities *(e.g. landfills, incinerators, waste transfer stations)*;
- large scale industrial activities (*e.g. pharmaceutical, cement manufacturing, power plants)*;
- intensive agriculture *(e.g. pigs, poultry)*;
- the contained use and controlled release of Genetically Modified Organisms *(GMOs)*;
- sources of ionising radiation *(e.g. x-ray and radiotherapy equipment, industrial sources)*;
- large petrol storage facilities;
- waste water discharges;
- dumping at sea activities.

National Environmental Enforcement
- Conducting an annual programme of audits and inspections of EPA licensed facilities.
- Overseeing local authorities' environmental protection responsibilities.
- Supervising the supply of drinking water by public water suppliers.
- Working with local authorities and other agencies to tackle environmental crime by co-ordinating a national enforcement network, targeting offenders and overseeing remediation.
- Enforcing Regulations such as Waste Electrical and Electronic Equipment (WEEE), Restriction of Hazardous Substances (RoHS) and substances that deplete the ozone layer.
- Prosecuting those who flout environmental law and damage the environment.

Water Management
- Monitoring and reporting on the quality of rivers, lakes, transitional and coastal waters of Ireland and groundwaters; measuring water levels and river flows.
- National coordination and oversight of the Water Framework Directive.
- Monitoring and reporting on Bathing Water Quality.

Monitoring, Analysing and Reporting on the Environment
- Monitoring air quality and implementing the EU Clean Air for Europe (CAFÉ) Directive.
- Independent reporting to inform decision making by national and local government *(e.g. periodic reporting on the State of Ireland's Environment and Indicator Reports)*.

Regulating Ireland's Greenhouse Gas Emissions
- Preparing Ireland's greenhouse gas inventories and projections.
- Implementing the Emissions Trading Directive, for over 100 of the largest producers of carbon dioxide in Ireland.

Environmental Research and Development
- Funding environmental research to identify pressures, inform policy and provide solutions in the areas of climate, water and sustainability.

Strategic Environmental Assessment
- Assessing the impact of proposed plans and programmes on the Irish environment *(e.g. major development plans)*.

Radiological Protection
- Monitoring radiation levels, assessing exposure of people in Ireland to ionising radiation.
- Assisting in developing national plans for emergencies arising from nuclear accidents.
- Monitoring developments abroad relating to nuclear installations and radiological safety.
- Providing, or overseeing the provision of, specialist radiation protection services.

Guidance, Accessible Information and Education
- Providing advice and guidance to industry and the public on environmental and radiological protection topics.
- Providing timely and easily accessible environmental information to encourage public participation in environmental decision-making *(e.g. My Local Environment, Radon Maps)*.
- Advising Government on matters relating to radiological safety and emergency response.
- Developing a National Hazardous Waste Management Plan to prevent and manage hazardous waste.

Awareness Raising and Behavioural Change
- Generating greater environmental awareness and influencing positive behavioural change by supporting businesses, communities and householders to become more resource efficient.
- Promoting radon testing in homes and workplaces and encouraging remediation where necessary.

Management and structure of the EPA
The EPA is managed by a full time Board, consisting of a Director General and five Directors. The work is carried out across five Offices:
- Office of Environmental Sustainability
- Office of Environmental Enforcement
- Office of Evidence and Assessment
- Office of Radiation Protection and Environmental Monitoring
- Office of Communications and Corporate Services

The EPA is assisted by an Advisory Committee of twelve members who meet regularly to discuss issues of concern and provide advice to the Board.

Water Quality in 2017:

An Indicators Report

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About this Report

Environmental indicators

Environmental indicators represent a significant aspect of the state of the environment and related human activities. Indicators focus on:

- trends in environmental changes,
- the stresses causing them,
- how the environment and its components respond to these changes, and
- societal response to prevent, reduce or ameliorate these stresses.

Indicators typically make complex phenomena easier to understand. This improves communication to decision makers and makes it easier to measure progress towards established goals. This report is an update to *Water Quality in 2016: An Indicators Report*;[1] it will focus on the same 16 indicators and provide an update on any changes.

16 indicators

There are 16 indicators in this report. Each indicator summarises a particular water quality parameter or issue. These indicators tell the story of the state of Ireland's aquatic environment. They look at the remote upland areas where many of our wide, meandering rivers begin, and at our abundant lakes and hidden groundwaters. They follow the estuaries that spill out into our coastal areas, and the beaches we treasure for their cleanliness and beauty.

The indicators present the current situation, an indication of recent change and, where possible, longer term trends. These trends provide information on the improvement or deterioration in aspects of water quality and help us decide what actions to take to protect and improve water quality. The indicators have been set out in a 'stand-alone' fashion so that a concise assessment is available for each.

Tracking progress

This information will help to track progress with the National River Basin Management Plan 2018–2021[2] (the Plan), the vehicle by which Ireland will bring about water quality changes through cooperation between the relevant state agencies and all stakeholders, including the public. We hope this and future reports will provide up-to-date information on how to adjust the actions we take to protect and improve water quality. These reports also provide an assessment of the continually changing physical and ecological environment while the Plan is being put into action.

[1] www.epa.ie/pubs/reports/water/waterqua/Water%20Quality%20in%202016%20An%20Indicators%20Report.pdf

[2] www.housing.gov.ie/sites/default/files/publications/files/rbmp_report_english_web_version_final_0.pdf

The Indicators

We selected these indicators based on their scientific value, ease of detection and relevance to policy implementation, both nationally and internationally, in the context of the EPA's existing core set of environmental indicators and following a review of other relevant water quality indicator sets maintained by the European Environment Agency. We also considered the indicators being developed to track progress in the implementation of the United Nations Sustainable Development Goals;[3] these goals aim to promote prosperity while protecting the planet and are aimed at all countries. One of the relevant goals is Goal 6: clean water and sanitation.

Nutrient pollution (caused by too much nitrogen and phosphorus in our waters) is the key environmental issue impacting on the state of surface waters in Ireland. This is why we focus on nutrient-based indicators in each of the main water categories (groundwater, rivers, lakes, estuaries and coastal waters). We also include the annual input of nutrients to our marine environment. The indicators also look at specific aspects of water quality in rivers, lakes, canals, estuaries and coastal waters. One indicator focuses on the loss of high-quality river sites in recent years; others cover the number of fish kills, the amount of faecal coliforms (bacteria) in groundwater and the quality of our bathing waters.

Where possible, indicators include trend analysis to help identify any change in the state of the aquatic environment. The level of insight gleaned from the analysis will depend on the indicator, but at the very least some information in terms of improvements or deterioration is presented where possible.

The 16 indicators are:

1: River quality
2: High-quality river sites
3: Nitrate in rivers
4: Phosphate in rivers
5: Canal quality
6: Lake biological quality
7: Total phosphorus in lakes
8: Fish kills
9: Trophic status of estuaries and coastal waters
10: Nitrogen in estuaries and coastal waters
11: Phosphorus in estuaries and coastal waters
12: Nutrient inputs to the marine environment
13: Nitrate in groundwater
14: Phosphate in groundwater

[3] https://www.un.org/sustainabledevelopment/sustainable-development-goals/

15: Bacteria in groundwater

16: Bathing water quality.

Insights

The environmental indicators used in this report are very useful because they allow us to read environmental signals, and give some insight into how our aquatic environment is changing. Some of these changes are negative and some are positive.

River quality decline

The strongest signal in this report is coming from our biological assessment of river quality (**Indicator 1**) and some worrying signs are emerging. We have seen a 3% reduction in river water quality since 2015. Some 56% of our river water bodies are at high or good quality with the remaining 44% at moderate or worse. When we compare the current data with the last full assessment in 2013–2015 we see that while 197 river water bodies have improved in quality, there has been a decline in the biological quality of 269 water bodies.

Still losing high-quality rivers

The number of our high-quality river sites (Q4–5 and Q5[4]) is continuing to decline, with a further 0.6% decline in 2017 (**Indicator 2**). This assessment now puts the percentage of high-quality sites at 17%, compared to 31.6% in the 1987–1990 period, meaning that the percentage of these sites has almost halved since the late 1980s. We have seen a modest increase in our most pristine waters (Q5), from 23 sites to 30 in the current period, but this is against a greater than 10-fold decline in the number of these sites since the late 1980s.

Nutrients

Nutrients, such as phosphate and nitrate, are responsible for eutrophication (pollution caused by too many nutrients which leads to a deterioration in water quality). The main sources of these nutrients are agriculture (slurry and chemical fertilisers) and sewage (waste water treatment plants). Higher levels of nutrient generally cause poorer water quality.

The nitrate levels in our rivers (**Indicator 3**) are relatively stable; however, current data suggest that the rate of recent improvements in nitrogen concentrations may be beginning to slow down. The south and south-east of the country have the highest river nitrate concentrations. This situation is mirrored in our estuarine and coastal waters, where some water bodies are exceeding their threshold values.

Long-term trends of phosphate in our rivers (**Indicator 4**) continue to be relatively stable, but there has been a significant reduction in the number of river sites with phosphorus concentrations needed to support high-quality rivers, from 58% in 2014–2016 to just over 48% in 2015–2017. There is also an increase in the percentage of sites with higher phosphorus concentrations that could lead to pollution, from 26.6% to 37.2% over the respective time periods. The increase in river phosphorus

[4] Biological quality in rivers is assessed using the Q-value. Values range from Q5 (high quality) to Q1 (bad quality). See Indicator 1.

concentration is a worrying development. If this trend continues it could lead to an increase in the proportion of water bodies becoming more polluted and failing their Water Framework Directive (WFD) objectives.

The nutrient inputs to the marine environment (**Indicator 12**) also indicate that despite historical reductions, there has been an increase in total nitrogen and total phosphorus loads to our marine environment since 2014.

Some positives

On a positive note, we are dealing very well with our bad quality river water bodies (**Indicator 1**). The number of these water bodies has dropped dramatically from 91 in 1987–1990 to just two in this current assessment. The number of fish kills in our waters has also seen a huge drop, down to just 14 reported cases compared with the worst years, 1987 and 1989, where there were more than 100 fish kills annually.

While we have made good progress in tackling these serious pollution events that have historically affected our rivers, some areas of the country still need our attention. The decline of river quality in the north-west is of concern, while rivers such as the Tolka in Dublin are regularly affected by fish kills. Further investigations of these serious pollution events will be required to identify the actions needed to address them.

Shift in focus

The declines seen in our rivers' indicators are an early warning signal that trends in water quality may be at a turning point and heading in the wrong direction. While not ignoring point source[5] pressures, we now need to redouble our efforts in tackling diffuse[6] pollution to follow on from the successes we have achieved in dealing with our serious pollution events from point sources.

Stable picture

Our remaining indicators are showing a more or less stable picture for now. It remains to be seen if current declines in water quality and increases in nutrients in our rivers will have a knock-on effect on our lakes, estuaries (transitional waters) and coastal waters and groundwaters.

Our lake biological quality (**Indicator 6**) declined by 1% in 2015–2017 relative to 2013–2015 and there has been a 4.7% drop in lake quality when compared with the 2007–2009 period. Total phosphorus concentrations in lakes (**Indicator 7**) are showing some signs of increase but further data will be required to confirm if this is a statistical trend. Lakes in Counties Cavan and Monaghan have the highest phosphorus levels in the country.

[5] Pollution with a specific point of entry to the water, for example a pipe discharging sewage.
[6] Pollution with no specific point of entry to the water, also sometimes called pollution from non-point sources; for example, pollution from agriculture or urban sewerage misconnections.

The canal quality indicator (Indicator 5) highlights the often overlooked excellent water quality in our canals. Canals have shown an improvement in quality from 10 (71%) canal water bodies being at good or maximum biological quality in 2013–2015 to 13 (93%) in 2015–2017.

Some 16% of our estuaries and coastal waters are classified as eutrophic and potentially eutrophic (Indicator 9). Nitrogen and phosphorus in our estuaries and coastal waters (Indicators 10 and 11) remain stable but higher nitrogen concentrations still affect the quality of some of our estuaries in the south and south-east.

A high proportion of groundwater sites (43%) are still contaminated with the bacterium *E. coli*, indicating the presence of faecal contamination (Indicator 15). This highlights the need for groundwater source protection and associated management and for regular testing of drinking water supplies from groundwater. Our groundwater quality for nutrients remains generally good, with stable pictures for both nitrate and phosphate (Indicators 13 and 14).The south and south-east of the country continue to have the greatest proportion of monitoring sites with higher nitrate concentrations. This is attributed largely to the impact of nutrient losses from agricultural sources.

The quality of Ireland's bathing waters remains good (Indicator 16), with 9 in 10 bathing waters meeting the minimum required standard of sufficient quality and 8 in 10 being at either good or excellent quality. Seven bathing waters out of a total of 142 had poor quality in 2017. Management measures in relation to these waters are ongoing and reported annually via the Bathing Water report.

Main Findings

Each of the indicators provides valuable information on the water environment. The main findings arising from them are as follows.

Rivers

- River biological quality fell by 3% (72 water bodies) since 2013–2015.
- 56% of our rivers are at high or good biological quality with the remaining 44% being at moderate or worse quality.
- The reduction in the number of river water bodies at bad quality is continuing. The number of water bodies in this category fell from five in 2016 to just two in 2017.
- The decline in high-quality sites (Q4–5 and Q5) is continuing. This trend must be reversed.
- There is a relatively stable picture with regard to nitrate concentrations in our rivers. This decreasing trend may be slowing down, with evidence of increasing nitrate concentration at some river sites.
- The number of river sites with phosphorus concentrations needed to support high-quality rivers dropped from 58% in 2014–2016 to just over 48% in 2015–2017. There is also an increase in the percentage of sites with higher phosphorus concentrations that are likely to lead to water quality issues.

Canals

- 93% of our canal water bodies were classified as being at good or maximum biological quality in 2015–2017, an improvement on 2013–2015, which had 71% of water bodies at that classification.

Lakes

- There has been a 1% decline in good or better quality compared to 2013–2015, and a decline of 4.7% in lakes classified as being of high or good quality since status assessments began in 2007–2009.
- Total phosphorus concentrations in lakes are relatively stable.

Fish kills

- There were only 14 reported fish kills in 2017 compared with 31 in 2016. Overall the number of fish kills in the past two decades has been decreasing.

Estuaries, coastal and marine

- Loadings of phosphorus and nitrogen to the marine environment have started to increase again since 2014, despite historical long-term reductions.

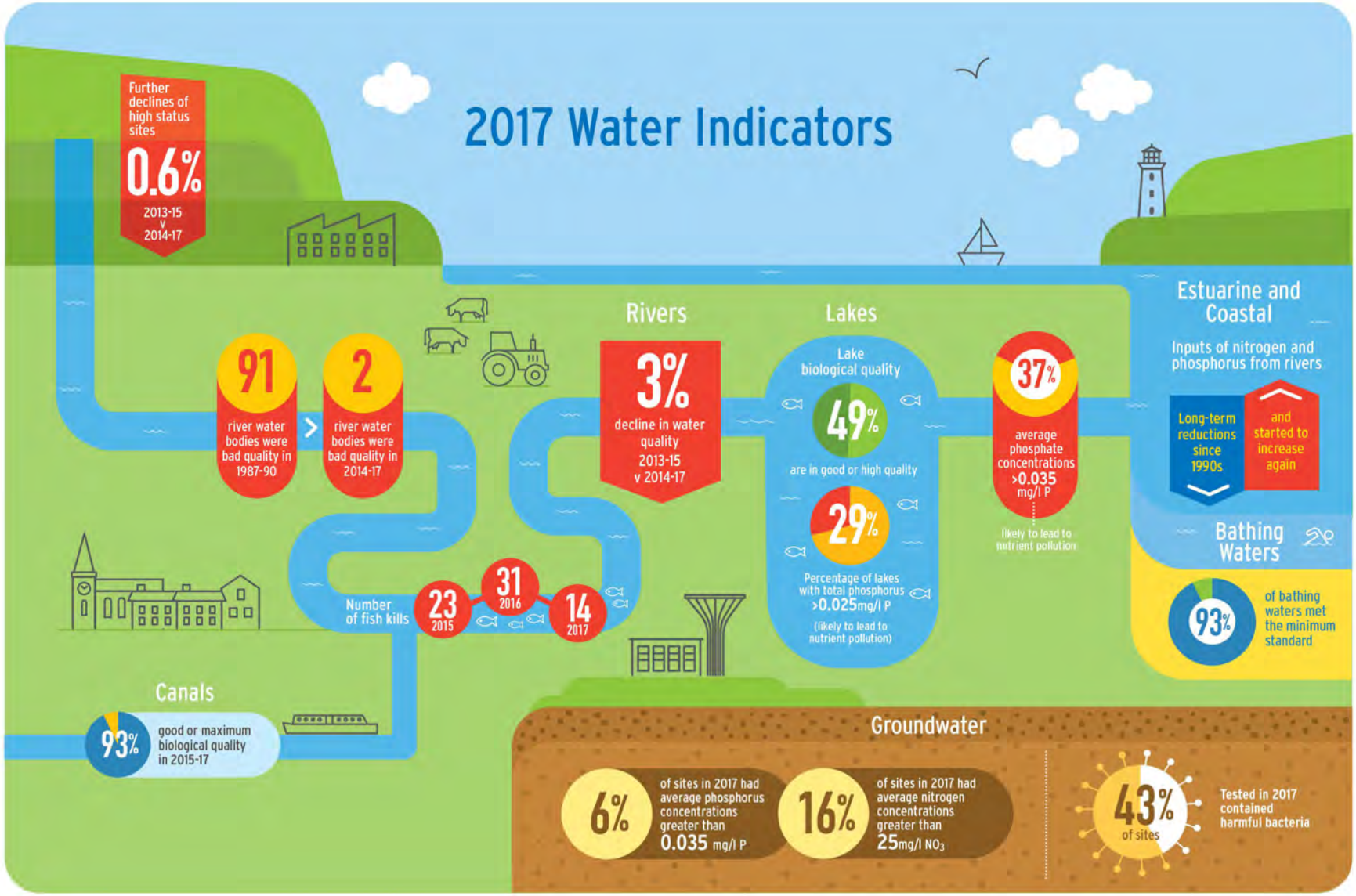
- 16% of our estuarine and coastal waters are classified as eutrophic and potentially eutrophic.
- Some 23 estuaries and coastal waters exceeded the winter dissolved inorganic nitrogen threshold, a similar number to the 2014–2016 period (29). The largest concentrations were seen in the south and south-east of the country. The Upper Bandon Estuary has seen a significant increase in winter concentrations since 2007.
- Of the 95 estuaries and coastal water bodies assessed for phosphorus, only one (Maigue Estuary, Co. Limerick) exceeded the relevant winter threshold compared to three in the 2010–2012 period. There is a clear upward trend in concentrations in the Upper Shannon Estuary from 2007 to 2017.

Groundwater

- Faecal bacteria were detected at 43% of groundwater monitoring sites in 2017 (42% in 2016), highlighting the necessity for testing of drinking water supplies from groundwater for microbial contamination and for the provision of adequate treatment.
- In 2017 the average nitrate concentration exceeded the Irish groundwater threshold value of 37.5 mg/l NO_3 at seven monitoring sites, with one site having average concentrations greater than the Drinking Water Standard of 50 mg/l $N0_3$. The south and south-east of the country continue to have the greatest proportion of monitoring sites with higher nitrate concentrations.
- 94% of the 195 groundwater sites monitored in 2017 had average phosphorus concentrations less than 0.035 mg/l P (Irish groundwater WFD threshold value).

