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Delegations will find attached document SWD(2026) 232 final - Part 23/27.

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PART 23/27

COMMISSION STAFF WORKING DOCUMENT

Member State country fiche on the implementation of Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources based on Member States reports for the period 2020–2023

European Commission

Portugal

Country staff working document
on the implementation of the Nitrates Directive

Period: 2020-2023

Contents

1. KEY FINDINGS AND RECOMMENDATIONS

Portugal submitted its report under the Nitrates Directive for the period 2020-2023 in June 2024 ([1]) via electronic reporting on Reportnet 3 portal ([2]).

This country staff working document is presented in line with the reporting guidelines and it is based on the data reported by the Member State ([3]), Eurostat and other EU official data sources. The Portuguese authorities were consulted for factual correctness. There may be differences with the information presented in their national report ([4]).

The numbers presented below are indicators of the situation in the Member State but need further interpretation to draw specific conclusions. In some cases, changes in the monitoring networks and in methodology for assessing trophic status may complicate comparisons between reporting periods.

1.1. Key findings

Pressures from agriculture

In Portugal, the utilised agricultural area (UAA) accounts for 42% of the country's total land area, which is higher than the EU average (38%). The livestock density is 0.6 livestock units per hectare (LSU/ha) of UAA, which is lower than the EU average of 0.7 LSU/ha, but there are regional variations with livestock densities above 1 LSU/ha UAA in one region. The gross nitrogen balance is 38 kg/ha UAA and the gross phosphorus balance is 3 kg/ha UAA ([5]).

Monitoring network

For groundwater, the density of the monitoring network is around 5 stations per 1 000 km^2, which is lower than the EU average (8 stations). Compared to the previous reporting period, the density decreased by 21%.

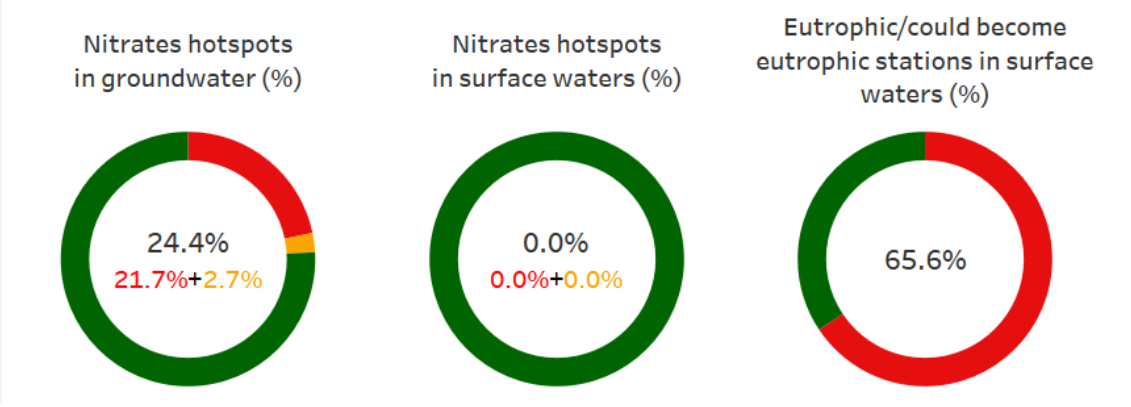
For surface freshwater, the density of the monitoring network is around 2 stations per 1 000 km^2, which is lower than the EU average (7 stations). Compared to the previous reporting period, the density decreased by 7%. The freshwater monitoring network includes rivers, lakes/water reservoirs.

For surface saline waters, transitional and coastal water are reported.

([1]) Final version was received in November 2024.
([2]) Reportnet 3 is an e-Reporting platform for reporting environmental and climate data to the European Environment Agency (EEA).
([3]) Only monitoring points electronically reported with nitrate concentration or tropic status, which were not removed from the monitoring network were considered for this assessment.
([4]) A uniform data-processing approach is applied to all Member States. In some instances, this may not fully correspond to the specific methodology used in the Member State.
([5]) The EU average is not available due to data gaps.

Water quality

Figure 1 – Share of monitoring points showing pollution in groundwater and surface waters



Note: The percentage share of **nitrate hotspots** refers to monitoring points with average annual nitrate concentrations ≥ 50 mg/l (red), or between 37.5 and 49.99 mg/l with an increasing trend (orange). This is calculated relative to the total number of points with measurements. The percentage share of monitoring points classified as **eutrophic or could become eutrophic** (red) is calculated relative to the total number of points with trophic status reported.

In **groundwater**, 78.3% of monitoring points show nitrate concentrations below 50 mg/l.

Overall, 24.4% of monitoring points fall in two categories illustrated in Figure 1, i.e. they show nitrate concentrations ≥ 50 mg/l (21.7%) or between 37.5 and 49.99 mg/l with an increasing trend (2.7%). Compared to the data reported in the previous reporting period, this represents an increase of 3.4 percentage points (from 21.0% to 24.4%). The regions with the highest share are Norte (52.9%), Alentejo (33.3%), and Oeste e Vale do Tejo (29.1%).

Compared to the previous reporting period, nitrate concentrations decreased in 24.9% of groundwater monitoring points and increased in 35.0%. Among points with nitrate concentration ≥ 50 mg/l, increases (62.5%) were more frequent than decreases (31.8%).

In **surface water,** 100% of monitoring points show nitrate concentrations below 50 mg/l and 34.4% are classified as non-eutrophic.

Therefore, none of the monitoring points show nitrate concentrations ≥ 50 mg/l, or between 37.5 and 49.99 mg/l with an increasing trend, as illustrated in Figure 1. 3% of surface water monitoring stations show nitrate concentrations ≥ 10 mg/l, which is relevant for eutrophication.

Compared to the previous reporting period, nitrate concentrations decreased in 8.8% of surface water monitoring points and increased in 11.3%.

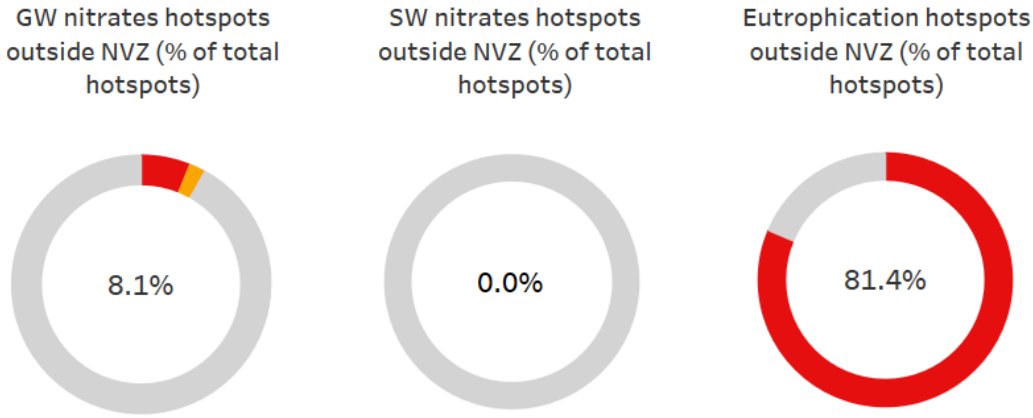
The share of monitoring points reported as eutrophic/could become eutrophic is 65.6% as illustrated in Figure 1. This represents an increase of 8.4 percentage points compared to the data reported in the previous period (from 57.3% to 65.7%). The regions with the highest share are Península de Setúbal (100%), Alentejo (82.4%) and Norte (70.7%).

Nitrate Vulnerable Zones

Portugal slightly adjusted the NVZ in the Autonomous Region of the Azores during the reporting period. The area of NVZ covers 6% of utilised agricultural area.

In Portugal, some monitoring points showing pollution are located outside NVZ. Figure 2 reflects that outside NVZ, there are 8.1% of groundwater monitoring points showing nitrate pollution (8 out of 100) and 81.4% of eutrophic/could become eutrophic points in surface waters (70 out of 86).

Figure 2 – Share of monitoring points showing pollution located outside Nitrate Vulnerable Zones (NVZ) in the reporting period 2020-2023



Note: The percentage of hotspots (stations either with average annual nitrate concentrations ≥ 50 mg/l or between 37.5 and 49.99 mg/l with an increasing trend) that are outside NVZ with respect to the total number of hotspots, and the percentage of eutrophic/could become eutrophic stations that are outside NVZ with respect to the total number of stations that are eutrophic/could become eutrophic. In red annual nitrate concentrations ≥ 50 mg/l resp. eutrophic/could become eutrophic, in orange annual nitrate concentrations between 37.5 and 49.99 mg/l with increasing trend, in grey hotspots inside NVZ.

Action Programme

Portugal did not modify its action programme during the reporting period.

1.2. Recommendations

- Review and where necessary reinforce measures to improve water quality, notably with a view to addressing:
  - high or increasing nitrate concentrations in groundwaters
  - high or increasing nitrate concentrations in surface waters
  - eutrophication of surface water bodies
- Review and where necessary update the designation of nitrate vulnerable zones to ensure that the designated zones include all areas with significant agricultural pressure that drain into:
  - waters that are eutrophic
- When preparing the Nitrates Action Programme and designating Nitrate Vulnerable Zones:
  - take into account objectives and deadlines of the Water Framework Directive, ensuring coherence with the 4th RBMP

    - consider introducing limitations on phosphorus fertilisation, if not yet implemented
    - ensure the cooperation between competent authorities in different sectors, such as agriculture and water, and with stakeholders
    - consider where measures could be simplified without compromising on results, working with the Commission and the other member States in the light of the findings of the evaluation of the Nitrates Directive
- Promote the dissemination of best practice, scientific knowledge and innovation to:
    - improve the analysis of expected future evolution in water quality and develop gap assessments for the nutrient load reductions required to reach water quality objectives
    - accelerate preparedness and resilience of action programmes and measures in the context of climate change

2. PRESSURES FROM AGRICULTURE

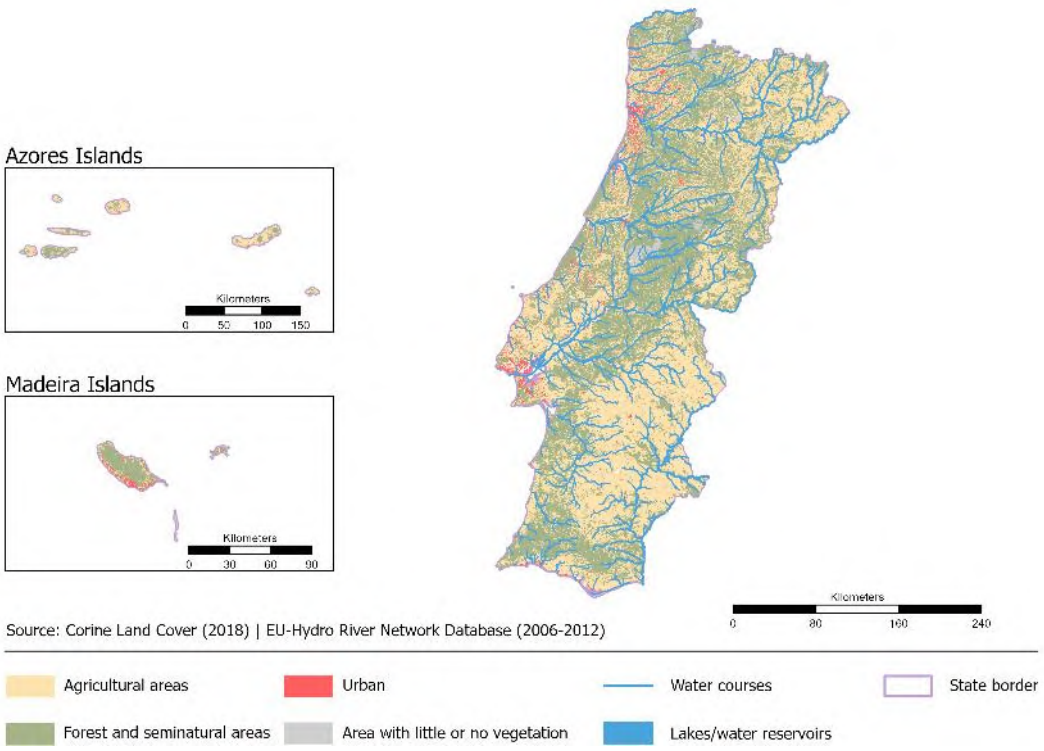
In Portugal, crop production accounted for the largest portion of the agricultural sector's total output value at 59.5% in the reporting period 2020-2023. Animal production followed with 34.2%, and other outputs made up 6.4% ([6]). The share of agricultural land used for organic farming increased significantly from 6.7% in the reporting period 2016-2019 to 17.3% in the reporting period 2020-2023 ([7]).

The risk of diffuse pollution of waters by nutrients from agriculture is primarily dependent on the agricultural pressures in the Member State, expressed in terms of utilised agricultural area (UAA), livestock density, the use of mineral and manure fertilisers, as well as the nitrogen and phosphorus balance. This section describes the evolution of these indicators.

2.1. Land use

The map below presents the distribution of land use in Portugal along with watercourses and lakes/water reservoirs.

Figure 3 – Land use distribution in Portugal



([6]) Source: Eurostat (aact_eaa01)
([7]) Source: Eurostat (ef_m_org)

The utilised agricultural area (UAA) in Portugal covered 3.9 million hectares in 2023, making up 42.4% of the country's total land area. Permanent grassland accounts for 54.4% of UAA, followed by permanent crops at 23.3% and arable land at 22.0%.

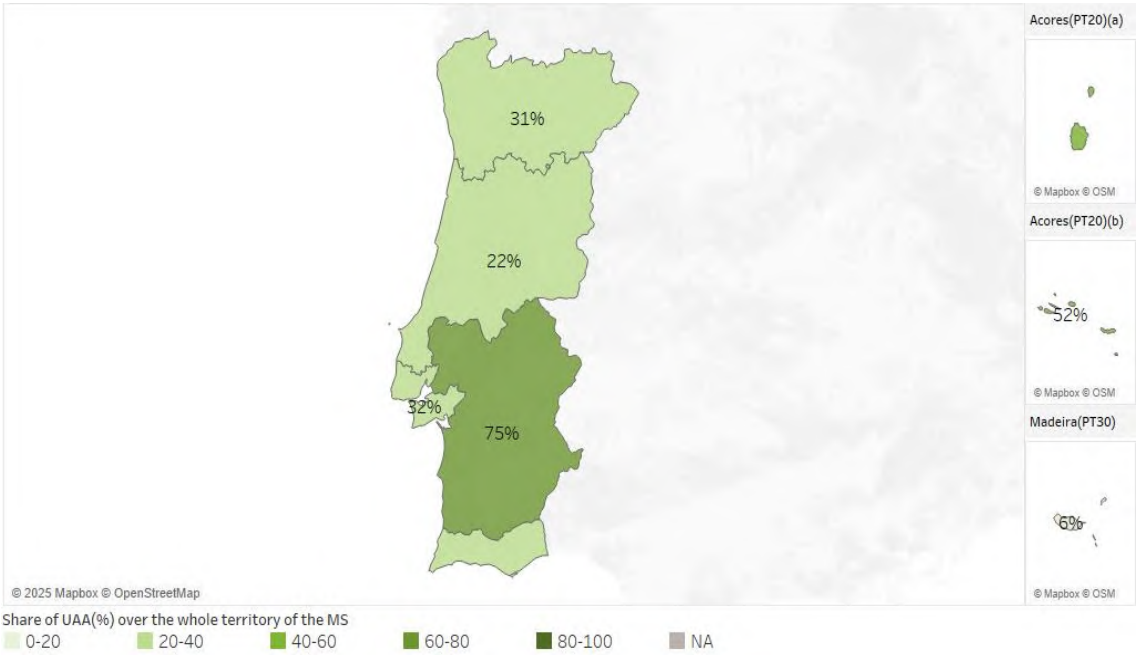
Table 1 – Evolution of the utilised agricultural area

	2010	2013	2016	2020	2023
utilised agricultural area (1000 ha)	3,668	3,642	3,642	3,964	3,861
arable land (1000 ha)	1,173	1,101	1,043	1,037	849
permanent grassland (1000 ha)	1,785	1,817	1,877	2,050	2,099
permanent crops (1000 ha)	691	709	705	861	899
kitchen gardens (1000 ha)	20	15	16	16	14

Source: Eurostat (ef_lus_main)

In 2020, the share of the UAA ranges from 75% in Alentejo, to 20% in Algarve.

