Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

Water Quality in Ireland 2010 - 2012

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

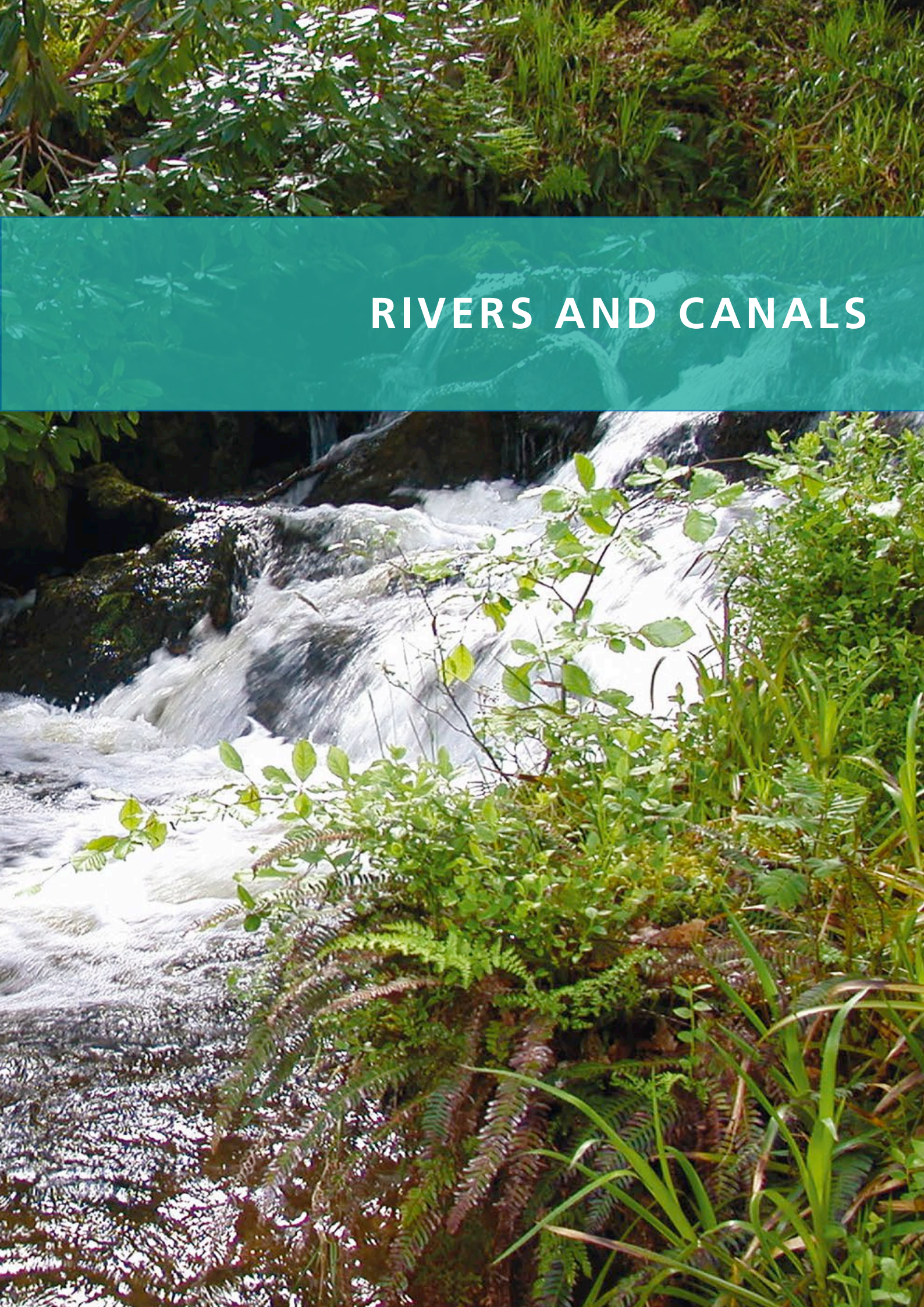
- Generating greater environmental awareness and influencing positive behavioural change by supporting businesses, communities and householders to become more resource efficient.
- Promoting radon testing in homes and workplaces and encouraging remediation where necessary.

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 Climate, Licensing and Resource Use
- Office of Environmental Enforcement
- Office of Environmental Assessment
- Office of Radiological Protection
- 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.



RIVERS AND CANALS

3. RIVERS AND CANALS

Authors: Catherine Bradley, Peter Webster, John Lucey, Martin McGarrigle, Patricia McCreesh, & Tara Gallagher (Inland Fisheries Ireland).

- 53% of monitored river water bodies (858) were at satisfactory ecological status, up 1% since the previous period.
- Of 13,300 kilometres of river channel length monitored using the biological Q value scheme, water quality was in high or good condition along 73% of the monitored river channels. This was up 4% from the last monitoring period and includes an overall increase in high status sites. Serious pollution resulting from urban wastewater and industrial pollution was reduced to 17 km of river channel length. This was down from 53 km in 2009.
- The two most important suspected causes of pollution are agriculture and municipal sources, accounting for 53% and 34% of cases respectively.
- Trends in nitrogen indicate that concentrations in rivers were generally reducing (52% of sites assessed) or stable (41% of sites assessed). The greatest reductions were in the intensive agriculture areas in the South-East and Midlands.
- Trends in phosphorus concentrations in rivers were stable in most parts of the country (69% of sites assessed). 24% of sites assessed showed decreasing concentrations.
- Fish kills were at an all-time low, with 70 recorded between 2010 and 2012 compared to 72 in the previous period, and 235 in the 1980s when it was at its highest.
- The level of compliance with Environmental Quality Standards for specific pollutants (hazardous substances) was high, with the main issue being naturally-occurring metals in known, mineral-rich mining areas.
- In general, the level of compliance with the Environmental Quality Standards (EQS) for priority and priority hazardous substances was very high. Polyaromatic hydrocarbons (PAHs) did show widespread exceedances of the EQS. However, these have been identified at EU level as ubiquitous persistent, bio-accumulative and toxic substances (uPBTs) which occur widely in the environment on a global scale, due principally to atmospheric deposition.
- The Grand and Royal Canals achieved good ecological potential. The canalised section of the Shannon-Erne Waterway was compliant with all water quality standards. However, the ecology of the canal was compromised by the hydromorphology of the canal (box-shaped profile) which makes it unsuitable for macrophyte and macroinvertebrate communities to develop. Therefore, they scored poorly.

Introduction

This chapter is based on the results from the second three-year survey of the WFD river monitoring programme (2010-2012). It also contains some minor revision of the results for the 2007-2009 period, following improvements in the assessment methods. Nationally, the adjustments in status for 2007-2009 were; High (13% to 12%) and Good (39% to 40%), with no change in other categories.

Under the Water Framework Directive requirements, the lowest scoring quality element determines the site's ecological status and the lowest scoring site determines the overall ecological status of a river water body. A river water body can have more than one monitoring site within its boundary. All operational and surveillance biological monitoring sites are examined and scored on their aquatic macroinvertebrate community.

Monitoring of water quality of Irish rivers has been undertaken since 1971, and while WFD Status is now the main mechanism for tracking environmental change, this report also assesses trends over the past three to four decades based on the parameters in use over that period.

During the 2010-2012 period, biological assessments were made at over 2,800 sites, and assessment of the supporting physico-chemical parameters, including nitrate, phosphate, BOD and ammonia, was undertaken at over 1,280 river sites. 180 representative surveillance monitoring sites were also sampled for a full suite of quality elements, including dangerous substances.

The chapter presents results at national and at individual River Basin District level. It also contains a summary of fish kill incidents recorded by Inland Fisheries Ireland (IFI), as well as an account of suspected causes of pollution compiled by the Agency. An assessment of canal water quality monitoring results compiled by IFI, on behalf of Waterways Ireland, is also presented.

Water Framework Directive ecological status

Under the WFD, water bodies are classified into five quality classes using a combination of biological quality elements, such as the macroinvertebrate fauna, macrophyte flora, fish communities, the supporting general physico-chemical conditions, and hydromorphology.

A total of 3,051 monitoring sites were used for ecological status assessments representing 1,624 river water bodies. **Figure 3-1** provides a breakdown of the ecological status nationally for the 2007-2009 and 2010-2012 periods. In the 2010-2012 period, 53% (858) of monitored river water bodies were classified as being at high or good ecological status, with 47% (766) classified at less than good ecological status.

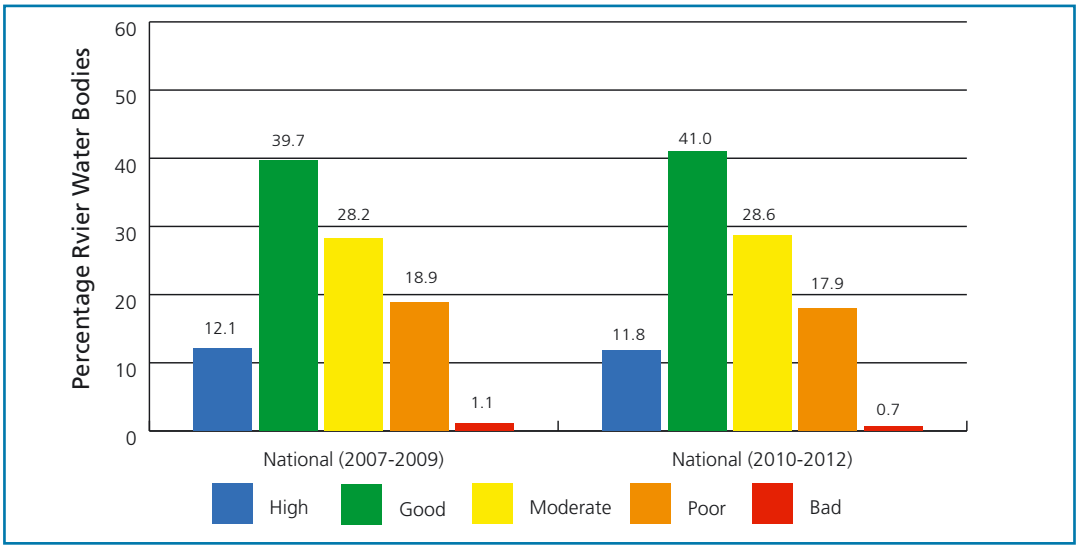


Figure 3-1. Comparison of Ecological Status between the two survey periods (2007-2009 (n= 1,573) and 2010-2012 (n=1,624)).

Table 3-1 provides a breakdown of the ecological status by river basin district (RBD) for the survey period. The less-densely populated South-Western and Western River Basin Districts continue to be ranked as the least polluted districts (**Table 3-1**). The more-densely populated and economically-developed east and north-east parts of the country are most affected by water quality degradation (**Figure 3-2**).

River Basin District	Number of Water bodies	High	Good	Moderate	Poor	Bad	Total
South-Western	278	71	132	62	13	0	278
		26%	47%	22%	5%	0%	100%
Western	276	52	139	62	21	2	276
		19%	50%	22%	8%	0.7%	100%
North-Western	213	21	72	45	71	4	213
		10%	34%	21%	33%	1.9%	100%
Shannon	393	25	176	108	81	3	393
		7%	45%	27%	21%	0.8%	100%
South-Eastern	285	17	103	117	47	1	285
		6%	36%	41%	16%	0.4%	100%
Eastern	144	5	37	58	43	1	144
		3%	26%	40%	30%	0.7%	100%
Neagh Bann	35	1	7	12	15	0	35
		3%	20%	34%	43%	0%	100%
National	**1,624**	**192**	**666**	**464**	**291**	**11**	**1,624**
		11.8%	**41.0%**	**28.6%**	**17.9%**	**0.7%**	**100%**

Table 3-1. Breakdown of the monitored river water bodies by ecological status categories at River Basin District (2010-2012).

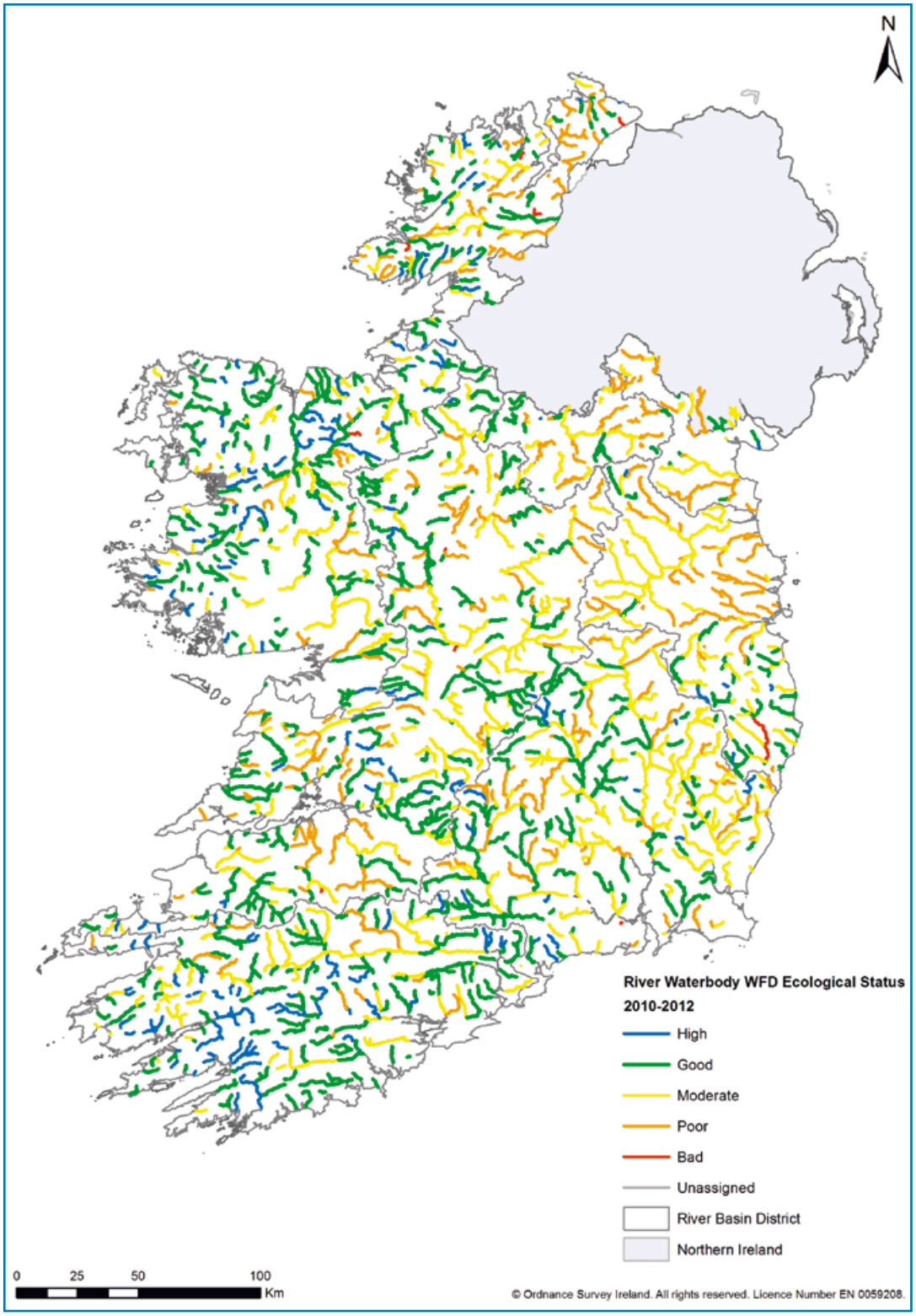


Figure 3-2. Map of ecological status for monitored river water bodies (n = 1,624) based on the lowest status by quality element and the lowest status by monitoring station within each water body.