Bathing water

- In 2017, the majority of bathing waters, 93%, met the minimum required standard of sufficient quality.


2017 Water Indicators
Further declines of high status sites
0.6%
2013-15 v 2014-17
91
river water bodies were bad quality in 1987-90
2
river water bodies were bad quality in 2014-17
Rivers
3%
decline in water quality 2013-15 v 2014-17
Lakes
Lake biological quality
49%
are in good or high quality
29%
Percentage of lakes with total phosphorus >0.025mg/l P
(likely to lead to nutrient pollution)
37%
average phosphate concentrations >0.035 mg/l P
likely to lead to nutrient pollution
Estuarine and Coastal
Inputs of nitrogen and phosphorus from rivers
Long-term reductions since 1990s
and started to increase again
Bathing Waters
93%
of bathing waters met the minimum standard
Number of fish kills
23 2015
31 2016
14 2017
Canals
93%
good or maximum biological quality in 2015-17
Groundwater
6%
of sites in 2017 had average phosphorus concentrations greater than 0.035 mg/l P
16%
of sites in 2017 had average nitrogen concentrations greater than 25mg/l NO3
43%
of sites
Tested in 2017 contained harmful bacteria

Indicator 1: River Quality

Ireland has more than 73,000 km of river channels. Three-quarters of these channels are very small streams that typically flow into larger rivers. The national monitoring programme assesses the quality of over 13,000 km of main channels across the country.

Macroinvertebrates are tiny animals without backbones; for example, insects, snails and worms. They have been widely used to assess water quality and the general health of rivers since the 1970s.

Assessment

The general health of macroinvertebrate communities in Irish rivers is assessed using the Quality Rating system (Q-value). This system categorises the biological quality of a river into five classes based on the diversity and abundance[7] of the macroinvertebrate community, namely:

- high,
- good,
- moderate,
- poor, and
- bad.

Rivers are divided into segments or water bodies for management and reporting purposes. Where there is more than one site in a river, the quality is reported as the lowest class recorded in the water body. The national monitoring programme revisits each site at least once every three years.

Findings

Based on the last three years of data, 1,298 (56%) of the river water bodies were in high or good biological quality (Figure 1, Map 1). The remaining 1,018 (44%) river water bodies were of moderate, poor or bad quality.

Trends

River biological quality fell by 3% since 2013–2015. Some 197 river water bodies have improved while 269 have declined, resulting in a net decline of 72 water bodies. A total of 1,838 river water bodies have remained at the same class when compared with their 2013–2015[8] survey results. This represents a decline in the number of river water bodies in high and good quality and an increase in moderate and poor quality. The number of river water bodies in bad quality fell from five in 2013–2015 to two (Aughboy_010 in Wexford and Ahavarraga Stream_010 in Limerick) in 2015–2017. This is a dramatic improvement from the historical high of 91 in the period between 1987 and 1990.

[7] The number of different types of macroinvertebrate.
[8] The biological monitoring programme runs on a three-year cycle and 2013–2015 was the last complete cycle suitable for comparison.

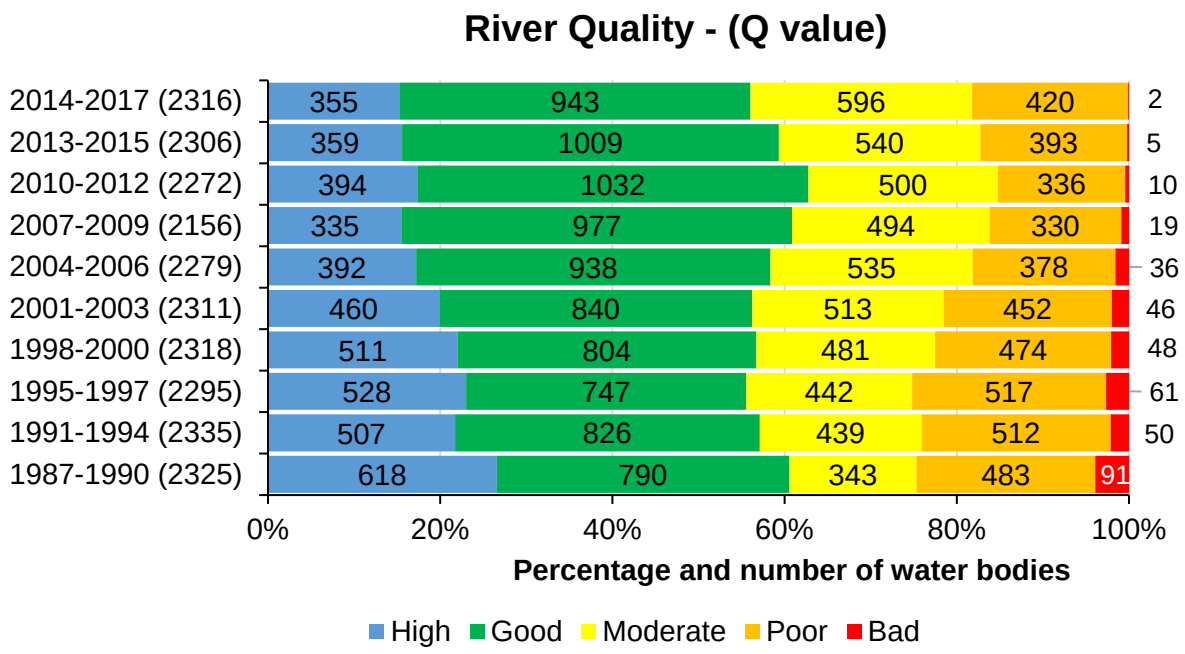


Figure 1: National trend in macroinvertebrate quality of water bodies using the Q-value quality rating system between 1987 and 2017. Number in parentheses on y-axis is total number of water bodies.

Of the 24 catchments[9] surveyed in 2016 and 2017, only five showed an overall improvement in the number of river water bodies classified as satisfactory (high or good) based on their biological quality:

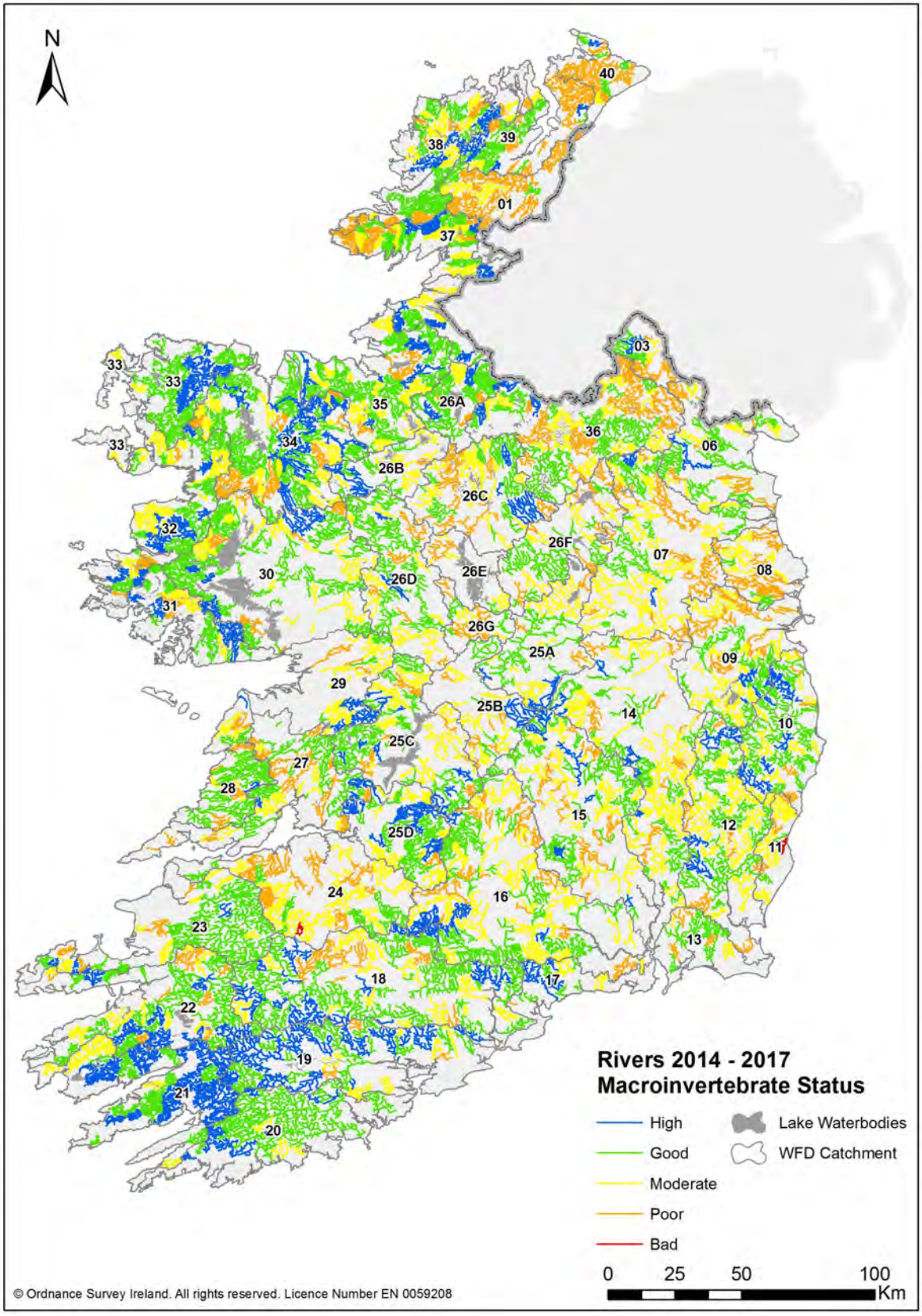
- Slaney,
- Ballyteigue–Bannow,
- Colligan–Mahon,
- Lee, Cork Harbour and Youghal Bay, and
- Tralee Bay,

The number of river water bodies at satisfactory quality (high or good) declined in 16 catchments, most notably in the:

- Suir,
- Upper Shannon[10],
- Shannon Estuary South, and
- Moy and Killala Bay.

[9] Land areas that drain into water bodies (groundwater, rivers, lakes, marine).
[10] Subcatchment of the overall Shannon catchment.

Map 1: 2014–2017 macroinvertebrate assessment for monitored river water bodies (*n* = 2,305).



Indicator 2: High-Quality River Sites

High quality at river sites is an indicator of largely undisturbed natural conditions. These sites are important for supporting aquatic species sensitive to pollution such as the protected, but declining, freshwater pearl mussel and juvenile salmon. The presence of high-quality sites can contribute significantly to species diversity and these sites are a source for species recolonisation of river stretches that are recovering from pollution.

Assessment

This indicator is based on a subset of the Quality Rating system (Q-value; see Indicator 1) covering the highest quality sites (Q5 sites)[11] and other high-quality sites (Q4–5 sites).

Findings

In each survey period the decline in high-quality sites (Q5 and Q4–5 sites) has continued, from:

- 31.6% in the 1987–1990 period, to
- 17.6% in 2013–2015, to
- 17.0% in 2014–2017 (a decrease of 0.6% or 14 sites).

There has been a minor improvement in the number of our most pristine sites (Q5) from 23 in 2013–2015 to 30 in 2015–2017. However, this is against a historic backdrop of very large declines:

- 13.4% in 1987–1990 period, to
- 0.7% in 2013–2015 (23 sites)
- 1.1% in 2015–2017 (30 sites) (Figure 2).

[11] The Q-value system ranges from Q1 to Q5. Q5 is the best water quality and Q1 is the worst.

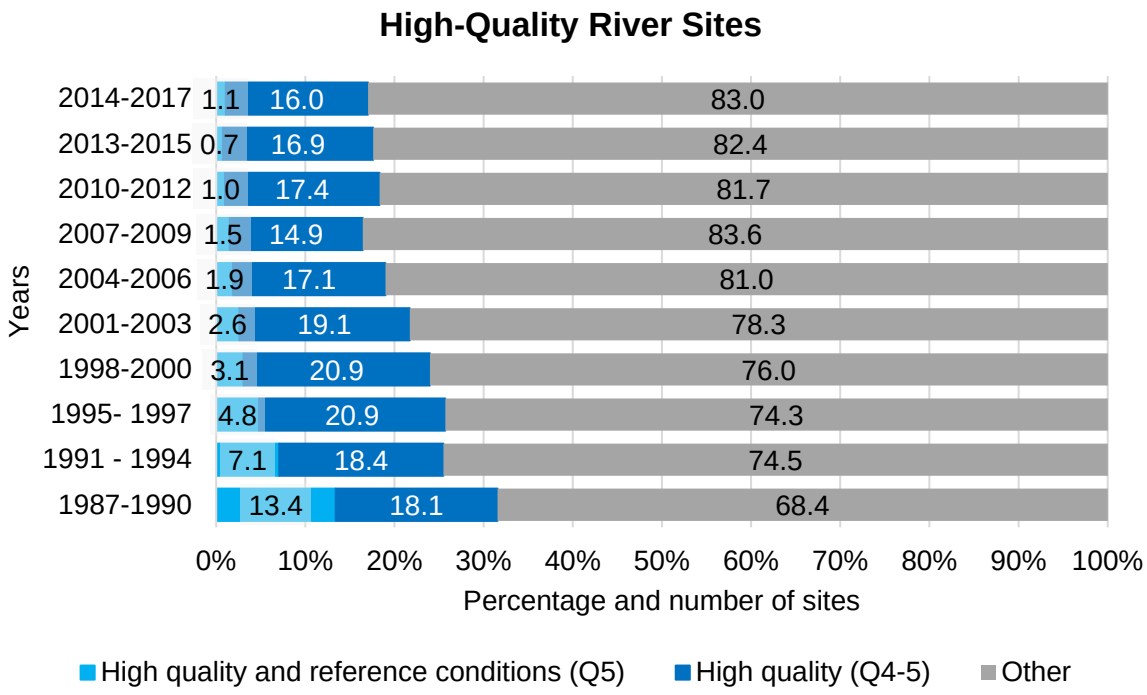


Figure 2: Trend in the percentage of high-quality river sites (Q5, Q4–5) since 1987.

The largest number of high-quality sites continues to be in the less densely populated and less intensively farmed regions in the west and south west. This ongoing loss of our most pristine rivers is a very significant concern. A large effort is required to protect the few remaining high-quality river sites and, where possible, return impacted ones to high quality.

Indicator 3: Nitrate in Rivers

The concentration of nitrate (NO_3)[12] in rivers is an indicator of nutrient enrichment and a potential human health indicator in drinking water.

Assessment

This indicator is based on categorising the three-year average nitrate concentration from 1,707 individual river sites in 709 rivers into six quality classes. There are no environmental quality standards for nitrate but average nitrate concentration values less than 4 mg/l NO_3 (0.9mg/l N) and less than 8 mg/l NO_3 (1.8mg/l N) are considered by the EPA to be indicative of high and good quality respectively. Nitrate was measured in 1,716 river sites in 2017 compared to 1,762 sites in 2016. Of these, 1,707 sites covering 709 rivers had data covering the previous reporting periods.

Findings

The 2015–2017 data for nitrate in rivers show that 60.9% of monitored sites have values below 8 mg/l NO_3 (Table 1). Nitrates in rivers have been relatively stable since 2007.

Table 1: Percentage and number of rivers and river sites in each nitrate concentration category for 2015–2017.[13]

3 year average	Categories of nitrate concentrations in rivers					
mg/l as NO_3	<4	4–8	8–12	12–25	25–37.5	37.5–50
No. of sites	706	333	281	368	17	2
% sites	41.4	19.5	16.5	21.6	1	0.1
No. of rivers	332	131	94	141	10	1
% of rivers	46.8	18.5	13.3	19.9	1.5	0.1

Only two river sites had average concentrations above 37.5 mg/l NO_3 for the 2015–2017 period. These are on the Aghalona stream in Carlow and on the Shambles river in Monaghan. Both these sites have historically elevated nitrate concentrations.

Map 2 shows the national distribution of average nitrate concentrations for the period 2015–2017. The south and south-east of the country have the highest relative nitrate concentrations.

Trends

A statistical analysis from 2007 to 2017 shows that 55% of river sites had stable nitrate concentrations since 2007. There is relatively little change in the percentage of sites with increasing and decreasing trends in nitrate concentrations since the last report. This appears to indicate that the historical improving trend may now be beginning to plateau; however, there has been a small increase in the percentage of sites with higher nitrate concentrations.

[12] Nitrate is generally measured as nitrate and nitrite together (total oxidised nitrogen (TON)), as the concentration of nitrite is usually negligible. Nitrate was measured separately for some sites, however.
[13] Percentages may not always sum to 100% due to rounding.

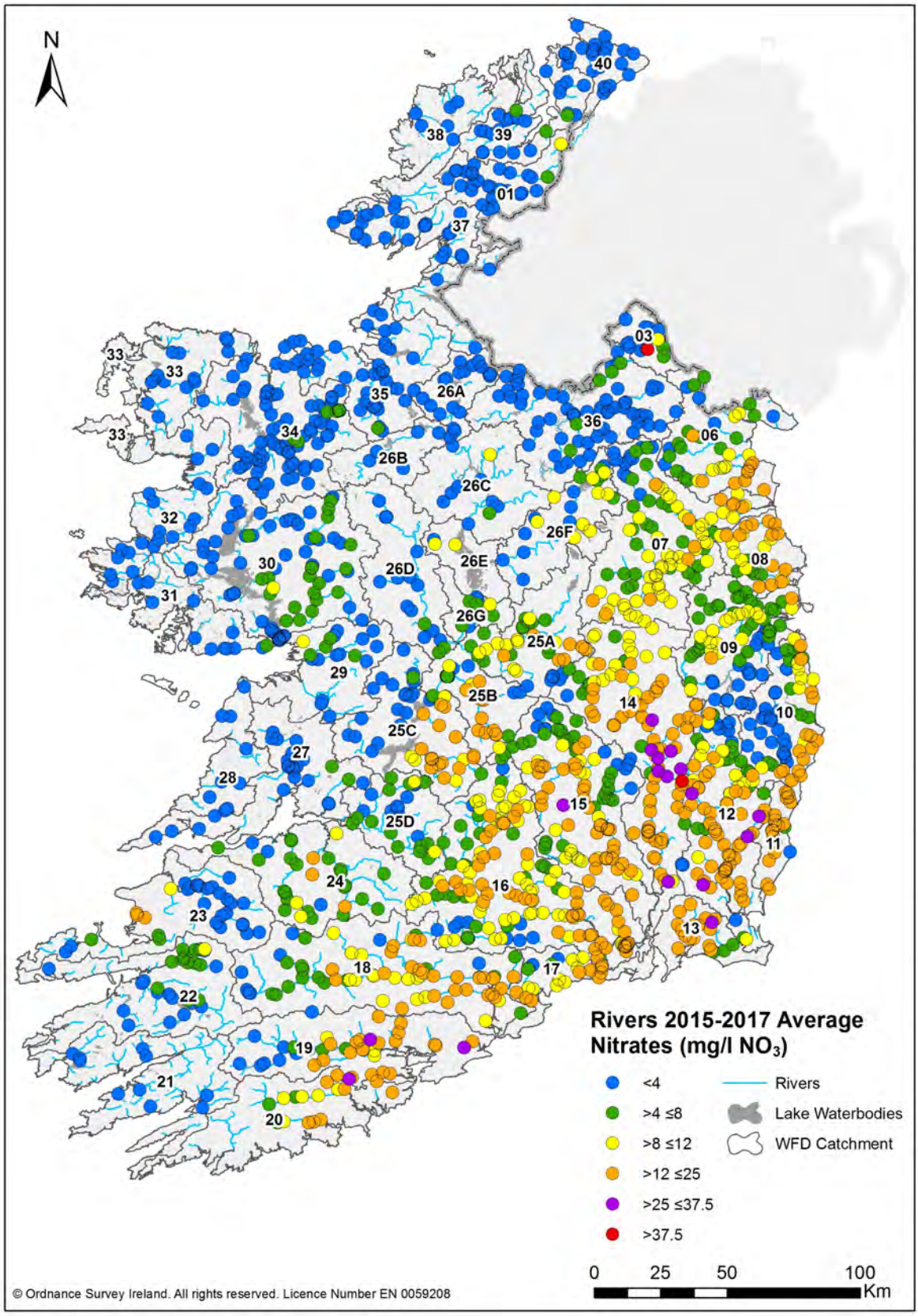
Overall, however, the data for 2017 reflect a relatively stable situation with regard to current concentrations of nitrate in Irish rivers. A national picture of these trends is presented in Map 3.