Figure 4 – Share of utilised agricultural area (UAA) at NUTS2 level in 2020 ([8])



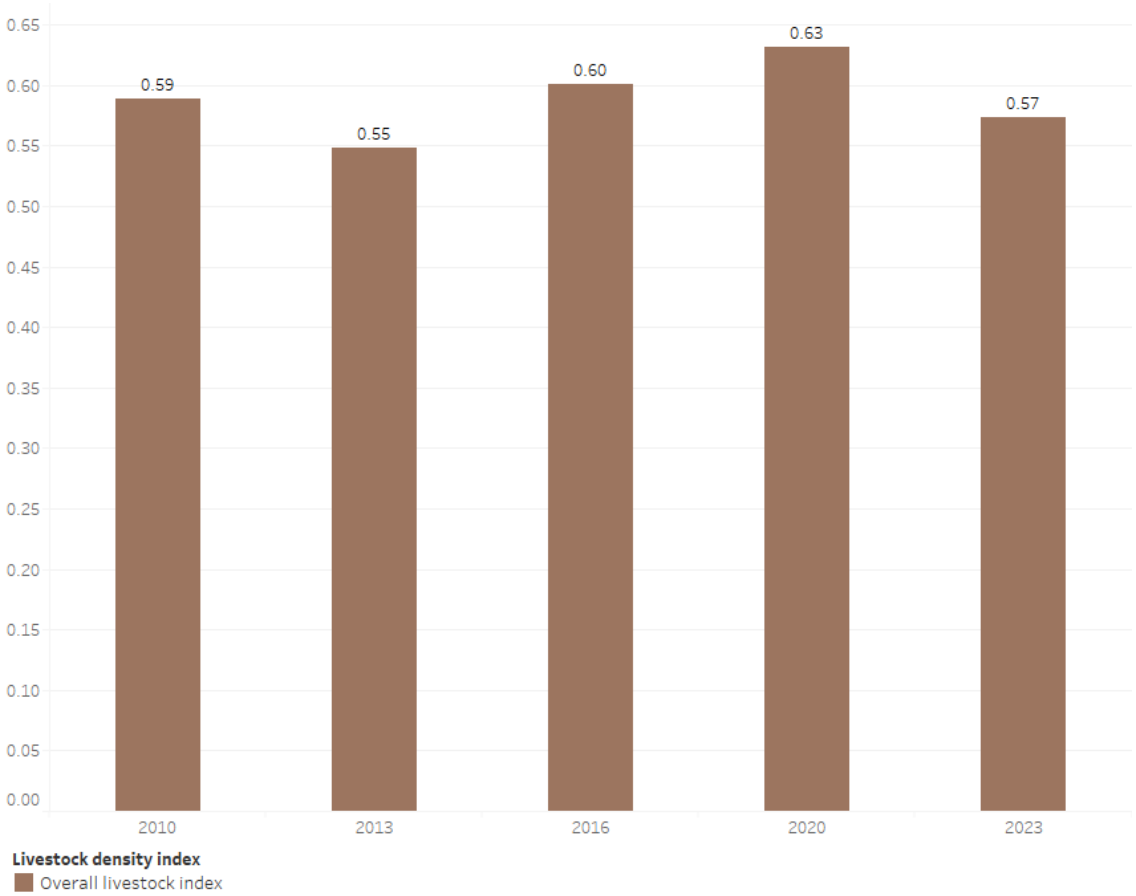
Source: Eurostat (ef_lus_main)

([8]) Latest available data.

2.2. Livestock density

In Portugal the livestock density was 0.57 livestock units per hectare (LSU/ha) of UAA in 2023. The livestock density remained stable between years 2010 and 2023, with a temporary increase in 2016 and 2020.

Figure 5 – Evolution of the livestock density (LSU/ha UAA)



Source: Eurostat (ef_fsi_lskds)

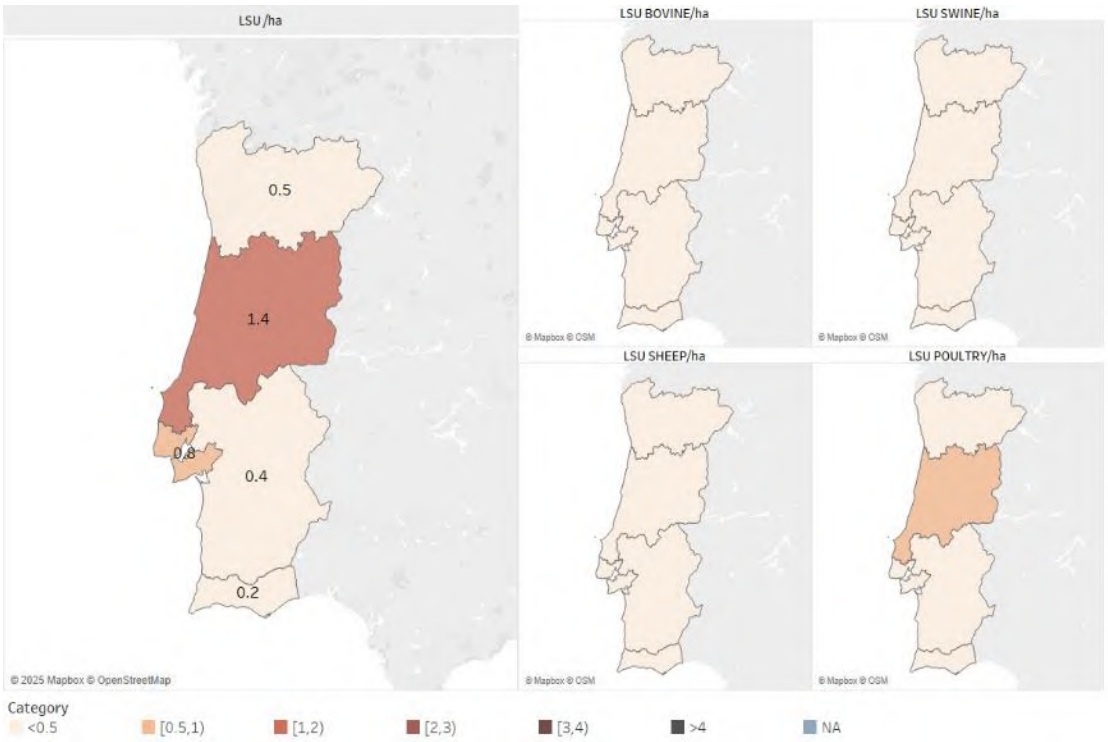
Table 2 – Evolution of the livestock numbers by animal type

	2007	2010	2013	2016	2020	2023
live bovines (Million heads)	1.49	1.50	1.47	1.64	1.69	1.53
of which dairy cows (Million heads)	0.27	0.24	0.23	0.24	0.23	0.22
live pigs (Million heads)	1.98	1.92	2.01	2.15	2.26	2.18
live poultry (Million heads)	NA	35.35	28.61	36.05	54.50	NA
live sheep (Million heads)	NA	2.23	2.07	2.25	2.30	2.22
live goats (Million heads)	0.44	0.42	0.40	0.35	0.37	0.34

Source: Eurostat, for live poultry and live sheep data complemented with FAOSTAT

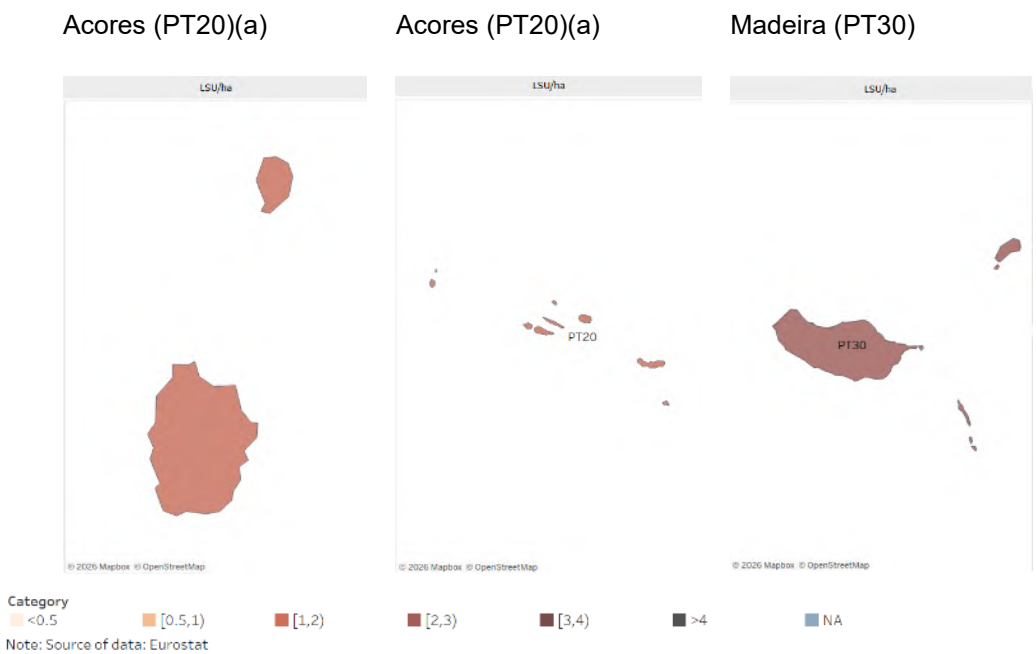
There are regional variations, with livestock densities of 1.4 LSU/ha UAA in Centro and 0.8 in Lisboa.

Figure 6 – Livestock density distribution by animal type (LSU/ha UAA) at NUTS2 level in 2020 in mainland Portugal ([9])



Source: Eurostat (Livestock units: ef_lsk_main; Utilised agricultural area: ef_lus_main)

Figure 7 – Livestock density distribution (LSU/ha UAA) in 2020 in Acores and Madeira ([10])



([9]) Latest available data.

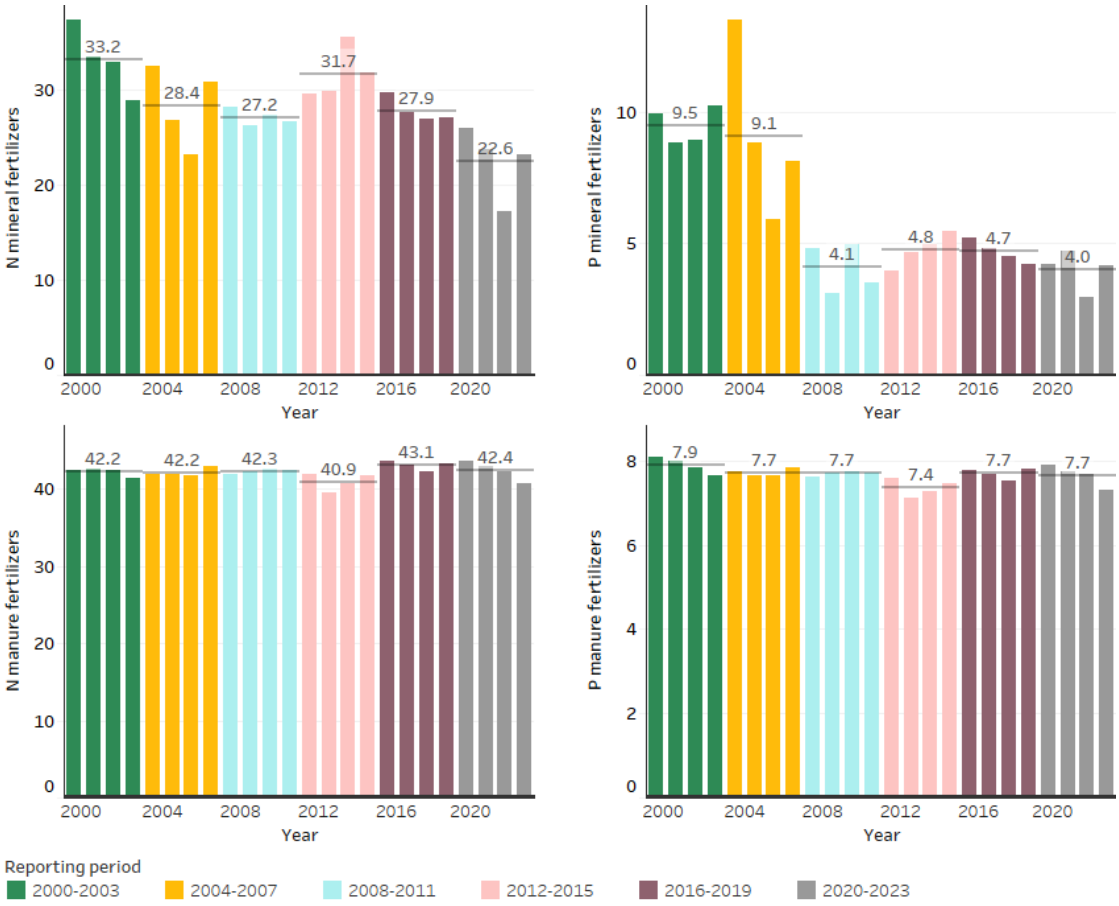
([10]) Latest available data. Livestock density for the Azores is 1.9 LSU/ha UAA and for Maderia is 2.2 LSU/ha UAA.

2.3. Nitrogen and phosphorus fertiliser use

In Portugal, the use of **nitrogen (N) fertilisers** was 22.6 kg/ha UAA for mineral fertilisers and 42.4 kg/ha UAA for manure fertilisers in 2020-2023. The use of mineral fertilisers has decreased by 5.3 kg/ha UAA and the use of manure fertilisers has decreased by 0.7 kg/ha UAA since the last reporting period.

The use of **phosphorus (P) fertilisers** was 4.0 kg/ha UAA for mineral fertilisers and 7.7 kg/ha UAA for manure fertilisers in 2020-2023. The use of mineral fertilisers decreased by 0.7 kg/ha UAA since the last reporting period and the use of manure fertilisers remained stable since the last reporting period.

Figure 8 – Evolution of nitrogen and phosphorus fertiliser use (kg/ha UAA)



Source: Eurostat (aei_pr_gnb)

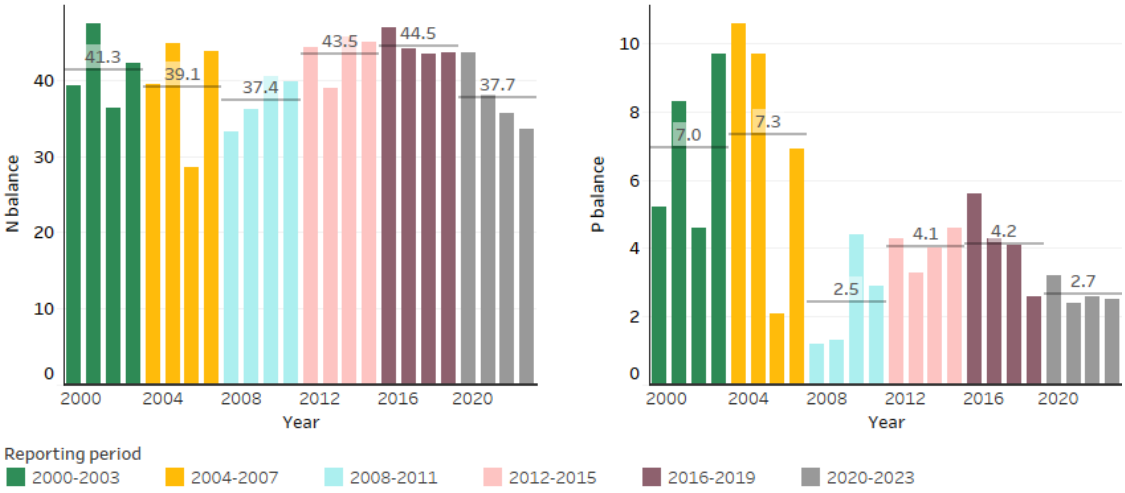
2.4. Nitrogen and phosphorus balance

The nutrient balance ([11]) per hectare of agricultural land (kg/ha UAA) is an indicator of the success that farmers have had in implementing balanced fertilisation, the resulting nutrient pressure from agriculture, and the risk of nitrogen losses to water and air.