Trends at River Basin District level

The percentage breakdown of the number of monitored river water bodies within each of the five ecological classes by RBD is shown in **Figure 3-3**. There were improvements in the percentage of the number of satisfactory river water bodies (i.e. high or good ecological status) in the Eastern RBD and Shannon RBD, while the South-Western RBD remained stable. A decline in the percentage number of satisfactory river water bodies was observed in the Neagh Bann and North-Western International RBDs, and in the South-Eastern and Western RBDs (**Figure 3-3**). However, the percentage of river water bodies classified at poor ecological status decreased in the Neagh Bann IRBD and the South-Eastern RBD, with a corresponding increase in river water bodies defined at moderate ecological status. There have been declines and improvements noted in all RBDs during the current survey period.

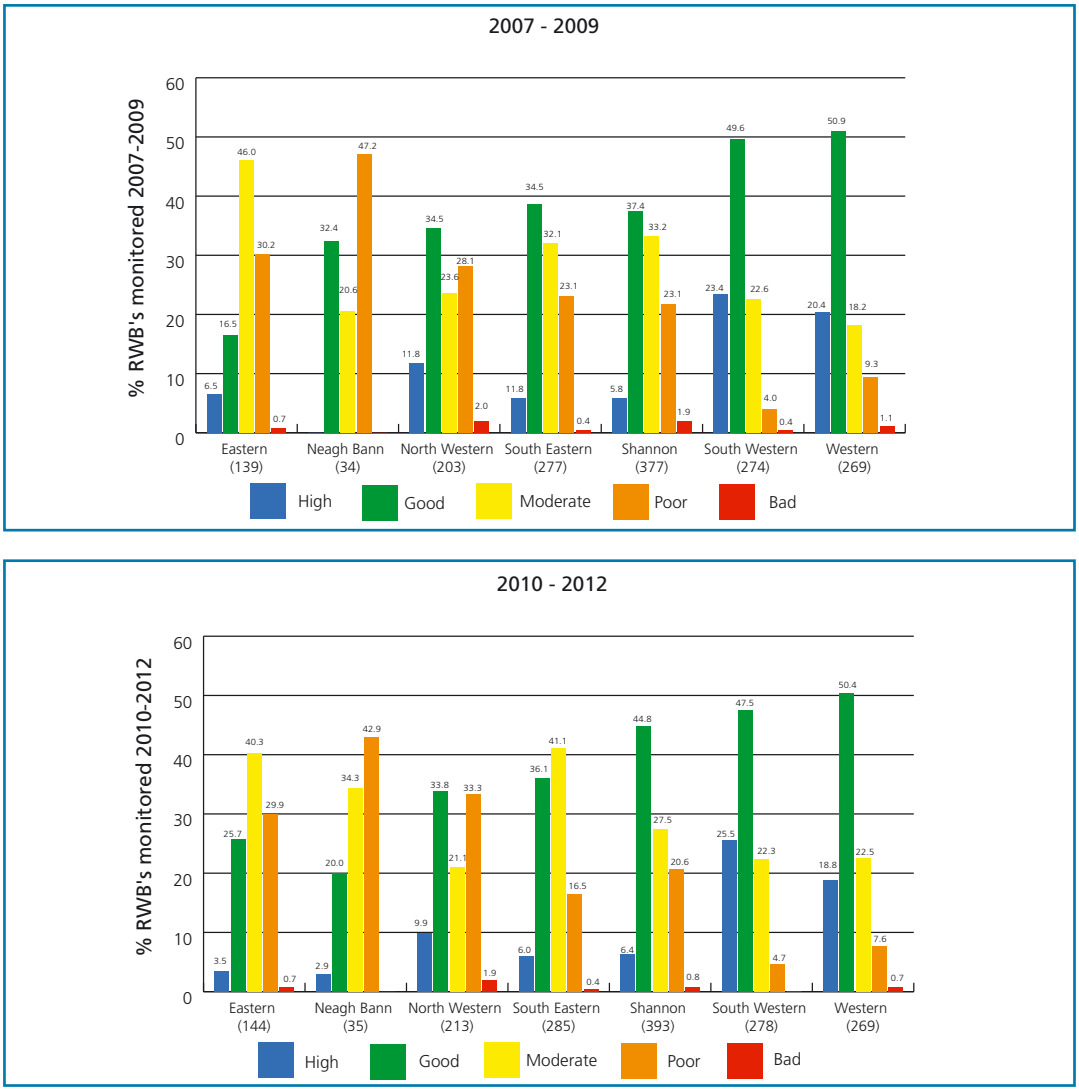


Figure 3-3. The percentage breakdown of the monitored river water bodies within each RBD, showing the final ecological status based on the lowest status for the available range of biological and physico-chemical quality elements within each water body between the two survey periods 2007-2009 and 2010-2012.

Table 3-2 illustrates the changes in river water body status between the two survey periods at the river basin district and national level. At the national level, 1,051 monitored river water bodies maintained their status. 579 river water bodies maintained a satisfactory status, while a total of 472 river water bodies remained at unsatisfactory status with no further declines. A total of 268 monitored river water bodies improved on their reported ecological status between the

two survey periods. Satisfactory improvements, i.e. reached at least good status, were evident at 150 of the river water bodies. Improvements were also evident at 74 river water bodies but not to good status. Although 57 river water bodies declined from high ecological status, a further 44 river water bodies improved from good to high ecological status in their latest assessment.

Number of River Water Bodies	Eastern	Neagh Bann	North-Western	South-Eastern	Shannon	South-Western	Western	National
Status Maintained	90	22	135	164	244	206	190	1,051
Maintained Satisfactory	18	6	62	74	121	153	145	579
Remained Unsatisfactory	72	16	73	90	123	53	45	472
Status Improved	25	4	25	61	83	37	33	268
Satisfactory to High	1	0	3	5	10	18	7	44
Unsatisfactory to Satisfactory	15	2	15	32	50	17	19	150
Improved still Unsatisfactory	9	2	7	24	23	2	7	74
Status Declined	22	7	37	48	48	31	41	234
Loss of High to Good	6	0	5	2	8	12	10	43
Satisfactory to Unsatisfactory	7	5	20	39	25	17	26	139
Unsatisfactory (further decline)	9	2	12	7	15	2	5	52
Overall Gains/ Losses	3	-3	-12	13	35	6	-8	34
Total No. monitored	**144**	**35**	**213**	**285**	**393**	**278**	**276**	**1624**

Table 3-2. Comparison of the changes in river water body status between the 2007-2009 and 2010-2012 survey periods at the RBD and national level.

The ecological status of 234 monitored river water bodies declined between the 2007-2009 and 2010-2012 survey periods, 139 of these water bodies declined to unsatisfactory ecological status. There was a total loss of 57 high status water bodies, the majority declining to good status (43). However, 14 of these river water bodies declined to unsatisfactory status. Further declines were also observed at 52 water bodies, which were already deemed unsatisfactory in the 2007-2009 survey. A total of 71 river water bodies monitored in the 2010-2012 period were not surveyed in the 2007-2009 period, therefore no comparison was possible between the two periods.

Trends were also examined at the river basin district level. The number of river water bodies that improved in status class ranged from four in the Neagh Bann IRBD to 83 in the Shannon IRBD. All river basin districts, except the Neagh Bann IRBD, lost high status water bodies. The number of river water bodies that declined in status ranged from seven in the Neagh Bann IRBD

to 48 in the Shannon IRBD and South-Eastern RBD. In comparing the overall improvements and declines, the greatest number of general improvements was evident in the Shannon IRBD and South-Eastern RBDs (**Table 3-2**).

Quality elements determining ecological status

Depending on the purpose of monitoring (whether for surveillance or operational purposes), different combinations of quality elements are monitored to determine ecological status. In the case of monitored water bodies, the ecological status assessment includes an assessment of macroinvertebrate fauna (EPA Q value scores) and supporting general physico-chemical (GPC) quality elements, where available. All quality elements are assessed in the surveillance network, including fish communities and hydromorphology. Where water bodies overlap with designated Freshwater Pearl Mussel sites, additional environmental water quality objectives are taken into account when assessed by the National Parks and Wildlife Service. There are currently 65 river water bodies in 27 designated areas containing Freshwater Pearl Mussel populations.

The quality element with the greatest impact on determining the overall ecological status is the macroinvertebrate fauna (**Figure 3-4**). Macroinvertebrates, on their own or in combination with other elements, are responsible for determining 92% of the monitored river water bodies' status. However, this is not entirely representative, as not all quality elements are monitored at all sites in the entire monitoring programme.

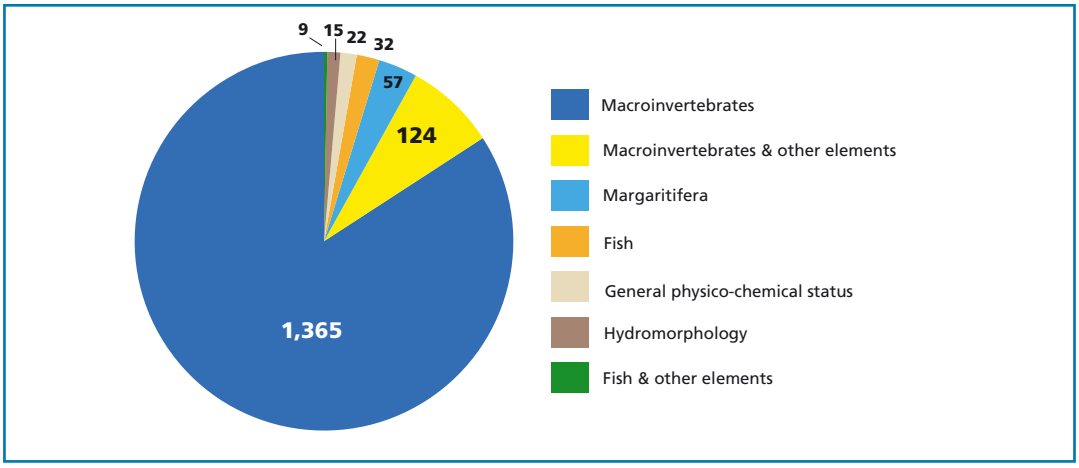


Figure 3-4. The number of river water bodies (n=1,624) status determined by the various quality elements examined in the 2010-2012 status assessment.

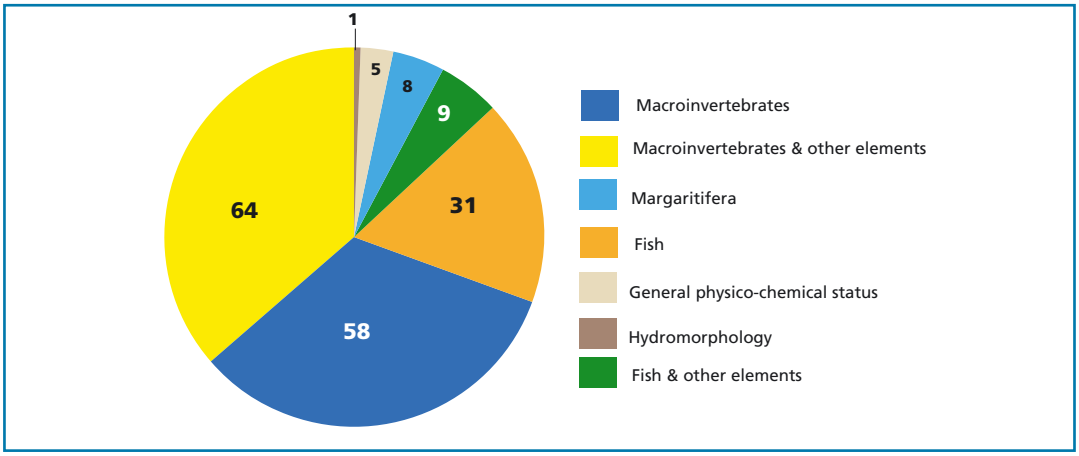


Figure 3-5. The number of surveillance river water bodies (n=176) status determined by the various quality elements examined in the 2010-2012 status assessment.

A more representative picture is provided by the surveillance network. The surveillance network has all the available monitoring tools applied and can highlight which element or combinations of elements are mainly determining ecological status when the full range of available classification tools are applied. In examining the 176 surveillance river water bodies, macroinvertebrates, either on their own or in combination with other elements, determine 69% of the river water bodies' status (**Figure 3-5**). The fish quality element also drives the status of a significant number of the surveillance river water bodies (23% alone or in combination with other elements). Additional biological quality elements, including the aquatic flora or plant community, are surveyed at the surveillance monitoring network of sites. While plant quality elements, including the diatoms, macroalgae, and macrophyte communities, are monitored in the surveillance network, classification metrics for these are currently undergoing further development. An assessment method is also being developed to assess the ecological impacts of acidification. These assessment methods will be included in future assessments.

River water quality: Biological pollution assessment

The macroinvertebrate monitoring and assessment method (Q-values), used on Irish rivers, is the most sensitive ecological assessment method available for detecting organic pollution and nutrient enrichment impacts on Irish rivers. The method has been intercalibrated with the monitoring tools from other European countries (European Commission, 2013). Status for the macroinvertebrates quality element corresponds closely to water quality defined by the Q-value surveys of rivers undertaken since 1971. The Q-values, therefore, provide a good historical record of 'water quality' since 1987. All the main-stem rivers are assessed for Q values, accounting for over 13,000 km of river channel length, as in previous surveys. The results of the 2010-2012 macroinvertebrate surveys show that 72.9% (9,689 km) surveyed rivers and stream channel length was in satisfactory or unpolluted condition (**Figure 3-6**). In terms of the Water Framework Directive, the 9,689 km of satisfactory river channel is subdivided into 22% (2,964 km) of the total channel surveyed at high, while 51% (6,725 km) was good for this quality element (**Figure 3-6**). The unsatisfactory 27% (3,641 km) of the surveyed channel is subdivided into 17.5% (2,316 km) slightly polluted/ eutrophic, 9.6% (1,277 km) moderately polluted, and 0.1% (17 km) classified as seriously polluted. The annual macroinvertebrate Q value river reports are summarised by Hydrometric area online[17] . A colour-coded River Quality Map, depicting biological quality at each of the 2,761 locations surveyed in the 2010-2012 period, accompanies this report.

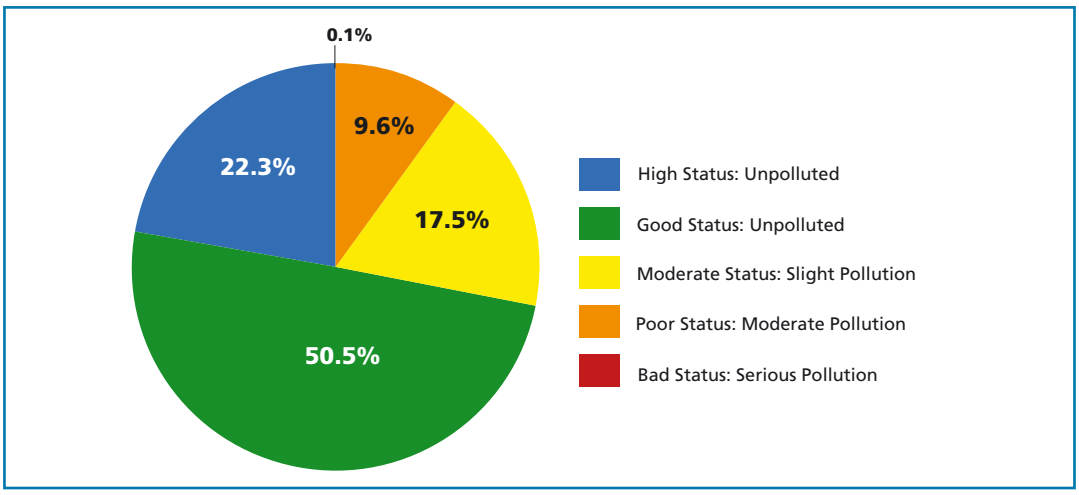


Figure 3-6. River quality 2010-2012: Percentage channel length monitored in each of the five WFD ecological status classes for macroinvertebrates (13,300 km).

