European Commission

JRC SCIENCE FOR POLICY REPORT

EU Regulation 1143/2014: assessment of invasive alien species of Union concern distribution

Member States reports versus JRC baselines

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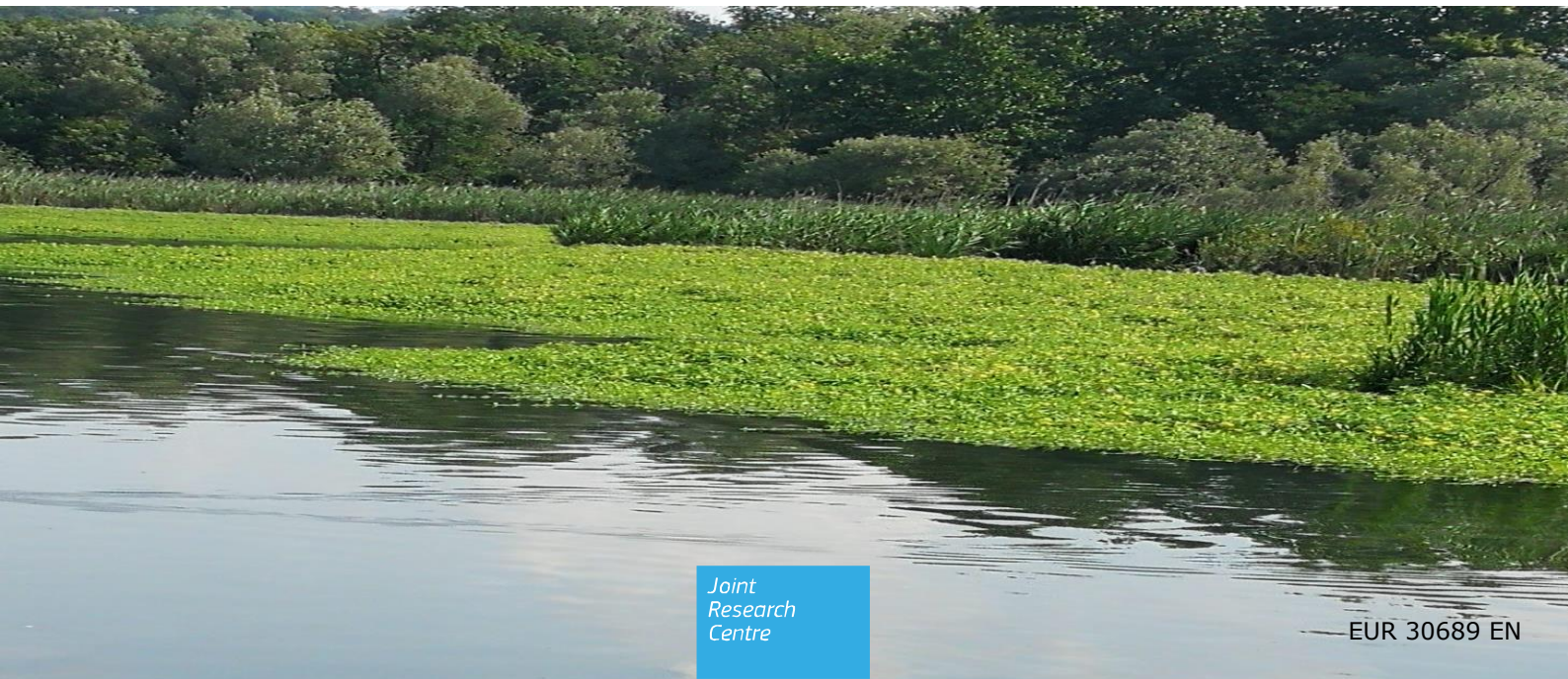

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Foreword

The global biodiversity assessment of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019) was a wake-up call for the dire ecological crisis the world is facing. It brought attention to the risk of extinction of up to one million species, and it identified the main direct drivers of biodiversity loss – among which are invasive alien species (IAS).

Both the IPBES assessment and the Global Biodiversity Outlook 5 concluded that the Aichi target 9 on IAS under the Convention for Biological Diversity was only partially achieved. In particular, prioritisation of IAS was satisfactory but for the other elements of the target, i.e., pathways prioritisation and management, and species control or eradication, the progress made was insufficient or there was only limited information to score it. IAS continued increasing globally and remained one of the main pressures negatively impacting on biodiversity.

The European Green Deal (2019) has strengthened the EU commitment to address biodiversity loss at the same level as climate change, leading by example on protecting and restoring nature. In this context, the EU Biodiversity Strategy for 2030 is arguably the most ambitious of its kind, aiming to protect and restore marine and inland ecosystems, and including actions to reduce pressures from IAS. This entails stepping up the implementation of the EU Regulation 1143/2014/EC on IAS and other relevant legislation and international agreements, with the objective of managing established IAS and decreasing the number of Red List species they threaten.

In 2019, EU Member States submitted their first reports on the application of the IAS Regulation. The analysis of these reports will inform a review of the application of the IAS Regulation in 2021.

This JRC assessment constitutes an important input to this review by providing a thorough analysis of the information reported by the Member States on the distribution of IAS of Union concern. The report includes important recommendations to the European Commission and the EU Member States on how to improve reporting, data sharing, the use of the dedicated European scientific information and notification tools (EASIN and NOTSYS) and the streamlining of data processing, which are essential for an effective implementation of the IAS Regulation.

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Abstract

Invasive Alien Species (IAS) are one of the main causes of biodiversity loss worldwide, a condition that severely affects Europe. The EU Regulation 1143/2014/EC (IAS Regulation), entered into force on 1 January 2015, establishes requirements for a coordinated set of actions to prevent, control and mitigate the impact of IAS. The IAS Regulation gives priority to a subset of IAS at European level, named as IAS of Union concern. By 1 June 2019, and every six years thereafter, MS shall report to the EC information about the implementation of the IAS Regulation. This report provides an analysis of the information reported by MS on the distribution of IAS of listed as of Union concern by 2017, recorded in their territory by December 2018. This information is correlated with the information available in the JRC baselines and complemented with MS notifications submitted via NOTSYS. The JRC baselines covered a period mostly overlapping the MS reporting period (2015-2018). For this reason, the spatial information in MS reports largely matched the JRC baselines. This also applies to species distribution records not validated by MS in the JRC baselines, proving that the JRC baselines provide good datasets, and are fit-for-purpose, for analyzing changes in species' distributions in relation to the implementation of the IAS Regulation. However, the observed differences could not be attributed to distributional trends of the species' populations, expanding or shrinking within EU countries. There were four main types of mismatch between the JRC baselines (MS validated records) and MS reports. Observed inconsistencies highlights the need of coherence in reporting updates on species' distributions and notification of new observations through NOTSYS. They may also reflect delays in data validation and synchronization among relevant data repositories, different interpretations among MS of what constitutes a detection of a regulated species requiring official notification, and on how to deal with casual records of species. The report provides recommendations aiming at addressing observed inconsistencies.

Acknowledgements

The authors would like to acknowledge the contributions and suggestions to this report made by colleagues of the DG ENV Unit D.2 Spyridon Flevaris, Myriam Dumortier[1], Juan Perez Lorenzo and Leonardo Mazza.

We also want to thank the EASIN Data Partners (https://easin.jrc.ec.europa.eu/easin/Partners/Partners) for sharing their data, and Member States competent authorities for their feedback to JRC baselines. The JRC work in support to reporting benefited from the collaboration with the European Environment Agency (EEA).

Finally, we would like to thank the EASIN Editorial Board members (http://easineb.jrc.ec.europa.eu/ the- board) for their contribution to ensuring EASIN data quality, Prof. Stelios Katsanevakis and Dr. Anna Maria Addamo for reviewing the spatial data of IAS of Union concern available from scientific literature.

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[1] Currently at INBO (Instituut Natuur- EN Bosonderzoek).

Executive summary

Policy context

Recognizing the need for a coordinated set of actions to prevent, control and mitigate the impact of IAS, the European Parliament and the Council adopted the EU Regulation no. 1143/2014/EC (EU 2014; hereinafter referred to as the IAS Regulation) on the prevention and management of the introduction and spread of IAS, which entered into force on 1 January 2015.

This report provides an analysis of the information reported by MS on the distribution of IAS of Union concern listed by 2017, as recorded in their territory until December 2018 (Article 24(1)b of the IAS Regulation). This information is correlated with the information available in the JRC baselines (Tsiamis et al. 2017, 2019a, b) and complemented with MS notifications submitted via NOTSYS.

Key conclusions/Main findings

Most of the IAS of Union concern addressed in this assessment are present in the EU territory, and several are widely distributed (32 IAS present in more than 5 MS) with higher concentrations of species in Western countries. Only five species are not currently present: *Corvus splendens*, *Microstegium vimineum, Parthenium hysterophorus, Persicaria perfoliata and Sciurus niger.* However, the JRC baselines (MS validated records) included records of *Corvus splendens* and *Parthenium hysterophorus.* These records could refer to casual records, and the species could have been eradicated prior to the reporting date.

The JRC baselines covered a time frame mostly overlapping the MS reporting period (2015-2018). For this reason, the spatial information in MS reports largely matched the JRC baselines. This also applies to species distribution records not validated by MS in the JRC baselines, proving that the JRC baselines provide good datasets, and are fit-for-purpose, for analysing changes in species' distributions in relation to the implementation of the IAS Regulation. However, the observed differences could not be attributed to distributional trends of the species populations, expanding or shrinking within EU countries.

We drew the following main recommendations:

1) Reporting of data needs to be improved for consistency and coherence among MS, in terms of the time frame of the records and early detections notified through NOTSYS.

2) IAS of Union concern already present in a MS territory according to the baselines may have been eradicated and thus not included in the MS reports. It would be useful if the MS would report also on these cases, with the aim of ensuring a complete official update of the concerned species distributions.

3) NOTSYS use by the MS should be improved and expanded as much as possible, to ensure that notifications provide the necessary timely information on new detections of IAS of Union concern, measures applied and their effectiveness, helping the surveillance and management of other MS.

4) Many other existing data collection programs can supplement species records reported from the MS official surveillance systems. EASIN aggregates data from a network of data partners, referring to several data collection initiatives, and can play a role in informing MS of new records, which after quality check could be notified through NOTSYS. This would increase coherence between data sources and the chance of prompt notification of new detections.

5) The discrepancies observed between the JRC baselines and the MS reports are mainly attributable to data availability. Enhanced data sharing should be promoted to allow a common EU information background and better effectiveness of the IAS Regulation.

6) Solving the identified issues will allow JRC to prepare in the future tailored data packages that will ease the work by MS in fulfilling their reporting obligations under Art. 24 of the IAS regulation.

Possible future developments

Based on this assessment, with the aim of improving the effectiveness of the IAS Regulation, we propose the following activities:

1) Promotion of data sharing between MS Competent Authorities and EASIN.

2) Streamlining of some technical implementation aspects, e.g., guidelines on common approaches for monitoring and for notifying early detections.

3) Training on EASIN and NOTSYS to MS representatives, following the release of new web services.

4) Joint workshops on cross border cooperation issues.

5) Identification and sharing of best practices by the EC, MS competent authorities, and relevant projects (e.g. LIFE); sharing can be facilitated through EASIN.

6) Promotion of Citizen Science and integration of generated data through EASIN, e.g., via the JRC "IAS in Europe" App and other applications.

7) Liaising with EU projects, such as LIFE and Interreg, dealing with eradication or management of IAS, by the JRC EASIN.

1 Introduction

1.1 Policy context

Alien Species are organisms unintentionally or deliberately introduced through human activities into regions beyond their natural range. Some of these, the Invasive Alien Species (IAS) are a main cause of biodiversity loss worldwide (Ricciardi et al. 2013; Jeschke et al. 2014; IPBES, 2019), a condition that severely affects Europe, where the damages cost over 12 billion euro every year (Kettunen et al. 2009). To tackle this problem, economic resources invested by the European Union (EU) in both the research and management of IAS have grown steadily over the years (Scalera 2010; Silva et al. 2014).

Recognizing the need for a coordinated set of actions to prevent, control and mitigate the impact of IAS, the European Parliament and the Council adopted the EU Regulation no. 1143/2014/EC (EU 2014; hereinafter referred to as the IAS Regulation) on the prevention and management of the introduction and spread of IAS, which entered into force on 1 January 2015. The IAS Regulation gives priority to a subset of IAS at European level, named as IAS of Union concern (Art. 4 "the Union list"). Species are included in this list because they can cause a severe damage to biodiversity in Member States (MS) justifying the adoption of dedicated measures at Union level (EU 2014). The list of IAS of Union concern is kept up to date following a Risk Assessment scrutiny and approval protocol[2]. By 2017, 49 taxa were listed[3]. In 2019, 17 taxa were added to the list[4]. MS must prevent the introduction and spread of listed species, enforce effective early detection and rapid eradication mechanisms for new introductions, and adopt management measures for those that are already widely spread.

The European Alien Species Information Network (EASIN; https://easin.jrc.ec.europa.eu/easin/) is the official information system supporting MS in the implementation of the IAS Regulation (EU 2014, Art. 25). EASIN, developed by the European Commission (EC) Joint Research Centre (Katsanevakis et al. 2012), aims to facilitate access to data on alien species in Europe, and to provide a single repository for accessing all the information necessary to underpin EU related policy and management decisions (Katsanevakis et al. 2013, 2015).

EASIN data were used for the preparation of the EU baselines on the geographical distribution of 48 out of the 49 IAS of Union concern listed by 2017 (*Nyctereutes procyonoides* was not covered, since its inclusion in the Union list took effect from 2 February 2019) (Tsiamis et al. 2017, 2019a, 2019b). These reports (hereinafter referred to as the JRC baselines) were based on the best available knowledge, resulting from an assessment of data aggregated through EASIN in collaboration with the MS Competent Authorities. The JRC baselines are essential for tracking new detections of IAS of Union concern in non-infested areas, and constitute a valuable tool supporting the implementation of the IAS Regulation. A similar baseline report focusing on the remaining 18 IAS of Union concern was published in 2021, including the 17 species added to the Union list in 2019 by the Commission Implementing Regulation EU 2019/1262/EC plus *Nyctereutes procyonoides* (Tsiamis et al. 2021).

To facilitate MS compliance with Art. 16 (Early detection notifications) and Art. 17 (Rapid eradication at an early stage of invasion) of the IAS Regulation, a European Alien Species Notification System (NOTSYS; https://easin.jrc.ec.europa.eu/notsys) has been developed within the EASIN platform, allowing MS Competent Authorities to notify the EC and all MS about new occurrences of IAS of Union concern on their territory, for reporting the eradication measures applied and on their effectiveness. After validation and privacy requirements verification, the information is used for updating the EASIN geodatabase.

[2] Commission Delegated Regulation EU 2018/968/EC

[3] Commission Implementing Regulation EU 2016/1141/EC of 13.07.2016 and Commission Implementing Regulation EU 2017/1263/EC of 12.07.2017

[4] Commission Implementing Regulation EU 2019/1262/EC of 25 July 2019

Article 24(1) of the IAS Regulation dictates that by 1 June 2019, and every six years thereafter, MS shall report the EC information about the implementation of the IAS Regulation. Amongst other, MS shall report the distribution of the IAS of Union concern present in their territory (Article 24(1)b), following the adopted technical formats for reporting[5].

To ease MS reporting obligations, JRC prepared tailored data packages in collaboration with DG ENV and the European Environment Agency (EEA). Data packages contained EASIN data, MS notifications via NOTSYS, and JRC baselines data, which format and content complied with the reporting obligations under Art. 24 of the IAS Regulation (https://easin.jrc.ec.europa.eu/easin/Services/Reporting).

1.2 Purpose of the report

The purpose of the present report is to provide an analysis of the information reported by MS on the distribution of 48 IAS of Union concern (Commission Implementing Regulation EU 2016/1141/EC and Commission Implementing Regulation EU 2017/1263/EC, with the exception of *Nyctereutes procyonoides*) present in their territories by the end of 2018 (Article 24(1)b of the IAS Regulation). This information is compared with the information available in the JRC baselines and with the MS notifications submitted via NOTSYS.

The overall aim of this report is to support the EC review on the implementation of the IAS Regulation through recommendations to the EC and MS to improve reporting, data sharing, and its overall effectiveness.

2 Methodology

2.1 Data Sources

2.1.1 Member States Reports

All MS[6], with the exception of PT (Table 1), provided the information on the distribution of the IAS of Union concern on their territory required by Article 24(1)b. EL did not provide spatial data at grid 10x10 km level (resolution level of the EEA reference grid, hereinafter referred to as grid-level, which is recognized by the INSPIRE Framework Directive 2007/2/EC, EU 2007; guidelines in INSPIRE 2013). RO provided distribution data through maps in JPEG format only, thus, they could not be compared with the grid-level information in the JRC baselines. The MS reported data cover the period 01/01/2015 - 31/12/2018 and the 48 IAS of Union concern included in the Union list by 2017 (*Nyctereutes procyonoides* is not covered).

[5] Commission Implementing Regulation EU 2017/1454/EC of 10 August 2017
[6] The information on UK, in the MS reports and JRC baselines, only relates to the time UK was member of the EU.

Table 1. Report and format of the data submitted by MS.

MS	Report submitted	Format
AT	YES	Gml file / Shapefile
BE	YES	Shapefile
BG	YES	Gml file / Excel file
CY	YES	Shapefile
CZ	YES	Shapefile
DE	YES	Shapefile
DK	YES	Shapefile
EE	YES	Shapefile
EL	YES	([1])
ES	YES	Gml file
FI	YES	Shapefile
FR	YES	Shapefile
HR	YES	Shapefile
HU	YES	Shapefile
IE	YES	Shapefile
IT	YES	Shapefile
LT	YES	Shapefile
LU	YES	Shapefile
LV	YES	Shapefile
MT	YES	Shapefile
NL	YES	Shapefile
PL	YES	GeoJSON
PT	NO	([1])
RO	YES	([2])
SE	YES	Shapefile
SI	YES	Shapefile
SK	YES	Shapefile
UK	YES	Shapefile

([1]) No spatial data reported
([2]) Only maps

2.1.2 JRC Baselines

The JRC baselines of the IAS of Union concern prepared by Tsiamis et al. (2017, 2019a, 2019b) contain the spatial distribution of the species across EU MS both at country-level and grid-level, gathered from EASIN data partners and literature review. MS Competent Authorities were invited to check the EASIN baseline data on the targeted species, at country and grid-level, and to supplement the available information with national data. In more detail:

a) Tsiamis et al. (2017) included the spatial information on the 37 IAS of Union concern (Commission Implementing Regulation EU 2016/1141/EC), corresponding to spatial records across EU MS up to 2016. The information was updated by Tsiamis et al. (2019b) for BG, IT, LU, CY, FI, with further available information up to 2016. The baseline records were checked and validated by 20 MS Competent Authorities at country-level, and by 16 MS Competent Authorities at grid-level. The remaining MS did not provide feedback and the relevant information in the JRC baseline correspond to the original EASIN dataset, considered as the best available knowledge in the absence of information from the relevant MS Competent Authorities.

b) Tsiamis et al. (2019a) included the spatial information of 11 IAS added to the list of Union concern in 2017 (Commission Implementing Regulation EU 2017/1263/EC), corresponding to spatial records in the EU MS up to 2018. *Nyctereutes procyonoides* was not included in the baseline since its inclusion to the Union list took effect from 2 February 2019. The baseline records were checked and validated by 21 MS Competent Authorities at country-level, and by 19 MS Competent Authorities at grid-level. The remaining MS did not provide feedback and the relevant information in the JRC baseline correspond to the original EASIN dataset, considered as the best available knowledge in the absence of information from the relevant MS Competent Authorities.

It should be noted that the JRC baselines did not include "historical records" of species not present anymore within MS territory (e.g., *Parthenium hysterophorus* in PL, *Eichhornia crassipes*, *Myocastor coypus*, *Nasua nasua, Procyon lotor* in SE, *Oxyura jamaicensis* in IE). Similarly, species recently eradicated from the MS territories (e.g., *Oxyura jamaicensis* in ES and in SE, *Procambarus fallax* f. *virginalis* in SE) were excluded from the JRC baselines.

2.1.3 NOTSYS Records

During the reporting period 2015–2018, 51 early detections of IAS of Union concern were notified by the MS via NOTSYS, corresponding to 16 species. The most reported species were *Vespa velutina nigrithorax* and *Oxyura jamaicensis*. The country with the highest number of notifications was DE. Of the notified detections, 22 were eradicated, 15 were not eradicated, 13 were under eradication and 1 corresponded to an eradication re-attempt (Table 2).

2.2. Analysis

The information reported by the MS on the distribution of the IAS of Union concern in their territory (Article 24(1)b) was compared with the distribution included in the JRC baselines (Tsiamis et al. 2017, 2019a, 2019b). The comparison was made both at country and grid-level per MS and per IAS of Union concern (48 taxa in total). Information validated by the relevant MS Competent Authority in the JRC baselines for each species and MS was highlighted.

The information provided by MS was also checked against the information coming from NOTSYS notifications, aiming to highlight any inconsistencies, such as:

a) species reported as new detections in NOTSYS, not eradicated, but missing from the MS reports.

b) b) species reported in MS reports, missing from the validated baseline information, but not reported through NOTSYS.

Table 2. Number of early detection notifications per species and MS. UE= Under Eradication, E= Eradicated, NE= Not Eradicated, ER = Eradication Re-attempt.

MS	Notification status	IAS of Union concern																Total
		Alternanthera philoxeroides	*Cabomba caroliniana*	*Eichhornia crassipes*	*Lagarosiphon major*	*Lithobates catesbeianus*	*Muntiacus reevesi*	*Myocastor coypus*	*Nasua nasua*	*Oxyura jamaicensis*	*Persicaria perfoliata*	*Procambarus clarkii*	*Procambarus fallax f. virginalis*	*Procyon lotor*	*Pueraria montana var. lobata*	*Threskiornis aethiopicus*	*Vespa velutina nigrithorax*	
AT	UE												1					1
	E																	0
	NE																	0
	ER																	0
BE	UE						1											1
	E																1	1
	NE																3	3
	ER																	0
CZ	UE												1					1
	E																	0
	NE																	0
	ER																	0
DE	UE		1	1			1			1								4
	E								1	1						1	1	4
	NE									3								3
	ER		1															1
DK	UE																	0
	E															1		1
	NE									1								1
	ER																	0
ES	UE					1												1
	E																	0
	NE																	0
	ER																	0
FR	UE						1											1
	E																	0
	NE																	0
	ER																	0

(Continues)

Table 2. (Continued)

MS	Notification status	IAS of Union concern																Total
		Alternanthera philoxeroides	*Cabomba caroliniana*	*Eichhornia crassipes*	*Lagarosiphon major*	*Lithobates catesbeianus*	*Muntiacus reevesi*	*Myocastor coypus*	*Nasua nasua*	*Oxyura jamaicensis*	*Persicaria perfoliata*	*Procambarus clarkii*	*Procambarus fallax f. virginalis*	*Procyon lotor*	*Pueraria montana var. lobata*	*Threskiornis aethiopicus*	*Vespa velutina nigrithorax*	
HU	UE																	0
	E																	0
	NE							1										1
	ER																	0
IE	UE				1													1
	E						1							2				3
	NE						1	1										2
	ER																	0
LU	UE																	0
	E							3										3
LU	NE																	0
	ER																	0
NL	UE																	0
	E	1									1						2	4
	NE										1			1			2	4
	ER																	0
PT	UE				1													1
	E																	0
	NE																	0
	ER																	0
SI	UE											1						1
	E														1			1
	NE																	0
	ER																	0
UK	UE																1	1
	E								1								4	5
	NE																1	1
	ER																	0
Total		1	2	1	2	1	5	5	2	6	2	1	2	3	1	2	15	51

3 Results

3.1 Presence of IAS of Union concern at country level

A detailed analysis of IAS records at country-level is provided in Annex 1. Comparison of IAS records was performed between the JRC baselines (Tsiamis et al. 2017, 2019a, 2019b) and MS reports (Article 24(1)b) for each EU MS. Discrepancies were highlighted in case baseline data, validated by MS Competent Authorities, did not match with MS reports data (Tables 3). Discrepancies between MS reports and NOTSYS notifications are depicted in summary in Table 4.

Table 3. IAS of Union concern present in the JRC baselines, validated by MS, not included in MS reports and not eradicated based on NOTSYS. N/A stands for countries/species without validated baseline data. Species marked with an '*' were tagged as casual (i.e., occasional species, with rare records, not reproducing in the wild or not overwintering) in the validated JRC baselines; species with number in superscript are linked with information given in MS reports.

MS	**IAS of Union concern**
AT	-
BE	*Nasua nasua**, *Parthenium hysterophorus**, *Sciurus niger*(1)*
BG	N/A
CY	-
CZ	*Eichhornia crassipes*, *Procambarus fallax f. virginalis*, *Threskiornis aethiopicus*
DE	N/A
DK	*Asclepias syriaca*, *Muntiacus reevesi*, *Myocastor coypus*, *Oxyura jamaicensis**
EE	*Alopochen aegyptiaca**, *Lysichiton americanus**
EL	*Corvus splendens, Lithobates catesbeianus*, *Threskiornis aethiopicus*
ES	*Corvus splendens**, *Lagarosiphon major*
FI	*Heracleum sosnowskyi*, *Oxyura jamaicensis*
FR	*Corvus splendens*(2)*, *Nasua nasua*
HR	-
HU	(3)
IE	*Eriocheir sinensis*, *Ludwigia grandiflora*(4), *Procyon lotor*(5)
IT	*Eriocheir sinensis*
LT	(3)
LU	*Pseudorasbora parva*
LV	*Corvus splendens*, *Heracleum mantegazzianum*, *Threskiornis aethiopicus*

(Continues)

Table 3. (Continued)

MS	IAS of Union concern
MT	N/A
NL	*Callosciurus erythraeus*, *Corvus splendens*, *Sciurus carolinensis*[*]
PL	*Corvus splendens*, *Threskiornis aethiopicus*[*]
PT	N/A
RO	N/A
SE	-
SI	*Lithobates catesbeianus*, *Oxyura jamaicensis*[*], *Procyon lotor*
SK	(3)
UK	*Heracleum persicum*, *Lithobates catesbeianus*, *Procyon lotor*[*], *Tamias sibiricus*[*], *Threskiornis aethiopicus*[*]

([1]) Eradicated at the beginning of 2015.
([2]) FR provided 1 spatial record, but at country level the species is marked as not present.
([3]) Country with validated and non- validated species datasets. For species with validated data no discrepancy was observed.
([4]) Eradicated in 2009.
([5]) Rare scattered casual occurrences were reported in IE with no evidence to suggest the species is reproducing; of the 8 animals verified during the reporting period (2015-2018), 2 animals of separate sites could not be tracked for removal.

Specific cases highlight the need for addressing the "casual" species in a consistent way:

- **DE:** *Vespa velutina nigrithorax* is marked as not present at country level, but spatial records at grid-level were provided.

- **LU**: *Myocastor coypus* is marked as unknown at country level, but 3 spatial records at grid-level were provided, with the following statement: "... since the species was eradicated in that site. In the other sites, those were casual records; following a monitoring the species could not be observed anymore. We could consider that the species is absent in LU".

- **PL**: *Procambarus clarkii* is marked as not present at country level, but one spatial record at grid-level was provided, with the following statement: "The only known case of finding this species in nature concerns the Samica River, where in 2014 one specimen was caught. However, there are no indications that it would breed there, and the author of the observation attributes it to a one-time release from aquarium. No other data on the occurrence of this species in Poland is currently available. There are currently no indications that the species in Poland creates populations".

- **FR:** provided one spatial record of *Corvus splendens*, but at country level the species is marked as not present.

3.2 Distribution of IAS of Union concern at grid-level

A detailed comparison for records of IAS of Union concern at grid-level between the JRC baselines (Tsiamis et al. 2017, 2019a, 2019b) and the MS reports (Article 24(1)b) is provided in Annex 2. The comparison was performed by distinguishing whether the records in the JRC baselines were validated or not by the MS Competent Authorities.

Figure 1 shows the cumulative number of IAS of Union concern at grid-level in the EU based on the MS reports. Dense grid-level species occurrences have been reported mainly from BE, DE, NL and UK.

Figures 2 and 3 show, respectively, the spatial extent of the IAS of Union concern per MS and their spread in the EU in JRC baselines validated by MS vs. MS reports for the relevant species. The JRC baselines (MS validated records) mostly match the related MS reports. The number of grid cells reported by MS was generally slightly higher than in the JRC baselines, except for FR where the reverse was observed. For spread of IAS of Union concern, there were also no large differences between JRC baselines and MS reports, with a few exceptions: the spread of *Elodea nuttallii* and *Orconectes limosus* was higher in the JRC baselines than in MS reports, the opposite was observed for *Alopochen aegyptiaca, Asclepias syriaca* and *Oxyura jamaicensis*.

Table 4. Discrepancies between MS reports and NOTSYS notifications.

MS	**IAS of Union concern**
AT	*Lysichiton americanus*: mentioned in the MS report, missing from the validated baseline data, but not notified in NOTSYS
DE	*Eichhornia crassipes*: notified in NOTSYS (under eradication) but not mentioned in the MS report
DK	*Oxyura jamaicensis*: notified in NOTSYS (not eradicated) but not mentioned in the MS report
EE	*Orconectes limosus* and *Procambarus fallax* f. *virginalis*: mentioned in the MS report, missing from the validated baseline data, not notified in NOTSYS
ES	*Oxyura jamaicensis*: mentioned in the MS report, missing from the validated baseline data, not notified in NOTSYS
FI	*Asclepias syriaca* and *Procyon lotor*: mentioned in the MS report, missing from the validated baseline data, not notified in NOTSYS
HR	*Ludwigia peploides* and *Pueraria montana* var. *lobata*: mentioned in the MS report, missing from the validated baseline data, not notified in NOTSYS
NL	*Vespa velutina nigrithorax*: notified in NOTSYS (not eradicated) but missing from the MS report. *Persicaria perfoliata*, considered as not present: notified in NOTSYS as observed at two plant nurseries, including information on containment and disposal measures applied.
SE	*Alopochen aegyptiaca*: mentioned in the MS report, missing from the validated baseline data, not notified in NOTSYS
SI	*Pueraria montana* var. *lobata*: mentioned in the MS report, missing from the validated baseline data, eradicated based on NOTSYS notification. *Procambarus clarkii*: notified in NOTSYS (under eradication), missing from the MS report
SK	*Heracleum sosnowskyi*: marked as unknown at country level in the MS report, but one spatial record at grid-level was provided, with the following reason: "*Only one specimen was recorded in 2017. It was eradicated on the spot*." However no relevant notification was made through NOTSYS
UK	*Vespa velutina nigrithorax*: notified in NOTSYS (not eradicated/under eradication), missing from the MS report

3.3 Distribution of IAS of Union concern at grid-level

The following figures (figure 4 to 136) show the distribution of specific IAS of Union concern at grid-level in the EU based on the JRC baselines, highlighting the records validated and non-validated by MS, the MS reports and the spread of each IAS of Union concern in the EU based on JRC baselines, the MS reports, and spatial overlap between the two datasets (common cells).

Figure 1. Cumulative number of IAS of Union concern in the EU at grid-level 10x10 km (except for PT, RO and EL, for reasons explained above): MS reports.

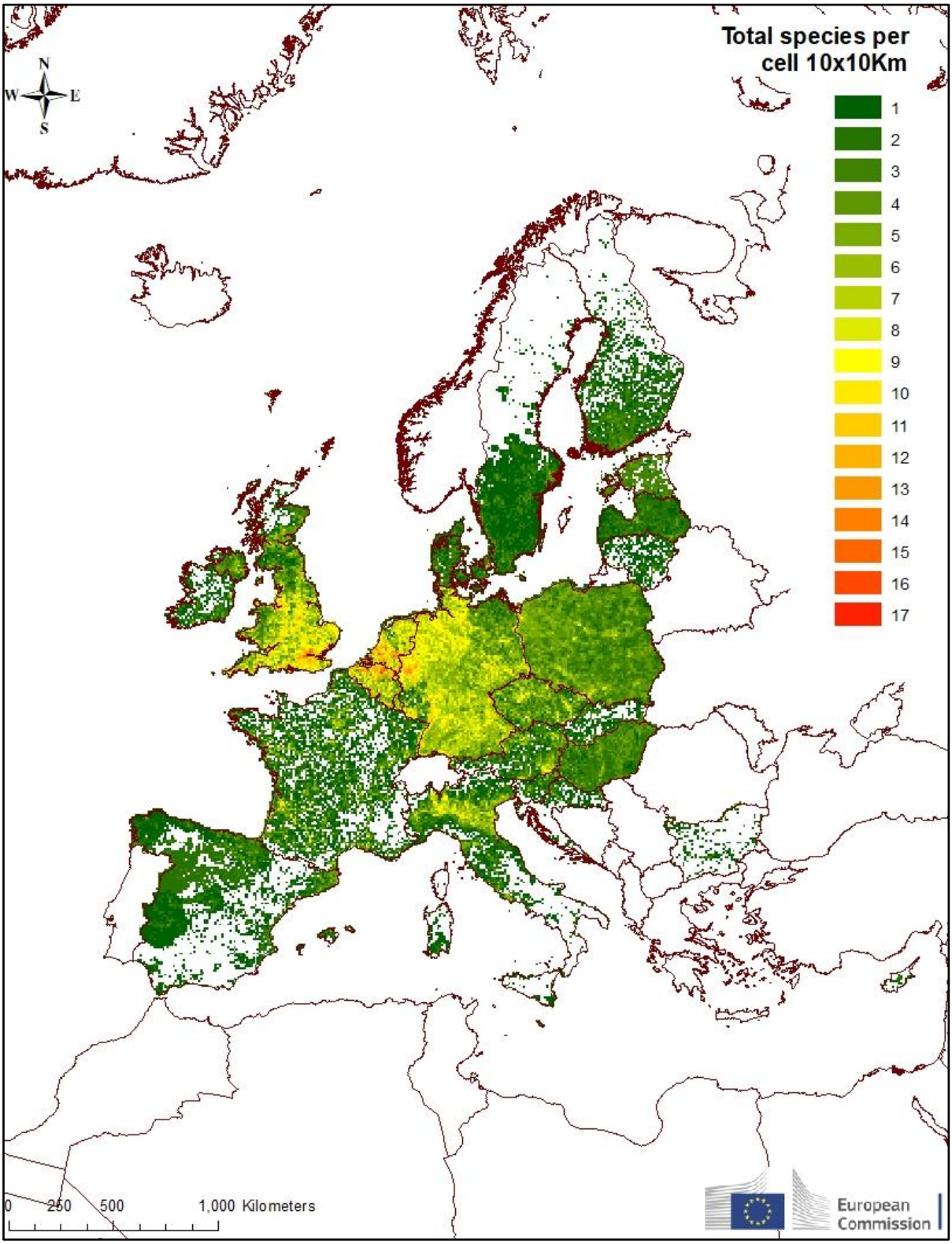


Figure 2. Spatial extent of the IAS of Union concern per MS (grid-level 10x10 Km): JRC baselines records validated by MS vs. MS reports for the relevant species.

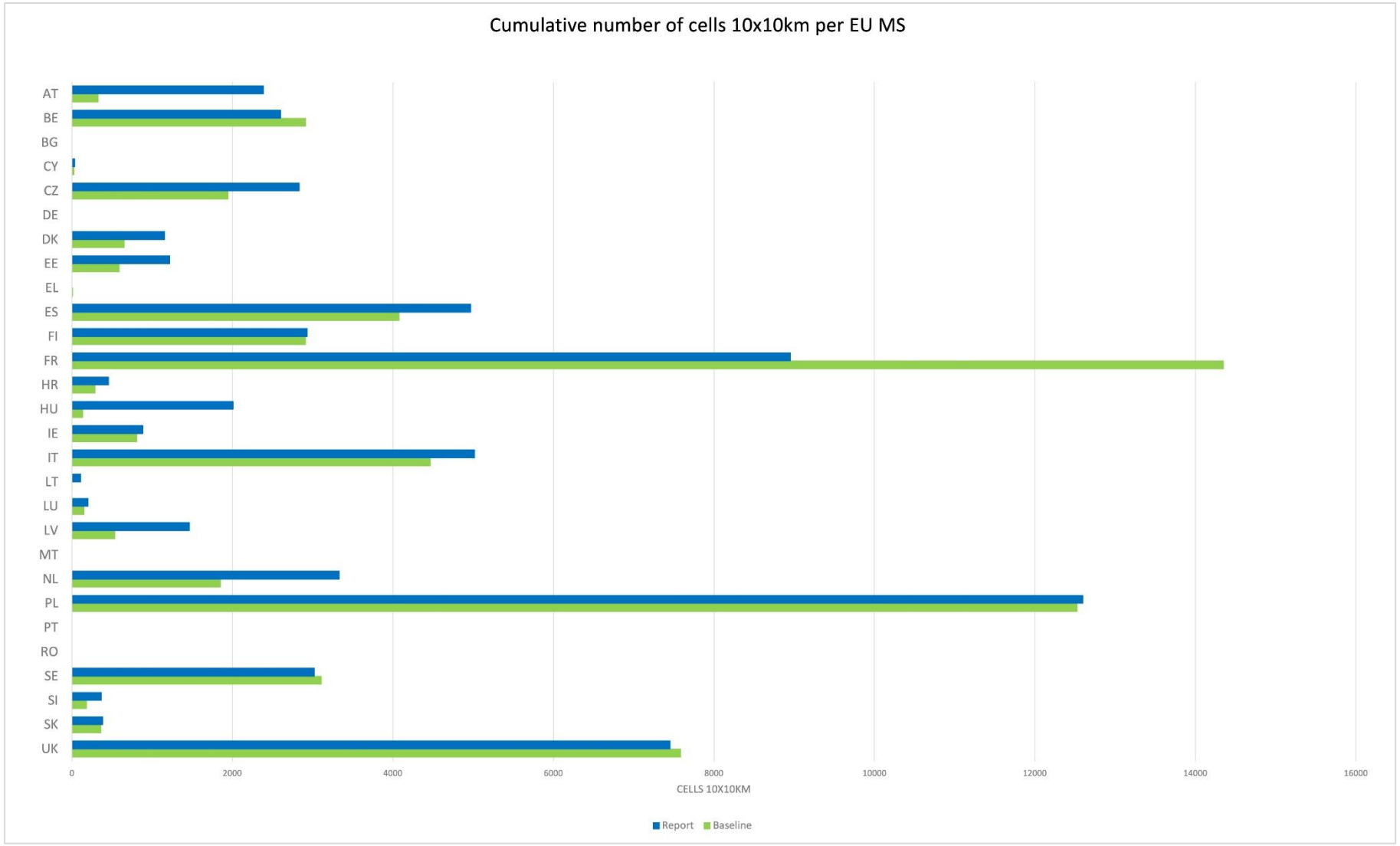


Figure 3. Spread of IAS of Union concern in the EU (grid-level 10x10 km): JRC baseline records validated by MS vs. MS reports.

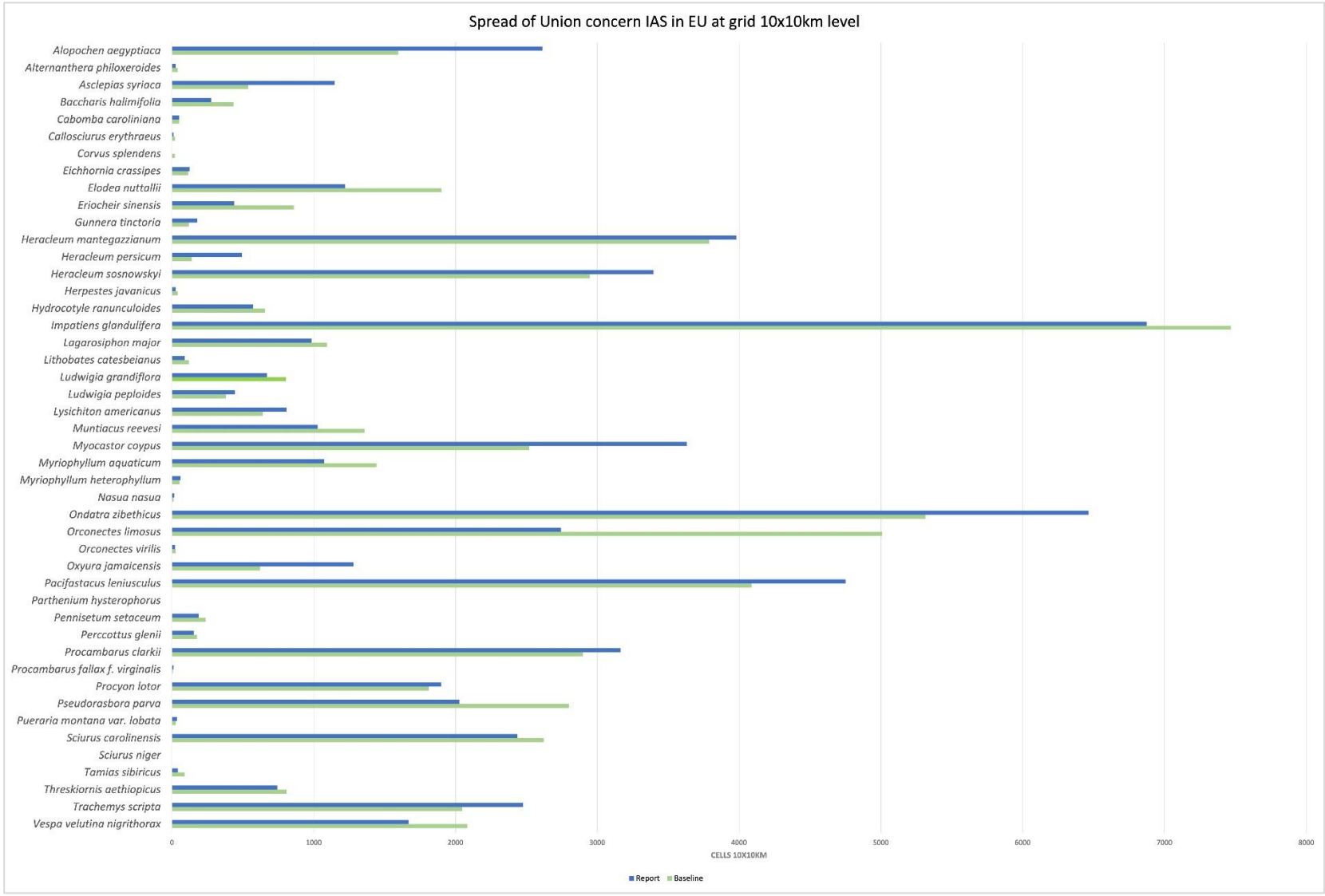


Figure 4. Distribution of *Alopochen aegyptiaca* in the EU (grid-level 10x10 km): JRC baselines, including MS validated and non-validated records.