Table 2: Nitrate trends[14] in river sites (numbers, %) categorised by direction and rate of change.

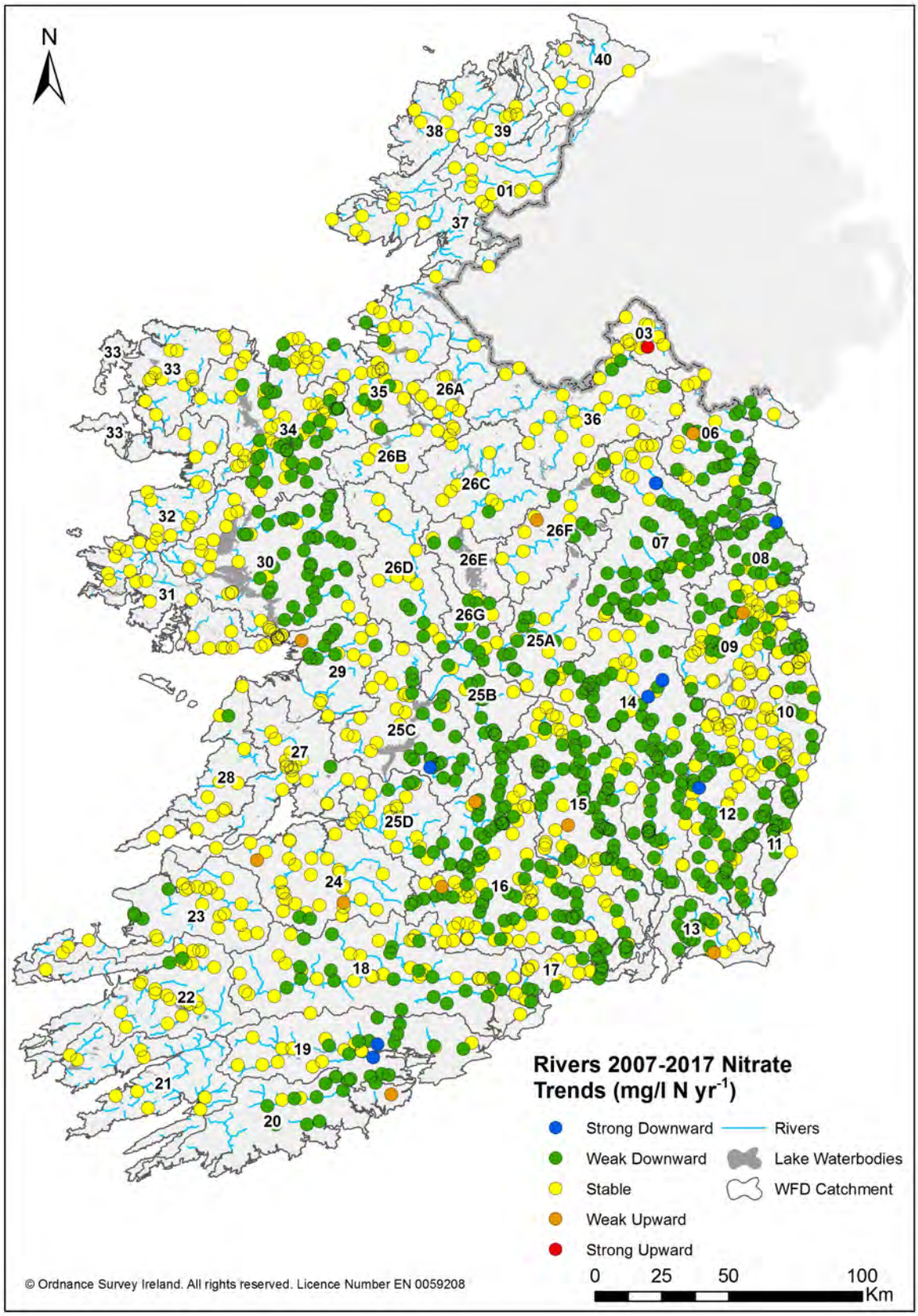
Classification	Rate of change (mg/l nitrogen/yr)	No. of sites	%
Strong improving	Reducing by more than 0.2	8	0.6
Weak improving	Reducing by between 0.05 and 0.2	616	43.5
Stable	Varying by less than ±0.05	778	55.0
Weak deterioration	Increasing by between 0.05 and 0.2	12	0.8
Strong deterioration	Increasing by more than 0.2	1	0.1

[14] Terms such as 'improving' and 'deteriorating' refer to water quality. Improving means reducing concentrations and deteriorating means increasing concentrations.

Map 2: Average nitrate concentration at river sites for 2015–2017.



Map 3: Trends in average nitrate concentration at river sites between 2007 and 2017 inclusive.



Indicator 4: Phosphate in Rivers

Phosphate is essential for plant growth, but too much phosphate can significantly damage the ecological health of rivers. Phosphate enters waters from a variety of sources, but primarily from:

- sewage and industrial discharges and
- agricultural land where animal manure and inorganic fertilisers have been spread.

Excessive amounts of phosphate in rivers are a key driver of eutrophication (effects of nutrient pollution)[15] in freshwaters.

Assessment

This indicator is based on categorising the three-year average phosphate[16] concentration from 1874 individual river sites in 702 rivers into six quality classes for the period 2015–2017.

Average phosphate concentrations of less than 0.025 mg/l P and less than 0.035 mg/l P have been established in Ireland as legally binding environmental quality standards (EQS) to support the achievement of high and good ecological status as required by the WFD. Concentrations of phosphate consistently greater than 0.035 mg/l P are likely to lead to nutrient pollution (see yellow, brown, purple and red dots in Map 4 to get a sense of the scale of the problem).

Findings

The 2015–2017 assessment of three-year averaged values for phosphate in rivers shows that 62.8% of monitored river sites are classed as either high or good quality based on the phosphate environmental quality standard. The remaining 37.2% of sites are classed as being of moderate or worse quality (Table 3).

The current assessment represents a significant reduction in the proportion of sites with low phosphate concentrations (less than 0.025 mg/l P) from 58% in 2014–16 to just over 48% in 2015–17. There is an increase in the percentage of sites in the moderately to seriously polluted range (greater than 0.035 mg/l P) from 26.6% in 2014–2016 to 37.2% in the present period. The increased concentrations are a worrying development as sustained trends would likely lead to an increase in the proportion of water bodies failing to meet their ecological status because of nutrient enrichment (see Indicator 1).

Of the 1,874 sites reported, 11 (0.6%) have very high concentrations above 0.1 mg/l P.

[15] Too many nutrients like phosphorus and nitrogen can cause ecological problems in rivers.
[16] Measured as molybdate reactive phosphate (MRP).

Table 3: Percentage and number of rivers and river sites in each phosphate concentration category for 2015–2017.

3-year average	Categories of phosphorus concentrations in rivers					
mg/l P	<0.025	0.025–0.035	0.035–0.05	0.05–0.1	0.1–0.25	>0.25
No. of sites	905	271	269	333	85	11
% sites	48.3	14.5	14.3	17.8	4.5	0.6
No. of rivers	355	84	88	134	33	8
% of rivers	50.6	12	12.5	19.1	4.7	1.1

Trends

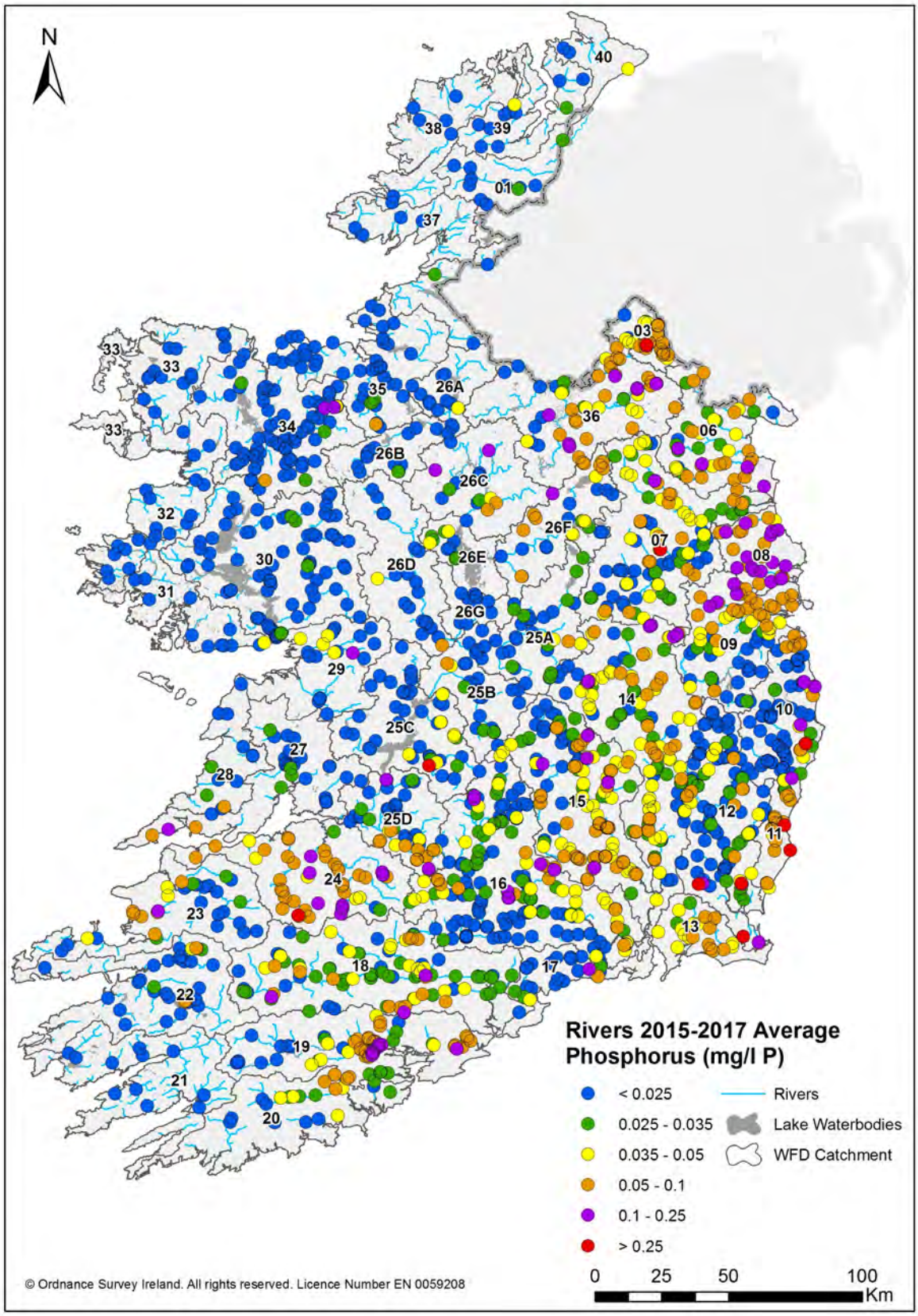
Long-term phosphate trends in the previous 2016 report indicated that almost all river sites showed either no change (74.4%) or a decrease (22.1%) in phosphate concentration. The updated long-term trends (2007 to 2017) show that 77.8% of sites showed no change while 17.6% of sites were decreasing in phosphate concentration (Table 4). The percentage of sites showing a decrease in concentration (17.6%) is still greater than the percentage of sites showing an increase (4.5%).

However, it still appears that these improvements in phosphate concentration have not been sufficient to lead to a discernible improvement in the ecological quality of the associated rivers. Map 4 illustrates the scale of the problem, with the yellow, brown, purple and red dots all indicating levels greater than those likely to lead to nutrient pollution. The north-east, south-east and south of the country have particularly high levels of phosphorus (greater than 0.035 mg/l P).

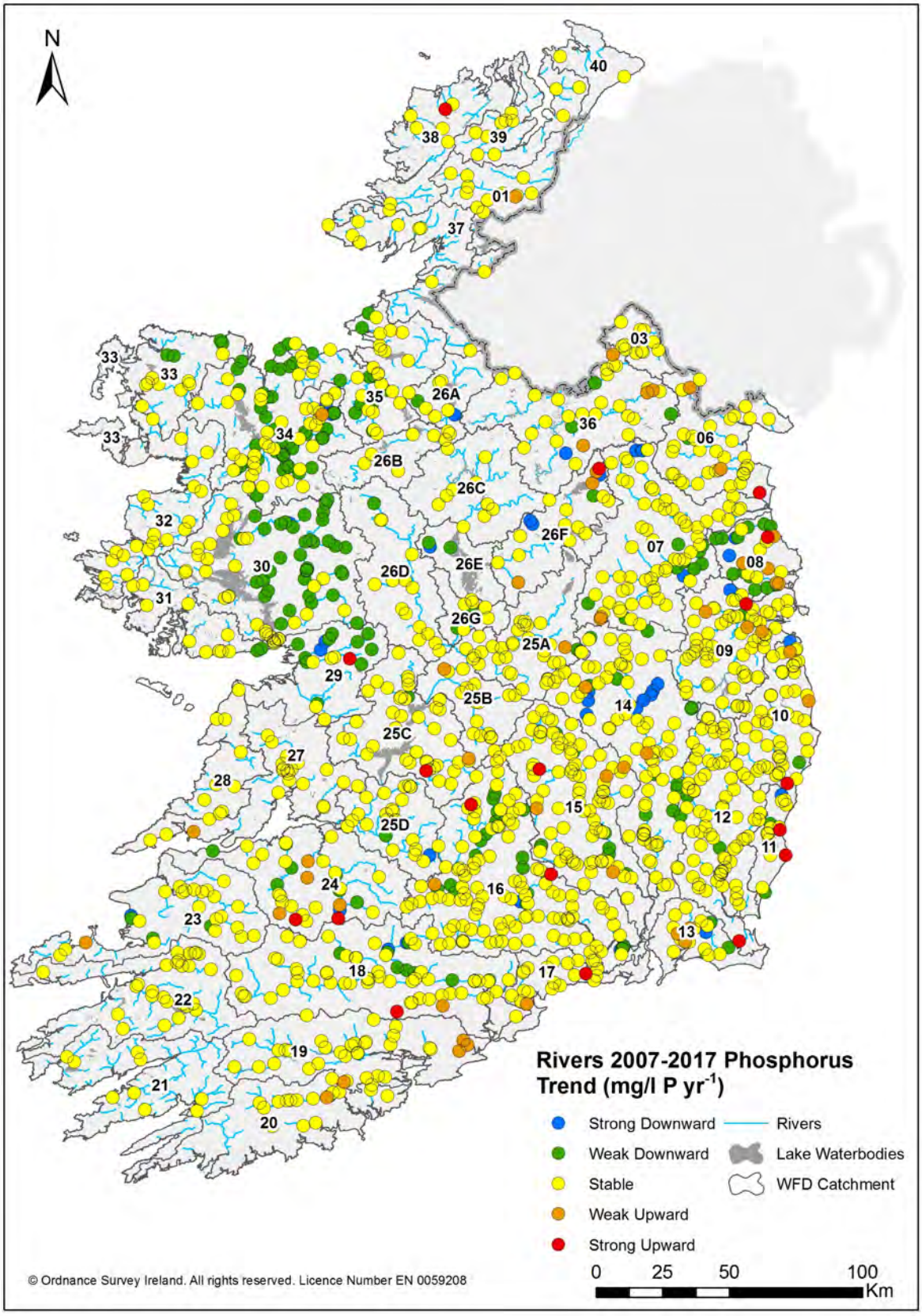
Table 4: Phosphate trends in river sites (numbers, %) categorised by direction and rate of change.

Classification	Rate of change (mg/l P/yr)	No. of sites	%
Strong improving	Reducing by more than 0.005	39	2.6
Weak improving	Reducing by between 0.002 and 0.005	222	15.0
Stable	Varying by less than ±0.002	1149	77.8
Weak deterioration	Increasing by between 0.002 and 0.005	49	3.3
Strong deterioration	Increasing by more than 0.005	18	1.2

Map 4: Average phosphate concentrations at river sites for the period 2015–2017.



Map 5: Trends in phosphate concentrations at river sites for the period 2007–2017.



Indicator 5: Canal Quality

Canals are important amenity areas for leisure activities, such as boating and fishing, and provide a habitat for many species including aquatic plants, insects, fish and birds. Waterways Ireland is responsible for the management, maintenance, development and restoration of the canal system throughout the island of Ireland. The main canal systems, the Royal and Grand Canals and sections of the Shannon–Erne Waterway, comprise 15 water bodies[17].

Assessment

A key element of the assessment of canal water quality is biological quality. Waterways Ireland assesses the biological quality of the canals by surveying the aquatic plants and invertebrates (tiny animals without backbones). Biological quality is presented in this indicator as five categories:

- maximum;
- good;
- moderate;
- poor; and
- bad.

Findings

During the 2015–2017 period, 13 (93%) canal water bodies were classified as being at good or maximum biological quality, an improvement on 2013–2015, which had 10 (71%) water bodies at the same classification (Figure 3). Biological quality in our canals has shown an overall improvement since the 2013–2015 period. This was due to improvements in the plant and macroinvertebrate (tiny animals without a backbone) communities at some sites.

