

## Chapter 69

# Assessment of Spanish Rivers Current and Future Ecological Status Using Urban Wastewater Dilution Factor



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**Abstract** The EU Water Framework Directive (WFD) ecological status classification of surface water bodies (SWBs) provides a synthetic assessment of how anthropogenic pressures impact on aquatic environments. In the evaluation of River Basins Management Plans of the second cycle (2015–2021), the EU commission reported the need for Spain: (i) to improve apportionment of pressures among individual sectors to be able to target appropriate measures, (ii) to take operational measures to mitigate climate change effects on the different sources of pressure affecting surface water quality status. Urban wastewater treatment plants (WWTPs) discharges to river SWBs represent an impactful point source of pressure. This study postulates that the dilution factor (DF) of WWTPs discharged to river flow can be estimated for EU Member states and can be used as suitable proxy to predict the EU SWBs ecological status. The implemented approach uses the available datasets centralized by the Environmental European Agency, and a focus on Spain's situation is provided. Climate change effects on SWBs river flows are considered using a set of scenarios based on IPCC regionalized estimates. Results confirm that cumulative WWTP discharge and DF can be estimated and mapped for EU member states. The study confirms that it is statistically sound to use DF to assess the probability for a SWB to reach or not a good ecological status. 21% and 33.9% of the SWBs in Spain show a decreasing DF for the projections based on the high representative concentration pathway emission scenarios (RCPs 4.5; 8.5), respectively for the early (2011–2040) and midcentury (2041–2070) periods. Using the DF as an indicator, results show that in the span of these two periods, 55% of the 1046 SWBs with a current good ecological status have a higher than 70% probability to lose their good ecological status classification.

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## 69.1 Introduction

Assessing the impacts of our urbanized society on water resources is key to their current and future preservation [1, 2]. Treated wastewater discharged from cities to rivers can convey chemicals and pollutants degrading ecological systems and compromising the downstream uses of the water resource. Rivers' capacity to dilute wastewater treatment plants (WWTPs) discharges (i.e. the dilution factor -DF) has been estimated at national to sub continental scales (i.e. U.S.A., China) to assess WWTP impacts on freshwater resource downstream uses [3–5]. However, whereas demographic based DF evaluations at world wide scale highlights low estimates for European member states at national levels [6], the DF has not been in detailed studied for the hydrographic system at the EU continental scale yet (only Germany has conducted a detailed country wide DF analysis [7]).

Still, the European water framework directive (WFD) lead to centralization of urban wastewater treatment plan (WWTPs) treated data emission [8]. Furthermore, the WFD lead to production of the ecological status or potential classification of the European surface water bodies (SWBs), providing a synthetic and systemic assessment of anthropogenic pressures impacts on aquatic environments [9]. In particular, the WFD [9] commands EU Member States to have their SWBs reaching a good ecological status by the end of the next River Basin District management plan cycle (2022–2027). Nonetheless, only 42% of European SWBs in the current River Basin District management plan (2015–2021) achieved a high or good ecological status [10]. Moreover, in the evaluation of the current River Basins Management Plans, the EU commission reported [10] the need: (i) to improve apportionment of pressures on water resource among individual sectors to be able to target appropriate measures, (ii) to take operational measure to mitigate climate change effects on the different sources of pressures affecting surface water quality status. Pan-European, estimation method for the ecological status probabilistic classification, based on assessment of the multiple pressures on European SWBs exists [11]. However, pressures related to punctual urban pollution and to climate change effect were not part of their approach whereas such pressures-impacts in detail assessment are needed [10–12].

Our hypothesis is that the DF can be evaluated for the European hydrographic system, can be a good proxy indicator of ecological status, and that both DF and ecological status will be affected by climate change. An integrated pan-European assessment of the DF, its correlation to the ecological status, and the prediction of the impacts of climate change on the ecological status, will allow to address the needs (i) and (ii) recalled here above. These assessments would support river basin district authorities to building up resilience by assessing SWBs at risk in the following river basin district management plan cycle. Yet, there are no studies quantifying either

the DF or the climate change effects on both the DF and the ecological status of European SWBs.