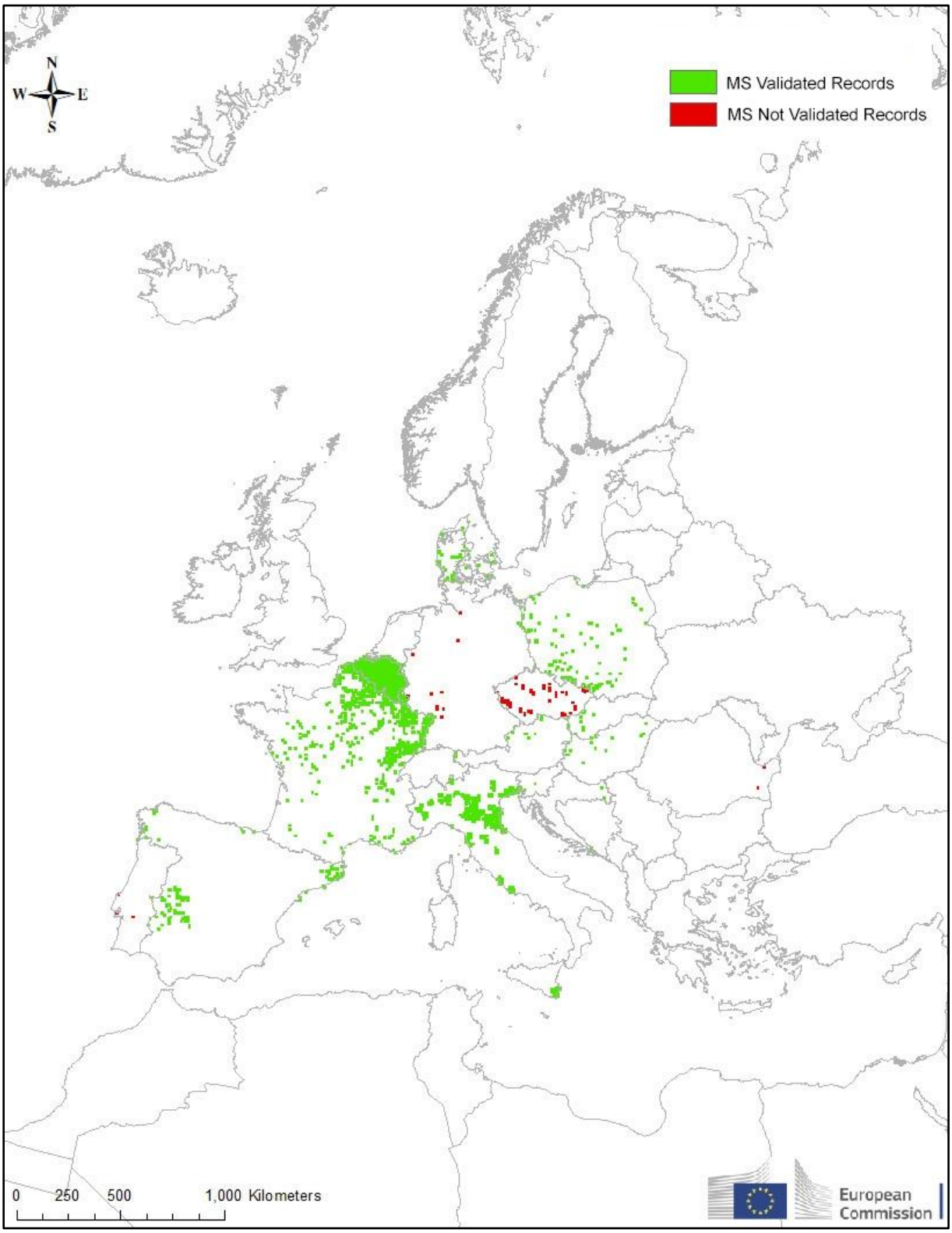


Figure 5. Distribution of *Alopochen aegyptiaca* in the EU (grid-level 10x10 km): MS reports.

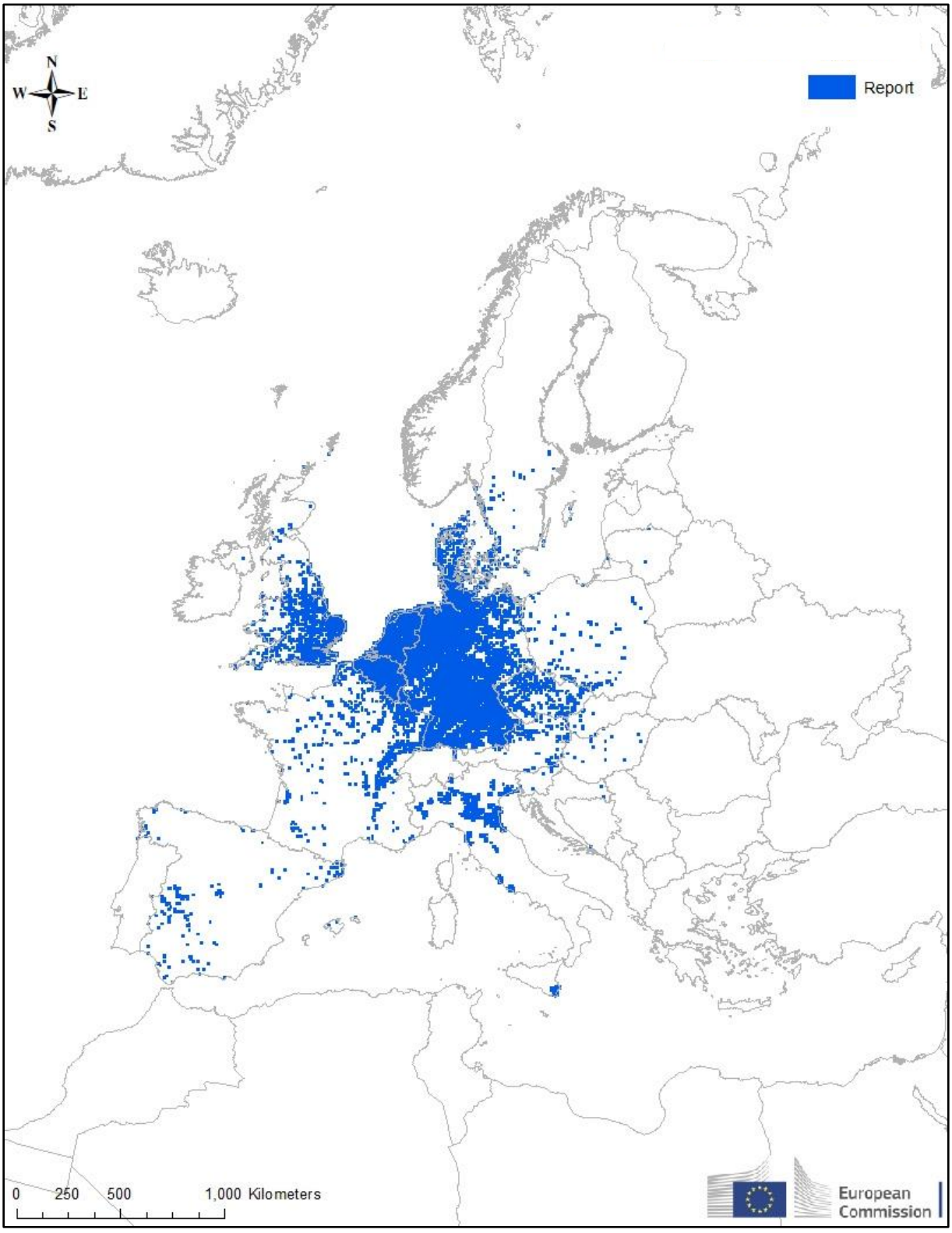


Figure 6. Spread of *Alopochen aegyptiaca* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

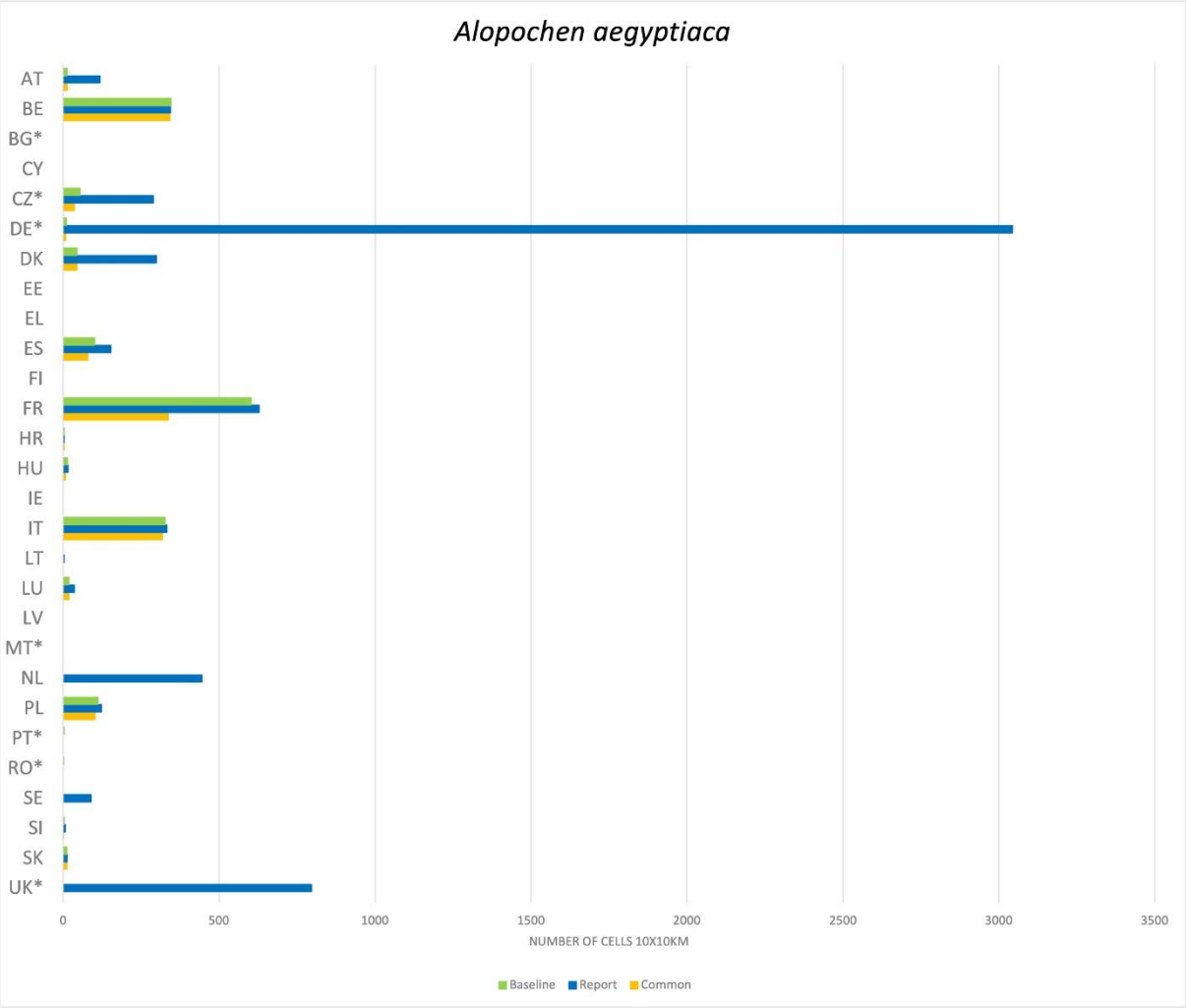


Figure 7. Distribution of *Alternanthera philoxeroides* in the EU (grid-level 10x10 km): JRC baselines, including only MS validated records.

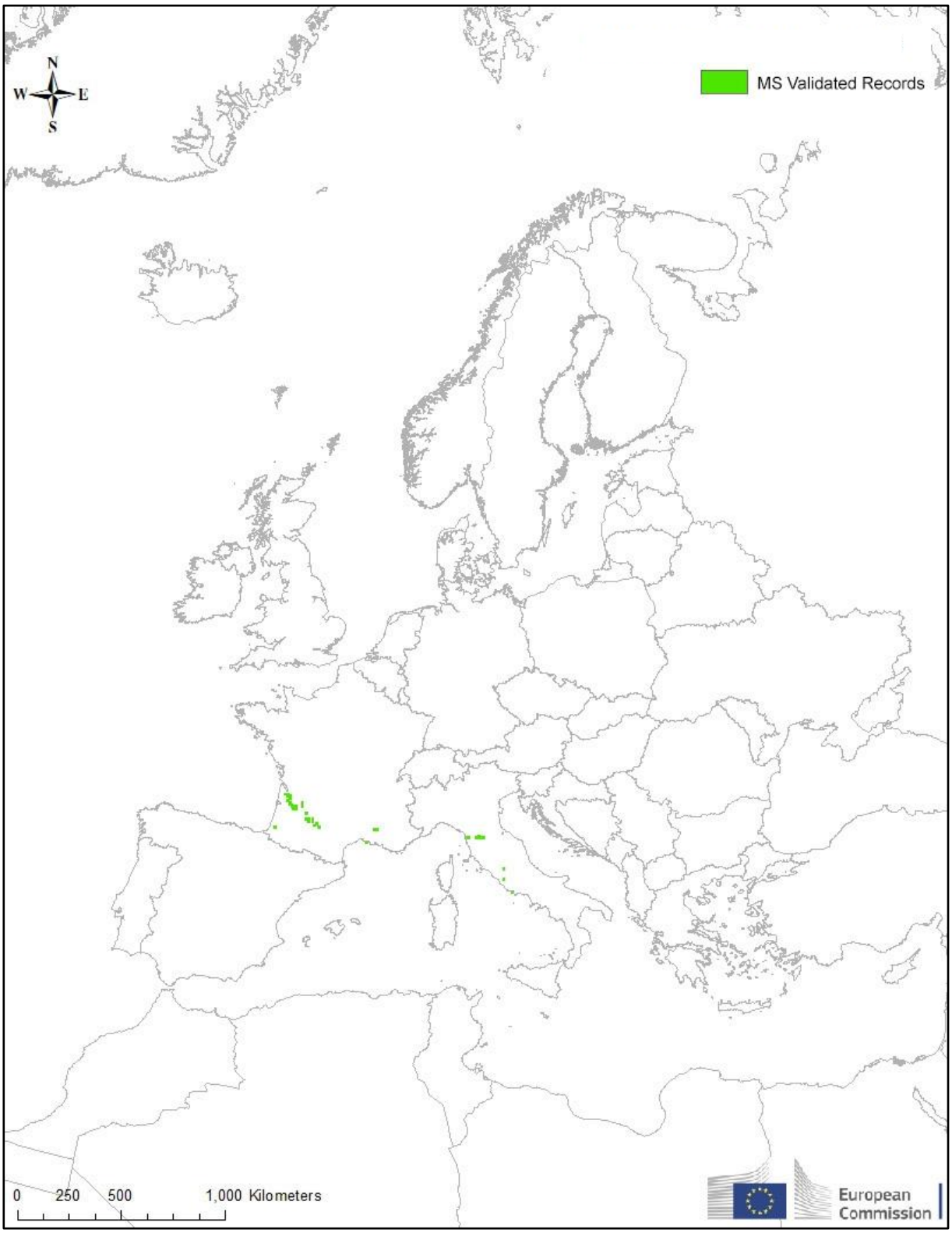


Figure 8. Distribution of *Alternanthera philoxeroides* in the EU (grid-level 10x10 km): MS reports.

Figure 9. Spread of *Alternanthera philoxeroides* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

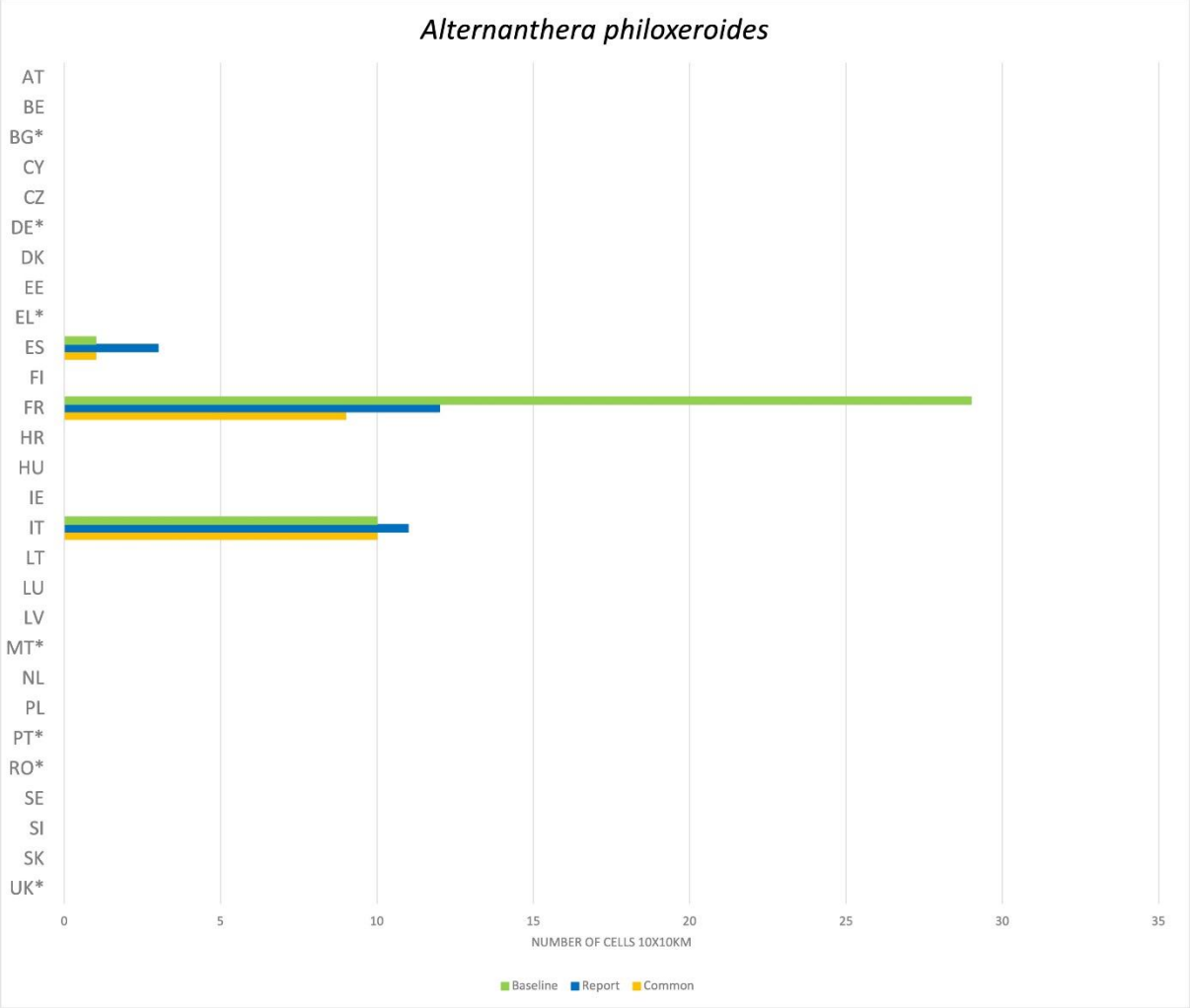


Figure 10. Distribution of *Asclepias syriaca* in the EU (grid-level 10x10 km): JRC baselines, including MS validated and non-validated records.

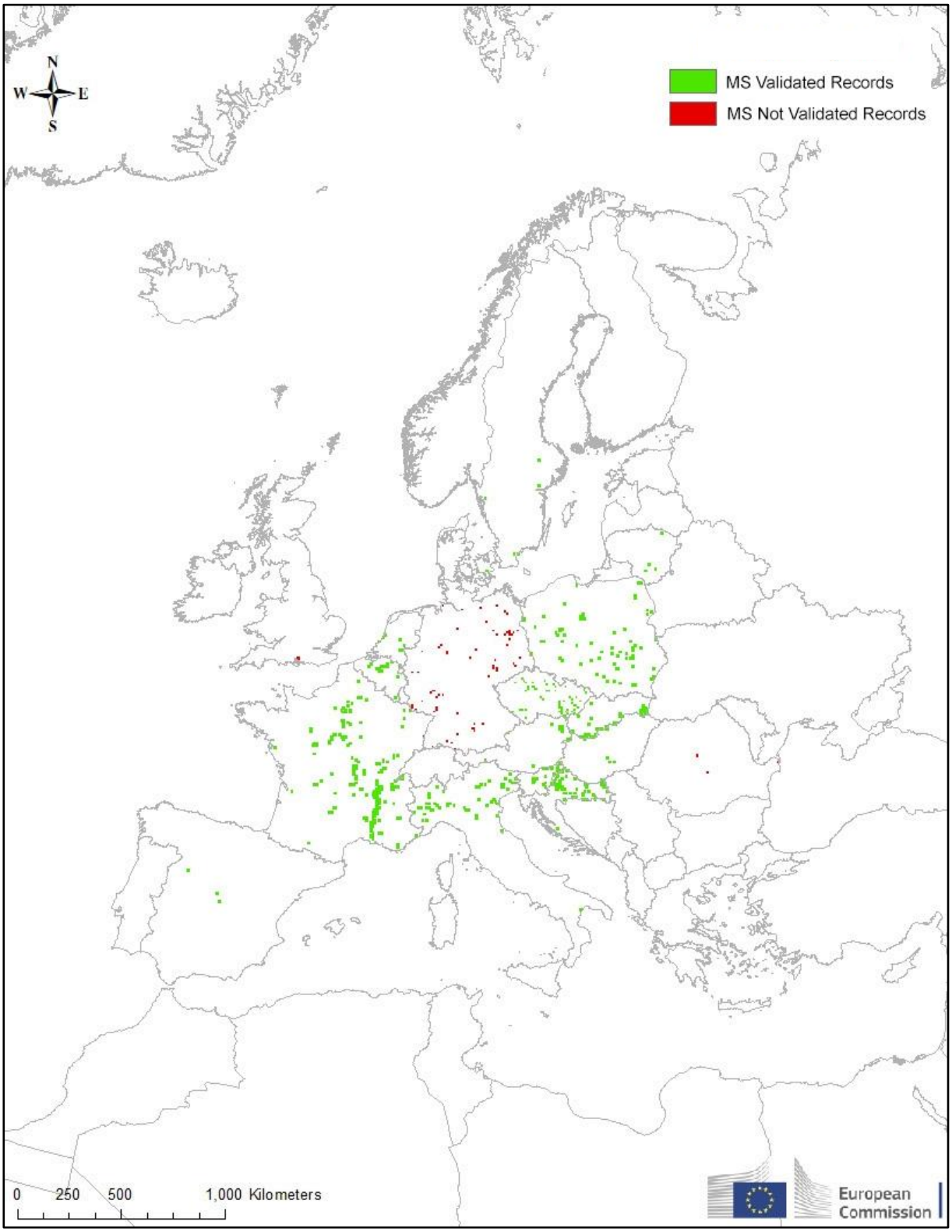


Figure 11. Distribution of *Asclepias syriaca* in the EU (grid-level 10x10 km): MS reports.

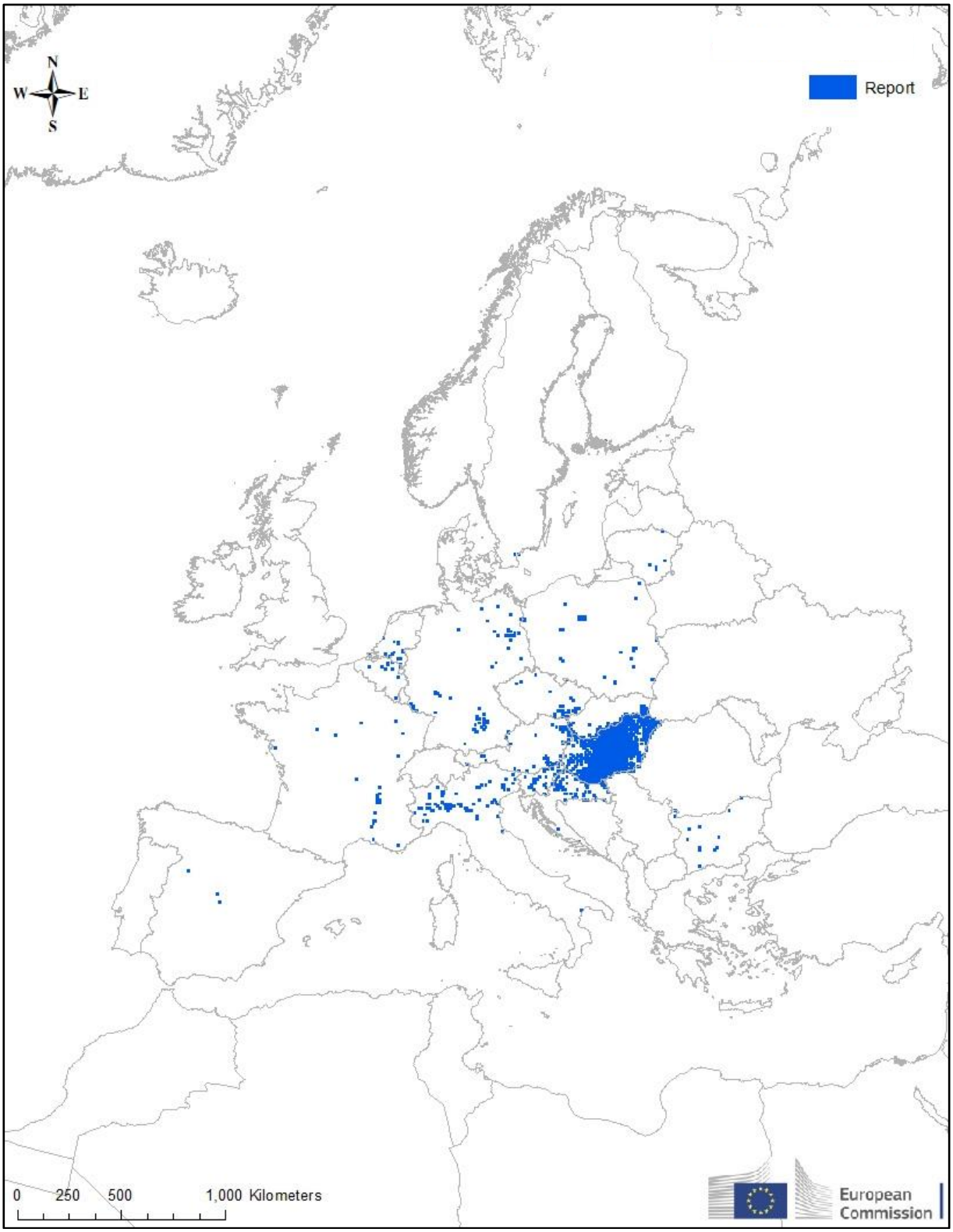


Figure 12. Spread of *Asclepias syriaca* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

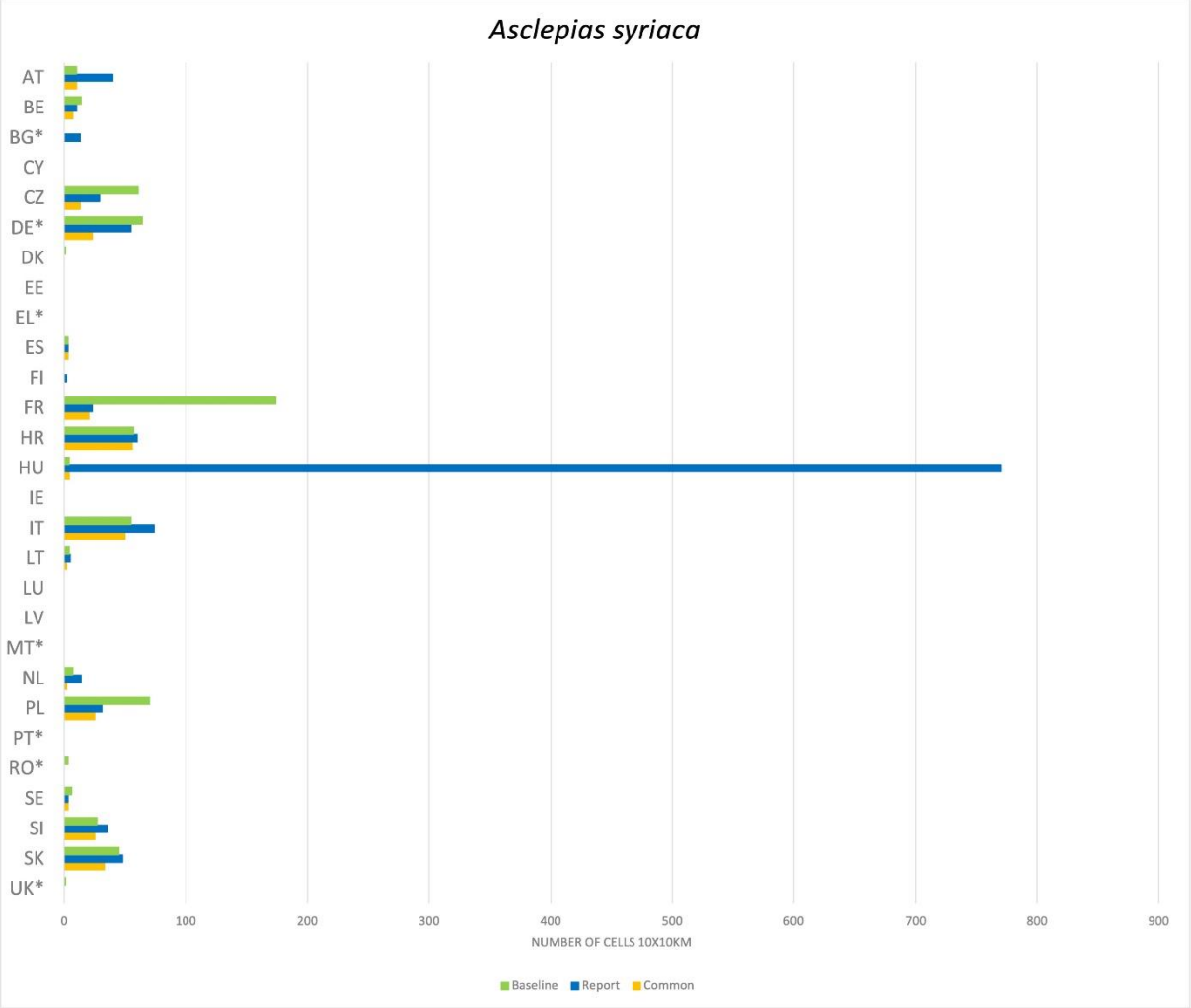


Figure 13. Distribution of *Baccharis halimifolia* in the EU (grid-level 10x10 km): JRC baselines, including only MS validated records.

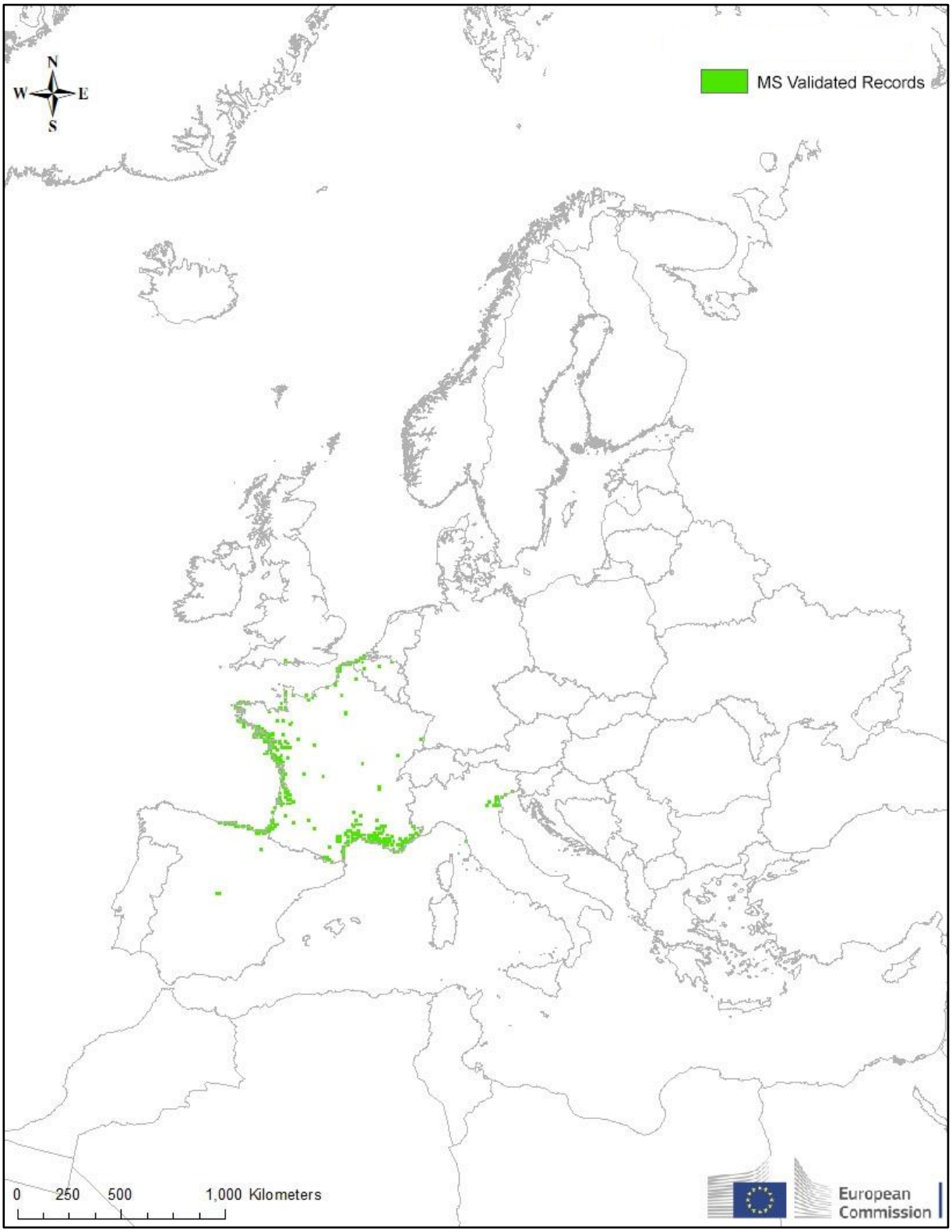


Figure 14. Distribution of *Baccharis halimifolia* in the EU (grid-level 10x10 km): MS reports.

Figure 15. Spread of *Baccharis halimifolia* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

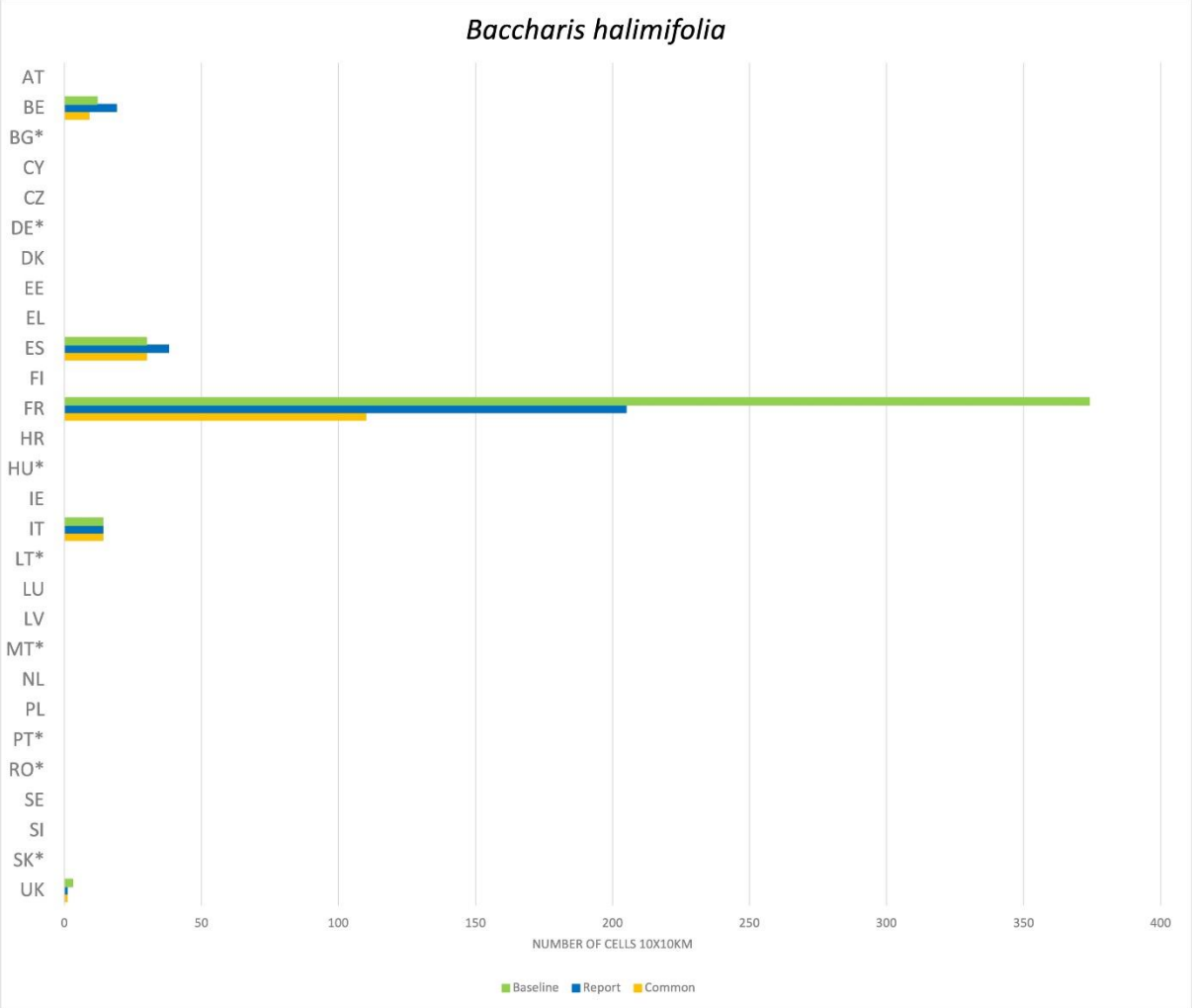


Figure 16. Distribution of *Cabomba caroliniana* in the EU (grid-level 10x10 km): JRC baselines, including MS validated and non-validated records.