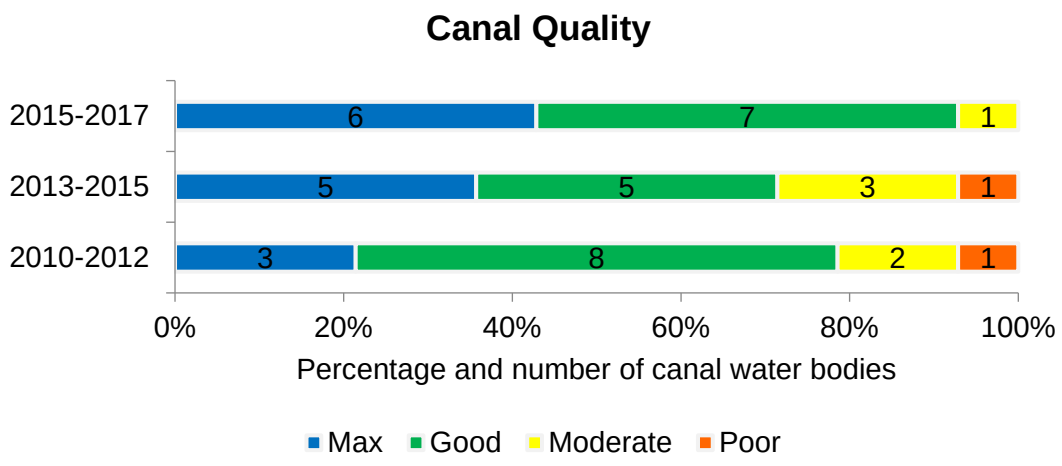
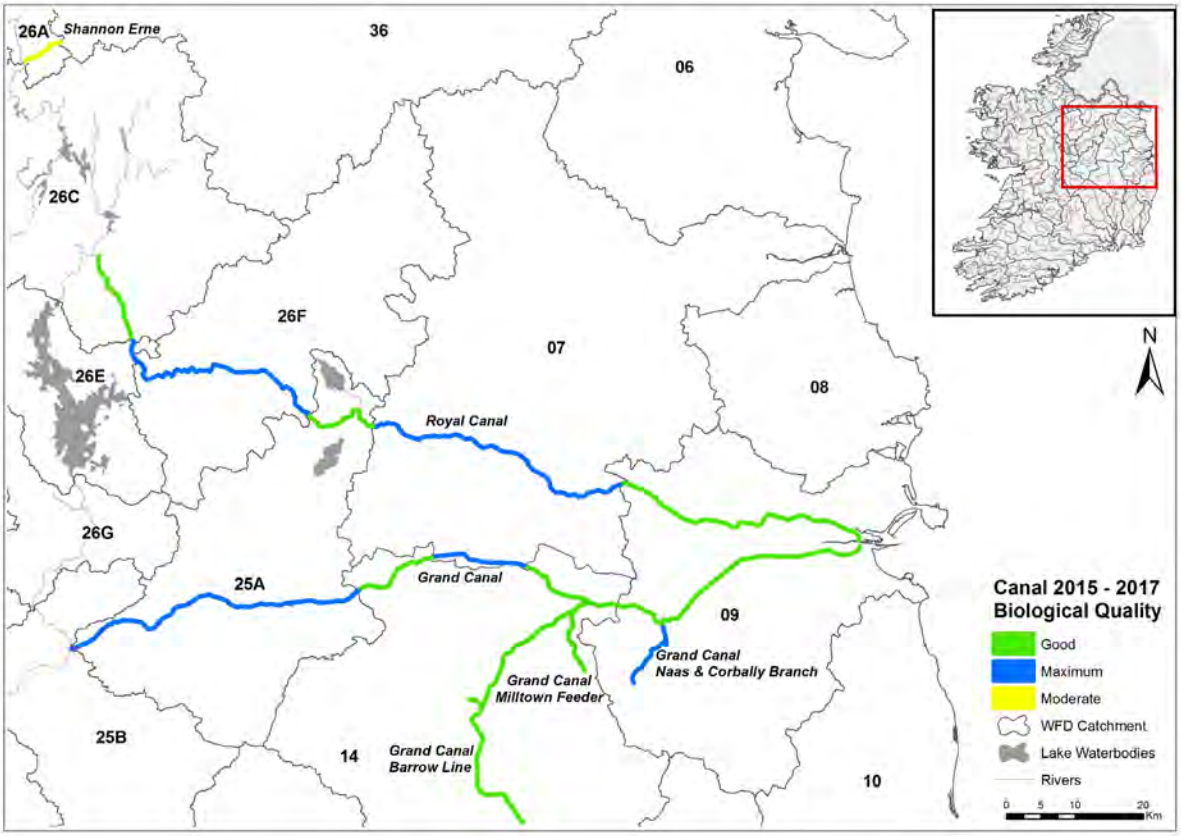


Figure 3: Biological quality of canals (percentage and number of water bodies) from 2010 to 2017.

[17] The Grand Canal Basin is assessed on physico-chemistry alone and is not included in this assessment.

Map 6: Biological quality of canals for 2015–2017.



Indicator 6: Lake Biological Quality

Ireland has more than 12,000 lakes; some are large and some are small. They are primarily located along the western seaboard and in the centre of Ireland, with relatively few in the east of the country. Lakes and reservoirs are the main source of drinking water for two million people in Ireland.

This indicator is based on the biological assessment of 224 monitored lakes (covering around 80% of the surface area of all lakes in Ireland) for the period 2015–2017.

Assessment

The biological elements that are assessed for lake biological quality are:

- macrophytes (aquatic plants),
- phytoplankton (tiny, free-floating plants),
- phytobenthos (algae attached to rocks), and
- fish.

Lake biological quality is reported as five quality classes, namely:

- high,
- good,
- moderate,
- poor, and
- bad.

This indicator identifies annual changes in the biological quality of lakes. It also shows the likely change in lake ecological status,[18] which is fully assessed every three years.

Findings

109 (49%) lakes were in high or good ecological quality and the remaining 115 (51%) lakes were less than good quality (Figure 4, Map 7). Thirty-four lakes improved in quality, while 26 lakes deteriorated between 2013–2015 and 2015–2017. This indicates a 1% decline in good or better quality compared to 2013–2015[19] and a decline of 4.7% of lakes since status assessments began in 2007–2009.

[18] Ecological status is reported for the WFD and includes biological, physico-chemical and hydromorphological status.

[19] The biology monitoring programme runs on a 3-year cycle and 2013–2015 was the last complete cycle suitable for comparison.

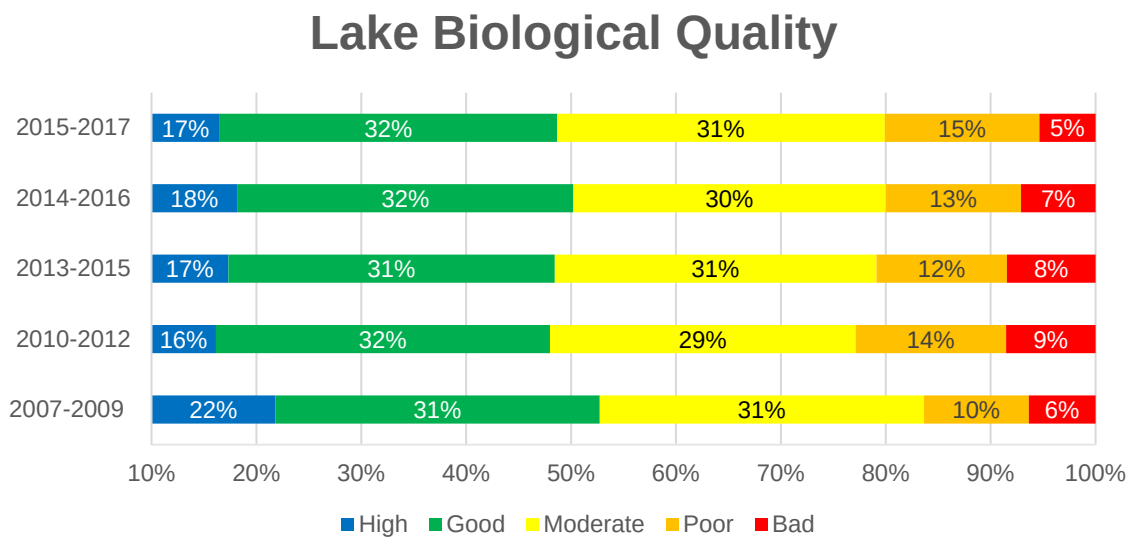


Figure 4: The biological quality of monitored lakes for 2015–2017 as percentage for each quality category.[20]

A change in the aquatic plant community was responsible for the deterioration in 13 of these lakes, seven of which were previously of good quality:

- Lough Arrow (Co. Sligo),
- Ballin Lough (Co. Mayo),
- Lough Conn (Co. Mayo),
- Keel Lough (Co. Mayo),
- Mushlin (Co. Cavan),
- Rowan (Co. Leitrim), and
- Lough Seecon (Co. Galway).

The deterioration in one previously good-quality lake, Lough Lene (Co. Westmeath), was due to an assessment of its fish community.

Seven lakes were at less than good quality but have deteriorated further, namely:

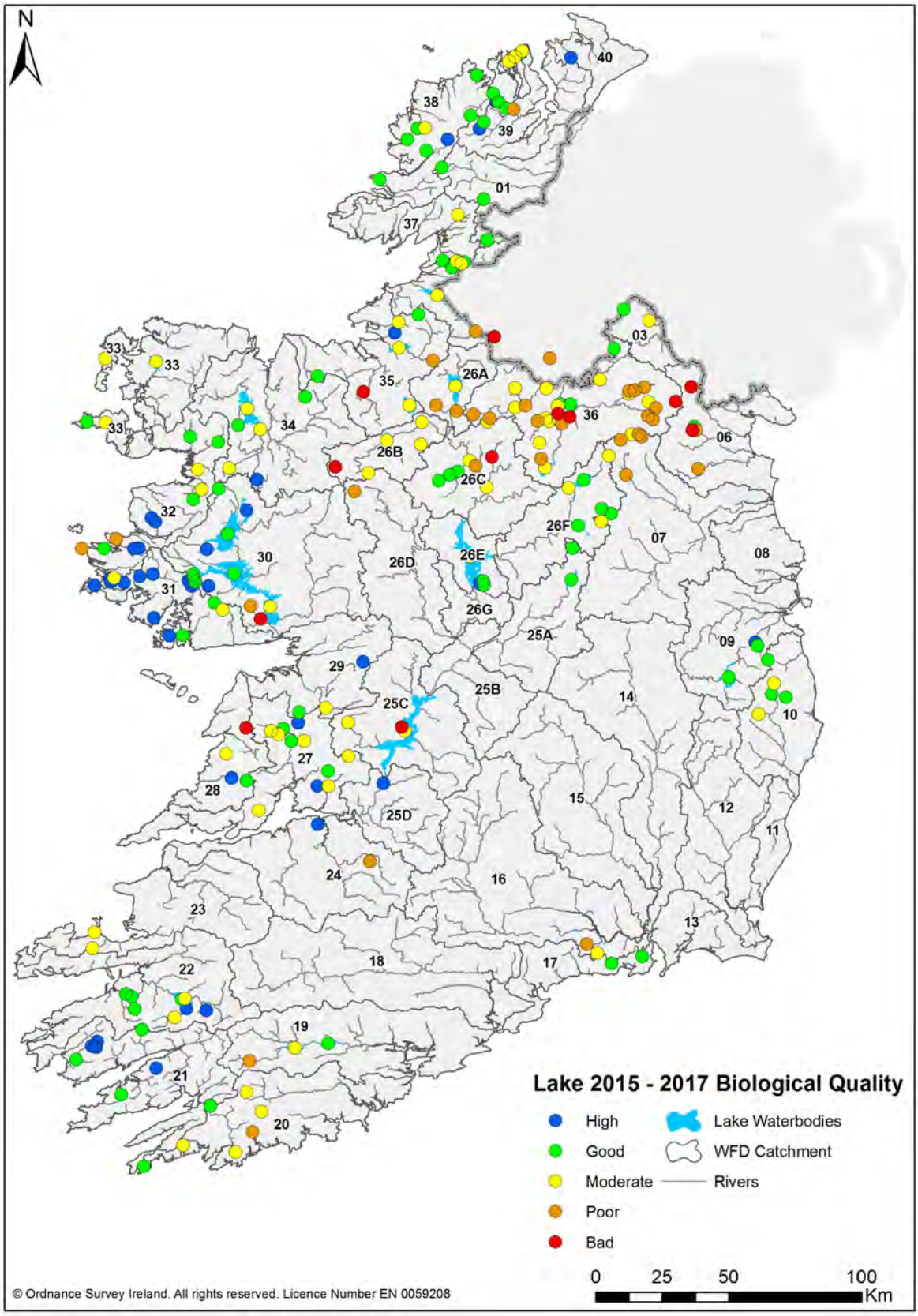
- Ballyquirke (Co. Galway),
- Belhavel Lough (Co. Leitrim),
- Lough Bofin LM (Co. Leitrim),
- Muckno (Co. Monaghan),
- Lough Rinn (Co. Leitrim),
- Lough Scur (Co. Leitrim), and
- Lough Macnean Upper (Co. Cavan).

[20] Percentages may not sum to 100% due to rounding.

Trends

Overall, high and good lake biological quality deteriorated by 1% compared to 2013–2015 and 4.7% compared to 2007–2009.

Map 7: Biological quality of lakes for 2015–2017.



Indicator 7: Total Phosphorus in Lakes

The concentration of total phosphorus (mg/l P) in lakes is a key quality indicator because of its impact on biological quality in freshwater. Nutrients such as phosphorus are essential for plant growth, but if present in excess amounts can lead to a significant decrease in water quality due to the proliferation of plants and algal blooms.

Assessment

This indicator is based on categorising the average three-year total phosphorus concentration in 224 monitored lakes into five quality classes:

- high,
- good,
- moderate,
- poor, and
- bad.

While there is no national environmental quality standard for phosphorus in lakes, average concentration values less than 0.010 mg/l P and less than 0.025 mg/l P are considered to indicate high and good quality, respectively. Concentrations greater than 0.025 mg/l P are likely to lead to nutrient pollution.

Findings

71% of lakes sampled had an average concentration value less than 0.025 mg/l P (Figure 5), a decrease on last year's reported value of 74%. There has been a welcome decrease of lakes classified as bad quality, from 3% in 2013–2015 to 2% in 2014–2016 to 1% in the current period. There has however been a 5% increase in lakes categorised as being of moderate quality or worse, from 24% (2013–2015) to 29% (2015–2017).

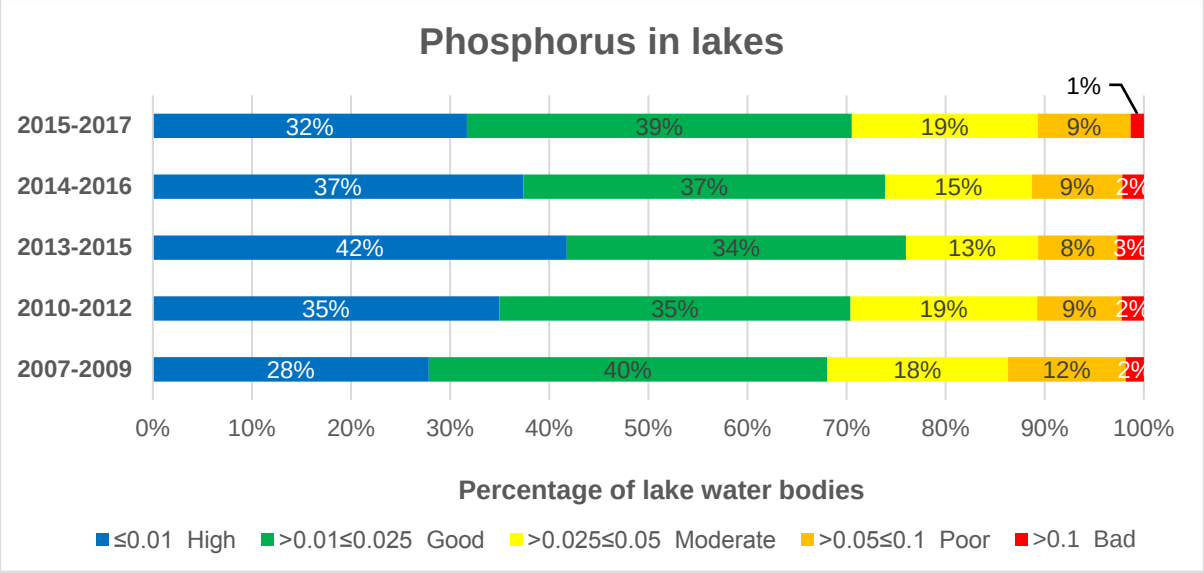


Figure 5: The relative frequency of the number of lakes falling into each quality class based on average phosphorus concentrations (mg/l P) measured over three-year time periods from 2007–2017.

Three monitored lakes had very high average phosphorus concentrations (greater than 0.1 mg/l P) in the 2015–2017 period (Map 8), namely:

- Farnham Lough (Co. Cavan),
- Lough Egish (Co. Monaghan), and
- Inner Lough (Co. Monaghan).

Trends

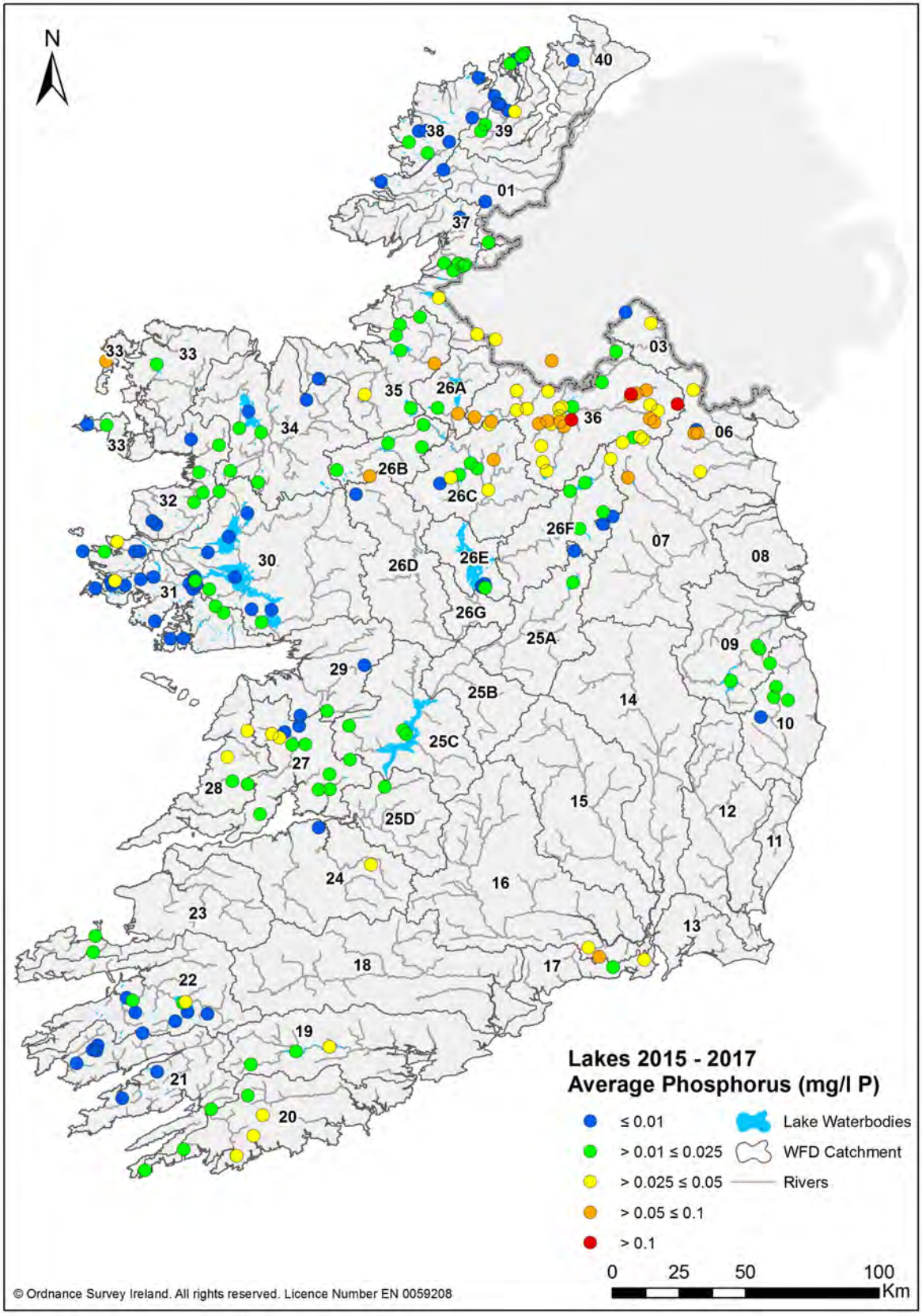
A trend assessment of 102[21] lakes was carried out using annual average data for 2007 to 2017. Eighty of the analysed lakes were stable. Two lakes had a strong deteriorating trend; these were Inner Lough (Co. Monaghan) and Drumlaheen Lough (Co. Leitrim).