In this study, we address these points through three main research question: (*Q1*) Can the main WWTPs discharge contribution to river SWBs be quantified and DF mapped at European scale? (*Q2*) Can the DF be used as a proxy indicator for the ecological status evaluation? (*Q3*) Can this DF be estimated at the early- midcentury horizons help to identify SWBs at risk? Positive answers would provide a simple way to identify and target SWBs at risk. Moreover, meanwhile assessing *Q1* to *Q3* an emphasize in the analysis is performed for Spain.

## 69.2 Material and Methods

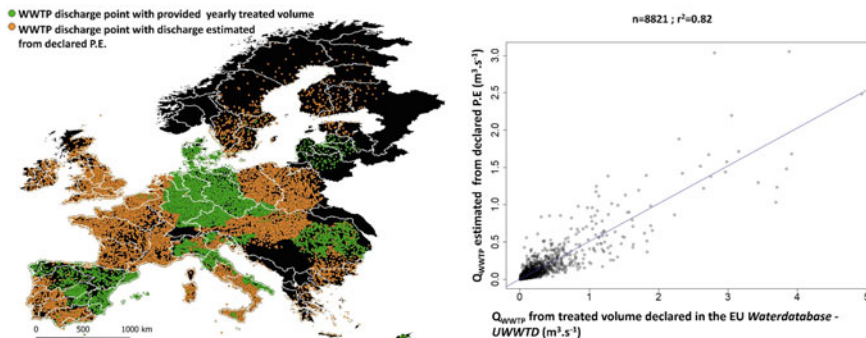
DF is calculated, as the sum of the WWTPs discharges in a given river network upstream of the considered river surface water body (SWBs). For each receiving stream, this conservative approach computes DF as follow:

$$DF = (Q_r + Q_{wwtp})/Q_{wwtp}; \quad (69.1)$$

where,  $Q_r$  is the river flow, and  $Q_{wwtp}$  is the cumulated WWTPs discharge, resulting from the sum of the discharges in the river network upstream from the discharge point, both in  $\text{m}^3 \text{s}^{-1}$ , and based on yearly averages estimates. To compute, the DF for each SWBs estimating the pan-European  $Q_{wwtp}$  in the river network, the Waterdatabase—UWWTD from the European Environmental Agency [13], and the EU river SWBs yearly average flow estimates from COPERNICUS data store platform E-HYPE hydrological model results [14, 15] have been used as described in this section.

### 69.2.1 European Wastewater and River Flow Datasets

The Urban Wastewater Treatment Directive—dataset UWWTD provides the yearly volume of wastewater treated by WWTPs larger than 2000 population equivalents (P.E.). This data is reported under the umbrella of the EU Water Framework Directive (Directive 2000/60/EC), by the EU Member States for the the 2nd River Basin Management Plan cycle (2016–2021). Waterdatabase—UWWTD analyze shows that the total 28,276 referenced WWTPs represent 24,892 discharge points releasing treated effluents into freshwater SWBs. The level of reporting of WWTPs annual treated volume varies among EU Member States (Fig. 69.1): 38.6% of the WWTPs have this information reported. Sixteen of the twenty-eight EU Member States provide this information, including nine members states reporting it for more than 90% of their WWTPs.



**Fig. 69.1** Reported and estimated EU WWTP discharge: network of EU urban wastewater treatment plant (WWTPs) with river basin districts boundaries in white (left); linear regression based on P.E. entering load to estimate WWTP discharge in river surface water bodies (right). Adapted with permission from “Climate change impact on EU rivers’ dilution capacity and ecological status”. Abily, M. et al. *Water Research*, 199, 117166

To estimate the treated volume of the remaining WWTPs, following strategy was apply.