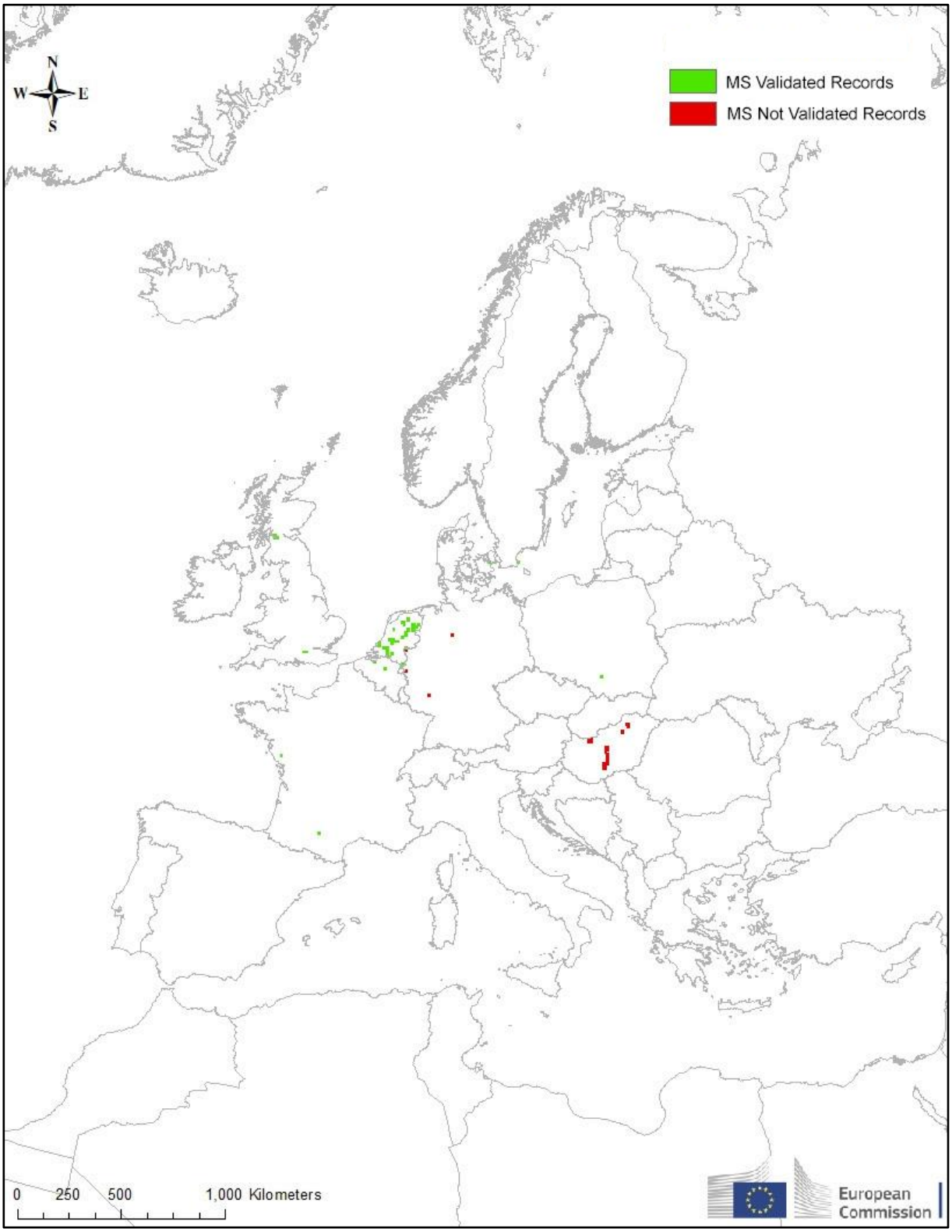


Figure 17. Distribution of *Cabomba caroliniana* in the EU (grid-level 10x10 km): MS reports.

Figure 18. Spread of *Cabomba caroliniana* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

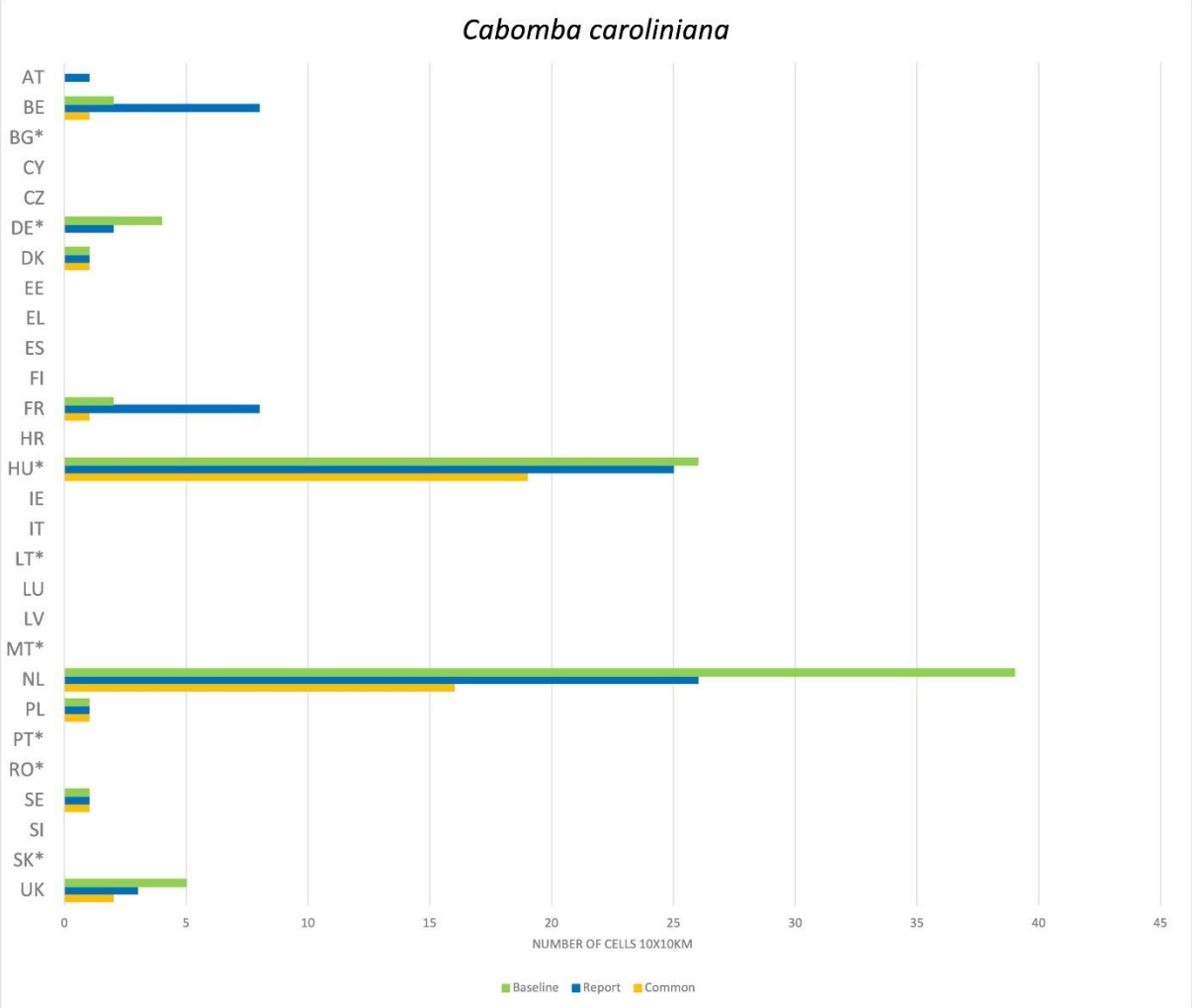


Figure 19. Distribution of *Callosciurus erythraeus* in the EU (grid-level 10x10 km): JRC baselines, including only MS validated records.

Figure 20. Distribution of *Callosciurus erythraeus* in the EU (grid-level 10x10 km): MS reports.

Figure 21. Spread of *Callosciurus erythraeus* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

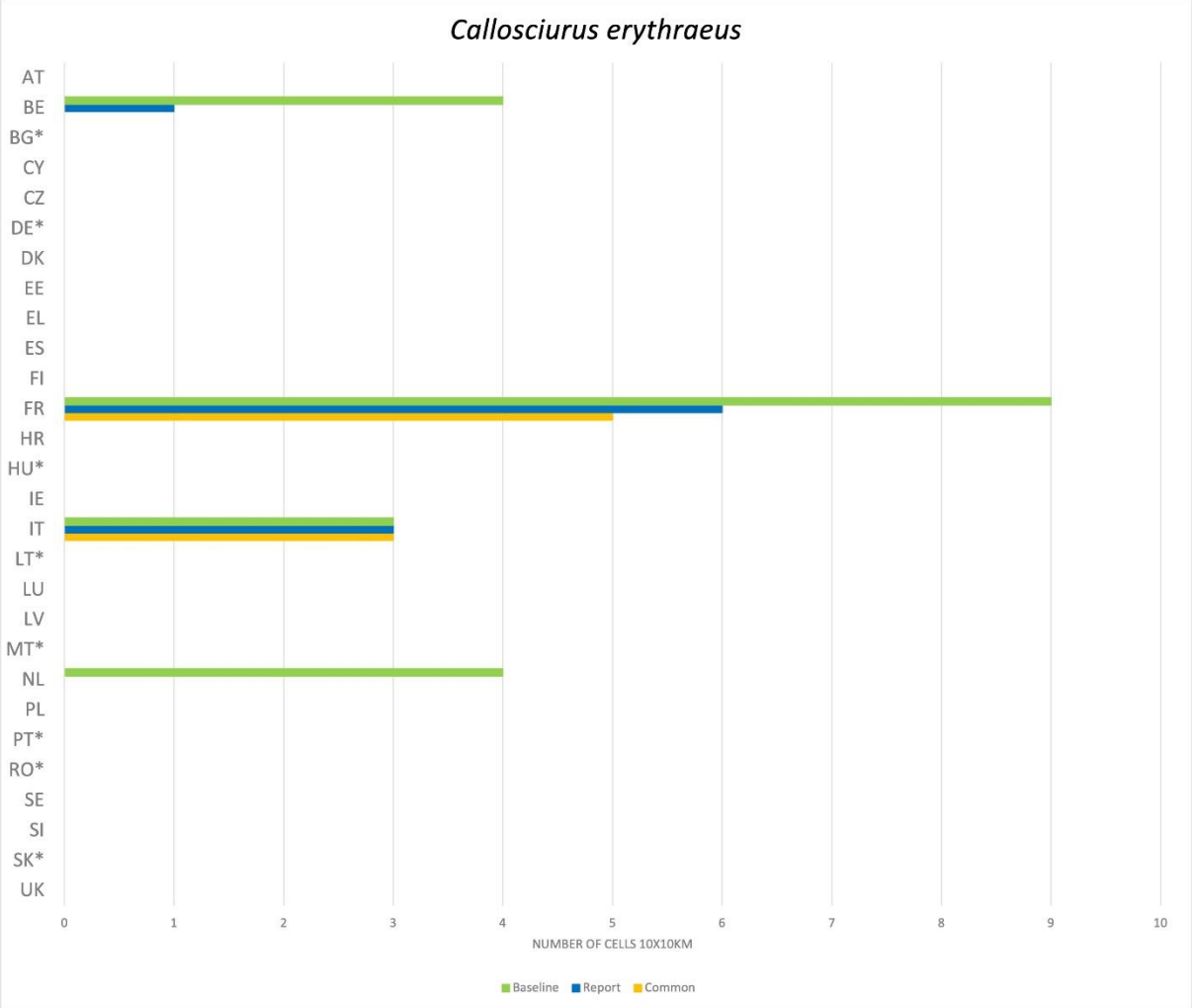


Figure 22. Distribution of *Corvus splendens* in the EU (grid-level 10x10 km): JRC baselines, including MS validated and non-validated records.

Figure 23. Distribution of *Corvus splendens* in the EU (grid-level 10x10 km): MS reports. FR has reported one spatial record, but at country level the species was marked as not present.

Figure 24. Spread of *Corvus splendens* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

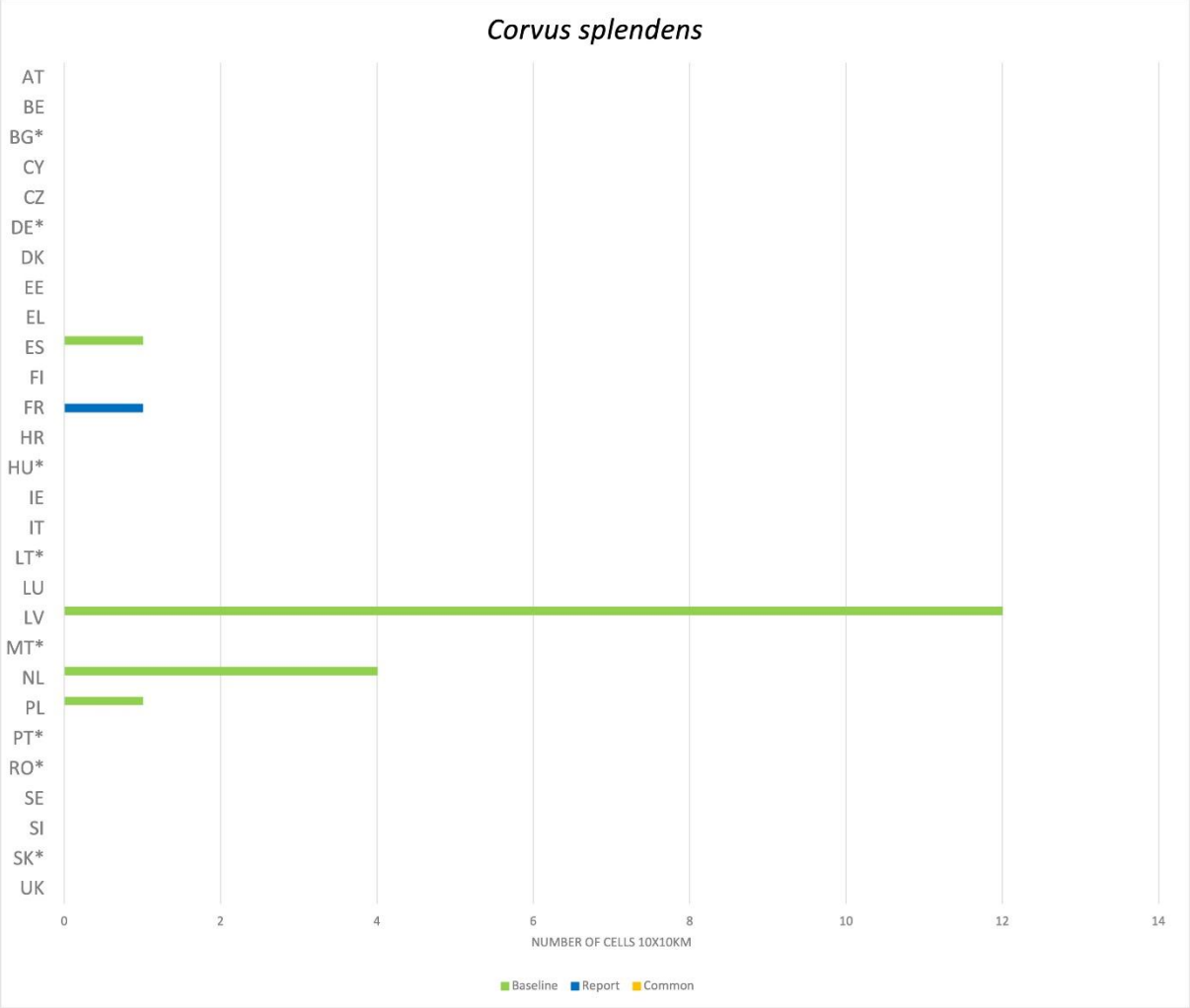


Figure 25. Distribution of *Eichhornia crassipes* in the EU (grid-level 10x10 km): a) JRC baselines, including MS validated and non-validated records.

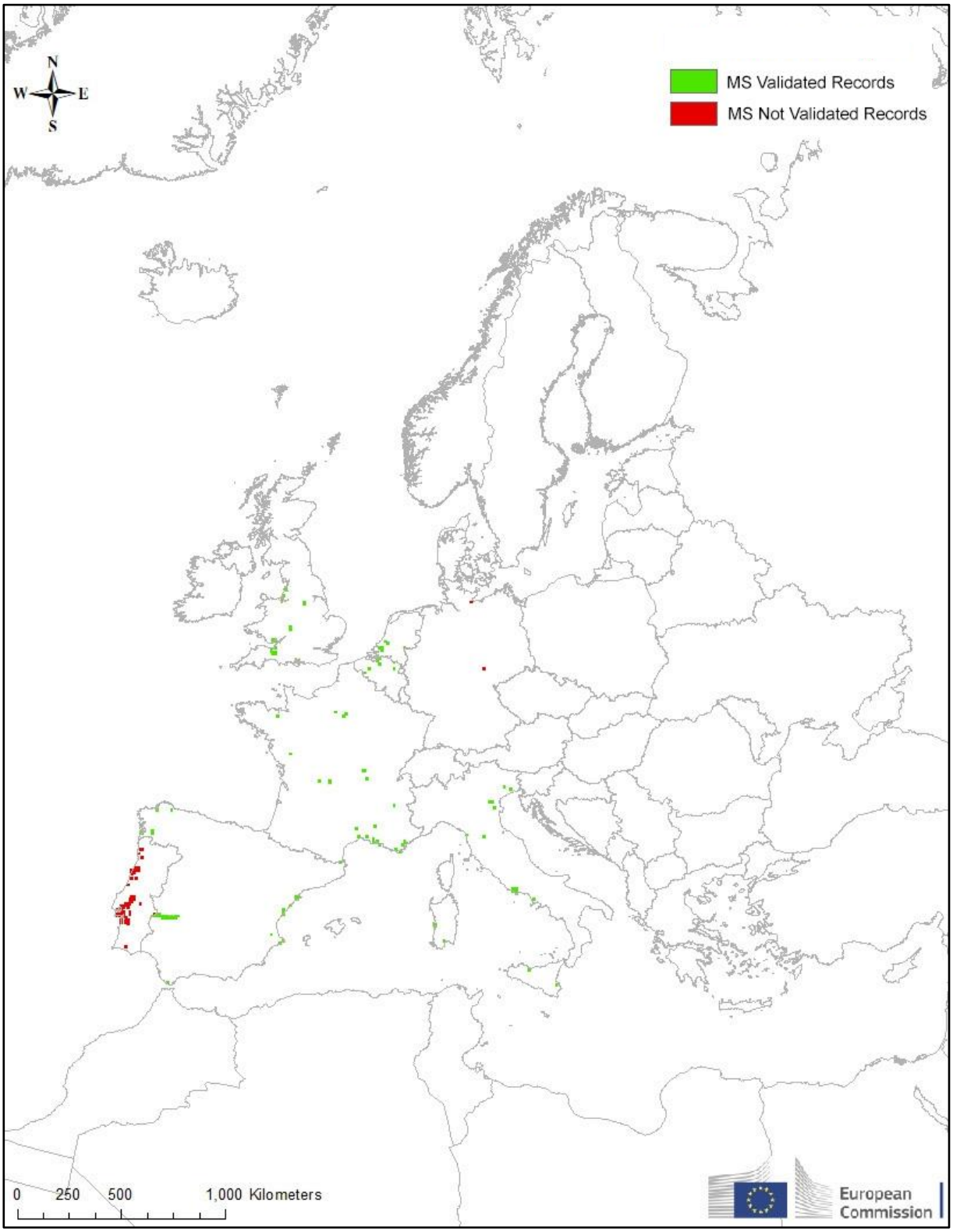


Figure 26. Distribution of *Eichhornia crassipes* in the EU (grid-level 10x10 km): MS reports.

Figure 27. Spread of *Eichhornia crassipes* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

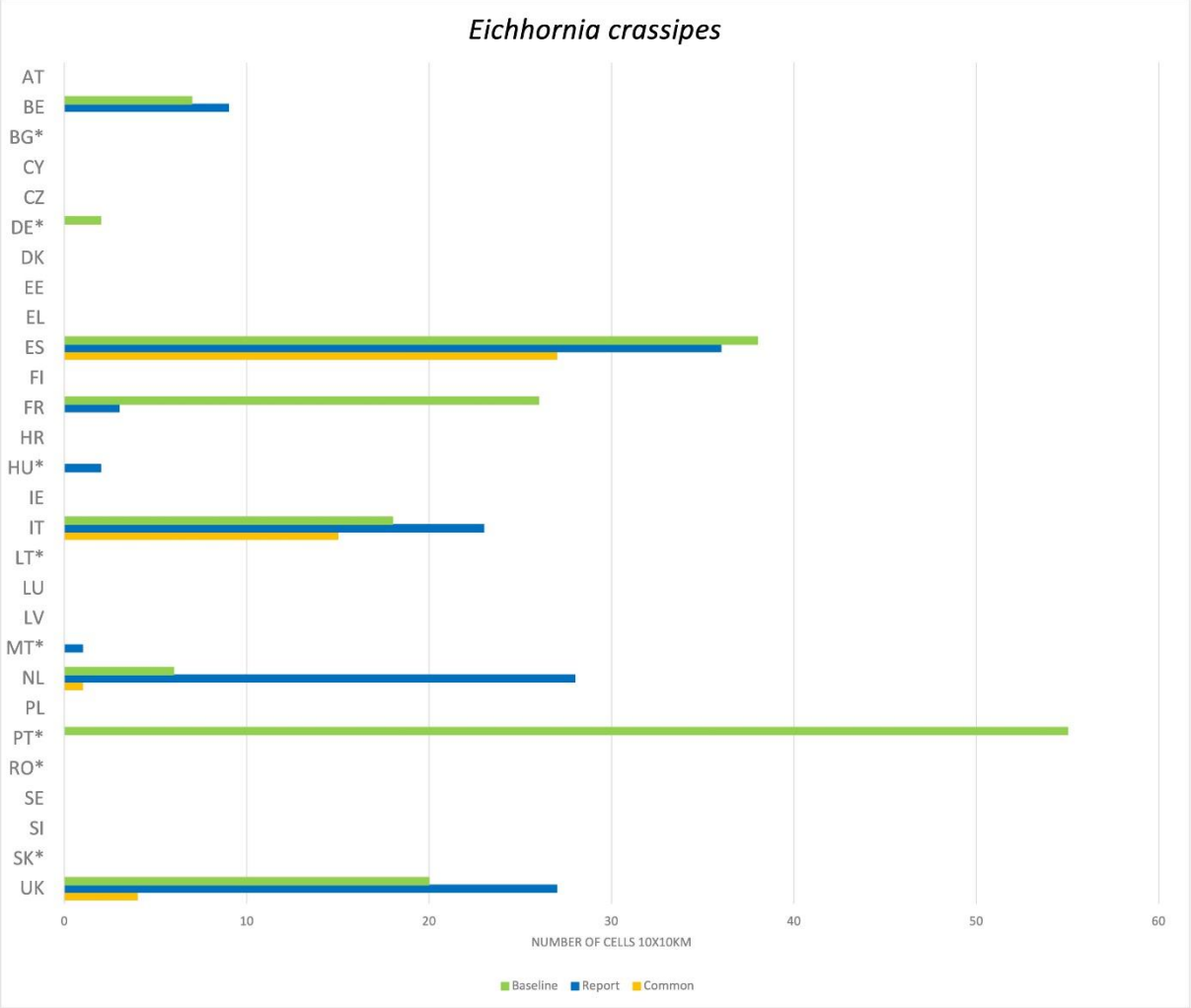


Figure 28. Distribution of *Elodea nuttallii* in the EU (grid-level 10x10 km): JRC baselines, including MS validated and non-validated records.

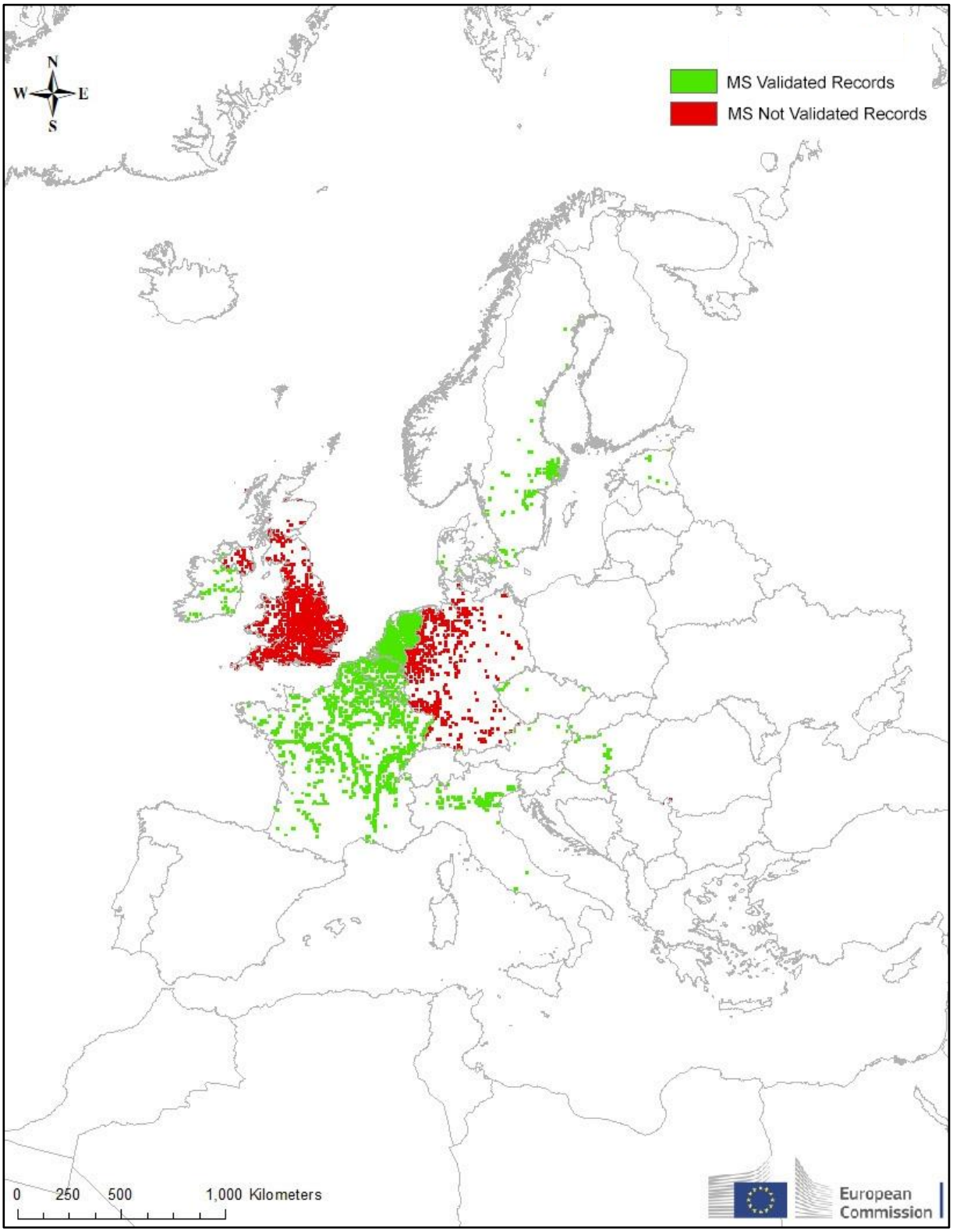


Figure 29. Distribution of *Elodea nuttallii* in the EU (grid-level 10x10 km): MS reports.

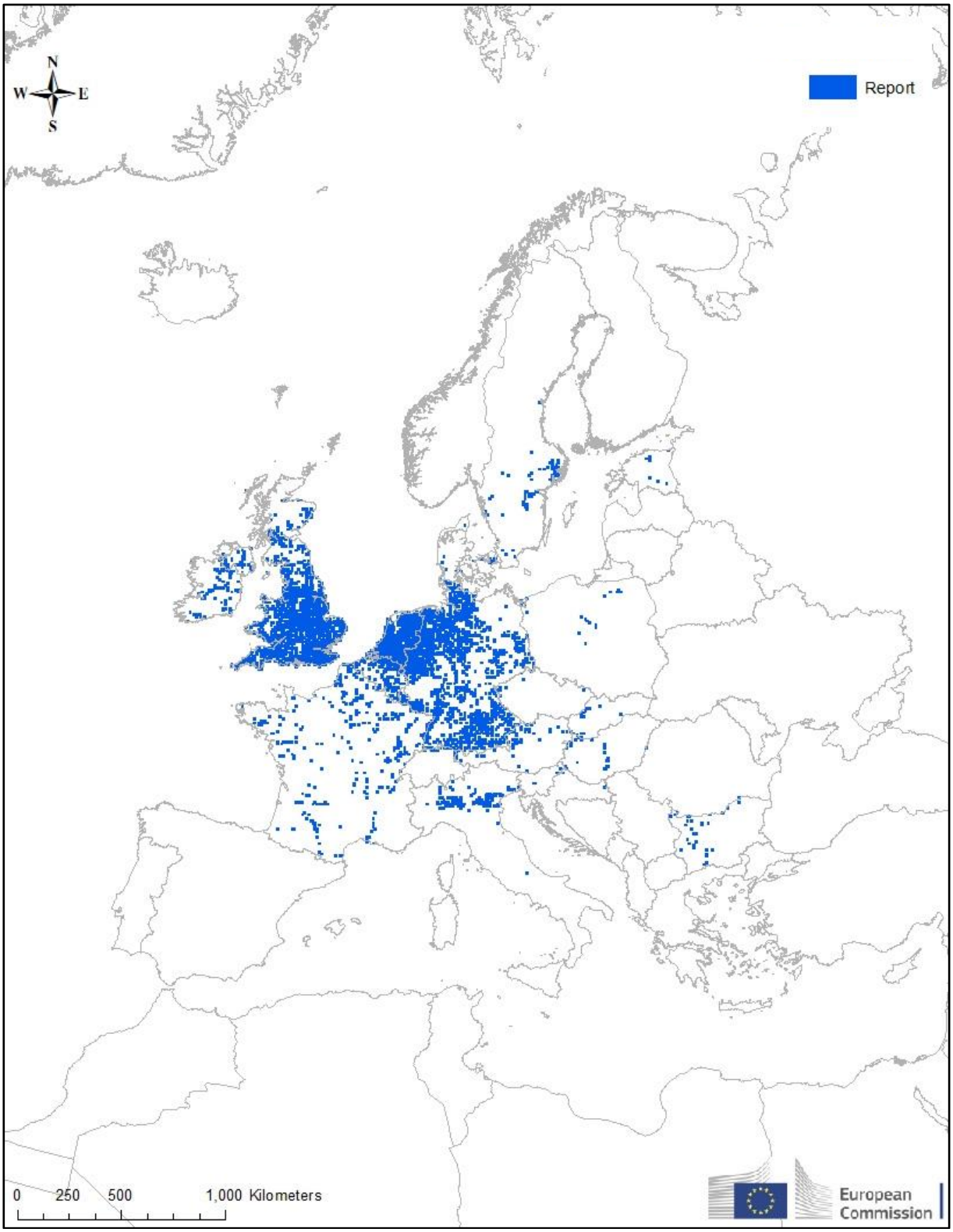


Figure 30. Spread of *Elodea nuttallii* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

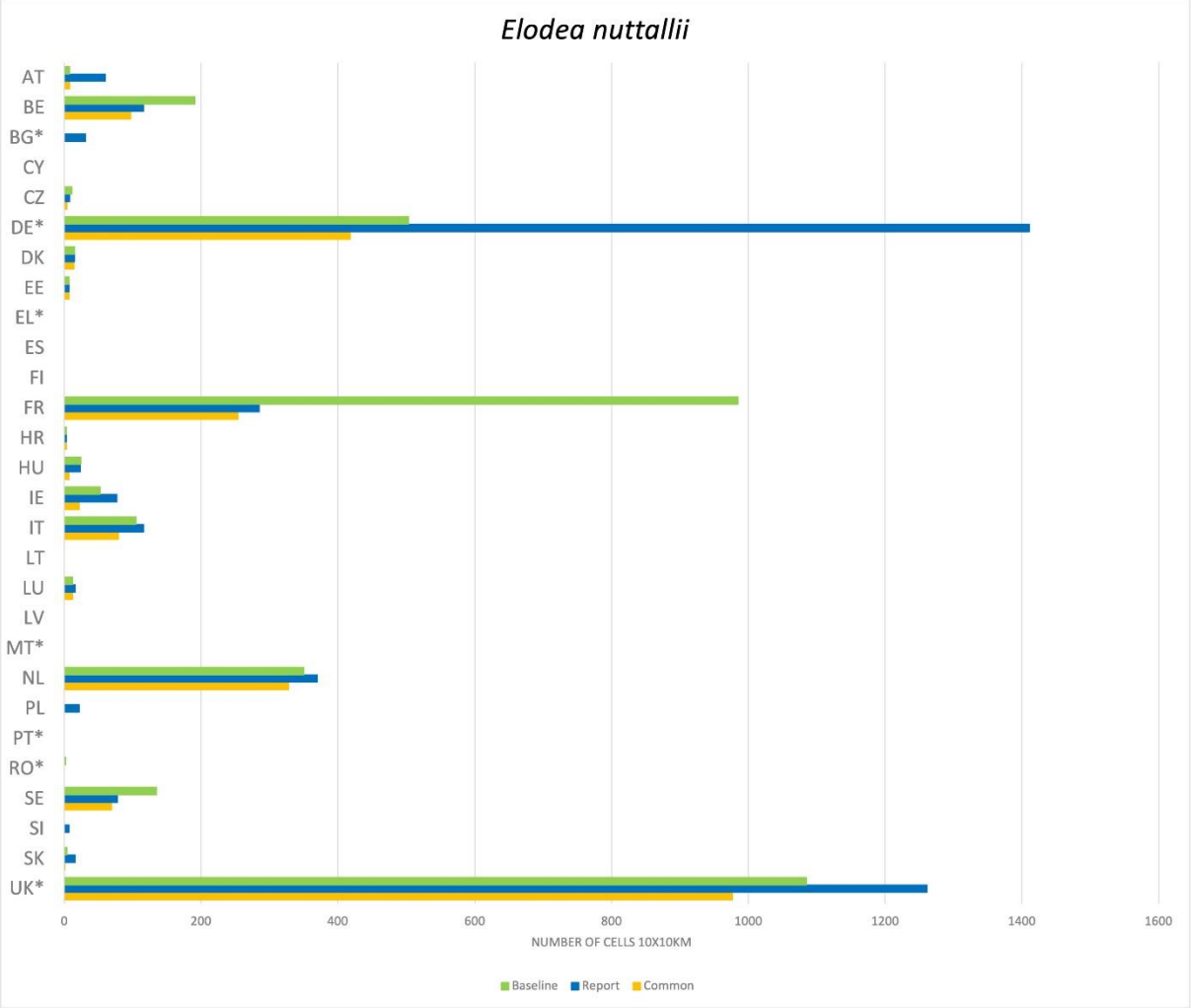


Figure 31. Distribution of *Eriocheir sinensis* in the EU (grid-level 10x10 km): JRC baselines including MS validated and non-validated records.

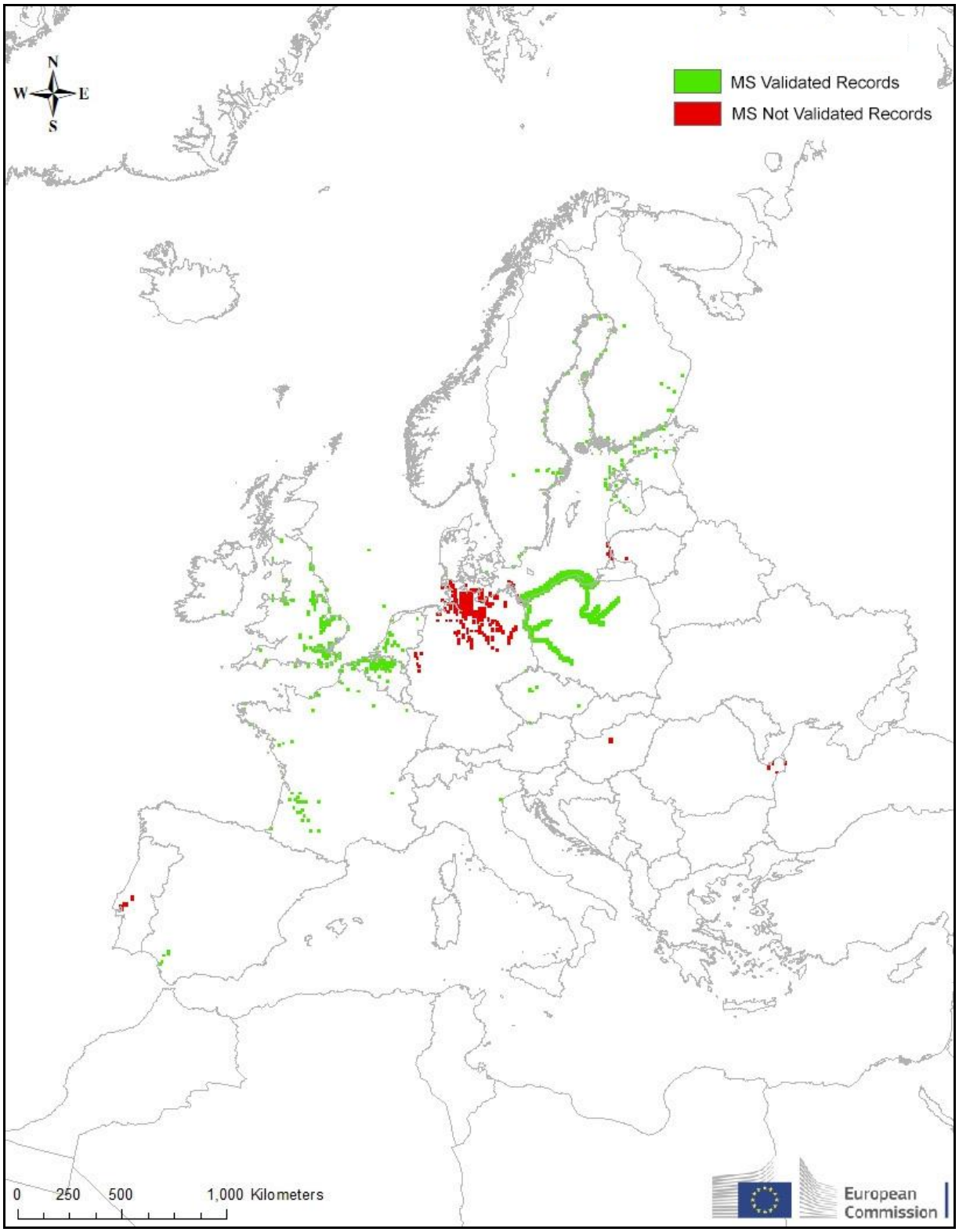


Figure 32. Distribution of *Eriocheir sinensis* in the EU (grid-level 10x10 km): MS reports.

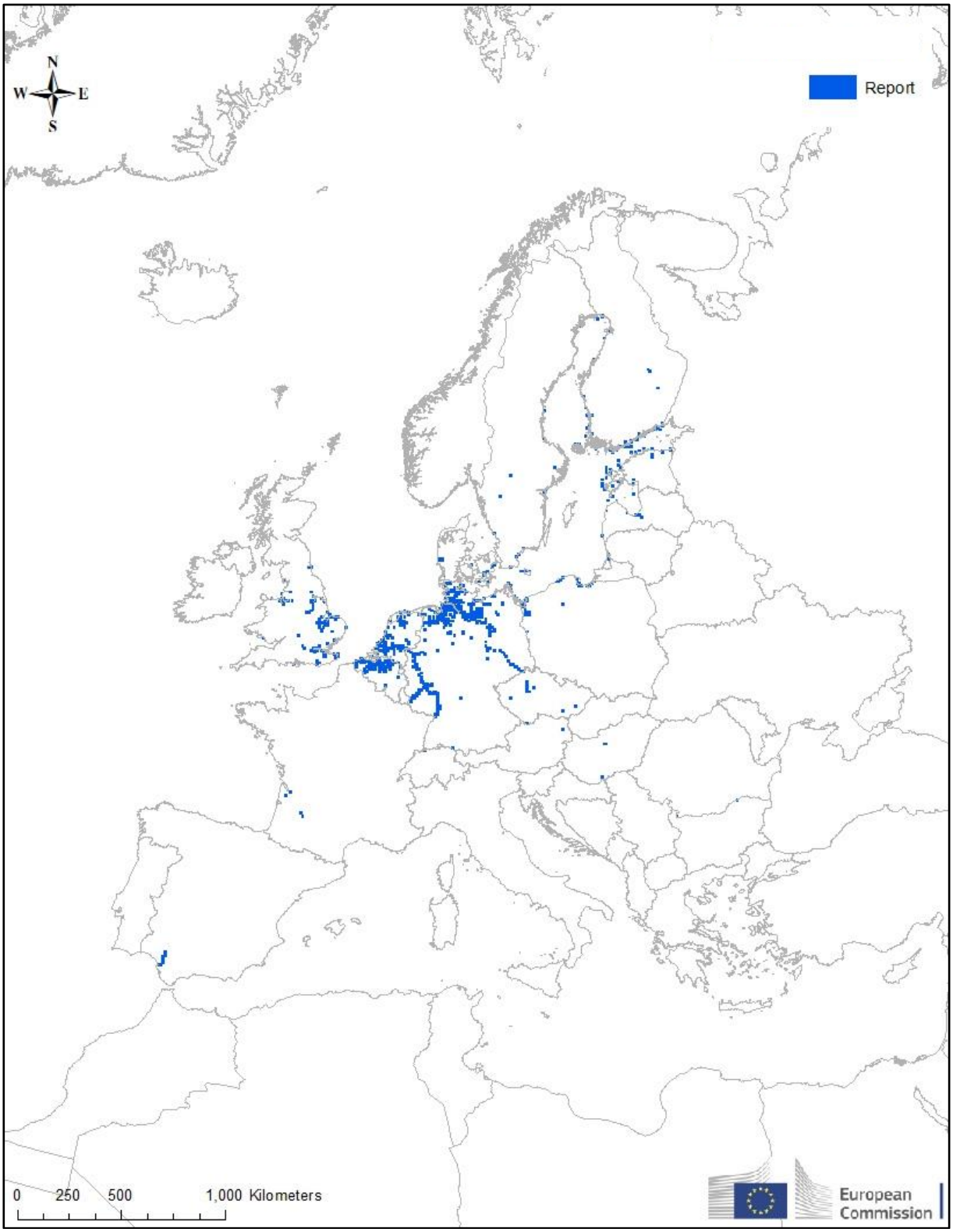


Figure 33. Spread of *Eriocheir sinensis* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

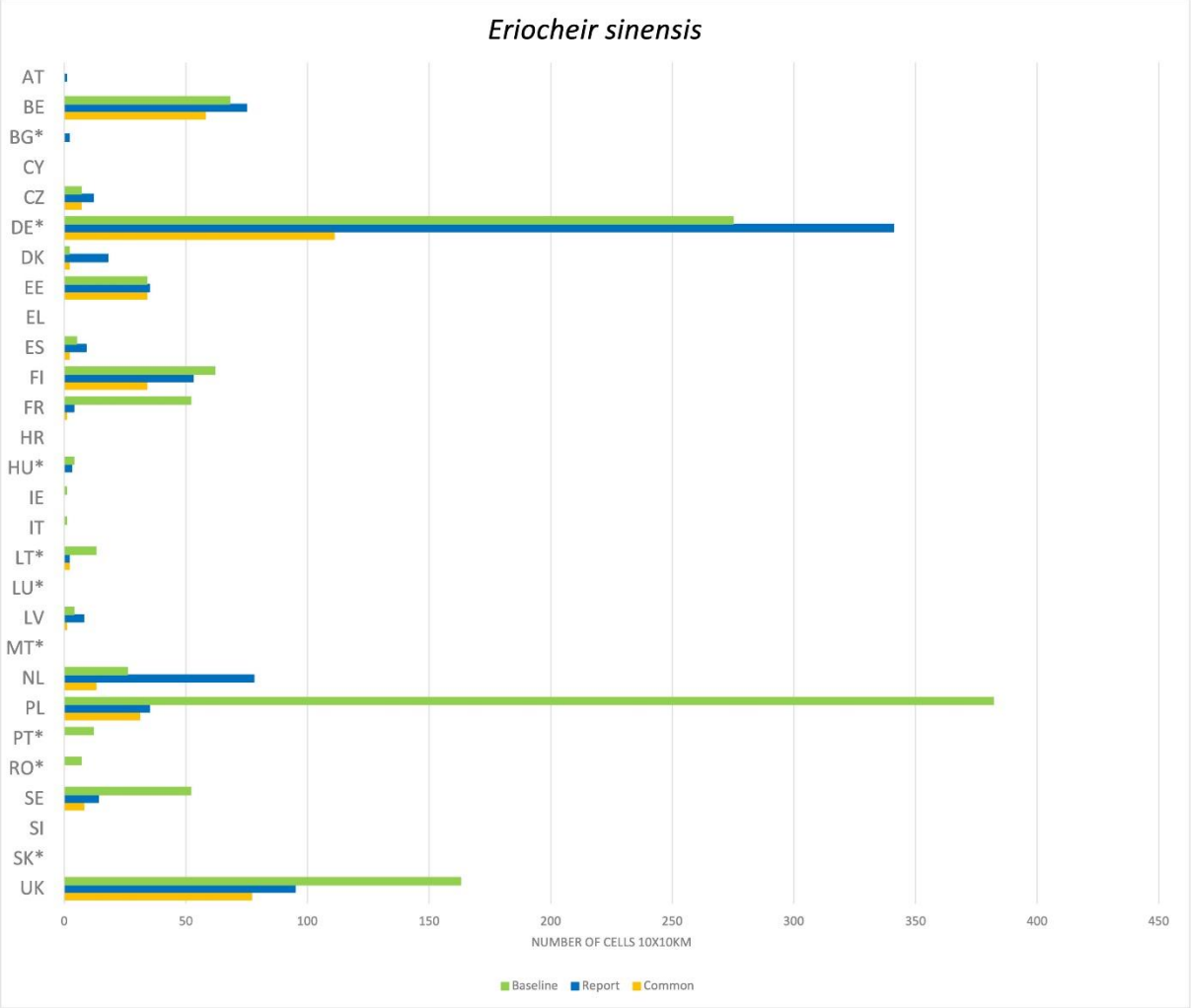


Figure 34. Distribution of *Gunnera tinctoria* in the EU (grid-level 10x10 km): JRC baselines including MS validated and non-validated records.