In Portugal, the **gross nitrogen (N) balance** was 37.7 kg/ha UAA in 2020-2023. The nitrogen balance decreased by 6.8 kg/ha UAA since the previous reporting.

The **gross phosphorus (P) balance** was 2.7 kg/ha UAA in 2020-2023. The phosphorus balance decreased by 1.5 kg/ha UAA since the previous reporting.

Figure 9 – Evolution of gross nitrogen and phosphorus balance (kg/ha UAA)



Source: Eurostat (aei_pr_gnb)

2.5. Nitrogen discharge to the environment

Portugal provided information that the nitrogen losses from agriculture were 164.2 kilotonnes during reporting period 2016-2019 and 121.9 kilotonnes during the reporting period 2020-2023. The agricultural sector's contribution to the country's total nitrogen loss decreased from 87.6% to 84.1%.

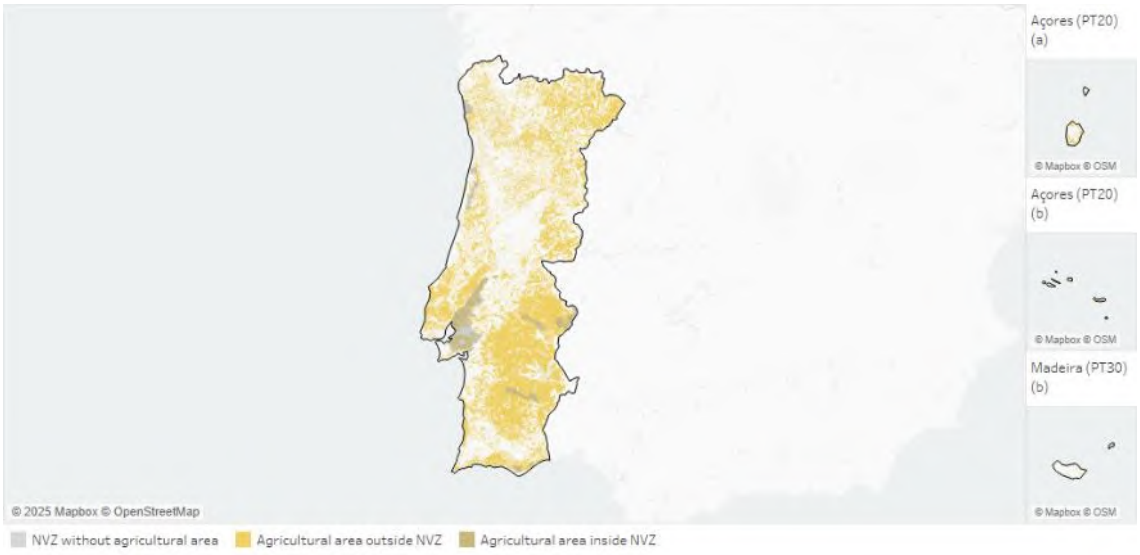
([11]) Gross nutrient balance (aei_pr_gnb)

3. NITRATE VULNERABLE ZONES

In line with Article 3 paragraph 2, Portugal designates nitrate vulnerable zones (NVZ) as all known areas of land in its territories which drain into the waters identified as polluted or at risk of being polluted and which contribute to pollution. Action programmes with mandatory measures are implemented in NVZ to reduce and prevent water pollution. The Nitrates Directive requires that the Member State reviews and if necessary, revise or add to the designation of vulnerable zones as appropriate, and at least every four years, to consider changes and factors unforeseen at the time of the previous designation.

In mainland Portugal nine nitrate vulnerable are designated and in the Autonomous Region of the Azores eight nitrate vulnerable zones, located on 3 of the 9 islands. In mainland Portugal, both the number and area of NVZs have remained unchanged since 2010, while the area of NVZs in the Autonomous Region of the Azores has been slightly adjusted since the previous reporting period. The map below shows the current NVZ designation relative to the agricultural area. The designated areas cover 4.4% of territory and 5.9% of UAA.

Figure 10 – Distribution of the Nitrates Vulnerable Zones (NVZ) and agricultural area



Note: Based on CORINE Land Cover data with simplified detail; some smaller agricultural areas may not appear.

4. NITRATES IN GROUNDWATER

4.1. Monitoring of nitrate concentrations in groundwater

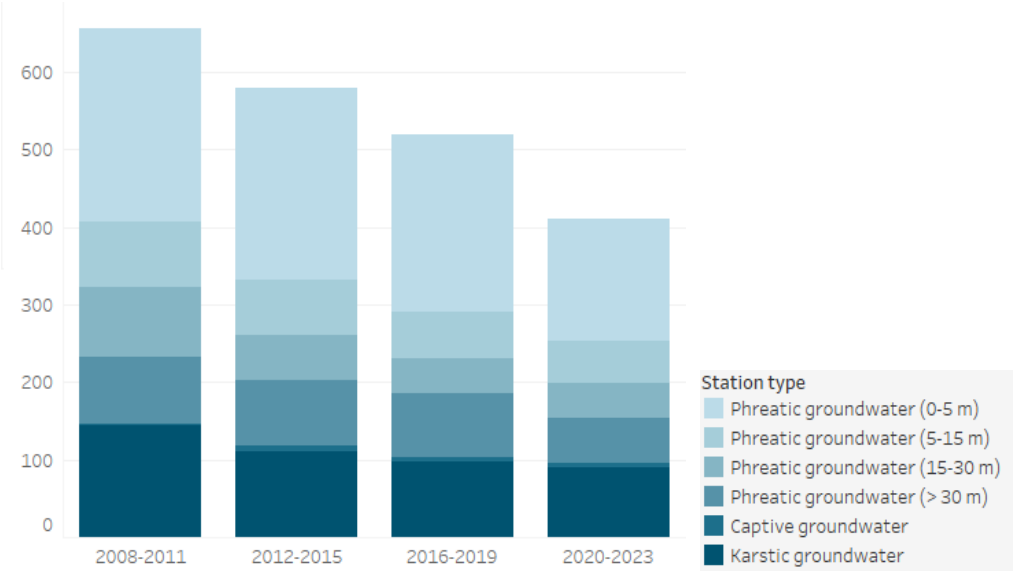
Water quality monitoring is conducted by the Portuguese Environment Agency (APA) on mainland Portugal and by the regional Directorate for Water Resources on the Azores. In the current reporting period (2020-2023) the operational monitoring network for inland (surface and groundwater) and transitional water bodies of the Azores Hydrographic Region has been implemented. In this context, from July 2020 to June 2023, operational monitoring of groundwater bodies with a status below Good was carried out. Sampling is performed every six months with one campaign in the high-water season and another in the low-water season. On mainland Portugal the number of monitoring stations decreased mostly because these stations ceased to be accessible. The number of monitoring stations for groundwater monitoring of the Azores Hydrographic region decreased significantly compared to the previous reporting period. A large part of the removed stations had nitrate concentrations below 25 mg/l. Some lost accessibility for sampling.

During the reporting period 2020-2023 nitrate concentrations were reported at 410 groundwater monitoring points. Of these monitoring points, 46.6% of monitoring points were located within NVZ and 53.4% outside NVZ. Altogether, the station density is 4.5 stations per 1 000 km^2

The overall number of monitoring points decreased by 110 (21.2%) compared to the previous reporting period. Since 2008-2011 the number of monitoring points has steadily decreased from over 600 to 410 in the current reporting period.

The graph below presents the changes in the monitoring network over the last four reporting periods.

Figure 11 – Evolution of groundwater monitoring network (monitoring points with measurements of nitrates)



In this reporting period, changes in nitrate concentrations compared to the previous monitoring period (trends) were assessed for 405 monitoring points, accounting for 98.8% of all points with measurements. The share of monitoring points with trends decreased compared to the previous reporting period, which was 99.8% in reporting period 2016-2019. The table below presents the number of monitoring points with measurements and trends in the last four reporting periods.

Table 3 – Number of groundwater monitoring points with measurements of nitrates and trends by station type ([12])

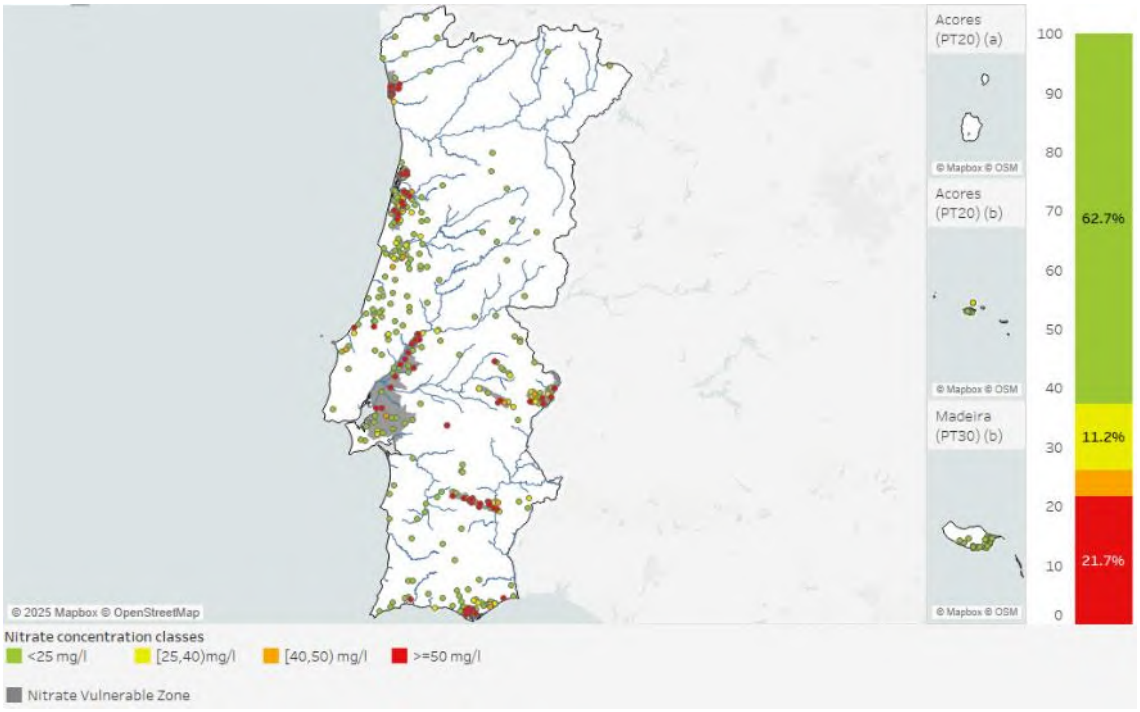
	Stations with measurements				Stations with trends			
Station type	2008-2011	2012-2015	2016-2019	2020-2023	2008-2011	2012-2015	2016-2019	2020-2023
Phreatic groundwater (0-5 m)	251	249	229	157	208	231	229	155
Phreatic groundwater (5-15 m)	83	70	60	54	79	70	60	54
Phreatic groundwater (15-30 m)	90	58	46	45	90	58	46	43
Phreatic groundwater (> 30 m)	86	85	81	58	74	76	80	58
Captive groundwater	3	7	6	6	3	7	6	6
Karstic groundwater	144	111	98	90	132	111	98	89
Not specified								
Total	657	580	520	410	586	553	519	405

([12]) Portugal reported that monitoring was discontinued in 115 monitoring points relative to the previous reporting period. Discontinuation may be due to nitrate concentrations below 25 mg/l, change in station code or type, or other specific reasons.

4.2. Nitrate concentrations in groundwater

In Portugal, 21.7% of groundwater monitoring points showed average nitrate concentrations equal to or above the drinking water threshold of 50 mg/l, whereas 4.4% had concentrations between 40-49.99 mg/l, 11.2% showed concentrations between 25-39.99 mg/ and 62.7% below 25 mg/l. The figure below shows a spatial distribution of the average nitrate concentrations and the shares in corresponding nitrate concentration classes.

Figure 12 – Map of average annual mean nitrate concentrations in groundwater and share of monitoring points by nitrate concentration class in the reporting period 2020-2023



Note: In the map, monitoring points with higher values are plotted on top. In the graph, the percentages below 5% are not labelled.

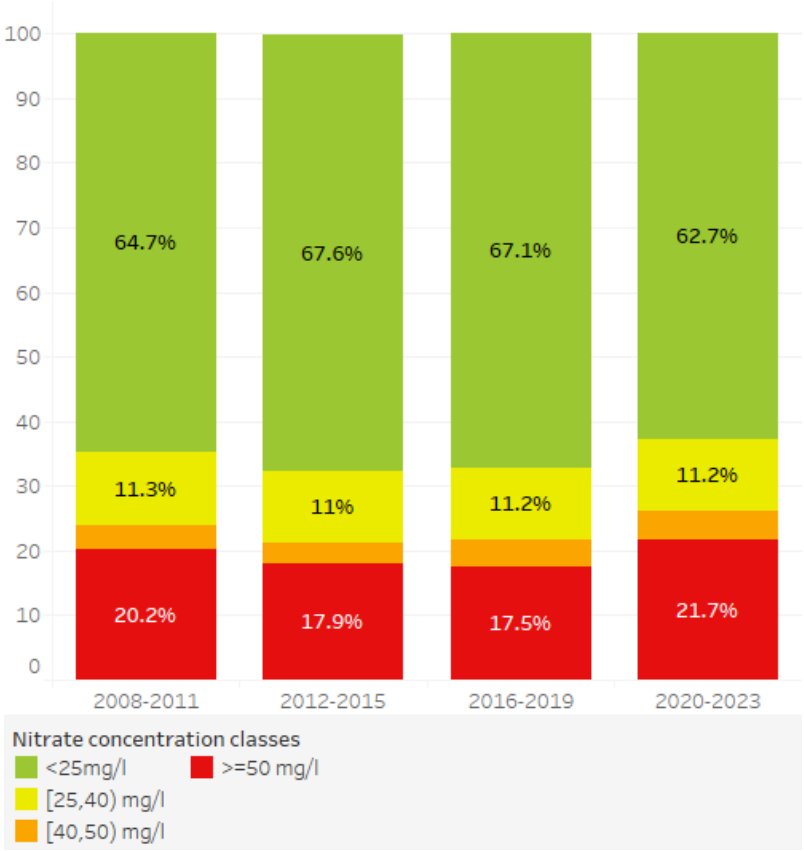
The station type category with the highest share of points with nitrate concentrations equal to or above the drinking water threshold of 50 mg/l was phreatic groundwater at depth 5-15m with a share of 38.9%, as shown in the table below.

Table 4 – Share of groundwater monitoring points by nitrate concentration class (mg/l) in the reporting period 2020-2023, categorised by station type

	Number of stations	% of Total	<25	[25,40)	[40,50)	>=50
Phreatic groundwater (0-5 m)	157	38.3%	48.4%	12.7%	4.5%	34.4%
Phreatic groundwater (5-15 m)	54	13.2%	42.6%	9.3%	9.3%	38.9%
Phreatic groundwater (15-30 m)	45	11.0%	84.4%	2.2%	4.4%	8.9%
Phreatic groundwater (> 30 m)	58	14.1%	93.1%	6.9%		
Captive groundwater	6	1.5%	100.0%			
Karstic groundwater	90	22.0%	66.7%	17.8%	4.4%	11.1%
Total	410	100.0%	62.7%	11.2%	4.4%	21.7%

Compared to the previous reporting period, the share of monitoring points with concentration ≥ 50 mg/l increased from 17.5% to 21.7%. The graph below presents the share of monitoring points per classes of nitrate concentrations in the last four reporting periods. Compared to the past four reporting periods the share of points with concentrations ≥50 mg/l and between 40-49.99 mg/l was highest in the current reporting period.

