Interreg
Italy - Croatia
NET4mPLASTIC

EUROPEAN UNION

# NET4mPLASTIC PROJECT

## WP4 – Act. 3 Numerical Simulations

## D 4.3.2

Identification of possible MP accumulation sites both on a climatological and event specific base

03 May, 2022 - Version 1

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# 1 Introduction

This deliverable summarize the results of the numerical simulations for microplastic dispersion pathways and potential accumulation areas implemented for the NET4mPLASTIC InterReg Project. The details of the simulation set up and implementation are provided in deliverables D3.2 and D4.3.1 of the project. Below a general description can be found to provide the general framework of the simulations.

The modeling set up is composed of two models run in sequence: the Regional Ocean Modeling System (ROMS, Haidvogel et al., 2000; Marchesiello et al., 2003; Peliz et al., 2003a and 2003b; Di Lorenzo, 2007; Dinniman et al., 2003; Budgell, 2005; Warner et al., 2005b; Wilkin et al., 2005, Shchepetkin AF, and McWilliams JC. 2003 and 2005) and the Lagrangian model ICHTHYOP (Lett et al., 2008). ROMS has been implemented for each pilot site (figure 1) starting from the implementation of the Regione Marche Oil Spill model that provides the initial and boundary conditions.

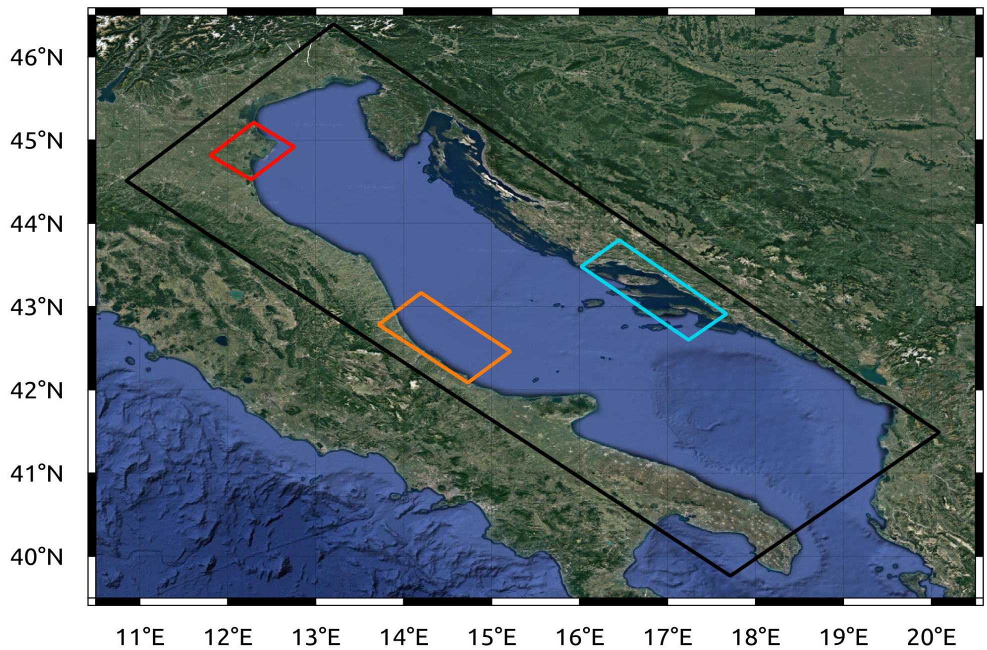



*Figure 1: The NET4mPlastic pilot sites: PS1 Po delta (red), PS2 Pescara (orange), PS4 Split (cyan) and the domain of the basin-wide simulation (black).*

ROMS outputs (currents, temperature and salinity fields) are used to force ICHTHYOP to simulate dispersion pathways and accumulation sites of microplastics of riverine origin.

Four pilot sites (figure 1) were identified for the scopes of the project: PS1 – Po Delta, PS2 – Pescara, PS4 – Split and PSB – Whole Adriatic. For each pilot site simulations were initialized on September 1st 2014 for a 4 month start up. Then, starting from January 1st 2015, a 4 year experimental run was done. The modeling results have been analyzed for each pilot site with the scope of identifying the potential coastal accumulation sites for microplastics of riverine origin on a daily and then climatological base. When looking at those results it is important to keep in mind that those are not forecasts of microplastic concentrations but an evaluation of the potential beaching. This is due to several reasons: I) not all physical and biological processes that drive microplastic dynamics in marine waters are well know and parameterized; ii) the sources of MP in these implementations are only each pilot site main rivers, this leads to an underestimation of the microplastic inputs since several potentially important sources (i.e. minor rivers, sewage and water treatment systems, other diffuse sources) have not been considered due to the lack of reliable data; iii) coastal beaches can act both as a sink and a source of microplastics since are subject to re-suspension due to waves and currents. Nevertheless the results presented here are based on state of the art models and give an accurate evaluation of microplastic pathways in coastal waters.

# 2 Event based analysis

The analysis of extreme events will be the focus of D4.3.3, hence here a brief analysis on the interaction between discharges and potential daily beaching (both in term of absolute and percentage values will be provided. Each pilot site will be discussed separately with the exception of PSB – Adriatic. This pilot site covers the whole basin hence it is subject to different dynamics and can not be considered as a uniform area in a event analysis. Nevertheless it can provide interesting insights on the climatological analysis of potential accumulation areas.

## 2.1 PS1 – Po Delta

Figure 2 and figure 3 show the daily average stream flow in $m^3/S$ for each river considered in PS1 superimposed to the total number of potentially beached particles (black lines in the left panels) and their percentage computed over the whole released particles. The plots clearly show how each river mouth behaves differently both in magnitude and percentage, mostly due to the that each mouth can present a different a different orientations and coastlines. Anyway those can be grouped depending on similar behavior as follows:

- Northern delta:
  - **Brenta**: this river is located in the northern part of the delta even if it is not branch of the Po River. Its mouth is positioned close to the model boundary, hence its potential beaching can be partially underestimated do to the model configuration. Generally speaking high discharges do not always result in elevated beaching, for example the events of 2016 and 2018 marked by green dots.
  - **Adige**: even if located close to the Brenta river, the Adige river (which as the Brenta is not a branch of the Po river) presents a different behavior with high absolute beaching during of high discharges (two examples are shown with

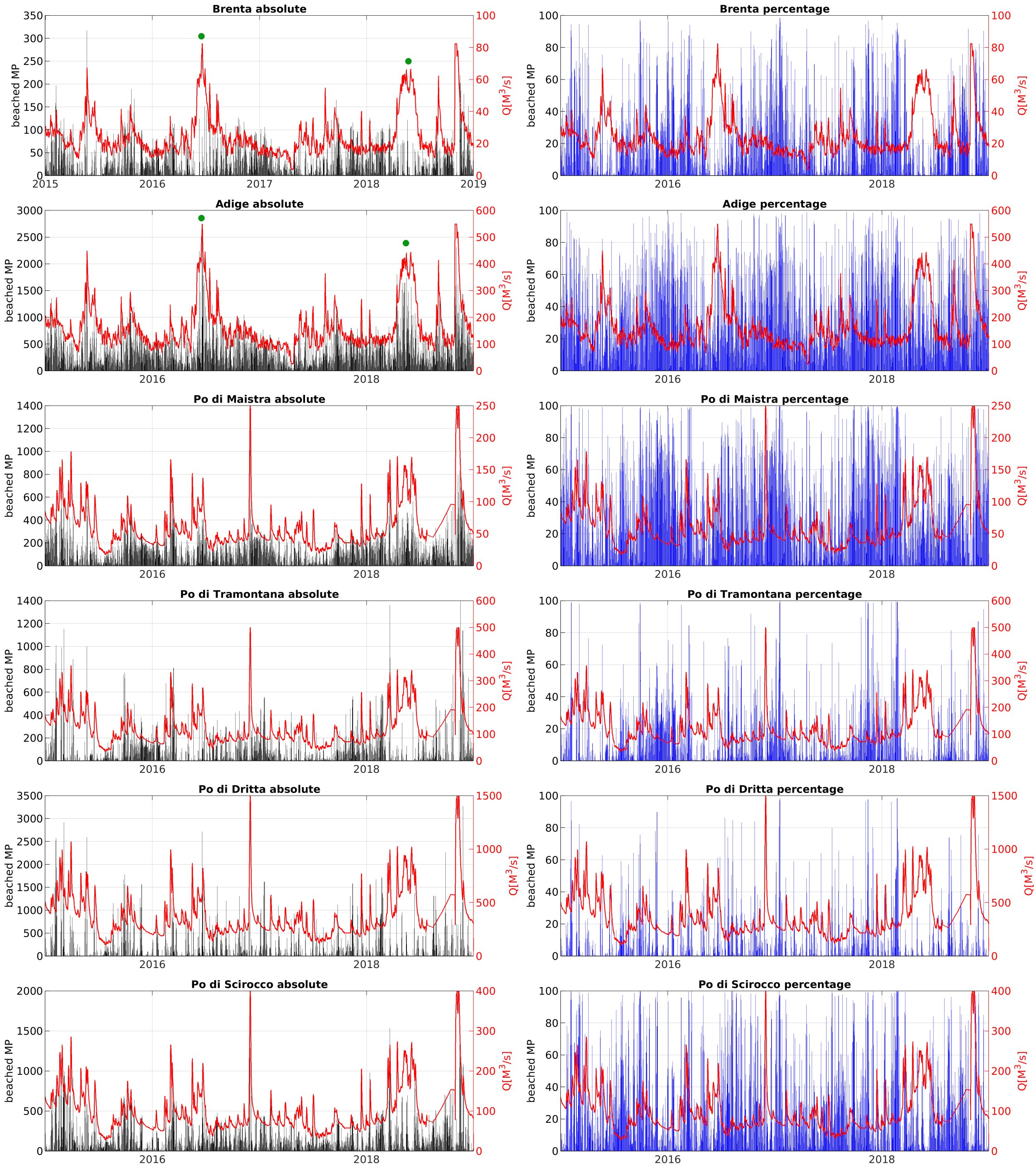



*Figure 2: PS1 – Po Delta absolute (right panels, black bars) and percent (left panels, blue bars) potential beaching. Each river average daily discharge is shown in red.*

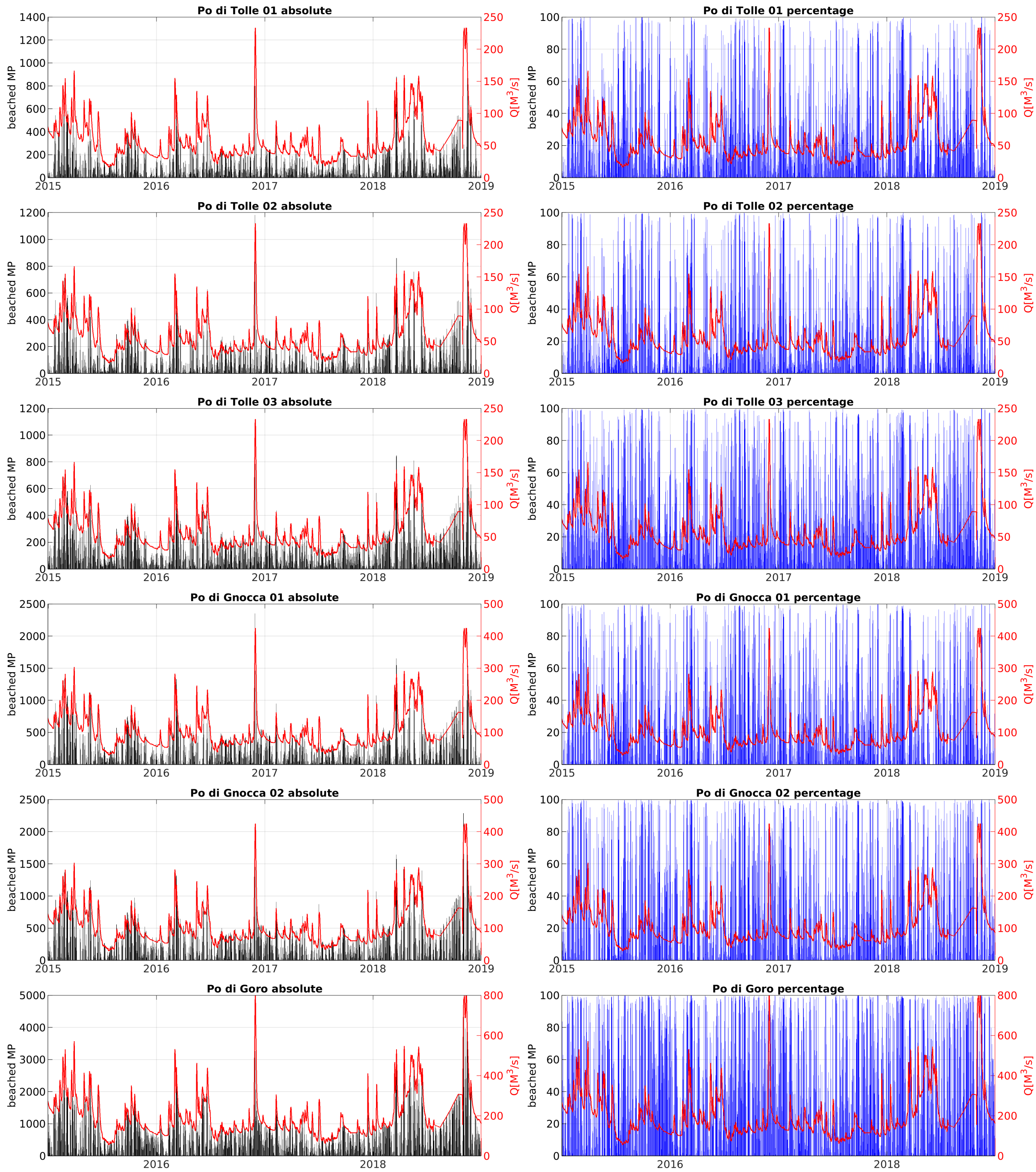



*Figure 3: PS1 – Po Delta absolute (right panels, black bars) and percent (left panels, blue bars) potential beaching. Each river average daily discharge is shown in red.*

green dots) but with the percentage of beached particles mostly affected by other factors than discharge (i.e. currents and local dynamics).
   - **Po di Maistra**: this mouth is located in the northern side of the delta and presents a similar behavior to the Adige.
- **Central delta:Po di Tramontana, Po di Dritta**: those are the three main branches of the Po river but and present the higher discharge rates and hence the higher inputs of microplastics. They are located at or very close to the tip of the delta which results in lower beaching values of the whole pilot site. Nevertheless during Bora events they can experience beaching percentages reaching almost 100%.
- **Southern mouths (Po di Scirocco, Po di Tolle, Po di Goro e Po di Gnocca)**: those mouths are all located along the southern edge of the delta and are exposed to the Western Adriatic current that flows along the coast. This configuration results in higher potential beaching both in magnitude and percentage.

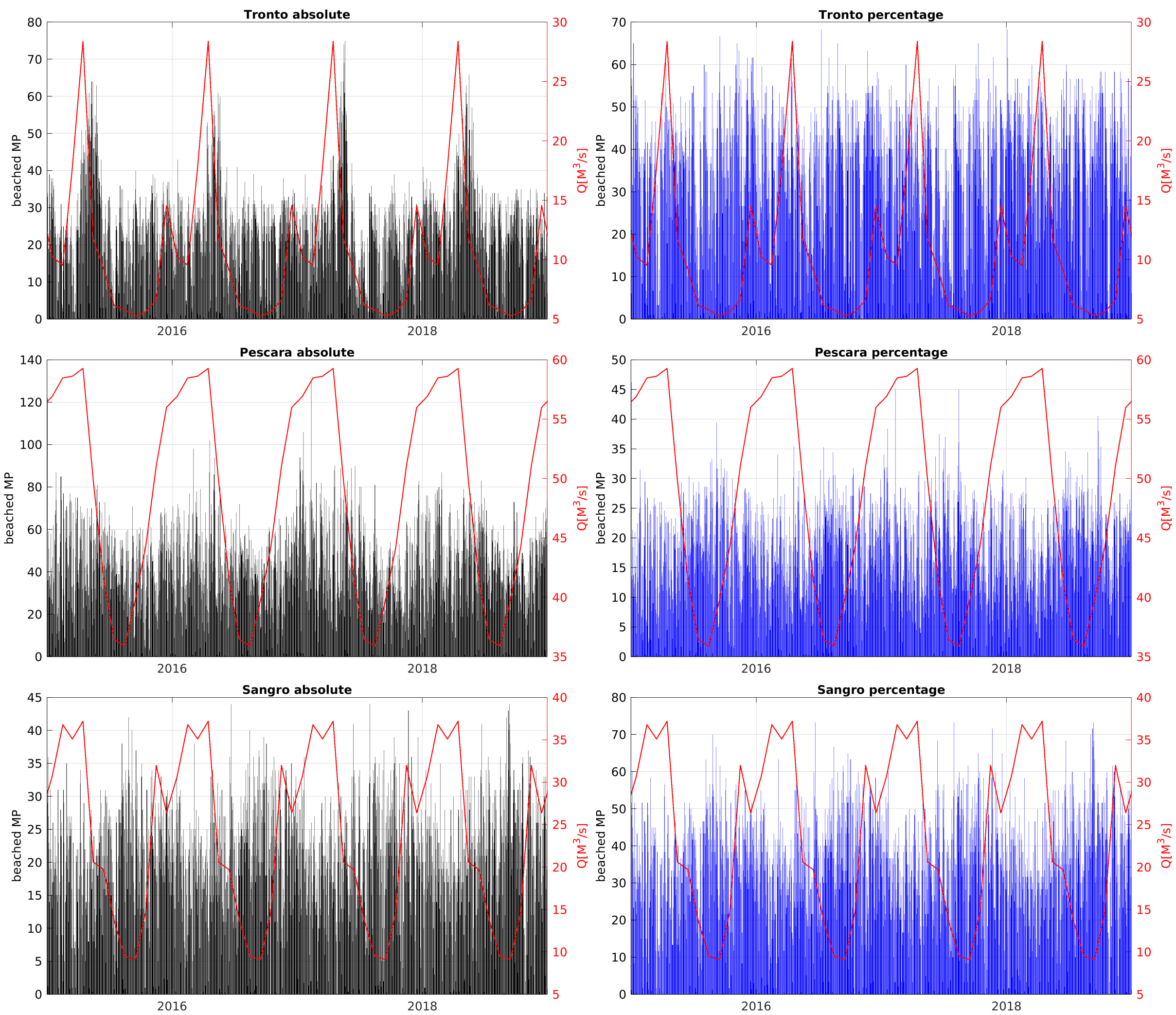
## 2.2 PS2 – Pescara

Figure 4 shows the daily average stream flow in $m^3/S$ for PS2 Pescara, the total number of potentially beached particles (black lines in the left panels) and their percentage computed over the whole released particles (blue lines in the right panels). For those rivers (Tronto, Pescara and Sangro) only climatological discharge values were available to force the simulations, hence the modeling results are somewhat impaired in considering the effects of daily variations in riverine discharges and beaching events will be more representative of the coastal current dynamics

The three rivers present a similar behavior with the absolute number of released microplastic particles that potentially beach closely following the river discharge, while the percent values have a more uniform distribution with most values ranging between 20 % and 40 % for the Prescara and Sangro and up to 60% for the Tronto River. IT is of interest to not how in absolute potential branching values the Tronto closely follows the riverine discharge. A fact that is hinting to a higher dependence on stream flow for this river potential beaching.