- (i) The number of habitants connected to a WWTP was estimated using the declared P.E. knowing that in EU one habitant releases in average 1.23 P.E. [16] as P.E. information is provided for all WWTPs in the database.
- (ii) Then, for each WWTP, the treated volume was estimated by multiplying the number of habitants connected to the WWTP by the Member State average habitant water consumption.
- (iii) Lastly, a linear regression was conducted between the reported annual treated volume from the WWTPs providing these values and P.E. of the WWTPs. Outliers removed before the linear regression were the 0.99 and 0.01 percentiles of the estimated and provided discharge ratio as well as Poland values where reported treated volumes are multiple folds higher than the rest of EU member states, leaving 8821 values for the linear regression. The equation obtained from the regression has a  $r^2$  of 0.82 (Fig. 69.1). and was used to estimate the flow out of P.E. for the remaining WWTPs.

The river flow data used for computation of the pan-European DF, is based on the dataset produced by the E-HYPEv3.1.2 hydrological model [14]. Data products of this multi-basin conceptual model are available through the Copernicus climate change Service portal [15]. E-HYPE produces flow routing over the gauged and ungauged catchments of EU River basin units. For pan-European DF computation, the yearly average river flow was used, as well as the monthly 50th percentile. E-HYPE is a semi-distributed hydrological modelling approach, which divides the European River Basins Districts (8.8 million of km) in 35,408 sub-catchments [17,

18]. Based on their flow signatures, gauged sub-catchments are divided in Hydrological Responses Units (HRU), correlated to catchment physiography characteristics. E-HYPE classifies HRU into 75 categories. Predictions in ungauged basins is performed based on similarities with a stepwise regionalization scheme in the calibration process. This hydrological modelling approach considers most of the standard natural hydrological surface and sub-surface processes (such as groundwater fluctuation, discharge generation, soil moisture, evapotranspiration). Main human activities directly impacting the hydrological cycle, such as irrigation or discharge control processes, are also included in E-HYPE modelling though considered as represented less accurately [14, 17, 18].

### **69.2.2 Climate Change Data and Scenarios**

This manuscript focuses on the influence of climate change, and other factors influencing the treated volume such as population growth in urban areas (increasing emission trend factor) and socio-political variables (habitant per capita consumption and water reuse policies -potential decreasing emission trend factors) are left aside for future research. Thus, the yearly volume of wastewater treated is here assumed to remain unchanged in future scenarios.

The temporal range of the analysis is limited to the next 50 years (up to 2070) which is in the range of WWTP urban water infrastructures lifespan. Climate Impact Indicator (CII) products from COPERNICUS climate change Service portal include the above-mentioned river flow for Europe [15]. CII provides river flow change estimates for three different 30-year periods 2011–2040, 2041–2070 and 2071–2100, for emission scenarios (RCPs 2.6; 4.5; 8.5). These river flow changes are simulated and provided using combinations of multiple global climate, regional climate and hydrological models [15, 19]. This study uses the 50th quantile monthly discharge estimates for the 2011–2040 and 2041–2070 periods, provided by the hydrological model E-HYPEv3.1.2 simulation results. For each RCPs (2.6; 4.5; 8.5) result of 50th quantile monthly discharge estimates were used to compute the DF while afterward averaging the DF result for a given RCP scenario.

### **69.2.3 Dilution Factor Assessment**

To obtain the DF for Europe, the cumulated urban wastewater effluent discharge ( $Q_{wwtp}$ ) and the river flow ( $Q_r$ ) were first computed under the format of raster grids before applying Eq. (69.1). The process to spatially cumulate along EU streams the discharge contributions of each WWTP, is based on a GIS approach using Flow Direction (FD) grids, location of the WWTP discharge points, and the estimated WWTP discharge.

In this study, the HydroSheds FD grid [20] of ~500 m resolution, and above 60°N, of the HYDRO1K FD grid [21] of ~1 km resolution are combined to produce the FD grid covering EU. Those two FD grids were originally generated based on Digital Elevation Models (DEM) pretreated to ensure the hydraulic continuity of the streams by the data providers [20, 21].

To cumulate the WWTP discharge, each of the discharge points was used to generate a drainage line base on the combined FD grids. Each drainage line respectively had the weight of the estimated WWTP discharge value (in  $\text{m}^3 \cdot \text{s}^{-1}$ ). The cumulative WWTP discharge grided for Europe is the sum of all the individual drainage line grid.