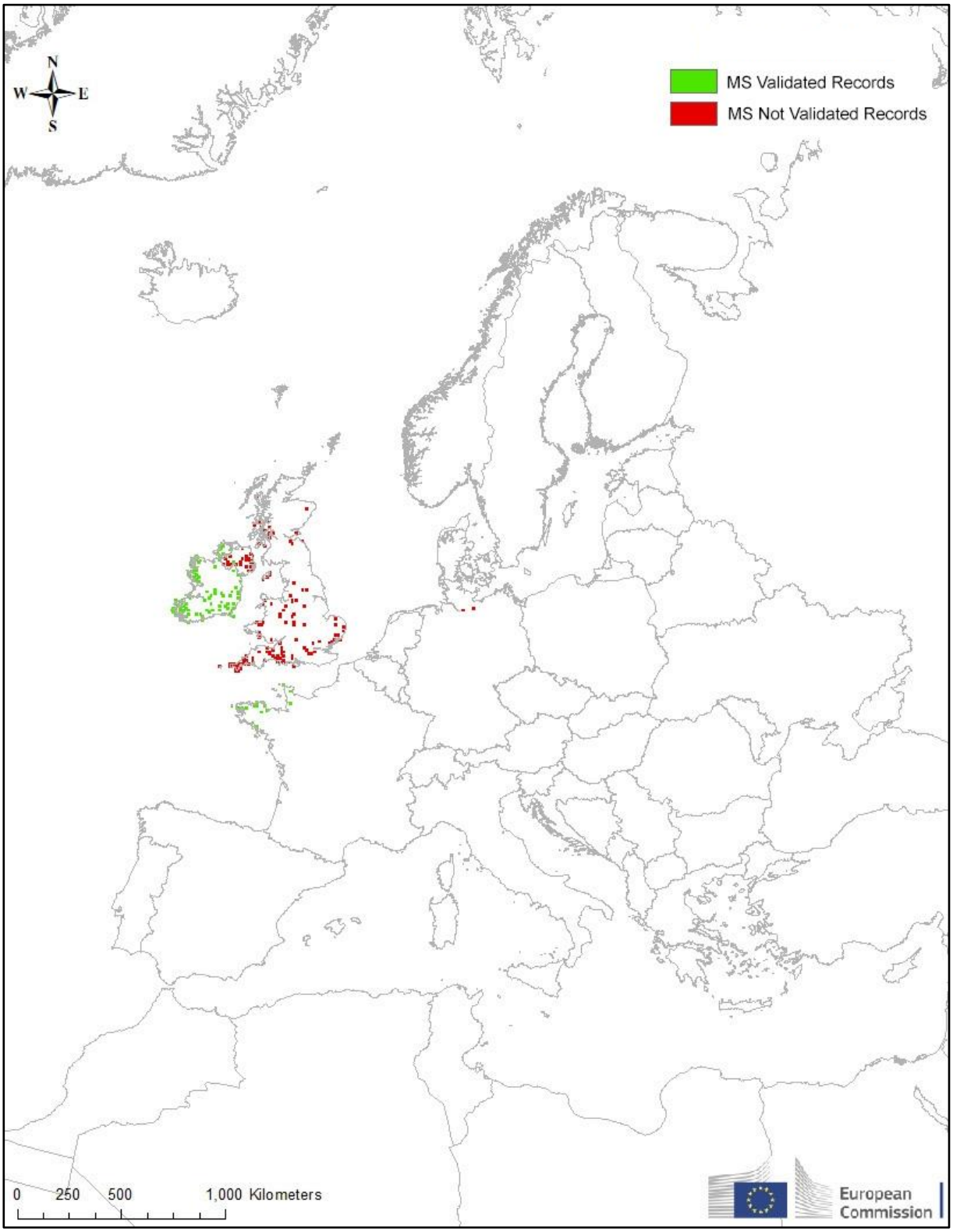


Figure 35. Distribution of *Gunnera tinctoria* in the EU (grid-level 10x10 km): MS reports.

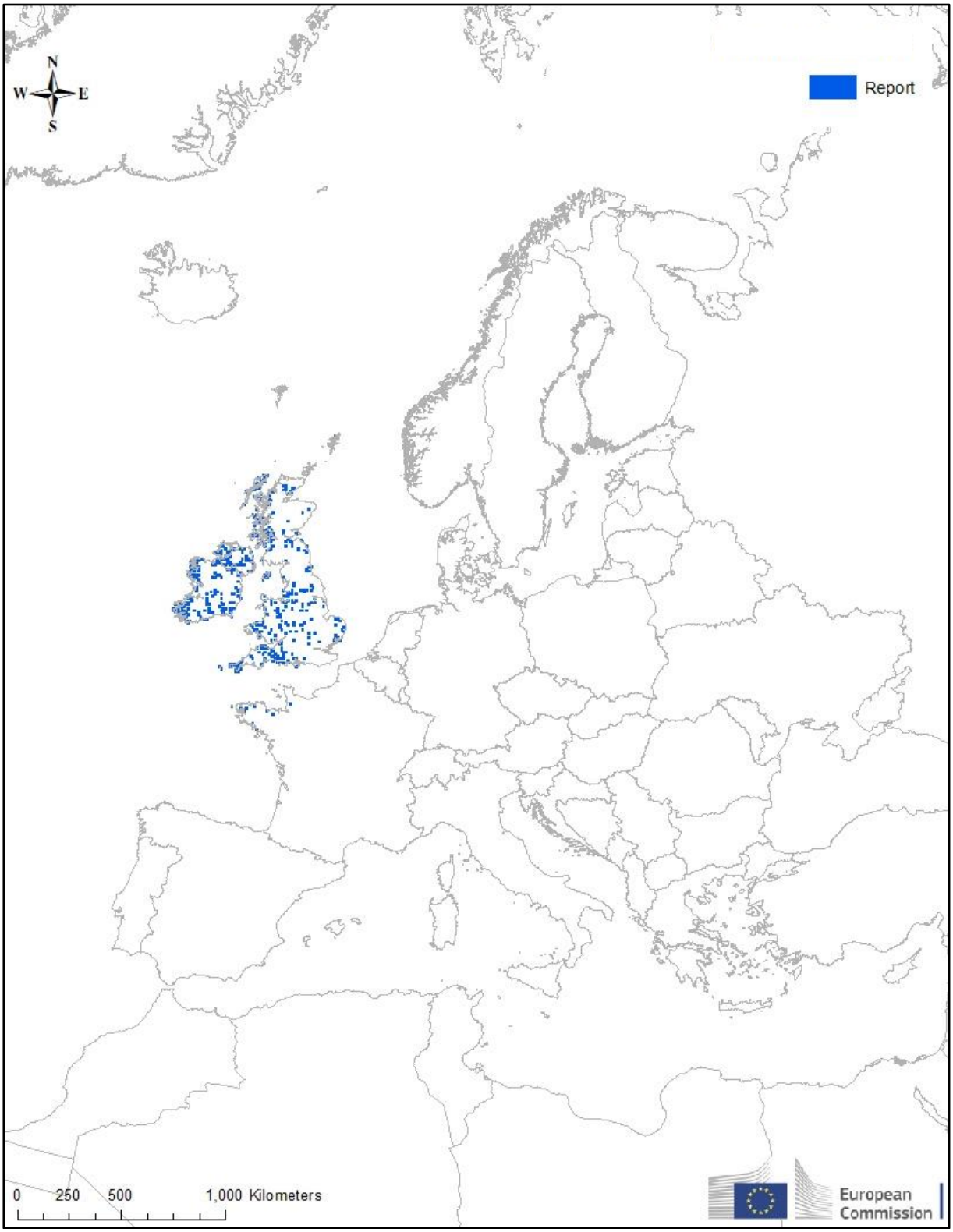


Figure 36. Spread of *Gunnera tinctoria* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

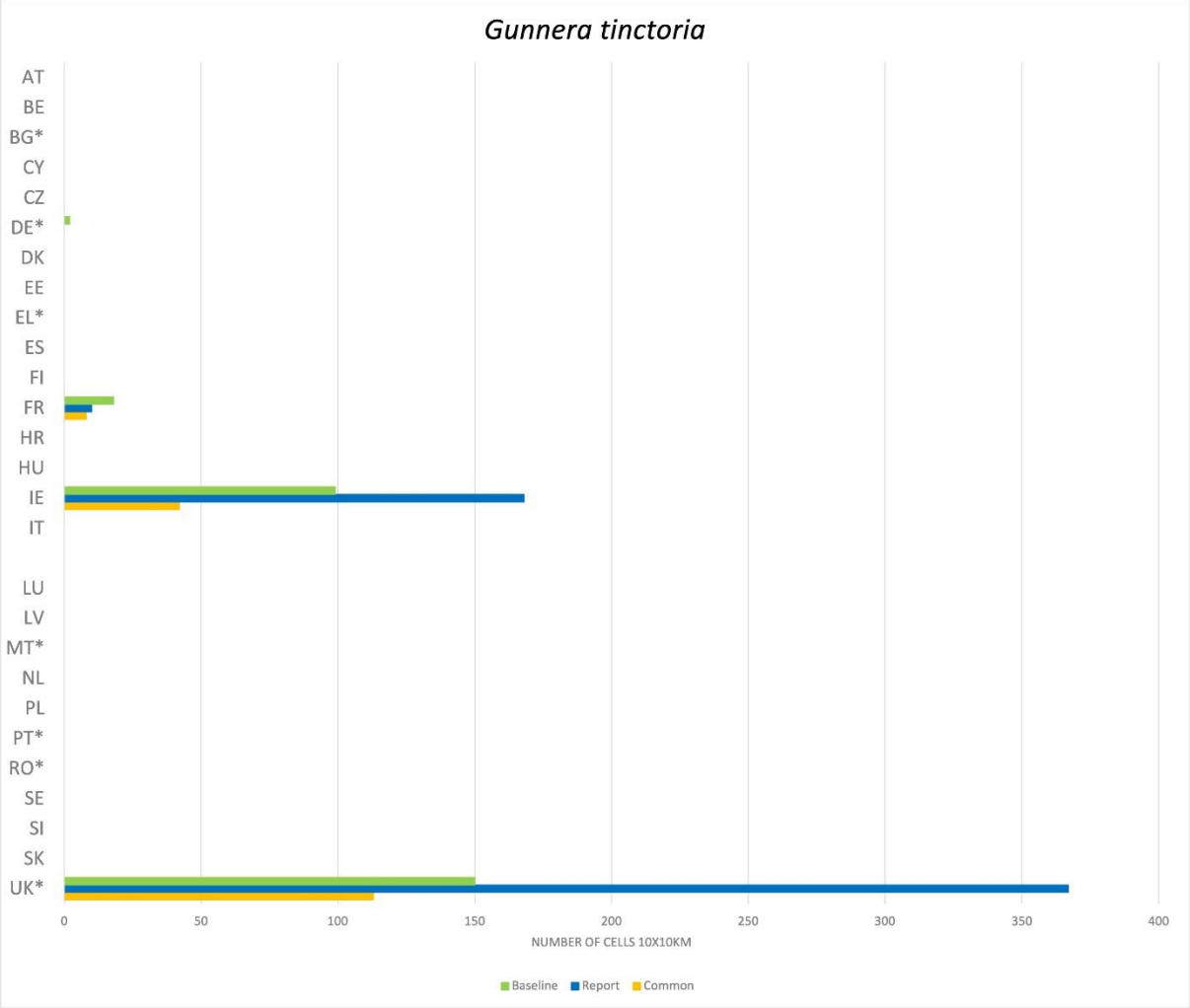


Figure 37. Distribution of *Heracleum mantegazzianum* in the EU (grid-level 10x10 km): JRC baselines, including MS validated and non-validated records.

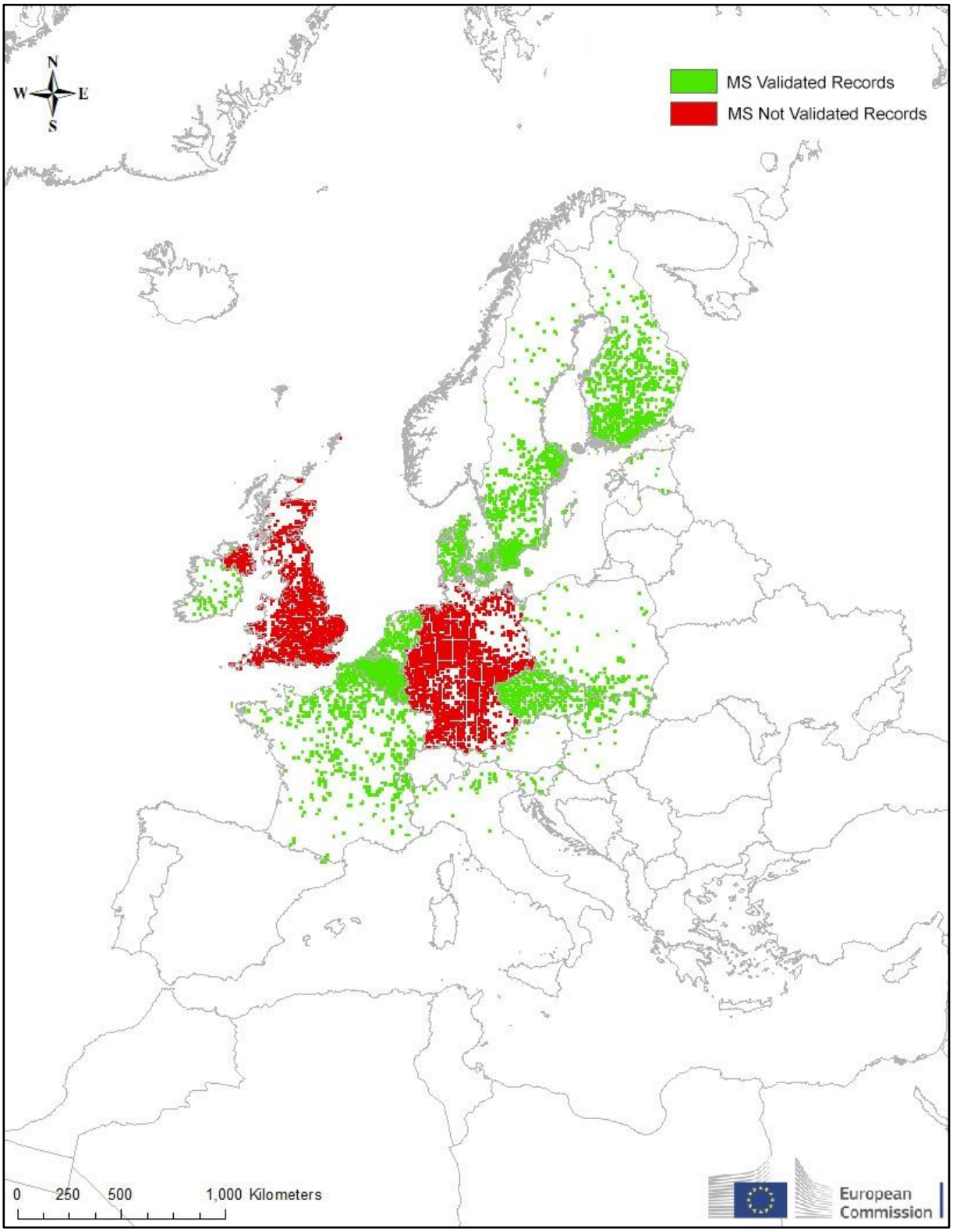


Figure 38. Distribution of *Heracleum mantegazzianum* in the EU (grid-level 10x10 km): MS reports.

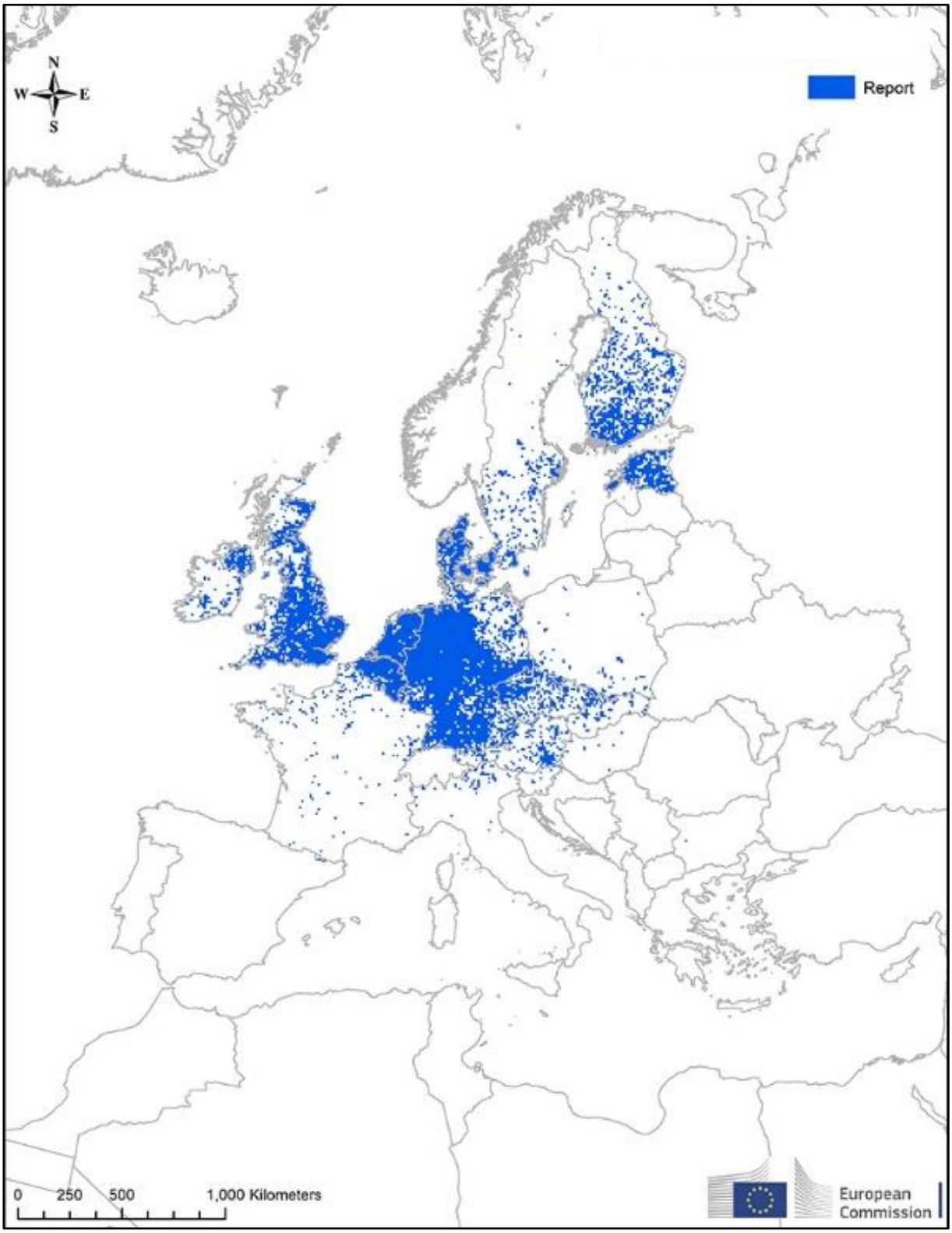


Figure 39. Spread of *Heracleum mantegazzianum* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

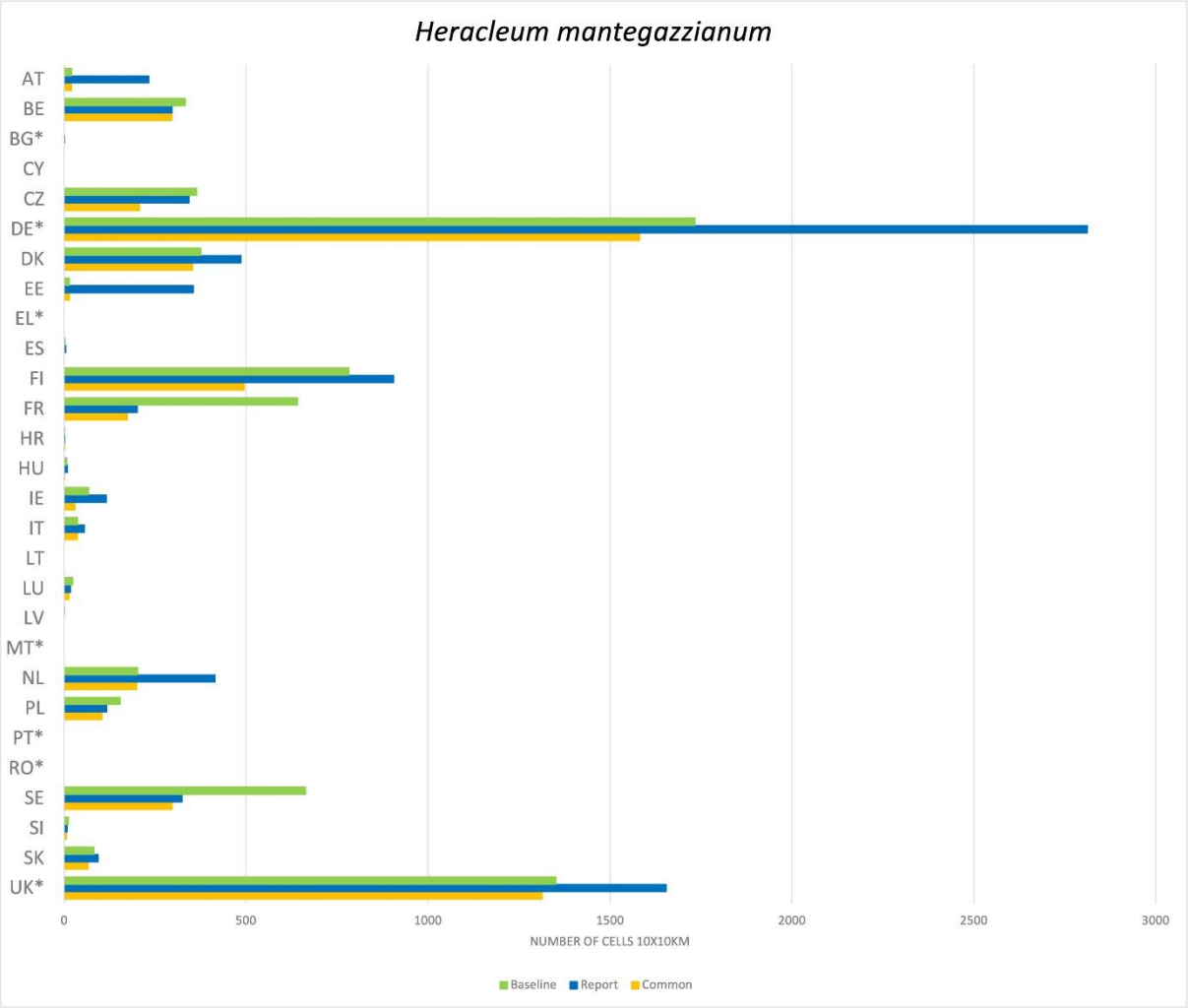


Figure 40. Distribution of *Heracleum persicum* in the EU (grid-level 10x10 km): JRC baselines, including only MS validated records.

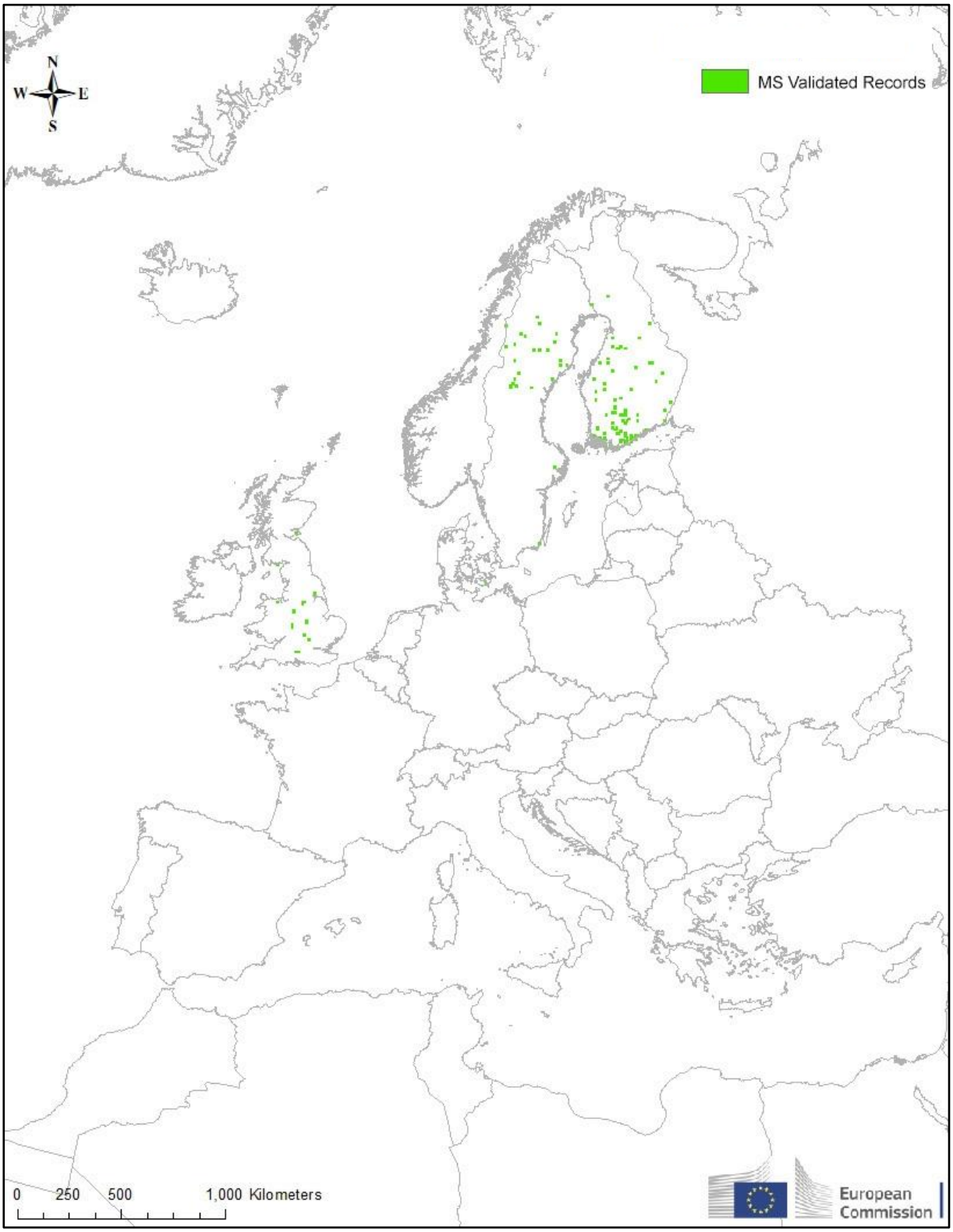


Figure 41. Distribution of *Heracleum persicum* in the EU (grid-level 10x10 km): MS reports.

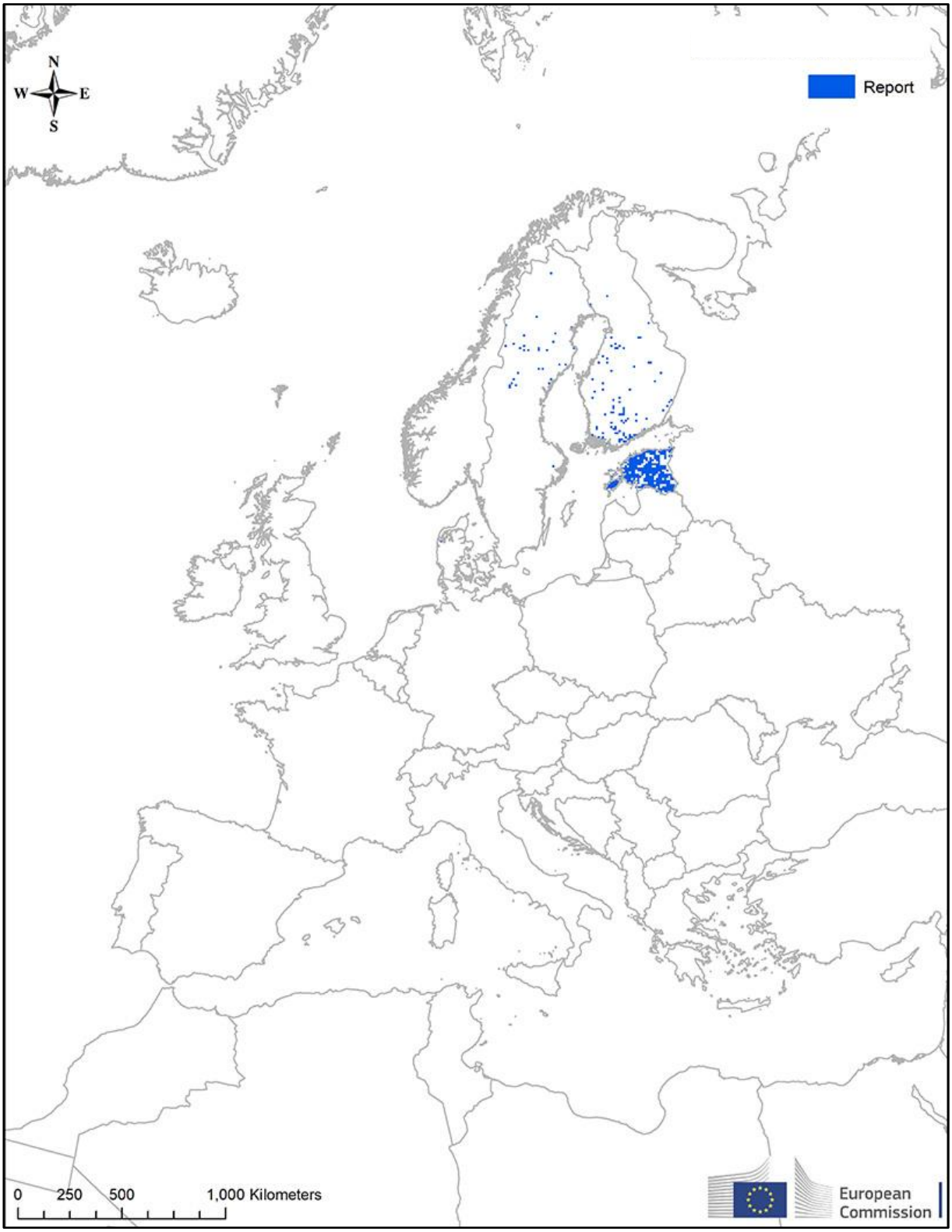


Figure 42. Spread of *Heracleum persicum* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

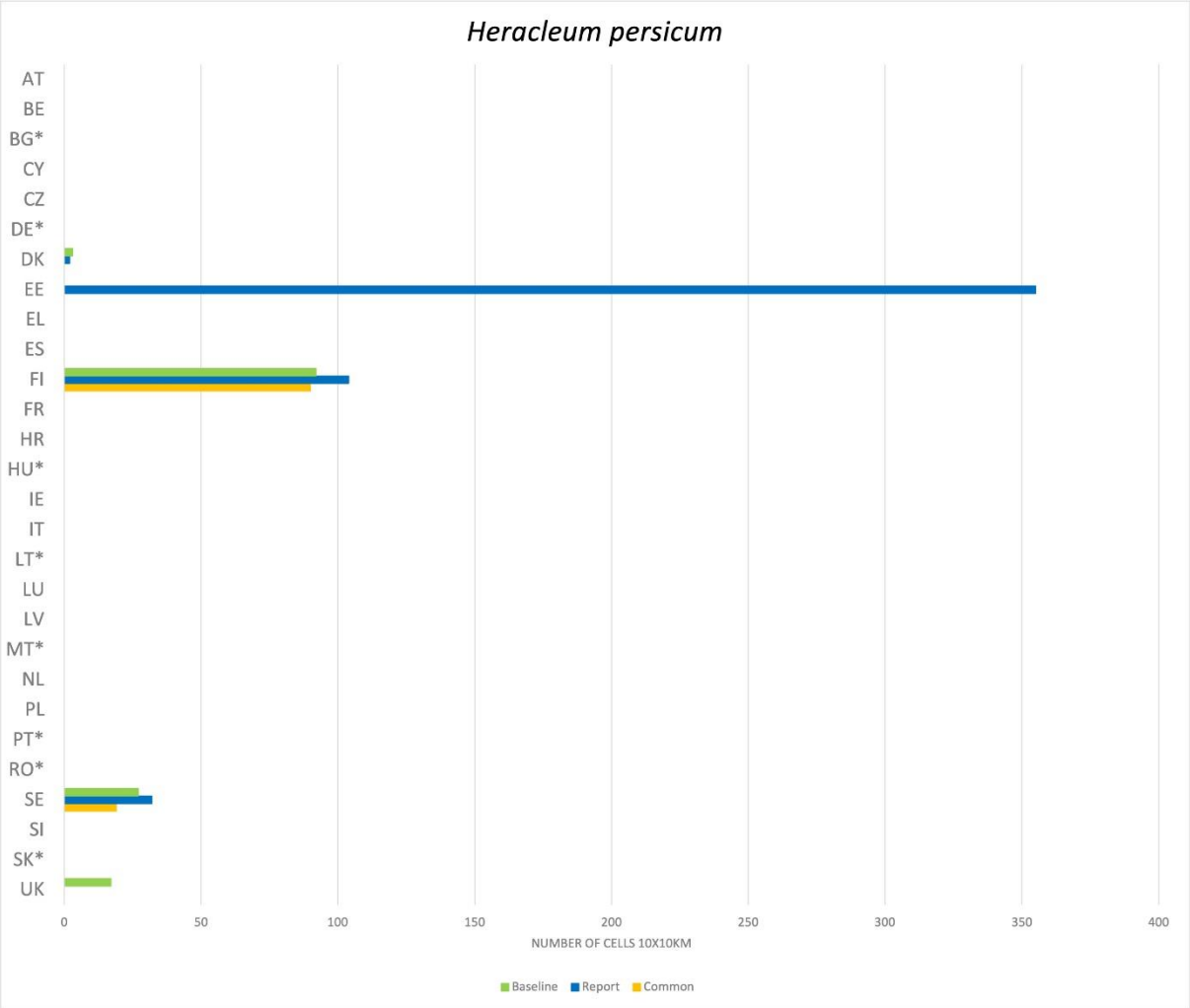


Figure 43. Distribution of *Heracleum sosnowskyi* in the EU (grid-level 10x10 km): JRC baselines including MS validated and non-validated records.

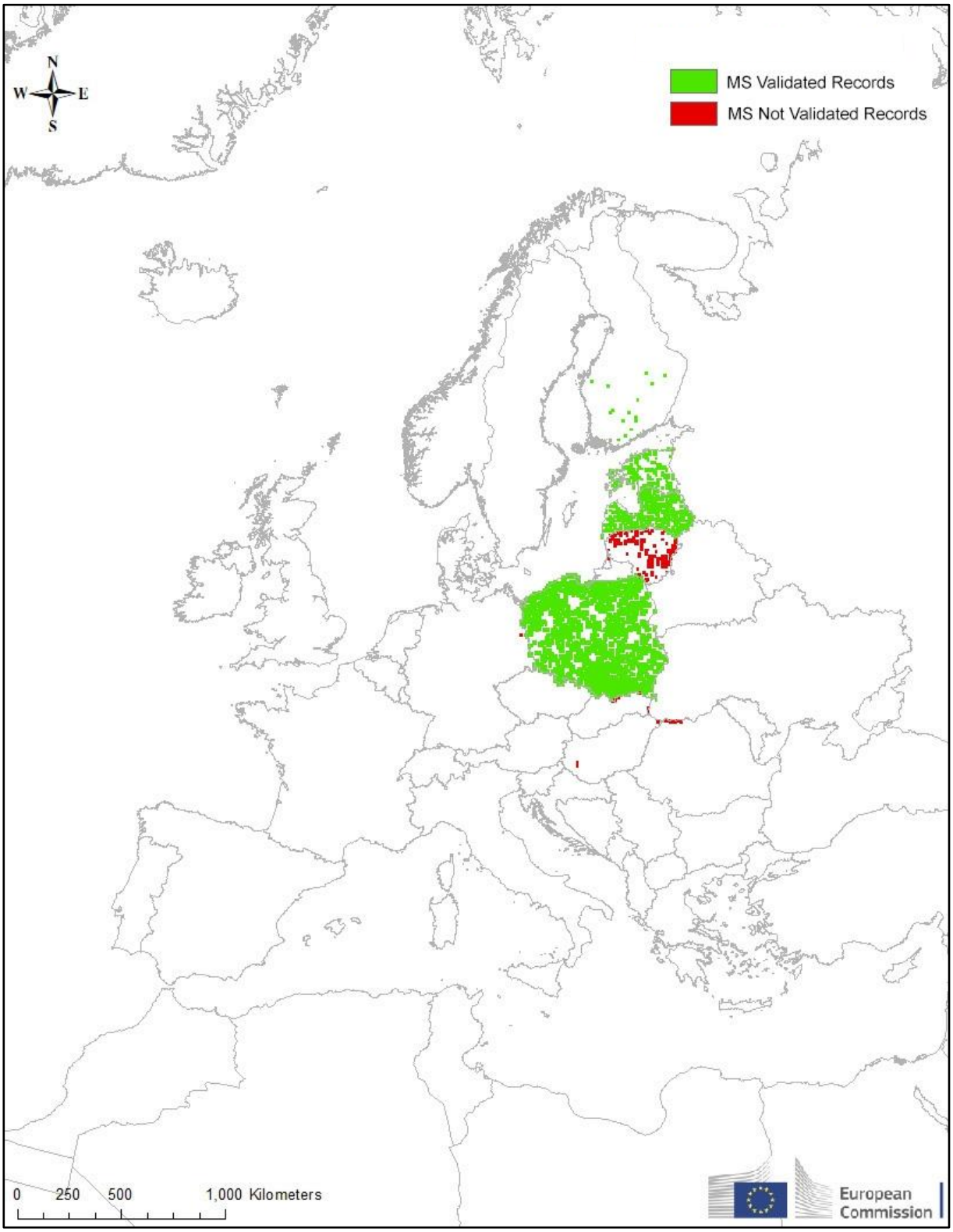


Figure 44. Distribution of *Heracleum sosnowskyi* in the EU (grid-level 10x10 km): MS reports.