[21] Number of lakes that met the statistical criteria to undergo an assessment using the Mann–Kendall and Sen trend test to determine the annual rate of change.

Table 5: Phosphate trends in lakes for the period 2007–2010 categorised by direction and rate of change.

Classification	Rate of change (mg/l P/yr)	No. lakes	%
Strong improving	Reducing by more than 0.005	0	0.0
Weak improving	Reducing by between 0.002 and 0.005	7	6.9
Stable	Varying by less than ±0.002	80	78.4
Weak deterioration	Increasing by between 0.002 and 0.005	13	12.7
Strong deterioration	Increasing by more than 0.005	2	2.0
No analysis	Data didn't meet statistical criteria	122	NA

Map 8: Average total phosphorus concentrations at all lakes for 2015–2017.



Indicator 8: Fish Kills

The presence of healthy fish stocks, particularly salmon and trout, in rivers, lakes and estuaries is an indicator of good water quality. A fish kill[22] is a sign of a catastrophic ecosystem disruption. Fish kills can occur within a localised stretch or over a large distance in a water body. There are many possible causes, but oxygen depletion in water is the principal reason for fish kills. These conditions can be brought about by organic pollution from agricultural, municipal and industrial sources and can result in excessive plant growth leading to low oxygen levels at night or when the vegetation decays.

Assessment

Inland Fisheries Ireland (IFI) compiles data on fish kills in Ireland annually.

Findings

In 2017, there were 14 fish kills, affecting 7.8 km of river with 2123 dead fish recovered.[23]
The causes of fish kills between 2010 and 2017 are varied but, where determined based on investigations carried out by IFI, are primarily due to agricultural practices (Table 6). The number of recorded fish kills per IFI region is shown on Map 9. IFI Limerick reported the highest number of fish kills caused by agricultural and urban (municipal) sources, while IFI Dublin reported the highest number caused by industrial sources but also by undetermined sources (Table 6). The highest overall number of fish kills (57) was recorded in the region covered by IFI Dublin since 2010.

Table 6: Causes attributed to reported fish kills by IFI between 2010 and 2017. Numbers correspond to the number of fish kills in each catchment area covered by the relevant IFI office (Map 9).

IFI Office	Agriculture	Municipal Works	Industrial Operations	*Other	Total
Dublin	4	4	10	39	57
Limerick	18	6	1	20	45
Macroom	7	3	9	18	37
Ballyshannon	5	6	1	18	30
Clonmel	9	1	0	19	29
Ballina/Galway	4	3	0	12	19
Total	47	23	21	126	217

*** Other:** Cause not determined. In some incidents, high temperatures and low water levels are suspected, but the cause could also be eutrophication or disease.

[22] A mass death of fish in a localised area, generally caused by pollution.
[23] https://www.fisheriesireland.ie/extranet/fisheries-protection/1514-fisheries-protection-review-2017-key-statistics/file.html

Trends

Fish kills for 2017 are low compared with long-term trends (Figure 6) and were significantly lower than 2016, when there were 31 reported incidents. Current figures indicate that fish kill numbers are at a historic low despite some occasional spikes.

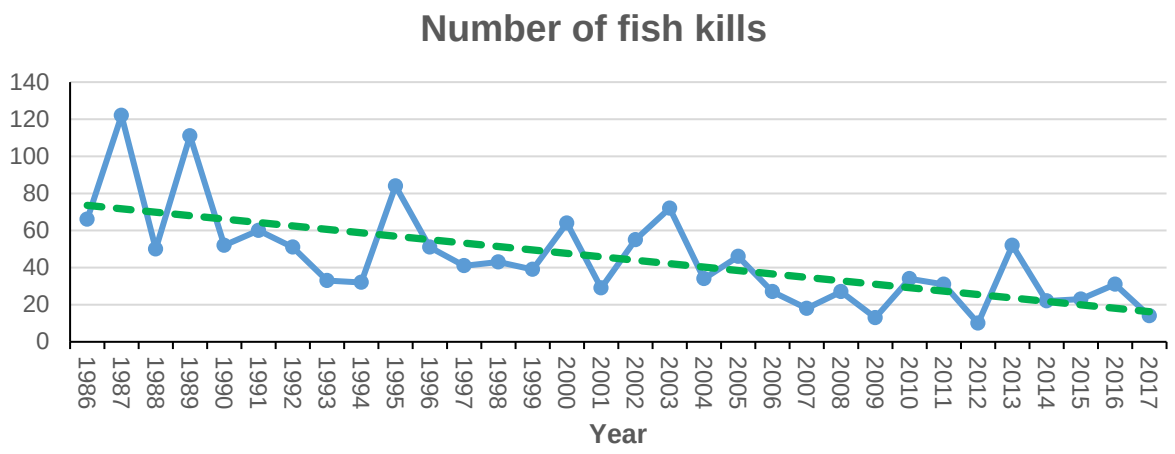


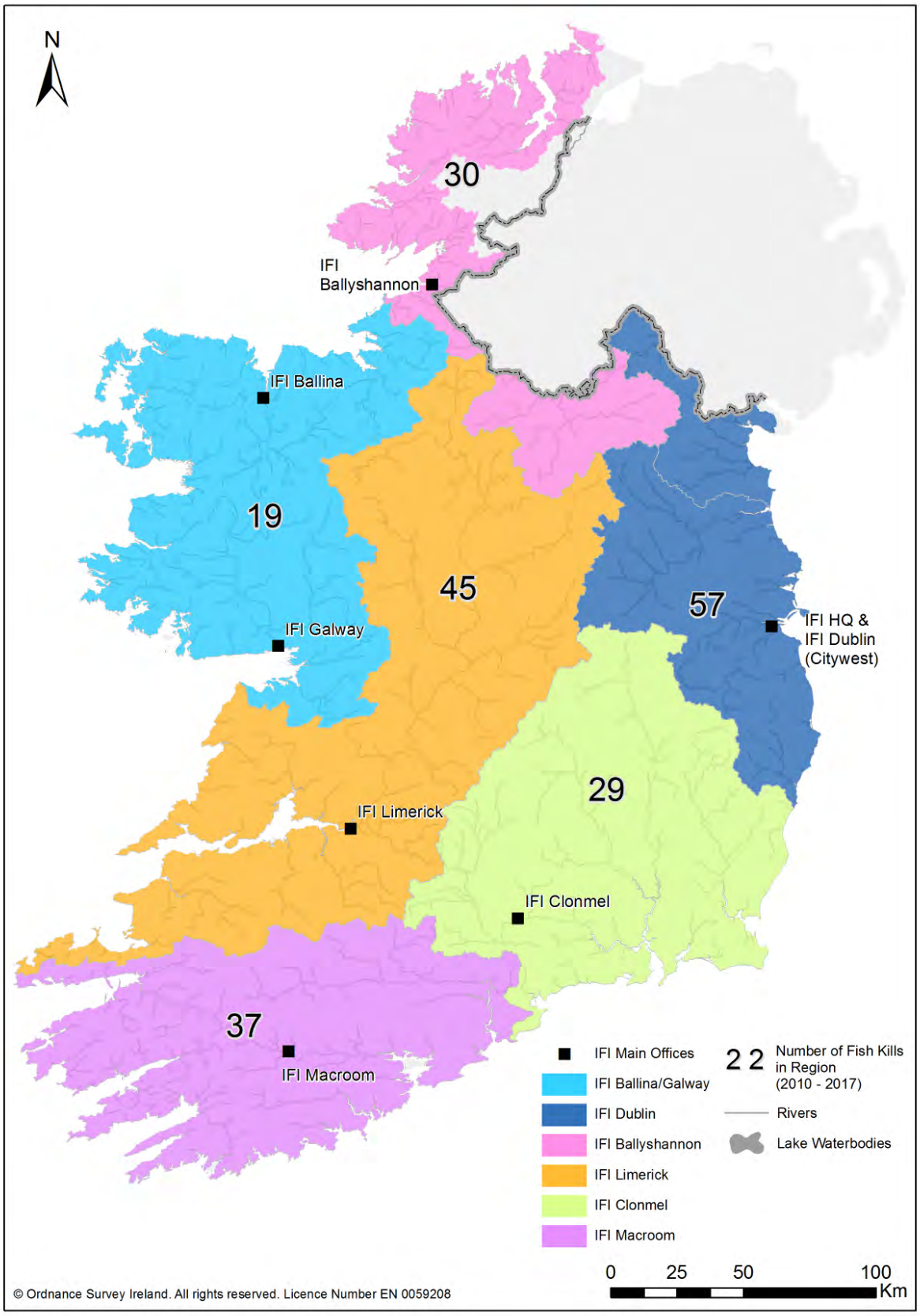
Figure 6: Number of reported fish kills per year from 1986 to 2017. Trend indicated as green line.

River Tolka

The previous indicators report mentioned the River Tolka in Dublin as being particularly vulnerable to fish kills, with at least seven reported kills on the river since 2010. Another fish kill was reported in September 2018,[24] with dead fish recorded over a 5 km stretch of the river. It was reported[25] that a sewer line became blocked and caused raw sewage to overflow into the river. This was a similar cause to the July 2017 fish kill. The upper Tolka is an area for action so local authorities will be investigating water quality in this area between now and 2021.

[24] https://www.fisheriesireland.ie/Press-releases/inland-fisheries-ireland-confirm-fish-kill-on-river-tolka.html
[25] http://www.epa.ie/newsandevents/incidents/recent/name,64694,en.html

Map 9: Number of fish kills in each IFI office region for 2010–2017.



Indicator 9: Trophic Status of Estuaries and Coastal Waters

Ireland has 7,500 km of coast and one of the largest sea areas in the EU. As our tidal waters cover more than 14,000 km^2, the area is broken down into more manageable units called water bodies. A representative number of these water bodies were selected to be monitored to provide an overall indication of the quality of Ireland's marine waters.

The assessment of trophic status is used to identify waters that may be sensitive to nutrient enrichment and the occurrence of eutrophication.[26] It is an assessment of the degree of eutrophication to which a water body is subjected. Too many nutrients can result in excessive plant and algae growth which severely impacts the normal functioning of our marine environment. This results in changes in the natural biological communities and an undesirable disturbance to the overall ecology.

Eutrophication in estuaries[27] and coastal waters can be caused by nitrogen and/or phosphorus. Phosphorus is generally considered the primary limiting nutrient in river-dominated estuaries while nitrogen is considered the primary limiting nutrient in coastal ecosystems. The limiting nutrient is the nutrient that is naturally in short supply under normal conditions. If the amount of the limiting nutrient increases, this may cause ecological problems.

Assessment

Trophic status is assessed by studying:

- nutrient levels such as phosphorus and nitrogen,
- growth of algae, and
- undesirable disturbance (as indicated by measurement of dissolved oxygen).

This indicator categorises the trophic status of these waters into four classes based on the above elements:

- eutrophic (the water body has issues in all of the elements – too much nutrients, high growth of algae and undesirable disturbance all occur together),
- potentially eutrophic (water body has issues in two elements and the third element is getting bad),
- intermediate (water bodies where there are issues with one or two elements) and
- unpolluted (water bodies with no issues).

[26] Too many nutrients, like phosphorus and nitrogen, can cause ecological problems in estuarine and coastal waters, like overgrowth of algae and plants that can lead to undesirable effects such as oxygen depletion. This is called eutrophication.
[27] Transitional waters.

Findings

Of the 102 water bodies assessed by this indicator,

- 4 (4%) were eutrophic,
- 12 (12%) were potentially eutrophic,
- 28 (27%) were intermediate, and
- 58 (57%) were unpolluted (Figure 7).

Fourteen water bodies improved and eleven deteriorated in trophic status compared to 2010–2012. The eutrophic or potentially eutrophic areas are predominantly located on the east and south coasts, with most of the unpolluted water bodies located on the south west, west and north-west coasts (Map 10). All of the impacted water bodies, with the exception of Malahide Bay, are estuaries.

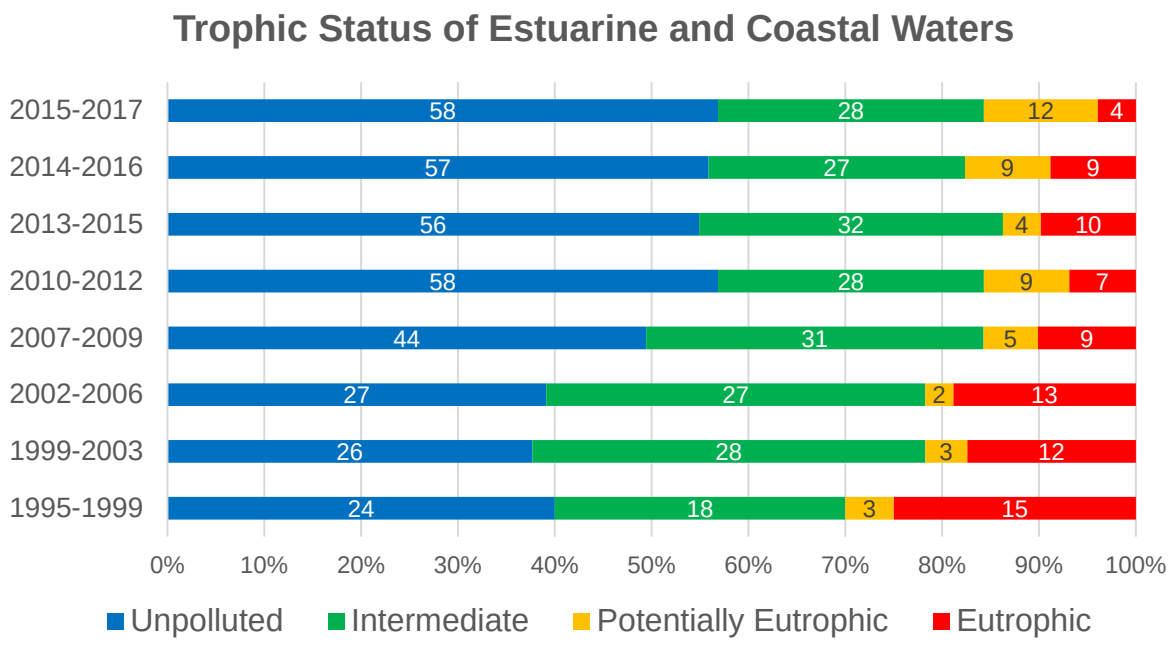
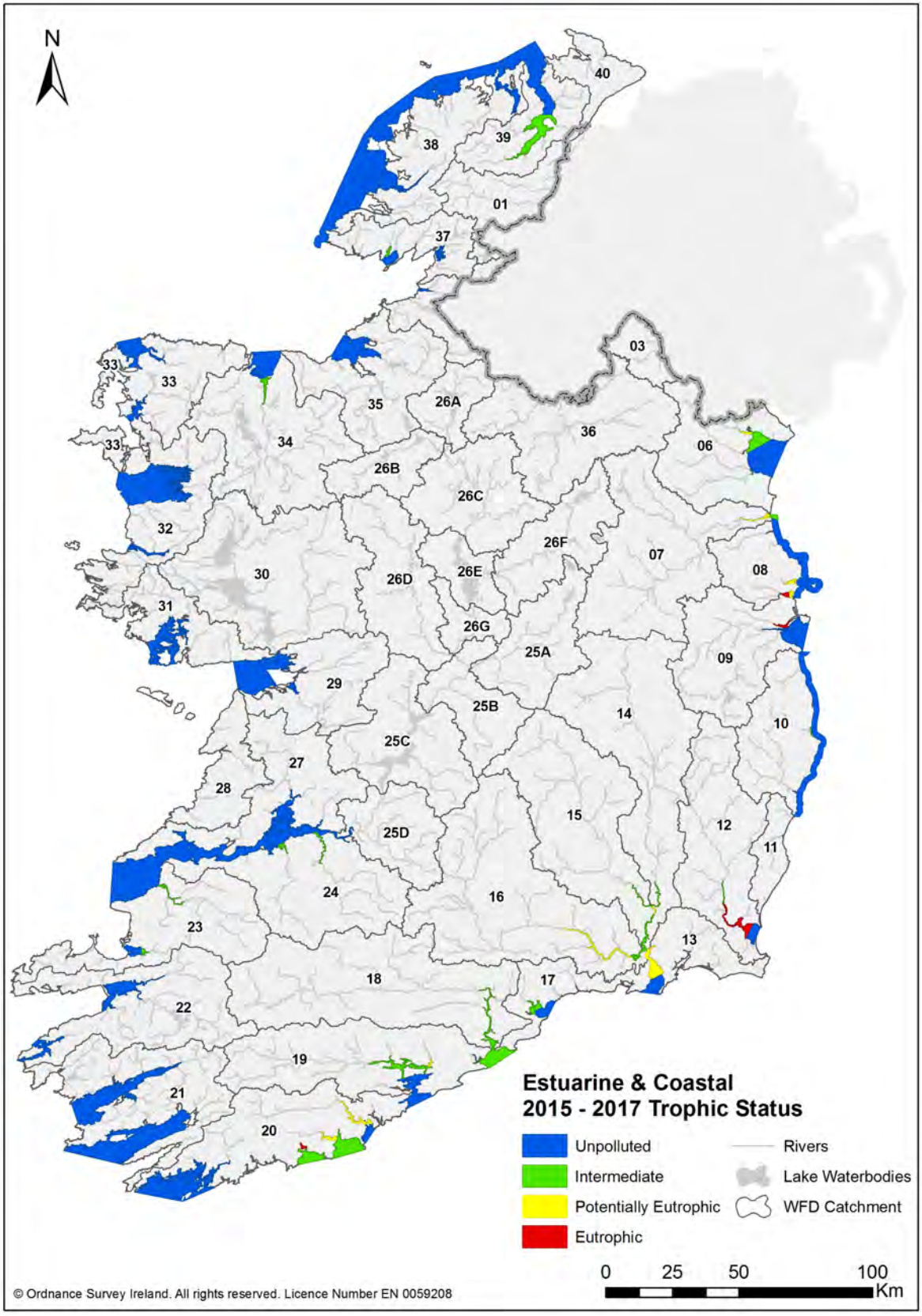


Figure 7: Numbers and percentages of estuaries and coastal water bodies at each trophic status since 1995.

Trends

The number of water bodies in each trophic category has remained relatively stable since 2010. What this means, though, is that improvements in one area are being cancelled out by deterioration in other areas.

Map 10: The 2015–2017 trophic status of estuarine and coastal waters.



Indicator 10: Nitrogen in Estuaries and Coastal Waters

Nitrogen is generally considered the primary limiting nutrient in coastal ecosystems, meaning that its concentration can control the growth of algae and aquatic plants. Increases in nitrogen can lead to elevated growth of phytoplankton (tiny, free-floating plants) and/or opportunistic seaweed (such as sea lettuce).

In winter the concentration of nitrogen as dissolved inorganic nitrogen[28] is expected to be at its highest due to the absence of any significant plant or algal growth.

Assessment

Thresholds have been defined for dissolved inorganic nitrogen in estuaries (transitional water bodies) and coastal waters for the different salinities, and there is an environmental quality standard for coastal waters. These thresholds range from ≤2.6 mg/l at a salinity of 0 to ≤0.25 mg N/l at a salinity of 34.5, and are used to assess quality of estuarine and coastal waters around Ireland.