17 http://www.epa.ie/QValue/webusers/

Water quality trends

Long-term national trends (1987-2012)

Thirteen thousand three hundred km of river channel has been monitored nationally since 1987 on a three-year cycle (**Figure 3-7**). During the 1990s, the proportion of unpolluted channel length (Class A) declined by 10% (from 77% to 67%) due to the spread of slight and moderate pollution. A welcome improvement has been seen in the latest survey, with the proportion of unpolluted channel increasing by 4% from 69% to 73%, the highest figure seen since before the 1991–1994 survey. The proportion of unpolluted channel length has seen an increase in both the high status (from 20% to 22%) and good status (from 49% to 51%) classes (**Figure 3-8**). The most significant trend was the decrease in slight pollution from 21% (2007–2009) to 18% (2010–2012). This category corresponds to moderate ecological status and is typically, though not always, due to eutrophication caused by excess nutrients. The proportion of poor status or moderately polluted channel is currently at 9.6%, down from a peak of 12.4% in the 1998-2000 period.

A further welcome development is the continued decrease in the percentage of surveyed channel classified as seriously polluted, down to 0.1% (17 km) from 0.4% (53 km). This is significantly less than that observed in the 1970s and early 1980s, when several hundred kilometres of river channel were classified as seriously polluted based on similar assessment techniques.

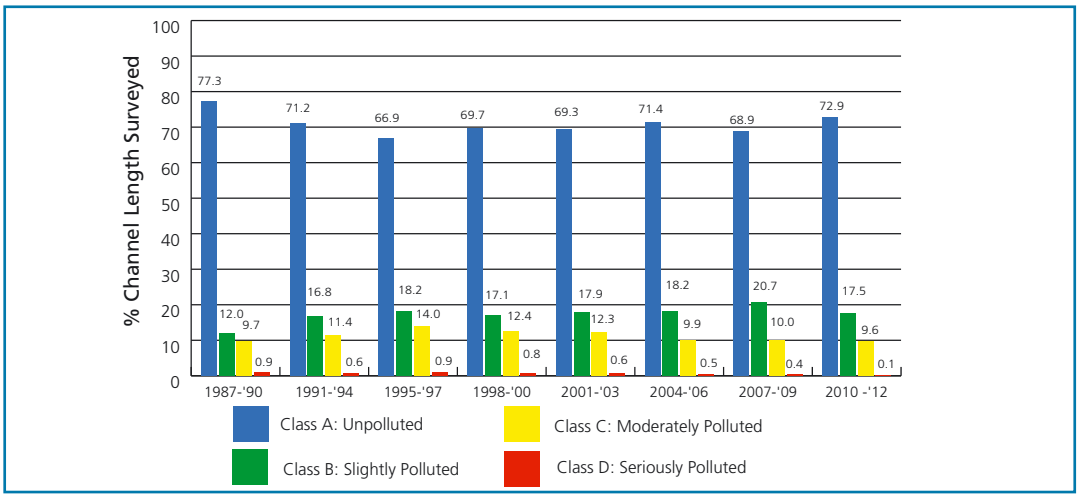


Figure 3-7. Trends in the 13,300 km baseline showing the percentage of surveyed channel nationally in the four EPA biological quality classes.

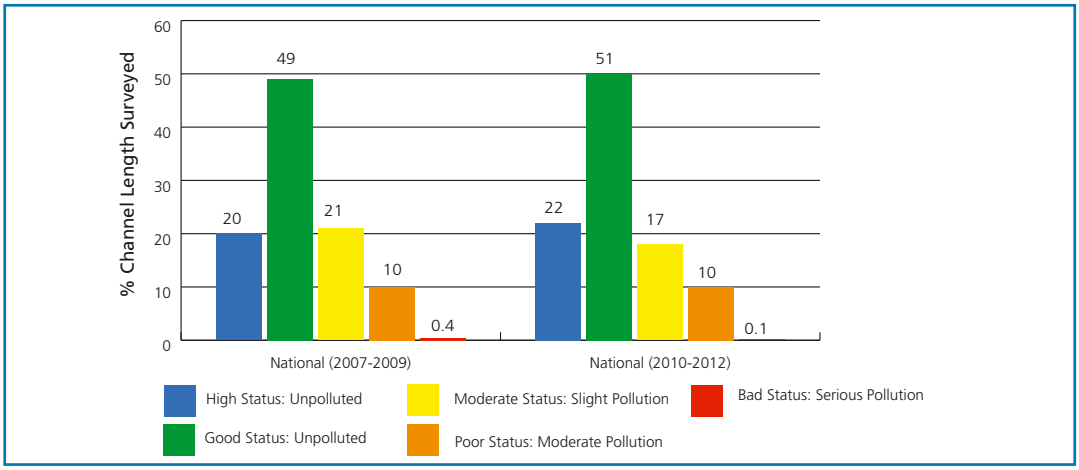


Figure 3-8. Recent trends in the 13,300 km baseline showing the percentage of surveyed channel nationally in the five WFD biological quality classes.

River water quality trends in the River Basin Districts (RBDs)

South-Western RBD

The South-Western River Basin District (SWRBD) remains the least polluted RBD in the country (**Figure 3-9**), with 93% of surveyed channel classified as unpolluted. The proportion of high status channel surveyed increased from 37% (832 km) to 41% (926 km), while the proportion of moderate status channel continues to decrease from 6% (143 km) to 5% (120 km). An unwelcome increase in poor status channel length, however, was noted.

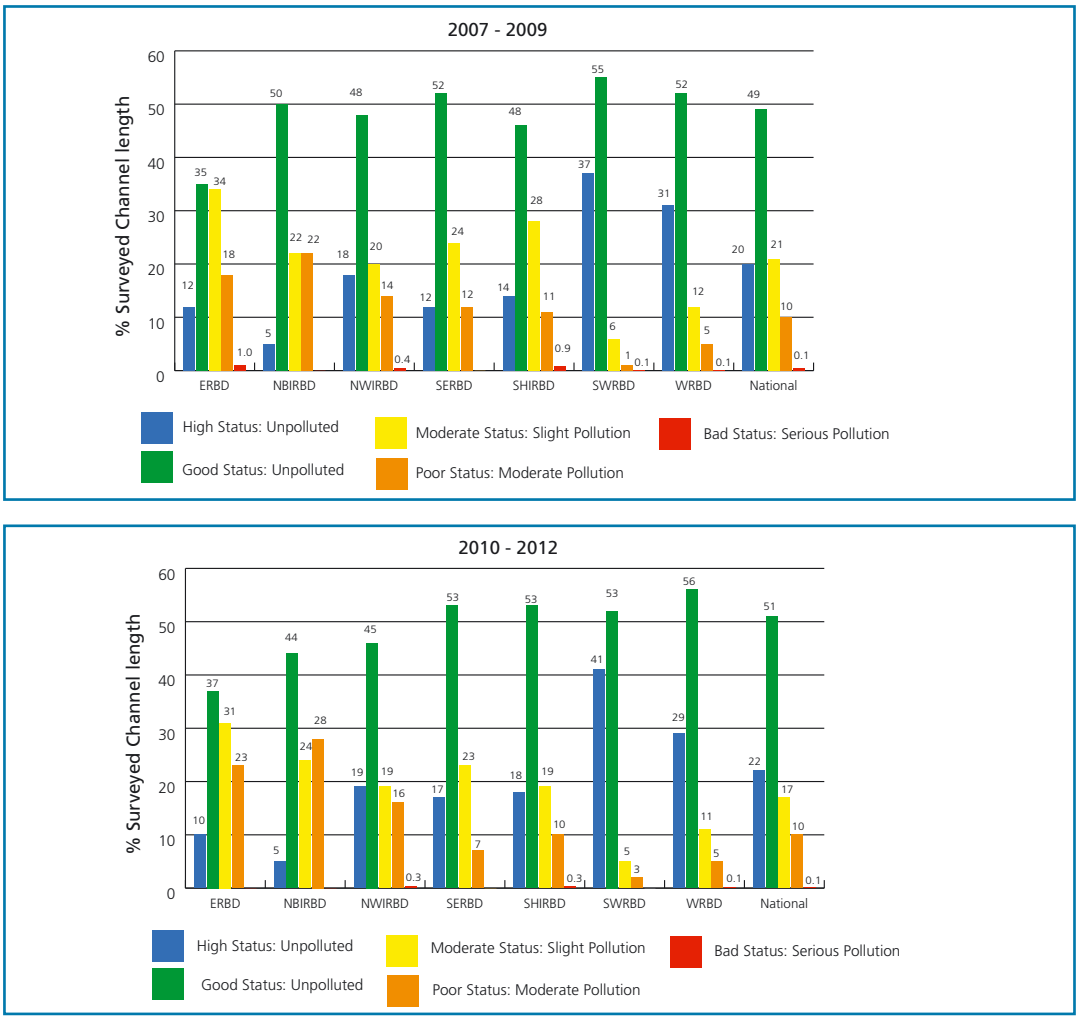


Figure 3-9. Trends in river quality based on the macroinvertebrate quality element as percentage surveyed channel length within each RBD between the two survey periods 2007-2009 and 2010-2012.

Western RBD

A significant proportion (84%) of surveyed channel was once again unpolluted in the Western RBD, however, there was a decline noted in the proportion of high status channel length. A welcome increase was observed in the extent of unpolluted channel, with a corresponding decrease in moderate status channel length (**Figure 3-9**). Serious pollution continues on the Tubbercurry Stream and Tubbercurry River due primarily to poorly treated wastewaters.

North-Western IRBD (South)

The proportion of channel classified as unpolluted in the North-Western International River Basin District (NWIRBD) declined from 66% to 65% (**Figure 3-9**). The percentage of high status channel increased from 18% to 19% of channel surveyed, while the good status channel

declined from 48% to 46%. A corresponding increase in the length of poor status channel was noted (from 254 km (2007–2009) to 290 km (2010–2012)) in the Erne, Donegal Bay, Gweebarra and Swilly catchments (hydrometric areas 36, 37, 38 and 39).

Serious pollution continued on the Swilly Burn, Maggy's Burn and Bredagh rivers in the current survey and was also newly noted on the Aighe River in 2012.

South-Eastern RBD

A significant improvement in the proportion of unpolluted channel from 64% to 70% of surveyed channel) was noted in the South-Eastern RBD (**Figure 3-9**). The proportion of high status channel increased from 12% to 17% of channel surveyed, while the good status channel length increased from 52% to 53%, with a corresponding reduction in poor status. The main improvements were in the Barrow, Nore and Suir rivers (hydrometric areas 14, 15 and 16).

Shannon IRBD (South)

A welcome improvement in the length of unpolluted channel from 60% (1,982 km) to 71% (2,362 km) was noted in the Shannon International River Basin District (SHIRBD) (**Figure 3-9**). Serious pollution, however, continues on the Ahavarraga Stream, Jiggy (Hind) and Laurencetown stream. Suspected causes include industrial and municipal wastewater discharges (see **Table 3-8**).

Neagh Bann IRBD (South)

An unwelcome decline in the length of unpolluted channel from 55% to 49% was noted in the Neagh Bann in the latest survey (**Figure 3-9**). The main decline was seen in hydrometric area 06 which covers the Fane, Glyde and Dee rivers. The length of good status channel declined from 50% to 44%, while the moderate and poor status channel increased in length.

Eastern RBD

The Eastern River Basin District (ERBD) continues to have the lowest percentage of unpolluted channel length (46%) (**Figure 3-9**). The ERBD is the most highly urbanised and industrialised region of the country. A loss of high status channel and increase in poor status channel was most notable in the Boyne and Liffey (hydrometric areas 07 and 09), while an increase in high and good status channel was noted in Avoca and Vartry catchment (hydrometric area 10). The Avoca river, although showing signs of some improvement for the macroinvertebrate community, continues to exhibit toxic poor status due to acid mine drainage.

High Status Trends

High ecological quality at river sites is an indicator of largely undisturbed conditions and reflects natural background status or only minor distortion from anthropogenic influences. Sites of high ecological quality are important for supporting healthy populations of aquatic species, like the freshwater pearl mussel and juvenile salmon, which are sensitive to disturbances, such as nutrient enrichment or siltation. The presence of high status stretches along a river system can contribute significantly to the overall species diversity and enables recolonisation of sensitive species to recovering river stretches.

The percentage number of high quality sites had almost halved in the 22 years between 1987 and 2012. In each survey period the decline continued, from 29.6% of the total sampled in the 1987-1990 period to 16.4% in 2007-2009 (**Figure 3-10**). However, a welcome increase in the numbers of high status sites in the latest survey (18.3%) will hopefully continue. The number of sites assigned Q5 high status reference condition continues to decline in the latest survey

(38 sites (2007-2009) to 27 (2010-2012)). **Figure 3-11** shows the distribution of 507 high status sites across the country. The Water Framework Directive requires Member States to protect and maintain high status water bodies, therefore targeted investigative monitoring and programmes of measures will be vital in halting the loss of, and subsequent restoring of, high status rivers.

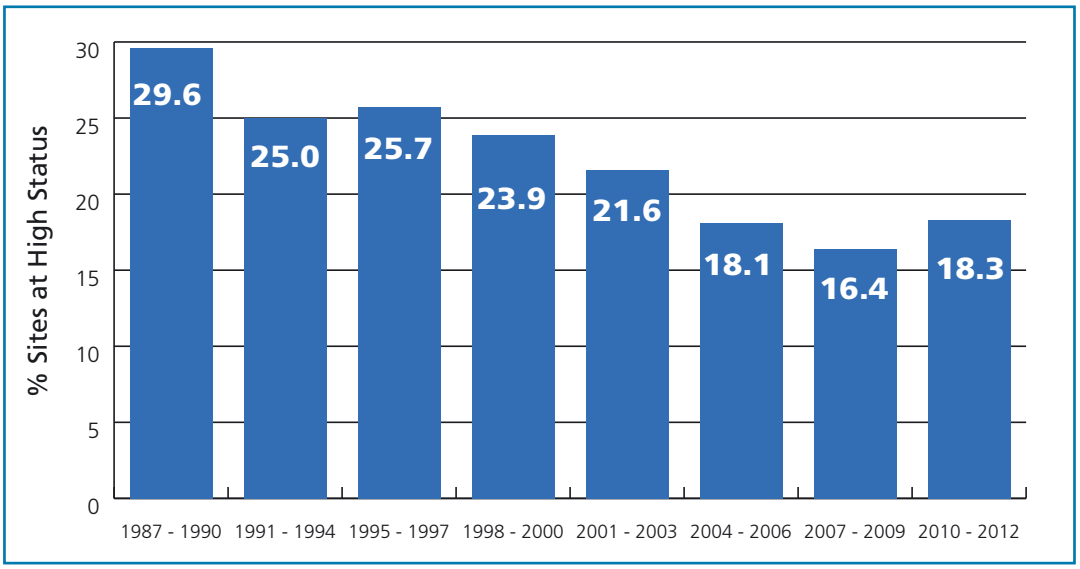


Figure 3-10. Long-term trends in the percentage number of high ecological quality (macroinvertebrate) river sites (1987 – 2012).