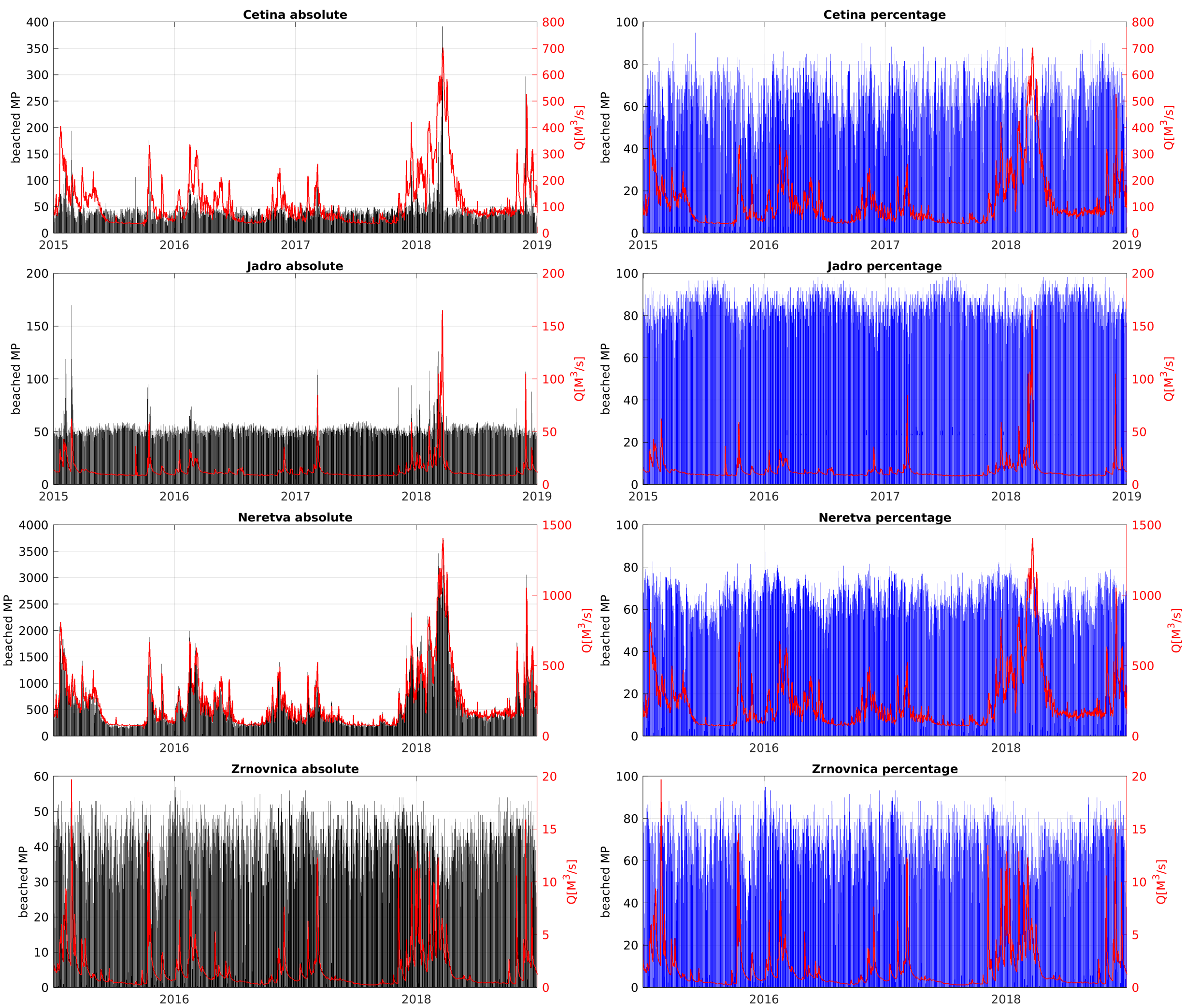
## 2.3 PS4– Split

Results for the Split Pilot Site (PS4) are shown in figure 5. As for the other PS the figure shows the daily average stream flow in $m^3/S$, the total number of potentially beached particles (black lines in the left panels) and their percentage computed over the whole released particles (blue lines in the right panels).




*potential beaching. Each river average daily discharge is shown in red.*

The most striking feature of this pilot site is that the percentage of beached particles is very high for all rivers considered, most of the time well above 50% and with peaks as high as 80%. In most case the absolute value of potentially beached microplastics follows very closely the river discharge values (this is especially clear for the Neretva rivers in which the absolute beaching follows almost exactly the river stream flow). This is mostly due to the presence of several islands inside the PS domain which




*beaching. Each river average daily discharge is shown in red.*

exponentially increase the coast line potentially at risk of beaching, if compared to the other PS.

When interpreting the results for this pilot site it has to be kept in mind that the minor rivers (Jadro, Cetina and Zrnovnica) often present discharge values below 15 m3/s. This was a threshold set in the PS implementation as the minimum value to compute the number of virtual microplastic released. Hence for most of the simulated period those rivers present a constant number of released particles.

# 3 Climatological analysis

The climatological analysis starts by computing the total percentage of potentially beached particle (calculated over the total number of microplastic released) on a yearly, seasonal and monthly way both as an aggregated and per mouth values.

## 3.1 PS1 – Po Delta

The climatological analysis for PS1 highlight the same grouping as those discussed in section 2.1. Results' plots are presented on a yearly (figure 6), seasonal (figure 7) and monthly base (figure18 ), the values for yearly and seasonal potential beaching are provided in appendix (table 1). The overall potential beaching on yearly base is 28% (figure 6, red column) and does not change significantly between seasons (ranging from 21.3 % for Summer months to 33% of Spring). The single mouths present a similar trend: lowest potential beaching during summer months and higher values during winter and/or Autumn (figure 7). As done for the event base analysis (section 2.1) the rivers in PS1 can be grouped into three different groups based on their position along the delta:

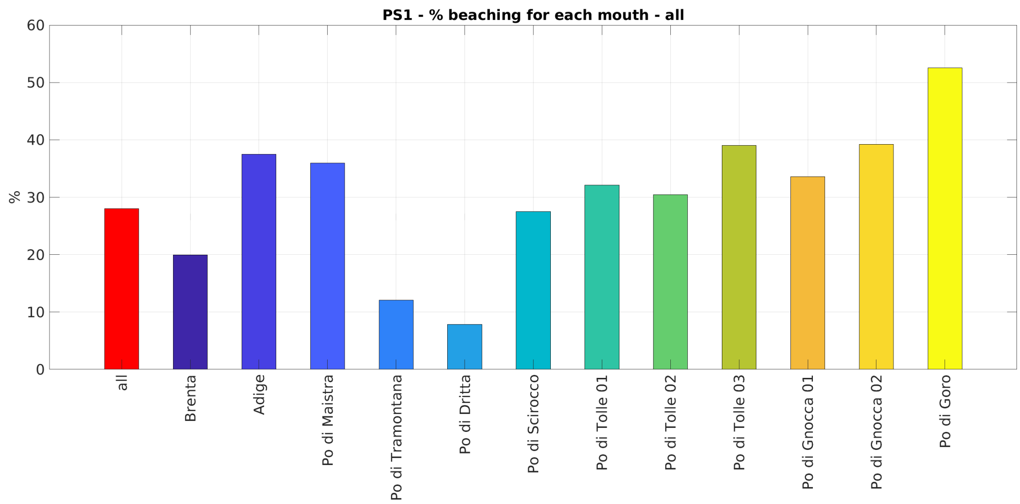



*Figure 6: PS1 – Po Delta. Percent of released particles that can potentially beach computed over the whole simulated per0i (2015–2018) for the whole pilot site (red bar) and for each river mouth.*

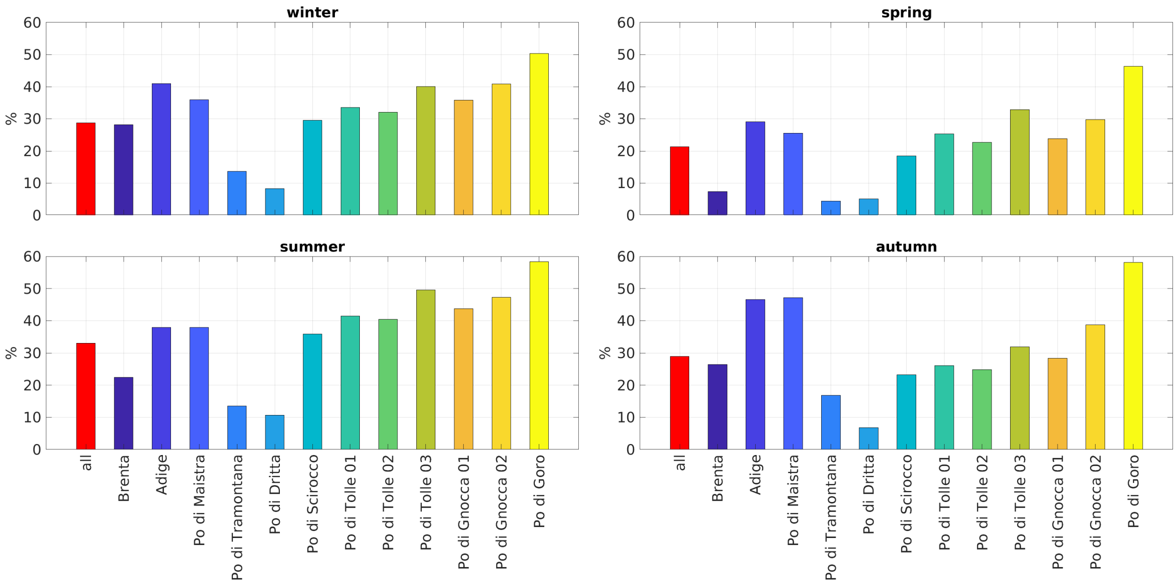



*Figure 7: PS1 – Po Delta. Seasonal percent of released particles that can potentially beach computed over the simulated period (2015–2018) for the whole pilot site (red bar) and for each river mouth.*

- Northern delta:
    - **Brenta**: it presents low values of potential beaching during summer (just 7.3 %) and values above 20% for the other seasons in contrast to the values of **Adige** and **Po di Maistra** that have higher percent of potential beaching throughout the year with smaller differences between seasons (always vales above 29 % and 25 % respectively).
- **Central delta:Po di Tramontana, Po di Dritta**: those present the lover potential beaching of the whole delta (values always below 16 %, and just of 4.1 and 5.1% in summer respectively) in spite of being the highest inputs.
- **Southern mouths (Po di Scirocco, Po di Tolle, Po di Goro e Po di Gnocca)**: inputs coming from those mouths are the one that are mostly subject to potential beaching with a yearly and seasonal values always higher than 30 % (up to 52.5 % of the Po di Goro).

The plots for monthly percentages can be found in appendix figure 18.

## 3.2 PS2 – Pescara

Results for the climatological analysis for PS2 – Pescara are shown in figure 8 (yearly values), figure 9 (seasonal values); monthly values plots and yearly and seasonal values are reported in appendix (respectively figure 19 and table 2).

In PS2 the overall percent of potentially beached particles is lower than PS1: 23.7% for the yearly value, and between 21.4% )winter) and 26.7% (Spring) for seasonal climatologies.

As for PS1 the single mouths can be grouped based on the coastline morphology and their respective potential impacts:

- **Tronto and Sangro**: those rivers present a coastline with an orientation similar to the coast just south of the Adige river and also have similar potential beaching values ranging from 34.1 % to 39.1% for the Tronto, and from 30.1% to 39.2% for the Sangro river.
- **Pescara:** the Pescara river mouth is located on a protruding part of the coastline, in a smaller scale but similar morphology of the tip of the Po Delta. The percent values of this mouth are much smaller than the other rivers of the Pilot site (between 16.1% in winter and 19.9% in summer).

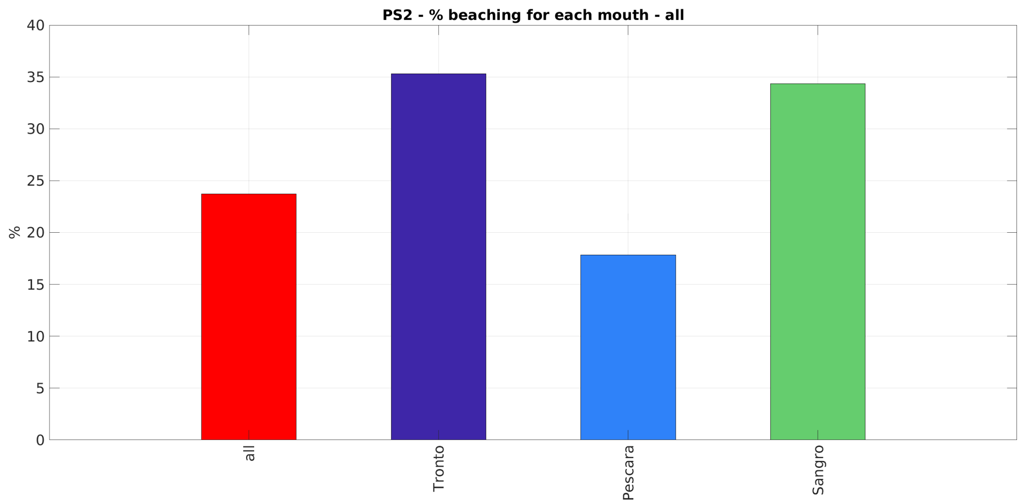



*Figure 8: PS2 – Pescara. Percent of released particles that can potentially beach computed over the whole simulated period (2015–2018) for the whole pilot site (red bar) and for each river mouth.*

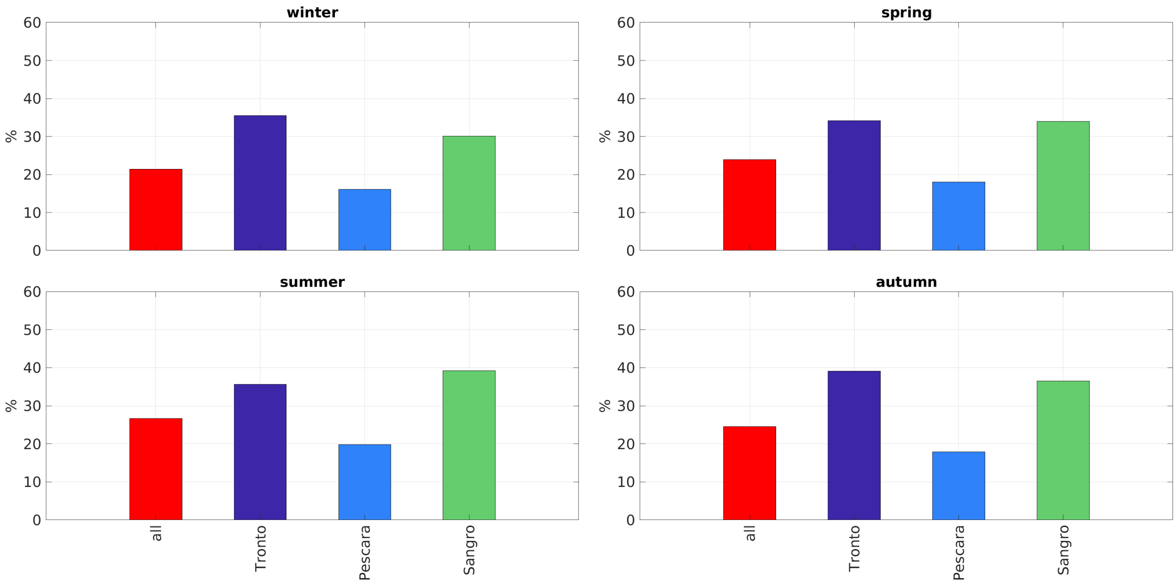



*Figure 9: PS2 – Pescara. Seasonal percent of released particles that can potentially beach computed over the whole simulated period (2015-2018) for the whole pilot site (red bar) and for each river mouth.*

## 3.3 PS4– Split

The plots of the climatological analysis for PS4 – Pescara on a yearly and seasonal base are respectively shown in figures 10 and 11; in appendix are reported the monthly values plots (figure 20)and yearly and seasonal values (table 3).