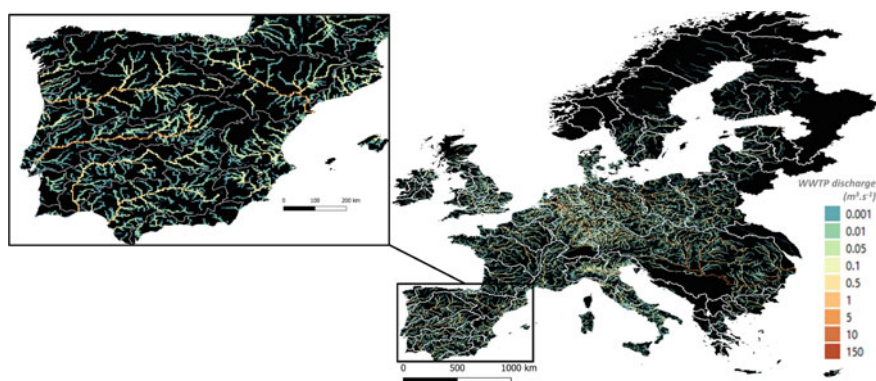
The river flow grid results from the conversion of the river flow data estimated at each of the 35,408 sub-catchments by the E-HYPEv3.1.2 hydrological model conversion to a raster grid. Combination of the cumulative WWTP discharge grid with river flow grid using Eq. (69.1) allowed to compute the DF grids.

European SWBs are provided as vectors (polylines) layer by the European Environmental Agency [13]. To attribute a DF value in a conservative manner for the SWBs, a 250 m spatial buffer for each SWB polyline is generated to extract the minimal DF value of the DF grid. Shortcoming of spatial buffering selection routine exist: in dense hydrographic regions several SWBs can potentially be selected, and upstream SWBs could be over-selected with thus an underestimated attributed DF value from the immediate downstream SWB.

#### ***69.2.4 Ecological Status or Potential and Dilution Factor Assessment***

SWBs' ecological status or potential (ecological status here after) is assessed under the umbrella of the WFD [8, 22] according to Member states individual methodology and centralized by the European Environmental Agency for each reporting period cycle (6 years). Based on an assessment of SWBs biological quality, physico-chemical quality and hydromorphologic elements, Ecological status are classified as either high, good, moderate, poor or bad. By the end of the next River Basin District management plan cycle (2022–2027), the WFD commands EU Member States to have their SWBs reaching a good ecological status. However, in the current River Basin District management plan (2015–2021), only 42% of European SWBs achieved a high or good ecological status [10].

Ordinal logistic regression is used to perform a generalized linear model [23] to predict the probability of SWBs to belong to the different ecological status classes based on DF values. This method establishes a probabilistic classification of SWBs using the DF value as predictor (Fig. 69.2b). Computed DF datasets and the SWBs Ecological status classification reported in 2016 for the second River basin management cycle (2016–2021) dataset where used. The temporal extent of the analysis does not refer to a specific year but is centered on the full 2016–2021 period. Following



**Fig. 69.2** Yearly averaged WWTPs discharge in EU SWB, with boundaries of the EU river basin districts are represented in white and emphasize on the Iberica peninsula