Figure 13 – Share of monitoring points in groundwater by class of nitrate concentration ([13]) in the current and previous reporting periods



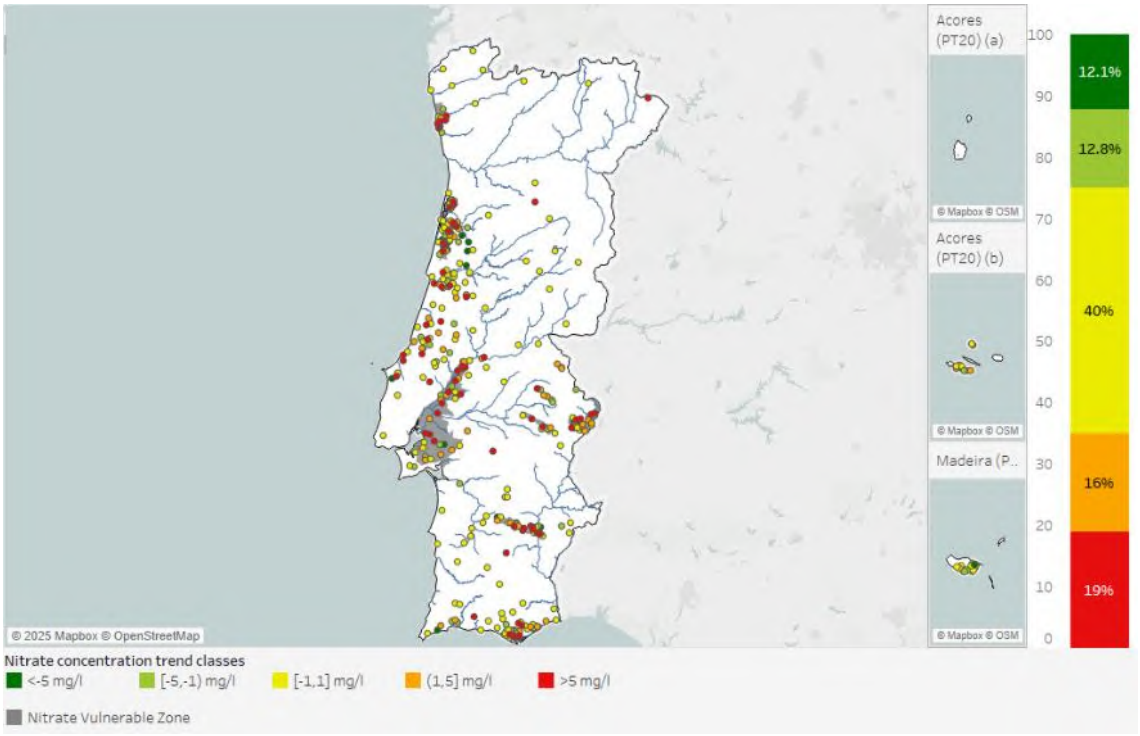
Note: The percentages below 5% are not labelled.

([13]) Average of annual mean values over the reporting period.

4.3. Trends in nitrate concentrations in groundwater

Compared to the last reporting period, there has been a decrease of nitrate concentrations in 24.9% of monitoring points and an increase in 35.0%. For the remaining 40.0% there was no significant change. The increase or decrease can be categorised as weak if it is between 1 and 5 mg/l, and as strong if it is above 5 mg/l.

Figure 14 – Map of trends in average annual mean nitrate concentrations ([14]) in groundwater between the periods 2016-2019 and 2020-2023 and share of monitoring points by trend class



Note: In the map, monitoring points with higher values are plotted on top.

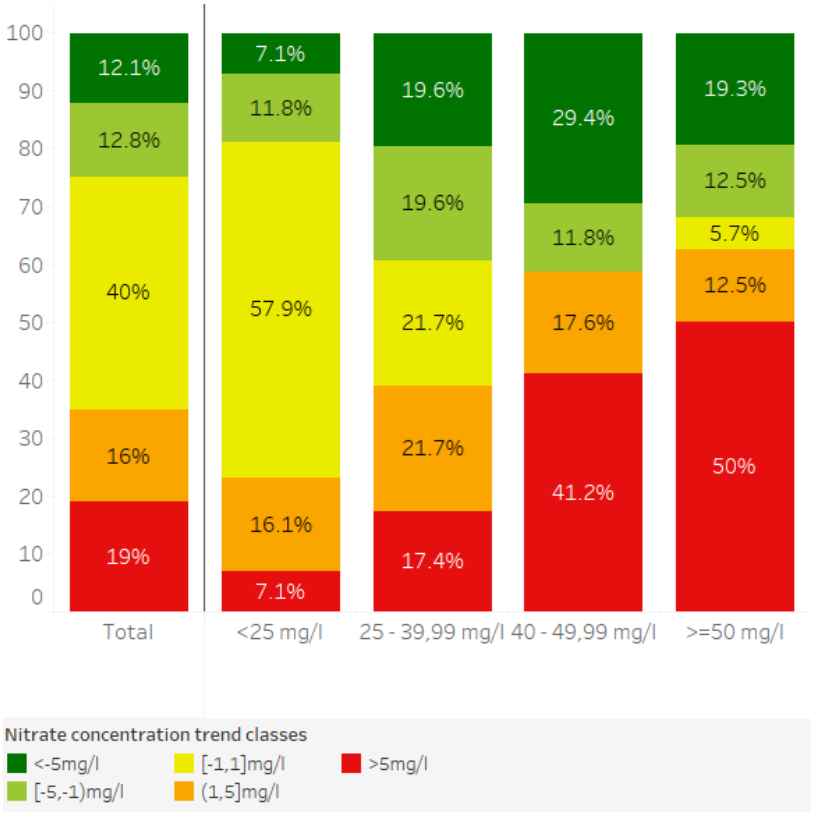
Table 5 – Share of groundwater monitoring points by trend class (mg/l) between the periods 2016-2019 and 2020-2023, categorised by station type

	Total Number of Stations	% Total Number of Stations	<-5	[-5,-1)	[-1,1]	(1,5]	>5
Phreatic groundwater (0-5 m)	155	38.3%	20.6%	10.3%	30.3%	14.8%	23.9%
Phreatic groundwater (5-15 m)	54	13.3%	9.3%	11.1%	37%	5.6%	37%
Phreatic groundwater (15-30 m)	43	10.6%	2.3%	14%	60.5%	11.6%	11.6%
Phreatic groundwater (>30 m)	58	14.3%	1.7%	12.1%	56.9%	24.1%	5.2%
Captive groundwater	6	1.5%			83.3%	16.7%	
Karstic groundwater	89	22.0%	11.2%	19.1%	34.8%	21.3%	13.5%
Total	405	100.0%	12.1%	12.8%	40%	16%	19%

([14]) The average of annual mean values of nitrate concentrations over the reporting period 2020-2023 compared to the average for the reporting period 2016-2019.

When looking at the trend for waters that are polluted during the current reporting period (equal to or above 50 mg/l), there has been an increase of nitrate concentration for 62.5% and a decrease for 31.8% the previous and the current reporting periods. The graph below shows the increase (in red and orange) and decreases (in green) per nitrate concentration class.

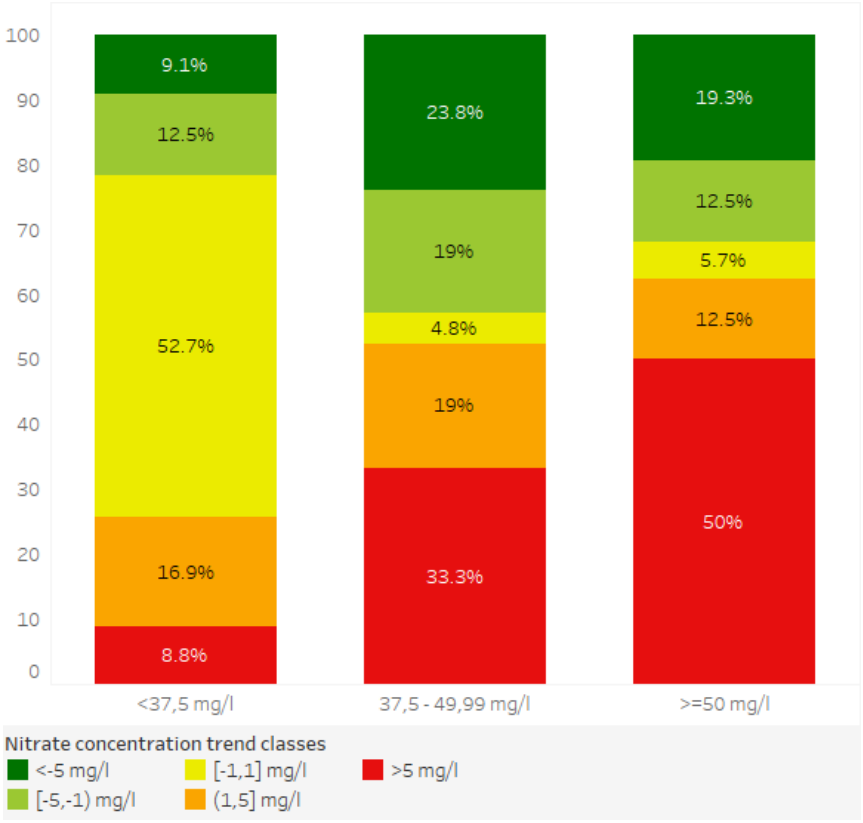
Figure 15 – Share of groundwater monitoring points by classes of trend between the periods 2016-2019 and 2020-2023, across different nitrate concentration classes (<24.99 mg/l, 25-39.99 mg/l, 40-49.99 mg/l and ≥50mg/l) ([15])



([15]) Nitrate concentration classes as per the Nitrates Directive report.

To better align the water quality assessment with the thresholds defined under the Groundwater Directive, trends were also calculated for the water quality class with nitrate concentrations between 37.5-49.99 mg/l. When looking at the trend in this concentration category, there has been an increase of nitrate concentration for 52.3% and a decrease for 42.8% of monitoring points.

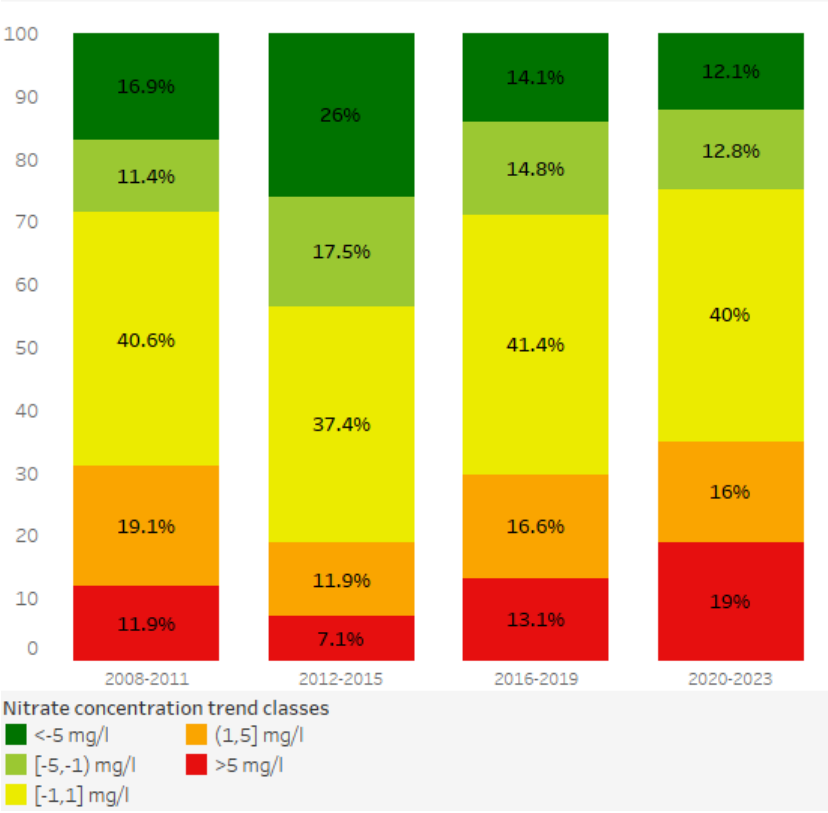
Figure 16 – Share of groundwater monitoring points by classes of trend between the periods 2016-2019 and 2020-2023, in different nitrate concentration classes (<37.5 mg/l, 37.5-49.99 mg/l and ≥50mg/l) ([16])



([16]) Nitrate concentration classes as in the Water Framework Directive guidance on GW status and trend assessment as division of nitrates quality standard (50mg/l and 75 % of this value [37.5 mg/l]).

Compared to the previous reporting period, there is a lower share of monitoring points with decreasing nitrate concentrations (24.9% in the current reporting period compared to 28.9% in the previous reporting period) and a higher share of monitoring points with increasing nitrate concentrations (35.0% compared to 29.7%). The graph below shows the share of monitoring points with increases (in red and orange), decreases (in green) and without significant change (in yellow) in nitrate concentrations between reporting periods.

Figure 17 – Share of groundwater monitoring points by class of nitrate concentration trend ([17]) in the current and previous reporting periods



([17]) Change in average annual mean nitrate concentrations compared to the previous reporting period.

4.4. Nitrate pollution hotspots in groundwater

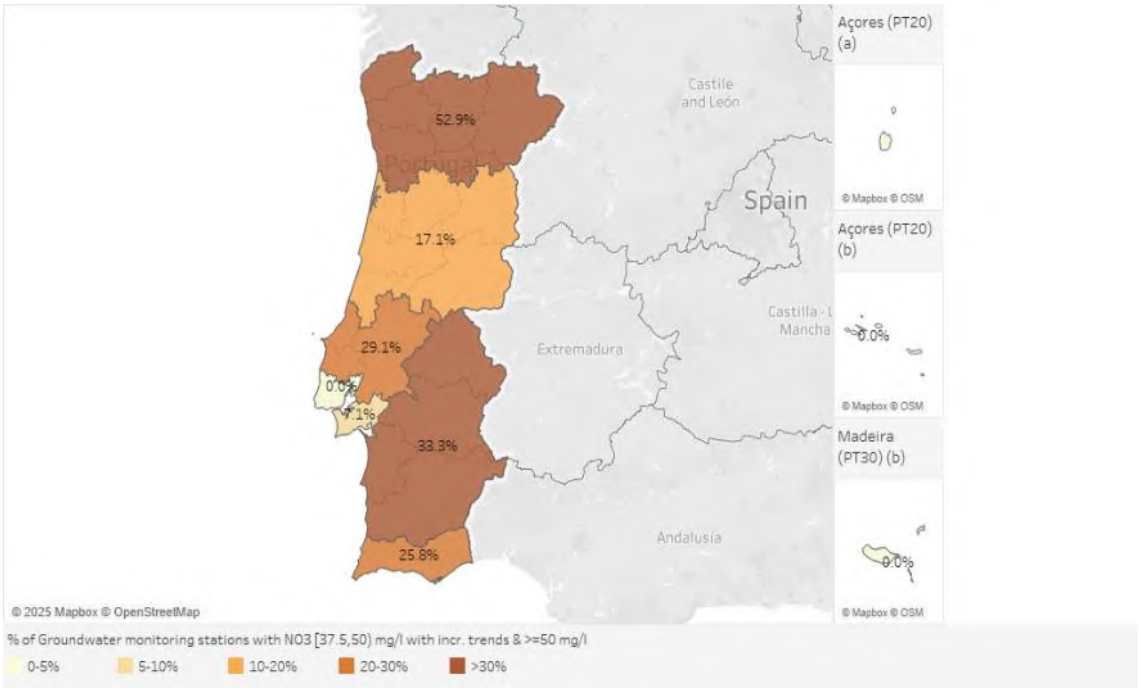
A nitrate pollution hotspot in groundwater is defined here as a monitoring point where the average annual nitrate concentration is either ≥ 50 mg/l or between 37.5 and 49.99 mg/l with an increasing trend. In Portugal there are 100 groundwater nitrate pollution hotspots, of which 8 are outside NVZ, accounting for 8.0% of all groundwater nitrate pollution hotspots.