The percentage of potential beaching in PS4 is strongly affected by the peculiar morphology of the site coastline. The area is characterized by the presence of several islands that increase significantly the coastline extension and the potential beaching areas. This results in overall potential beaching percentages of 66.4 % for the yearly climatology and always above 63.4 % for seasonal ones. The disaggregated analysis for Cetina, Neretva and Zrnovnica present similar values. A separate case is the smaller Jadro River. This river mouth is located in the Gulf of Split in the northernmost area of PS4. The lower exchanges with the rest of the basin result in much higher percentages of potential beaching always above 81.7 % (autumn) with the highest value in Spring (87.4%).

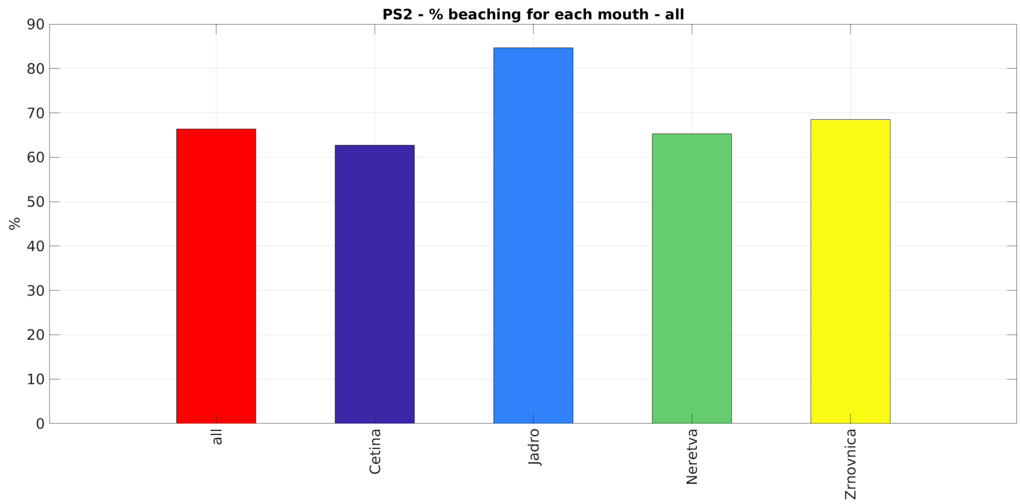
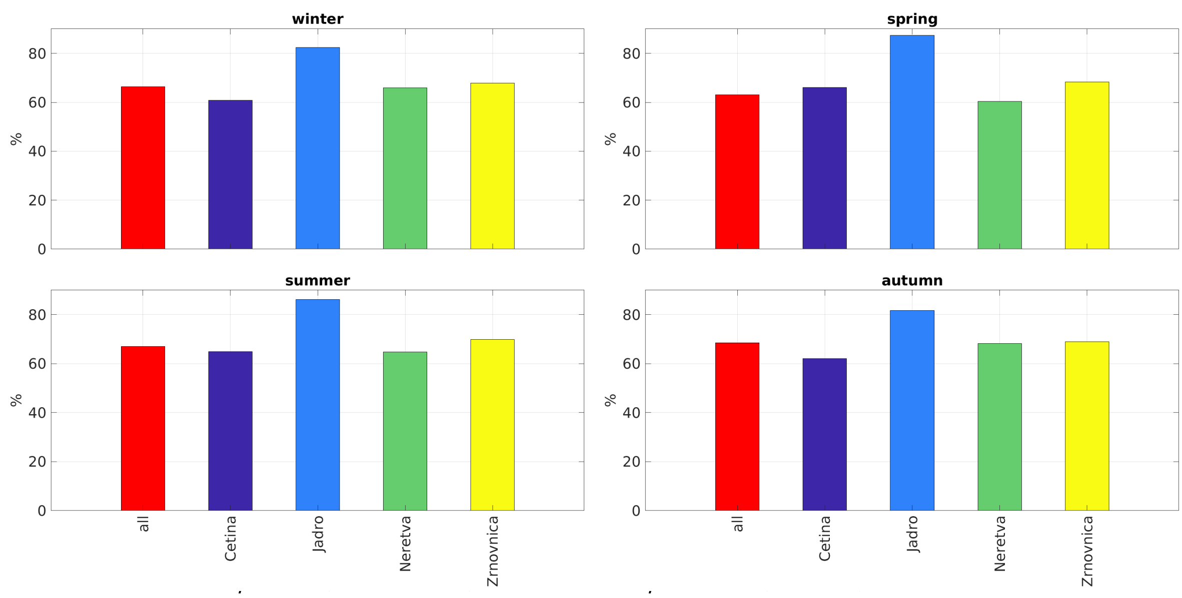



*Figure 10: PS4 – Split. Percent of released particles that can potentially beach computed over the whole simulated period (2015–2018) for the whole pilot site (red bar) and for each river mouth.*



### 3.4 PSB – Adriatic

Figure 12 and figure 13 show the percentage of potential branching for each of the rivers implemented for Pilot Site 4 – Adriatic (monthly values and data table are shown in appendix in figure 21 and 22 and table 4 respectively). The Adriatic sea comprehends different types of coasts that can be subjected to significantly different dynamics hence the overall potential beaching, that reaches almost 60% for the overall and seasonal values, is less significant than the values computed for each individual river. As in PS4 the Neretva presents values higher than 90% in all considered periods. This is an higher evaluation than the one computed based on the PS4 simulations, but can be explained by the fact that PS4 Lagrangian model tracked each particle for a 20 days period, giving them time to beach over the whole basin and not only inside the smaller pilot site area.
The rivers of the Northern Adriatic (Isonzo, Tagliamento, Piave, Brenta) all present very similar values with a beaching probability of about 70%. In those simulations the Brenta potential beanching is higher than the one computed with PS1 simulations. This partially connected to the fact that in PS1 the Brenta mouth was located very close to the boundary of the model domain. The Po river branches percentages are in line with those computed in PS1 and present lower values for the Northern and Central part of

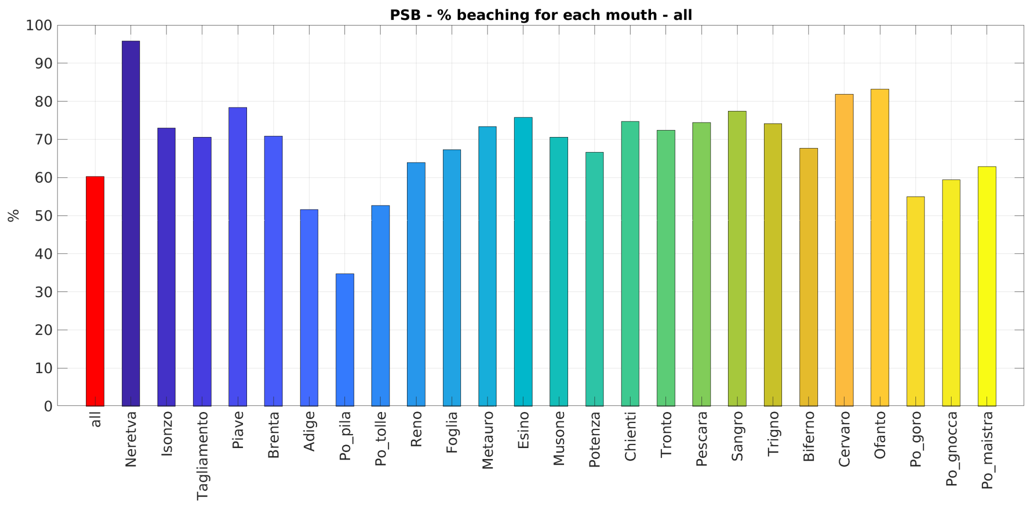



*Figure 12: PSB – Adriatic. Percent of released particles that can potentially beach computed over the whole simulated period (2015-2018) for the whole pilot site (red bar) and for each river mouth.*

the delta (Po di Maistra, Po di Pila and Po di Tolle) and higher values for the southern part of the Delta ( Po di Goro, Po di Gnocca).

The rivers of the southern Adriatic (Reno, Foglia, Metauro, Esino, Musone, Potenza, Chienti, Tronto, Pescara, Sangro, Trigno, biferno, Cervaro and Ofanto) have all similar potential beaching values between 60% and 80% (with higher values for the southernmost rivers).

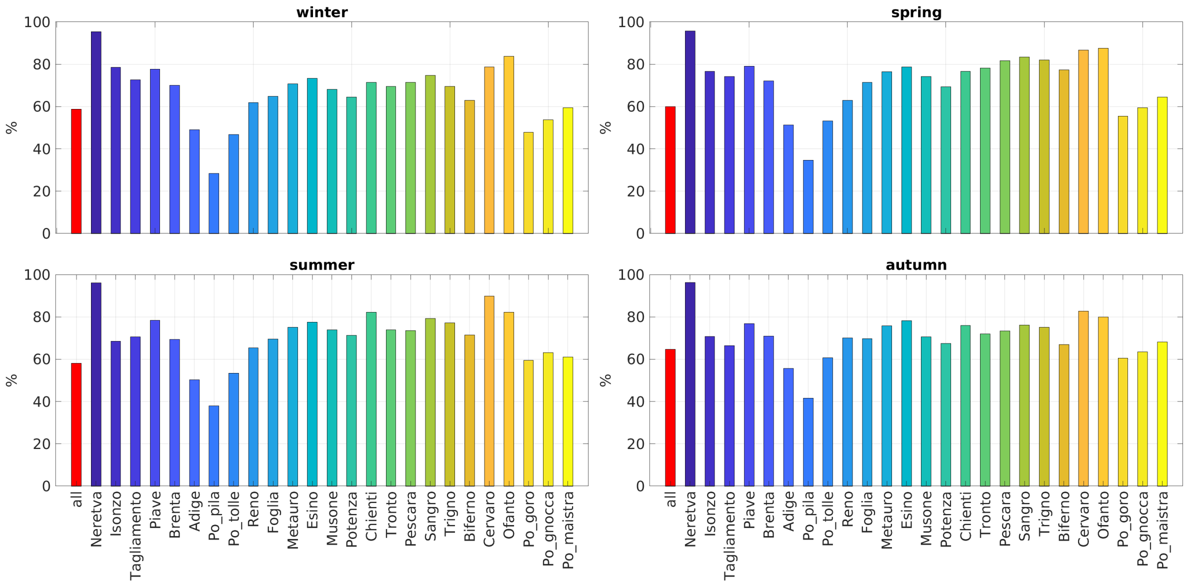



*Figure 13: PSB – Adriatic. Seasonal of released particles that can potentially beach computed over the whole simulated period (2015–2018) for the whole pilot site (red bar) and for each river mouth.*

# 4 Accumulation maps

Starting from the Lagrangian simulations for each pilot site a series of accumulation maps have been computed as described in NET4mPLASTIC deliverable D4.3.1 and 4.3.2. This analysis has been performed based on a yearly, seasonal, monthly and daily climatological intervals. The yearly and seasonal maps will be shown and discussed in this deliverable while the monthly will not be discussed since they represent a level of detail that goes beyond the scope of the deliverable. Nevertheless the monthly maps are available on the Regione Marche server for use inside the project. Daily maps will be the focus of deliverable 4.3.3.

## 4.1 PS1 – Po Delta

The yearly (figure 14) potential accumulation of microplastic (expressed as the percentage of microplastics released from rivers that potentially beach) in the Po delta closely follows the average circulation (characterized by the presence of the Western Adriatic Current - WAC) of the area that flows along the coast of the Delta. Three main areas of potential accumulation can be found:

- the coast just south of the Adige river which is impacted only by microplastic coming from the Adige itself and the Brenta.
- The southern inlet of the Scardovari lagoon: this accumulation site is mostly connected to the presence of the lagoon inlet and the conformation of the reference grid in the area
- the coast between Lido di Volano and Porto Garibaldi: this area results to be the one at risk of the higher impacts and receives microplastics coming mostly form the Po di Goro mouth but also from all the southern delta branches of the Po river.

A secondary accumulation site can be identified between the three mouths of the Po di Tolle due to the local circulation that traps part of the released microplastics between the mouths.

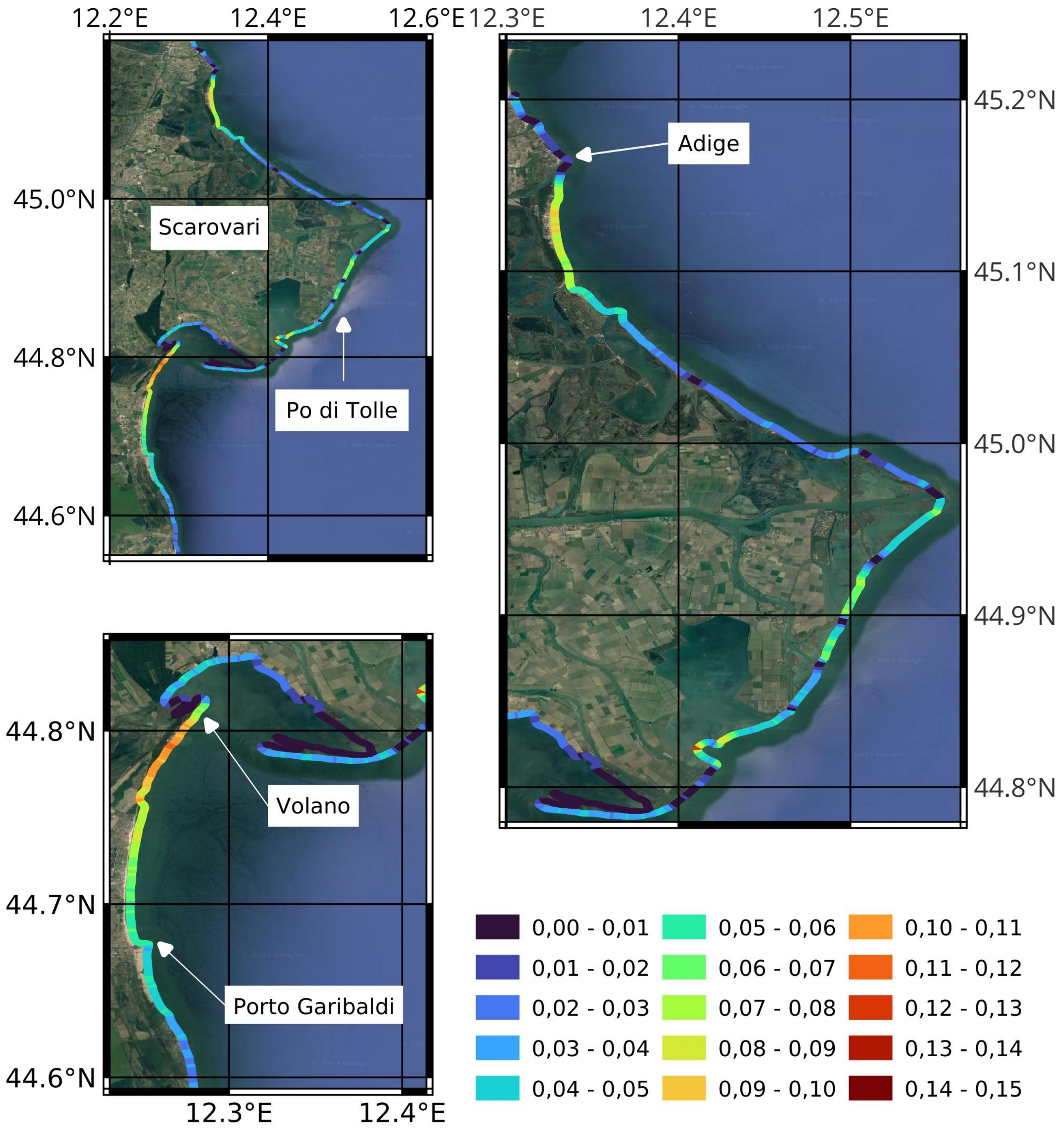



*Figure 14: PS1 – Po Delta. Percentage of potentially beached particles computer over the whole particles released.*

It is of interest to note how each river mouth is clearly visible in the distribution of potential beaching with values of 0. This is due to the fact that in the modeling chain implementation it is not possible for particles to beach.

Seasonal distribution of potential beaching can be found in appendix figures 23, 24, 25 and 26 and will not be discussed here since the sites of potential accumulation are the same as those of the yearly climatology, just with different magnitudes.

## 4.2 PS2 – Pescara

Potential accumulation for PS2 – Pescara on a yearly base is shown in figure 15, seasonal maps are shown in appendix (figures 27 and 28). The PS2 – Pescara coastline is rather simple with a continuous stretch of coast that goes from north-west to south-east without any significant topographical feature that could impact the potential distribution of microplastics of riverine origin.

As for PS1 the potential accumulation on a yearly base is mostly driven by the presence of the WAC that drives most of the released microplastics southward from each river mouths. Two main accumulation sites can be found in the coast south than Tronto and Sangro. The Pescara rivers present higher values right near the river mouth but lower impacts along the coast. This can be considered as a result of the position of the Pescara mouth that pushes most of the released microplastics toward the open ocean. Seasonal (figures 27 and 28) distribution present the same features just with different magnitude depending on the season.