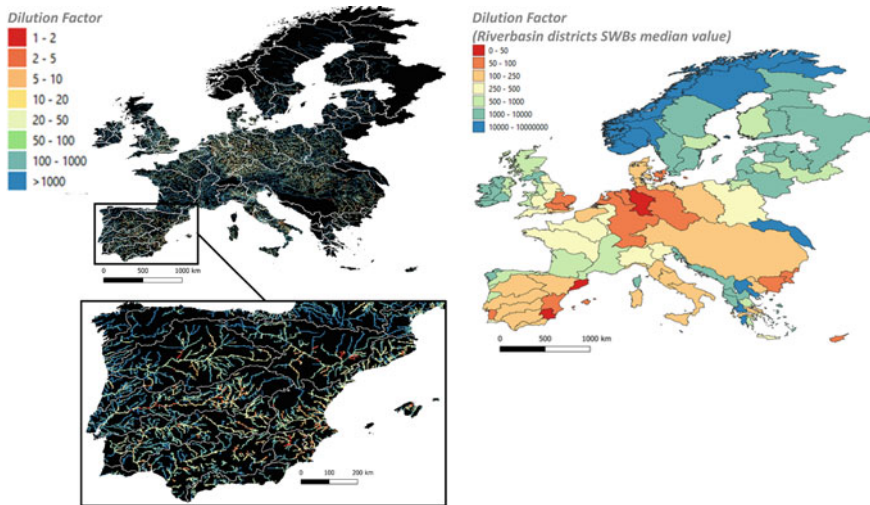
the same principle, binomial logistic regression was used to perform a generalized linear model assessing the probability of SWBs to belong to one of the two state of the binary response variable (reaching or not reaching the good ecological status) based on the DF predictor. These models were performed using R packages [24, 25]. The logistic regression process was performed using training data representing 75% of the total dataset. The accuracy (ratio of samples correctly predicted over the total number of sample) was estimated with the remaining 25% of the data for model validation. The accuracy is reported as the mean of the logistic regression model ran 100 times with random sampling for the training/validation dataset selection.

## 69.3 Results

### 69.3.1 Dilution Factor of the WWTPs Discharge into Rivers SWBs ( $Q_1$ )

Results shows that 40,074 over 106,654 referenced river SWBs in Europe directly or indirectly receive WWTPs discharge as mapped and quantified in Fig. 69.2. The three largest shares of treated effluent in EU rivers can represent up to 149, 84, and 54  $\text{m}^3 \text{s}^{-1}$  at the estuary of Rhine, Danube and Pô River Basin Districts, representing respectively 6, 1 and 3% of their yearly average flow. These numbers recall and enhance the prime importance in European of WWTPs effluent contribution to river flow quantity and thus quality, bearing in mind potential impacts regarding on water quality of low concentration WWTP effluent components such as micro pollutant and pollutant of emerging concern [26–29].

In the Iberica peninsula, in Spain, the Ebro river has a 33.3  $\text{m}^3 \text{s}^{-1}$  whereas the Spanish-Portuguese rivers, the Tagus and the Douro, are the two Iberico River Basin



**Fig. 69.3** Dilution factor capacity of EU SWBs, with focus on Spain(left) and dilution factor median values of EU SWBs per river basin districts (right). Adapted with permission from “Climate change impact on EU rivers’ dilution capacity and ecological status”. Abily, M. et al. *Water Research*, 199, 117166

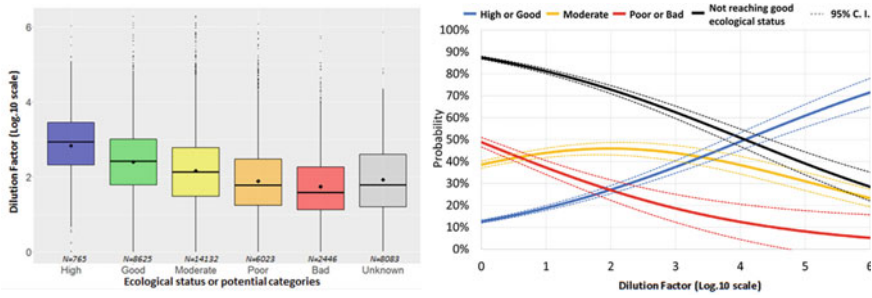
Districts having the most important WWTPs discharge contribution with respectively  $15.7$  a  $9.1 \text{ m}^3 \text{ s}^{-1}$ . These values representing respectively 8, 3 and 1.5% of their yearly average flow.

DF mapping result (Fig. 69.3) assess the pan-European capacity from riverine SWBs to dilute WWTP discharges. This result from global standpoint analysis, enhance that the Mediterranean and central Europe are the zones where the DF tends to be lower compared to the rest of Europe. Low DF in the Central Europe explains as it is densely populated areas where wastewater effluents are discharged in SWBs leading to high  $Q_{wwtps}$  values. If the densely populated coastal Mediterranean areas have a significant number of WWTPs discharge points directly into the Mediterranean Sea, the low  $Q_r$  leads to limited dilution capacity for more inland SWBs of this region.