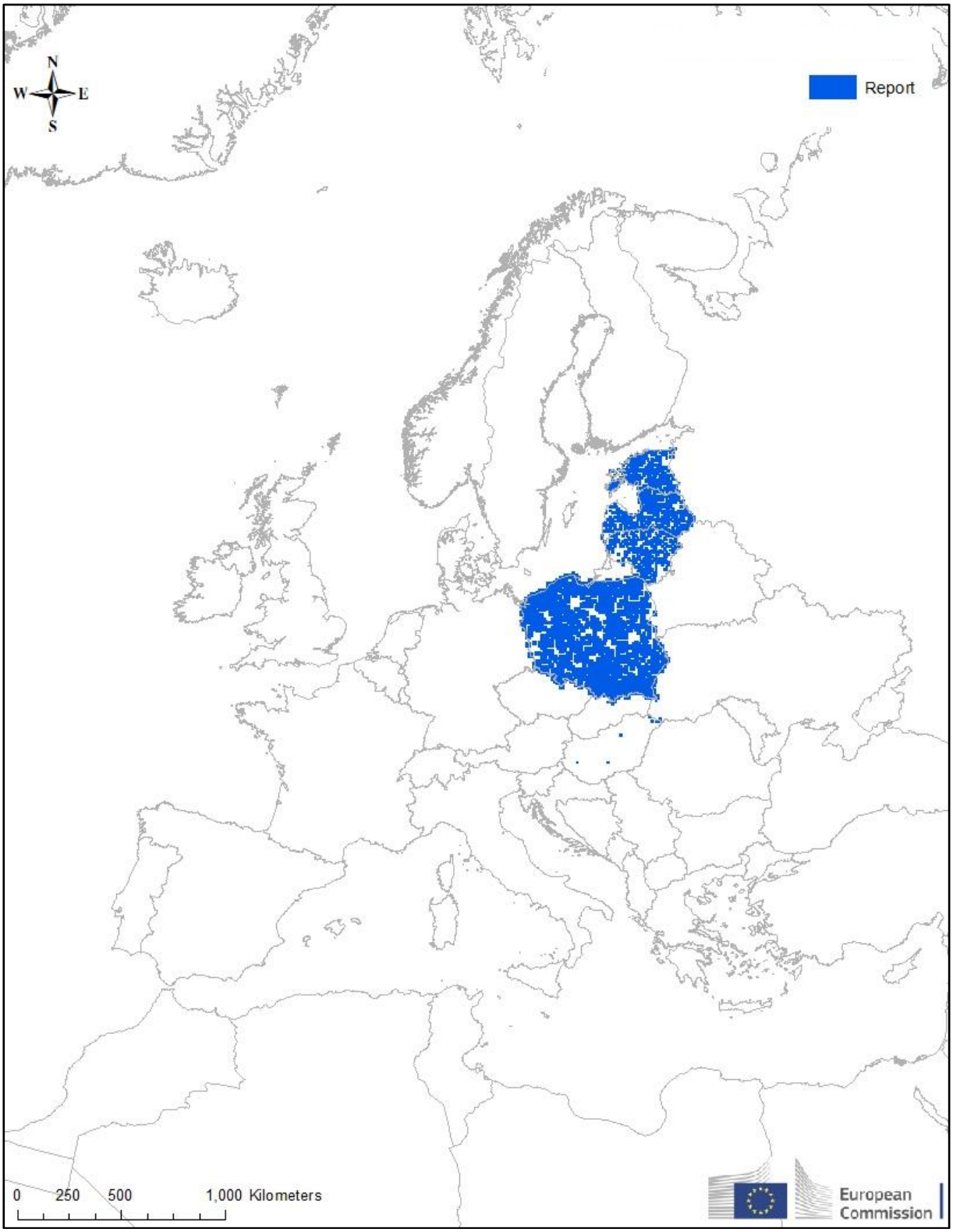


Figure 45. Spread of *Heracleum sosnowskyi* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

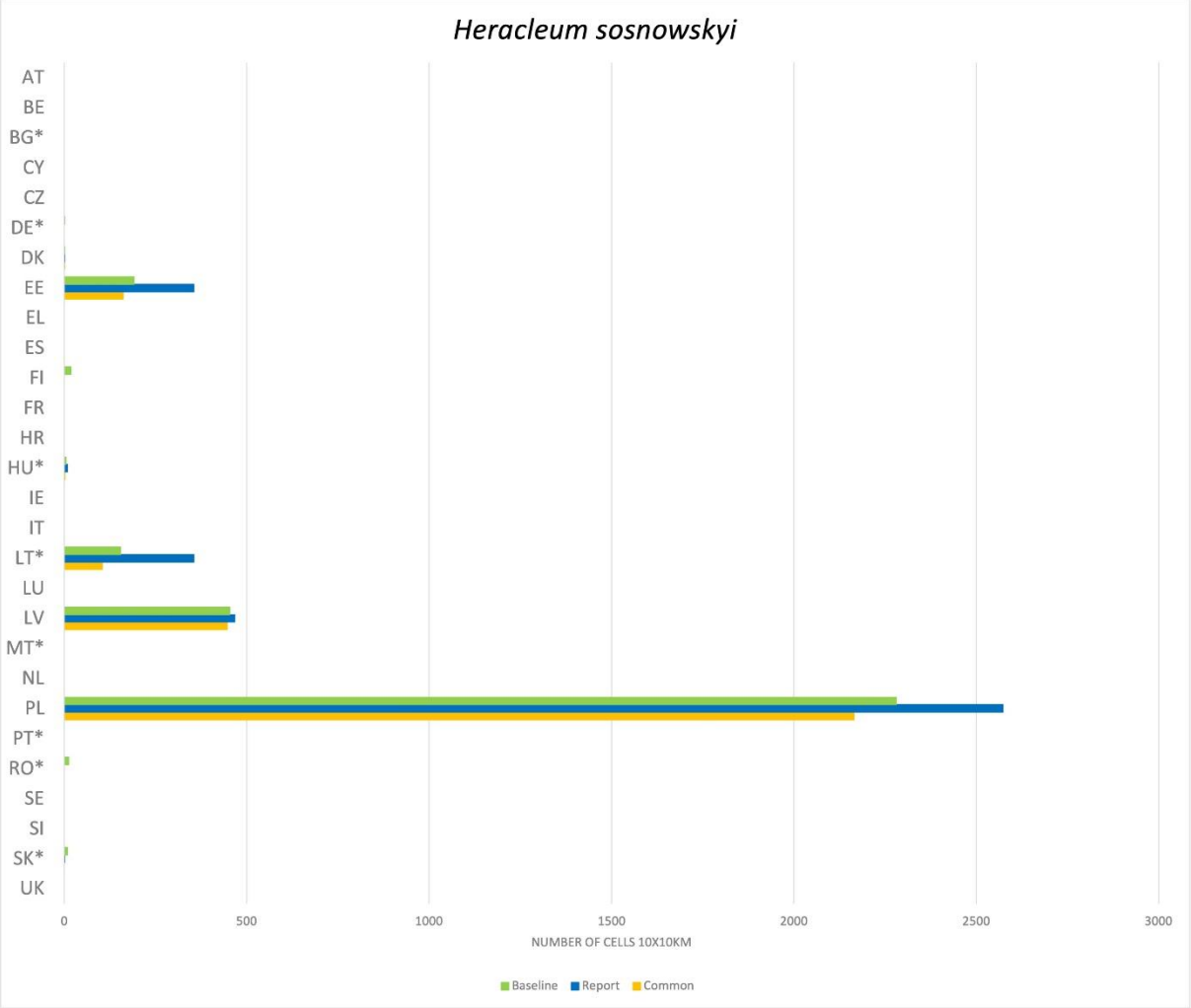


Figure 46. Distribution of *Herpestes javanicus* in the EU (grid-level 10x10 km): JRC baselines, including only MS validated records.

Figure 47. Distribution of *Herpestes javanicus* in the EU (grid-level 10x10 km): MS reports.

Figure 48. Spread of *Herpestes javanicus* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

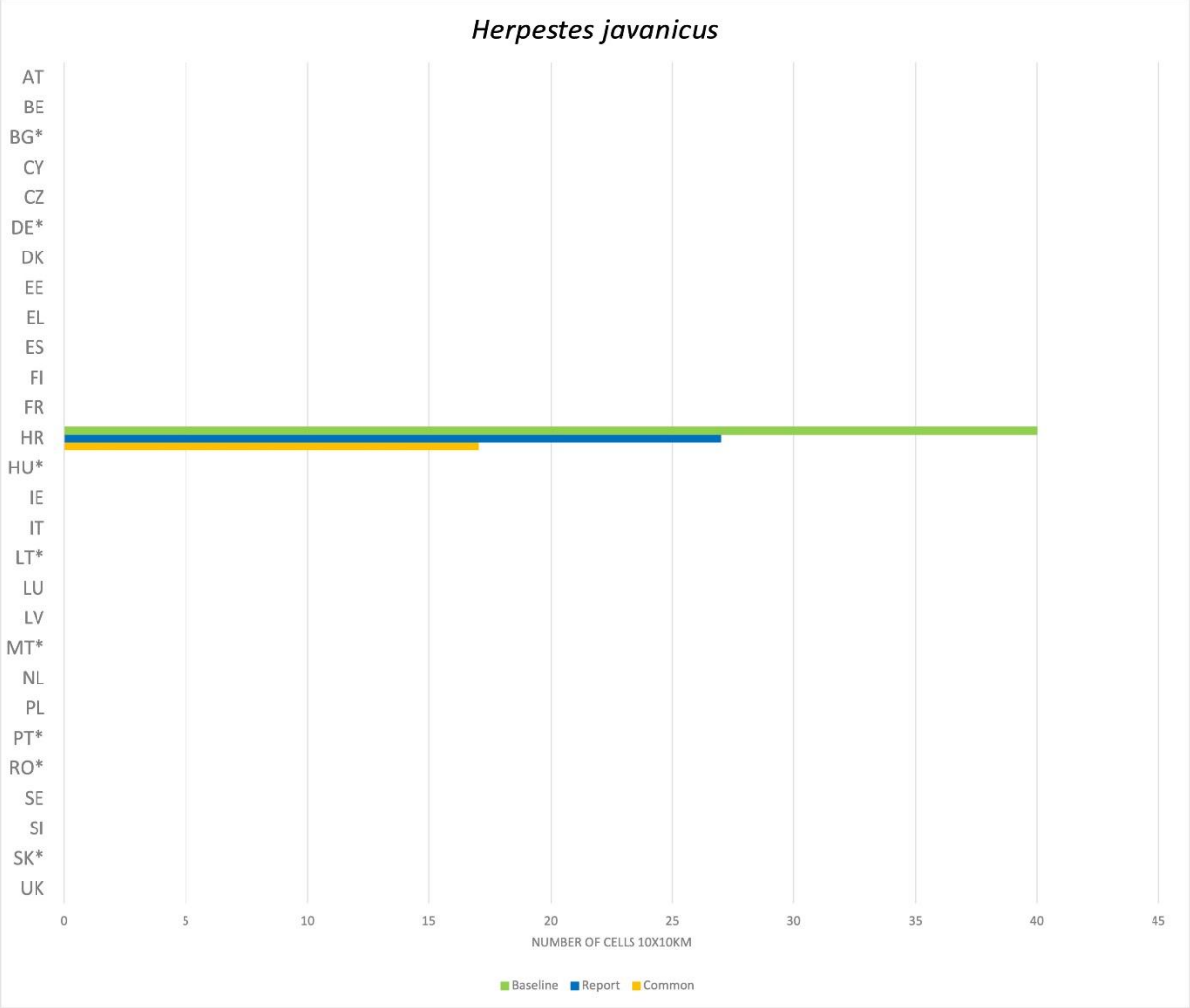


Figure 49. Distribution of *Hydrocotyle ranunculoides* in the EU (grid-level 10x10 km): JRC baselines, including MS validated and non-validated records.

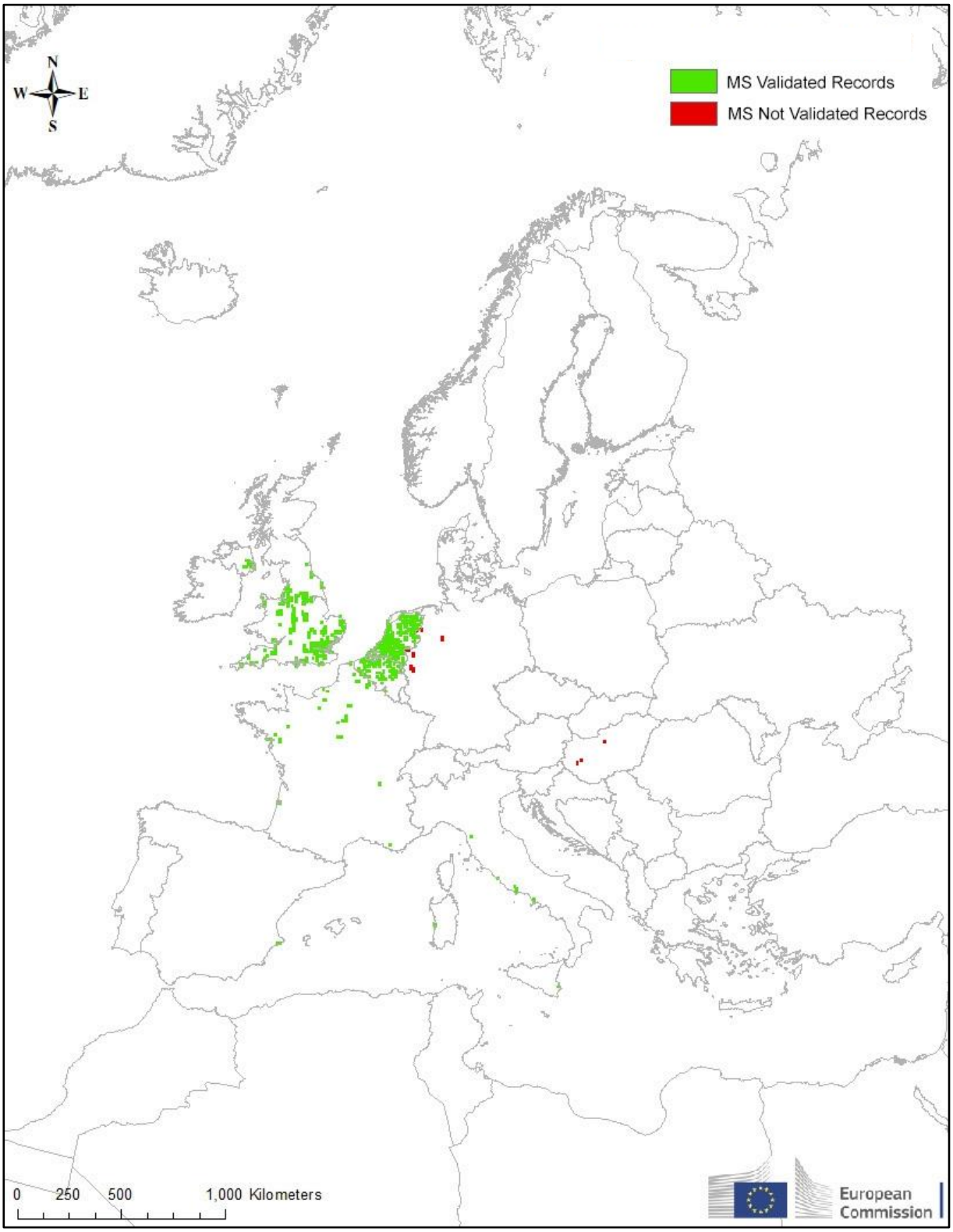


Figure 50. Distribution of *Hydrocotyle ranunculoides* in the EU (grid-level 10x10 km): MS reports.

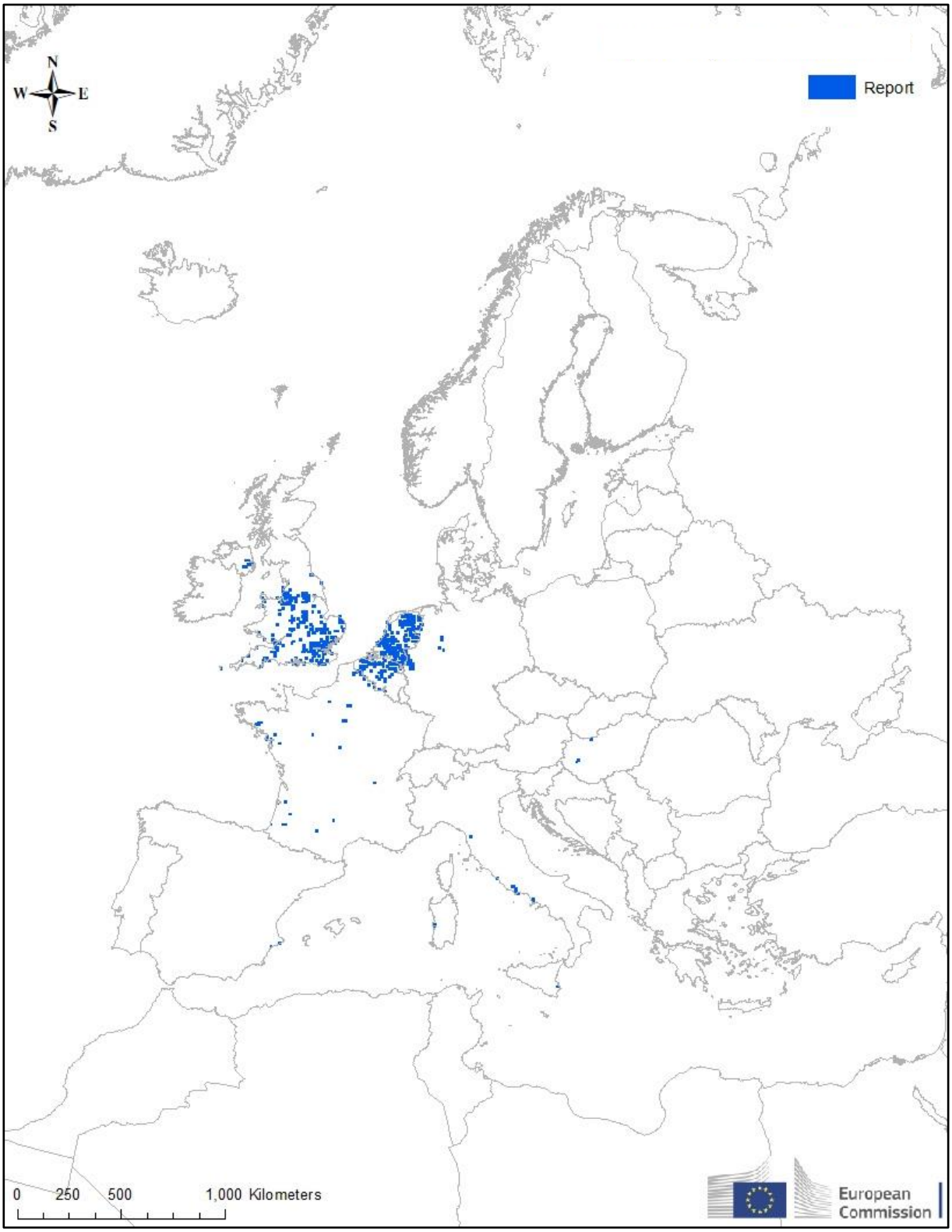


Figure 51. Spread of *Hydrocotyle ranunculoides* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

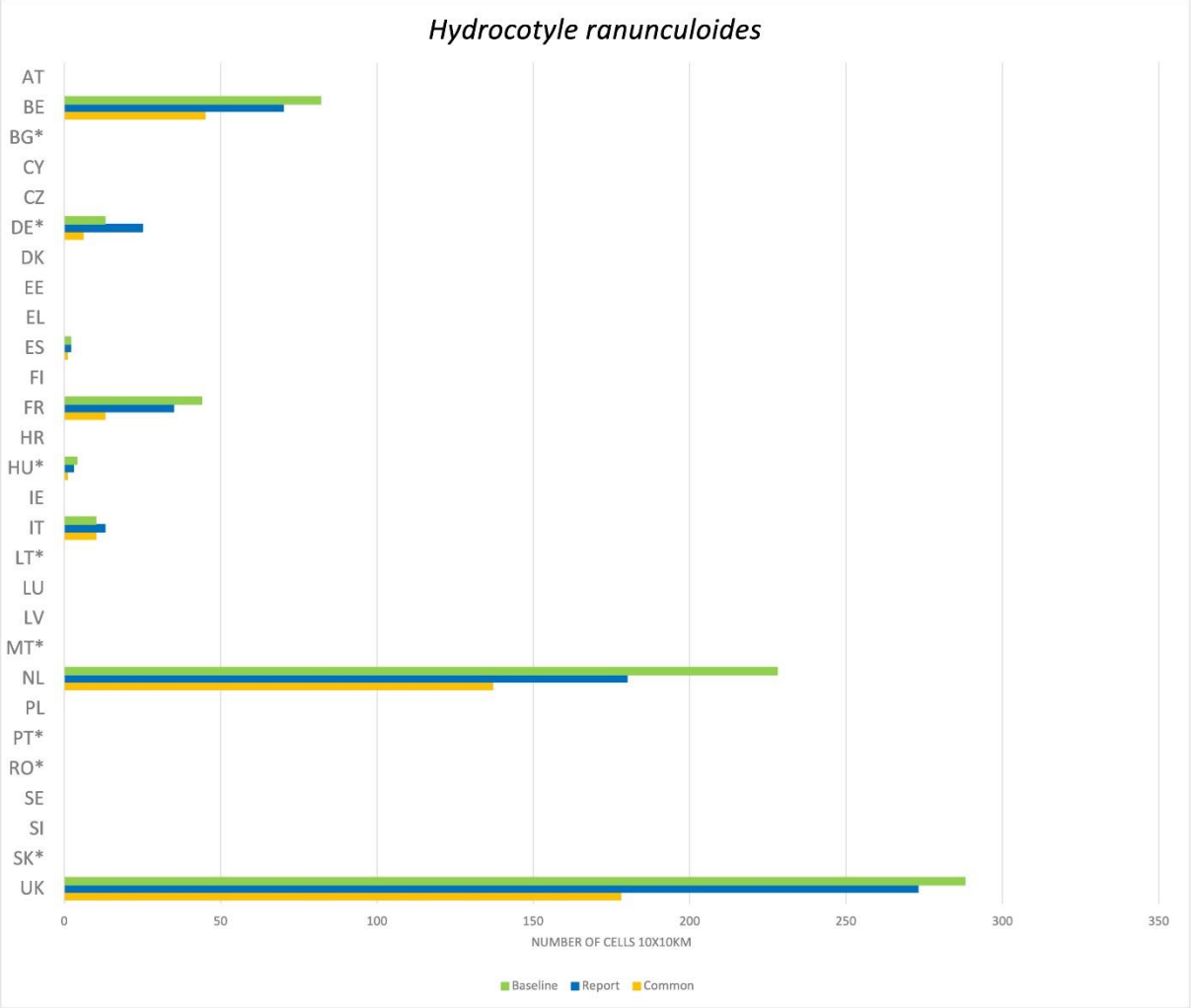


Figure 52. Distribution of *Impatiens glandulifera* in the EU (grid-level 10x10 km): a) JRC baselines including, MS validated and non-validated records.

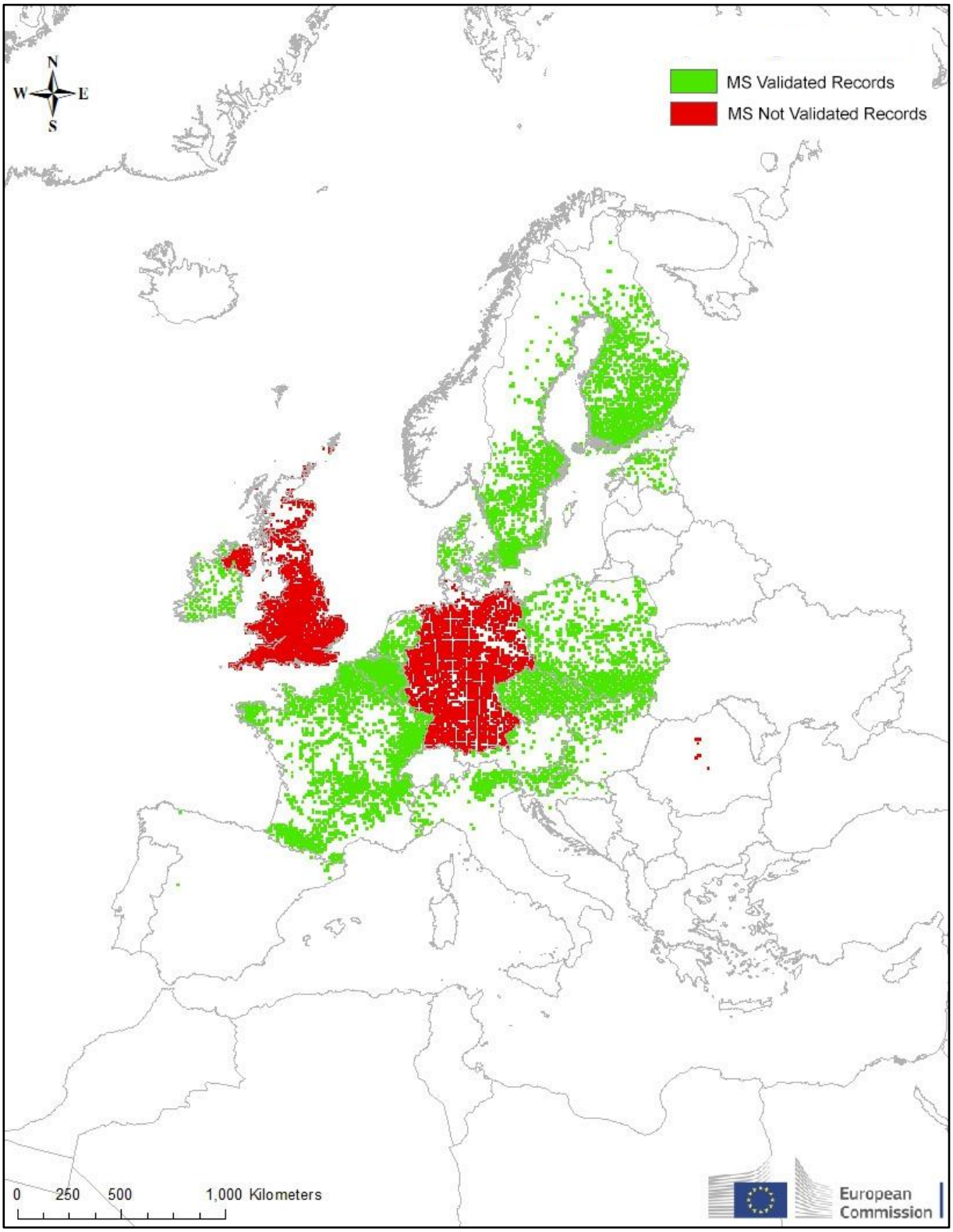


Figure 53. Distribution of *Impatiens glandulifera* in the EU (grid-level 10x10 km): MS reports.

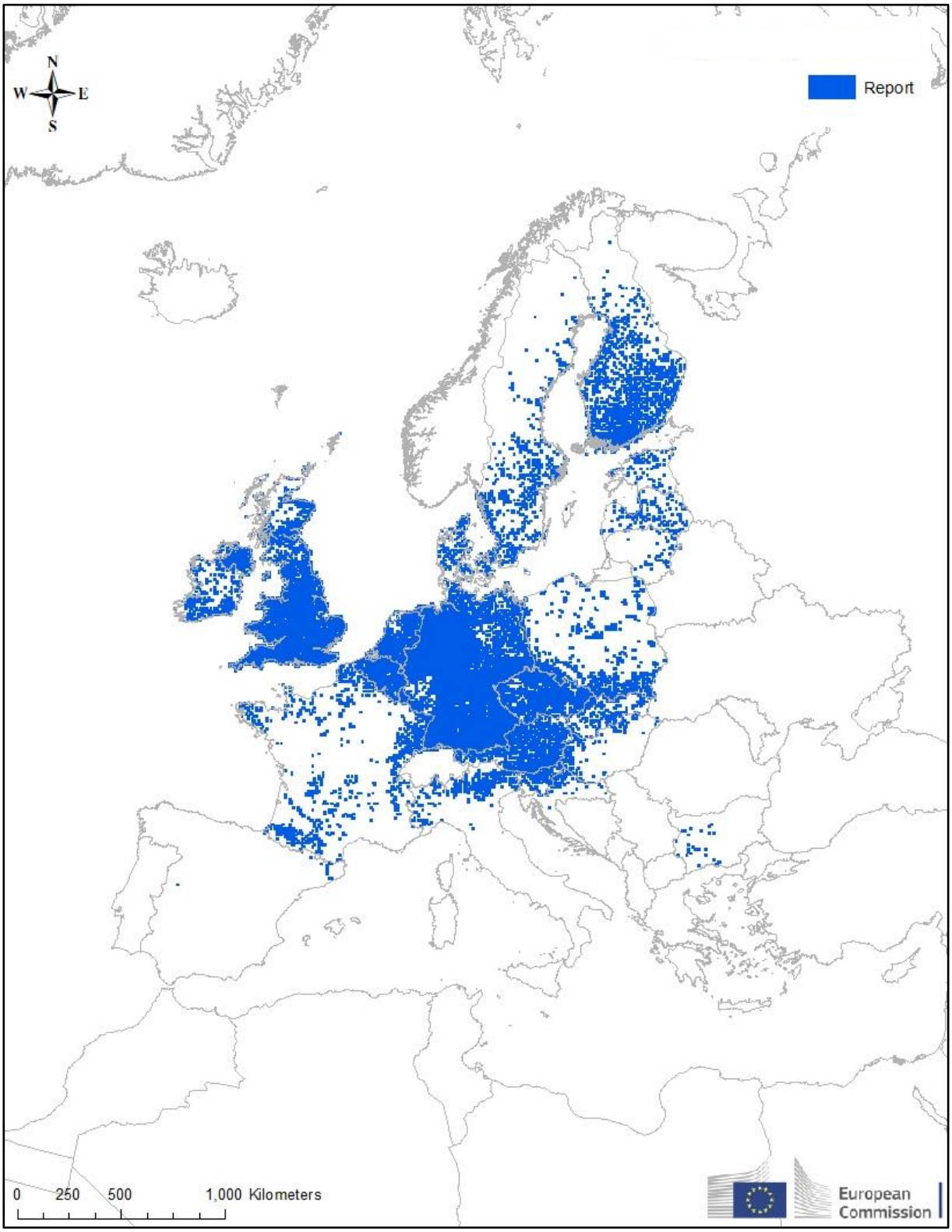


Figure 54. Spread of *Impatiens glandulifera* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

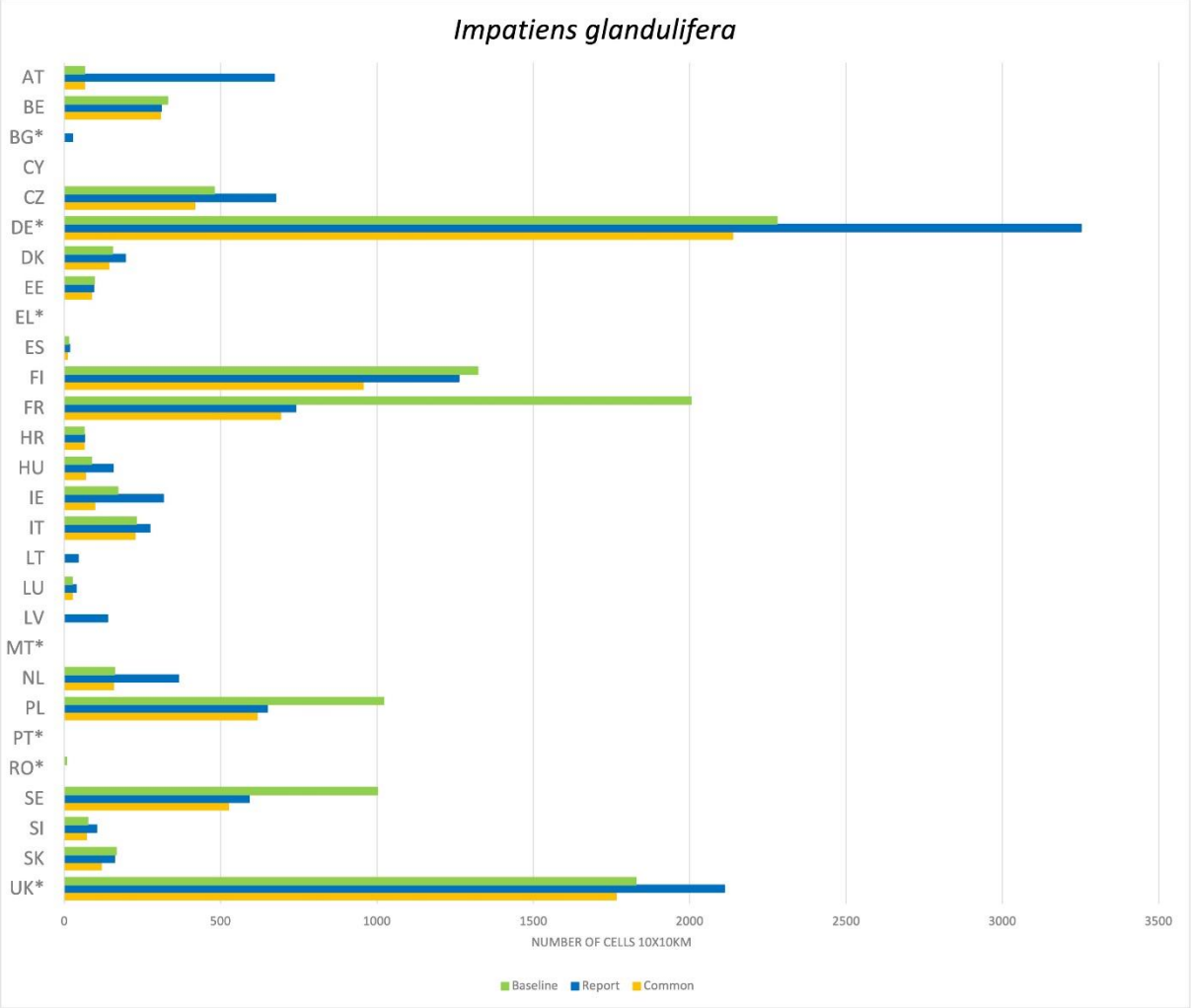


Figure 55. Distribution of *Lagarosiphon major* in the EU (grid-level 10x10 km): a) JRC baselines, including MS validated and non-validated records.

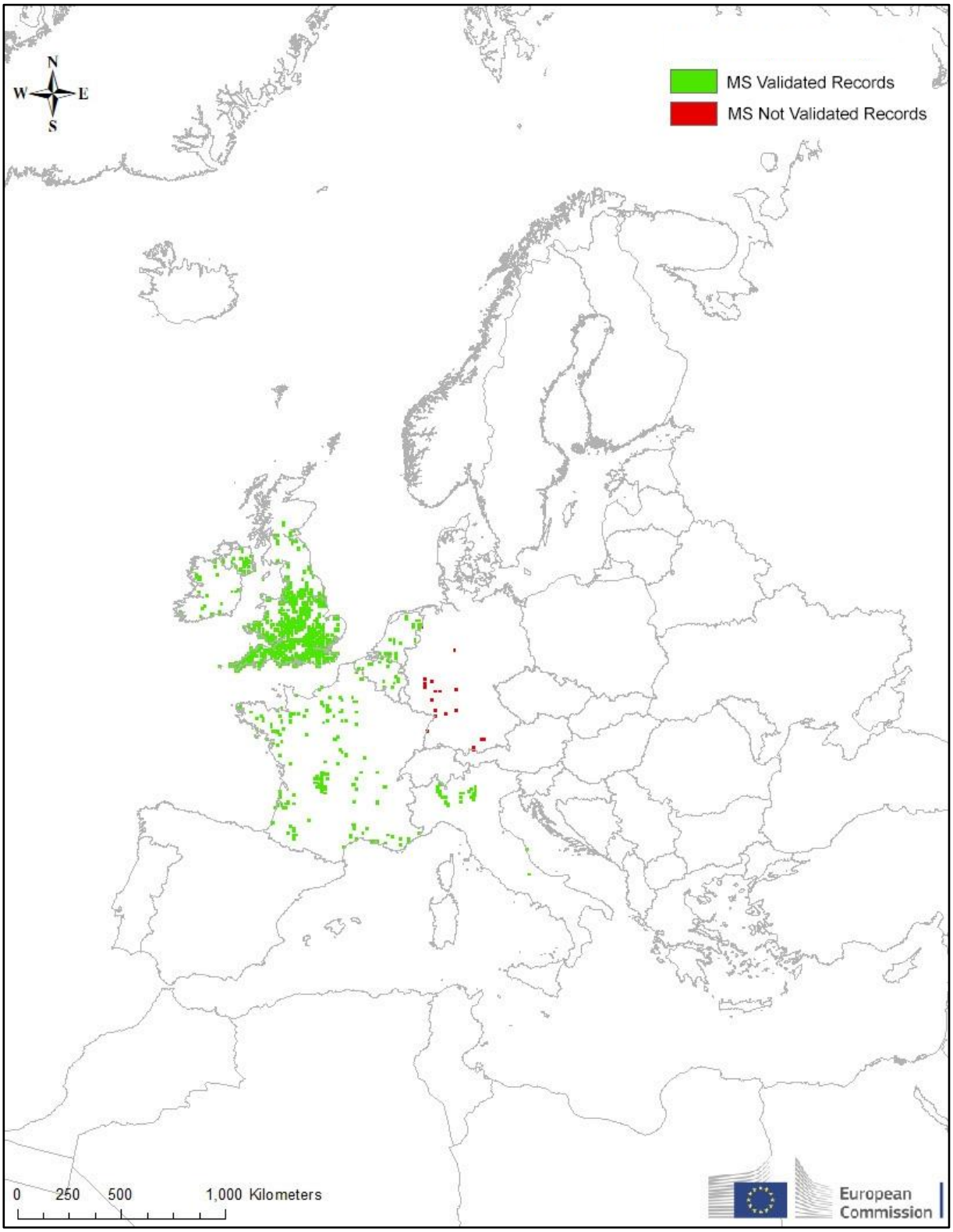


Figure 56. Distribution of *Lagarosiphon major* in the EU (grid-level 10x10 km): MS reports.