## 4.3 PS4 – Split

PS4 – Split potential accumulation rates are shown in figure 16 for yearly values and in appendix figures 29, 30, 31 and 32 for seasonal values. PS4 presents a more complicated distribution due to the presence of several islands and gulfs. The main contributor of microplastics is the Neretva river whose impacts can be seen with high values of potential beaching all along the Paljesac peninsula, on the southern coast of the island of Hvar, along he coast of Omis (where also the Cetina river can has a significant impact) and to a lesser degree on the southern and northern coasts of the

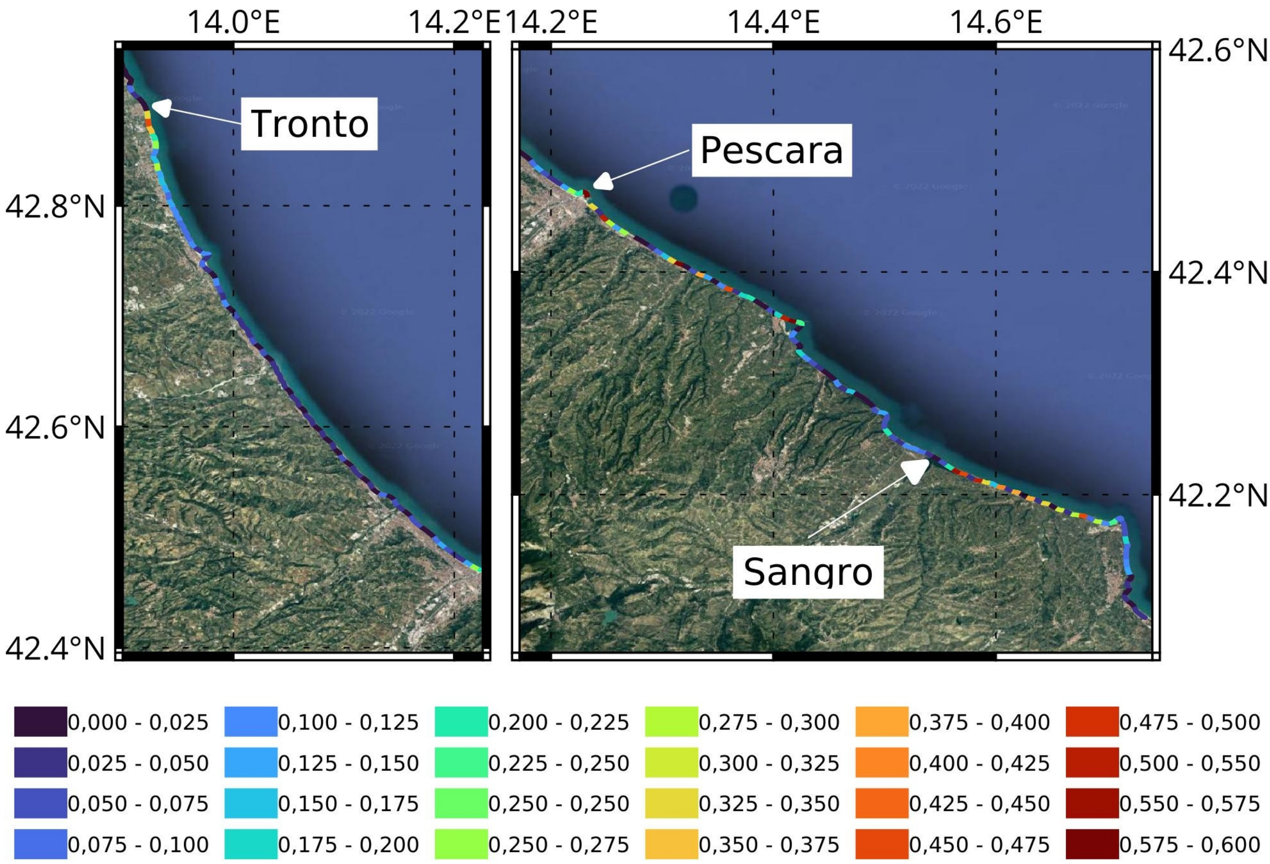


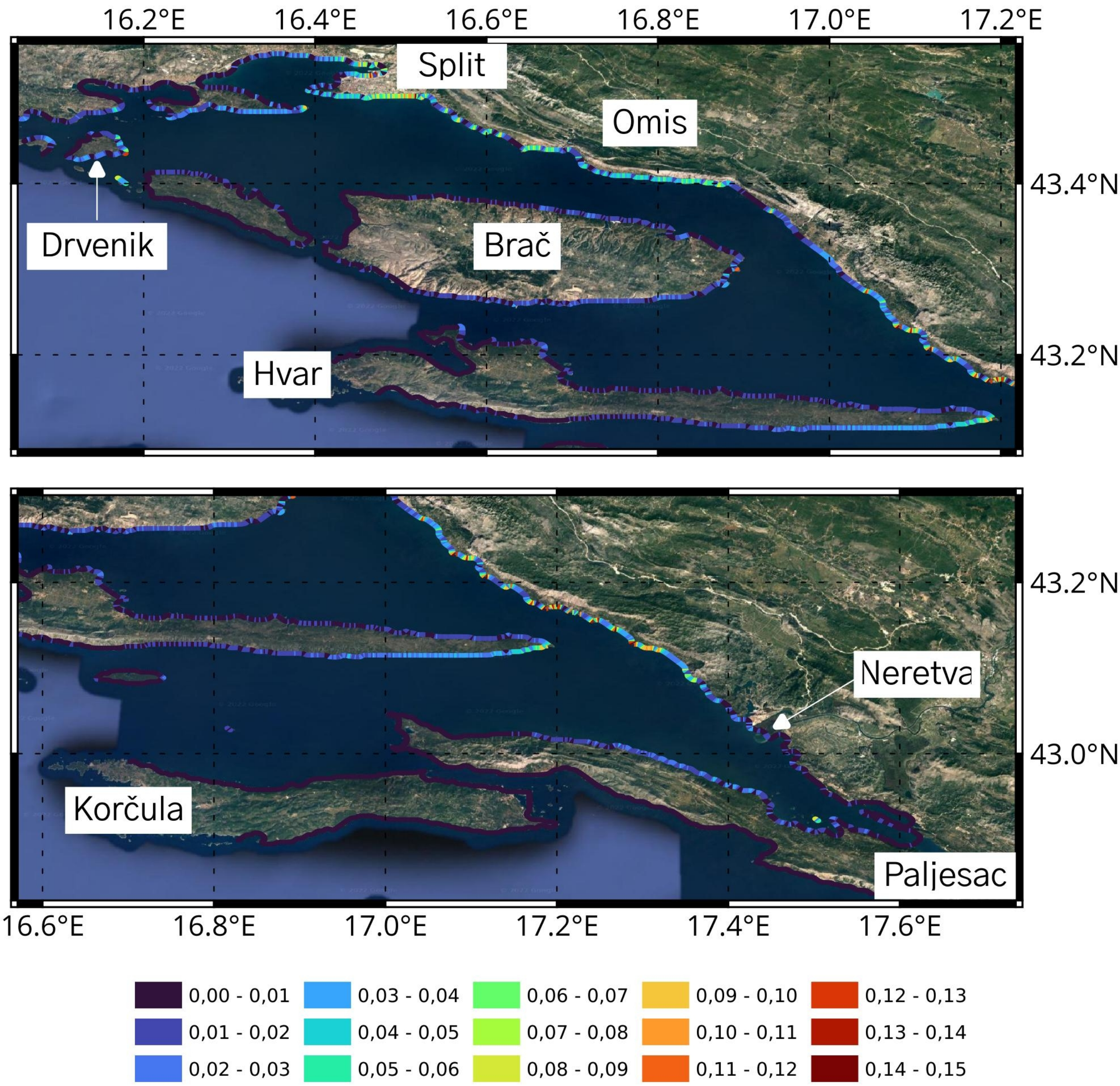

*Figure 15: PS2 – Pescara. Percentage of potentially beached particles computer over the whole particles released. The PS maps has been split in two parts (northern coast on left panel) and southern coast in right panel) to provide a better visualization.*

island of Brač. The coast south Split is the main accumulation site since it can receive microplastics coming from all the river present in the pilot site while coast inside the gulf of Split are mostly impacted by the Jadro river.

The presence of the islands is a fundamental driver of the potential beaching in PS4 and results in much higher beaching percentages if compared to other pilot sites, even the outermost islands inside the domain can be significantly impacted. An example of this is the small island of Drevenik that is located on the northwestern corner of the model domain and relatively far away from all riverine mouths but that nevertheless present high percentages of potential accumulation.

## 4.4 PSB – Adriatic

PS4 – Adriatic numerical results can provide a general description of the potential impacts of microplastics of riverine origin at a basin wide scale. When interpreting those



results it has to be kept in mind that the hydrodynamical model used for those simulation has a much lower resolution than the other pilot sites (1 km compared to 100 m for PS1 and 400m for PS2 and PS4) hence the coastal processes that drives microplastics dynamics are resolved only on a rough scale.

The yearly potential accumulation percentage is shown in figure 8 (seasonal plots are provided in appendix, figures 33, 34, 35 and 36. Those results can be divided into 4 main groups:

- The Po Delta as expected it presents the highest values for potential accumulation in line with what shown by PS1 simulations.
- The Dalmatian coast and islands where is clearly visible the influence of the Neretva river (it has to be kept in mind that the Neretva is the only source of microplastics used in that area to be consistent with the Regione Marche Oil Spill model implementation).
- The northern coasts of the Adriatic marked by the presence of several rivers that results in a diffuse risk of accumulation along the whole northern coats.
- The western coast where the potential beaching is mostly limited to areas close to each river mouth.

Apart from Dalmatia, the numerical results show that most of the Eastern Adriatic coast do not present any potential beaching. This is due to the fact that no source of microplastic (with the exception of the Neretva) was implemented in this area due to the lack of needed data. Hence those low values of accumulation are connected to the limits of the implementation and do not represent a real condition.

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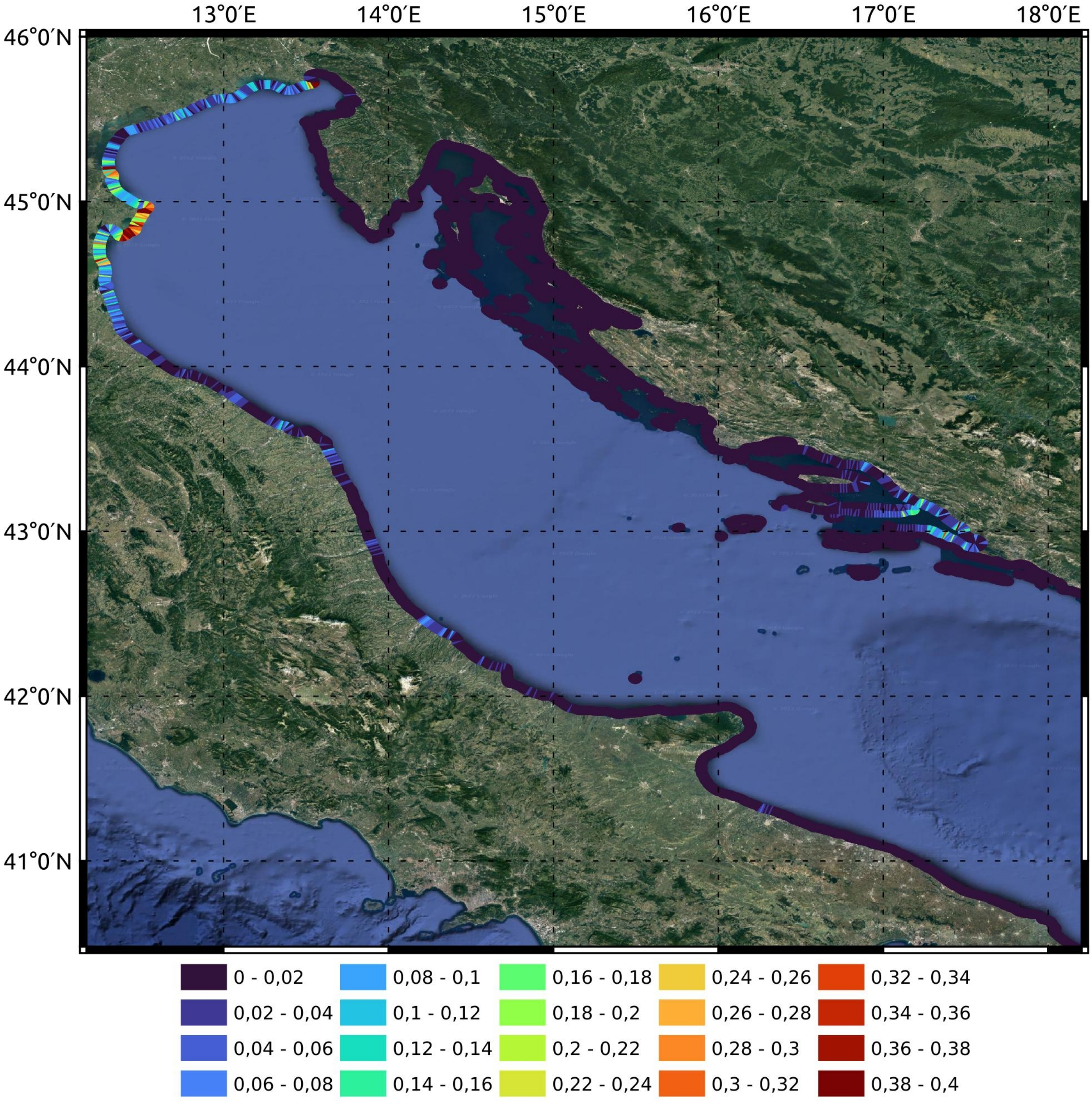


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er, 577p., ISBN: 978-1-4020-3981-2.

# 6 Appendix

*Table 1: PS1 – Po Delta. Potential beaching as percent of released particles.*

| | all | winter | spring | summer | autumn |
|---|---|---|---|---|---|
| all | 28.0 | 28.7 | 21.3 | 33.0 | 28.9 |
| Brenta | 19.9 | 28.1 | 7.3 | 22.4 | 26.4 |
| Adige | 37.5 | 41.0 | 29.0 | 37.9 | 46.6 |
| Po di Maistra | 35.9 | 35.9 | 25.5 | 37.9 | 47.2 |
| Po di Tramontana | 12.1 | 13.6 | 4.4 | 13.6 | 16.9 |
| Po di Dritta | 7.8 | 8.3 | 5.1 | 10.6 | 6.8 |
| Po di Scirocco | 27.5 | 29.6 | 18.4 | 35.8 | 23.2 |
| Po di Tolle 01 | 32.1 | 33.5 | 25.3 | 41.4 | 26.1 |
| Po di Tolle 02 | 30.4 | 32.1 | 22.7 | 40.4 | 24.8 |
| Po di Tolle 03 | 39.0 | 40.0 | 32.8 | 49.5 | 31.9 |
| Po di Gnocca 01 | 33.6 | 35.8 | 23.8 | 43.7 | 28.3 |
| Po di Gnocca 02 | 39.2 | 40.9 | 29.8 | 47.3 | 38.7 |
| Po di Goro | 52.5 | 50.3 | 46.4 | 58.3 | 58.1 |

*Table 2: PS2 – Pescara. Potential beaching as percent of released particles.*

| | all | winter | spring | summer | autumn |
|---|---|---|---|---|---|
| all | 23.7 | 21.4 | 23.9 | 26.7 | 24.5 |
| Tronto | 35.3 | 35.5 | 34.1 | 35.6 | 39.1 |
| Pescara | 17.8 | 16.1 | 18.0 | 19.9 | 17.9 |
| Sangro | 34.4 | 30.1 | 34.0 | 39.2 | 36.5 |

*Table 3: PS4 – Split. Potential beaching as percent of released particles.*

| | all | winter | spring | summer | autumn |
|---|---|---|---|---|---|
| **all** | 66.4 | 66.4 | 63.1 | 67.1 | 68.6 |
| **Cetina** | 62.7 | 60.9 | 66.1 | 64.9 | 62.0 |
| **Jadro** | 84.6 | 82.5 | 87.4 | 86.1 | 81.7 |
| **Neretva** | 65.3 | 65.9 | 60.4 | 64.8 | 68.2 |
| **Zrnovnica** | 68.5 | 67.9 | 68.3 | 69.9 | 68.9 |

*Table 4: PSB – Adriatic. Potential beaching as percent of released particles.*

| | all | winter | spring | summer | autumn |
|---|---|---|---|---|---|
| all | 60.3 | 58.7 | 60.0 | 58.1 | 64.8 |
| Neretva | 95.8 | 95.4 | 95.7 | 96.2 | 96.3 |
| Isonzo | 73.0 | 78.6 | 76.6 | 68.4 | 70.8 |
| Tagliamento | 70.5 | 72.6 | 74.2 | 70.6 | 66.4 |
| Piave | 78.3 | 77.6 | 79.1 | 78.3 | 76.8 |
| Brenta | 70.9 | 70.1 | 72.1 | 69.4 | 71.0 |
| Adige | 51.6 | 49.1 | 51.3 | 50.3 | 55.6 |
| Po di Maistra | 62.9 | 59.5 | 64.5 | 61.1 | 68.1 |
| Po di Pila | 34.7 | 28.3 | 34.6 | 37.9 | 41.6 |
| Po di Tolle | 52.7 | 46.7 | 53.2 | 53.4 | 60.6 |
| Po di Goro | 54.9 | 47.9 | 55.5 | 59.5 | 60.5 |
| Po di Gnocca | 59.4 | 53.8 | 59.5 | 63.0 | 63.5 |
| Reno | 63.9 | 61.8 | 62.9 | 65.4 | 70.0 |
| Foglia | 67.3 | 64.8 | 71.4 | 69.5 | 69.7 |
| Metauro | 73.3 | 70.7 | 76.4 | 75.1 | 75.8 |
| Esino | 75.7 | 73.4 | 78.6 | 77.6 | 78.1 |
| Musone | 70.6 | 68.2 | 74.2 | 73.9 | 70.6 |
| Potenza | 66.7 | 64.5 | 69.3 | 71.2 | 67.5 |
| Chienti | 74.7 | 71.4 | 76.6 | 82.3 | 75.9 |
| Tronto | 72.4 | 69.6 | 78.2 | 73.9 | 72.0 |
| Pescara | 74.4 | 71.5 | 81.7 | 73.6 | 73.3 |
| Sangro | 77.4 | 74.7 | 83.5 | 79.3 | 76.1 |
| Trigno | 74.2 | 69.5 | 82.0 | 77.1 | 75.1 |
| Biferno | 67.7 | 62.9 | 77.4 | 71.5 | 66.9 |

| | | | | | |
|---|---|---|---|---|---|
| **Cervaro** | 81.8 | 78.8 | 86.8 | 89.8 | 82.7 |
| **Ofanto** | 83.2 | 83.8 | 87.6 | 82.2 | 79.9 |