Figure 18 – Groundwater nitrate pollution hotspots (map) and their distribution inside and outside Nitrate Vulnerable Zones (table)

	inside NVZ	outside NVZ	Total
Groundwater [37.5,50) with incr. trend	9	2	11
>=50	83	6	89
Total	92	8	100

The NUTS2 regions with the highest share of hotspots are Norte (52.9%), Alentejo (33.3%), and Oeste e Vale do Tejo (29.1%).

Figure 19 – Share of groundwater nitrate pollution hotspots at NUTS2 level



5. NITRATES IN SURFACE WATERS

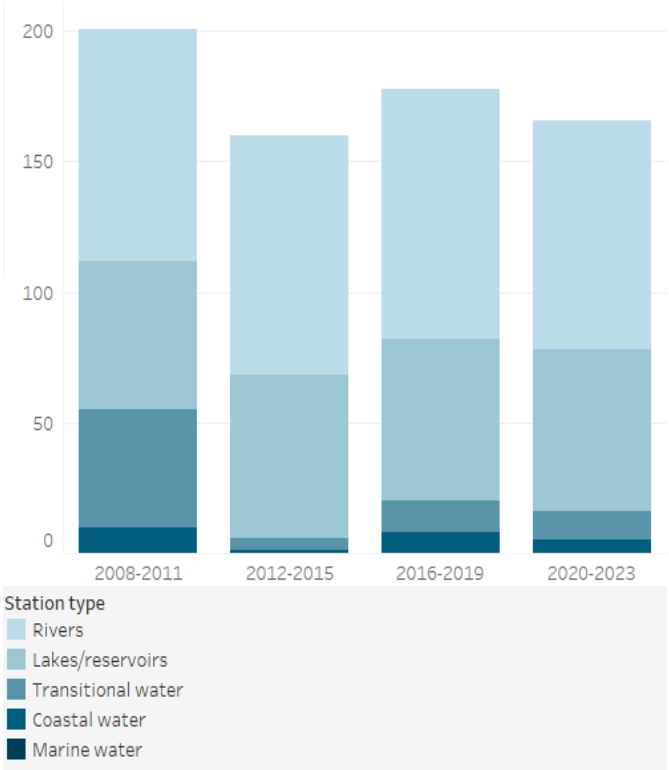
5.1. Monitoring of nitrate concentrations in surface waters

Same as for groundwater monitoring, water quality monitoring is conducted by the Portuguese Environment Agency (APA) on mainland Portugal and by the regional Directorate for Water Resources on the Azores.

During the reporting period 2020-2023 nitrate concentrations were reported at 166 surface water monitoring points. Among these, 53.0% were in rivers, 37.3% were in lakes or reservoirs, and 9.6% were in saline waters. The freshwater monitoring points density was 1.6 stations per 1 000 km^2. Of these monitoring points, 12.0% freshwater monitoring points were located within NVZ and 88.0% outside NVZ.

The overall number of monitoring points decreased by 12 (6.7%) compared to the previous reporting period. The graph below presents the changes in the monitoring network over the last four reporting periods.

Figure 20 – Evolution of surface water monitoring network (monitoring points with measurements of nitrates)



In this reporting period, changes in nitrate concentrations compared to the previous monitoring period (trends) were assessed for 159 monitoring points, accounting for 95.8% of all points with measurements. The share of monitoring points with trends increased compared to the previous reporting period (87.6% in reporting period 2016-2019). The table below presents the number of monitoring points and the number of monitoring points with trends in the last four reporting periods.

Table 6 – Number of surface water monitoring points with measurements of nitrates and trends per type ([18])

	Stations with measurements				Stations with trends			
Station type	2008-2011	2012-2015	2016-2019	2020-2023	2008-2011	2012-2015	2016-2019	2020-2023
Rivers	89	92	96	88	61	89	90	81
Lakes/reservoirs	57	62	62	62	49	54	62	62
Transitional water	45	5	12	11	1	2	4	11
Coastal water	10	1	8	5				5
Marine water								
Total	201	160	178	166	111	145	156	159

([18]) Portugal reported that monitoring was discontinued in 19 monitoring points relative to the previous reporting period. Discontinuation may be due to nitrate concentrations below 25 mg/l, change in station code or type, or other specific reasons.

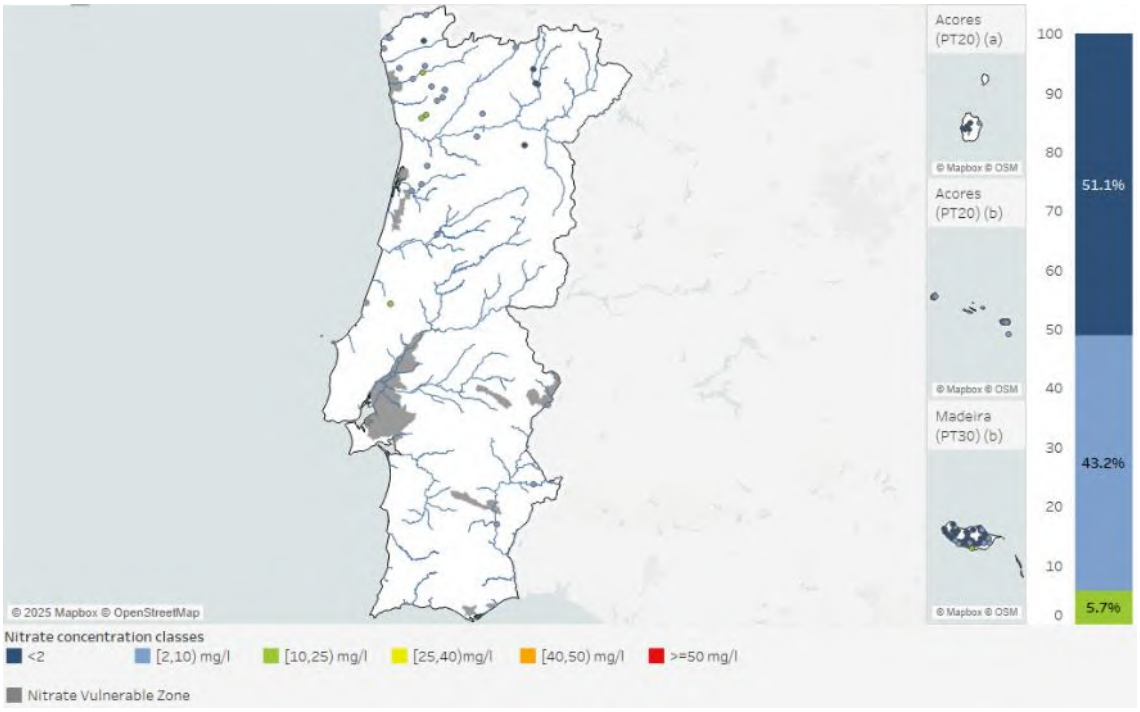
5.2. Nitrate concentrations in surface waters

Rivers

In Portugal, none of the monitoring points in rivers showed average nitrate concentrations equal to or above the drinking water threshold of 50 mg/l, and at or above 25 mg/l, whereas 5.7% showed concentrations between 10-24.99 mg/l, 43.2% in the class 2-9.99 mg/l and 51.1% below 2 mg/l.

It is relevant to look at the distribution in nitrate concentration classes below 25 mg/l for surface water as there can be a risk of eutrophication in lower concentration classes.

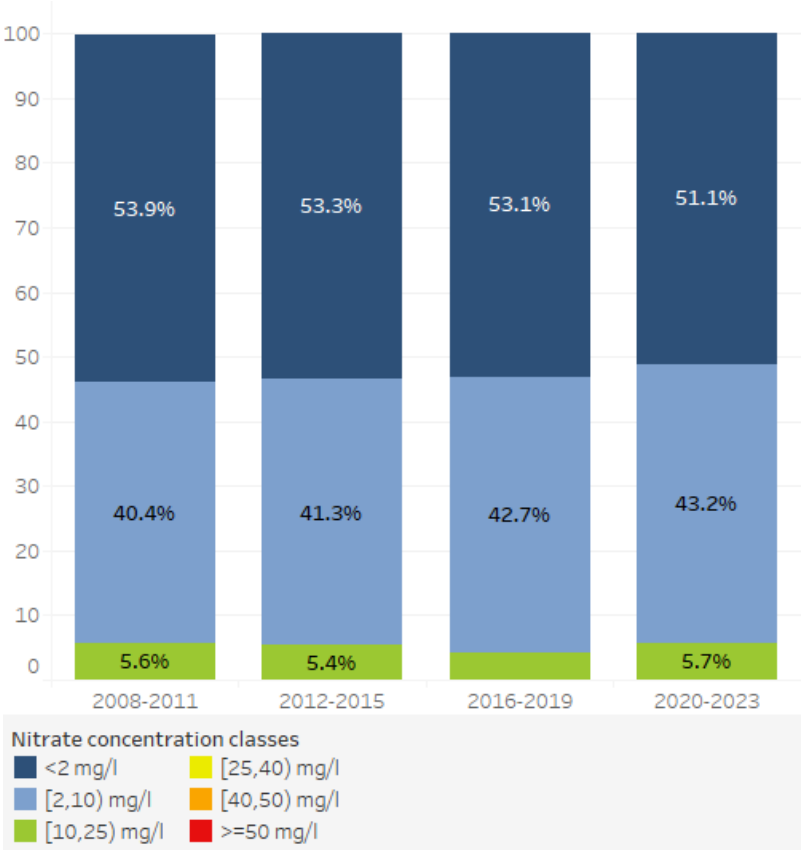
Figure 21 – Map of average annual mean nitrate concentrations in rivers and share of monitoring points by concentration class in the reporting period 2020-2023



Note: In the map, monitoring points with higher values are plotted on top.

Compared to the previous reporting period, the share of monitoring points in rivers with concentrations ≥ 50 mg/l remained at 0%. The graph below presents the shares of monitoring points per classes of nitrate concentration in the last four reporting periods. Over the current and past three reporting periods the share in the concentration classes <25 mg/l remained relatively stable.

Figure 22 – Share of monitoring points in rivers by class of nitrate concentration ([19]) in the current and previous reporting periods



Note: The percentages below 5% are not labelled.

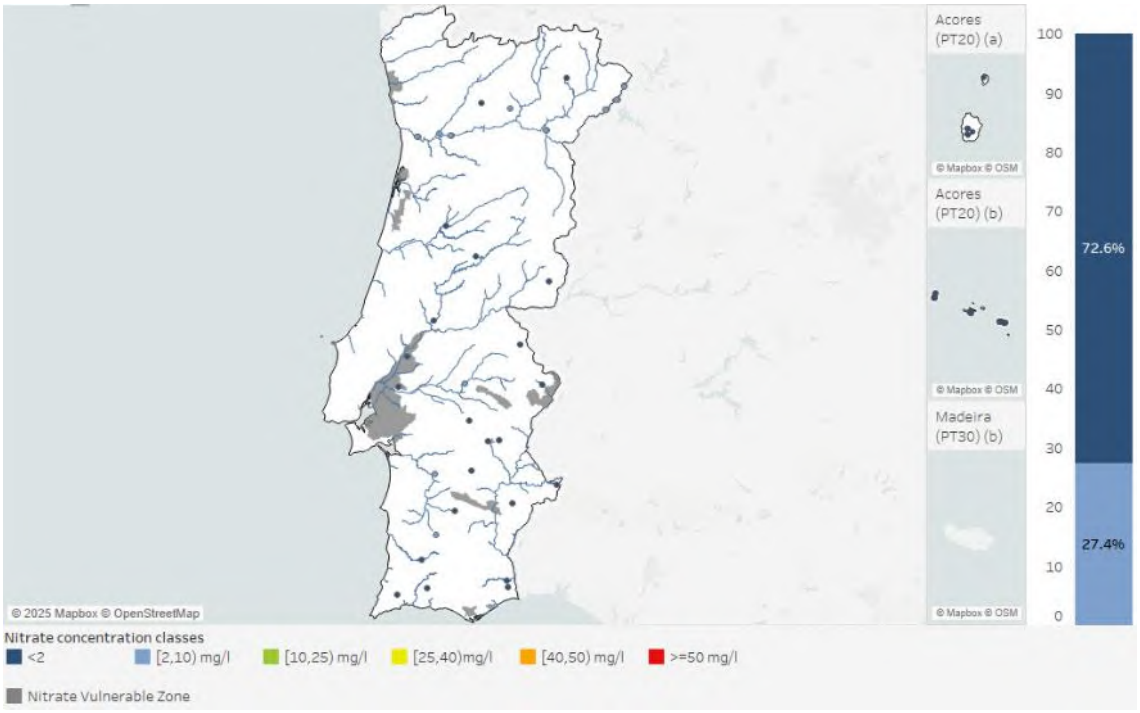
([19]) Average of annual mean values over the reporting period.

Lakes/water reservoirs

In Portugal, none of the freshwater monitoring points in lakes/water reservoirs showed average nitrate concentrations equal to or above the drinking water threshold of 50 mg/l, and at or above 10 mg/l, whereas 27.4% showed concentrations in the class 2-9.99 mg/l and 72.6% below 2 mg/l.

It is relevant to look at the distribution in nitrate concentration classes below 25 mg/l for surface water as there can be a risk of eutrophication in lower concentration classes.

Figure 23 – Map of average annual mean nitrate concentrations in lakes/water reservoirs and share of monitoring points by concentration class in the reporting period 2020-2023



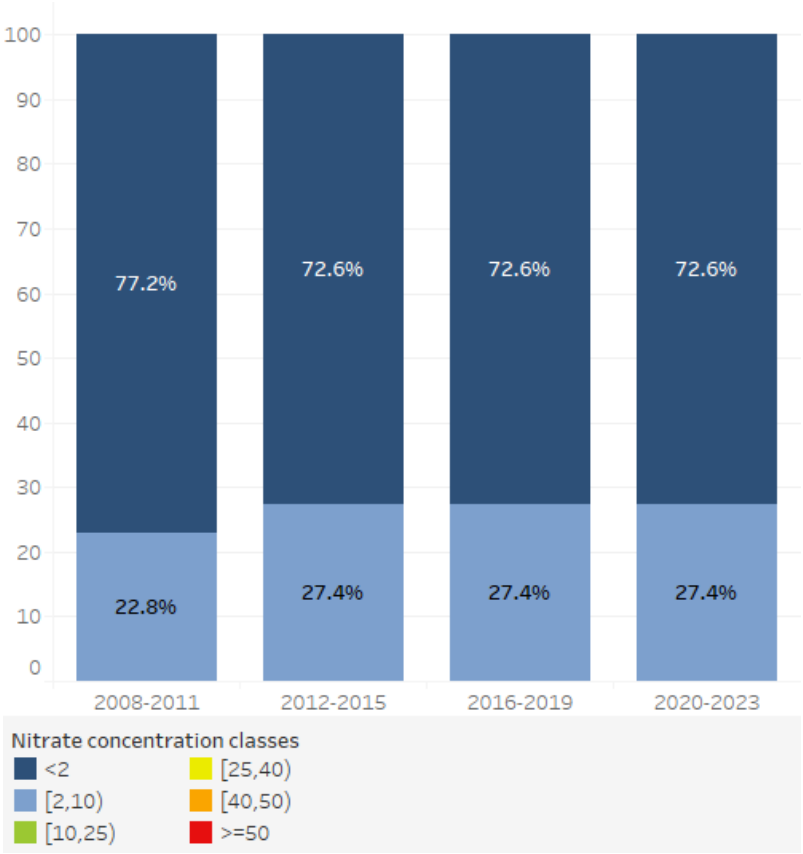
Note: In the map, monitoring points with higher values are plotted on top.