### 69.3.2 *DF Uses as a Proxy Indicator of Ecological Status (Q2)*

In EU, regarding ecological status classification of the 40,074 SWBs receiving directly or being downstream of the WWTPs effluent release, results enhance that 31,991 of them have a reported ecological status: 9390 have at least a good ecological status; 22,601 do not reach a good ecological status. 8083 of these SWBs receiving directly or indirectly WWTPs discharge have thus a yet unknown or unreported ecological status, highlighting a need for a method supporting the ecological status





**Fig. 69.4** Dilution factor and Ecological status correlation: distribution of the dilution factor among the ecological status or potential categories (left); logistic regression analysis displaying probabilities grouping of ecological status categories for a given dilution factor, including (black line) the binary logistic regression probability of compliance with the WFD regulation (reaching or not a good ecological status) for a given dilution factor (right). Adapted with permission from “Climate change impact on EU rivers’ dilution capacity and ecological status”. Abily, M. et al. Water Research, 199, 117166

assessment and update. The DF estimated for the 40,074 SWBs were grouped by their ecological status categories and presented as box plots (Fig. 69.4). The share of European SWBs across these categories is 2% High, 27% Good, 44% Moderate, 19% Poor, and 8% Bad. The shift in DF distribution per ecological status categories shows that the ecological status of SWBs worsens as their dilution factor decreases.

The performed logistic regression considering the DF and a binary classification of the SWBs as a function of their ecological (good or higher than good versus lower than good), thus allows to estimate the probability of compliance with the WFD objectives for a given dilution factor (Fig. 69.4). The classification accuracy of this binary logistic regression model is of 0.70, and results indicate that there is probability of not achieving the good ecological status of 72% for those SWBs with DF values lower than 100. When considering a DF of 10, the probability of not achieving the good ecological status rises to more than 80%. Thus, the binary logistic regression allows using DF to estimate ecological status in where the member states did not report ecological status, or in climate change scenarios. In the first case, this regression model was used to estimate the ecological status for 8083 SWBs (out of the 40,074 SWBs receiving WWTP contribution) with unreported or unknown ecological status. In these SWBs, their DF (Fig. 69.4) was used to estimate the probability of achieving the good ecological status, and results indicate that 38% of these SWBs will not achieve the good ecological status.

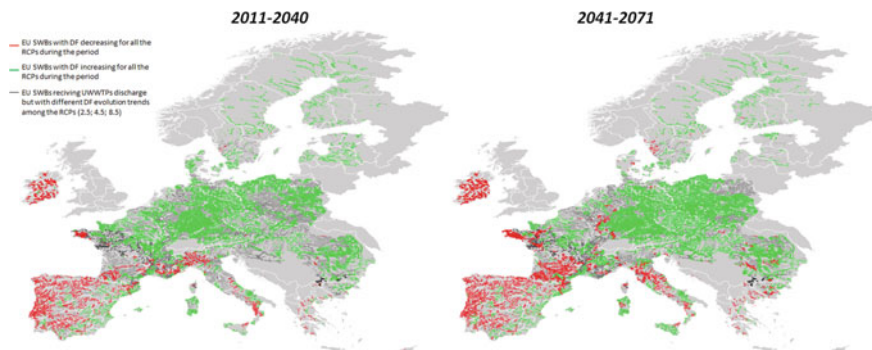
## 69.4 DF and Ecological Status on the Horizons 2011–2040 and 2041–2070 (Q3)

The DF was recalculated using the 50th percentile of the predicted flows in the European SWBs based on the RCPs 2.6, 4.5 and 8.5 [15, 19] for the early (2011–2040) and mid (2041–2071) century periods. Compared to the reference period, DF decreases jointly for the three RCPs in 11% and 17% of the European SWBs receiving WWTP discharges for the early and the midcentury periods respectively. The magnitude of the decrease is in average of  $-0.9\%$  and  $-1.7\%$  and median value shift is  $-8.3\%$  and  $-9\%$  for the two respective periods. A DF increasing trend occurs jointly for the three RCPs in 41% and 45% of the SWBs over the two respective periods, by an average of  $5.2\%$  and  $6.3\%$  and a respective median DF value shift by  $8\%$  and  $8.2\%$  is observed.