Dissolved inorganic nitrogen concentrations above the thresholds indicate the presence of increased nitrogen levels from human pollution sources. The indicator uses the median[29] winter concentration for the period 2015–2017 to assess exceedance against the assessment threshold.

Findings

Twenty-three of the 95 estuarine and coastal water bodies assessed were above the threshold (Map 11). This is lower than the number of water bodies (29) exceeding the threshold in the previous assessment.

Four water bodies had the highest dissolved inorganic nitrogen concentrations:

- Glashaboy Estuary (Co. Cork),
- Owencurra Estuary (Co. Cork),
- Upper Barrow Estuary (Co. Kilkenny), and
- Lower and Upper Slaney Estuary (Co. Wexford).

Clonakilty Bay remains the only coastal water body to be above the threshold and to breach the corresponding environmental quality standard for coastal waters.

The estuaries with the highest median winter dissolved inorganic nitrogen concentrations were in the:

- Glashaboy Estuary (4.9 mg N/l),

[28] Nitrite + nitrogen + ammonia. Note that here nitrate is expressed as N rather than NO_3 as is the case for the other indicators in the report, and the numerical expression using NO_3 is four times greater than when N is used.
[29] The middle point of a list of numbers.

- Upper Barrow Estuary (3.8 mg N/l),
- Upper Slaney Estuary (3.8 mg N/l),
- Barrow Nore Estuary Upper (3.3 mg N/L), and
- New Ross Port (3.3 mg N/l).

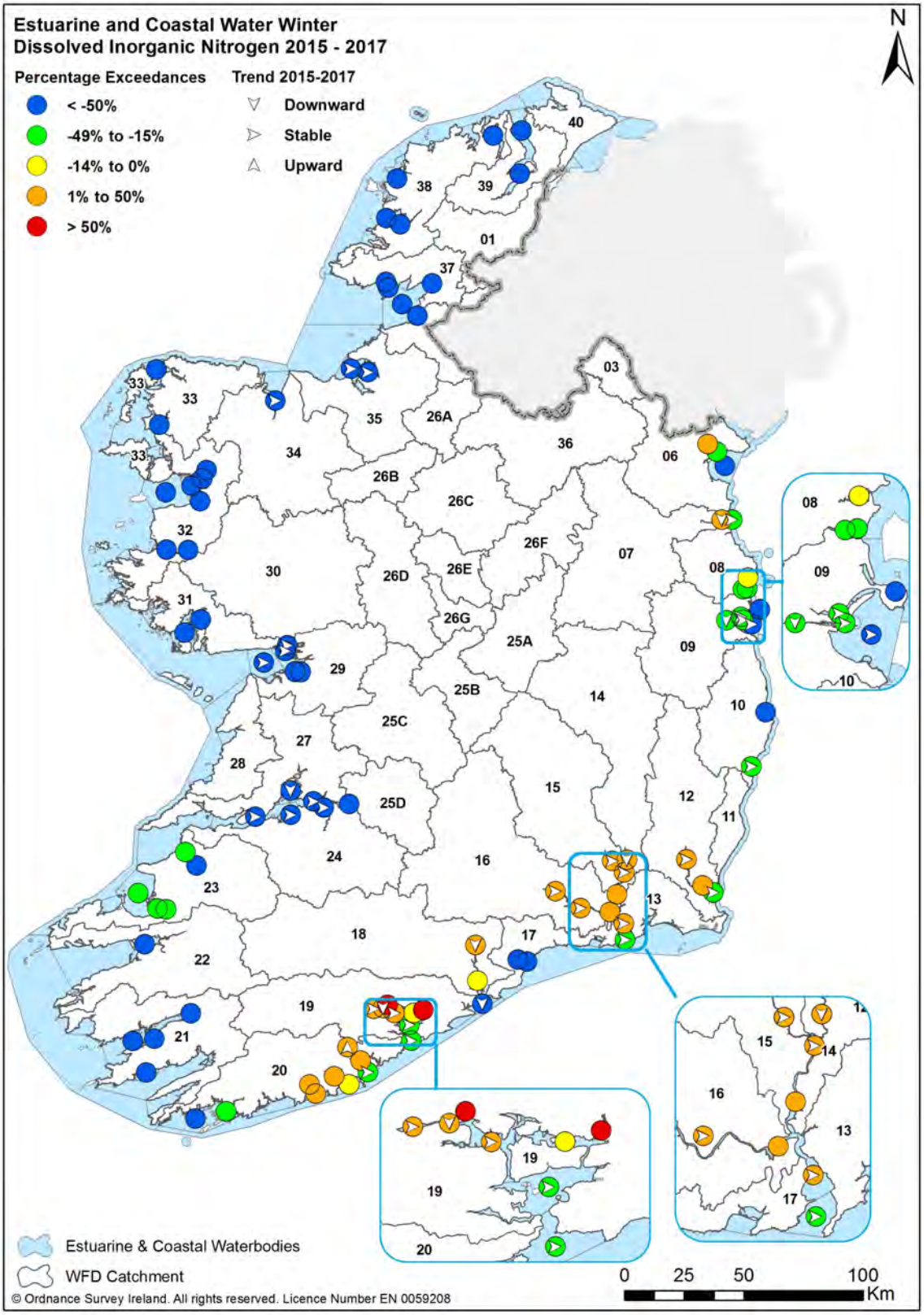
Trends

The EPA undertook a trend analysis of winter median concentrations in estuarine and coastal water bodies in 19 catchments from 2007 to 2017. A significant trend was found in 36 water bodies of the 95 assessed. The upper Bandon Estuary was the only water body where a significant increase was found. The Bandon estuary is an area for action so local authorities will be investigating water quality in this area between now and 2021. Since 2007, there has been a significant decrease in dissolved inorganic nitrogen in seven water bodies, namely:

- Upper Blackwater (Co. Waterford),
- Boyne Estuary (Co. Louth),
- Lower Lee Estuary (Co. Cork),
- Upper Liffey (Co. Dublin),
- Fergus Estuary (Co. Clare),
- Barrow Estuary (Co. Kilkenny), and
- Youghal Bay (Co. Cork).

A stable trend was detected in the remaining 28 water bodies.

Map 11: Winter dissolved inorganic nitrogen levels in estuarine and coastal waters 2015–2017 showing percentage exceedances, above and below assessment level and trend analysis in 19 catchments.[30]



[30] Points with no trend indicator have not been included in the trend analysis.

Indicator 11: Phosphorus in Estuaries and Coastal Waters

Phosphorus[31] is important in estuarine systems because it is limiting (meaning that the concentration of this nutrient can control the growth of algae and aquatic plants) (see Indicator 10) in lower salinity waters. If present in sufficient concentration it can cause eutrophication (effects of nutrient pollution).

In winter the concentration of phosphorus is expected to be at its highest due to the absence of any significant plant or algal growth. This gives an indication of the amount of phosphorus available in the system for growth of plants and algae.

Assessment

Thresholds have been defined for phosphorus in coastal waters for the different salinities[32] and there is an environmental quality standard for estuarine waters (S.I. 272, 2009).[33] The assessment threshold is 0.060 mg/l P for fresh to intermediate waters and ranges from 0.059 to 0.040 mg P/l for intermediate to full salinity waters. Phosphorus concentrations above these thresholds can indicate excess phosphorus entering surface waters due to human activity.

Findings

Only one of the 95 water bodies assessed, (Maigue Estuary, Co. Limerick) exceeded the relevant salinity winter phosphorus threshold. Three water bodies, including the Maigue and Deel estuaries (Co. Limerick), breached the threshold in the 2010–2012 assessment period.

The majority (97%) of estuaries and coastal waters had median[34] phosphorus values less than 0.040 mg/l P, with over half of these having levels less than 0.020 mg/l P.

The highest winter phosphorus concentrations were found in the:

- Maigue Estuary, Co. Limerick (0.069 mg/l P),
- Deel Estuary, Co. Limerick (0.054 mg/l P), and
- Erne Estuary, Co. Donegal (0.04 mg/l P).

Trends

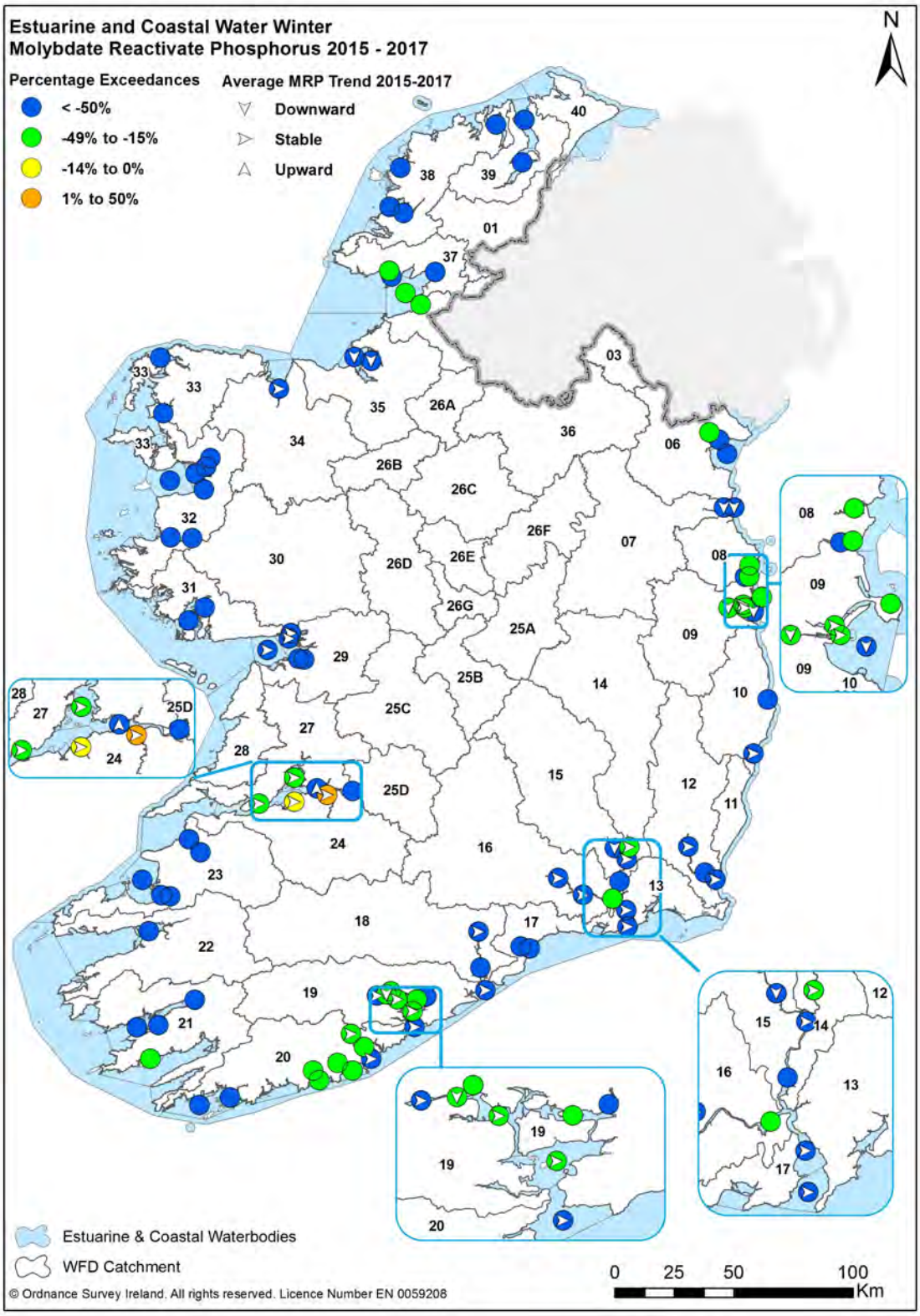
Trend analysis of winter median phosphorus concentrations in estuarine and coastal waters in 19 catchments was undertaken between 2007 and 2017. There is a clear upward trend in concentrations

[31] Measured as molybdate reactive phosphate (MRP)
[32] How salty the water is: fresh water, intermediate, full.
[33] http://www.irishstatutebook.ie/eli/2009/si/272/made/en/print
[34] The middle point of a list of numbers.

over the 11-year period in the Upper Shannon Estuary, Co. Limerick. At the other end of the scale the results show that concentrations in eight water bodies decreased significantly over that period, namely:

- Boyne Estuary and the Boyne Estuary plume zone (Co. Louth),
- Lower Lee Estuary (Co. Cork),
- Upper Liffey Estuary and Dublin Bay (Co. Dublin),
- Nore Estuary (Co. Kilkenny), and
- Garvogue Estuary and Sligo Bay (Co. Sligo).

Map 12: Winter phosphate levels in estuarine and coastal waters 2015–2017 showing percentage exceedances, above and below assessment level and trend analysis.[35]



[35] Dots with no trend indicator have not been included in the trend analysis.

Indicator 12: Nutrient Inputs to the Marine Environment

Overabundance of nutrients in estuarine and coastal zones can cause excessive growth of seaweed and phytoplankton (tiny, free-floating plants), with knock-on effects throughout the ecosystem. Measuring the amount of nutrients entering the sea provides a useful indicator of trends in the loss of nutrients from land-based sources.

Assessment

To assess the amount of nutrients entering the sea, monitoring of the inputs of total phosphorus and total nitrogen into the marine environment from 19 major rivers has been ongoing since 1990.[36] The inputs are calculated based on nutrient concentrations, which are measured 12 times a year, and river flow, which is measured continuously.

Findings

Nutrient inputs from Irish rivers have varied over the 28 years since monitoring began (Figure 8). Loads of total nitrogen[37] were highest in the 1990s, then decreased until 2014. There was a noticeable increase in total phosphorus loads in the mid-1990s and then a sharp reduction in loads in the late 1990s and early 2000s. Since 2014, loads of both nutrients have increased.

Reductions in total nitrogen and phosphorus loads were seen in all rivers since they peaked in the 1990s. On a national basis, the loadings of measured total nitrogen and total phosphorus have decreased by 35,117 tonnes (37%) and 1,278 tonnes (49%) respectively when comparing long-term loads from 1990–1992 to 2015–2017.

Trends

In recent years the rate of reduction in both nutrients slowed, with loads increasing since 2014. The average total nitrogen in 2015–2017 had increased by 3,200 tonnes (6%) since 2012–2014. Average total phosphorus rose by 240 tonnes (22%) over the same period.

[36] As part of the Oslo–Paris Convention for the Protection of the North East Atlantic strategy to combat eutrophication in the marine environment.

[37] To remove the influence of inter-annual changes in river flow, the inputs are normalised by a factor which represents the long-term average flow rate for each river.

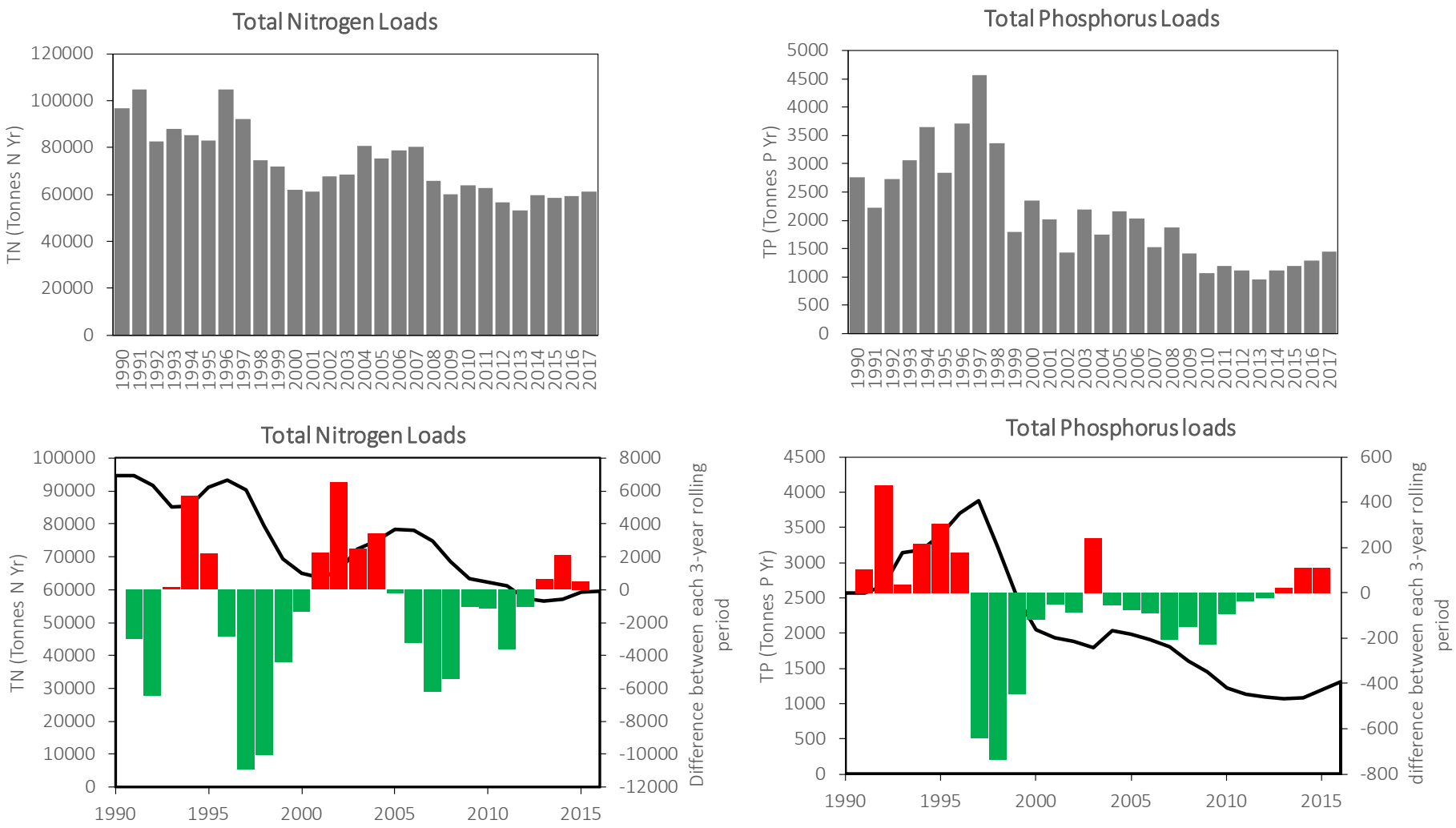


Figure 8: Loads of total nitrogen and total phosphorus (tonnes per year) between 1990 and 2017 for all monitored rivers combined. Areas under the black line (bottom graphs) indicate loads when averaged over three-year rolling periods. Green bars indicate a reduction from one three-year rolling period to the next; red bars indicate an increase.

Indicator 13: Nitrate in Groundwater

Groundwater is water located beneath the ground surface in spaces that are sometimes called aquifers. The National Groundwater Monitoring Programme assesses the general state of groundwater quality and groundwater levels and flows. This information is used to help protect groundwater used for public and private drinking water supplies and is also used to help protect the ecology of any surface waters that receive groundwaters.

Nitrate (NO_3) is found naturally in low concentrations in groundwater. Groundwater can also be an important pathway for the movement of nitrate from pollution sources to water ecosystems. Nitrate is often the limiting nutrient in marine ecosystems (meaning that the concentration of this nutrient can control the growth of algae and aquatic plants) (see Indicator 10). Nitrate concentrations impact on ecology at lower levels than the drinking water standard.

Assessment

Nitrate concentrations higher than 10 mg/l NO_3 are usually indicative of inputs relating to human activities. Groundwater is widely used for drinking water in Ireland and the drinking water standard of 50 mg/l NO_3 relates to potential for harm to human health. This indicator is based on the annual average nitrate concentration for 195 groundwater monitoring sites that are monitored three times per year.