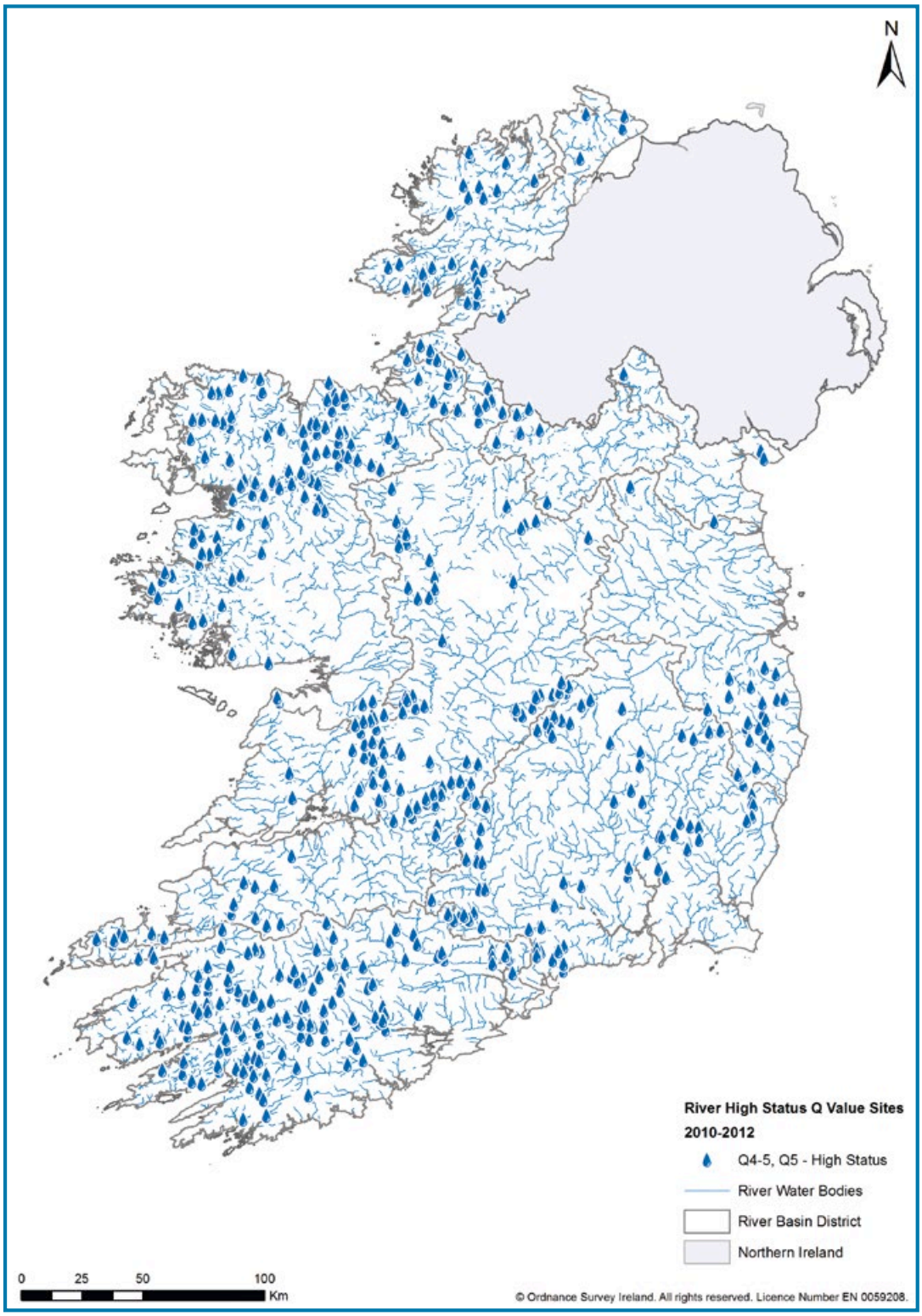


Figure 3-11. Map showing the location of the 507 high status Q value (Q4-5, Q5) sites across the country.

Other ecological quality elements: Fish

Surveillance monitoring of fish ecological status results

Inland Fisheries Ireland undertook monitoring of fish at 172 surveillance monitoring sites, as part of the WFD monitoring programme over the 2008–2012 survey period (**Figure 3-12**).

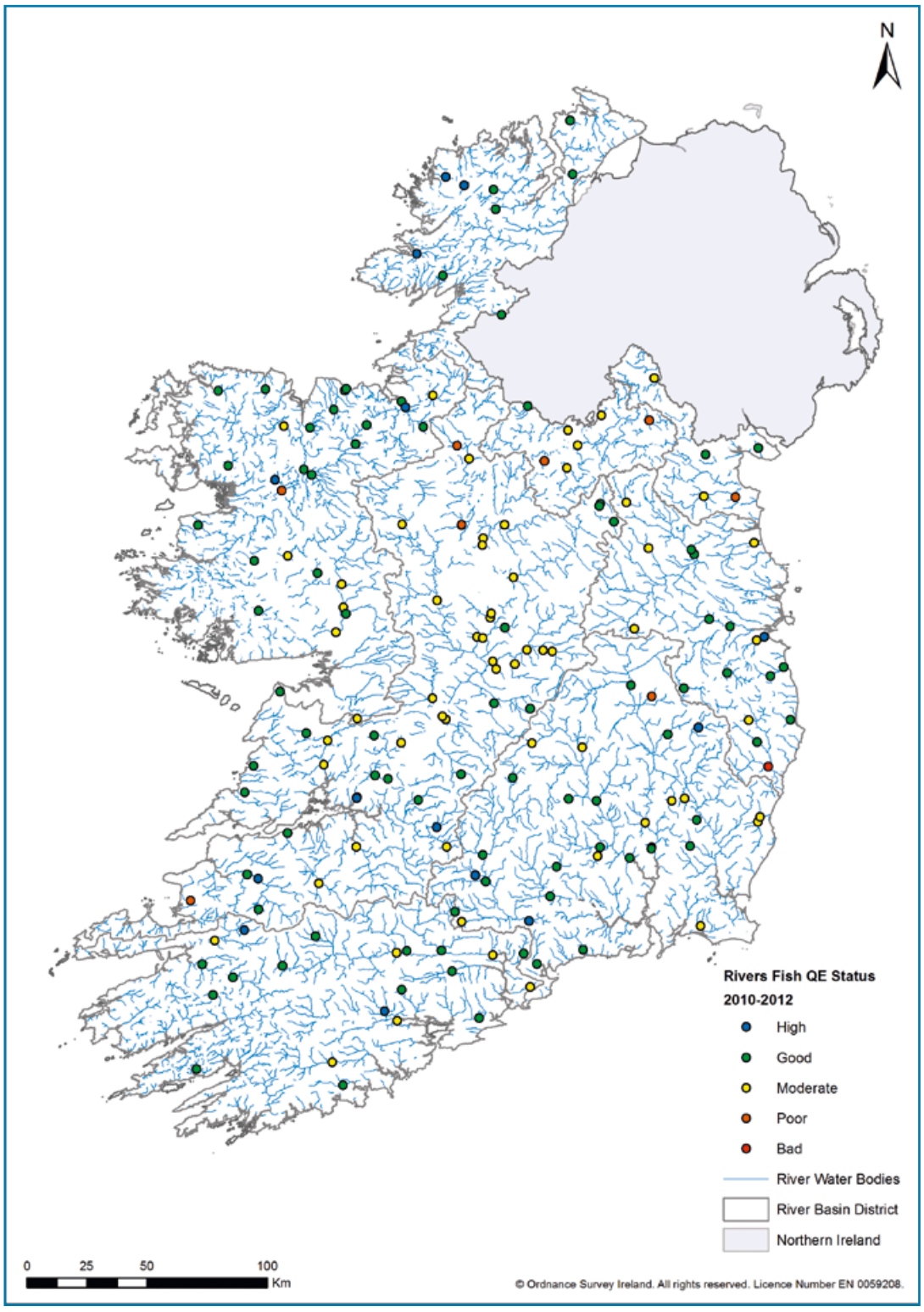


Figure 3-12. Ecological status of fish biological quality element in Irish rivers 2008–2012.

The survey results indicate that 59% of sites surveyed across the country were of high or good status (**Table 3-3**). 36% of sites surveyed were at moderate status, while 5% of sites indicated poor, and 1% of sites were classified at bad status. The fish status results were the element determining 18% (31) of the monitored surveillance river water bodies ecological status. Future investigative work will be needed to examine the causes of these declines where the other elements are not showing a similar pattern.

River Basin District	High	Good	Moderate	Poor	Bad	Total
Neagh Bann	0%	40%	40%	20%	0%	5
North-Western	19%	44%	25%	13%	0%	16
Eastern	6%	56%	33%	0%	6%	18
Shannon	8%	35%	52%	6%	0%	52
South-Eastern	10%	55%	32%	3%	0%	31
South-Western	9%	64%	27%	0%	0%	22
Western	7%	64%	25%	4%	0%	28
Total	**9%**	**50%**	**36%**	**5%**	**1%**	**172**

Table 3-3. Status results for fish populations in each of the WFD river basin districts based on 172 surveillance sites surveyed in the 2008-2012 period.

Fish kills

Data on fish kills are compiled annually by Inland Fisheries Ireland (IFI) since its establishment in 2010, with the Central Fisheries Board having previously recorded these based on returns from the Regional Fisheries Boards. Fish mortalities in rivers are only reported as 'kills' if there is a strong suspicion that the deaths are pollution-related or otherwise unnatural. The total number of reported fish kills in freshwaters (rivers and lakes) between 2010 and 2012 (**Figure 3-13**) was the lowest ever recorded (70 compared to 72 in the previous period). The wet summers in both 2009 and 2012, resulting in higher summer river flows and fuller lakes, may have reduced stresses on fish populations caused by low water levels which normally occur during the summer period.

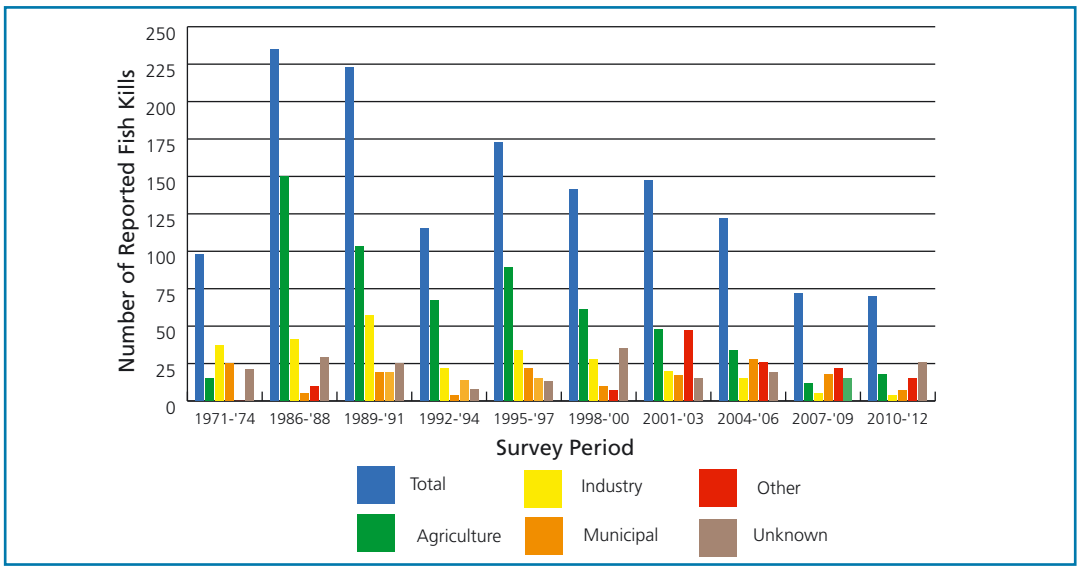


Figure 3-13. Number of reported fish kills and suspected causes since 1971.

The breakdown, of fish kills in 2010-2012 across the seven River Basin Districts (RBDs) (**Table 3.4**) shows that the highest number (20) occurred in the combined Eastern RBD and Neagh Bann IRBD, and the lowest number (7) in the North Western IRBD. Where the source of the kill was identified, agriculture accounted for the greatest number (18).

River Basin District	Agriculture	Industry	Municipal	Other	Unknown	Total	%
Eastern/Neagh Bann	1	1	1	6	11	20	28.6
North-Western	2	1	1	0	3	7	10.0
Western	1	0	3	2	3	9	12.9
Shannon	5	0	1	2	1	9	12.9
South-Eastern	5	0	0	3	4	12	17.1
South-Western	4	2	0	3	4	13	18.6
Total	**18**	**4**	**6**	**16**	**26**	**70**	**100**

Table 3-4. Number of fish kills in RBDs and suspected or confirmed causes in the period 2010-2012.

Chemical and physico-chemical elements supporting the ecological status of rivers

WFD monitoring incorporates an assessment of the general physico-chemical water quality conditions and compliance with standards for a range of toxic substances (called specific pollutants) which are necessary to support the achievement of good ecological status in rivers. In the period 2010-2012, the river surveillance sites were monitored on a monthly basis for a range of physico-chemical parameters, with metals and specific organic pollutants measured at a differing range of stations each year. The quality of waters was assessed against the Environmental Quality Standards (EQS) set in legislation. The monitoring programme covering 2010-2012 was reviewed following an extensive survey in 2006 which sought to determine the presence / absence of a large number of potential pollutants, as well as the findings of monitoring during 2007-2009. This led to a number of non-detected parameters being removed from the programme and being replaced by additional parameters of concerns, such as pesticide residues.

Surveillance sites were selected to identify changes due to anthropogenic or climatic pressures rather than being targeted to risk sites, but there is also an extensive network of operational sites covering both biological and physico-chemical monitoring where there may be specific identifiable pressures. Similar suites of analyses are reported for operational monitoring stations, with the exception of metals and organics. Approximately 1,373 operational and surveillance river sites chemical data representing 566 rivers and streams across the country were examined in the 2010-2012 period.

Nutrients (phosphorus/nitrogen)

The principal concerns for Irish rivers remain the impact of eutrophication (due to nutrient enrichment) and oxidation conditions. Increases in biochemical oxygen demand (BOD) as a consequence of organic loadings to rivers are also a concern in some areas. The following charts and maps (Figures 3-15 to 3-22) show the average concentrations for these parameters, both for the WFD surveillance stations and for all reported sites with at least five years of continuous

data – approximately 1,460 stations. In general, a comparison of the nutrient concentrations in Irish rivers against those of mainland Europe shows that Irish rivers typically fall into the lower range in terms of nutrient levels (EEA, 2012)[18].

Some marked reductions, particularly in nitrate concentrations, have been observed over the period 2007–2012. Nitrogen is retained less by soils, and changes in nutrient application rates may have a more pivotal role than in the case of phosphorus, where it tends to be retained by soils for many years. Examining trends shows that the greatest reductions in nutrients appear to be in the tillage and intensive agriculture areas in the South-East and Midlands.

Phosphorus						Total Oxidised Nitrogen					
µg/l P	s↓	w↓	‹–›	w↑	s↑	mg/l N	s↓	w↓	‹–›	w↑	s↑
<10		4	20			**<0.2**	-	1	18	6	1
10 - 20	3	5	43	1		**0.21 - 0.5**	4	8	12	2	-
20 - 35	3	10	41	6	1	**0.51 - 1**	7	14	11	1	-
36 - 50	1	2	7	4	1	**1.01 - 2**	16	10	12	-	-
51 - 75	3	3	4	4		**2.01 - 5**	15	13	17	2	-
76 - 100	-	-	4	-	1	**5.01 - 10**	3	1	1	-	-
>100	1	1	1	-	1						
Total	11	25	120	15	4	**Total**	44	47	71	11	1

Table 3-5. Trends in phosphorus and nitrogen concentration over time (2007-2012) for the WFD surveillance sites.