Table 7 – Share of freshwater monitoring points by nitrate concentration class (mg/l) in reporting period 2020-2023, categorised by station type

	Number of stations	% of Total	<2	[2,10)	[10,25)	[25,40)	[40,50)	>=50
Rivers	88	58.7%	51.1%	43.2%	5.7%			
Lakes/reservoirs	62	41.3%	72.6%	27.4%				
Total	150	100.0%	60.0%	36.7%	3.3%			

Compared to the previous reporting period, the share of monitoring points in lakes/water reservoirs with concentration ≥ 50 mg/l remained at 0%. The graph below presents the shares of monitoring points per classes of nitrate concentration in the last four reporting periods. Over the current and past three reporting periods the share in the concentration categories <25 mg/l remained relatively stable with only slight increases in class 2-9.99 mg/l and decreases in <2 mg/l from 2008-2011 to 2012-2015.

Figure 24 – Share of monitoring points in lakes/water reservoirs by class of nitrate concentration ([20]) in the current and previous reporting periods



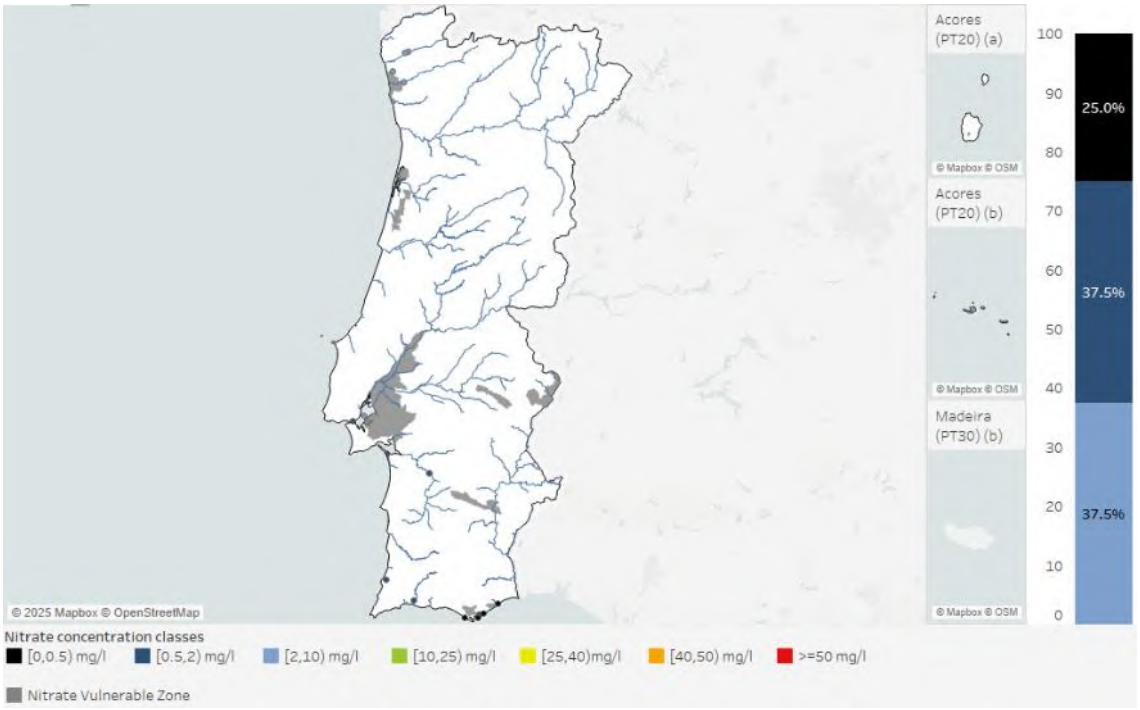
([20]) Average of annual mean values over the reporting period.

Saline waters ([21])

No points in saline waters monitoring points showed average nitrate concentrations ≥ 10 mg/l, 37.5% showed concentrations between 2-9.99 mg/l and 37.5% between 0.5-2 mg/l and 25.0% below 0.5 mg/l.

It is relevant to look in detail at very low nitrate concentrations, also below 0.5 mg/l and between 0.5 mg/l and 2 mg/l, because saline waters tend to have very low concentrations and some saline waters can become eutrophic even at concentrations below 2 mg/l.

Figure 25 – Map of average annual mean nitrate concentrations in saline waters and share of monitoring points by concentration class in reporting period 2020-2023



Note: In the map, monitoring points with higher values are plotted on top.

It is also relevant to look separately at transitional waters as they typically show higher nitrate concentrations. In Portugal, none of the monitoring points showed average annual mean nitrate concentrations at or above 10 mg/l, 54.5% in the class 2-9.99 mg/l, 45.0% between 0.5-2 mg/l and none below 0.5 mg/l, as shown in the table below.

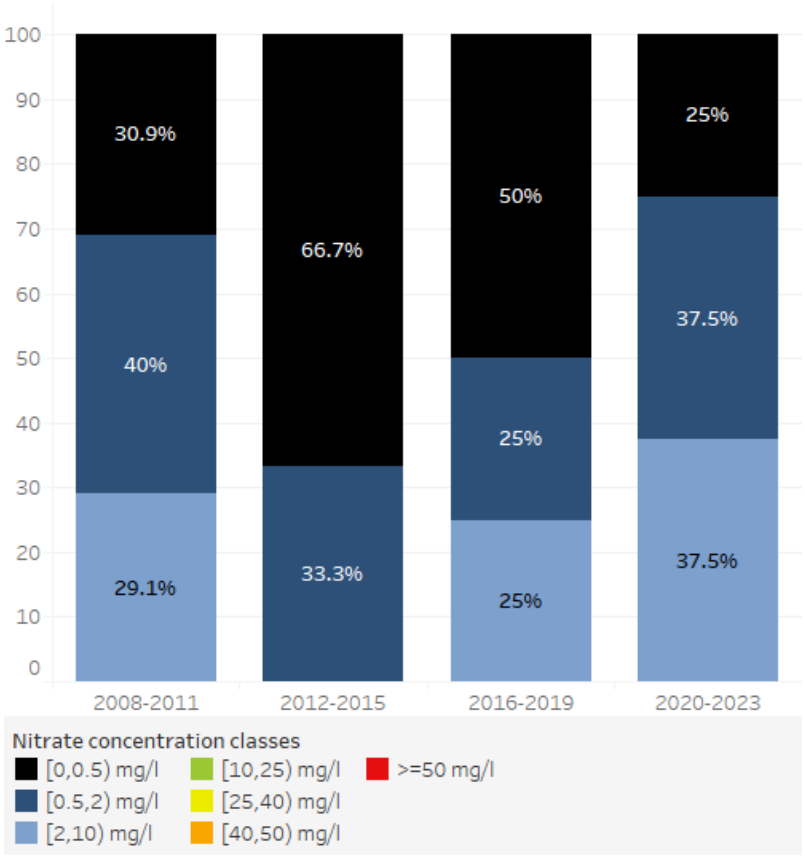
Table 8 – Share of saline water monitoring points by nitrate concentration class (mg/l) in the reporting period 2020-2023, categorised by station type

	Number of stations	% of Total	<0.5	[0.5,2)	[2,10)	[10,25)	[25,40)	[40,50)	>=50
Transitional water	11	68.8%		45.5%	54.5%				
Coastal water	5	31.3%	80.0%	20.0%					
Marine water									
Total	16	100.0%	25.0%	37.5%	37.5%				

([21]) This includes coastal, marine and transitional waters.

The graph below presents the shares of monitoring points per classes of nitrate concentration in the last four reporting periods.

Figure 26 – Share of monitoring points in saline waters by class of nitrate concentration ([22]) in the current and previous reporting periods



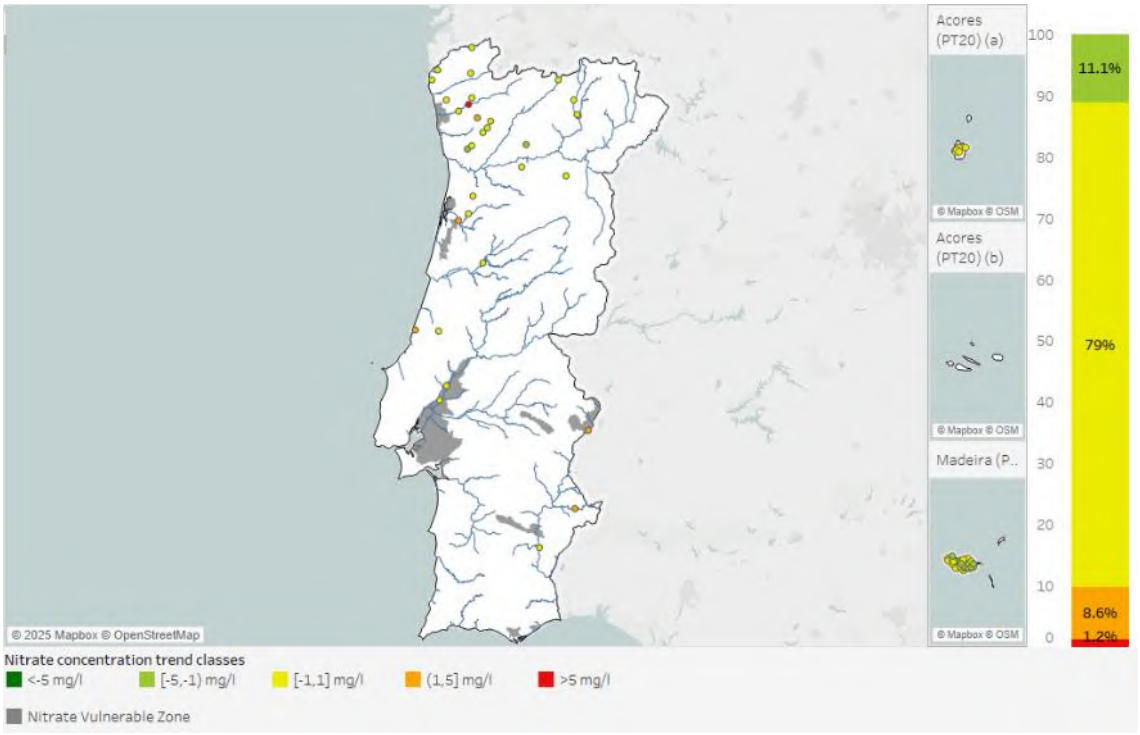
([22]) Average of annual mean values over the reporting period.

5.3. Trends in nitrate concentrations in surface waters

Rivers

Compared to the last reporting period, there has been a decrease of nitrate concentrations in 11.1% of monitoring points and an increase in 9.8%. For the remaining 79.0% there was no significant change. The increase or decrease can be categorised as weak if it is between 1 and 5 mg/l, and as strong if it is above 5 mg/l.

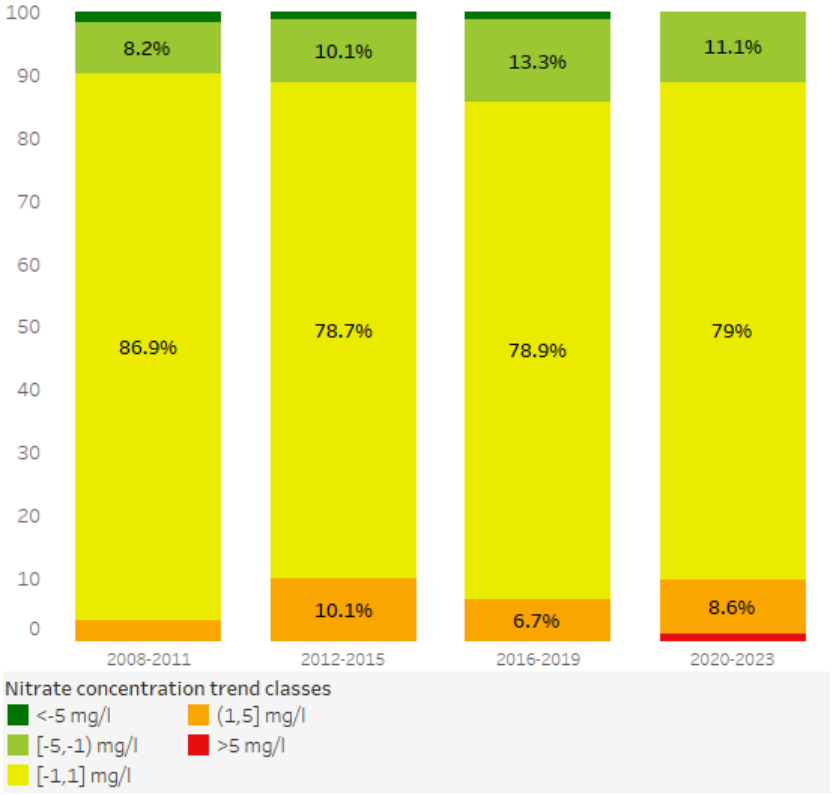
Figure 27 – Map of trends in average annual mean nitrate concentrations in rivers between the periods 2016-2019 and 2020-2023 and share of monitoring points by trend class



Note: In the map, monitoring points with higher values are plotted on top.

Compared to the previous reporting period, there is a lower share of monitoring points with decreasing nitrate concentrations 11.1% in the reporting period 2020-2023 compared to 14.4% in the previous reporting period) and a higher share of monitoring points with increasing nitrate concentrations (9.8% compared to 6.7%). The graph below shows the share of monitoring points with increases (in red and orange), decreases (in green) and without significant change (in yellow) in nitrate concentrations between reporting periods.

Figure 28 – Share of monitoring points in rivers by class of nitrate concentration trend ([23]) in the current and previous reporting periods



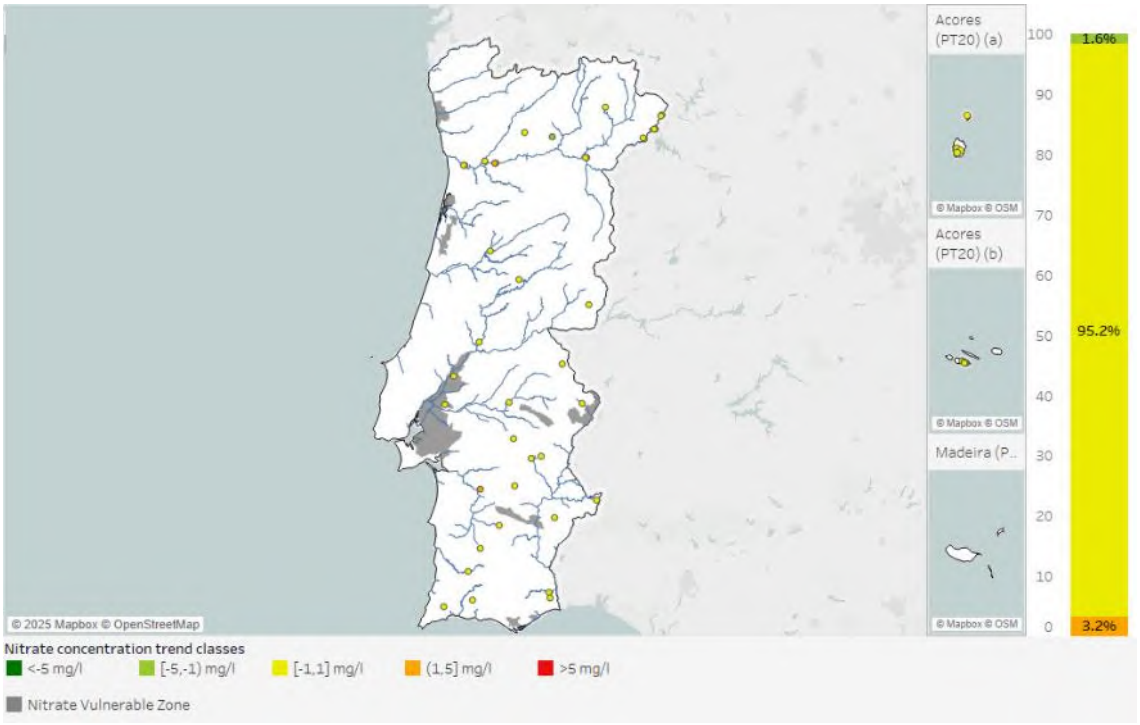
Note: The percentages below 5% are not labelled.