Findings

Nationally, average nitrate concentrations in groundwater have seen a modest reduction since 1995 (Figure 9). The proportion of sites with concentrations greater than 25 mg/l NO_3 from 2014 to 2017 was greater than for the preceding five years (2009 to 2013). In 2017 the average nitrate concentration exceeded the Irish groundwater WFD threshold value concentration of 37.5 mg/l NO_3 at seven monitoring sites, with one site having average concentrations greater than the Drinking Water Standard of 50 mg/l $N0_3$.

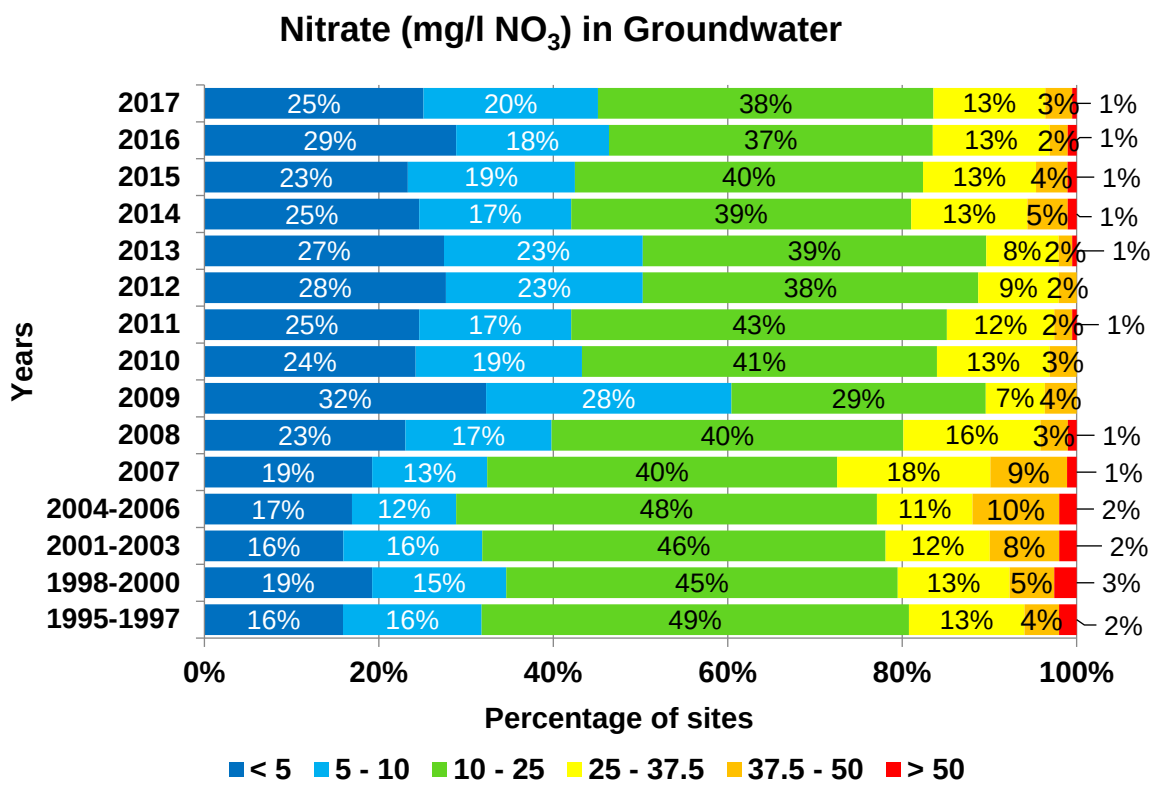


Figure 9: The percentage of groundwater sites in each quality class based on average nitrate concentrations measured from 1995 to 2017.

Generally, the south and south-east of the country continue to have the greatest proportion of monitoring sites with higher nitrate concentrations (Map 13).

Trends

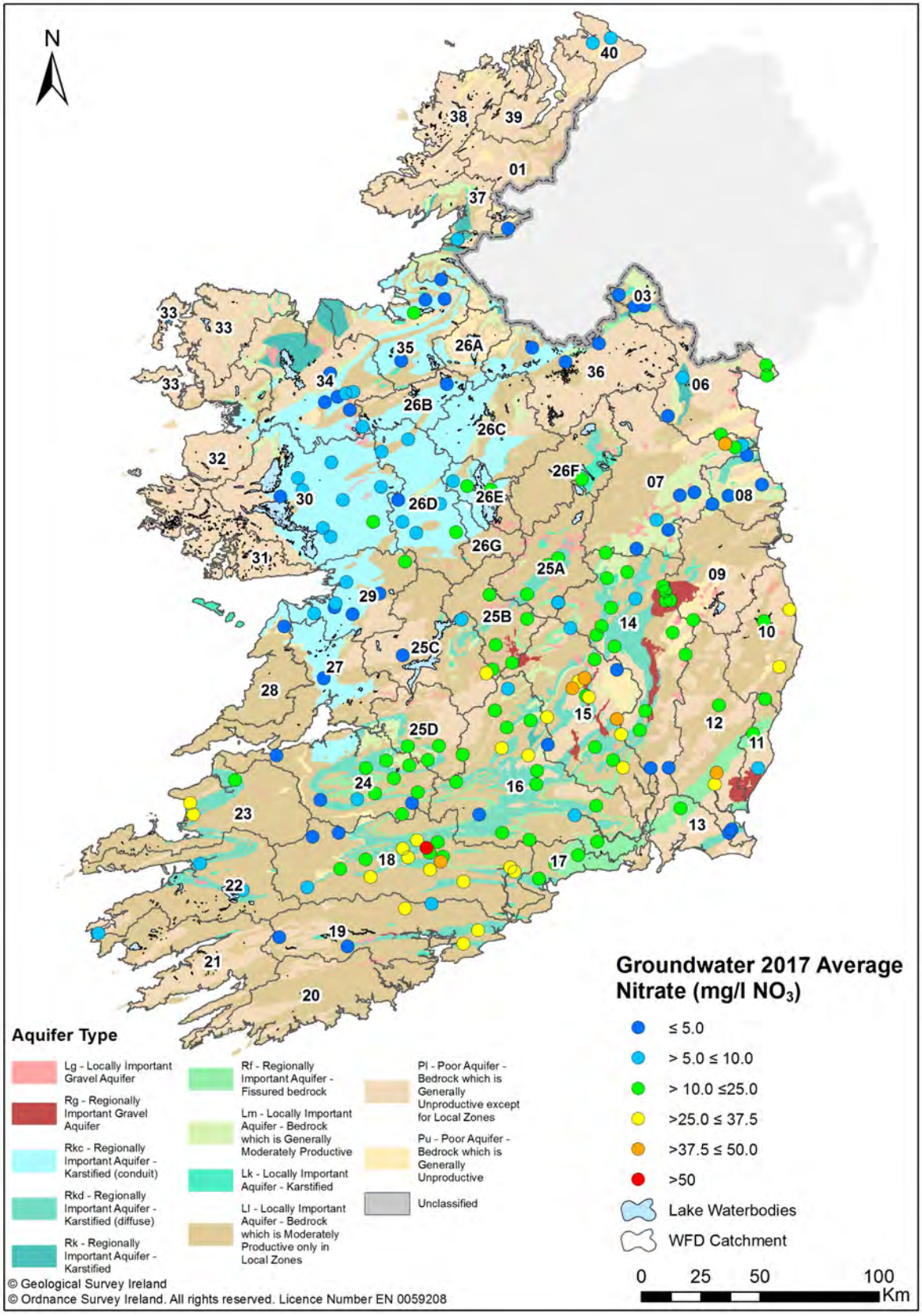
The EPA carried out a trend assessment[38] using annual average data for the 10-year period 2008 to 2017. Statistically significant trends were determined for 27% of sites (Table 7). This analysis indicated that 13 sites are improving (decreasing nitrate concentrations) and 20 sites are deteriorating (increasing nitrate concentrations). In terms of long-term change, four of the 35 sites with a statistically significant trend are expected to have concentrations greater than 37.5 mg/l NO_3 in 2027. This may result in future failures to meet WFD objective requirements if these trends are not investigated and measures are not taken, where appropriate, to address identified significant pressures.

[38] Mann–Kendall trend test to determine statistically significant trends (to 90% confidence) and Sen's trend test to determine the annual rate of change.

Table 7: Summary of the groundwater nitrate trend assessment for 2008 to 2017.

Statistically significant trend	Rate of change predicted (mg/l NO_3 per year)	Number of sites	Percentage of total sites assessed (*n* = 195)
Strong decreasing	Decreasing by more than 1	7	4%
Weak decreasing	Decreasing by between 0.25 and 1	6	3%
No statistical trend	Trend not detected	143	73%
Stable	Varying by less than ±0.25	19	10%
Weak increasing	Increasing by between 0.25 and 1	16	8%
Strong increasing	Increasing by more than 1	4	2%

Map 13: Average nitrate concentrations in 2017 at EPA groundwater monitoring sites.



Indicator 14: Phosphate in Groundwater

Groundwater is an important pathway for the movement of phosphorus[39] from some pollution sources to surface water ecosystems, particularly in catchments with thin soils or where bedrock comes through the soil at the surface.

Assessment

The Irish groundwater WFD threshold value of 0.035 mg/l P is considered when assessing the contribution of phosphorus in groundwater to surface waters. This indicator is based on the annual average phosphorus concentrations for 195 groundwater monitoring sites.

Findings

Of the 195 groundwater sites monitored in 2017, 183 (94%) had average phosphorus concentrations less than 0.035 mg/l P. The remaining proportion (6%) is comparable to recent years (Figure 10). In 2017, there was a 3% increase in monitoring sites with average concentrations less than 0.015 mg/l P. Five monitoring sites (3%) had average concentrations greater than 0.050 mg/l P in 2017. The monitoring sites with phosphorus concentrations above the WFD groundwater threshold value of 0.035 mg/l P are dispersed geographically (Map 14).

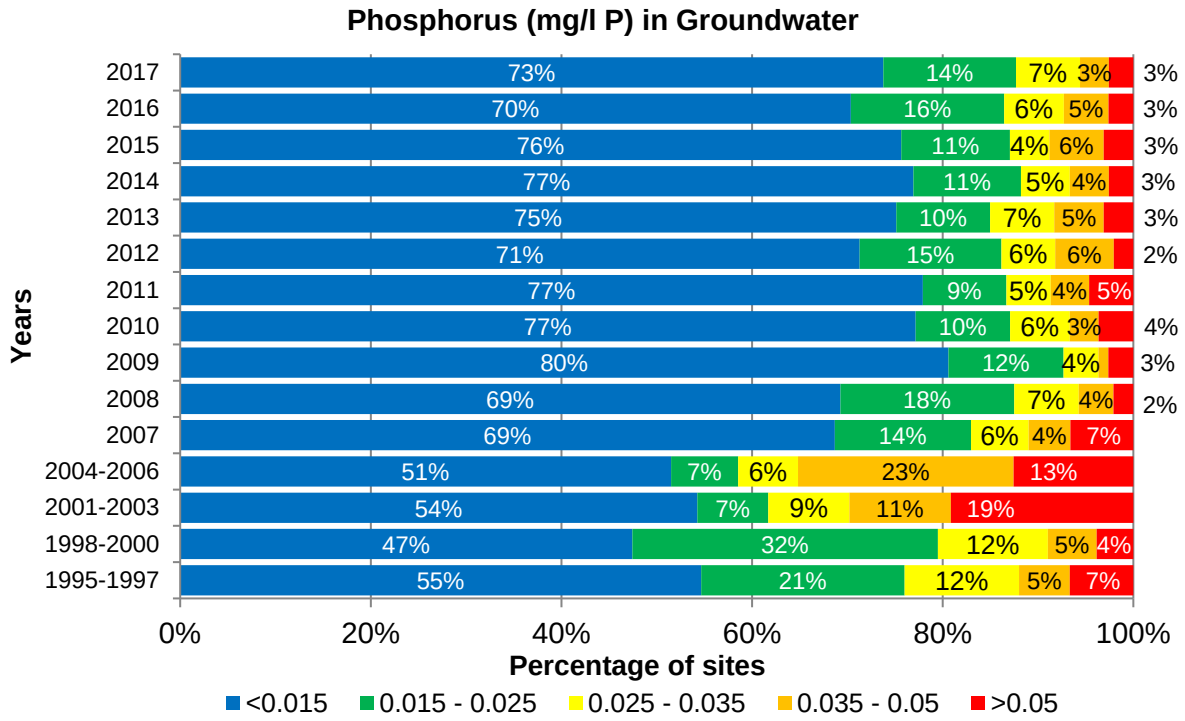


Figure 10: The percentage of groundwater sites falling into each quality class based on average phosphorus concentrations measured from 1995 to 2017.

[39] Measured as molybdate reactive phosphate (MRP).

There has been a modest reduction in groundwater phosphorus concentrations since 2008, which has resulted in fewer groundwater bodies being classified as being at poor groundwater status (Figure 10). During the second WFD cycle status assessment (2009 to 2015), less than 1% of the area of the country was classified as being at poor groundwater status (nine groundwater bodies) due to the contribution of phosphorus from groundwater to surface water bodies at less than good status.

Trends

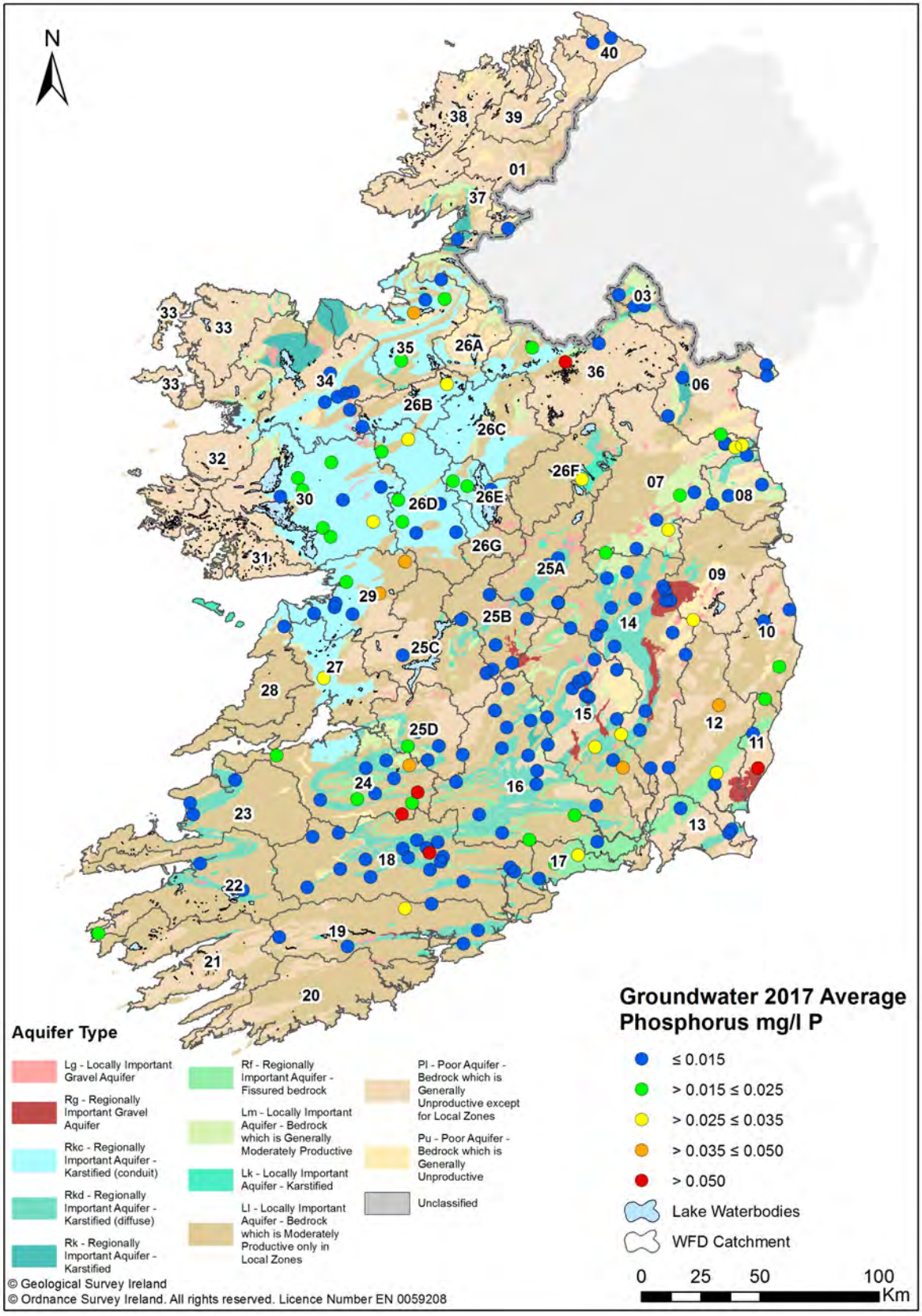
A trend assessment of 195 sites (Table 8) was carried out using annual average data for the 10-year period from 2008 to 2017.[40] Some 99% of sites had no trend or were stable. Fifteen of the 60 sites with statistically significant trends were projected to have concentrations greater than 0.035 mg/l P in 2027, indicating a risk of failure to meet the requirements of the WFD.

Table 8: Summary of the groundwater phosphorus trend assessment for 2008 to 2017.

Statistically significant trend	Rate of change predicted (mg/l P per year)	Number of sites	Percentage of total sites assessed (n = 195)
Strong decreasing	Decreasing by more than 0.005	0	0%
Weak decreasing	Decreasing by between 0.002 and 0.005	0	0%
No statistical trend	Trend not detected	135	69%
Stable	Varying by less than ±0.002	58	30%
Weak increasing	Increasing by between 0.002 and 0.005	2	1%
Strong increasing	Increasing by more than 0.005	0	0%

[40] Mann–Kendall trend test to determine statistically significant trends (to 90% confidence) and Sen's trend test to determine the annual rate of change.

Map 14: Average phosphorus concentrations in 2017 at EPA groundwater monitoring sites.



Indicator 15: Bacteria in Groundwater

Escherichia coli (*E. coli*) is a bacterium that is often used as an indicator of faecal contamination of water. *E. coli* is only found in the faecal material of humans and other warm-blooded animals. Its presence indicates contamination of groundwater by faecal matter and that pathogens (disease-causing organisms) may be present. The source of the contamination is generally agriculture or septic tanks. Many private water supplies abstract from groundwater and may have limited or no treatment.[41] The drinking water regulations[42] specify a value of zero number/100 ml *E. coli*.