Overall, adequate data were available for orthophosphate and TON during 2007-2012 for 175 surveillance river sites for the purpose of assessing trends. Data was examined to identify if a trend existed and the magnitude of that trend. The trends were assessed in terms of strength (strong / weak) and direction (increasing / stable / decreasing) (**Table 3-5** and **Figure 3-14**).

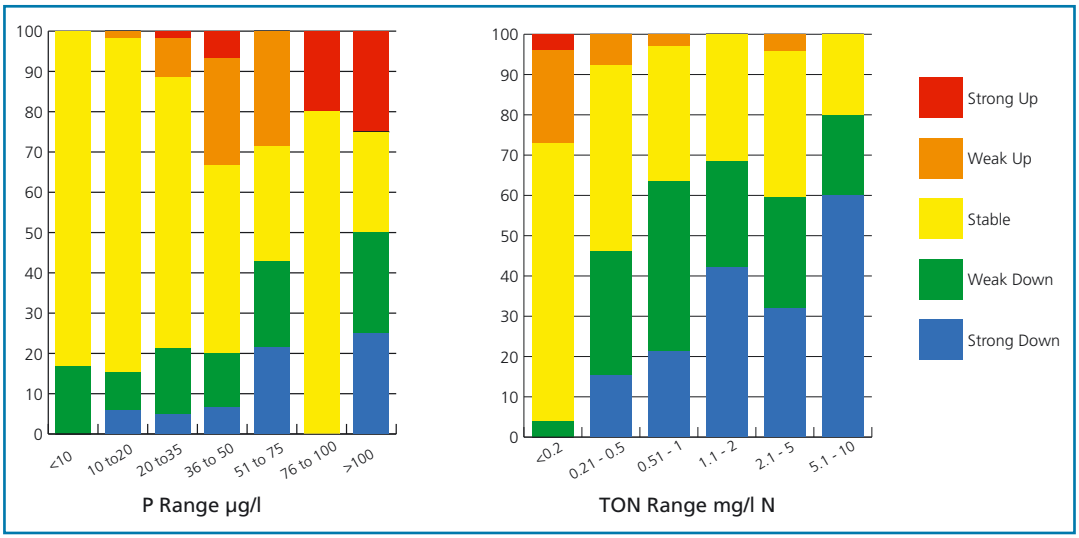


Figure 3-14. Orthophosphate (phosphorus) trends and total oxidised nitrogen (TON) trends for 175 WFD surveillance sites (2007 -2012).

18 http://www.eea.europa.eu/data-and-maps/indicators/nutrients-in-freshwater/nutrients-in-freshwater-assessment-published-3

In the case of phosphorus, the greatest improvements have been observed in rivers where, in general, phosphate values are in the region of the good – moderate boundary between 20 – 75 µg/l P. These represent almost 50% of all of the surveillance sites. Improvements were observed in 22 (24.4%) of 90 stations in this range. Overall, 120 stations (68.6%) showed no obvious trends, while 19 (10.9%) showed an increasing trend, though in four (2.3%) of these the trend was deemed to be of environmental significance. The greatest improvements were observed in the Liffey and Avoca Vartry catchment (hydrometric area 9 and 10 (Wicklow / Kildare) and Shannon (Roscommon / Offaly / Longford / Westmeath).

The most significant reductions in total oxidised nitrogen (Nitrate + Nitrite) are evident in much of the mid-east and south-eastern counties, where nitrogen loadings have long been associated with inputs from intensive livestock and tillage farming. The Lee valley in Co. Cork (hydrometric area 19) is the only area in this group not to have witnessed any meaningful reduction. Similar patterns were noted in groundwater.

Nutrient trends by hydrometric area and by concentration range are shown below in **Figures 3-15** and **Figures 3-16** for the surveillance stations.

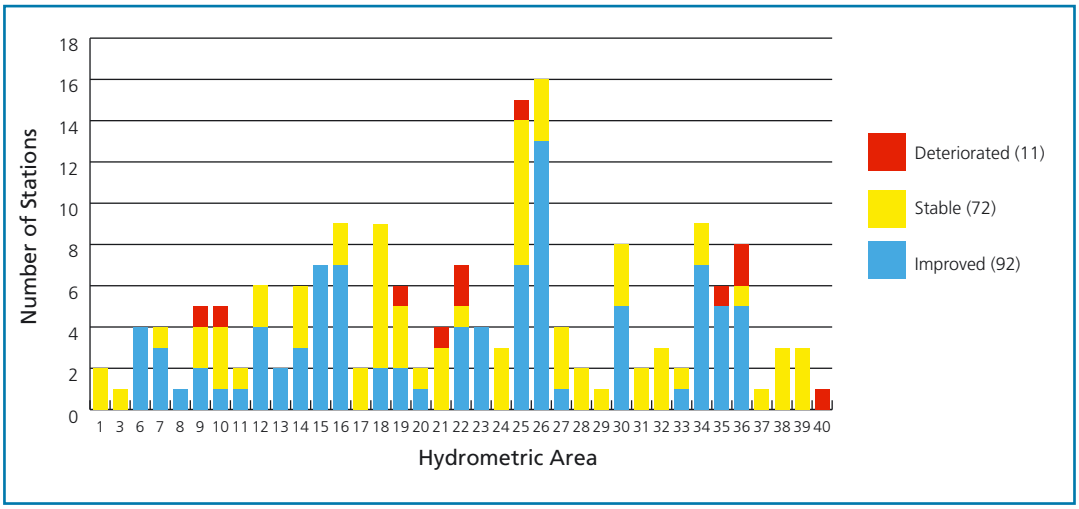


Figure 3-15. Total oxidised nitrogen (TON) changes between 2007 and 2012 for the WFD surveillance sites by hydrometric area.

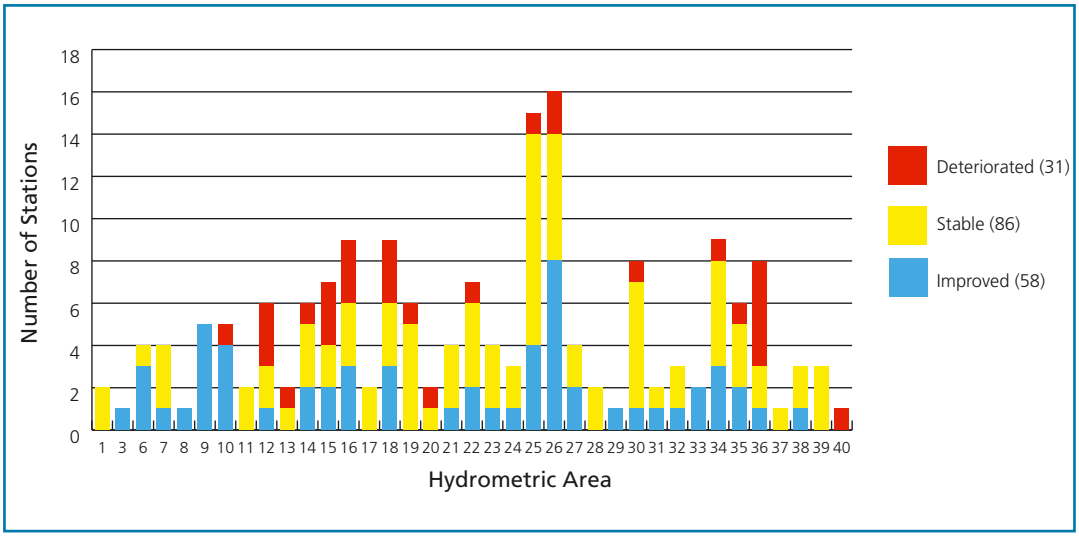


Figure 3-16. Orthophosphate changes between 2007 and 2012 for the WFD surveillance sites.

Figure 3-17 maps the national orthophosphate trends 2007–2012 by hydrometric area for all operational and surveillance monitoring sites available, while the second map shows the average river orthophosphate concentrations (mg/l P) 2010-2012 available for operational and surveillance monitoring sites.

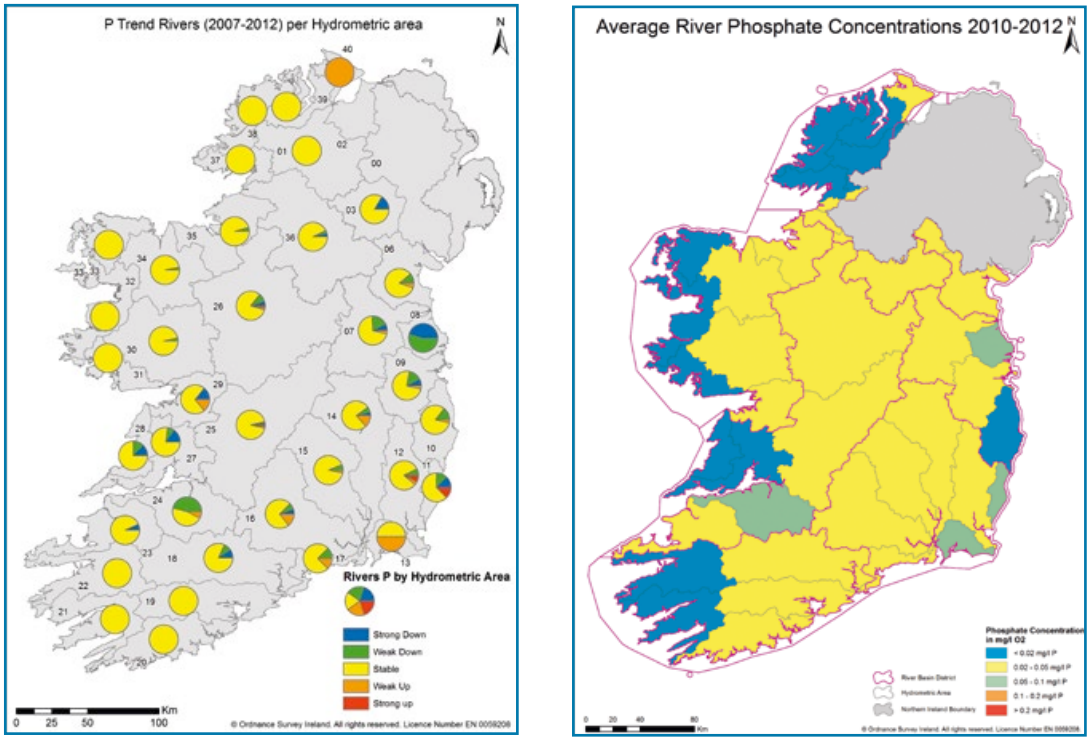


Figure 3-17. Map showing orthophosphate trends 2007–2012 by Hydrometric area for all operational and surveillance monitoring sites available. For those hydrometric areas bordering Northern Ireland, data reflects rivers in the Republic of Ireland only and map showing average river orthophosphate concentrations (mg/l P) 2010-2012 available for operational and surveillance monitoring sites.

In the case of total oxidised nitrogen (TON), there is a much more widespread pattern of reducing nitrogen concentrations across almost all areas (**Figures 3-15**). 124 of the 175 stations (70.9%) exhibit averaged TON concentrations of <2 mg/L N. 92 monitoring stations (52.6%) showed a decreasing trend, with 45 (25.7%) showing a marked reducing trend though, in many cases, this now appears to be beginning to stabilise, suggesting that future reductions may be less marked.

Figure 3-18 maps the total oxidised nitrogen (TON) trends across 175 WFD surveillance stations (2006-2012), the total oxidised nitrogen (TON) trends by hydrometric area for all operational and surveillance monitoring stations in the Republic of Ireland, and the average river nitrate concentrations (mg/l N) 2010-2012 for all available operational and surveillance sites.

Laboratory analysis for nutrients

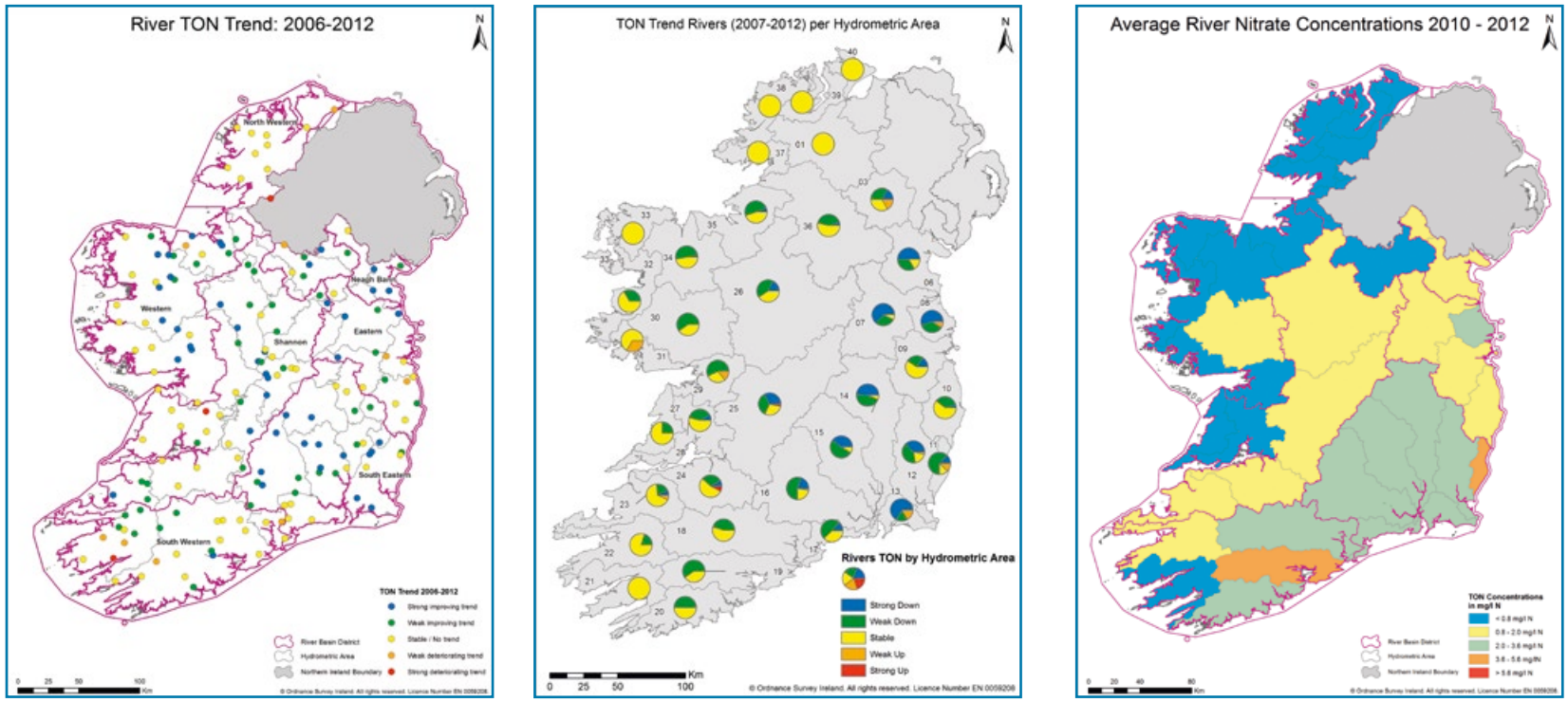


Figure 3-18. Maps showing total oxidised nitrogen (TON) trends across 175 WFD surveillance stations (2006-2012), the total oxidised nitrogen (TON) trends by hydrometric area for all operational and surveillance monitoring stations in the Republic of Ireland, and the average river nitrate concentrations (mg/l N) 2010-2012 for all available operational and surveillance sites.