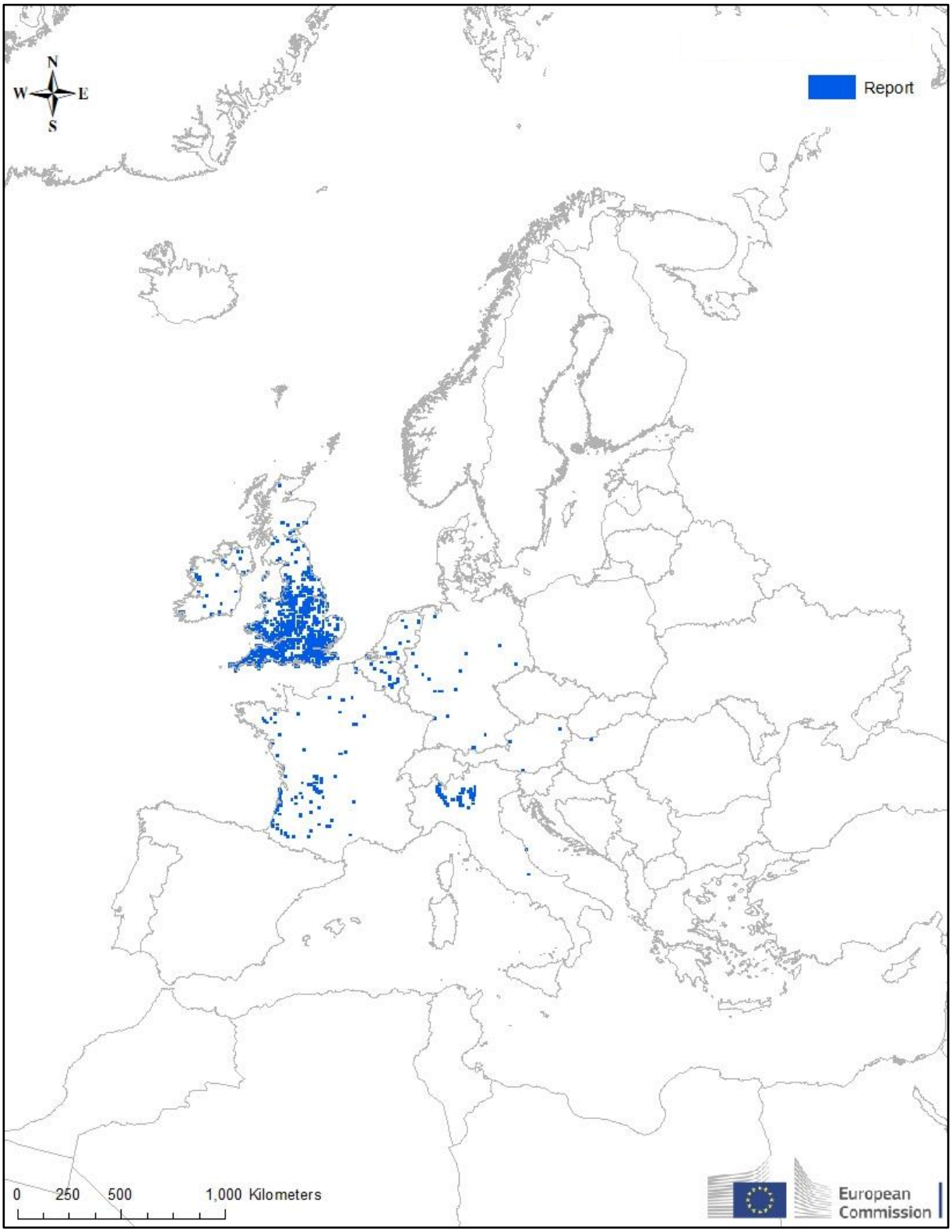


Figure 57. Spread of *Lagarosiphon major* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

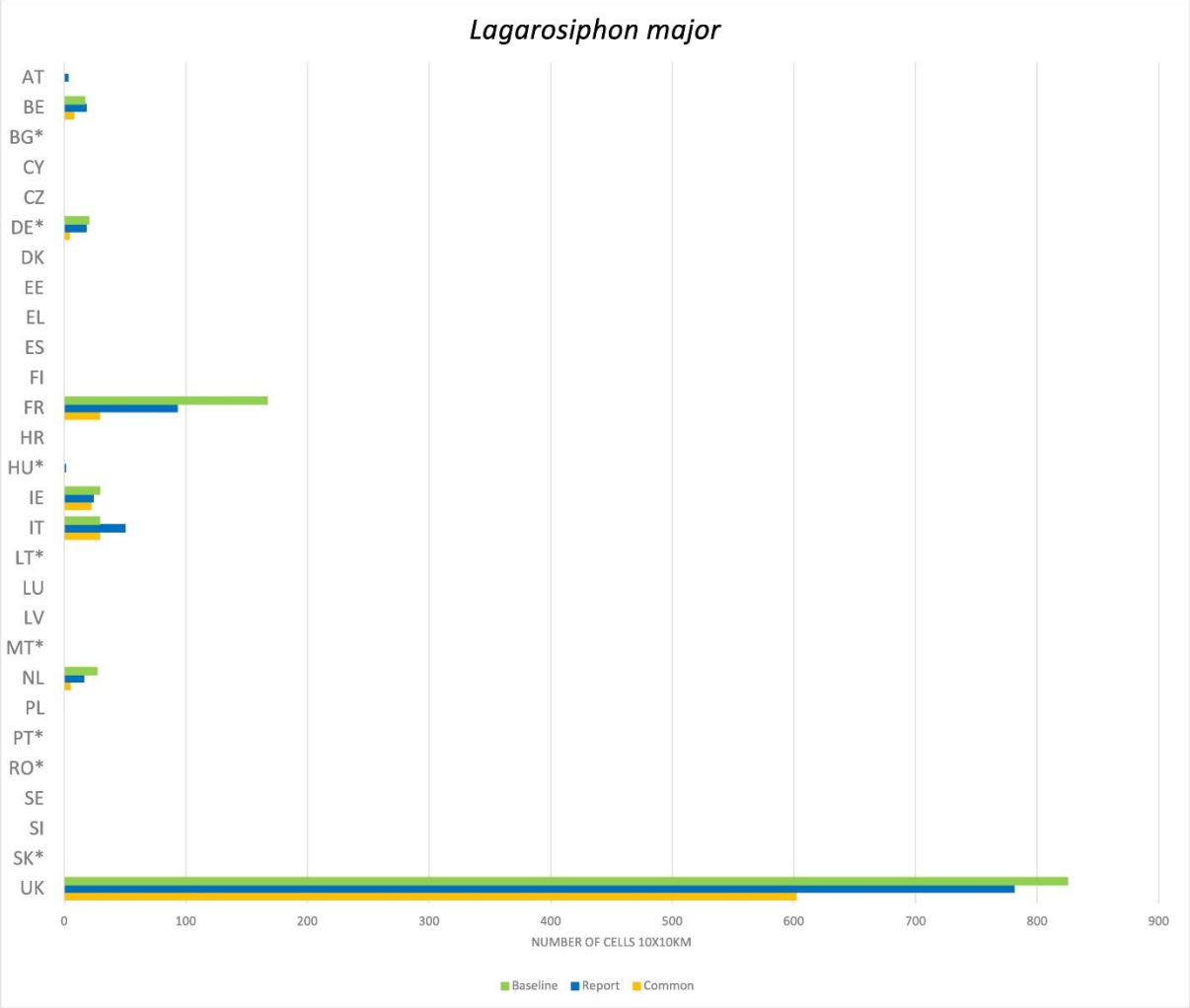


Figure 58. Distribution of *Lithobates catesbeianus* in the EU (grid-level 10x10 km): a) JRC baselines, including MS validated and non-validated records.

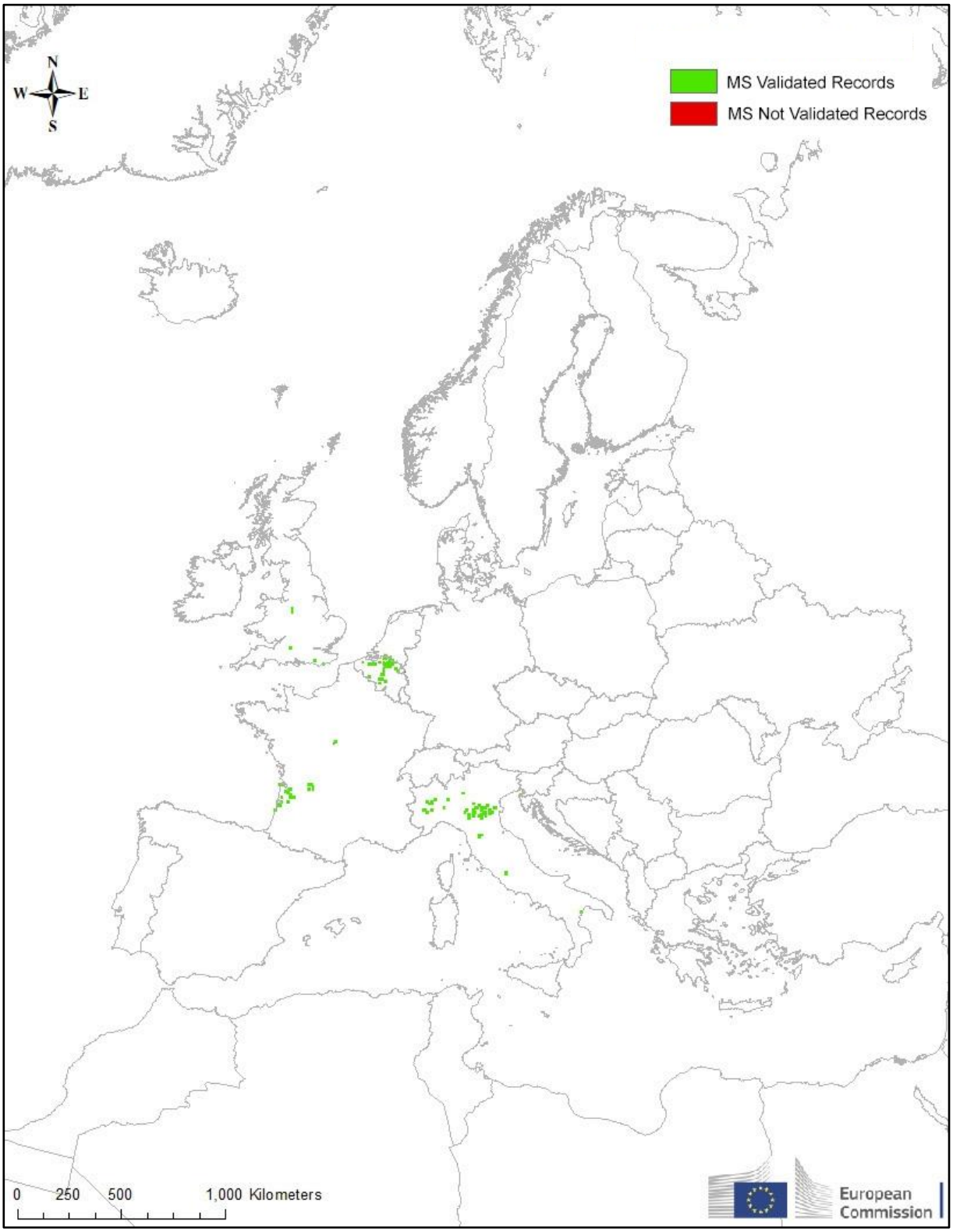


Figure 59. Distribution of *Lithobates catesbeianus* in the EU (grid-level 10x10 km): MS reports.

Figure 60. Spread of *Lithobates catesbeianus* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

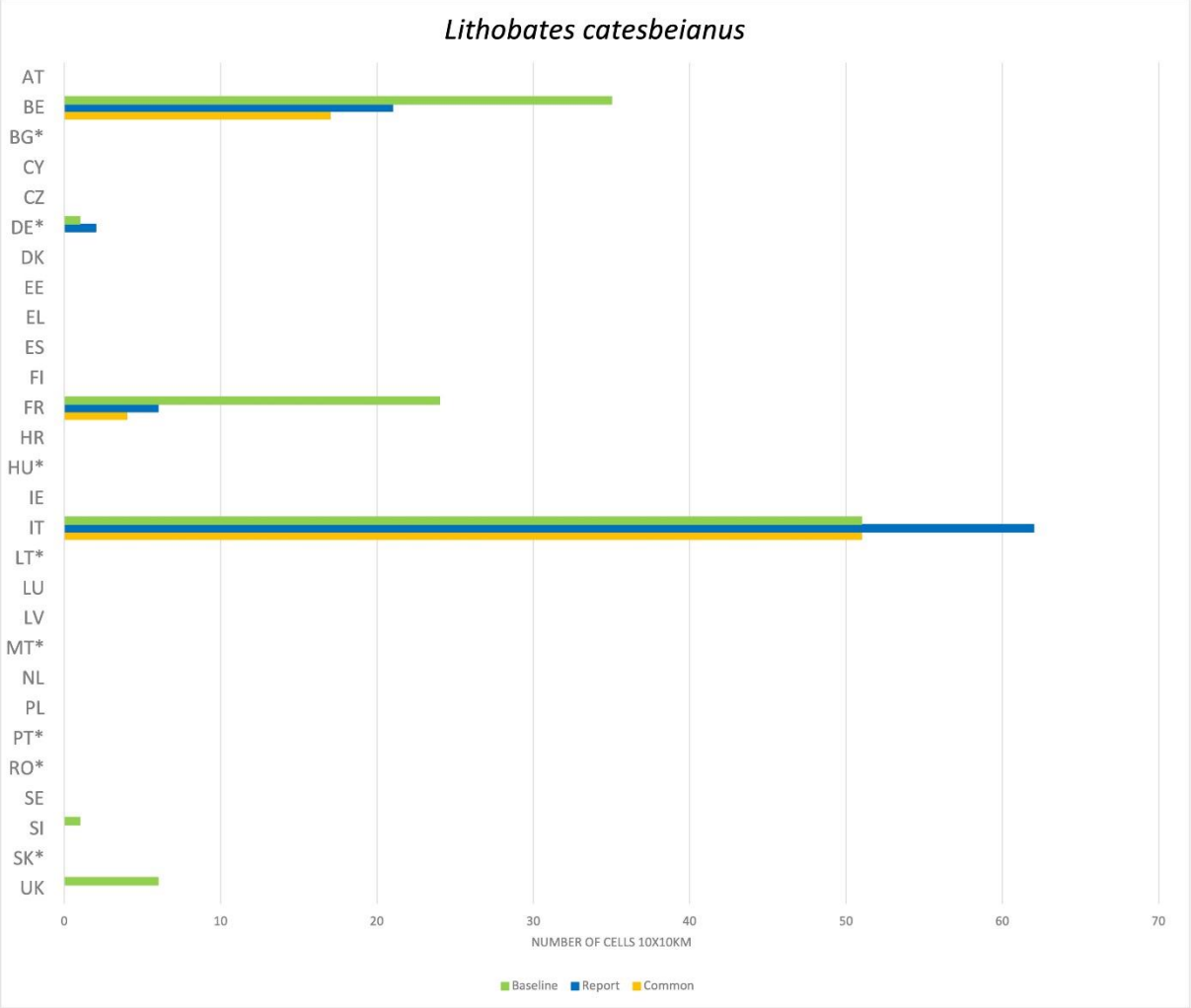


Figure 61. Distribution of *Ludwigia grandiflora* in the EU (grid-level 10x10 km): a) JRC baselines, including MS validated and non-validated records.

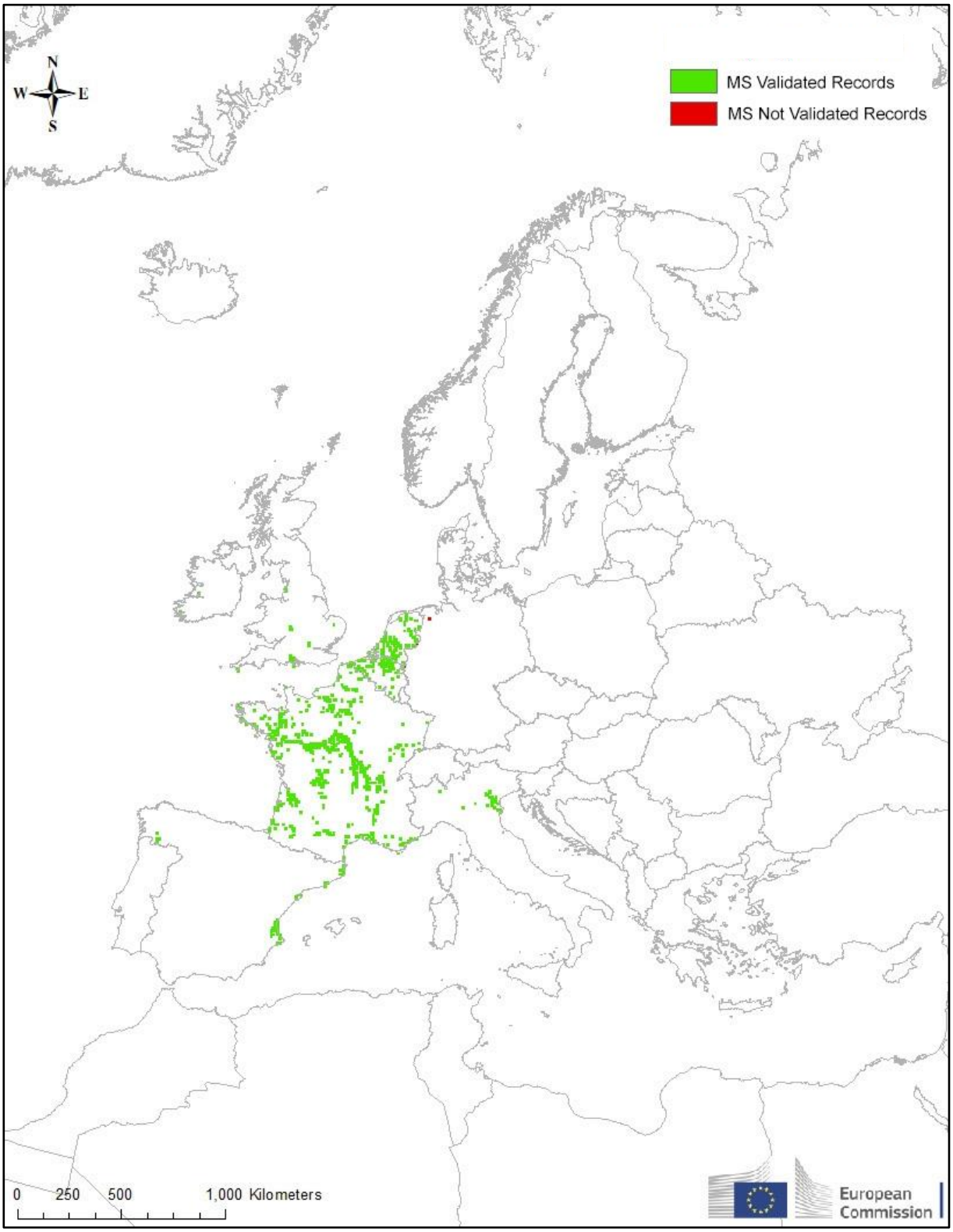


Figure 62. Distribution of *Ludwigia grandiflora* in the EU (grid-level 10x10 km): MS reports.

Figure 63. Spread of *Ludwigia grandiflora* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

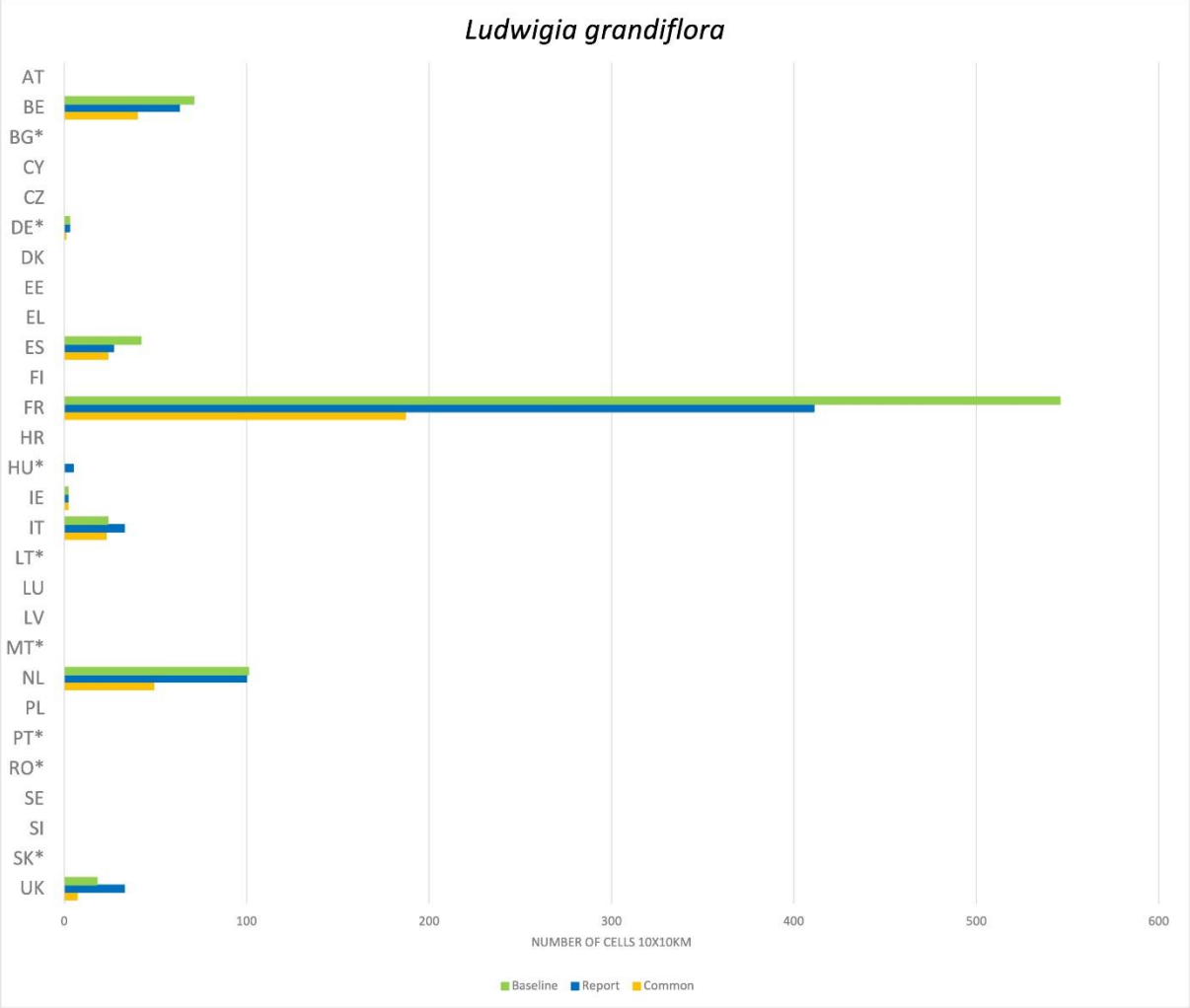


Figure 64. Distribution of *Ludwigia peploides* in the EU (grid-level 10x10 km): a) JRC baselines, including only validated baseline records.

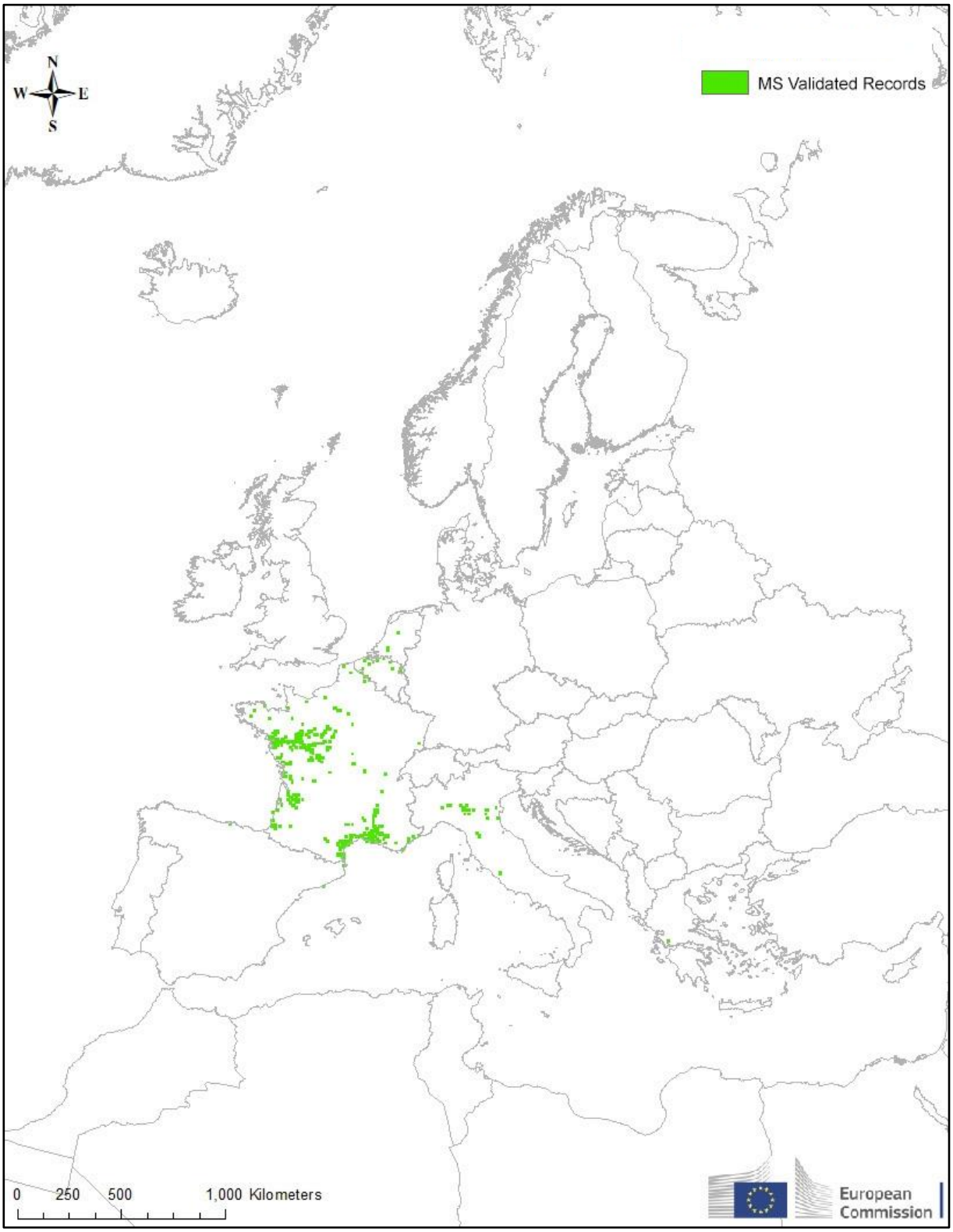


Figure 65. Distribution of *Ludwigia peploides* in the EU (grid-level 10x10 km): MS reports.

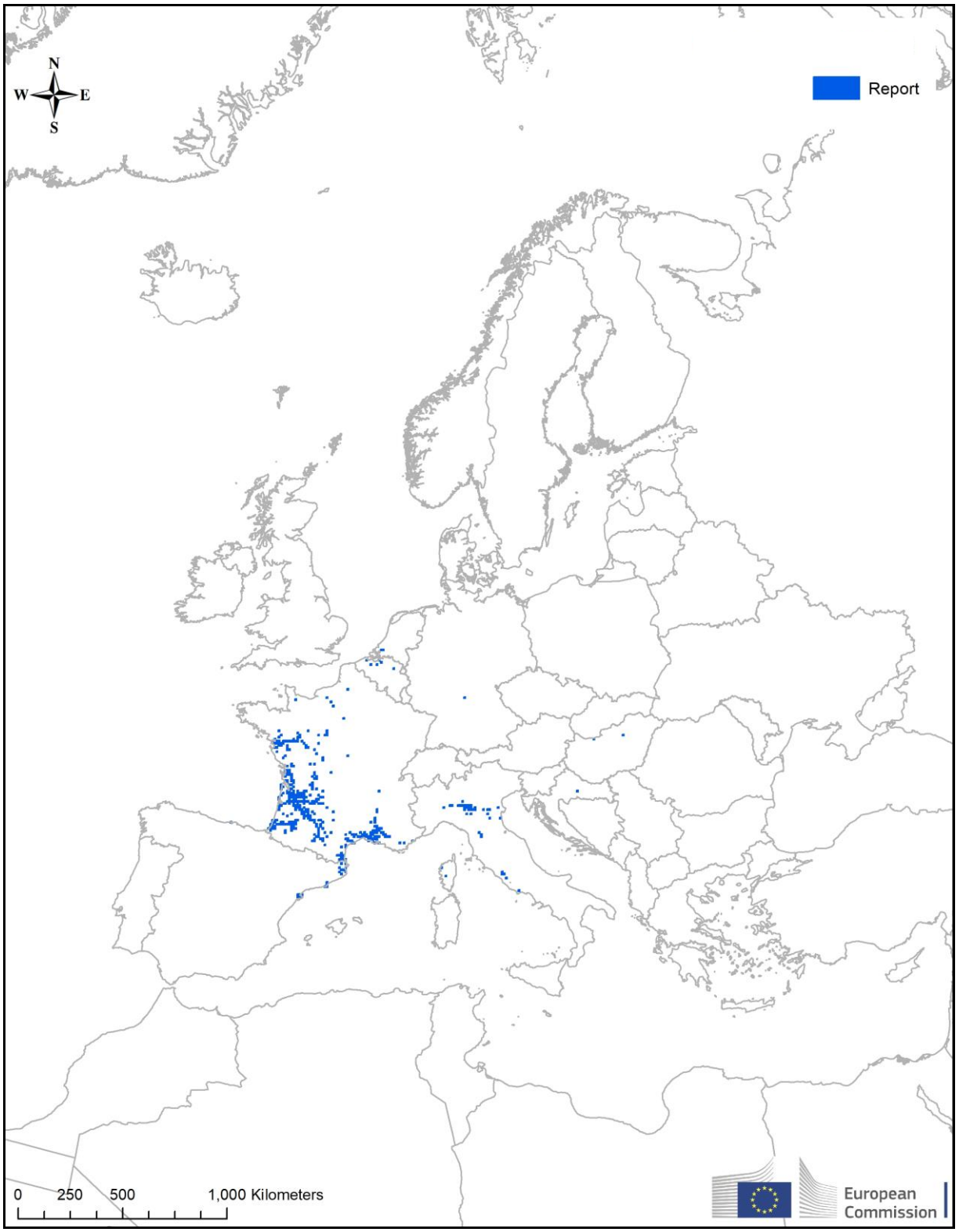


Figure 66. Spread of *Ludwigia peploides* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

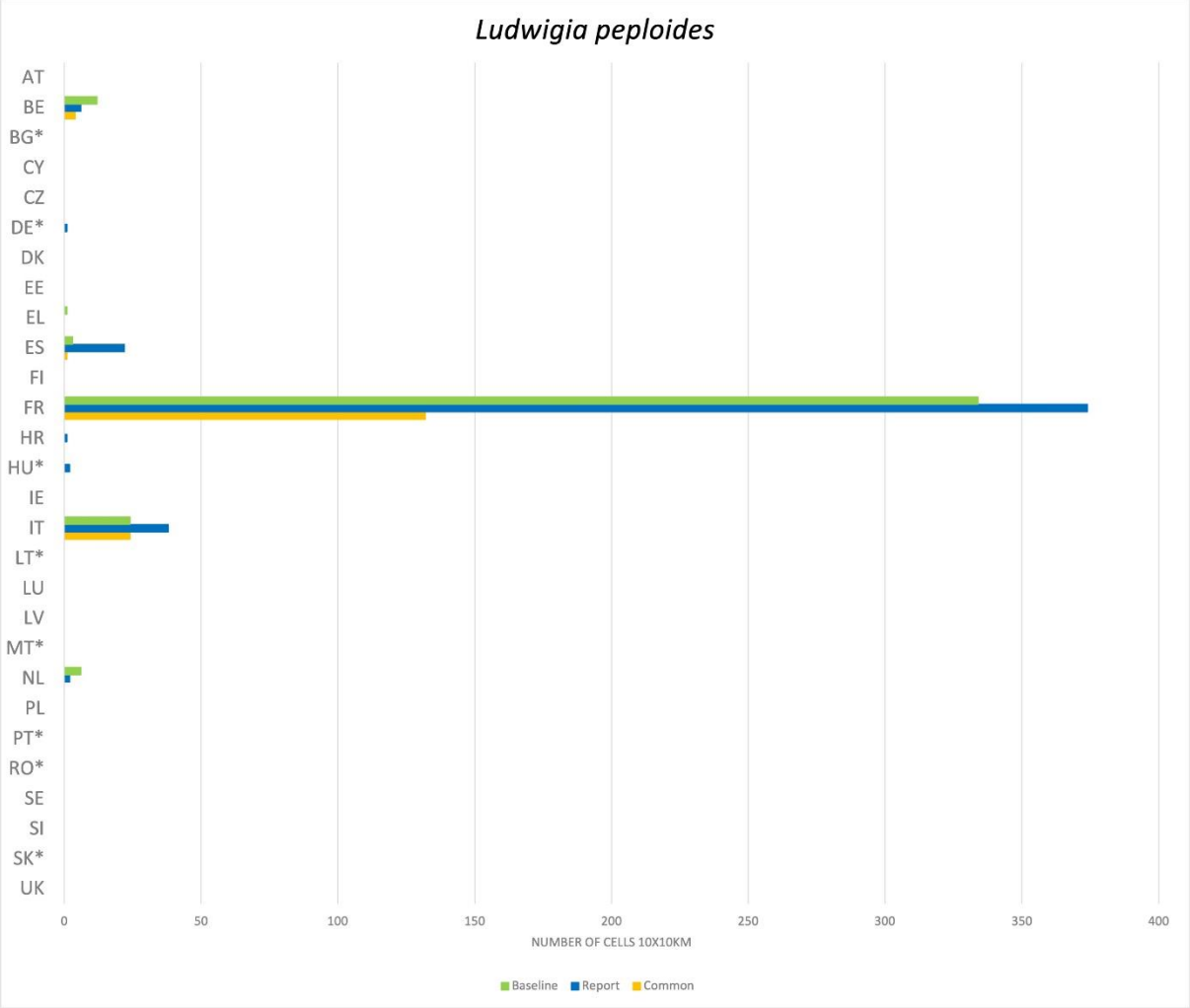


Figure 67. Distribution of *Lysichiton americanus* in the EU (grid-level 10x10 km): a) JRC baselines, including MS validated and non-validated records.

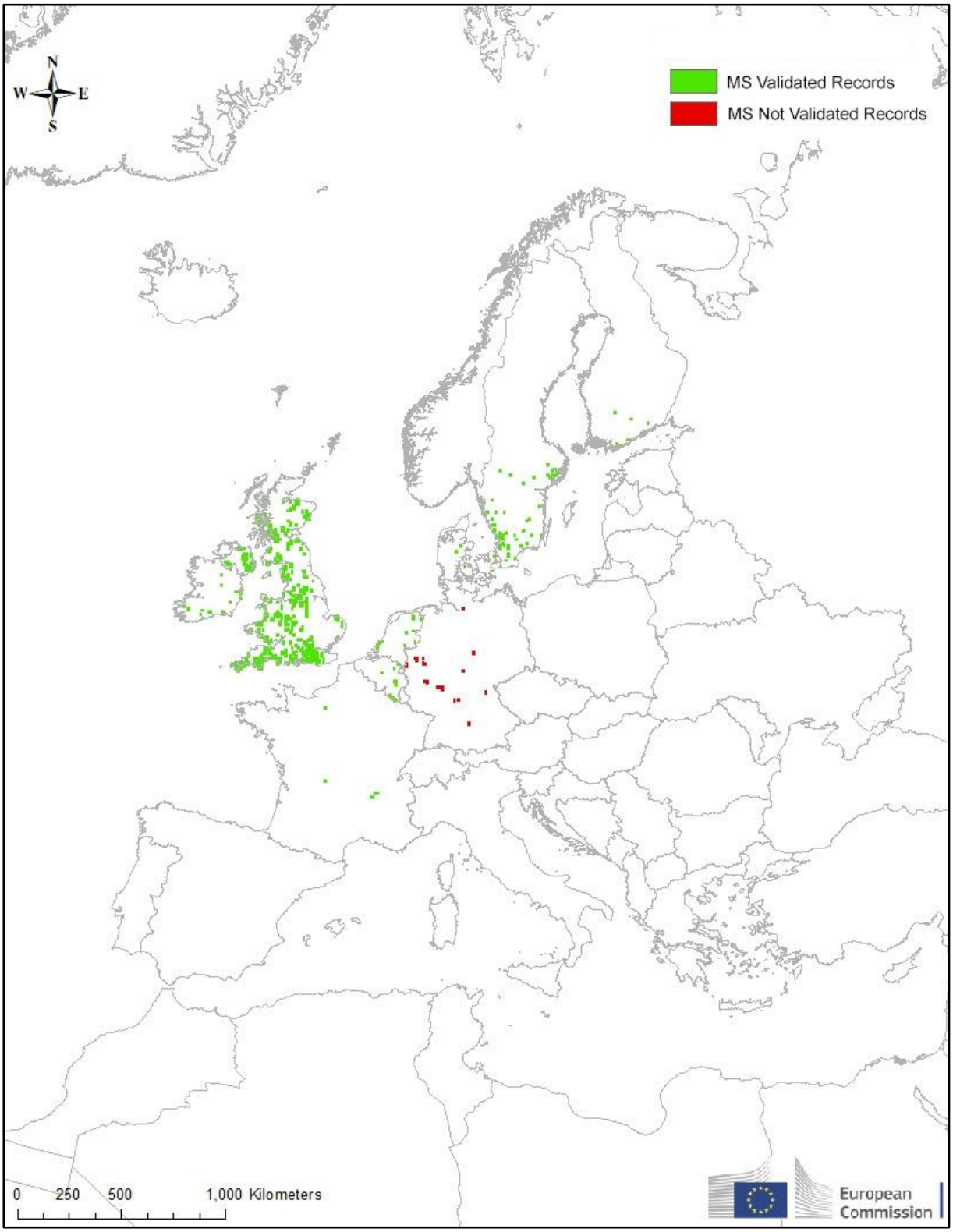


Figure 68. Distribution of *Lysichiton americanus* in the EU (grid-level 10x10 km): MS reports.

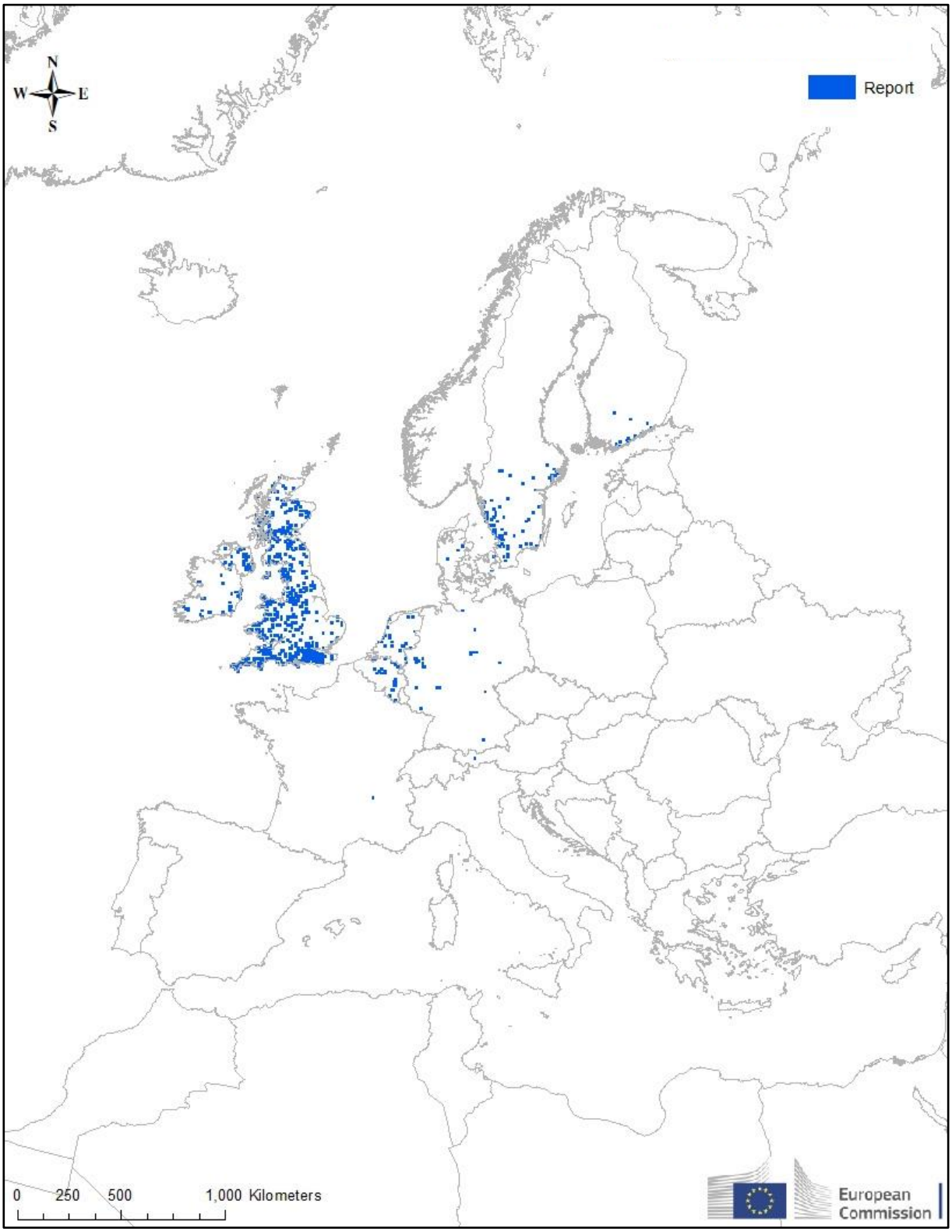


Figure 69. Spread of *Lysichiton americanus* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

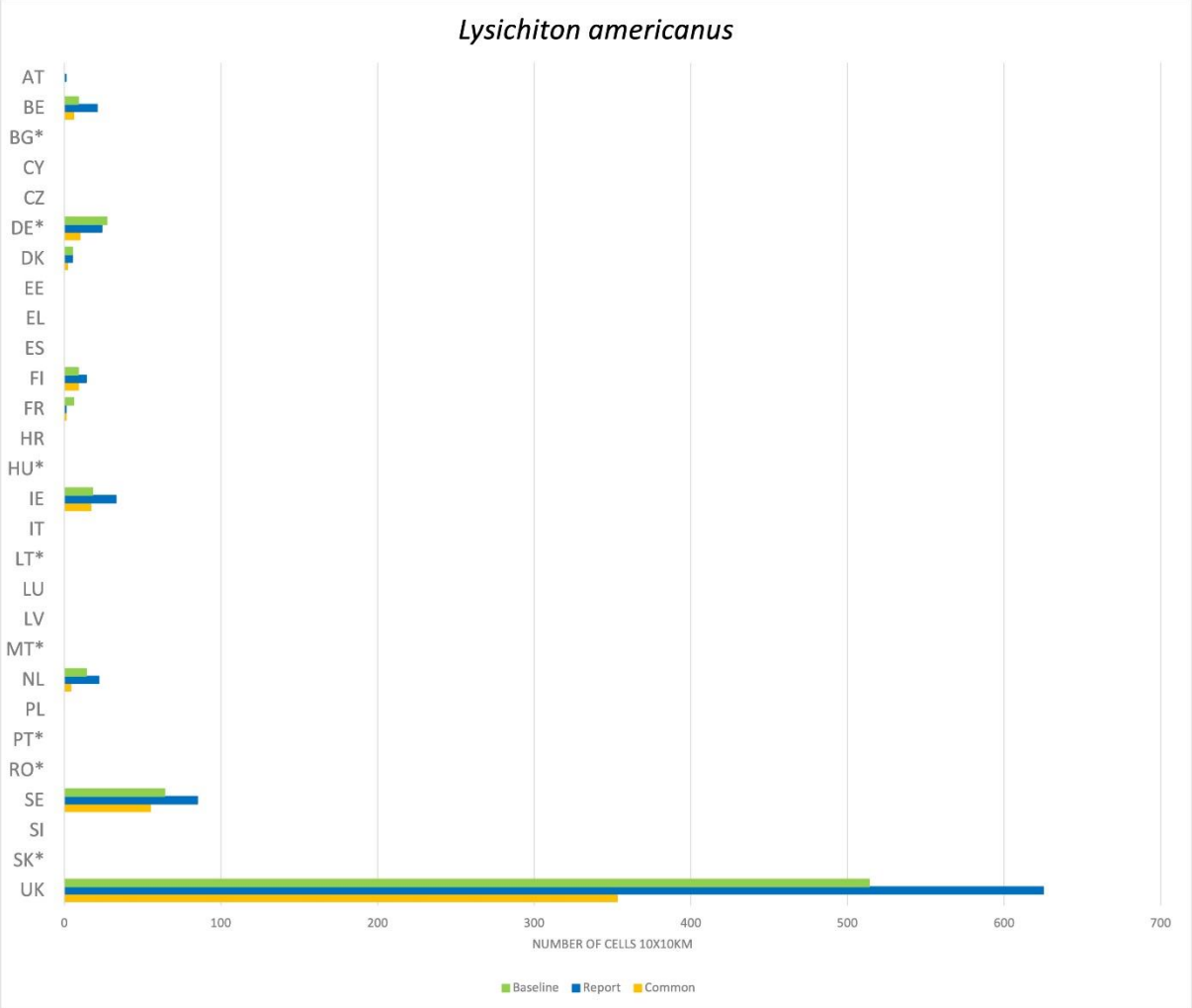


Figure 70. Distribution of *Muntiacus reevesi* in the EU (grid-level 10x10 km): a) JRC baselines, including MS only validated baseline records.