*Figure 18: PS1 – Po Delta. Monthly percent of released particles that can potentially beach computed over the whole simulated period (2015–2018) for the whole pilot site (red bar) and for each river mouth*

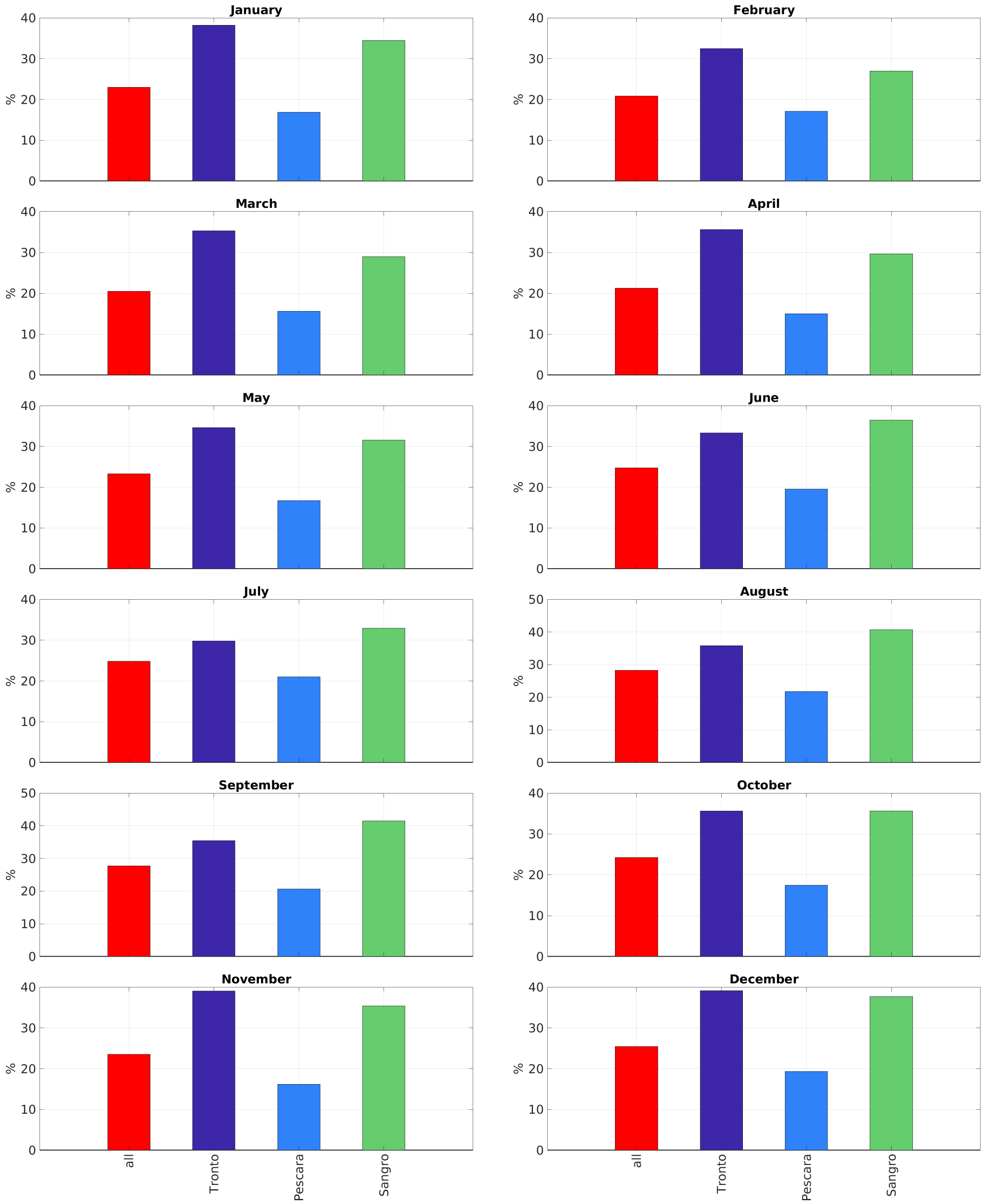


*Figure 19: PS2 – Pescara. Monthly percent of released particles that can potentially beach computed over the whole simulated period (2015–2018) for the whole pilot site (red bar) and for each river mouth.*

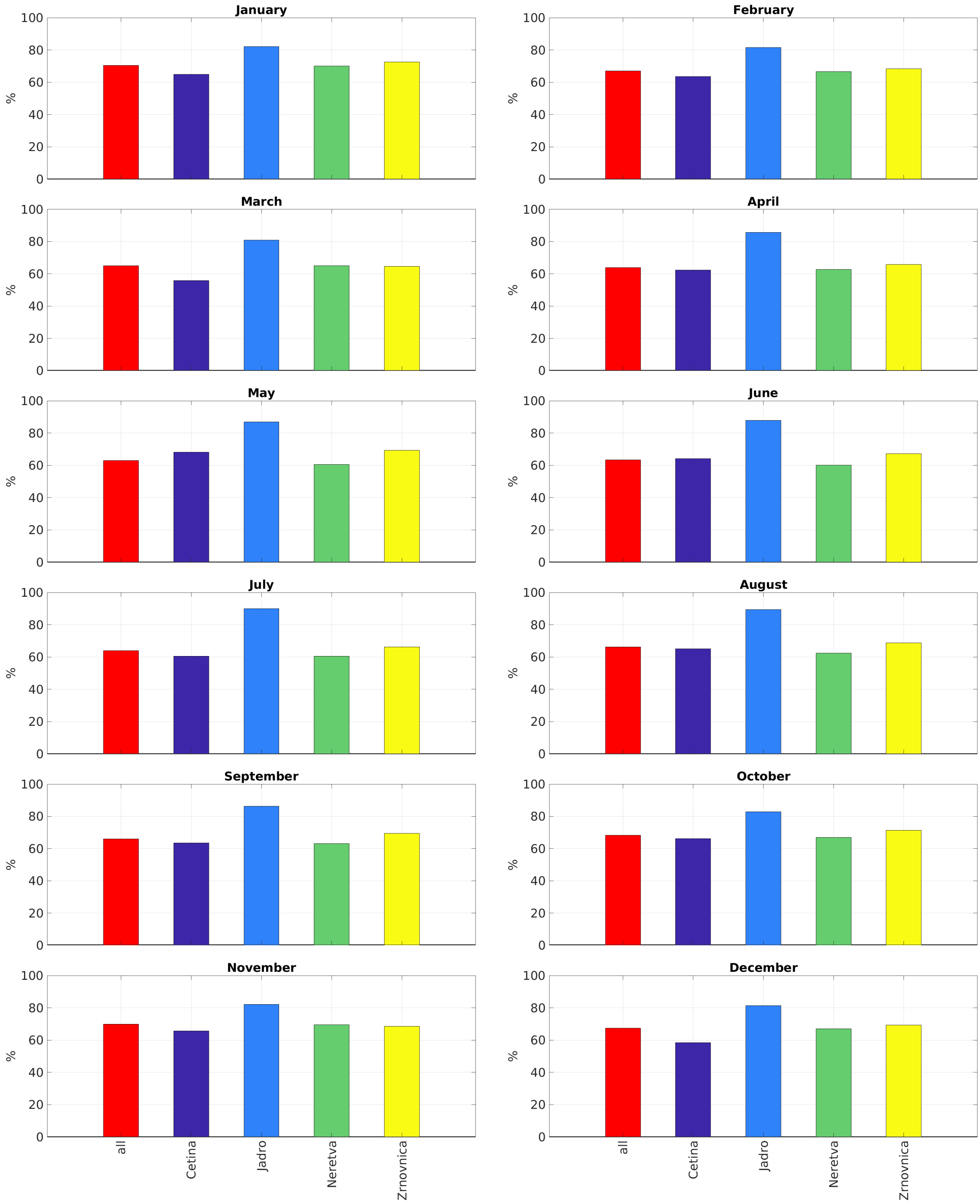


*Figure 20: PS4 – Split. Monthly of released particles that can potentially beach computed over the whole simulated period (2015–2018) for the whole pilot site (red bar) and for each river mouth.*

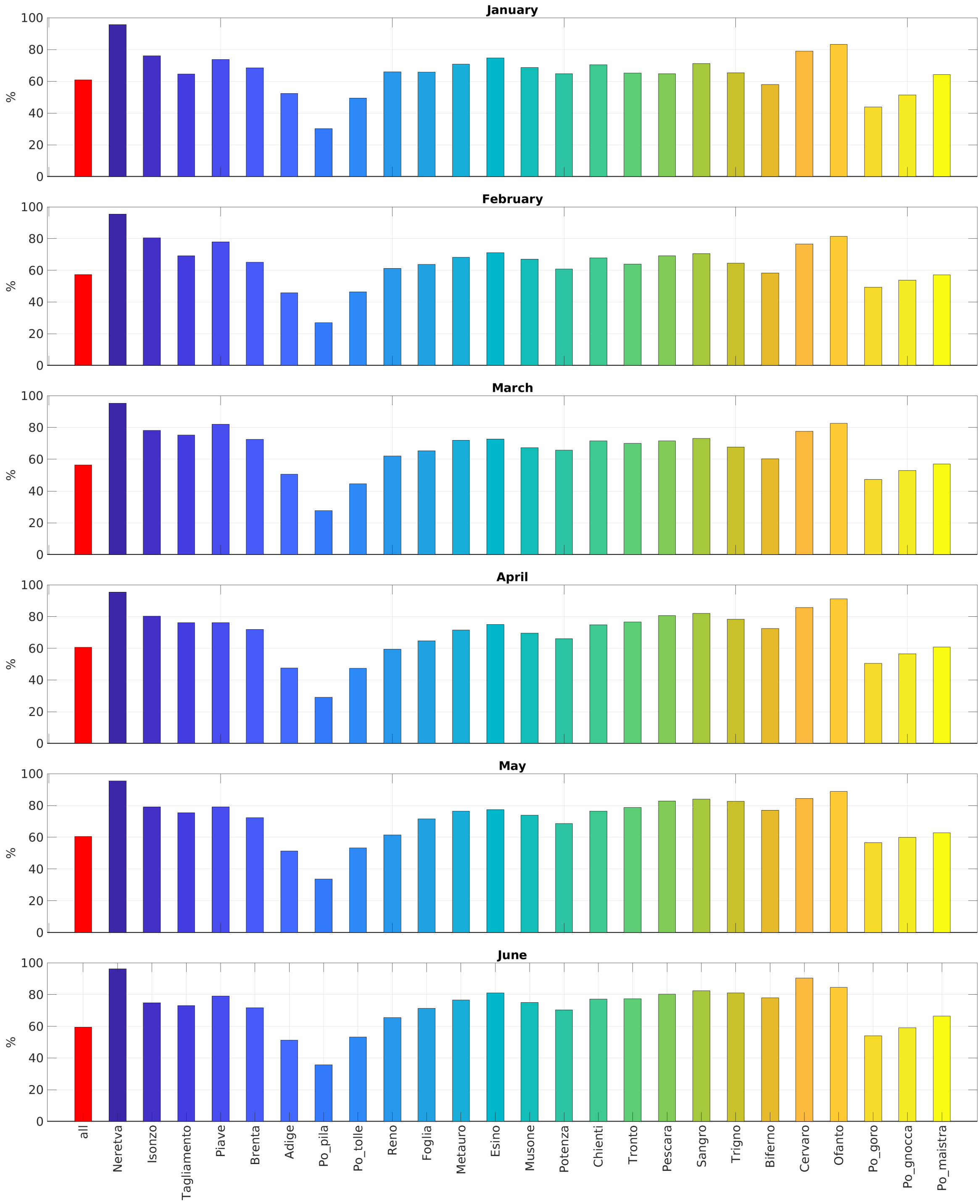


*Figure 21: PSB – Adriatic. Monthly (January–June) of released particles that can potentially beach computed over the whole simulated period (2015–2018) for the whole pilot site (red bar) and for each river mouth.*

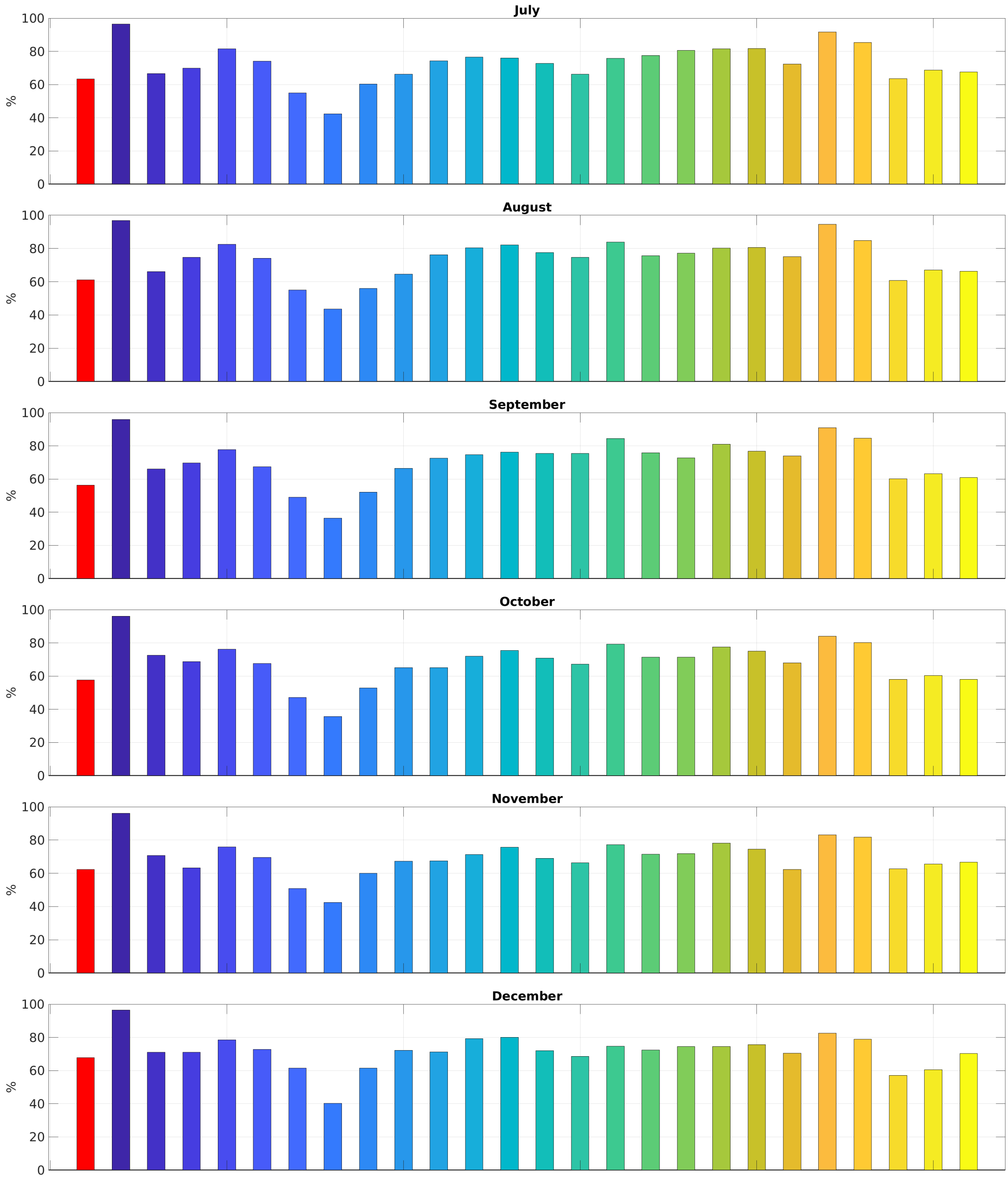


*Figure 22: PSB – Adriatic. Monthly (July–December) of released particles that can potentially beach computed over the whole simulated period (2015–2018) for the whole pilot site (red bar) and for each river mouth.*