Organic enrichment parameters

There appear to be improvements in average Biological Oxygen Demand (BOD) concentrations in Counties Limerick, Clare, Monaghan, and in the lower Shannon, however, many river BOD values are close to the reporting limits for laboratories and overall averages can be influenced by improvements in the performance of reporting laboratories (**Figure 3-19**).

Ammonia reductions have been observed in Counties Limerick, Clare, Kilkenny, Laois, Wicklow and Monaghan (**Figure 3-20**).

It is a similar picture for phosphorus, with improvements predominantly in the greater Dublin area and in County Meath (**Figure 3-17**).

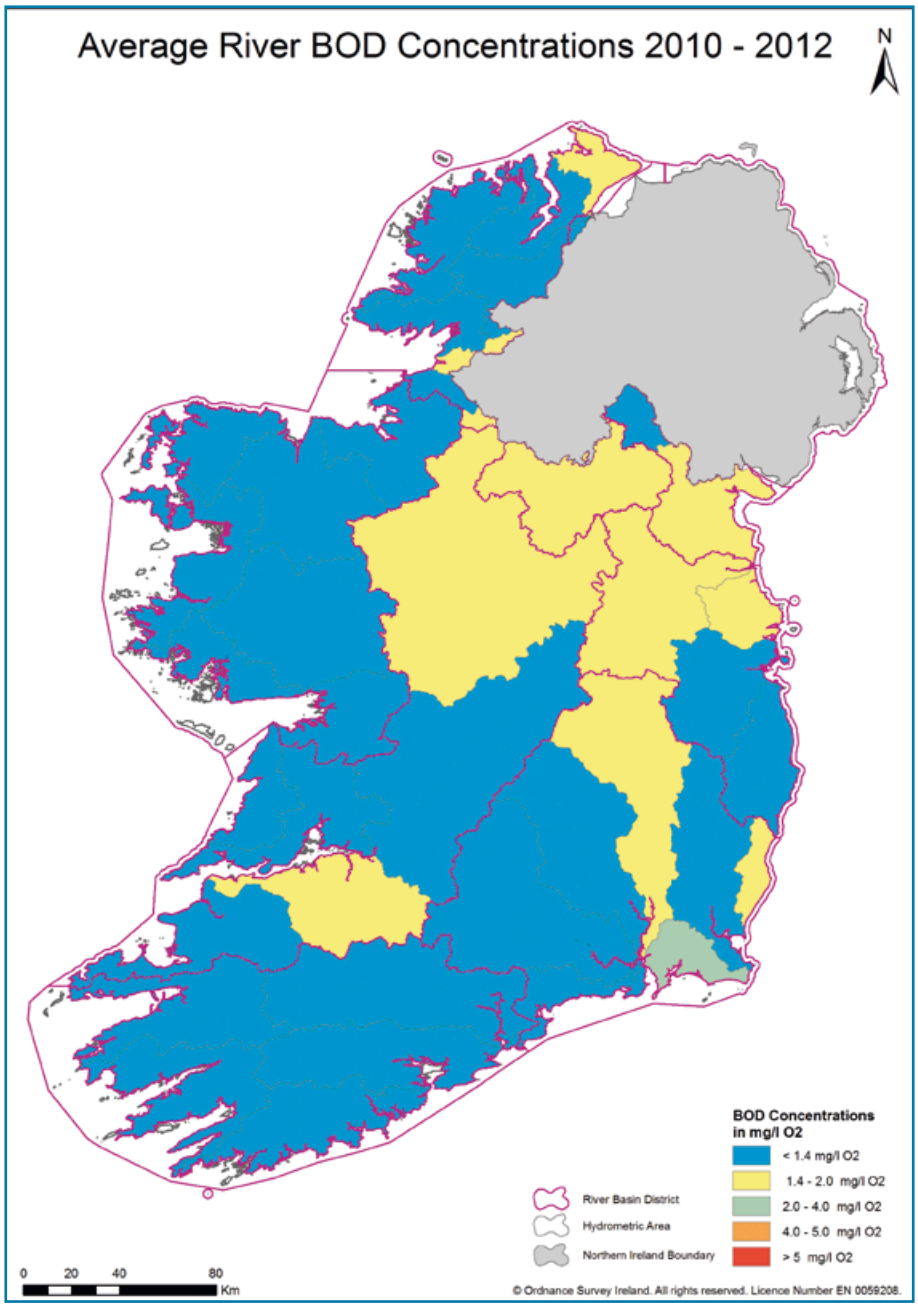


Figure 3-19. Map showing average river Biochemical Oxygen Demand (BOD) concentrations (mg/l O2) 2010-2012 available for operational and surveillance monitoring sites.

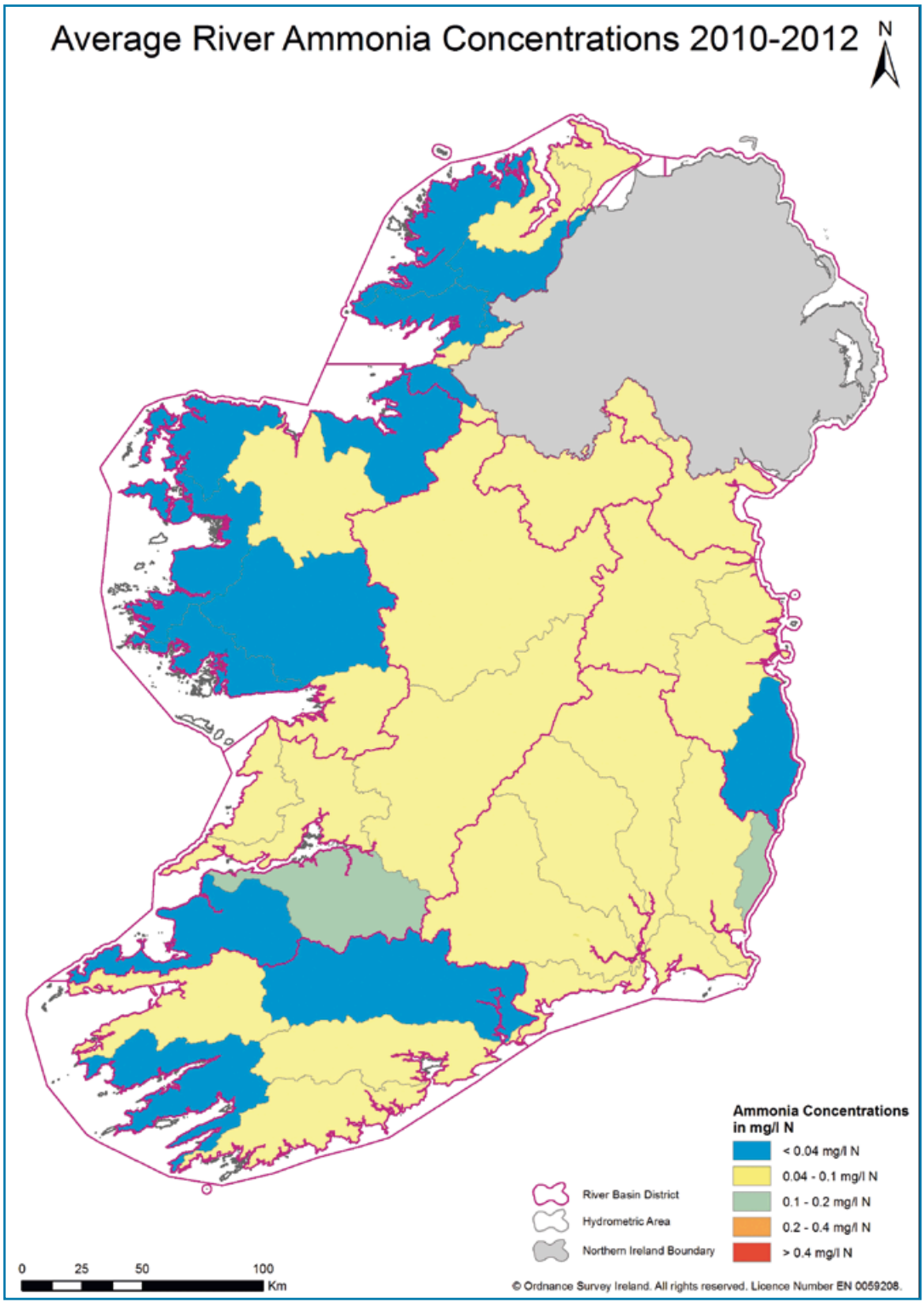


Figure 3-20. Map showing average river ammonia concentrations (mg/l N) 2010-2012 available for operational and surveillance monitoring sites.

Specific pollutants

The Water Framework Directive requires that Member States identify specific pollutants and set standards for them. specific pollutants are toxic substances that are discharged in significant quantities into the water environment. The selection of substances for subsequent EQS development and inclusion in the national monitoring programme commenced in 2006 with a screening programme for 161 substances at 23 sites across the country, including major rivers, lakes, and coastal waters, which were selected based on potential risk. Based on this screening programme, the 16 specific pollutants were prioritised for standard development. These included a range of commonly-used pesticides, plant protection products, metals, organic solvents and cyanide. National Environmental Quality Standards (EQSs) have been established for 16 specific pollutants in law. Table 3-6 outlines the results of the specific pollutants monitored in Irish rivers over the 2007-2012 period.

Substance	Period of monitoring	Number of river sites monitored	Number of river sites confirmed as exceeding an EQS (either AA or MAC)	Number of river sites exceeding the Annual Average (AA) EQS	Number of river sites exceeding the Maximum Allowable Concentration (MAC)
Arsenic	2007-2009	322	0	0	NA
	2010-2012	194	0	0	NA
Chromium III [5]	2007-2009	326	17	15	6
	2010-2012	203	10	10	0
Chromium VI	2007-2009	Not	-	-	-
	2010-2012	nm	-	-	-
Copper[2]	2007-2009	507	36[4]	36[4]	NA
	2010-2012	439	5	5	NA
Cyanide	2007-2009	194	0	0	NA
	2010-2012	37	0	0	NA
Diazinon	2007-2009	nm	-	-	-
	2010-2012	19	0[3]	0	0
Dimethoate	2007-2009	nm	-	-	-
	2010-2012	19	0	0	0
Fluoride	2007-2009	316	1	0	0
	2010-2012	133	0	0	0
Glyphosate	2007-2009	180	0	0	0
	2010-2012	79	1	0	1
Linuron	2007-2009	114	0	0	0
	2010-2012	78	0	0	0
Mancozeb	2007-2009	nm	Measured in 2006 as part of Dithiocarbamates suite – no detects found		
	2010-2012	nm	-	-	-

Substance	Period of monitoring	Number of river sites monitored	Number of river sites confirmed as exceeding an EQS (either AA or MAC)	Number of river sites exceeding the Annual Average (AA) EQS	Number of river sites exceeding the Maximum Allowable Concentration (MAC)
Monochlorobenzene	2007-2009	212	0	0	NA
	2010-2012	68	0	0	NA
Phenol	2007-2009	nm	Measured in 2006 – no significant detection rate observed		
	2010-2012	nm			
Toluene	2007-2009	226	0	0	NA
	2010-2012	68	0	0	NA
Xylenes	2007-2009	105	0	0	0
	2010-2012	nm	-	-	-
Zinc[2]	2007-2009	506	16	16	NA
	2010-2012	443	15	15	NA

Table 3-6. Specific pollutants monitored in rivers in the period 2007-2012.

Notes:

1. NA = No MAC value applicable.
2. Nm = Not monitored.
3. For cadmium, copper, and zinc multiple EQS criteria apply related to water hardness.
4. Limits of detection for this parameter are above the EQS threshold.
5. Multiple detection limits reported during this time period, with several exceeding the EQS threshold.
6. Chromium was measured as total chromium. No data available for Hexavalent Cr.

Overall, the level of compliances with EQSs for specific pollutants is high (**Table 3.6**). The analytical Limit of Detection for Diazinon is above the EQS. Of the 18 rivers where analysis was targeted, only two values were above the Limit of Detection.

Metals

Concentrations of metals in Irish rivers tend to be relatively low and come principally from geological weathering, via inputs from urban or industrial wastewater treatment plants, and from mining discharges. The main areas where metals are frequently found at elevated concentrations are in the traditional mineral mining areas - most notably in Wicklow and Tipperary. The Avoca, Drish, Rossestown and Yellow / Kilmastulla rivers accounted for a largest proportion of the chromium and zinc exceedances of the AA-EQS values (**Table 3-6**).

Information of the spatial distribution of metals in soils can be found in the Soil Geochemical Atlas of Ireland[19] published by Teagasc. For most metals, annual average EQS (AA-EQS) values apply but for some, e.g. chromium, maximum allowable concentration (MAC) values also apply. The AA-EQS values for copper and zinc are based on water hardness, with multiple values applying. The lowest threshold concentrations are associated with naturally soft waters. Few Irish rivers have carbonate hardness of below 10 mg/l of $CaCO_3$, however, a few in the north-west and in the far south-west would be very close to this value. Around 30% of monitored rivers are in the 10-100 mg/l hardness range.

Chromium

The analytical methods commonly used for metals analysis do not differentiate between the more common trivalent chromium (Cr III) and the more hazardous hexavalent species (Cr VI). Of the 2,532 results covering 138 rivers, there were 20 monitoring stations (12 rivers) which failed to meet the AA-EQS. Of these, 10 stations (four rivers) were significantly above the EQS, with the remainder being just above the EQS or where averaged values were based on fewer than four samples. There were no MAC exceedances.

Copper

Copper can be found in most areas at generally low concentrations and was detected in almost two-thirds of samples. As well as being due to geological sources, it is a common component of wastewater discharges coming from both industrial sources and from domestic plumbing. Copper exceedances consisted mainly of exceedances of the annual average of 5 µg/l set for waters with hardness of less than 100 mg/l of $CaCO_3$. This situation applies to almost one-third of all Irish rivers. Few surveillance stations indicated any issues. Of the 5,400 results covering 215 rivers, there were five monitoring stations (four rivers) which exceeded EQS values. The average Cu concentration for all samples was ca. 2.8 µg/l. Four rivers, the Avoca and Dargle in the Eastern RBD, and the Fergus and Yellow / Kilmastulla in the Shannon IRBD, are in mining areas.

Zinc

Like copper, zinc occurs naturally and is found virtually everywhere. It too is a common plumbing metal and the sources are generally the same. Its presence is also linked to areas rich in lead ore.

Of the 7,199 results, covering 443 monitoring stations (237 rivers), there were 15 exceedances of EQS values. Exceedances of the annual average EQS of 50µg/l EQS were observed in the Avoca and Glenealo in the ERBD, and in the Brown Flesk and the Owveg in the South-Western RBD. Exceedances of the annual average of 100µg/l for harder waters were observed in the Garryard Stream and Kilmastulla river in the Shannon region, together with the Drish and Rossestown in the South-Eastern RBD. When the influence of the high mining area samples is removed, the median Zinc concentration is approximately 5µg/l and is comparable to the average concentration from the 171 WFD surveillance monitoring stations.

Pesticides for which there are currently no Environmental Quality Standards

There are currently around 350 "active substances" approved for use in Ireland, of which many are plant protection products or biocides. For the period 2010-2012, monitoring was targeted more specifically toward those substances for which detects had been observed. Monitoring was carried out across 70 representative rivers. Some of these substances may be proposed for future designation as specific pollutants, if considered to be discharged in significant quantities.