([23]) Change in average nitrate concentrations compared to the previous reporting period.

Lakes and water reservoirs

Compared to the last reporting period, there has been a decrease of nitrate concentrations in 1.6% of monitoring points and an increase in 3.2%. For the remaining 95.2% there was no significant change. The increase or decrease can be categorised as weak if it is between 1 and 5 mg/l, and as strong if it is above 5 mg/l.

Figure 29 – Map of trends in average annual mean nitrate concentrations in lakes/water reservoirs between the periods 2016-2019 and 2020-2023 and share of monitoring points by trend class



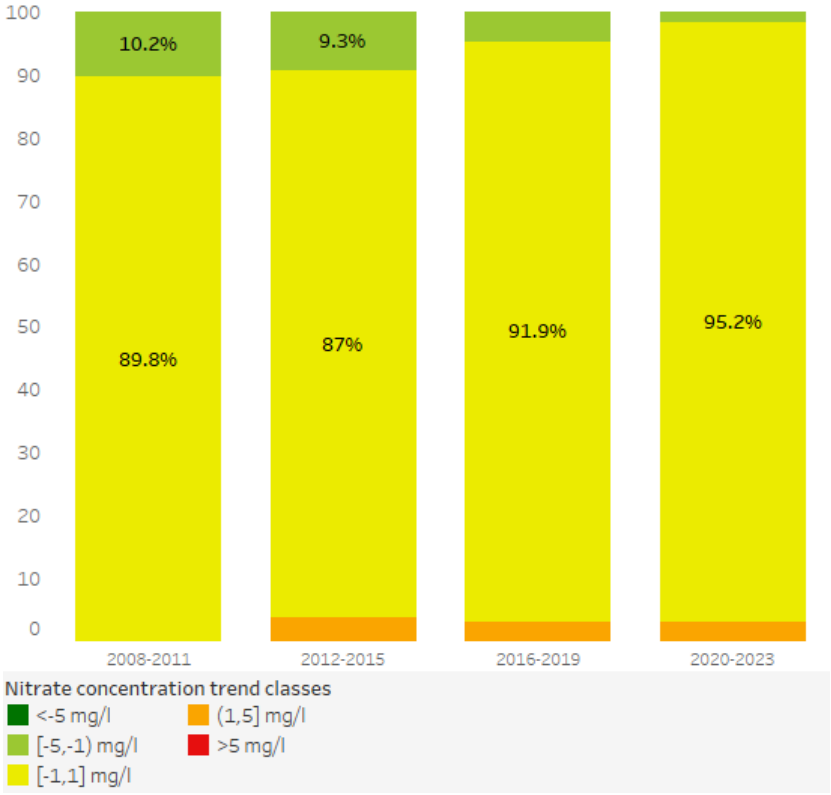
Note: In the map, monitoring points with higher values are plotted on top.

Table 9 – Share of freshwater monitoring points by trend class (mg/l), categorised by station type

	Total Number of Stations	% Total Number of Stations	<-5	[-5,-1)	[-1,1]	(1,5]	>5
River	81	56.6%		11.1%	79%	8.6%	1.2%
Lake/Reservoir	62	43.4%		1.6%	95.2%	3.2%	
Total	143	100.0%		7%	86%	6.3%	0.7%

Compared to the previous reporting period, there is lower share of monitoring points with decreasing nitrate concentrations (1.6% in the reporting period 2020-2023 compared to 4.8% in the previous reporting period) whereas the share of monitoring points with increasing nitrate concentrations remained stable (3.2% compared to 3.2%). The graph below shows the share of monitoring points with increases (in red and orange), decreases (in green) and without significant change (in yellow) in nitrate concentrations between reporting periods.

Figure 30 – Share of monitoring points in lakes/water reservoirs by class of nitrate concentration trend ([24]) in the current and previous reporting periods



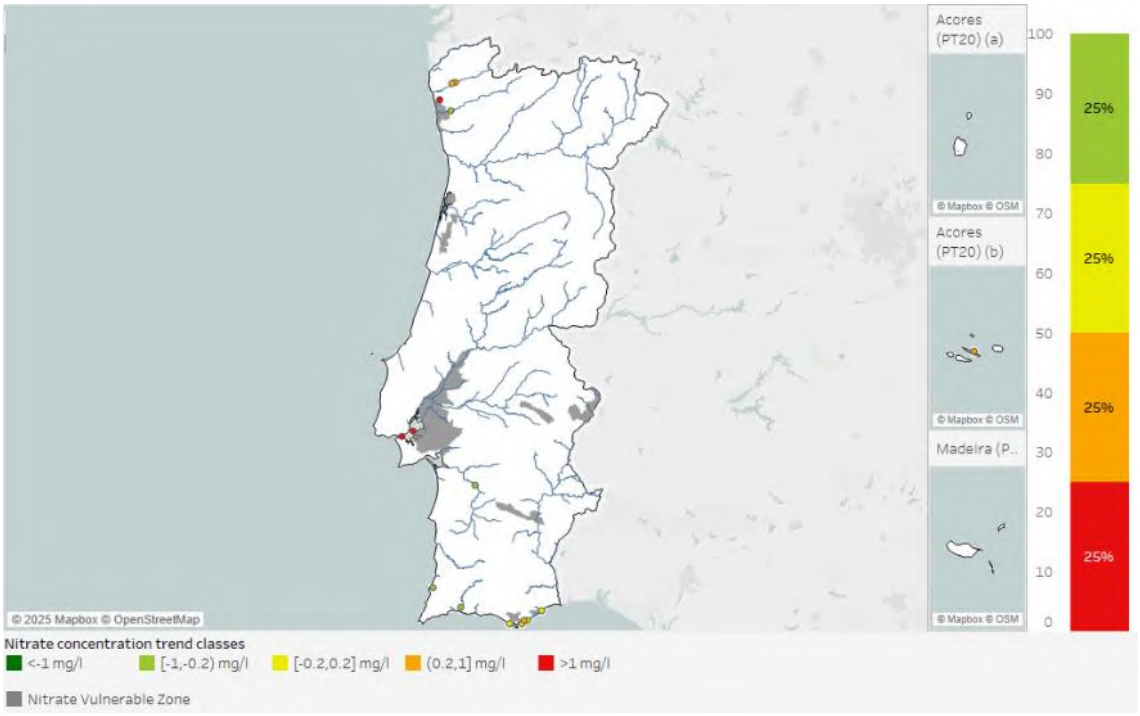
Note: The percentages below 5% are not labelled.

([24]) Change in average nitrate concentrations compared to the previous reporting period.

Saline waters

Compared to the last reporting period, there has been a decrease of nitrate concentrations in 25.0% of monitoring points and an increase in 50.0%. For the remaining 25.0% there was no significant change. The increase or decrease can be categorised as weak if it is between 0.2 and 1 mg/l, and as strong if it is above 1 mg/l.

Figure 31 – Map of trends in average annual mean nitrate concentrations in saline waters between periods 2016-2019 and 2020-2023 and share of monitoring points by trend class



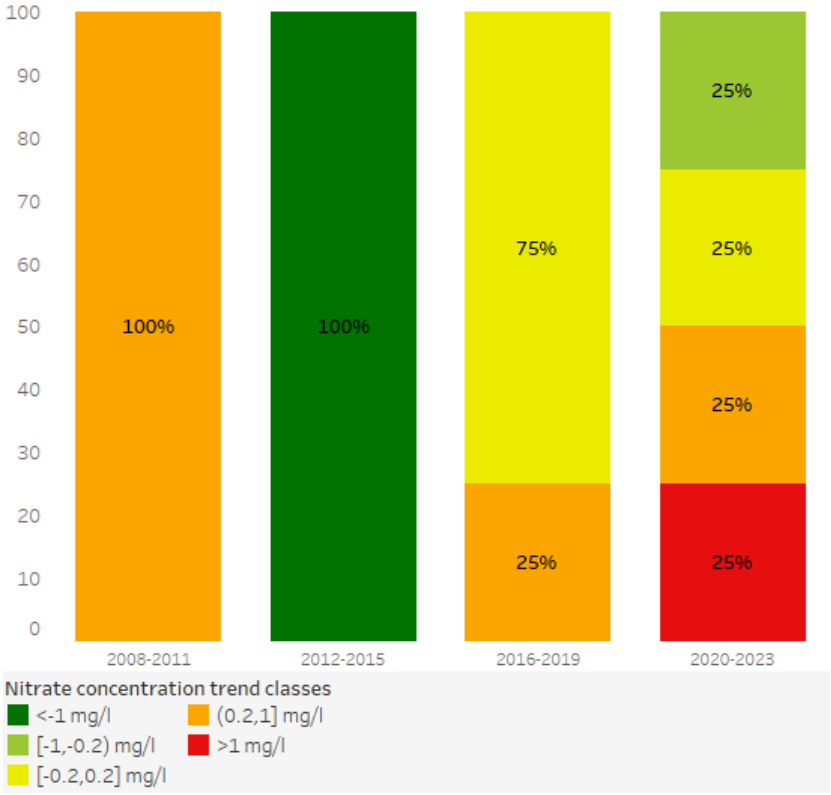
Note: In the map, monitoring points with higher values are plotted on top.

Table 10 – Share of saline water monitoring points by trend class (mg/l), categorised by station type

	Total Number of Stations	% Total Number of Stations	<-1	[-1,-0.2)	[-0.2,0.2]	(0.2,1]	>1
Transitional water	11	68.8%		36.4%		27.3%	36.4%
Coastal water	5	31.3%			80%	20%	
Marine water							
Total	16	100.0%		25%	25%	25%	25%

Compared to the previous reporting period, there is higher share of monitoring points with decrease of nitrate concentrations (25.0% in the current reporting period compared to 0% in the previous reporting period) but also a higher share of monitoring points with increase of nitrate concentrations (50.0% compared to 25.0%). The graph below shows the share of monitoring points with increases (in red and orange), decreases (in green) and without significant change (in yellow) in nitrate concentrations between reporting periods.

Figure 32 – Share of monitoring points in saline waters by classes of nitrate concentrations ([25]) in the current and previous reporting periods



([25]) Change in average nitrate concentrations compared to the previous reporting period.

5.4. Nitrate pollution hotspots in surface waters

A nitrate pollution hotspot is defined here as a monitoring point where the average annual nitrate concentration is ≥ 50 mg/l or between 37.5 and 49.99 mg/l with an increasing trend. There are no surface water nitrate pollution hotspots.

6. EUTROPHICATION OF SURFACE WATERS

6.1. Monitoring of trophic status in surface waters

During the reporting period 2020-2023 trophic status was reported at 131 monitoring points. Among these, 40.5% were in rivers, 47.3% were in lakes or reservoirs, and 12.2% were in saline waters. The station density of monitoring points, where trophic status was assessed equals to 1.3 stations per 1 000 km^2. Of these monitoring points, 15.7% of freshwater monitoring points were located within NVZ and 84.3% outside NVZ.

The overall number of freshwater monitoring points increased by 2 (3.3%) and number of saline water monitoring points decreased by 2 (11.1%) compared to the previous reporting period. Since 2008-2011 the number of monitoring stations has increased. Points in saline surface waters were added in 2016-2019.

Figure 33 – Evolution in surface water monitoring network (number of points with trophic status reported)

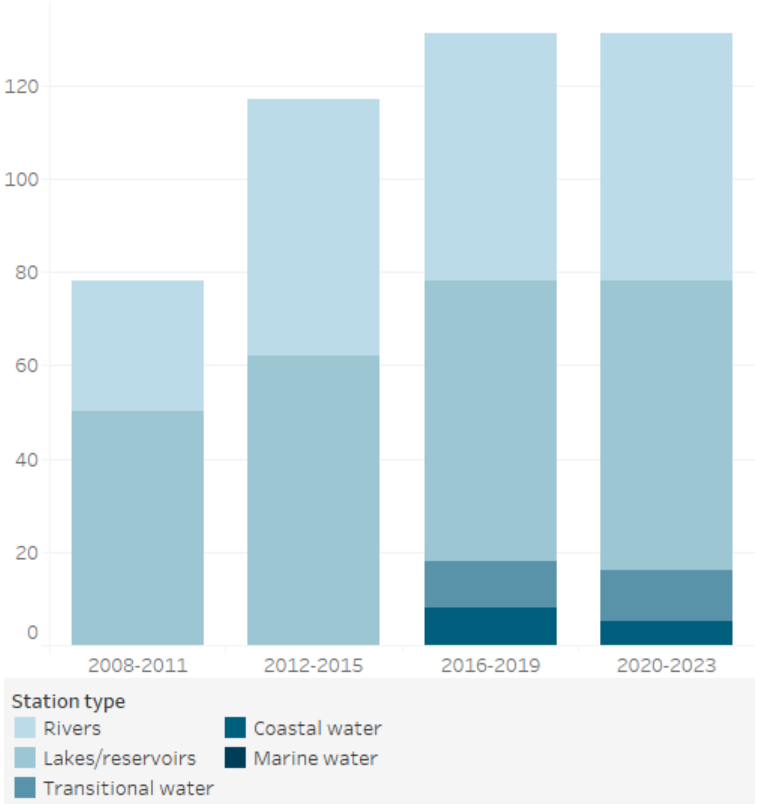


Table 11 – Number of monitoring points reporting trophic status by station type ([26])

Station type	Stations with trophic status			
	2008-2011	2012-2015	2016-2019	2020-2023
Rivers	28	55	53	53
Lakes/reservoirs	50	62	60	62
Transitional water			10	11
Coastal water			8	5
Marine water				
Total	78	117	131	131

6.2. Methodology for the assessment of trophic status

The classification criteria laid down under the Water Framework Directive in the 3rd River Basin Monitoring Plan were used to assess ecological status/potential. Water courses on mainland Portugal have been divided into three major groups according to their varying conditions regarding water hardness and the size of the basin.

Eutrophication assessment was conducted by the indicators nitrate and total phosphorus both on mainland Portugal, the Azores and the autonomous region of Madeira. For reservoirs, transitional and coastal waters chlorophyll-a was monitored additionally. Portugal reported that the parameters and limit values used in the eutrophication assessment for the Nitrates Directive align with those of the Water Framework Directive.

([26]) Portugal reported that monitoring was discontinued in 5 monitoring points relative to the previous reporting period. Discontinuation may be due to nitrate concentrations below 25 mg/l, change in station code or type, or other specific reasons.

6.3. Eutrophication of surface waters

Rivers

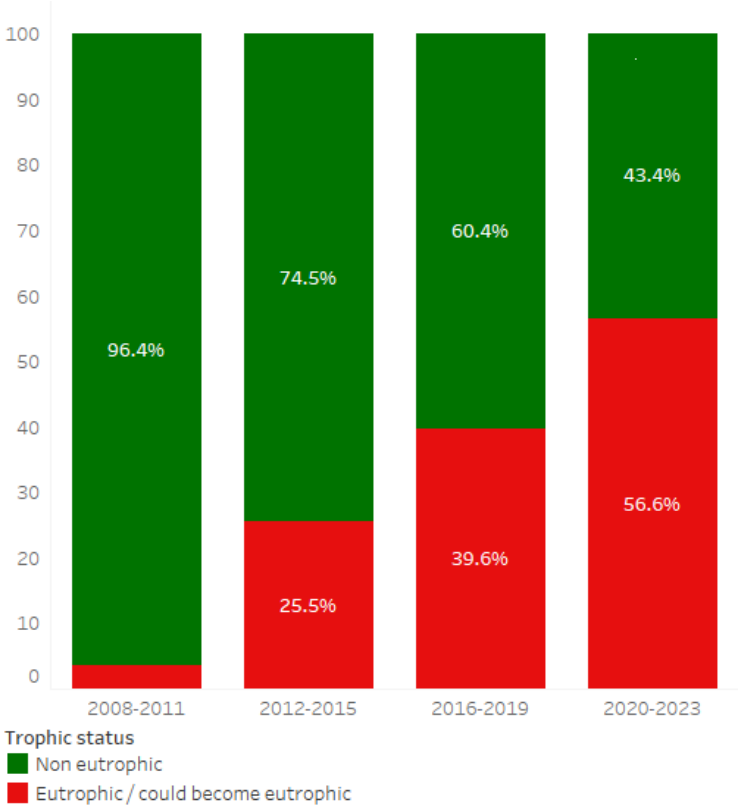
56.6% of monitoring points in rivers were eutrophic/could become eutrophic. The figure below shows the shares in respective classes in a graph and spatial distribution in the map.