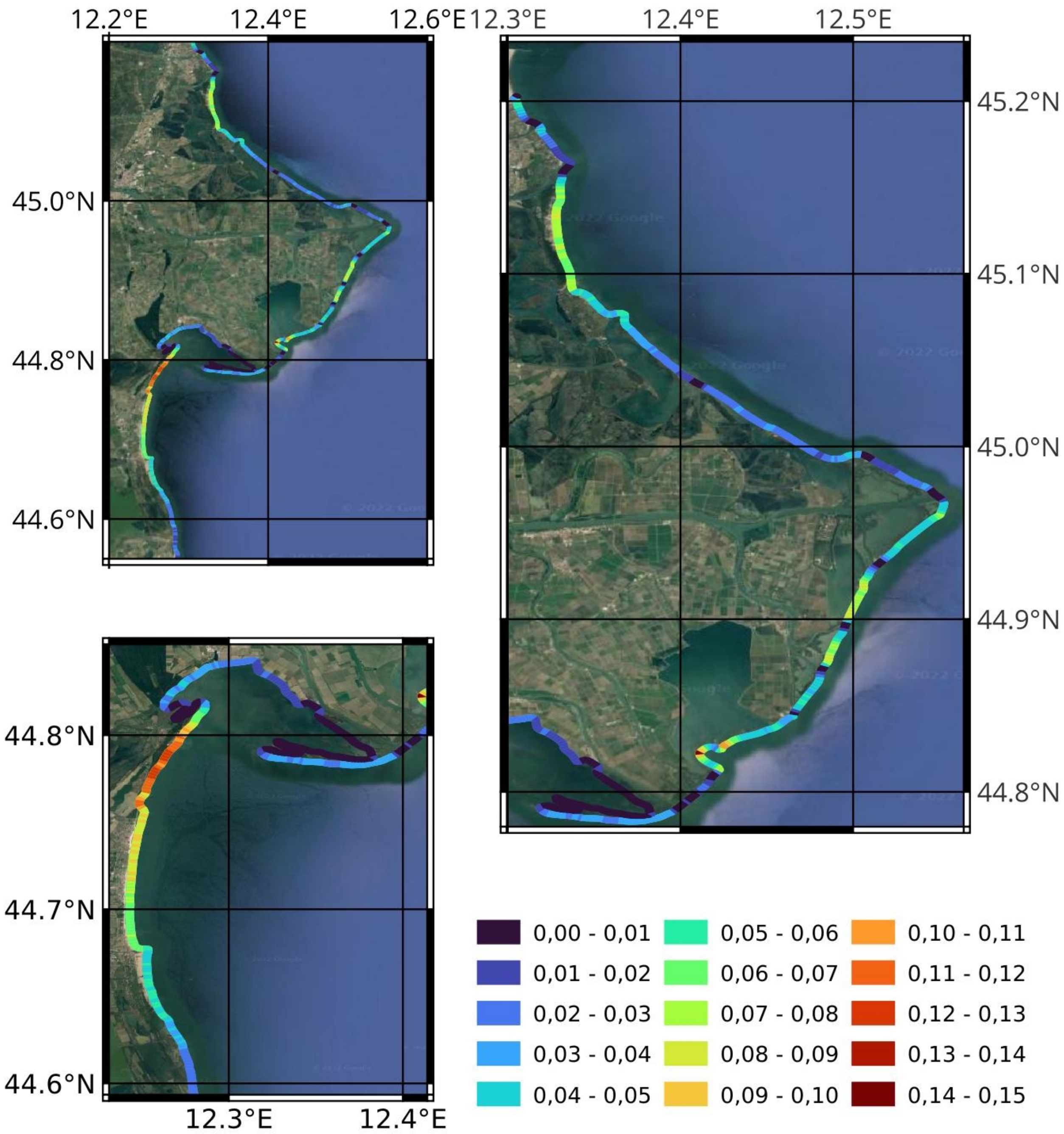


*Figure 23: PS1 – Po Delta. Winter percentage of potentially beached particles computer over the whole particles released.*

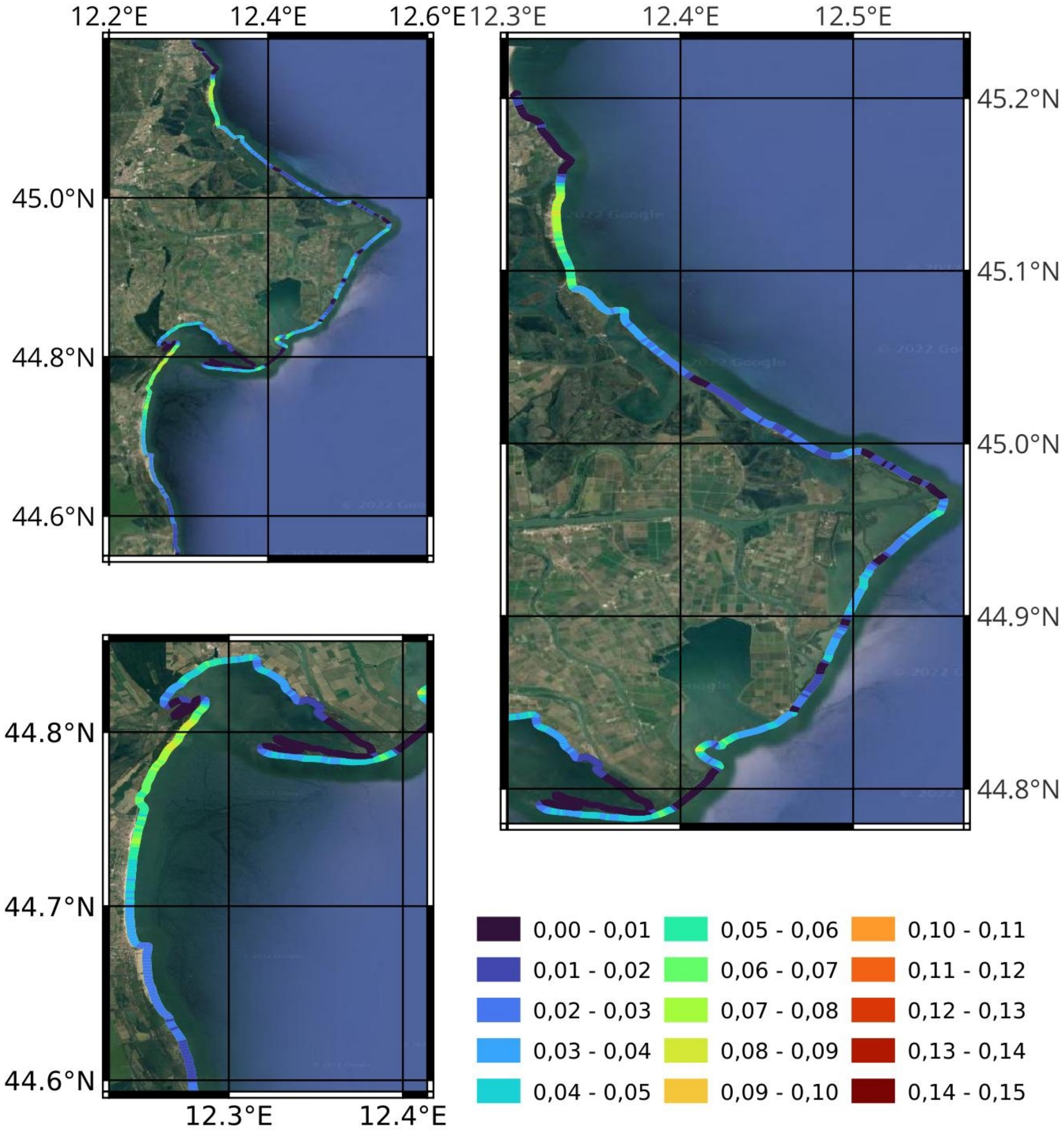


*Figure 24: PS1 – Po Delta. Spring percentage of potentially beached particles computer over the whole particles released.*

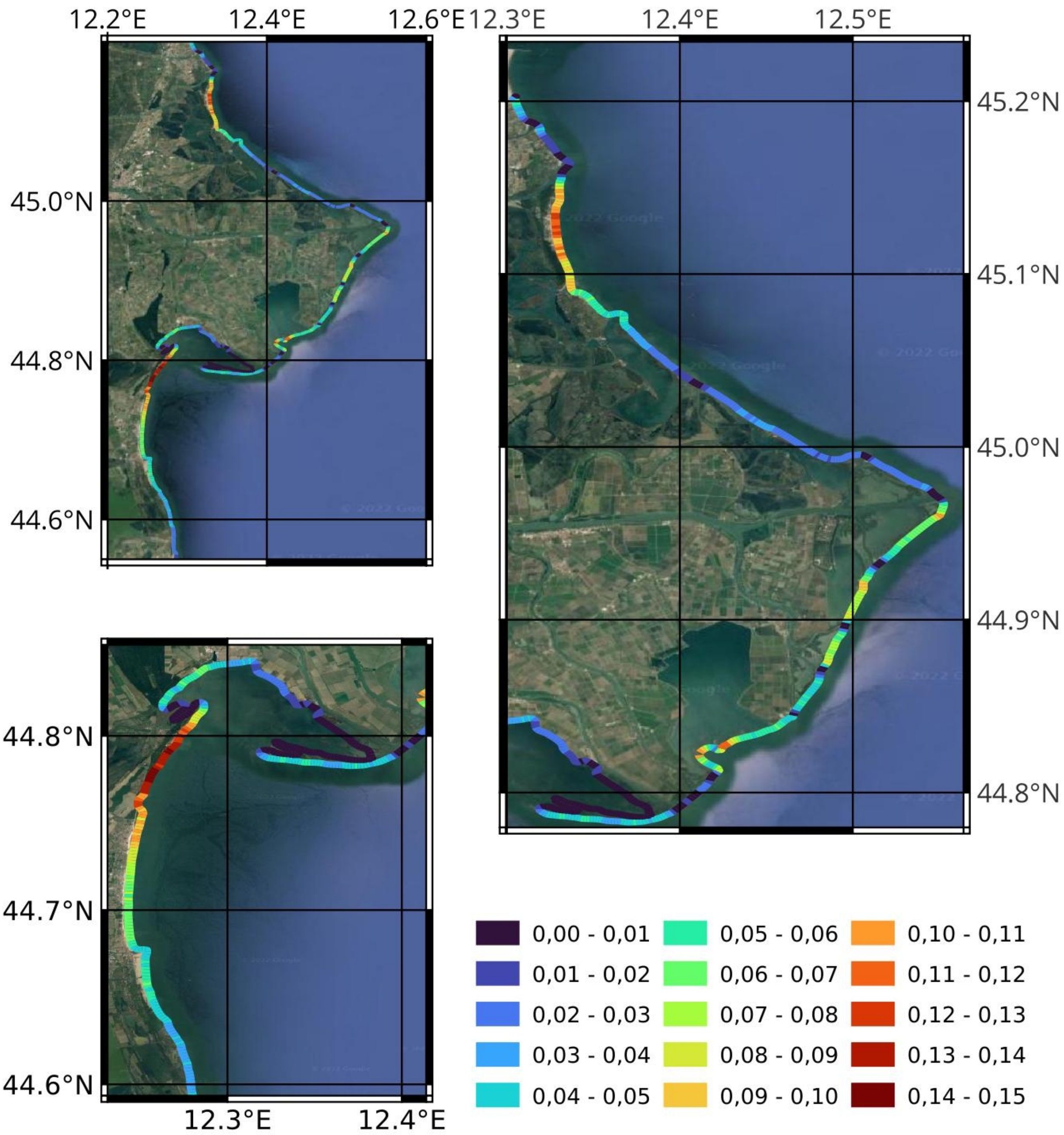


*Figure 25: PS1 – Po Delta. Summer percentage of potentially beached particles computer over the whole particles released.*

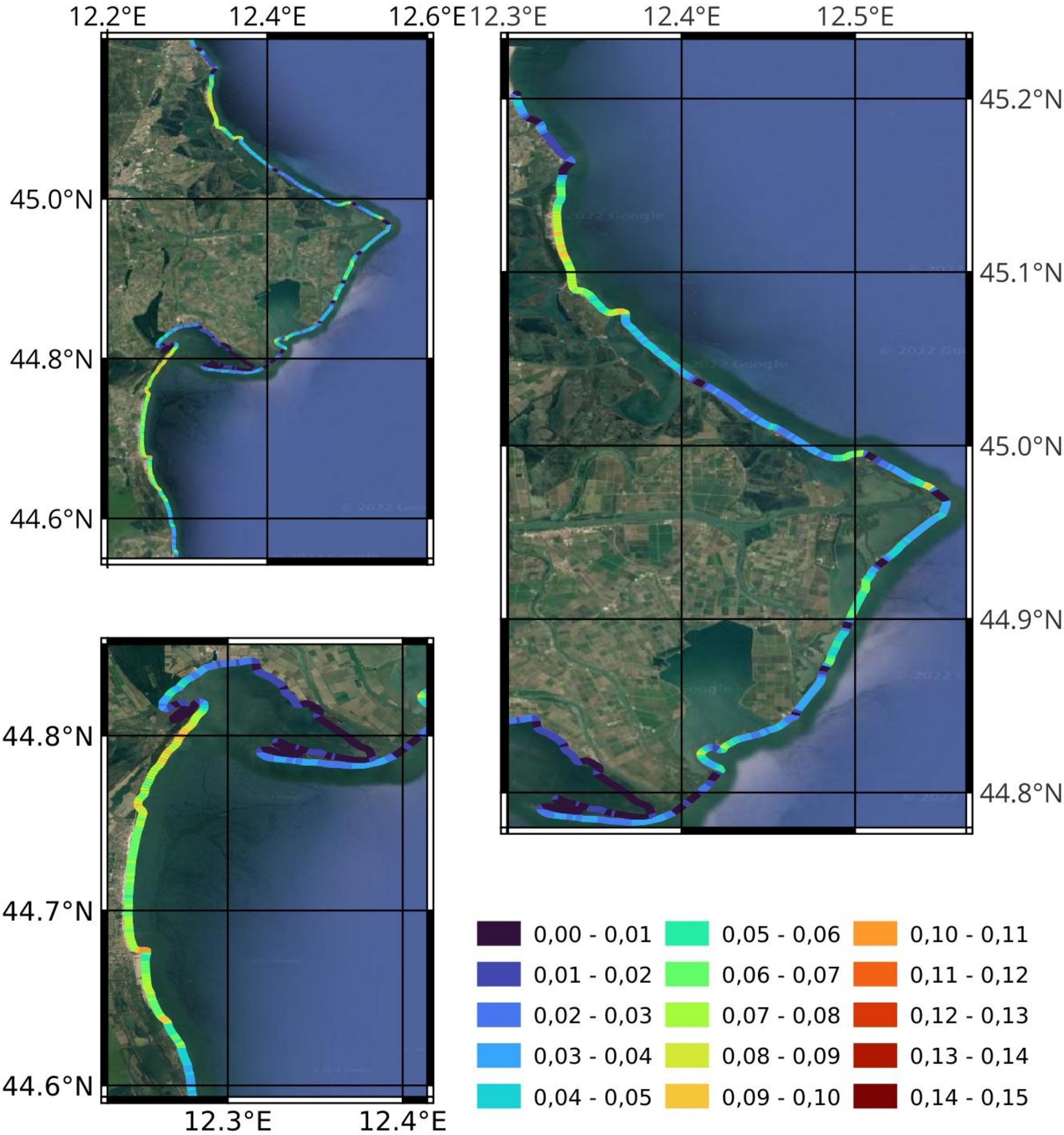


*Figure 26: PS1 – Po Delta. Autumn percentage of potentially beached particles computer over the whole particles released.*

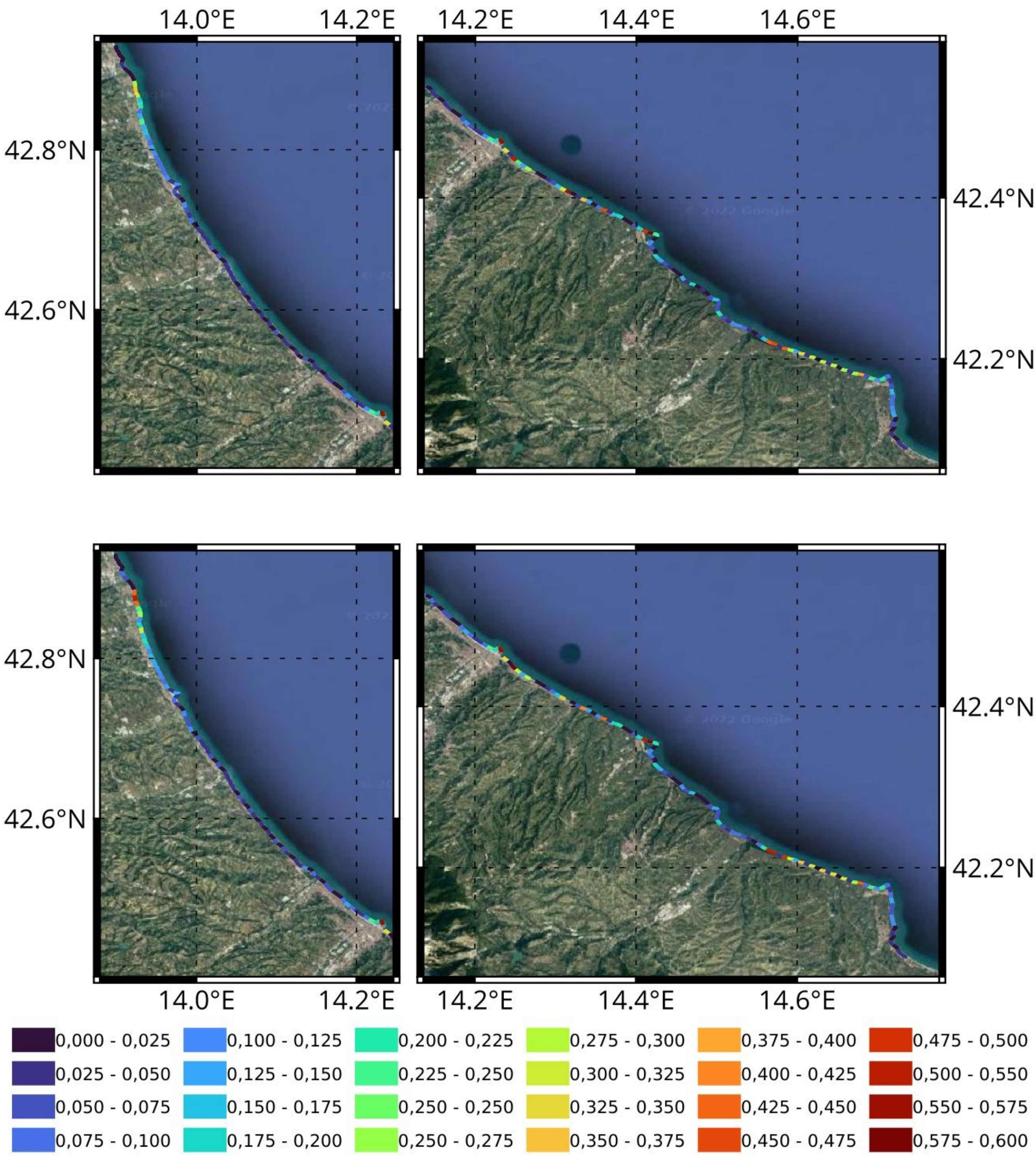


*Figure 27: PS2 – Pescara. Winter (top) and Spring (bottom) percentage of potentially beached particles computer over the whole particles released.*