Assessment

This indicator summarises the results of monitoring of 195 national groundwater monitoring network sites for *E. coli* and categorises the results into five bands based on the level of contamination. Results for 2017 and previous years are given in Figure 14 for comparison purposes.[43]

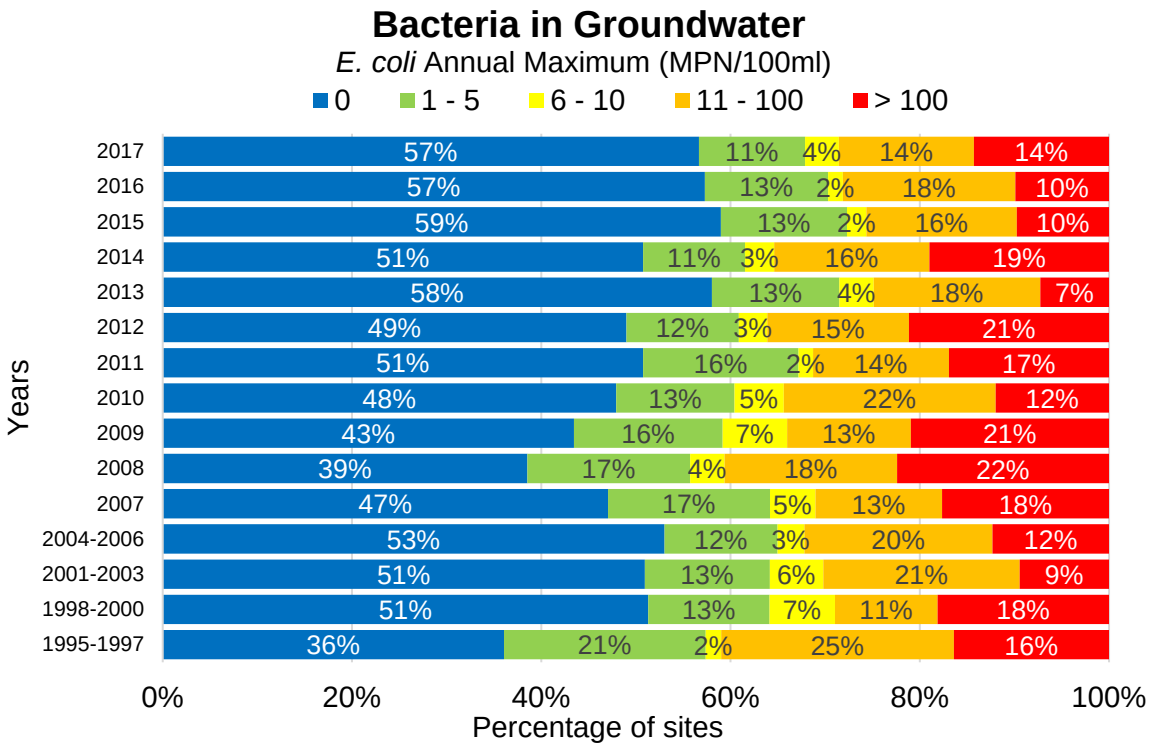


Figure 11: Annual maximum *E. coli* at groundwater quality monitoring sites, 1995 to 2017.[44]

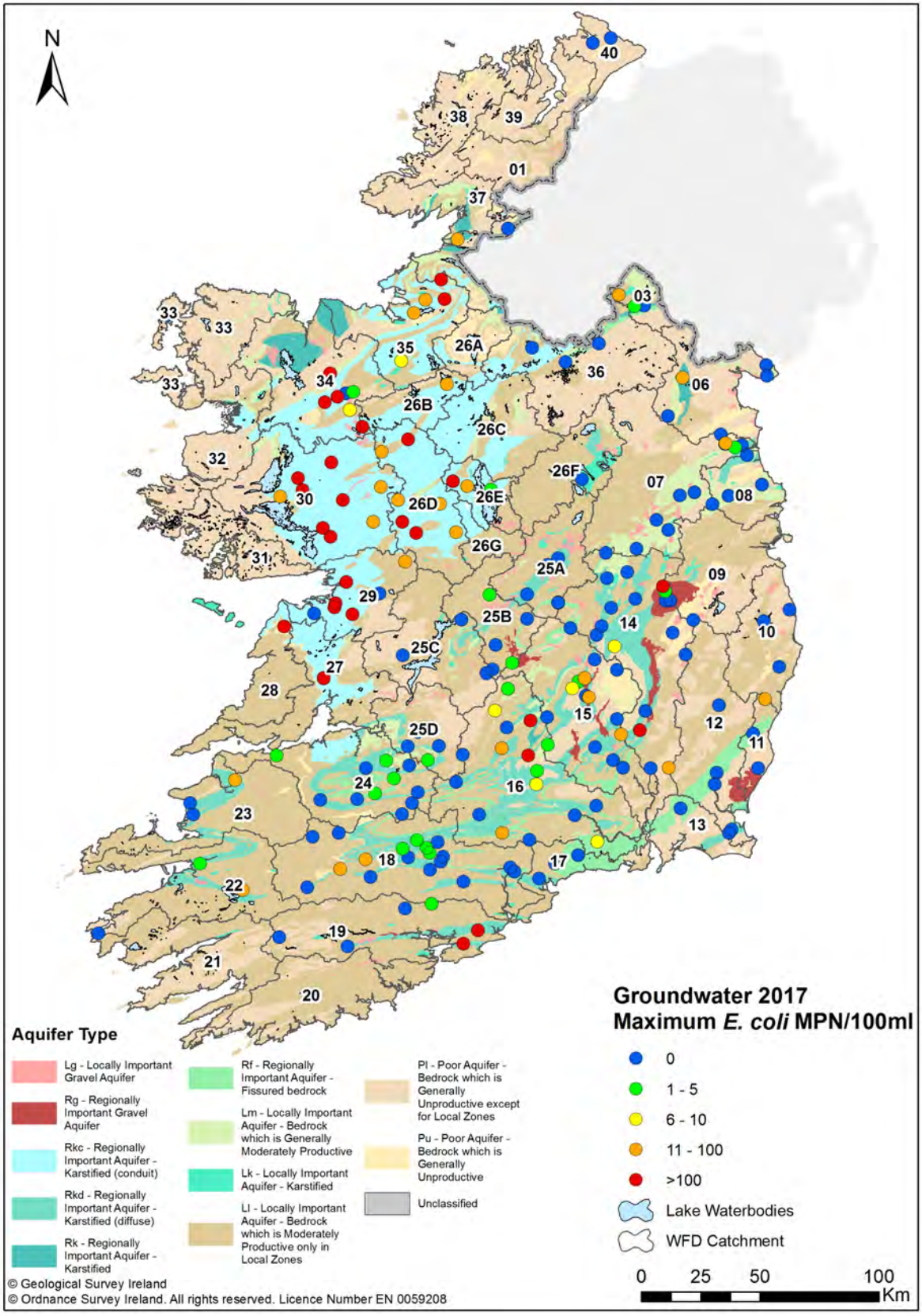
[41] EPA, 2017. *Focus on Private Water Supplies*. http://www.epa.ie/pubs/reports/water/drinking/Focus%20on%20Private%20SuppliesV6.pdf
[42] S.I. No. 122 of 2014 EU (Drinking Water) Regulations 2014.
[43] The assessment only includes monitoring sites with at least one sample in 2016. Some sample results historically have been reported as 'faecal coliforms' and these have been included as *E. coli* for this assessment.
[44] MPN = most probable number, the unit used to measure bacteria in groundwater.

Findings

Eighty-five (43%) of the 195 groundwater monitoring sites had a sample contaminated with one or more *E. coli* in 2017. The high proportion of monitoring sites with *E. coli* detections reflects both the presence of pressures and the naturally vulnerable nature of groundwater in some parts of the country, for example the karst limestone aquifers in the west of Ireland (Map 15). These factors highlight the need for testing of drinking water supplies from groundwater for microbial contamination and for the provision of adequate treatment. This is particularly relevant for households and other private supplies which may not have treatment in place for microbial contaminants.

The EPA recommends that all drinking water supplies be monitored at least once a year for *E. coli*, with greater frequencies required for some supply types.

Map 15: Maximum annual *E. coli* in 2017 at EPA groundwater monitoring sites.



Indicator 16: Bathing Water Quality

Beaches are important recreational areas that attract both residents and tourists. The microbiological quality of bathing waters is important to minimise illness caused by ingesting water while swimming.

Assessment

In the 1970s the European Union introduced the Bathing Water Directive, which contained rules and monitoring requirements to ensure that beaches were a safe place to bathe. A revised version of the Directive was introduced in 2006 which came fully into effect in 2014. The revised Directive seeks to reduce the risk to bathers and to improve health protection by introducing stricter standards for bathing water quality and a new approach to assessment. The assessment of bathing water quality now uses the monitoring data for the current and three previous bathing seasons (on a rolling basis) rather than focusing solely on the most recent bathing season.

In 2017, 142 bathing waters were assessed and categorised into four categories based on the level of compliance with standards relating to *E. coli* and intestinal Enterococci.[45] Under the system waters are classified into four main categories:

- excellent,
- good,
- sufficient, and
- poor.

As a minimum, all bathing waters are required to meet the 'sufficient' standard.

Findings

In 2017, the majority of bathing waters, 132 out of the 142 assessed, met the minimum required standard of sufficient quality. Some 120 bathing waters were classed as being either excellent or good quality, with most of these (102) being in the excellent category. Seven locations were assessed to be in poor quality:

- Merrion Strand (Dublin City),
- Sandymount Strand (Dublin City),
- Loughshinny (Fingal),
- Rush South (Fingal),
- Portrane (Fingal),
- Ballyloughane (Galway City), and
- Clifden (Galway County).

The public can still access and use these beaches but restrictions or prohibitions on bathing may be in place, so beach users are advised to check current restrictions and water quality, via

[45] *E. coli* and intestinal Enterococci are types of bacteria that can be harmful to human health.

the www.beaches.ie website, on bathing water notice boards at the beach, or from the relevant local authority.

Overall, bathing water quality has remained static since the new Regulations came into effect, with little change in the number of areas in excellent quality.

You can get more information about bathing water quality in the Annual Bathing Water Report on the EPA website at:
http://www.epa.ie/pubs/reports/water/bathing/Bathing%20Water%20Quality%20in%20Ireland%20-%202017.pdf

What next?

The *Ireland's Environment – An Assessment 2016*[46] report highlighted, in terms of water quality, that the best of the best were getting worse and the worst of the worst were getting better. The report recommended that Ireland *'implement measures that achieve ongoing improvements in the environmental status of water bodies from the source to the sea*'. A similar picture is evident from this indicators report, with a further decline evident in our rivers.

It is clear that action to tackle point source pollution is bearing fruit, as evidenced by fewer river water bodies at bad quality and a reduction in fish kills, but this report also indicates that diffuse pollution to our waterways is continuing to be a challenge and that we will need to redouble our efforts to tackle this.

Actions

Ireland's River Basin Management Plan 2018–2021[47] (the Plan), published in April this year, set the approach that Ireland as a nation will take to protect our water quality. The Plan sets clear targets and actions to address water quality issues and its full implementation will be critical in addressing the decline in water quality and protecting waters that are currently at high or good quality. The actions of the newly created local authority Waters Programme, which encompasses the Waters and Communities Office and the Catchment Assessment Team, provide a much needed opportunity to identify the local issues causing impacts on water. Together with the new Agricultural Sustainability Support and Advisory Programme (ASSAP) operated by Teagasc and the dairy cooperatives, they also provide the means to implement targeted and measurable actions to protect and improve our natural waters. They will not be able to achieve these improvements alone though, and need the active support and action of other public bodies and communities and businesses living and working in our catchments.

The EPA will continue to support the work of the Local Authorities Water Programme and ASSAP and will through its own work address pressures from EPA-regulated operations. It will continue to assess and report on the state of the water environment to inform its own actions and the actions of others. In this context, the EPA will publish the next *Water Quality in Ireland* report (2015–2018) in 2019. That report will be an update of this indicators report by including 2018 data but will also have a more in-depth analysis of water quality issues in Ireland to inform the implementation of the Plan and planning for the future.

[46] www.epa.ie/pubs/reports/indicators/SoE_Report_2016.pdf

[47] www.housing.gov.ie/sites/default/files/publications/files/rbmp_report_english_web_version_final_0.pdf

AN GHNÍOMHAIREACHT UM CHAOMHNÚ COMHSHAOIL
Tá an Ghníomhaireacht um Chaomhnú Comhshaoil (GCC) freagrach as an gcomhshaol a chaomhnú agus a fheabhsú mar shócmhainn luachmhar do mhuintir na hÉireann. Táimid tiomanta do dhaoine agus don chomhshaol a chosaint ó éifeachtaí díobhálacha na radaíochta agus an truaillithe.

Is féidir obair na Gníomhaireachta a roinnt ina trí phríomhréimse:

Rialú: *Déanaimid córais éifeachtacha rialaithe agus comhlíonta comhshaoil a chur i bhfeidhm chun torthaí maithe comhshaoil a sholáthar agus chun díriú orthu siúd nach gcloíonn leis na córais sin.*

Eolas: *Soláthraímid sonraí, faisnéis agus measúnú comhshaoil atá ar ardchaighdeán, spriocdhírithe agus tráthúil chun bonn eolais a chur faoin gcinnteoireacht ar gach leibhéal.*

Tacaíocht: *Bímid ag saothrú i gcomhar le grúpaí eile chun tacú le comhshaol atá glan, táirgiúil agus cosanta go maith, agus le hiompar a chuirfidh le comhshaol inbhuanaithe.*

Ár bhFreagrachtaí

Ceadúnú
Déanaimid na gníomhaíochtaí seo a leanas a rialú ionas nach ndéanann siad dochar do shláinte an phobail ná don chomhshaol:
- saoráidí dramhaíola *(m.sh. láithreáin líonta talún, loisceoirí, stáisiúin aistrithe dramhaíola)*;
- gníomhaíochtaí tionsclaíocha ar scála mór *(m.sh. déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta)*;
- an diantalmhaíocht *(m.sh. muca, éanlaith)*;
- úsáid shrianta agus scaoileadh rialaithe Orgánach Géinmhodhnaithe *(OGM)*;
- foinsí radaíochta ianúcháin *(m.sh. trealamh x-gha agus radaiteiripe, foinsí tionsclaíocha)*;
- áiseanna móra stórála peitril;
- scardadh dramhuisce;
- gníomhaíochtaí dumpála ar farraige.

Forfheidhmiú Náisiúnta i leith Cúrsaí Comhshaoil
- Clár náisiúnta iniúchtaí agus cigireachtaí a dhéanamh gach bliain ar shaoráidí a bhfuil ceadúnas ón nGníomhaireacht acu.
- Maoirseacht a dhéanamh ar fhreagrachtaí cosanta comhshaoil na n-údarás áitiúil.
- Caighdeán an uisce óil, arna sholáthar ag soláthraithe uisce phoiblí, a mhaoirsiú.
- Obair le húdaráis áitiúla agus le gníomhaireachtaí eile chun dul i ngleic le coireanna comhshaoil trí chomhordú a dhéanamh ar líonra forfheidhmiúcháin náisiúnta, trí dhíriú ar chiontóirí, agus trí mhaoirsiú a dhéanamh ar leasúchán.
- Cur i bhfeidhm rialachán ar nós na Rialachán um Dhramhthrealamh Leictreach agus Leictreonach (DTLL), um Shrian ar Shubstaintí Guaiseacha agus na Rialachán um rialú ar shubstaintí a ídíonn an ciseal ózóin.
- An dlí a chur orthu siúd a bhriseann dlí an chomhshaoil agus a dhéanann dochar don chomhshaol.

Bainistíocht Uisce
- Monatóireacht agus tuairisciú a dhéanamh ar cháilíocht aibhneacha, lochanna, uiscí idirchriosacha agus cósta na hÉireann, agus screamhuiscí; leibhéil uisce agus sruthanna aibhneacha a thomhas.
- Comhordú náisiúnta agus maoirsiú a dhéanamh ar an gCreat-Treoir Uisce.
- Monatóireacht agus tuairisciú a dhéanamh ar Cháilíocht an Uisce Snámha.

Monatóireacht, Anailís agus Tuairisciú ar an gComhshaol
- Monatóireacht a dhéanamh ar cháilíocht an aeir agus Treoir an AE maidir le hAer Glan don Eoraip (CAFÉ) a chur chun feidhme.
- Tuairisciú neamhspleách le cabhrú le cinnteoireacht an rialtais náisiúnta agus na n-údarás áitiúil *(m.sh. tuairisciú tréimhsiúil ar staid Chomhshaol na hÉireann agus Tuarascálacha ar Tháscairí)*.

Rialú Astaíochtaí na nGás Ceaptha Teasa in Éirinn
- Fardail agus réamh-mheastacháin na hÉireann maidir le gáis cheaptha teasa a ullmhú.
- An Treoir maidir le Trádáil Astaíochtaí a chur chun feidhme i gcomhair breis agus 100 de na táirgeoirí dé-ocsaíde carbóin is mó in Éirinn.

Taighde agus Forbairt Comhshaoil
- Taighde comhshaoil a chistiú chun brúnna a shainaithint, bonn eolais a chur faoi bheartais, agus réitigh a sholáthar i réimsí na haeráide, an uisce agus na hinbhuanaitheachta.

Measúnacht Straitéiseach Timpeallachta
- Measúnacht a dhéanamh ar thionchar pleananna agus clár beartaithe ar an gcomhshaol in Éirinn *(m.sh. mórphleananna forbartha)*.

Cosaint Raideolaíoch
- Monatóireacht a dhéanamh ar leibhéil radaíochta, measúnacht a dhéanamh ar nochtadh mhuintir na hÉireann don radaíocht ianúcháin.
- Cabhrú le pleananna náisiúnta a fhorbairt le haghaidh éigeandálaí ag eascairt as taismí núicléacha.
- Monatóireacht a dhéanamh ar fhorbairtí thar lear a bhaineann le saoráidí núicléacha agus leis an tsábháilteacht raideolaíochta.
- Sainseirbhísí cosanta ar an radaíocht a sholáthar, nó maoirsiú a dhéanamh ar sholáthar na seirbhísí sin.

Treoir, Faisnéis Inrochtana agus Oideachas
- Comhairle agus treoir a chur ar fáil d'earnáil na tionsclaíochta agus don phobal maidir le hábhair a bhaineann le caomhnú an chomhshaoil agus leis an gcosaint raideolaíoch.
- Faisnéis thráthúil ar an gcomhshaol ar a bhfuil fáil éasca a chur ar fáil chun rannpháirtíocht an phobail a spreagadh sa chinnteoireacht i ndáil leis an gcomhshaol *(m.sh. Timpeall an Tí, léarscáileanna radóin)*.
- Comhairle a chur ar fáil don Rialtas maidir le hábhair a bhaineann leis an tsábháilteacht raideolaíoch agus le cúrsaí práinnfhreagartha.
- Plean Náisiúnta Bainistíochta Dramhaíola Guaisí a fhorbairt chun dramhaíl ghuaiseach a chosc agus a bhainistiú.

Múscailt Feasachta agus Athrú Iompraíochta
- Feasacht chomhshaoil níos fearr a ghiniúint agus dul i bhfeidhm ar athrú iompraíochta dearfach trí thacú le gnóthais, le pobail agus le teaghlaigh a bheith níos éifeachtúla ar acmhainní.
- Tástáil le haghaidh radóin a chur chun cinn i dtithe agus in ionaid oibre, agus gníomhartha leasúcháin a spreagadh nuair is gá.

Bainistíocht agus struchtúr na Gníomhaireachta um Chaomhnú Comhshaoil
Tá an ghníomhaíocht á bainistiú ag Bord lánaimseartha, ar a bhfuil Ard-Stiúrthóir agus cúigear Stiúrthóirí. Déantar an obair ar fud cúig cinn d'Oifigí:
- An Oifig um Inmharthanacht Comhshaoil
- An Oifig Forfheidhmithe i leith cúrsaí Comhshaoil
- An Oifig um Fianaise is Measúnú
- Oifig um Chosaint Radaíochta agus Monatóireachta Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáideacha

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag comhaltaí air agus tagann siad le chéile go rialta le plé a dhéanamh ar ábhair imní agus le comhairle a chur ar an mBord.

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An Ghníomhaireacht um Chaomhnú Comhshaoil

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