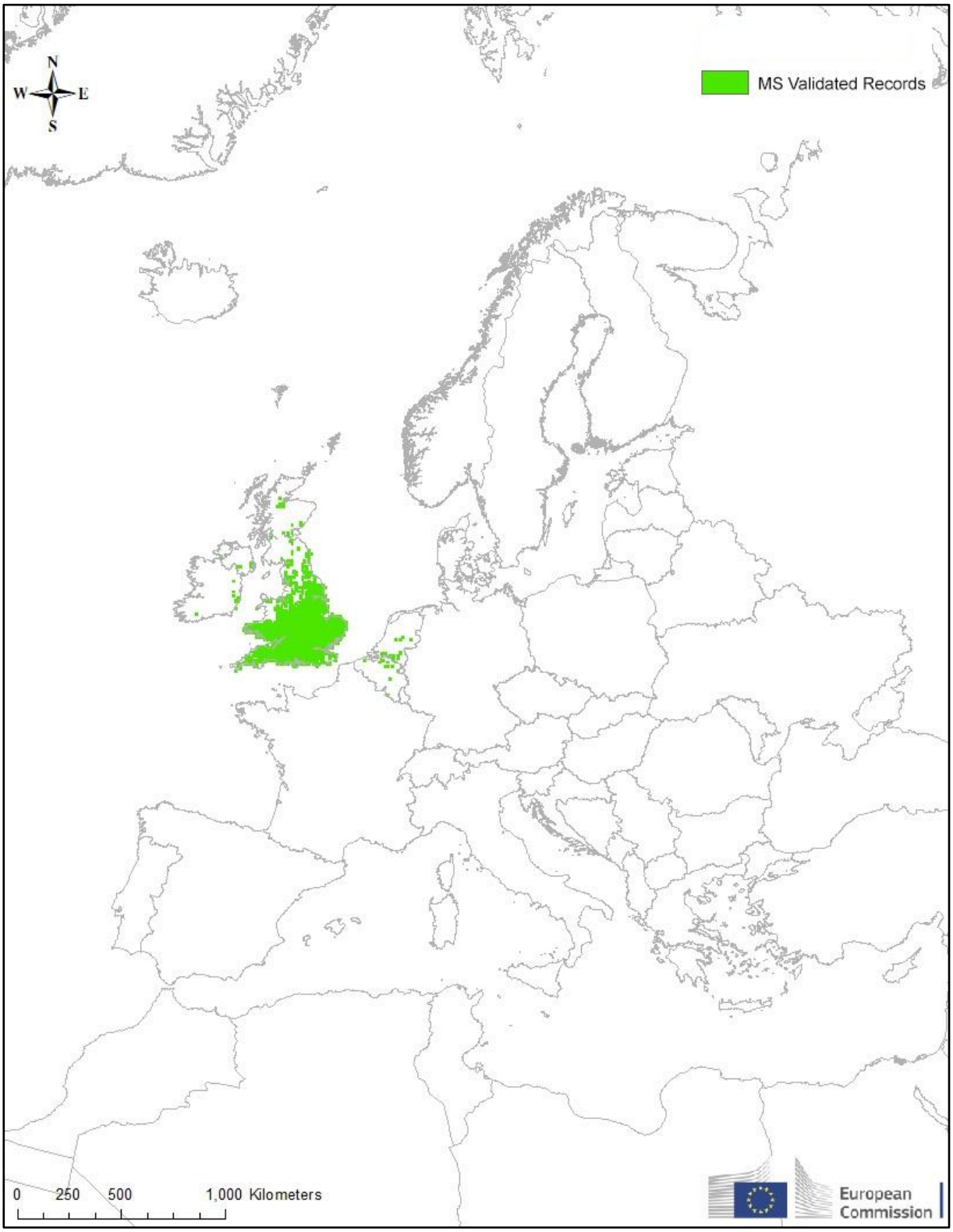


Figure 71. Distribution of *Muntiacus reevesi* in the EU (grid-level 10x10 km): MS reports.

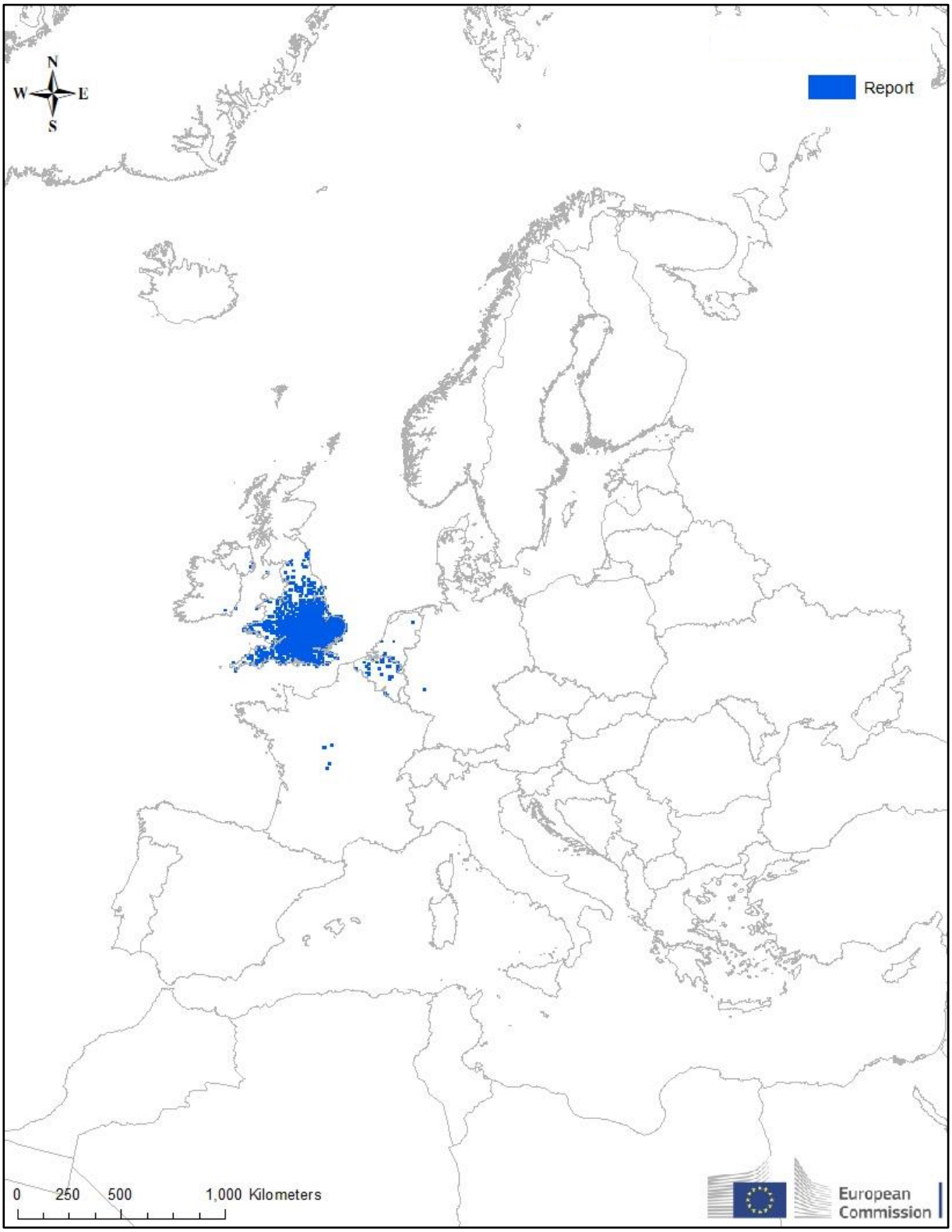


Figure 72. Spread of *Muntiacus reevesi* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

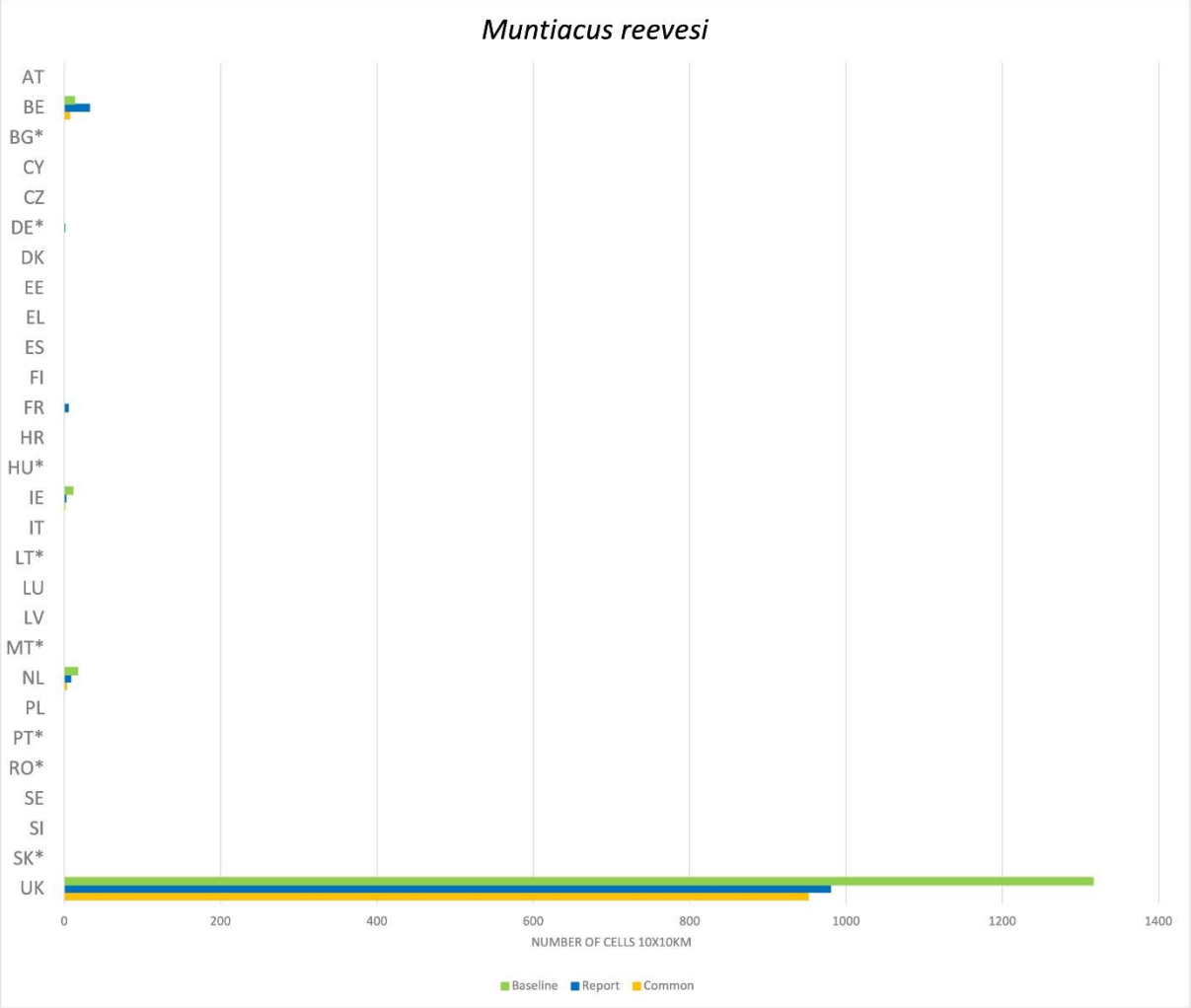


Figure 73. Distribution of *Myocastor coypus* in the EU (grid-level 10x10 km): a) JRC baselines, including MS validated and non-validated records.

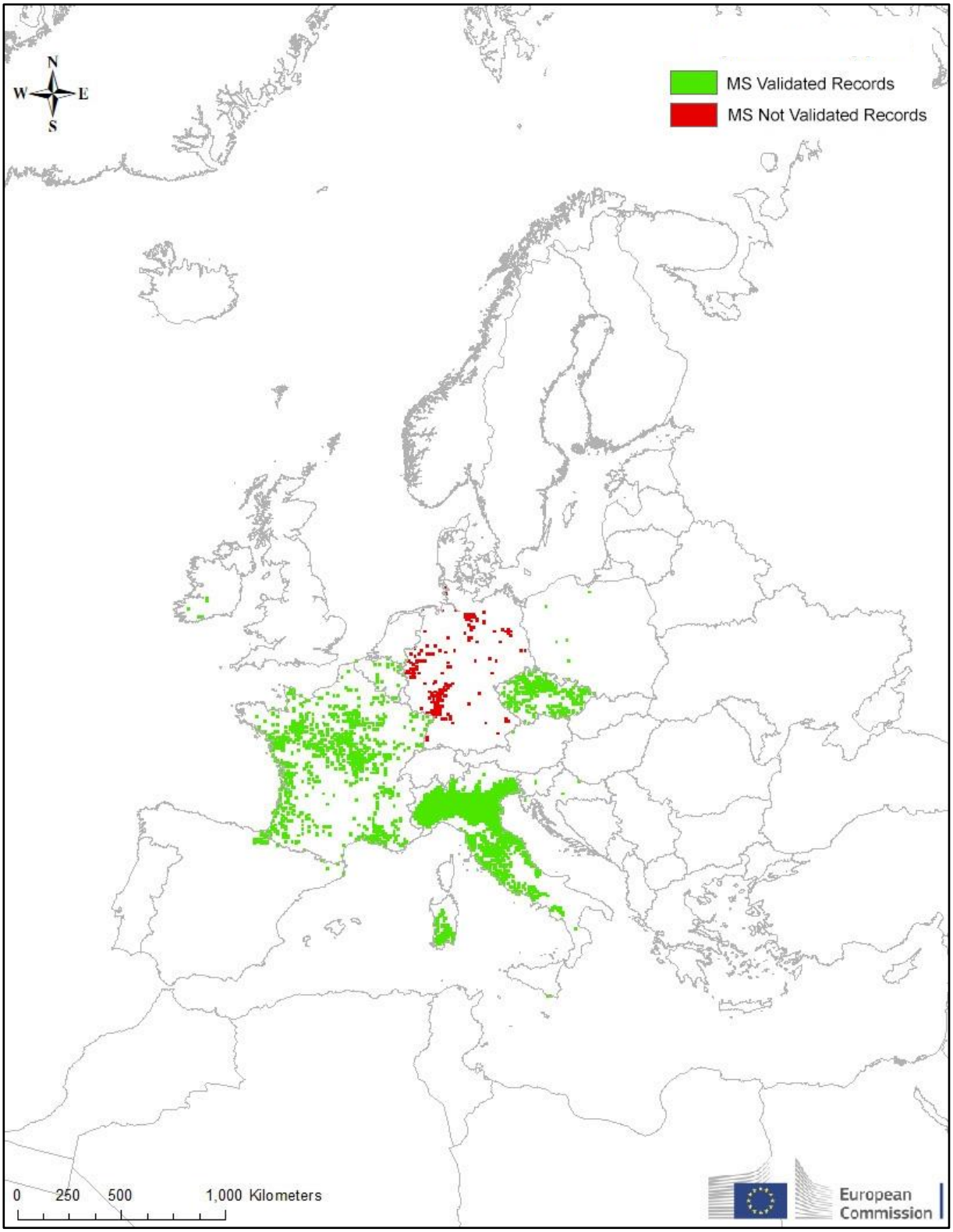


Figure 74. Distribution of *Myocastor coypus* in the EU (grid-level 10x10 km): MS reports.

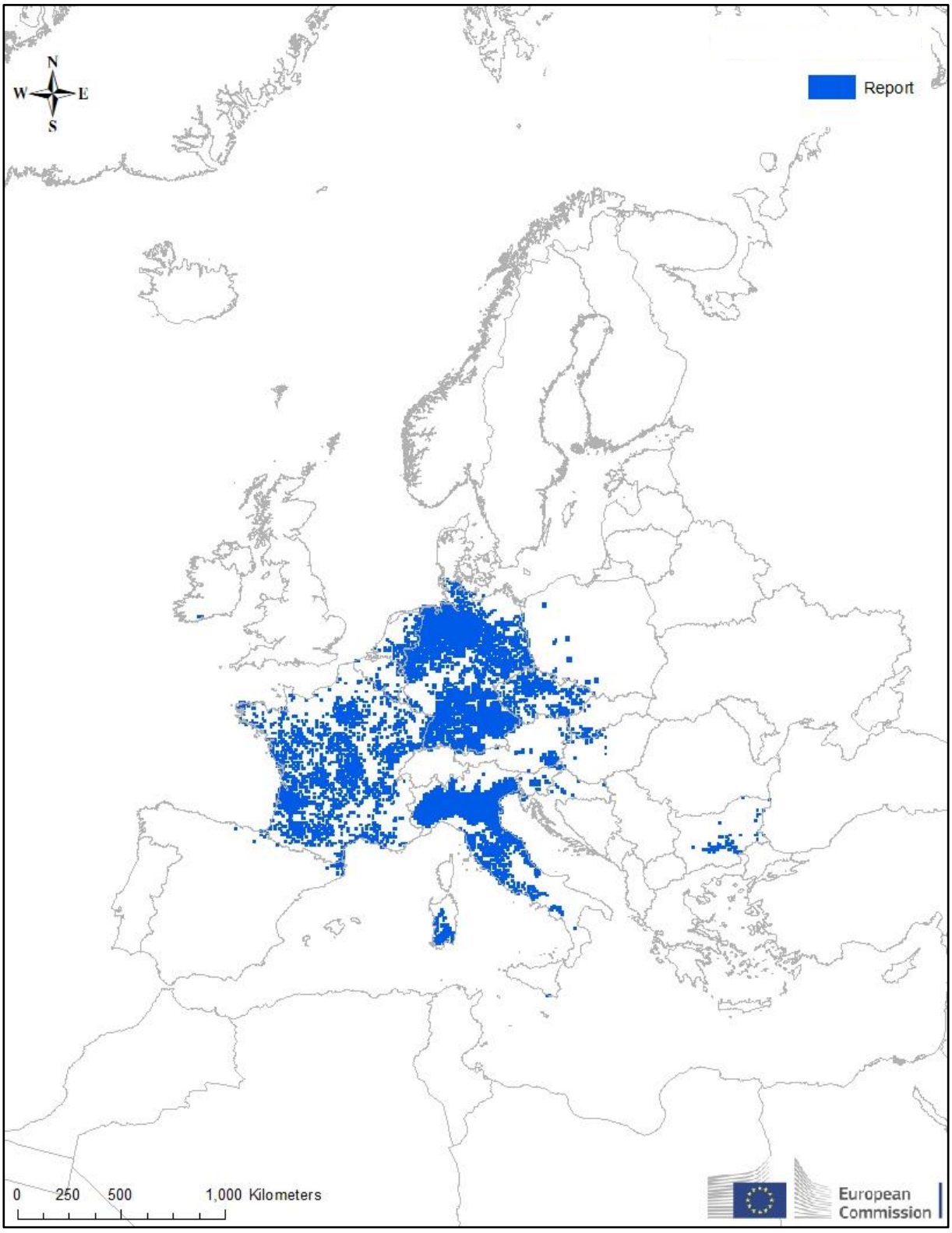


Figure 75. Spread of *Myocastor coypus* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

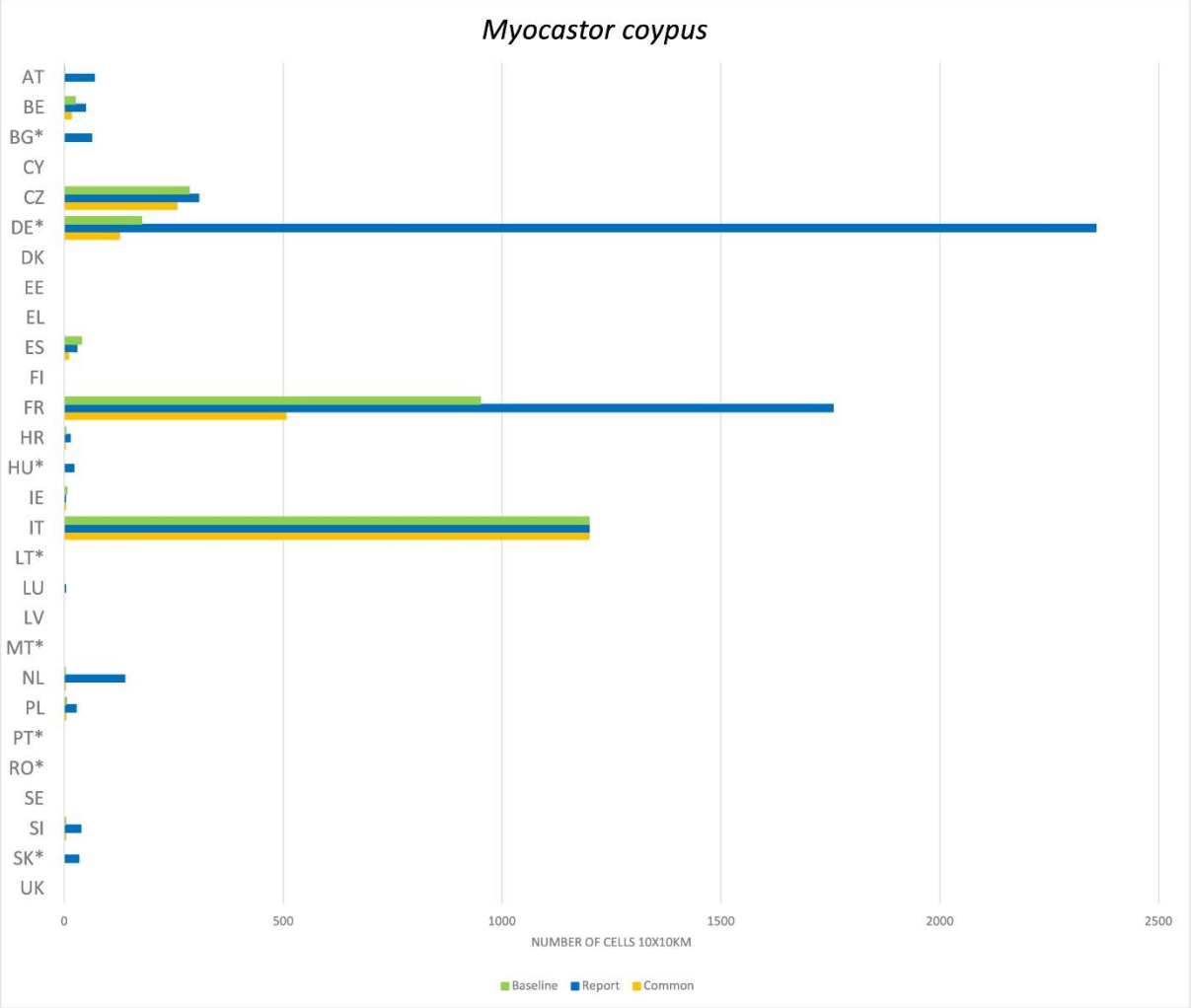


Figure 76. Distribution of *Myriophyllum aquaticum* in the EU (grid-level 10x10 km): a) JRC baselines, including MS validated and non-validated records.

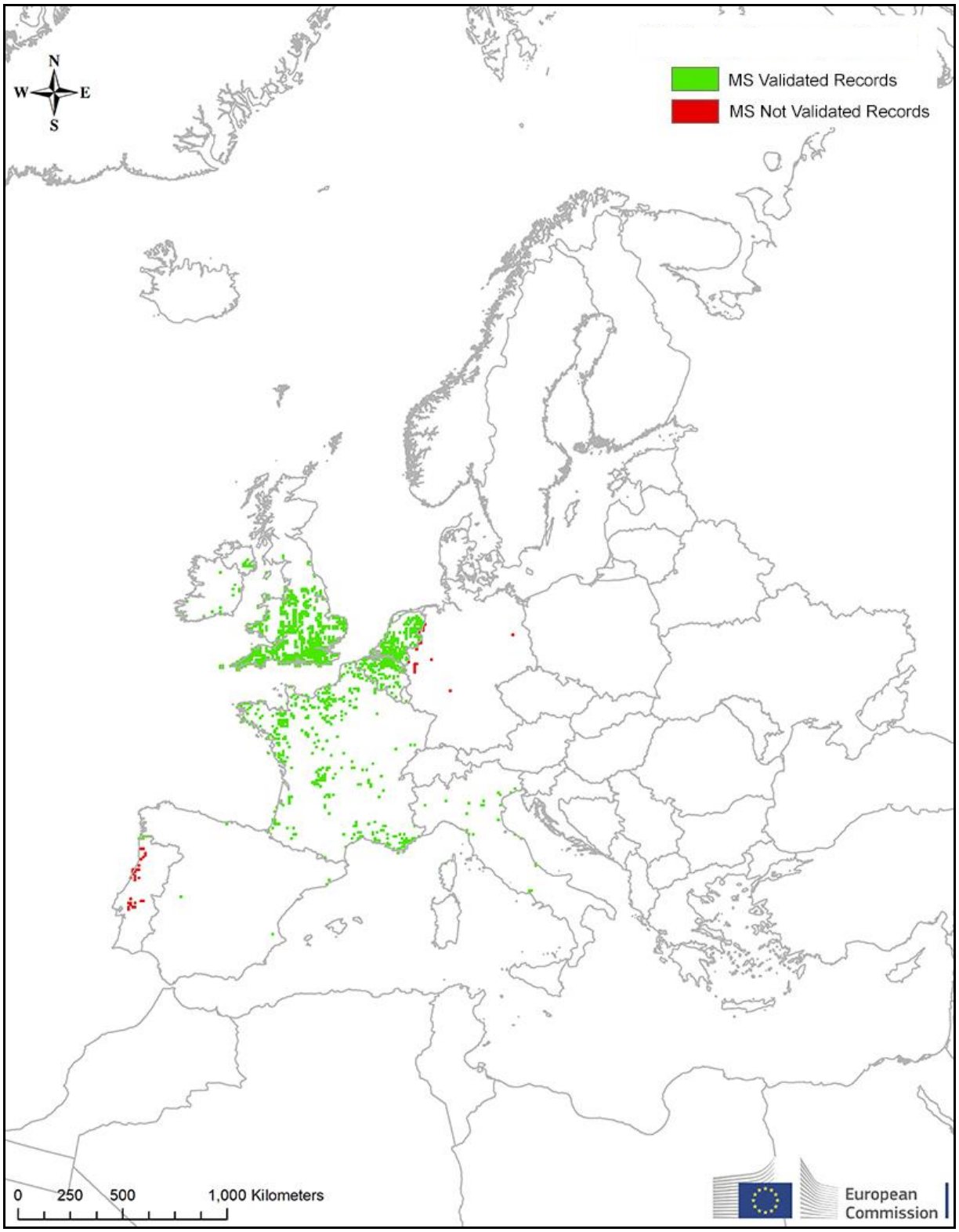


Figure 77. Distribution of *Myriophyllum aquaticum* in the EU (grid-level 10x10 km): MS reports.

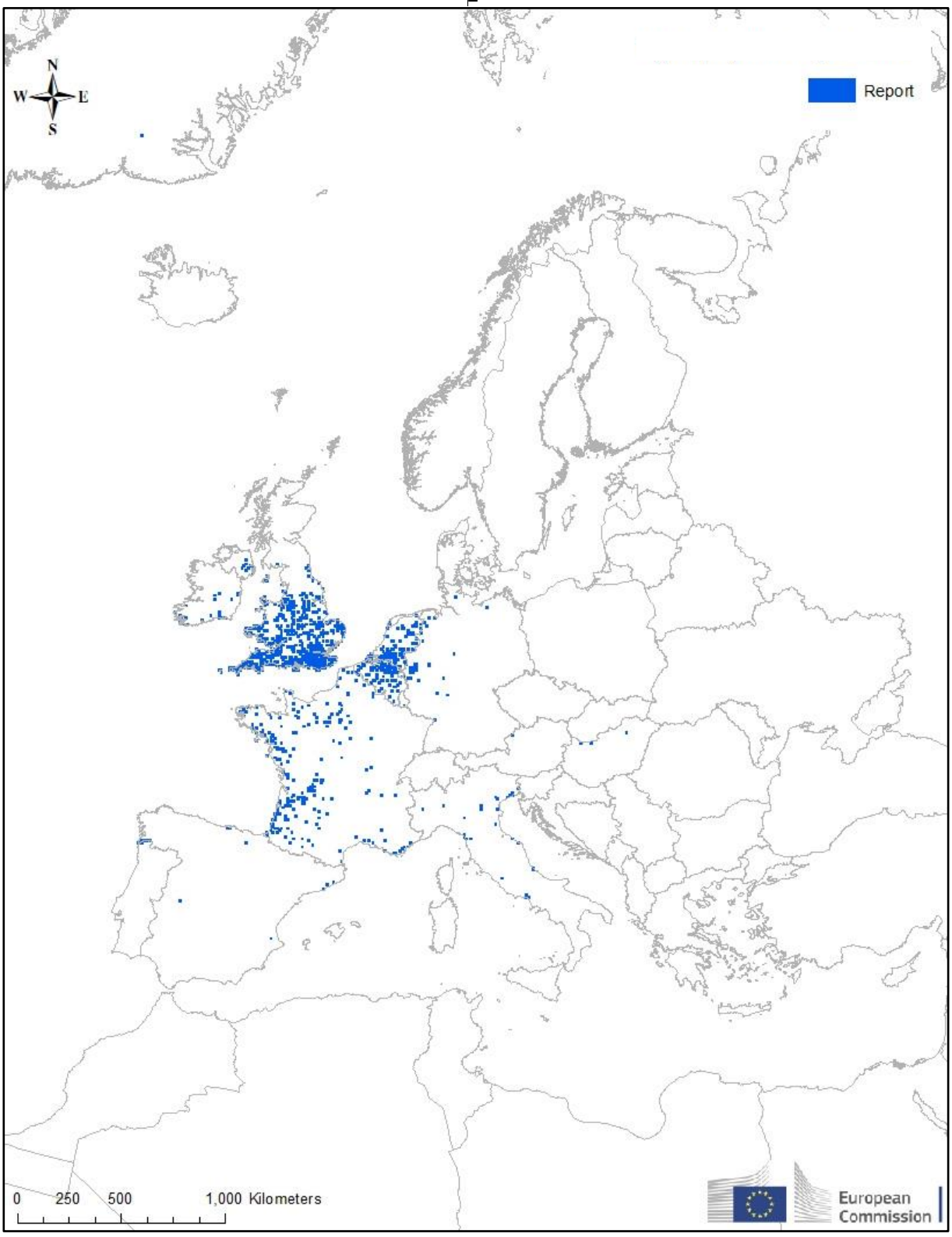


Figure 78. Spread of *Miriophyllum aquaticum* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

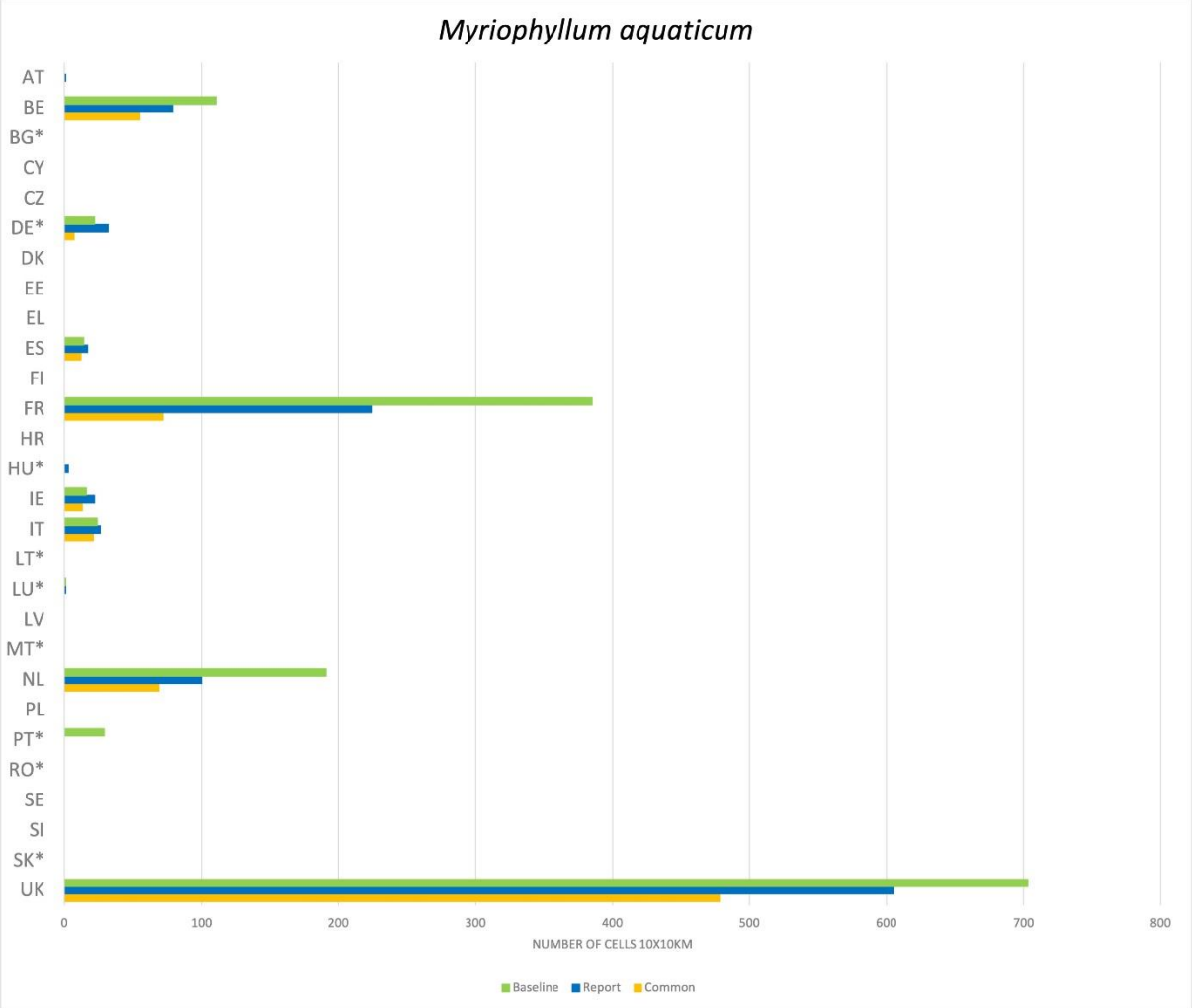


Figure 79. Distribution of *Myriophyllum heterophyllum* in the EU (grid-level 10x10 km): a) JRC baselines, including MS validated and non-validated records.

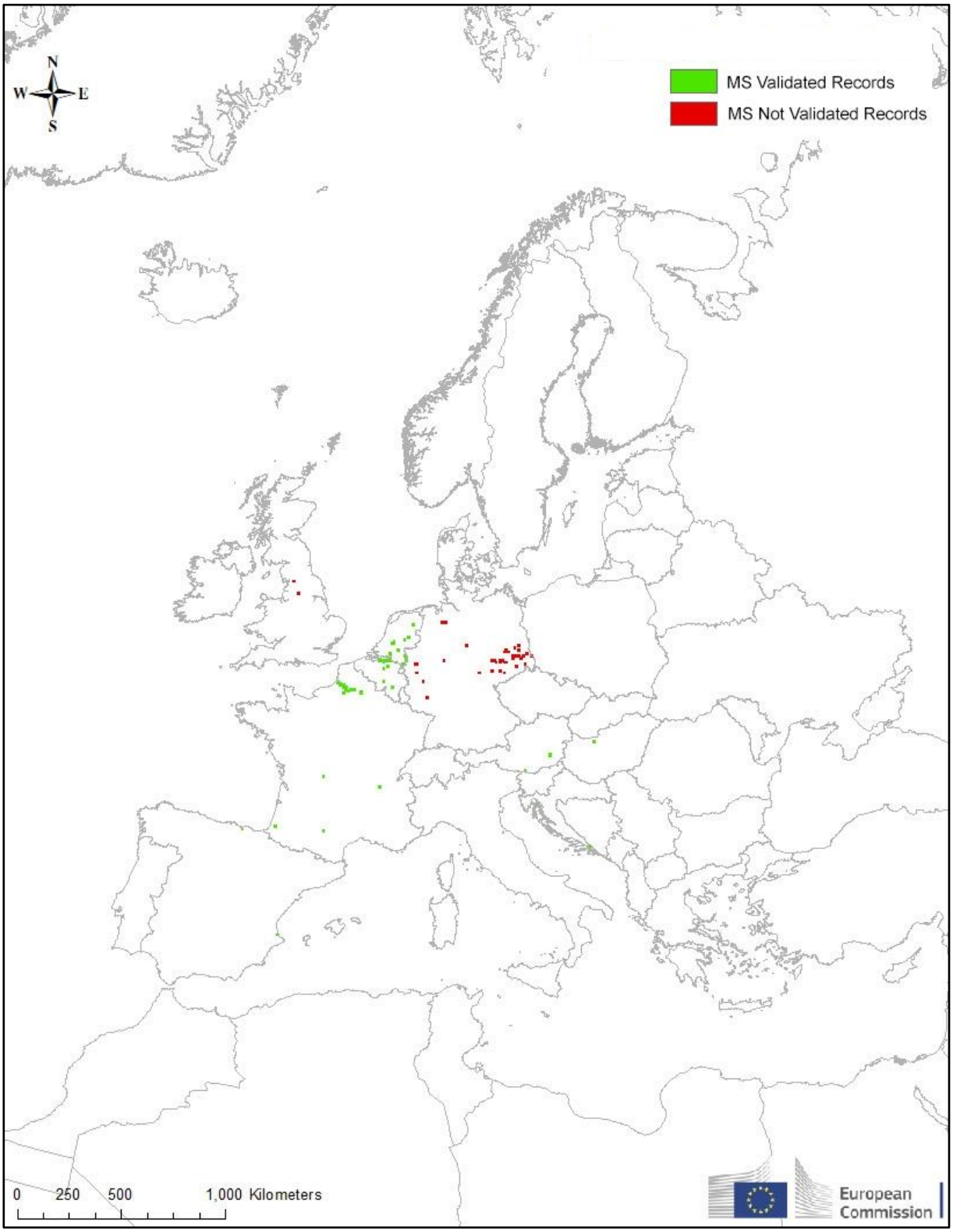


Figure 80. Distribution of *Myriophyllum heterophyllum* in the EU (grid-level 10x10 km): MS reports.