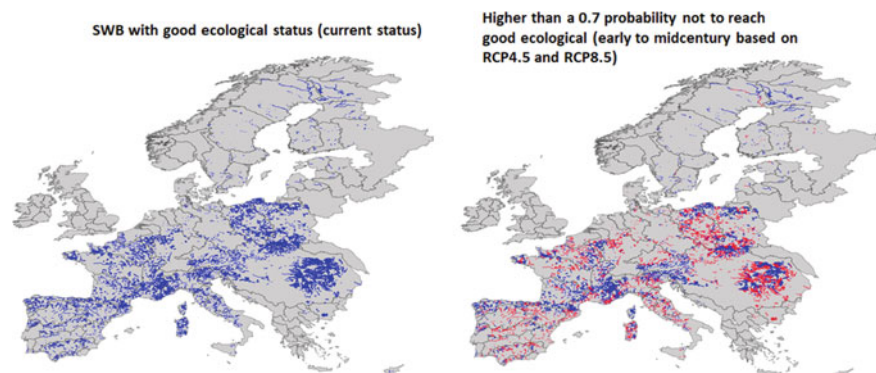
When considering the full 2011–2070 period, 9% of the SWBs decrease consistently and 31% consistently increase, jointly for the three RCPs. The mapping of the SWBs with common evolution trend for the three RCPs for the two periods (Fig. 69.5) reveals a spatial pattern at the continental level where the SWBs which consistently decrease are located mostly West and South.

The SWBs DF of the western and the southern parts of Europe decrease to great extent independently of the RCPs, with greater extent for higher emission scenarios. Central and northern European regions show an increasing of their SWBs DF values but the highest the emission scenario and later the period, the less clearly pronounced the trend becomes.

A more detailed analysis is performed considering exclusively the two high RCPs (4.5; 8.5). In that case, about 50% of the 40,074 European SWBs receiving WWP discharge show consistent DF increasing or decreasing trends independently of the scenario and the period. Results enhance that there is three times more SWBs affected by a consistent DF increase (15,433) compare to those suffering a DF decrease (5261). Member states (Austria, Deutschland, Denmark, Poland and Sweden) with



**Fig. 69.5** Mapping of EU SWBs with a consistent DF decreasing or increasing trend for RCP2.5, RCP4.5 and RCP 8.5 over the early (left) and midcentury periods (right)



**Fig. 69.6** Mapping of SWBs reaching a good ecological status in the current period (left) and of their probability (middle, right, in red) not to reach in the good status anymore in the 2011–2070 period according to DF computation based on the two highest RCPs scenarios

dense hydrographic systems located in the northern and central part of Europe own two third of the SWBs with increasing DF trends are in these member states. At the opposite, Eastern and southern member states (Spain, France, Portugal, Italy, Ireland and Greece) own 4994 of the 5261 SWBs with a consistent decrease jointly observed for the two high RCPS during the two periods. Quantitatively, the DF increases over the stretch of the studied period (2011–2070) by 5.7% in average for the whole for Europe. Only Portugal, Spain, Greece and Ireland show a nationwide overall average decrease of their DF for the two high RCPs during at least one of the two periods.

Figure 69.6 results show the SWBs where climate change is likely to have a strong impact on ecological status using the DF-ecological status relationship previously established. The SWBs at risk of not reaching a good ecological status anymore are identified and the emphasize is put on the SWBs with a current good ecological status jointly at risk in the two high emission scenarios over the 2011–2070 period. Overall, in Europe, 42% of the 9390 SWBs with a current good ecological status receiving WWTPs discharge would be at risk, with probability higher than 0.7 ( $DF < 100$ ), of not reaching this good status anymore either during the early or mid-century period. This goes down to 6% of these SWBs if considering the risk with a probability higher than 0.8 ( $DF < 10$ ).