19 http://erc.epa.ie/safer/iso19115/display?isoID=105

Pesticide	No. of samples	% detect	No (%) of rivers where detected
2, 4-D	910	2.5%	18 (25.7%)
2 6-Dichlorobenzamide	316	2.2%	7 (10%)
AMPA	870	0.2%	1 (1.4%)
Chlorpyriphos	151	0%	0%
Clopyralid	11	0%	0%
Dichlobenil	587	0.7%	4 (5.7%)
Dichlorprop	11	0%	0%
Epoxiconazole	131	0%	0%
Malathion	149	1.3%	2 (2.8%)
MCPA	910	7.9%	29 (41.4%)
MCPB	5	0%	0%
Mecoprop	879	10.9%	40 (56%)
Triclopyr	10	0%	0%

Table 3-7. Pesticides for which there are currently no Environmental Quality Standards.

2-methyl-4-chlorophenoxyacetic acid (MCPA) is most often used to assist in the management of reeds / rushes and was detected at 41% of rivers monitored. 56% of rivers (96 results) were reported at or above the limit of detection for methylchlorophenoxypropionic acid (Mecoprop), however of these, only 15 (1.7%) samples showed notably elevated concentrations (**Table 3-7**). Overall, some pesticide residues were detected in 60 (85.7%) of the 70 rivers monitored during the assessment period. In general, it would seem that pesticides do not appear to be a particular problem in Ireland. However, concern has been expressed over the increased use of substances, such as MCPA for weed control, and the possible impacts of substances, such as Cypermethrin, in areas of high water quality (Q4-5, Q5). They are among several additional substances that are included for further studies in a STRIVE research project currently underway. Cypermethrin has now been added to the revised list of priority substances in Directive 2013/39/EU and will require measures, where necessary, to achieve the relevant EQSs.

Chemical status of rivers (priority and priority hazardous substances)

Environmental Quality Standards (EQSs) have been set at European level in Directive 2008/105/EC for 22 priority substances and a number of other pollutants, as well as 13 priority hazardous substances. Values are generally set as annual averages and /or maximum allowable concentrations. These standards are used to determine the chemical status of rivers. Compliance with relevant standards results in waters being classified as at good chemical status. Non-compliance results in waters being classified as being at poor chemical status. These substances have been identified as posing a significant risk to surface waters at EU level, and the objective of designating substances is to put specific measures in place for the progressive reduction of discharges, emissions and losses of priority substances, and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances.

Each year, approximately one-third of all of the surveillance sites are monitored monthly for these pollutants. A summary of monitoring results is presented in Appendix 1. Apart from ubiquitous persistent, bio-accumulative and toxic substances (uPBTs) (see below), the level of compliance with the EQSs for priority and priority hazardous substances is very high. Of the pesticides monitored, only Isoproturon exceeded the annual average EQS in the River Nanny

(Eastern River Basin District) due to the influence of one very high result (4.2µg/l) in October 2011. It is widely used for controlling the growth of broad-leaved weeds and grasses, in both spring and winter seasons.

Both atrazine and simazine have been banned since 2007. However, some rare occurrences have been detected at low levels, below EQS. Clearly, some old stocks may still be in use. Di(2-ethylhexyl)- phthalate (DEHP) is a widely-used plasticiser, and traces were found in 92 of 114 rivers (81.5%), however, no values were found above the EQS of 1.3µg/l.

Cadmium

Environmental Quality Standard values for cadmium present an analytical challenge, as the limits of detection (LOD) of current laboratory techniques are insufficiently sensitive to determine, with certainty, whether breaches of the EQS values have occurred. Of the 2,706 results covering 204 river stations, there were 19 stations which apparently exceeded the AA-EQS, with five of these exceeding the respective MAC threshold. Of these, eleven can be deemed to exceed the relevant EQS. Rivers where EQS exceedances were recorded included the Avoca and Glenealo in the Eastern River Basin District, the Drish, Glengalla, and Rossestown in the South-Eastern River Basin District, and the Garryard Stream and Yellow/Kimastulla rivers in the Shannon district due to natural geological anomalies. These are also all in known mining areas.

Nickel

Nickel is a commonly-occurring element in nature, though its presence in soils is generally much lower than, for example, copper and zinc. It is quite prominent in soils in Counties Wicklow and Meath, and in some parts of Limerick. The EQS is set at 20µg/l, and of the 5,115 results covering 358 stations (219 rivers), only two rivers, the Rossestown and Drish, showed any EQS exceedances.

Lead

There are several areas in Ireland with comparatively high and naturally-occurring lead concentrations, mostly in the east of the country. In 2010-2012, of the 2,705 samples covering 203 stations (138 rivers), 26 stations exceeded the AA-EQS of 7.2 µg/l, however of these, only 13 stations (five rivers), notably the Drish, Rossestown and Tay in the south-eastern RBD, the Garryard Stream, Kilmastulla, Newport (Tipperary), and Yellow/Kilmastulla in the Shannon region, exceeded the EQS with any degree of certainty. In all of the other cases, annual averages were generally just above the EQS or were based on relatively few samples.

Ubiquitous persistent, bio-accumulative and toxic substances

Brominated diphenylethers, mercury, polyaromatic hydrocarbons (PAHs) and tributyl tin (TBT) have been identified as ubiquitous persistent, bio-accumulative, and toxic substances (PBTs) under Directive 2013/39/EU. These, and other substances that behave like PBTs, can often be found for decades in the aquatic environment at levels posing a significant risk, even if extensive measures to reduce or eliminate emissions of such substances have already been taken. Some are also capable of long-range transport and are largely ubiquitous in the environment. Therefore, non-compliant results do not infer specific issues local to a water body or indeed river basin district.

Freshwater fish (trout and perch) were sampled and analysed for mercury in 22 lakes but not in rivers. Results for all fish samples showed concentrations exceeding the EQS of 20µg/kg, ranging from 38-388 µg/kg. These concentrations are consistent with other studies across Europe, indicating the widespread distribution and persistence of this element. However, it should be

noted that the concentrations were well below standards for fishery products[20] and therefore, do not pose a risk to human health. Airborne deposition of mercury from fossil fuel combustion is widely regarded as the principal source. Similarly, mussel samples from marine waters showed exceedance of the biota standard in some places.

PAHs are a group of ring-structured organic compounds that are commonly associated with the combustion of fossil fuels. They are also present in run-off from roads. They have a strong affinity to solids and may be present from both fuel spillages or bound to particulate material, such as tyre residues. They present an undesirable parameter in waters even at very low concentrations due to their build-up in the aquatic food chain. During the period 2010-2012, the presence of one or more of the five substances comprising this grouping was found in 65 of the 79 stations surveyed (82.3%). Of the 4,245 results from 68 rivers, the detection rate was 14.9%. Two additional compounds, anthracene and fluoranthene, are also measured in this family of substances. Anthracene, fluoranthene and benzo-a-pyrene all have individual EQS values, with no exceedances of the AA-EQS or MAC observed. There are two sets of grouped parameters where the EQS is set as the sum of both components. These are (benzo(b) flouranthene / benzo(k)fluoranthene) with an AA-EQS of 0.03µg/l. There were 17 detects, however, no exceedances of the EQS were observed. The second grouping is for the pairΣ (benzo(b)flouranthene / benzo(k)fluoranthene). The EQS for this pairing is just 0.002 µg/l, and these were detected in 56 of the 79 stations monitored, with the AA-EQS being exceeded at 40 stations, with eight cases where the results were significantly above the EQS. The average value across all 68 rivers was just over twice the AA-EQS at 0.0045µg/l. It is important to recognise that this EQS of 0.002µg/l is extremely low. The standard allowed in drinking water (for total PAHs) is five times higher at 0.01µg/l. Calculations based on measurements of PAHs in ambient rainfall would indicate that the typical background concentrations in our rivers appear to be arising most likely from airborne deposition.

Applying the drinking water standard for the grouped parameter Σ (benzo(b)flouranthene / benzo(k)fluoranthene) would result in exceedances occurring at seven stations. These were noted in the Eastern RBD on the River Barrow at Monasterevin, Greese river and Tully stream, in the Shannon region on the Clodiagh (Tullamore), in the South-Western RBD on the Womanagh and Blackwater (Munster) at Killavullen Bridge, and in the Western RBD on the Kilcrow River in Galway.

Other trace organic compounds

The WFD monitoring programme also examines the presence of a range of compounds known as volatile organic compounds (VOCs). These include common solvents such as trichloroethylenes (used in dry cleaning processes), chloroform and dichloromethane (common industrial solvents), benzene and hexachlorobutadiene (from road run-off), as well as a wide range of other halogenated compounds. In total over the three-year period, 33,122 measurements were made covering 57 substances. There were no breaches of EQS values for any of these substances. Only 228 measurements detected these substances. Of these, 67 detects were for chloroform which is a common by-product of drinking water disinfection processes. Pentachlorophenol was found on two occasions in the Laune and Maine rivers in Co. Kerry. Both occurrences appear to be isolated events. Studies were also undertaken to determine concentrations of hexachlorobenzene (HCB) and hexachlorobutadiene (HCBD) in freshwater fish in lakes. None of the samples analysed showed exceedances of EQS standards for either HCB or HCBD.

20 European Commission Regulation (EC) No.1881/2006 as amended by Regulation 629/2008 sets maximum levels for certain contaminants, such as mercury, cadmium and lead, in fishery products

Causes of water pollution

While the causes of observed pollution, as determined by using the biological macroinvertebrate Q-Value assessments, may not always be proven, it is often clear what the likely causes are. Causes, such as discharges from municipal wastewater treatment plants or silage effluent discharges from farms, are usually obvious. In the case of more diffuse pollution, a number of approaches are taken to specify the nature of the pollutant source. These include on-site investigations, such as catchment walks and sampling smaller streams, to pinpoint the location of pollution sources. In addition, examining available information on changing land use over time and ordnance survey aerial photography can be helpful in investigating causes of water pollution.

Using the WFD macroinvertebrate classification, a total of 562 sites were classified at moderate status, 398 were deemed to be at poor status, while 10 sites were at bad status.

Suspected causes of pollution recorded nationally at 840 of these monitored sites are summarised in **Figure 3-21**. The polluted sites were examined in some detail to assess the likely main cause of pollution in each case. Where more than one cause was suspected, these were recorded. The breakdown discussed in this report only applies to the main suspected cause of pollution recorded in each case. As in previous surveys, the two most important suspected causes of pollution are agriculture and municipal wastewater discharges, accounting for 53% and 34% respectively of the polluted sites examined.

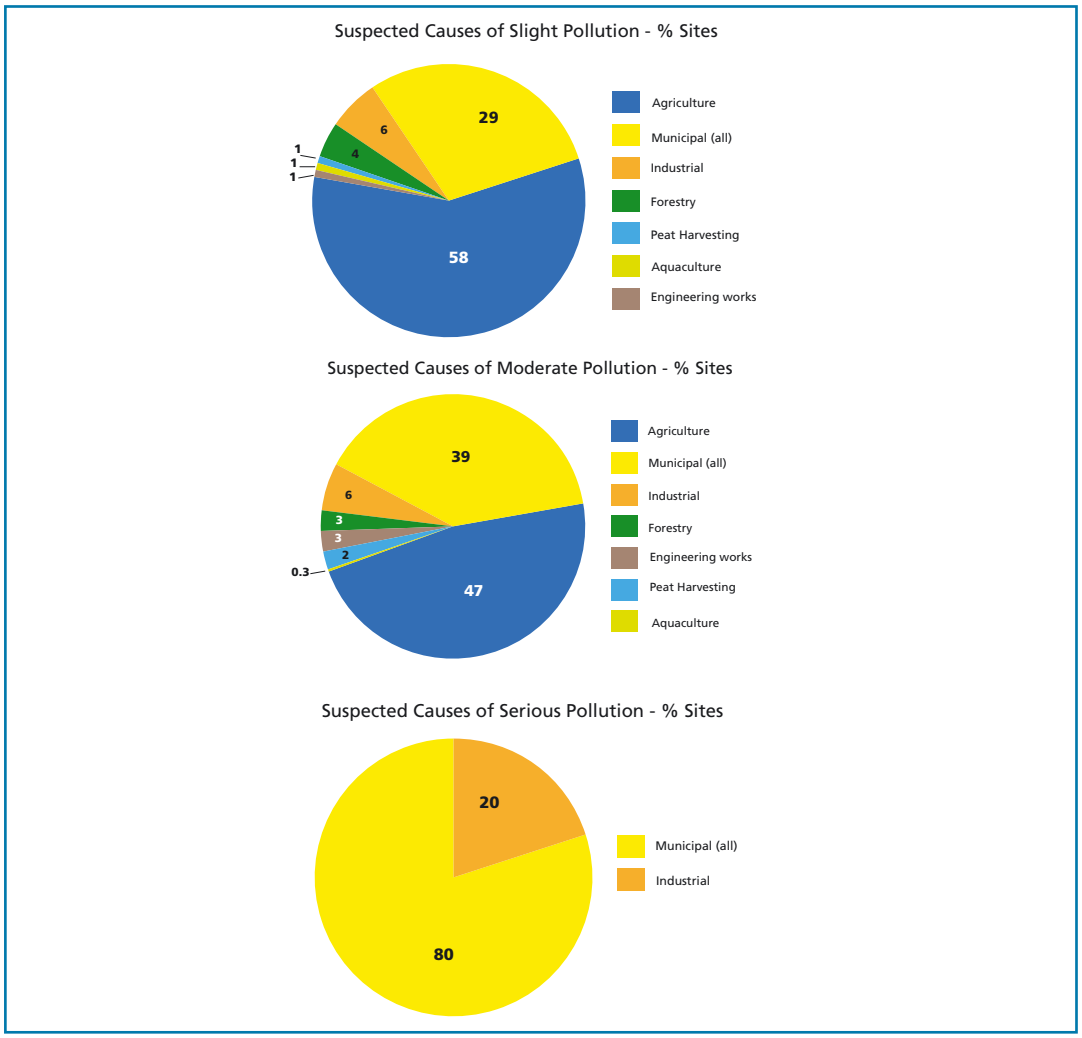


Figure 3-21. Percentage of polluted river sites surveyed in 2010-2012 grouped by severity of pollution (slight, moderate and serious) and suspected cause where assigned.

Slight pollution

Agriculture, primarily diffuse agricultural pollution causing eutrophication, was the main suspected cause of pollution assigned to over half of the cases of slight pollution (**Figure 3-21**). Slight pollution corresponds to moderate ecological status under the Water Framework Directive assessments. Municipal sources accounted for 28% of the sites in this category. The majority of these cases were due to suspected nutrient losses from municipal wastewater treatment plants but also a wider range of urban impacts, such as diffuse urban run-off, landfills and water treatment works. Industrial and forestry pollution sources accounted for 6% and 4% respectively of the cases of slight pollution examined. The main effect of these sources is eutrophication, i.e. greatly enhanced plant and algal growth caused by the plant nutrients phosphorus and nitrogen. Siltation is also another impact frequently encountered with slight pollution. Sensitive species, including the Freshwater Pearl Mussel and fish, can be affected by the smothering effects of inert or organic silt from sources mentioned above but also from engineering works, such as dredging, civil works and peat harvesting.

Moderate pollution

Moderate pollution, as indicated by the EPA's macroinvertebrate survey, is most likely to be classified as poor ecological status under the Water Framework Directive. The majority of instances of moderate pollution could also be attributed to agricultural sources and municipal sources (47% and 39% respectively) (**Figure 3-21**). The main effect from this pollution is intense eutrophication. In agriculture, primarily diffuse losses, including farm yard losses, siltation due to bank erosion, cattle access to streams, and losses from tillage land, were suspected. Municipal discharges from wastewater treatment plants were the main suspected case in the municipal category, with landfills and diffuse urban run-off also suspected. Suspected industrial sources of pollution accounted for 6%, while engineering and forestry impacts were each attributed to 3% recorded at sites examined.