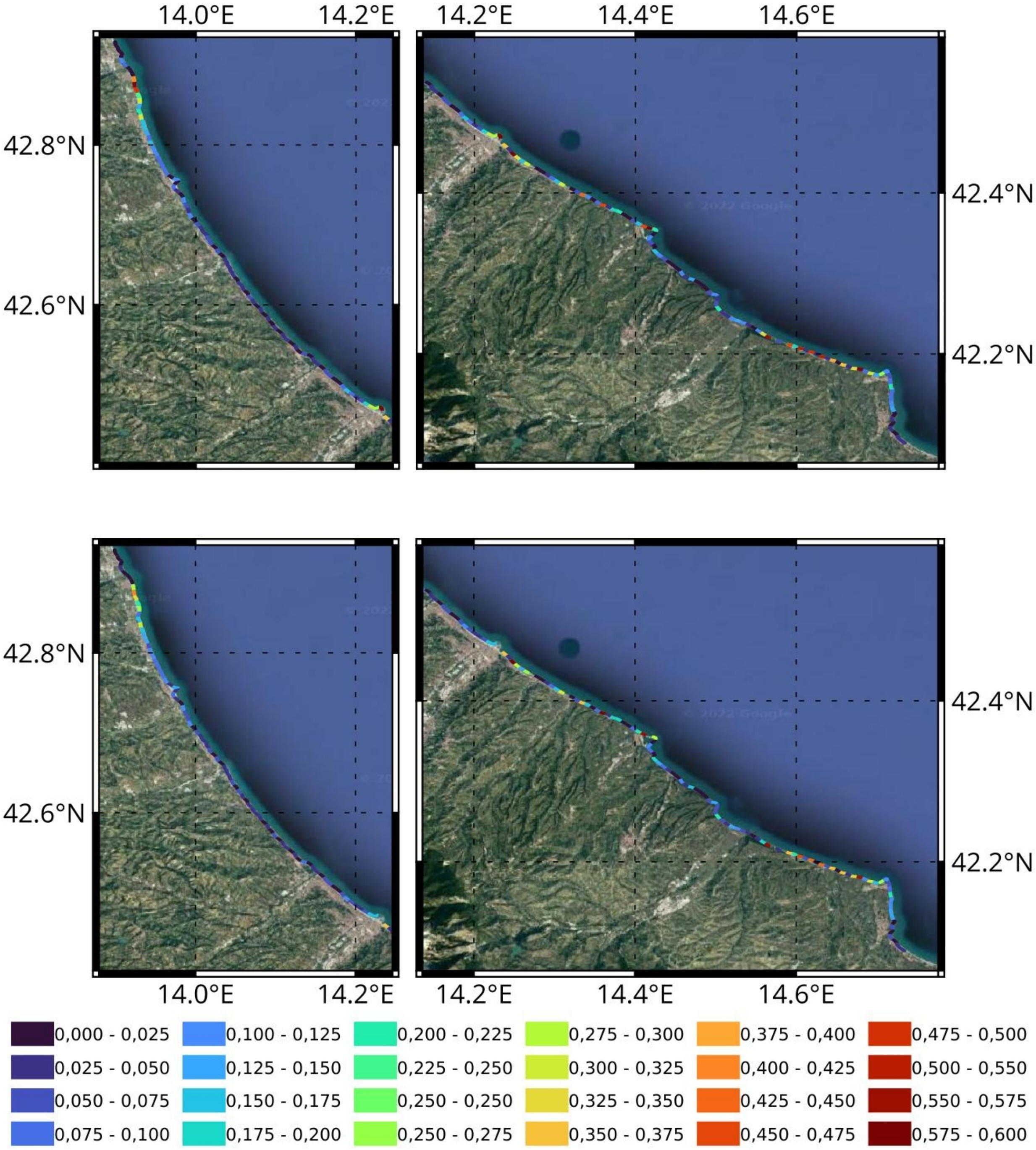


*Figure 28: PS2 – Pescara. Summer (top) and Autumn (bottom) percentage of potentially beached particles computer over the whole particles released.*

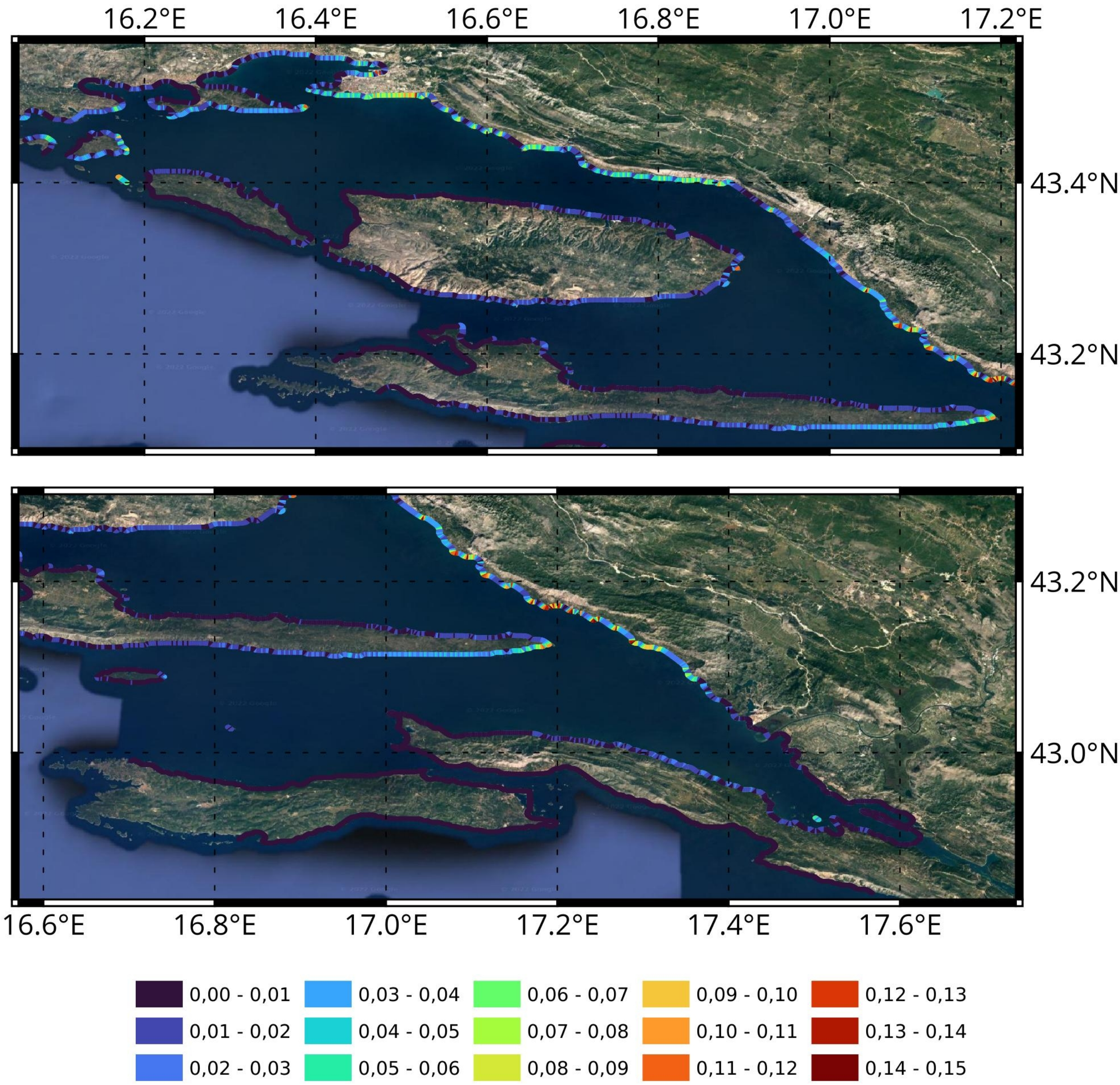


*Figure 29: PS4 – Split. Winter (top) percentage of potentially beached particles computer over the whole particles released.*

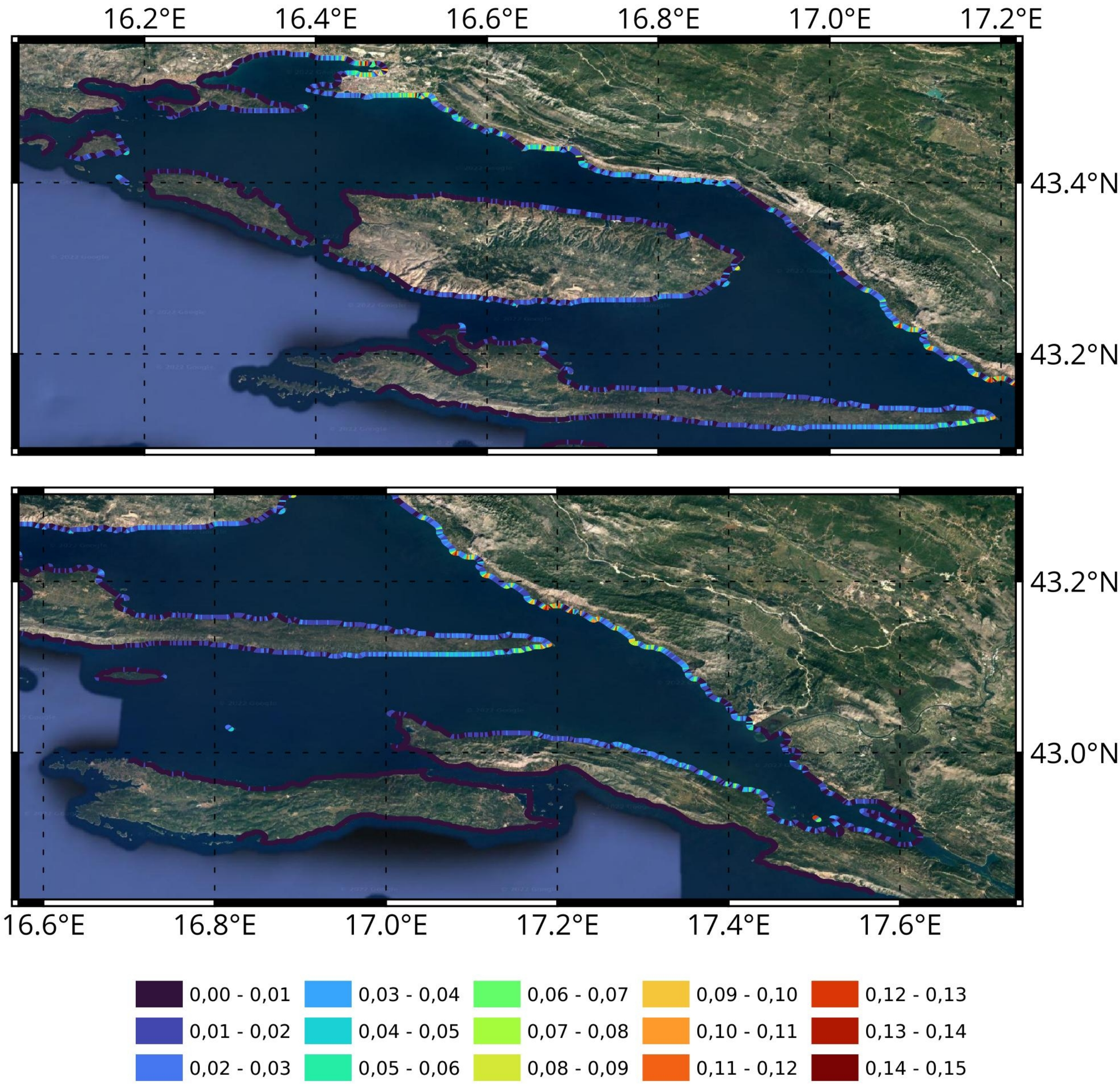


*Figure 30: PS4 – Split. Spring (top) percentage of potentially beached particles computer over the whole particles released.*

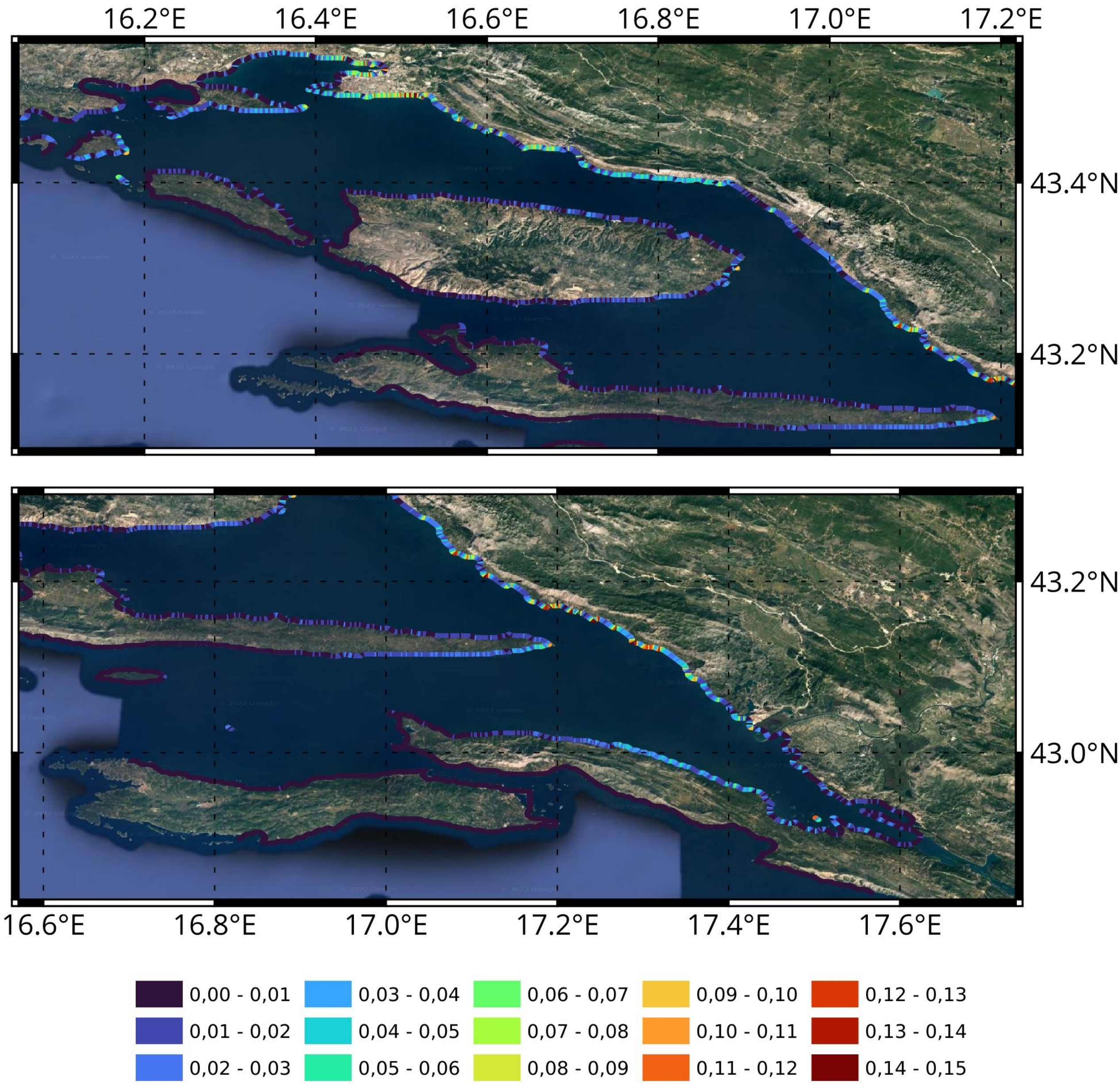


*Figure 31: PS4 – Split. Summer (top) percentage of potentially beached particles computer over the whole particles released.*