Results displayed in Table 69.1 completes the mapping information analysis, pinpointing this high emission scenarios impacts on SWBs which suffer a joint DF decrease in both periods (2011–2040 and 2041–2070). It represents in Europe 15.5% of the SWBs which have currently a good ecological status and 8% of the SWBs with a yet unknown ecological status who have a probability higher than 0.7 not to reach this good ecological status anymore. Portugal, Spain, France and Italy represent 95% of the total 1452 SWBs which have a 0.7 probability to have their good ecological status downgraded due to climate change. The same list of member states plus Ireland represent 80% of the 648 SWBs with unknown ecological status which will suffer a DF decreased combined with a 0.7 probability not to reach a good ecological status.

**Table 69.1** SWBs consistently not reaching a good ecological status anymore in future projections. Adapted with permission from “Climate change impact on EU rivers’ dilution capacity and ecological status”. Abily, M. et al. Water Research, 199, 117166

Member states	Number of SWBs reaching a good ecological status during the reference period	SWBs with a 0.7 probability not to reach a good ecological status		Number of SWBs with unknown ecological status during the reference period	SWBs with a 0.7 probability not to reach a good ecological status	
		Num	(in %)		Num	(in %)
AT	966	–	–	28	–	–
BE	93	–	–	11	–	–
BG	30	13	43.3	193	92	47.7
CY	8	–	–	5	–	–
CZ	121	–	–	2	–	–
DE	383	–	–	151	–	–
DK	2	–	–	2415	2	0.1
EE	10	–	–	201	–	–
EL		–	–	330	51	15.5
ES	1046	718	68.6	99	18	18.2
FI	126	–	–	1	–	–
FR	1731	413	23.9	1534	101	6.6
HR	127	–	–	–	–	–
HU	19	–	–	294	–	–
IE		–	–	902	27	3
IT	1448	176	12.2	1000	79	7.9
LU	1	–	–	–	–	–
LV	7	–	–	101	–	–
NL	1	–	–	43	–	–
NO		–	–	2	–	–
PL	1170	–	–	2	–	–
PT	109	92	84.4	766	278	36.3
RO	1260	28	2.2	–	–	–
SE	274	12	4.4	–	–	–
SI	50	–	–	3		
SK	408	–	–	–	–	–
Grand Total	9390	1452	15.5	8083	648	8

## 69.5 Conclusions

In this study, the DF use as a proxy indicator of the ecological status of river SWBs has been tested and showed statistical significance to discriminate the probability of SWBs to reach or not a good ecological status. Uses of DF as a simple proxy

indicator allows to identify SWBs at risks when current ecological status is not known or monitored. Furthermore, it enables to apply emission scenarios to build up new knowledge on climate change impact on SWBs ecological status. For river basin district authorities, this allows to prioritize investment measures, by improving knowledge on apportionment of pressures on the water resource related to punctual pollution and supports operational measure taking to mitigate climate change effects on the different sources of pressures affecting surface water quality status.

Overall, we found for the three RCPs (2.6; 4.5; 8.5) scenarios that climate change effects lead to a consistent DF decrease for 11% of the 40,074 European river SWBs receiving WWTP discharge for the early century. This share reaches 17% for the midcentury period. Spain, France, Portugal and Italy represent 80% of the total 5261 EU SWBs consistently affected during early and midcentury periods by a DF diminution when applying the two high RCPs scenarios. Member states in northern and central parts of Europe have an overall DF increase trend, induced by RCPs scenarios which does not impact in a significant way the ecological status of their SWBs.

Assessment of high RCPs (4.5; 8.5) scenarios impacts on the dilution factor allow to identify that 42% of the 9390 European SWBs receiving WWTPs discharge currently with a good ecological status will have a higher than 0.7 probability not to reach this good status anymore in the early (2011–2040) or midcentury (2041–2070) periods. In Spain, results show that in the span of these two periods, 55% of the 1046 SWBs with a current good ecological status have a higher than 70% probability to lose their good ecological status classification.

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