Figure 34 – Map of trophic status in rivers and share of monitoring points by trophic class in the reporting period 2020-2023

Note: In the map, eutrophic/could become eutrophic monitoring points are plotted on top.

Compared to the previous reporting period, the share of eutrophic/could become eutrophic monitoring points increased from 39.6% to 56.6%. The graph below presents the shares of monitoring points according to their trophic status in the last four reporting periods. The share of eutrophic/could become eutrophic monitoring points has steadily increased since 2008-2011.

Figure 35 – Share of monitoring points in rivers by class of trophic status in the current and previous reporting periods



Note: The percentages below 5% are not labelled.

Lakes and water reservoirs

80.6% of monitoring points in lakes/water reservoirs were eutrophic/could become eutrophic. The figure below shows the shares in respective classes in a graph and spatial distribution in the map.

Figure 36 – Map of trophic status in lakes/water reservoirs and share of monitoring points by trophic class in the reporting period 2020-2023

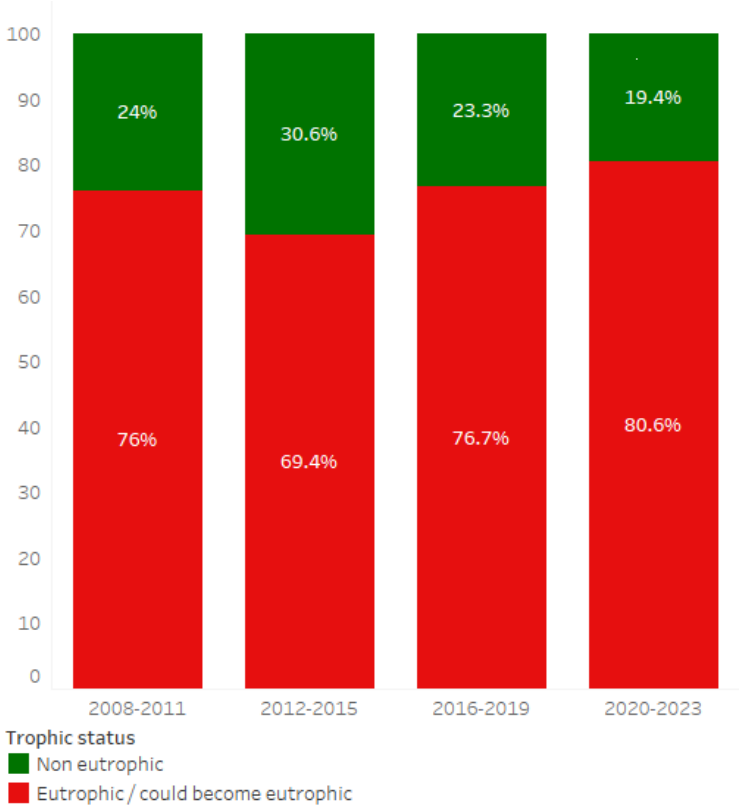
Note: In the map, eutrophic/could become eutrophic monitoring points are plotted on top.

Table 12 – Share of freshwater monitoring points by class of trophic status, categorised by station type

Station type	Number of Stations	% of Total	Non-eutrophic	Eutrophic/could become eutrophic
Rivers	53	46.1%	43.4%	56.6%
Lakes/reservoirs	62	53.9%	19.4%	80.6%
Total	115	100.0%	30.4%	69.6%

Compared to the previous reporting period, the share of eutrophic/could become eutrophic monitoring points increased from 76.7% to 80.6%. The graph below presents the shares of monitoring points according to their trophic status in the last four reporting periods. The share of eutrophic/could become eutrophic stations has increased since 2012-2015 from 69.4% to 80.6%.

Figure 37 – Share of monitoring points in lakes/water reservoirs by class of trophic status in the current and previous reporting periods



Saline waters

37.5% of saline water monitoring points were eutrophic/could become eutrophic. The figure below shows the shares in respective classes in a graph and spatial distribution in the map.

Figure 38 – Map of trophic status in saline waters and share of monitoring points by trophic class in the reporting period 2020-2023

Note: In the map, eutrophic/could become eutrophic monitoring points are plotted on top.

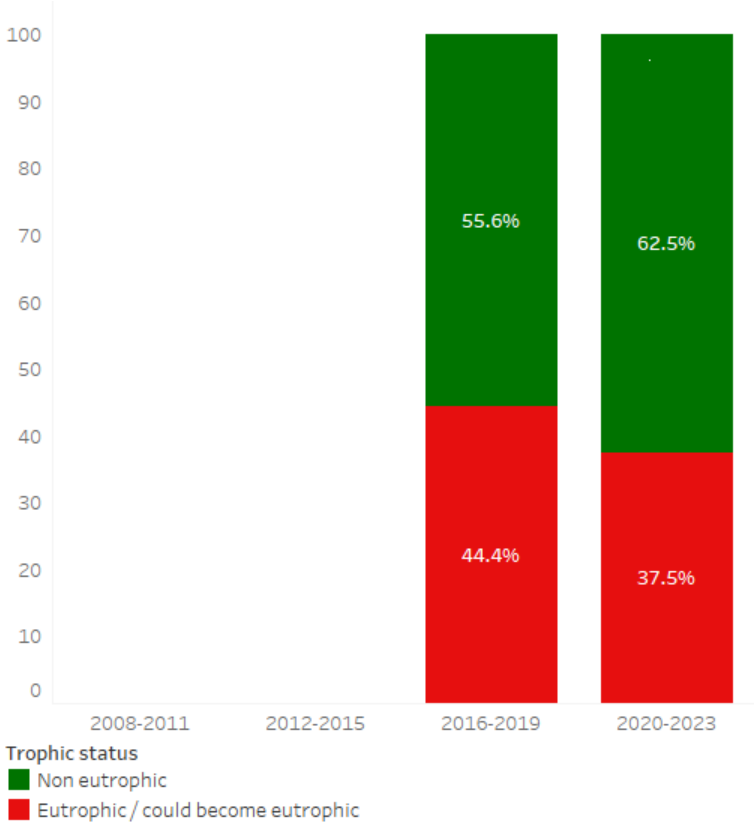
It is relevant to look separately at different types of saline waters (transitional, coastal and marine). In Portugal, 54.5% of transitional water and none of the coastal water monitoring points were eutrophic/could become eutrophic, as shown in the table below.

Table 13 – Share of saline water monitoring points by class of trophic status, categorised by station type

Station type	Number of Stations	% of Total	Non-eutrophic	Eutrophic/could become eutrophic
Transitional water	11	68.8%	45.5%	54.5%
Coastal water	5	31.3%	100.0%	
Marine water				
Total	16	100.0%	62.5%	37.5%

Compared to the previous reporting period, the share of eutrophic/could become eutrophic monitoring points in saline waters decreased from 44.4% to 37.5%. The graph below presents the shares of monitoring points according to their trophic status in the last two reporting periods. For 2008-2011 there were no stations reported with trophic status.

Figure 39 – Share of monitoring points in saline waters by class of trophic status in the current and previous reporting periods



6.4. Eutrophication hotspots in surface waters

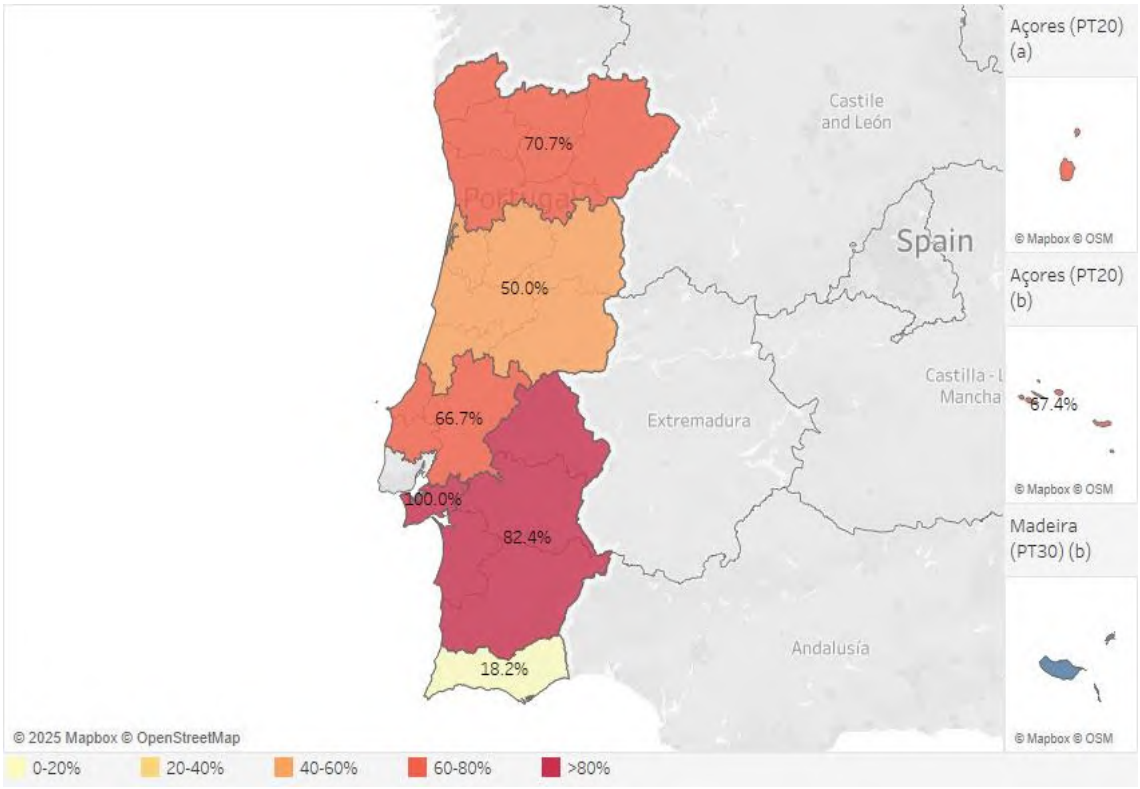
A eutrophication hotspot in surface waters is defined here as a monitoring point with trophic status evaluated as “eutrophic” or “could become eutrophic”. Overall, there are 86 surface water monitoring points which were reported eutrophic/could become eutrophic, of which 70 are outside NVZ, accounting for 81.4% of all eutrophication hotspots in the country.

Figure 40 – Eutrophic/could become eutrophic monitoring points (map) and their distribution inside and outside Nitrate Vulnerable Zones (table)

	inside NVZ	outside NVZ	Total
Rivers	3	27	30
Lakes	12	38	50
Transitional water	1	5	6
Total	16	70	86

The regions with the highest share of hotspots are Península de Setúbal (100%), Alentejo (82.4%) and Norte (70.7%).

Figure 41 – Share of eutrophic/could become eutrophic monitoring points at NUTS2 level



7. NITRATES ACTION PROGRAMME

The Nitrates Directive mandates the establishment of a code of good agricultural practice that shall be implemented by farmers on a voluntary basis and promoted through training and information for farmers. Action programmes with mandatory requirements for farms should be established and enforced in NVZ or across the entire territory with mandatory measures applicable to all farms in those areas. These requirements primarily focus on implementing good practices for the handling of fertilisers and manure on farms to minimise the risk of nutrient leaching and run-off from fields. Annex II and III of the Directive set the types of measures to be included. The directive leaves wide discretion to Member States to design the measures in line with local circumstances. Compliance with the action programme measures is monitored by public authorities.

The action programmes contain measures concerning fertiliser application (periods when land application of different types of fertilisers is prohibited, land application on steeply sloping ground, prohibition of land application on water-saturated, flooded, frozen or snow-covered ground, the conditions for land application of fertiliser near water courses, balanced fertilisation and the amount of livestock manure that can be applied to the land), and the capacity of storage vessels for livestock manure. They may also include additional measures in relation to fertilizer planning and record keeping, land use management, including the use of crop rotation systems, minimum vegetation cover during sensitive periods, irrigation systems and other relevant measures complementing the nitrates action programme.

7.1. Measures in the action programme and code of good agricultural practices

The Code of Good Agricultural Practice (CGAP) was first published in 1997 and has subsequently been revised and updated. The current CGAP was approved by Order No 1230/2018. It applies at national level and is mandatory within designated nitrate vulnerable zones.
The first Nitrates action programme was adopted in 1998. The most recent update dates from 2012. Currently, a single action programme applies to all NVZ on mainland Portugal, as established by Ordinance No. 259/2012, of 28 August 2012. In the Autonomous Region of the Azores, three regional action programmes apply to the NVZ, as set out in Ordinance No 92/2012 of 23 August 2012, Ordinance No 110/2012 of 28 December 2012, and Ordinance No 111/2012 of 28 December 2012.
The action programmes are not amended in the period 2020-2023.

A consolidated overview of the action programme currently in force is provided in a separate document ([27]).

([27]) https://environment.ec.europa.eu/publications/summaries-national-nitrates-action-programmes_en

7.2. Controls

Compliance with the requirements of the action programme was monitored through on-site inspections carried out by the territorially competent Regional Directorate for Agriculture and Fisheries (DRAP).

The proportion of farms inspected on-site within NVZ varied considerably, ranging from 0% to 40% depending on the zone. On mainland Portugal, inspection rates ranged between 1% and 16.7%, with the highest inspection rate recorded in the Esposende - Vila do Conde (16.7%) and the lowest in the Estarreja – Murtosa, Litoral Centro and Tejo (1.0%). On mainland Portugal, controls were carried out in all NVZs. In the Autonomous Region of the Azores, on-site inspections were conducted in only three of the eight NVZ, namely Lagoa das Furnas, Lagoa das Sete Cidades, Lagoa do Capitão,

On mainland Portugal, the most frequently identified non-compliances related to fertiliser application in accordance with a fertilisation balance, with infringement rates ranging between 3.4% and 24.0%. These infringements concerned both the application of non-adapted fertiliser doses and the absence of required fertilisation records. Other significant non-compliances reported on mainland Portugal included exceedances of the annual amounts of livestock manure applied (0-21.4%), non-compliance with fertiliser prohibition periods (0-11.3%), deficiencies in the capacity or construction of manure storage facilities (0-10.7%), and exceedances of maximum permitted fertiliser application levels (0-16.7%).

In the Autonomous Region of the Azores, only non-compliances related to exceedances of maximum permitted fertiliser levels were reported, with an infringement rate of 25.0%.

The difficulties encountered in implementing the Action Programme vary between NVZs on mainland Portugal and include social and economic factors as well as climatic constraints. The Portuguese progress report indicates that the current Action Programme is perceived as overly complex and as imposing an excessive number of standards.

In the NVZs of the Autonomous Region of the Azores, the reported implementation challenges relate primarily to the limits on maximum quantities of inorganic nitrogen, particularly in permanent pasture areas, where producers seek to increase productivity.

8. WATER QUALITY OUTLOOK

The Faculty of Science, University of Lisbon (FCUL) was commissioned to develop groundwater modelling techniques to forecast water quality developments within the NVZ. They developed numerical models to simulate underground flow and the transport of mass in NVZ of mainland Portugal. The numeric model was conducted in FEFLOW. Values from the period 2016-2017 have been used as reference. Input concentration was calculated by using the annual average for each monitoring station. The simulation time period corresponds to 24 years. At the end of the numerical simulation, i.e., in 2040, the areas of the vulnerable zones which still have nitrate concentrations equal to or above 50 mg/l were calculated.

According to the simulation only three out of nine vulnerable zones, Litoral Centro, Estremoz-Cano and Luz de Tavira, will be recovered after 24 years. The remaining zones will have areas with nitrate concentrations exceeding 50 mg/l, ranging from 1.5% to 6.7% of the NVZ.

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