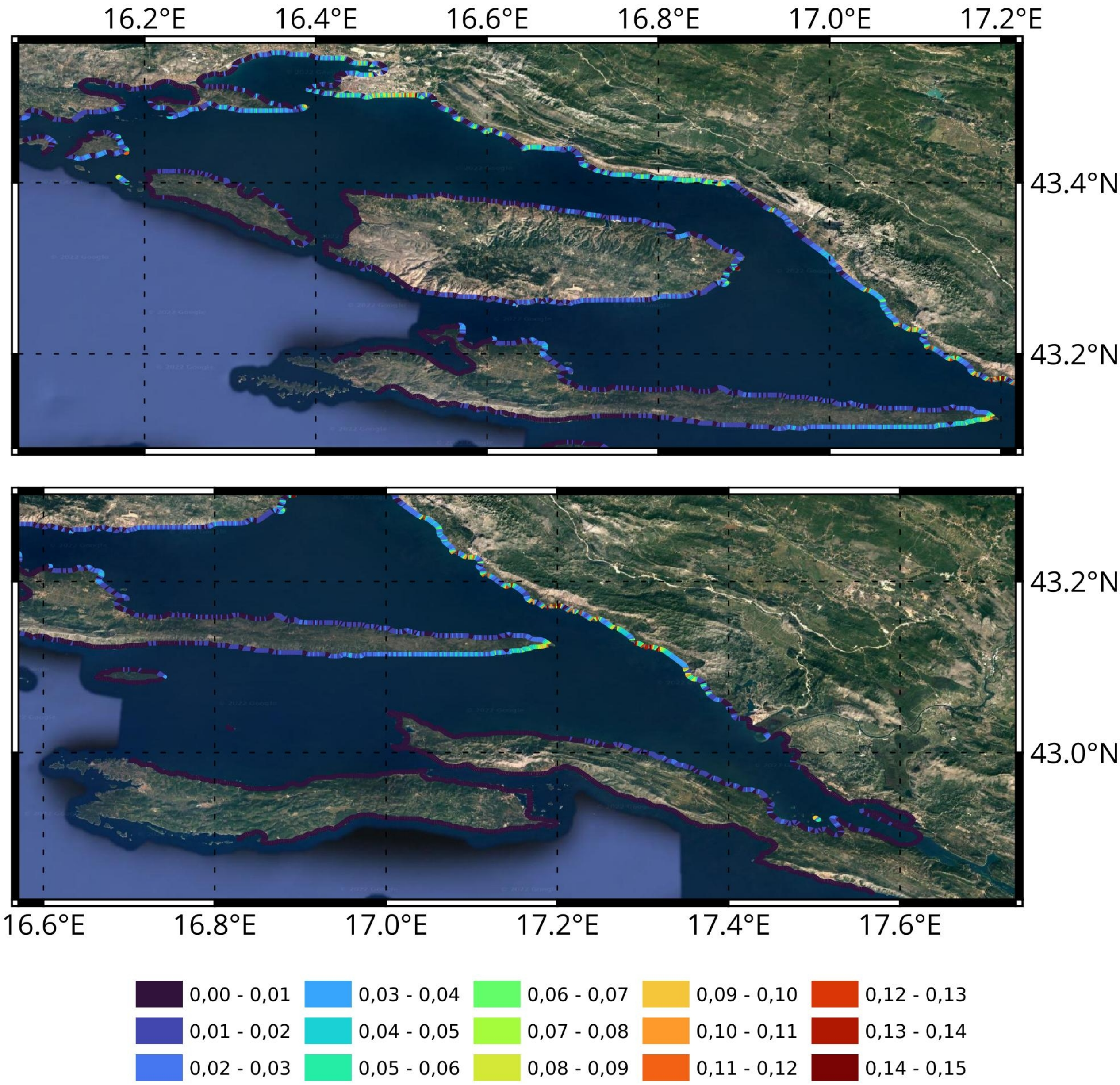


*Figure 32: PS4 – Split. Autumn (top) percentage of potentially beached particles computer over the whole particles released.*

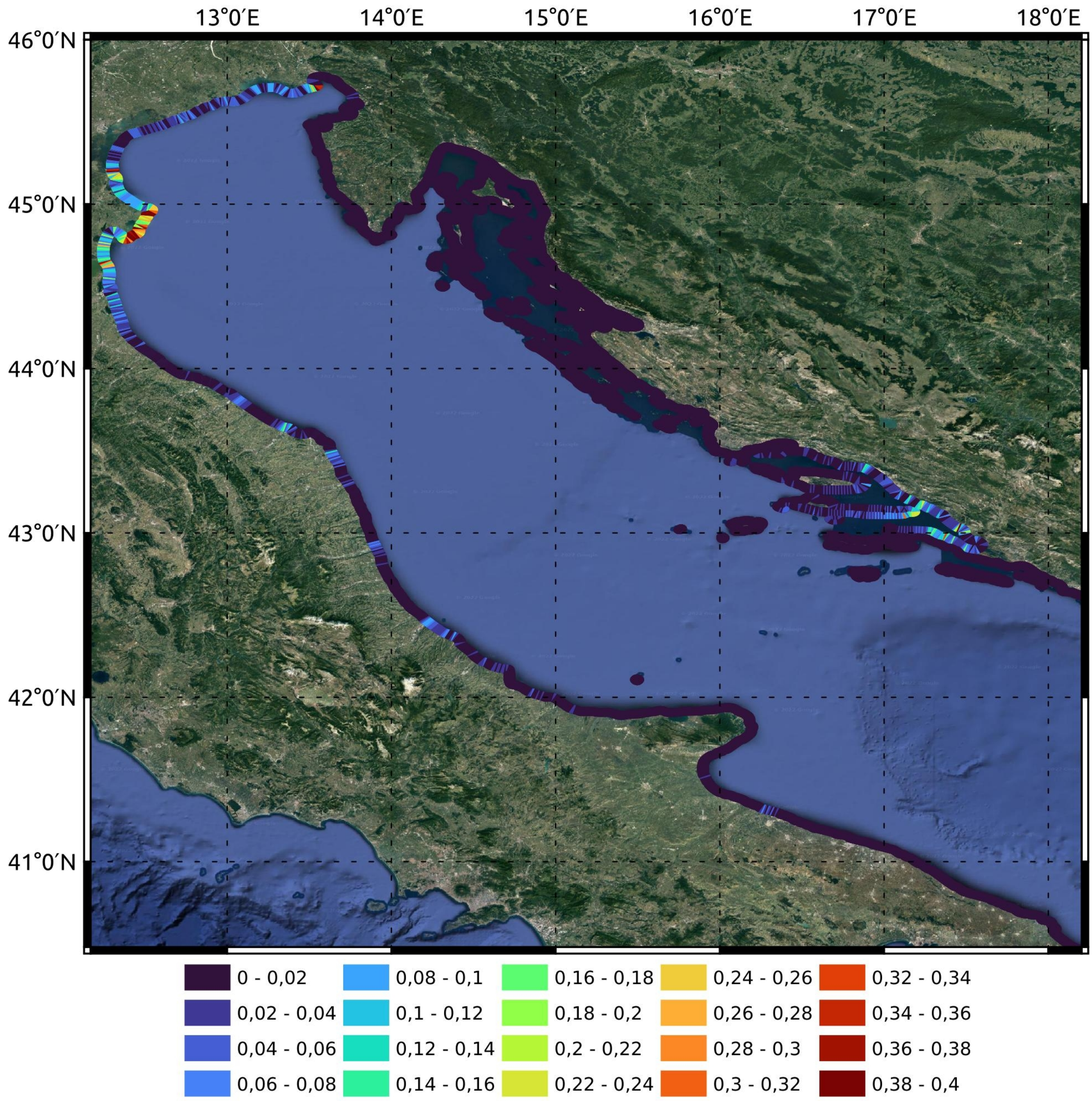


*Figure 33: PSB – Adriatic. Winter (top) percentage of potentially beached particles computer over the whole particles released.*

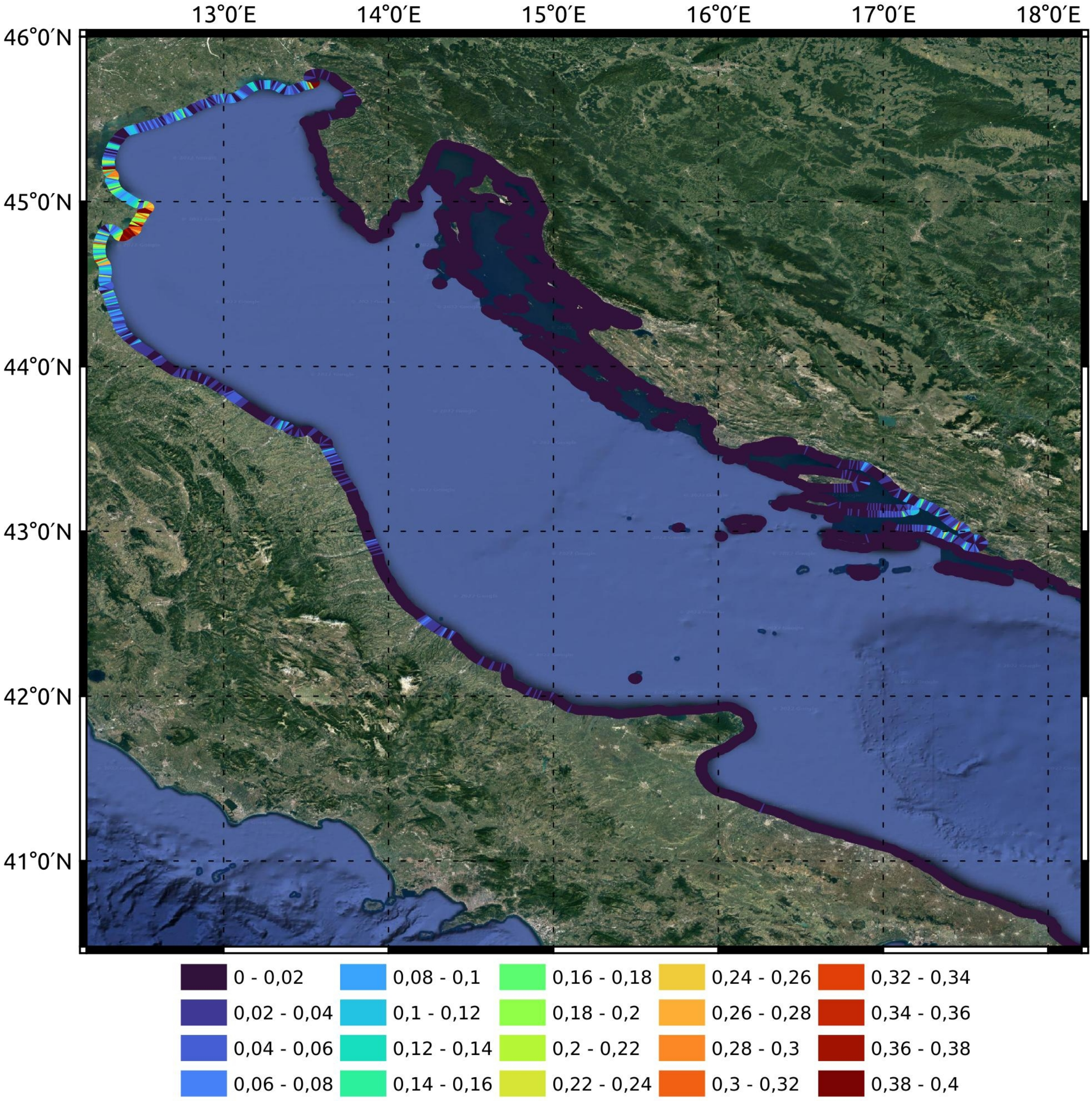


*Figure 34: PSB – Adriatic. Spring (top) percentage of potentially beached particles computer over the whole particles released.*

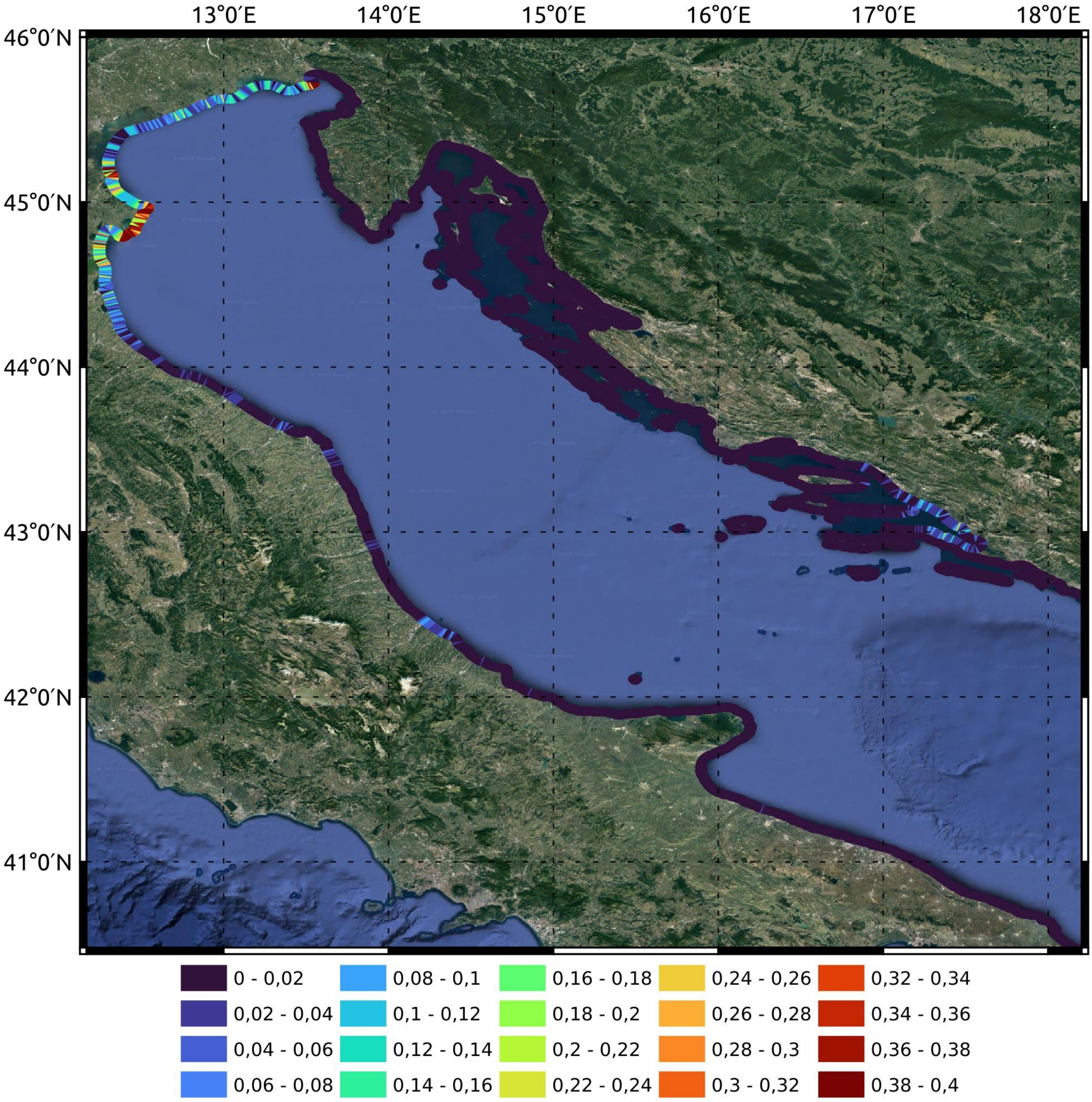


*Figure 35: PSB – Adriatic. Summer (top) percentage of potentially beached particles computer over the whole particles released.*

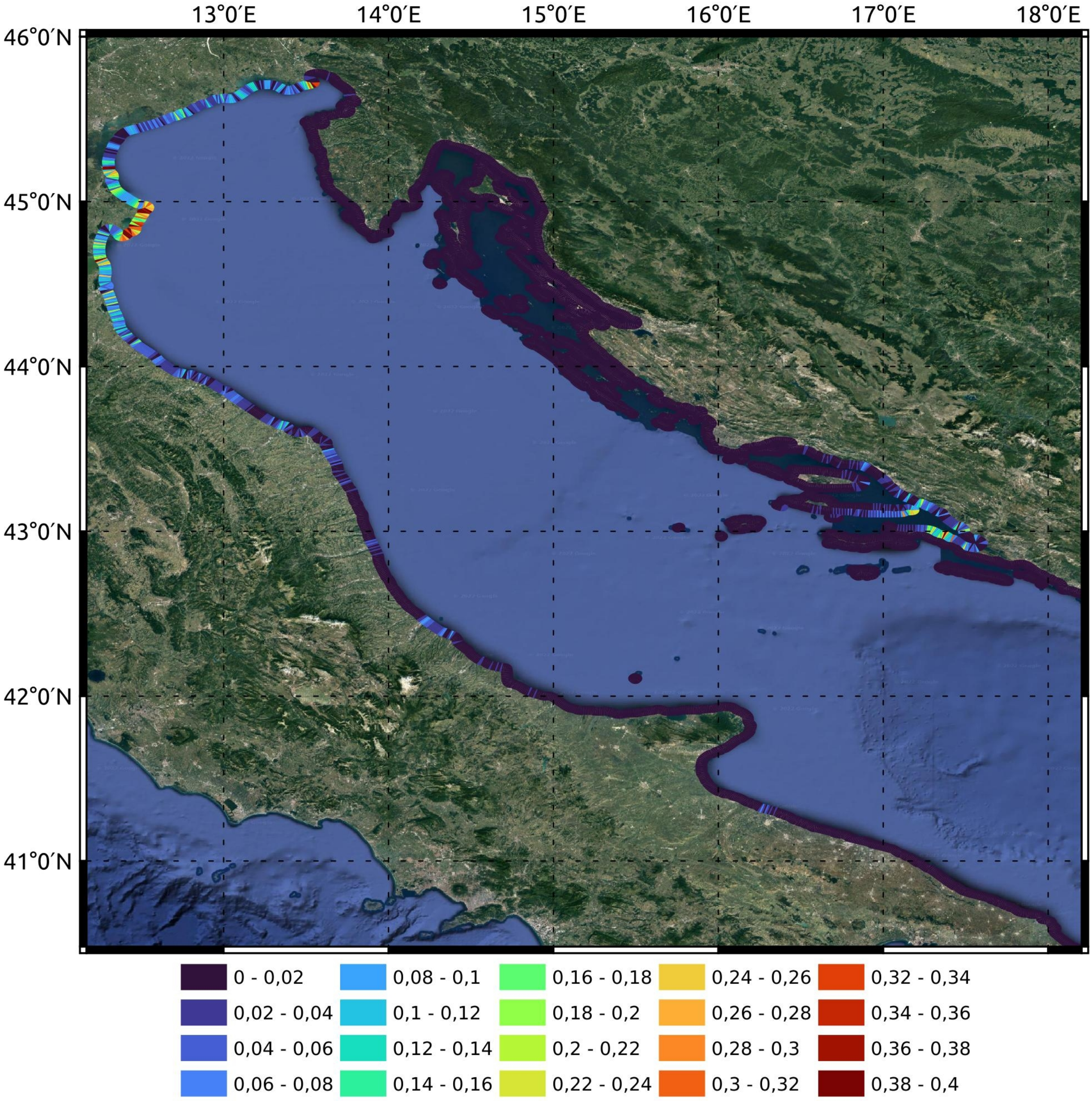


*Figure 36: PSB – Adriatic. Autumn (top) percentage of potentially beached particles computer over the whole particles released.*