Serious pollution

The extent of serious pollution has been reduced significantly in recent years due to increased enforcement[21]. There were 13 river sites classified as seriously polluted (bad ecological status) at some point during the 2010–2012 survey. Of these, four sites were newly classified as seriously polluted. Three of these sites improved in quality when resurveyed to assess the programme of measures applied to implement remediation. A total of 11 sites improved on their 2007-2009 serious pollution classification when surveyed in 2010–2012, leaving a total of 10 sites currently classified as seriously polluted (**Table 3-8**), representing 0.1% (16.9 km) of the total channel length surveyed. This represents a further significant improvement on the 2007–2009 survey when 19 locations (0.4% of channel length surveyed) were deemed seriously polluted.

21 Focus on urban waste water treatment in 2013. Environmental Protection Agency (2013)

River Name	Code	Location	County	Channel length (km)
Industrial				
Laurencetown Stream	26L070300	Br NW Ballyhoose (West Br)	Galway	3.9
Aighe	38A030150	Br NNW of Cashel	Donegal	1
Municipal				
Swilly Burn	01S030200	Br 1.5 km SE of Raphoe S Magheraha	Donegal	1.5
St John's	16S030300	Bleach Bridge	Waterford	Not available
Ahavarraga Stream	24A020400	Br 0.5 km d/s Priests Br	Limerick	2.5
Jiggy (Hind)	26J010090	Br WSW Ardsallagh Beg	Roscommon	3
Tubbercurry	34T020050	Br 1 km W. of Tubbercurry	Sligo	2.5
Tubbercurry Stream	34T030400	At old railway bridge	Sligo	Not available
Maggy's Burn	39M010300	Br Just u/s Lough Fern	Donegal	2
Bredagh	40B020400	Br in Moville	Donegal	0.5
Total (km)				**16.9**

Table 3-8. Serious pollution river locations 2010 – 2012.

Of the fourteen sites which improved, three have returned to good status, one has improved to moderate status, and the remaining 10 sites have improved to poor status. Municipal wastewater treatment plants are the suspected cause of pollution for eight of the current seriously polluted sites, while industrial discharges are suspected of causing pollution at the remaining two locations (**Table 3-8**).

Water quality and ecological potential of canals and their feeder streams

Canals are designated as Artificial Water Bodies (AWBs) under the WFD. Canals are required to achieve good ecological potential rather than good ecological status which pertains to natural water bodies. For classification purposes, the ecological potential can be maximum, good, moderate, poor or bad.

Waterways Ireland is responsible for the management, maintenance, development and restoration of the inland navigable waterway system throughout the island of Ireland, principally for recreational purposes. It is currently responsible for the Barrow Navigation, the Erne System, the Grand Canal, the Lower Bann Navigation, the Royal Canal, the Shannon-Erne Waterway and the Shannon Navigation. Inland Fisheries Ireland (IFI) operates a fisheries development programme for Waterways Ireland in the Republic of Ireland. As part of this programme, IFI carries out water quality monitoring of the canals for the purposes of the Water Framework Directive (WFD). The waterways covered include the Grand Canal, Royal Canal and the canalised section of the Shannon-Erne Waterway.

The canals traverse the Eastern, South-Eastern and Shannon River Basin Districts (RBDs) and are divided into 11 Artificial Water Bodies (AWBs) for the WFD canal monitoring programme. In the current assessment period (2010-2012), a recently-developed system for assessing the ecological potential of UK and Irish Canals was used to classify canals in Ireland. In total, 332 km of channel was monitored, with 42 surveillance monitoring sites assessed for biology, physico-chemistry and hydromorphology. Biological assessment was undertaken by surveying

for macroinvertebrates and macrophytes. Supporting physico-chemistry data was obtained from a sub-set of routinely monitored parameters, including total phosphorus, soluble reactive phosphorus, total oxidised nitrogen, ammonia, BOD, and coliforms. The integration of the biological, physico-chemical and hydromorphological quality elements was used to classify the overall ecological potential of the canal water bodies. Chemical status was not assessed, as the monitoring of priority or dangerous substances is only considered when deemed to be discharging into canals from natural water bodies.

Biological quality elements

Assessment of the canals using macroinvertebrates indicates generally good biological conditions in the Royal and Grand Canals, with 43% of sites classified at maximum, and 45% achieving good potential (**Figure 3-22**). Four sites on the main channel of the Grand Canal were at moderate ecological potential, including two sites in Kildare (Sallins and Ticknevin) and two in Offaly (west of Daingean and Tullamore). The canalised section of the Shannon-Erne Waterway was classified as poor, when assessed using the macroinvertebrate quality element.

Results were similarly positive for the Royal and Grand Canals in terms of macrophyte assessment, with 34% of sites at maximum potential and 64% of sites classified as good (**Figure 3-22**). A number of sites in both canals had to be downgraded from maximum to good due to the presence of the invasive aquatic plant Nuttall's Pondweed. The Shannon-Erne Waterway was classified at moderate potential in terms of the macrophyte quality element.

Physico-chemical and hydromorphological quality elements

The majority of sites were compliant with the water quality standards throughout 2010-2012, with 90% of sites achieving good ecological potential (**Figure 3-22**). Three sites experienced high BOD readings on a number of occasions and were classified as moderate. These include a site on the Grand Canal at Hazelhatch, Co. Dublin, a site on the Barrow Line of the Grand Canal at Athy, and a site on the Royal Canal at Castleknock in Dublin. Exceedances of ammonia and total phosphorus occurred at a Grand Canal site located west of Daingean, Co. Offaly, also resulting in a moderate classification. When assessed for hydromorphology, all Royal and Grand Canal sites were at maximum ecological potential, while the Shannon-Erne Waterway was classified as less than good.

The surveillance monitoring programme on the canals involved the routine sampling of a number of feeder streams. These feeders can be a source of nutrient and organic enrichment to the main channels and, depending on their location, are subject to point source pollution from municipal wastewater infrastructure or diffuse pollution from agricultural run-off. Any impacts from the feeder streams in 2010-2012 tended to be minor and localised, and did not affect overall water quality in the canal water bodies. However, a fish kill on the 27th level of the Barrow Line in Athy in December 2010 was attributable to pollution from a surface water drain discharging directly to the canal. High levels of *E. coli*, an indicator of faecal contamination, occurred on a number of occasions in the Grand Canal Basin in Dublin and in a surface water drain discharging to the Royal Canal at Kilcock, Co. Kildare.

Combined ecological potential

When the biological, physico-chemical and hydromorphological quality elements were combined, all water bodies in the Grand and Royal Canals achieved good ecological potential in the 2010-2012 period (**Table 3-9**). The canalised section of the Shannon-Erne Waterway had a poor classification in terms of macroinvertebrates and, applying the one-out-all-out rule, was classified as poor overall. While this water body was compliant with the water quality standards for the period, the biological potential is compromised by the hydromorphology of the canal. Its box-shaped profile and resultant poor aquatic flora means that it cannot achieve good ecological potential when assessed using the macrophyte and macroinvertebrate quality elements.

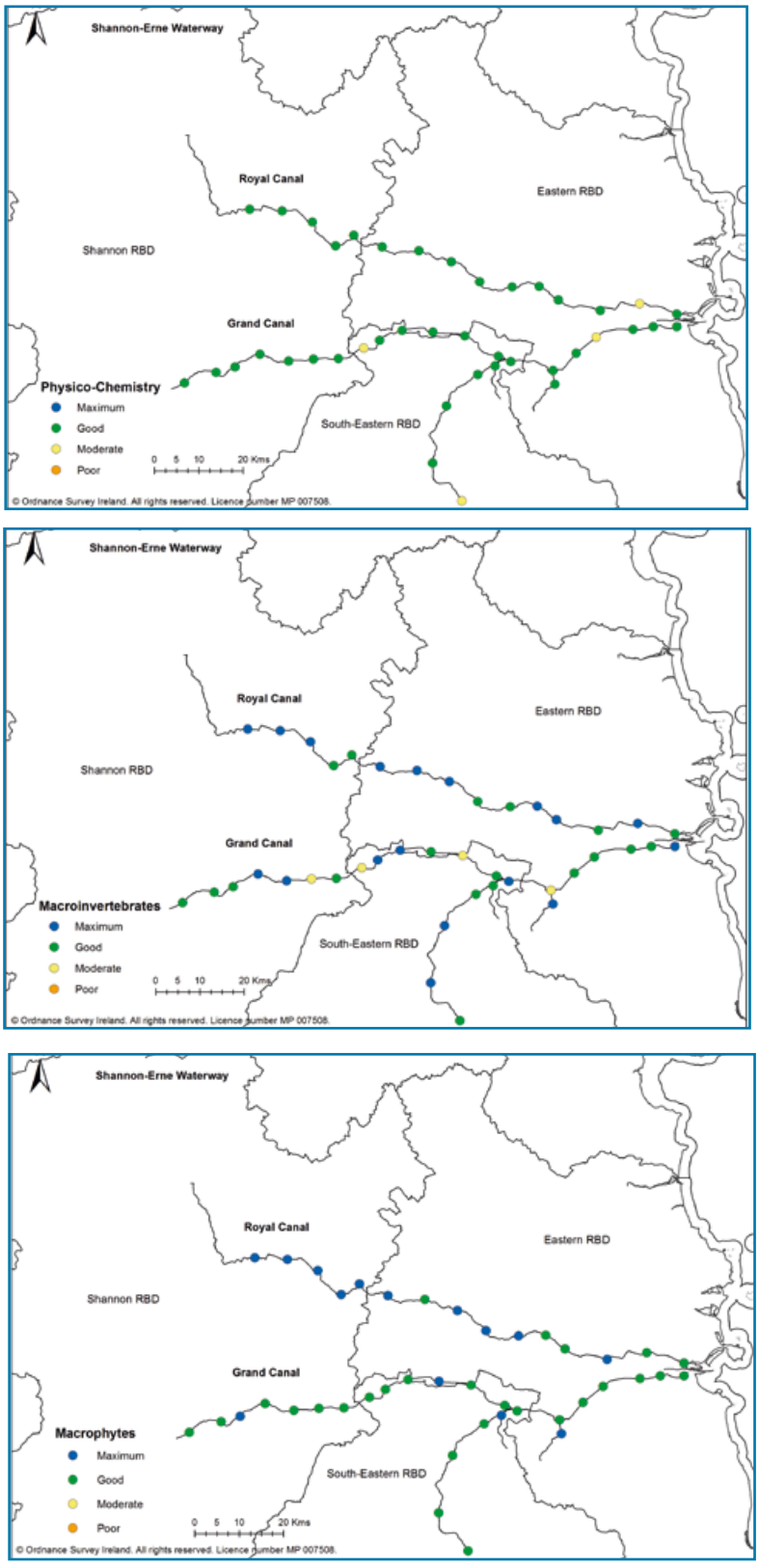


Figure 3-22. Maps of canal sites monitored for the Water Framework Directive (WFD) showing the ecological potential class based on the physico-chemical, macroinvertebrate and macrophyte quality elements.

River Basin District	Artificial Water Body (AWB)	Combined Ecological Potential
	ROYAL CANAL	
Eastern	Royal Canal Main Line	Good
Shannon	Royal Canal Main Line West of Lough Owel	Good
	GRAND CANAL	
Eastern	Grand Canal Main Line East of Lowtown	Good
South-Eastern	Grand Canal Main Line East of Lowtown	Good
South-Eastern	Grand Canal Main Line West of Lowtown	Good
Eastern	Grand Canal Main Line West of Lowtown	Good
Shannon	Grand Canal Main Line	Good
Eastern	Grand Canal Naas & Corbally Branch	Good
	BARROW LINE	
South Eastern	Grand Canal Milltown Feeder & Old Barrow Line	Good
South Eastern	Grand Canal Barrow Line	Good
	SHANNON-ERNE	
Shannon	Shannon-Erne Waterway	Poor

Table 3-9. Status classification of Artificial Water Bodies (AWBs) in 2010-2012.

Conclusions

- The proportion of river channel deemed to be in satisfactory condition has improved in the current period. 73% of river channel is at high or good macroinvertebrate status, this represents a 4% improvement on the previous survey.
- In WFD terms, 53% of monitored river water bodies (by number) are at satisfactory ecological status, however, Ireland still faces a considerable challenge, with 47% of these river water bodies currently failing to meet the WFD objectives of reaching good ecological status.
- The number of high status sites and corresponding percentage of high status channel length increased by almost 2% in the 2010-2012 survey period.
- The number of seriously polluted sites has further decreased to a current low of 10 sites.
- There has been a further decline in the number of fish kills reported in freshwaters (rivers and lakes) in the period under review (2010-2012), the lowest recorded to date.
- The principal concerns for Irish rivers remain the impact of eutrophication (due to nutrient enrichment) and oxidation conditions.
- A total of 840 monitored river sites were examined for suspected sources of pollution in the current survey. The two most important suspected sources of pollution are agriculture and municipal wastewater discharges.
- Trends in total oxidised nitrogen (TON), however, are indicating that concentrations in rivers are showing some degree of reduction (52% of sites assessed) or are stable (41% of sites assessed). The greatest reductions in nutrients appear to be in the tillage and intensive agriculture areas in the South-East and Midlands.

- Trends in phosphorus concentrations in rivers are stable in most parts of the country (69% of sites assessed). The average orthophosphate concentrations are less than the good EQS (i.e. <0.02 mg/l P) threshold for approximately two-thirds of the rivers examined, and therefore it is more difficult to demonstrate any significant trend between years examined due to seasonal variations. The greatest improvements have been observed in rivers where, in general, P values are in the good – moderate boundary (24% of sites assessed).
- Overall, the level of compliances with Environmental Quality Standards for specific pollutants is high in Irish rivers. The main issue is from metals in known, mineral-rich mining areas.
- Apart from ubiquitous PBTs, the level of compliances with the Environmental Quality Standards for priority and priority hazardous substances is very high.
- All water bodies in the Grand and Royal Canals achieved good ecological potential in the 2010-2012 period. The canalised section of the Shannon-Erne Waterway had a poor classification. While this water body was compliant with the water quality standards for the period, the biological potential was compromised by the hydromorphology of the canal.

Recommendations / follow-up actions

- The adoption and implementation of river basin management plans are beginning to show positive results, however, the pace of improvement is slow. Continued integrated catchment management planning and targeting of programmes of measures can only continue to influence the pace of change.
- River water bodies have been significantly revised so that the monitoring network will, in future, be more representative for the purpose of assessing the status of rivers. The original 4,565 water bodies have been reconfigured into approximately 3,200 water bodies. Therefore, the basis for the reporting of water status in future will change to some degree.
- The Water Framework Directive requires ecological status to be defined using all biological elements, namely the macroinvertebrates, plants and fish at surveillance sites. The status classification schemes for macrophytes and phytobenthos are currently undergoing further development and testing. These assessment methods could also be used at operational monitoring sites where they are deemed to be the most sensitive assessment method for the pressure being assessed. Once finalised and tested at the European level in the Intercalibration process, they will be adopted for use in Irish rivers. The Fish Classification Scheme 2 (FCS2) was intercalibrated at European level and adopted for use in assessing the fish populations of Irish rivers for WFD reporting. The survey results have shown some mismatch with the other biological elements and will need to be examined further to understand whether pressures other than enrichment may be causing the response, e.g. hydromorphological pressures such as barriers to access, etc.

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 Aeráide, Ceadúnaithe agus Úsáide Acmhainní
- An Oifig Forfheidhmithe i leith cúrsaí Comhshaoil
- An Oifig um Measúnú Comhshaoil
- An Oifig um Cosaint Raideolaíoch
- 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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