Figure 81. Spread of *Miriophyllum heterophyllum* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

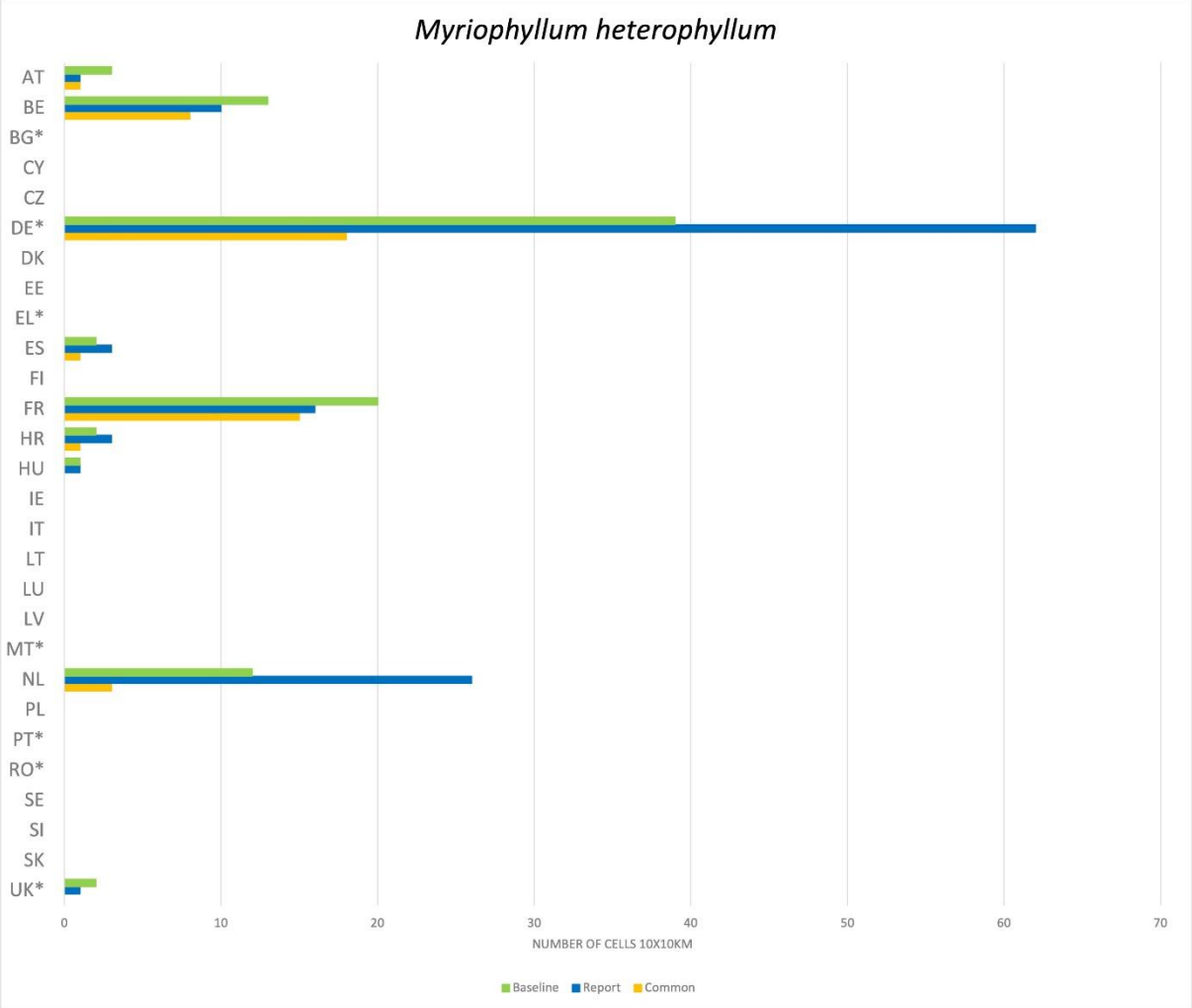


Figure 82. Distribution of *Nasua nasua* in the EU (grid-level 10x10 km): a) JRC baselines, including only validated baseline records.

Figure 83. Distribution of *Nasua nasua* in the EU (grid-level 10x10 km): MS reports.

Figure 84. Spread of *Nasua nasua* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

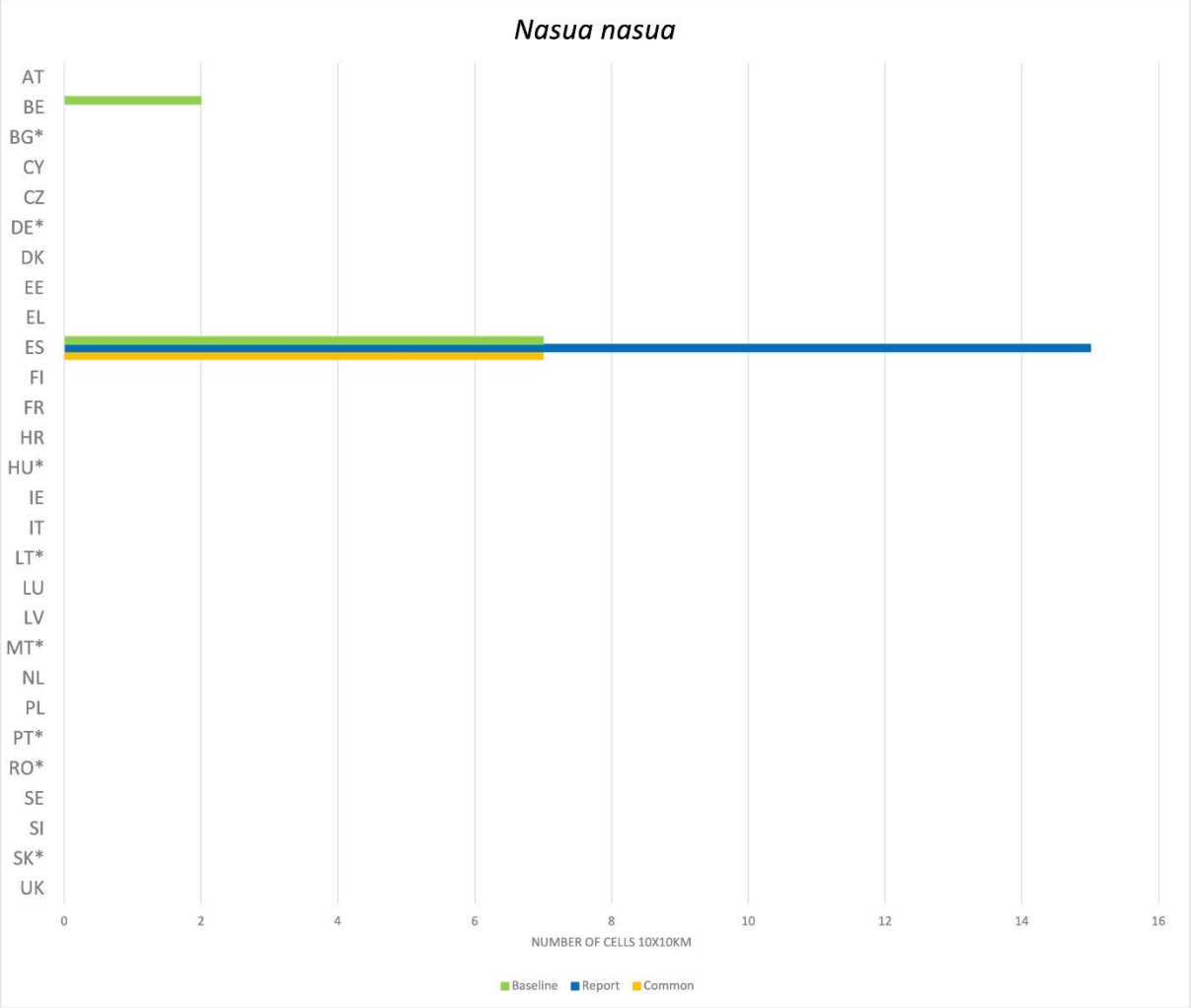


Figure 85. Distribution of *Ondatra zibethicus* in the EU (grid-level 10x10 km): a) JRC baselines, including MS validated and non-validated records.

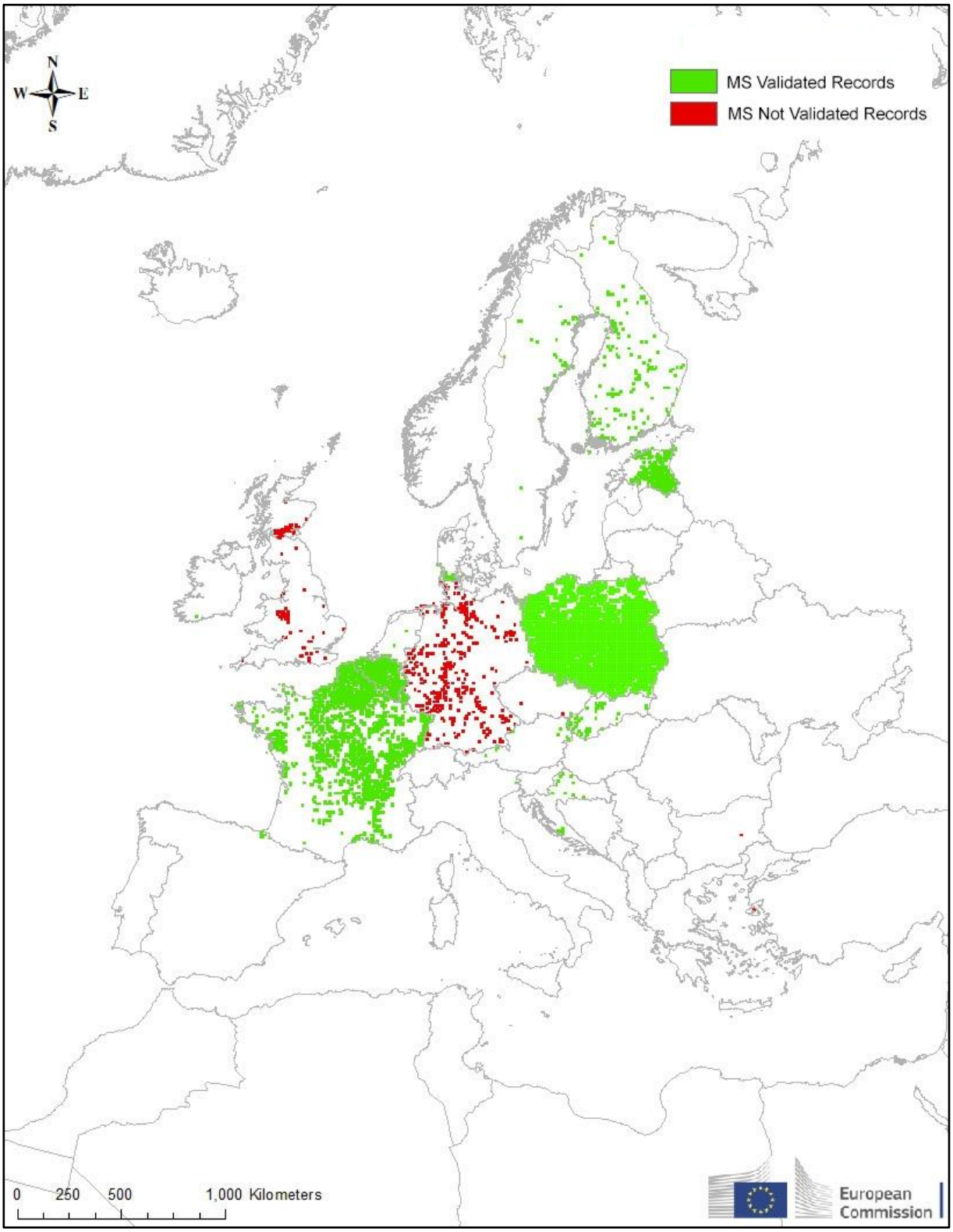


Figure 86. Distribution of *Ondatra zibethicus* in the EU (grid-level 10x10 km): MS reports.

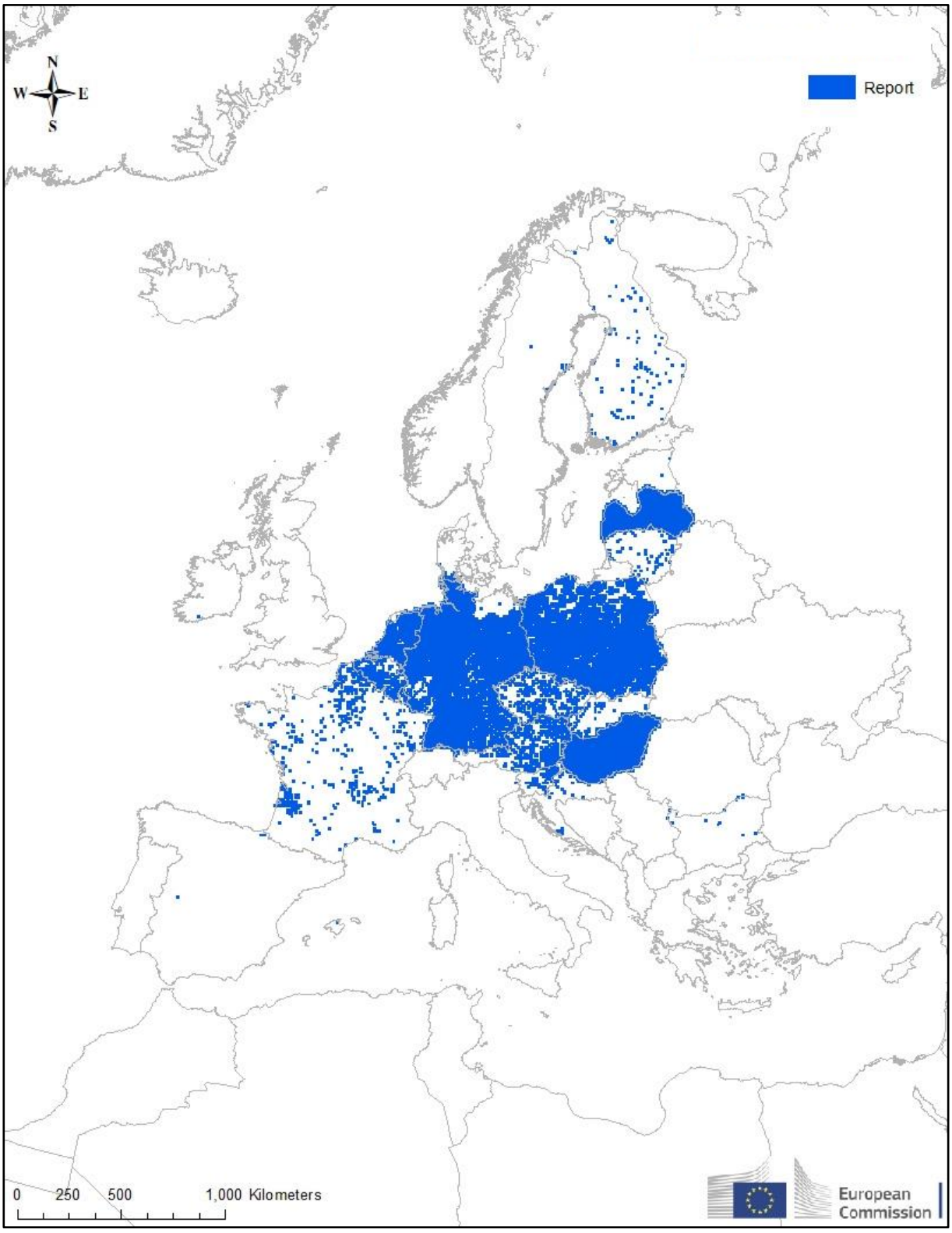


Figure 87. Spread of *Ondatra zibethicus* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

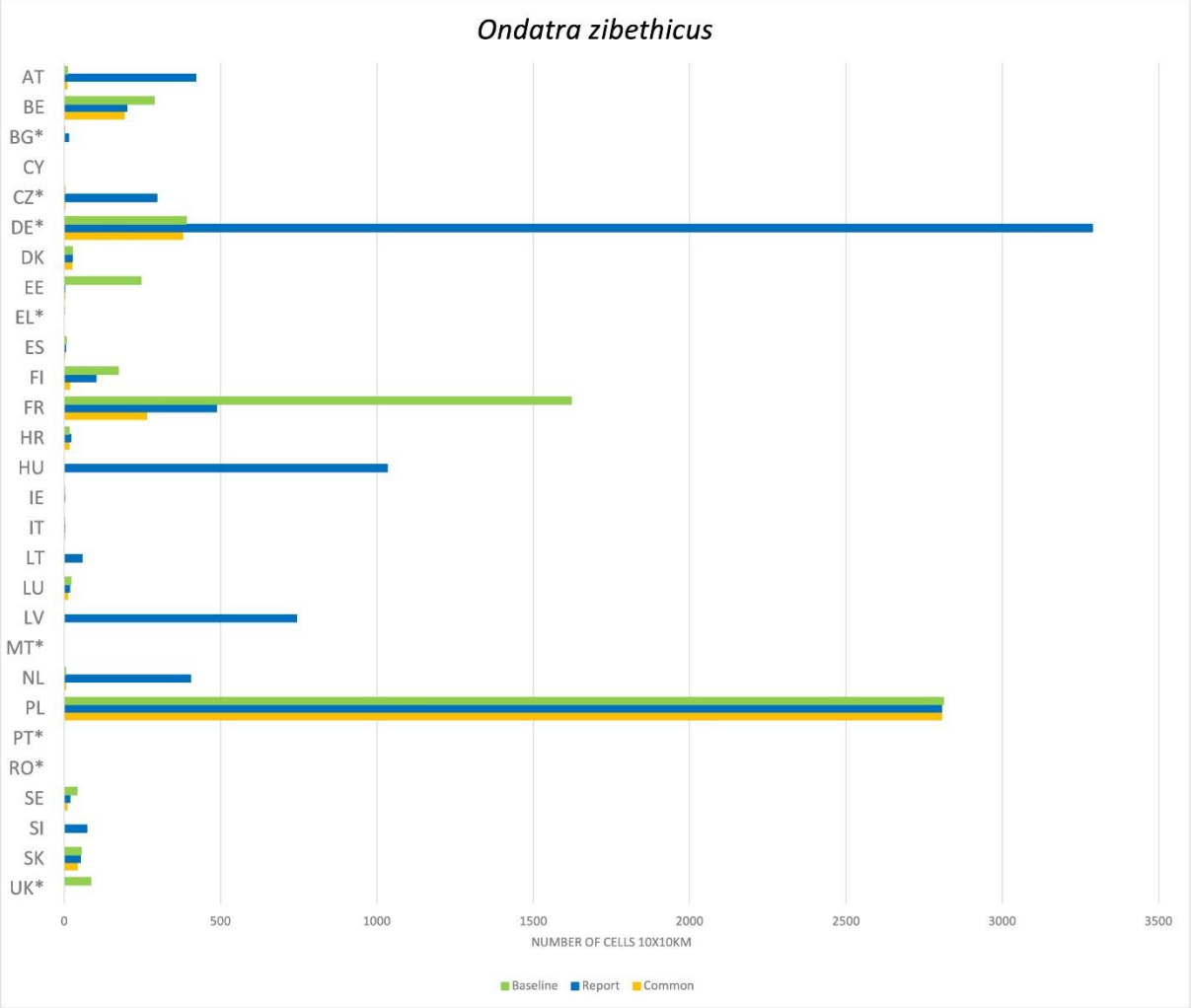


Figure 88. Distribution of *Orconectes limosus* in the EU (grid-level 10x10 km): a) JRC baselines, including MS validated and non-validated baselines.

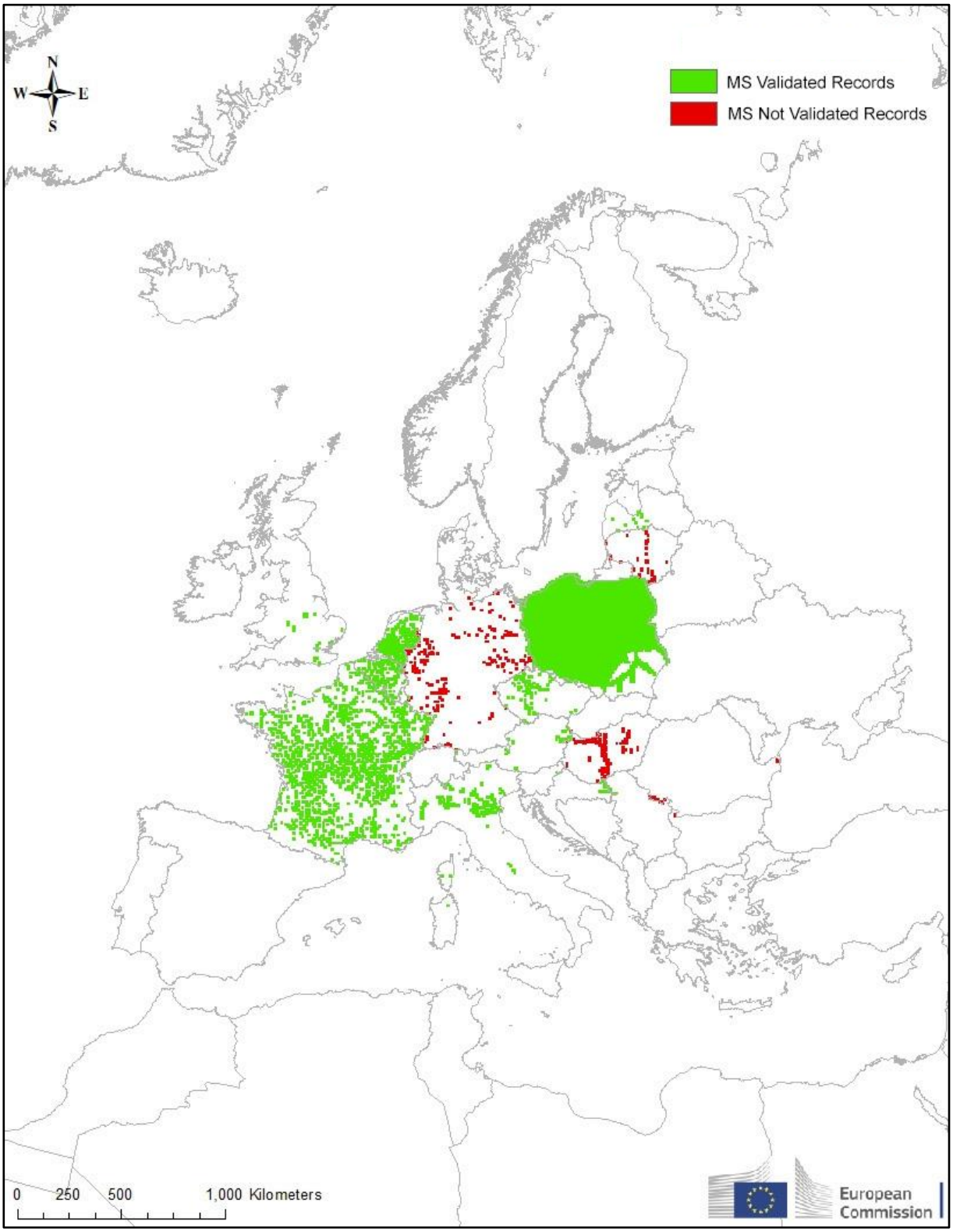


Figure 89. Distribution of *Orconectes limosus* in the EU (grid-level 10x10 km): MS reports.

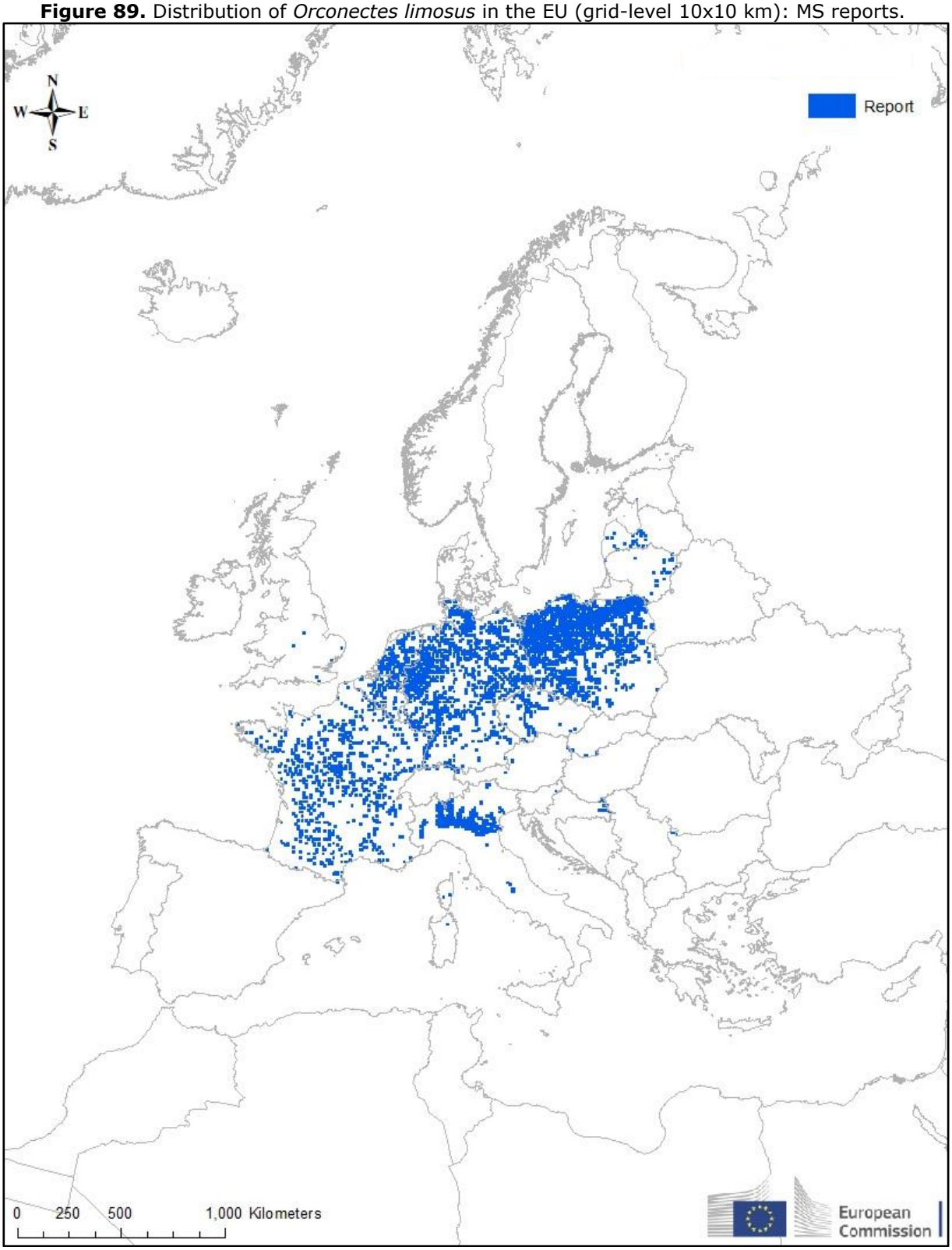


Figure 90. Spread of *Orconectes limosus* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

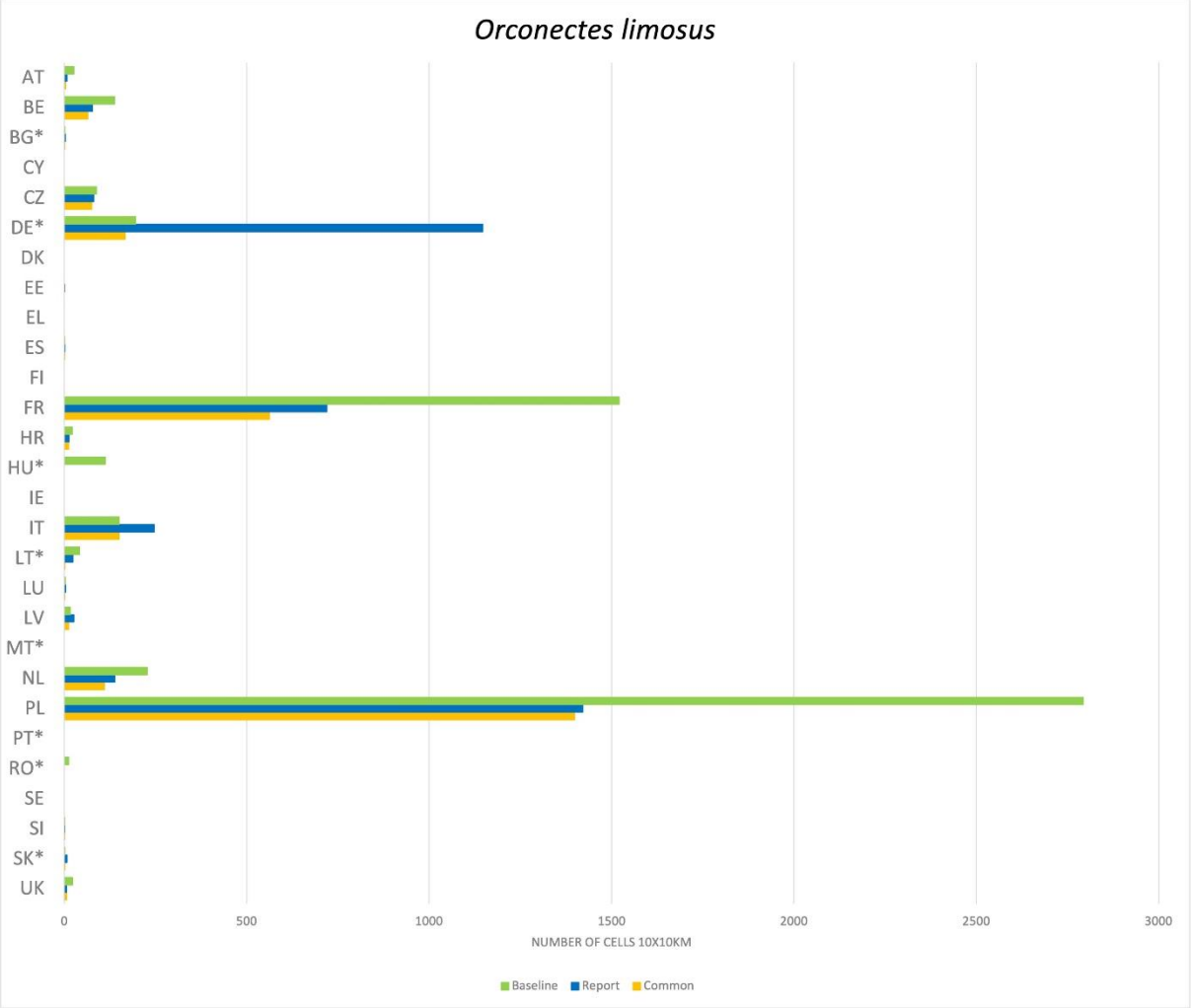


Figure 91. Distribution of *Orconectes virilis* in the EU (grid-level 10x10 km): JRC baselines, including MS validated and non-validated records.

Figure 92. Distribution of *Orconectes virilis* in the EU (grid-level 10x10 km): MS reports.

Figure 93. Spread of *Orconectes virilis* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

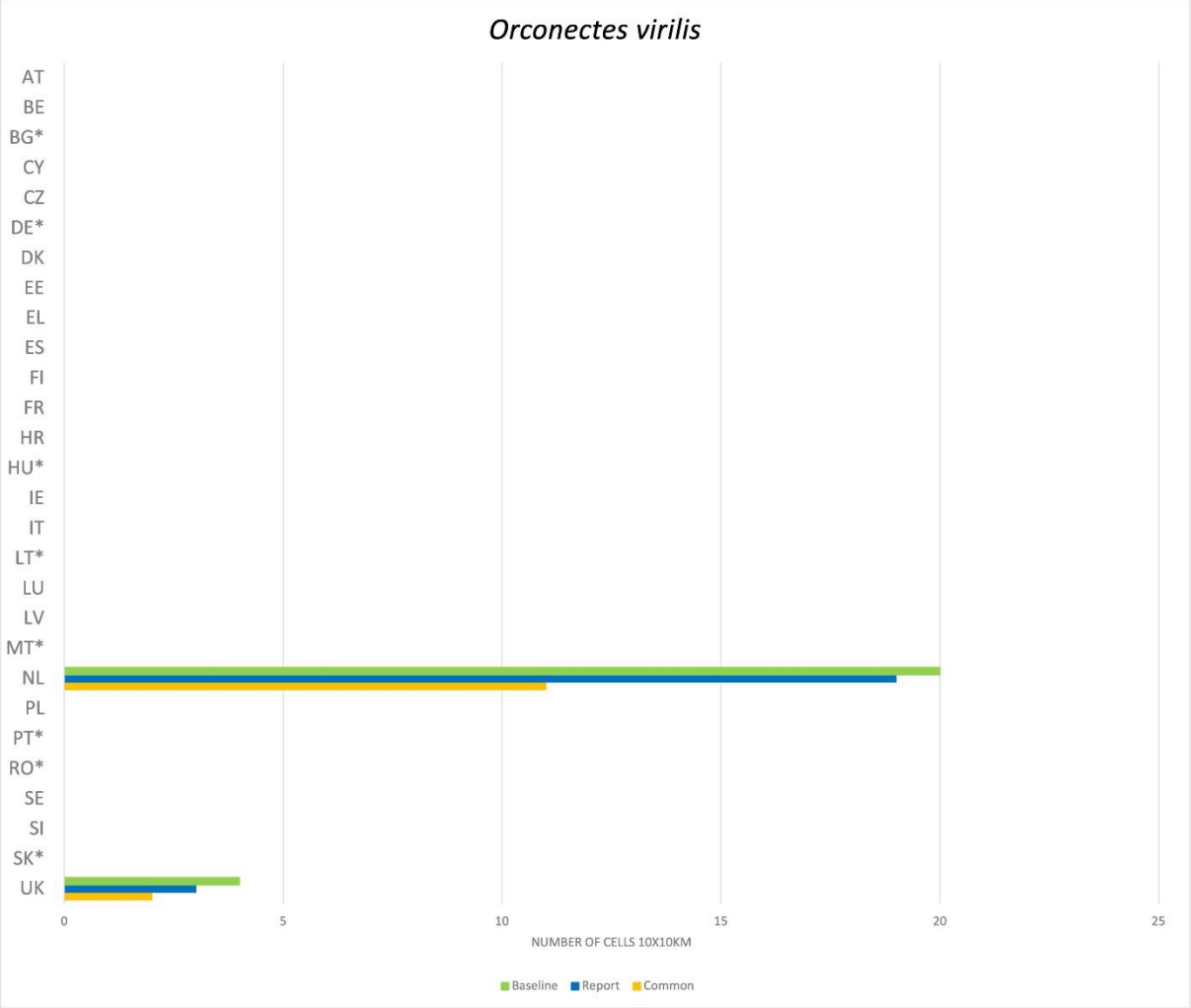


Figure 94. Distribution of *Oxyura jamaicensis* in the EU (grid-level 10x10 km): JRC baselines, including MS validated and non-validated records.

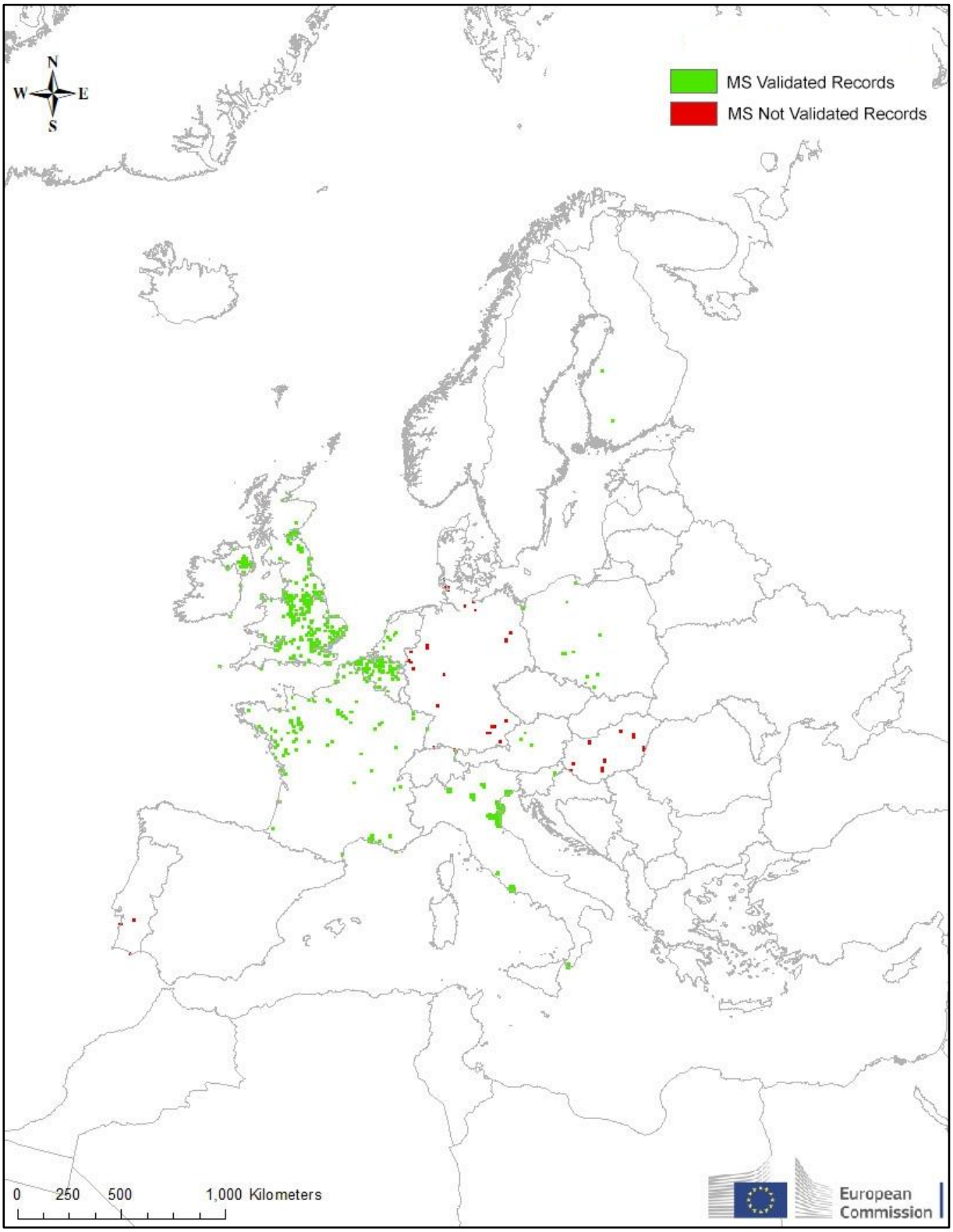


Figure 95. Distribution of *Oxyura jamaicensis* in the EU (grid-level 10x10 km): MS reports.

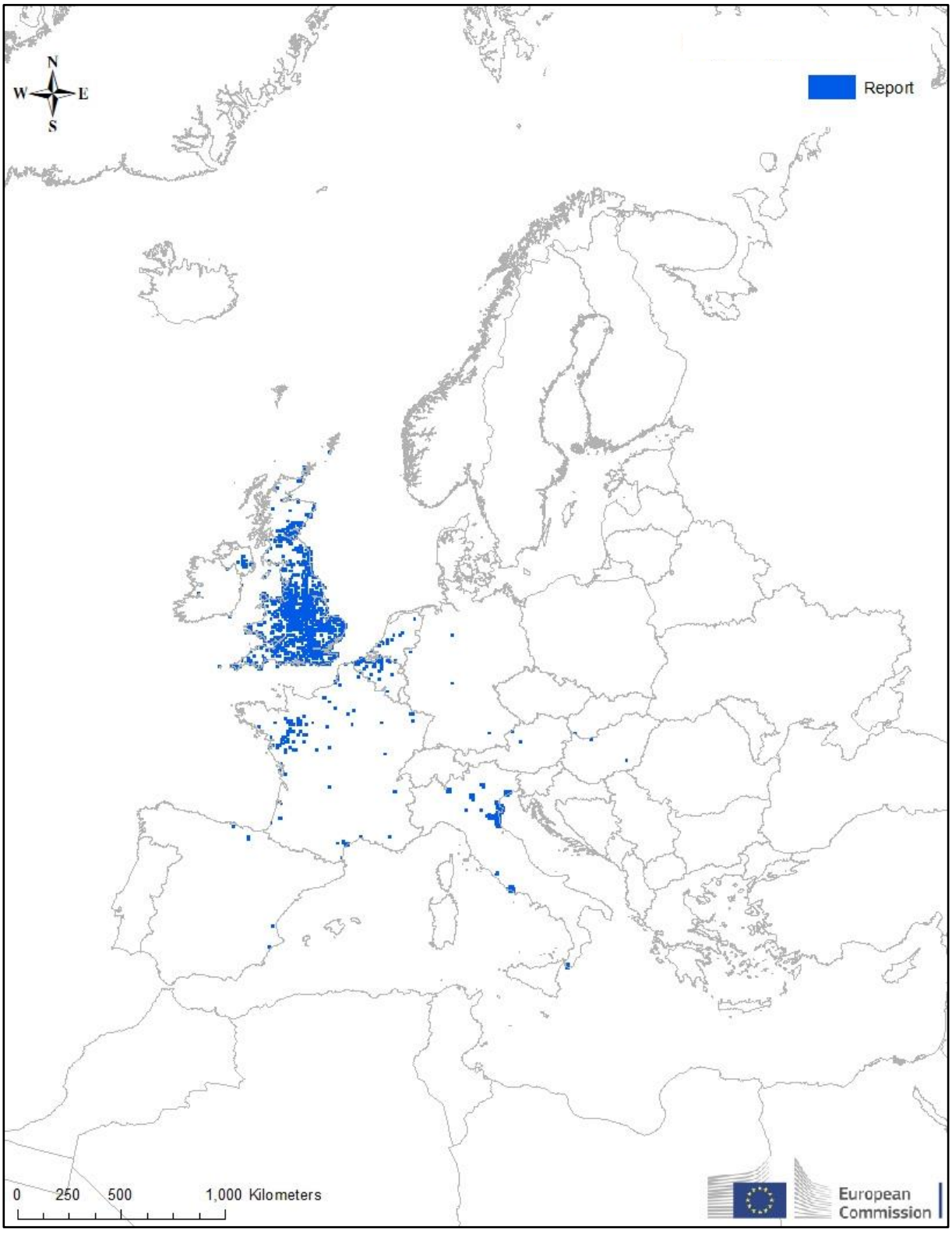


Figure 96. Spread of *Oxyura jamaicensis* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

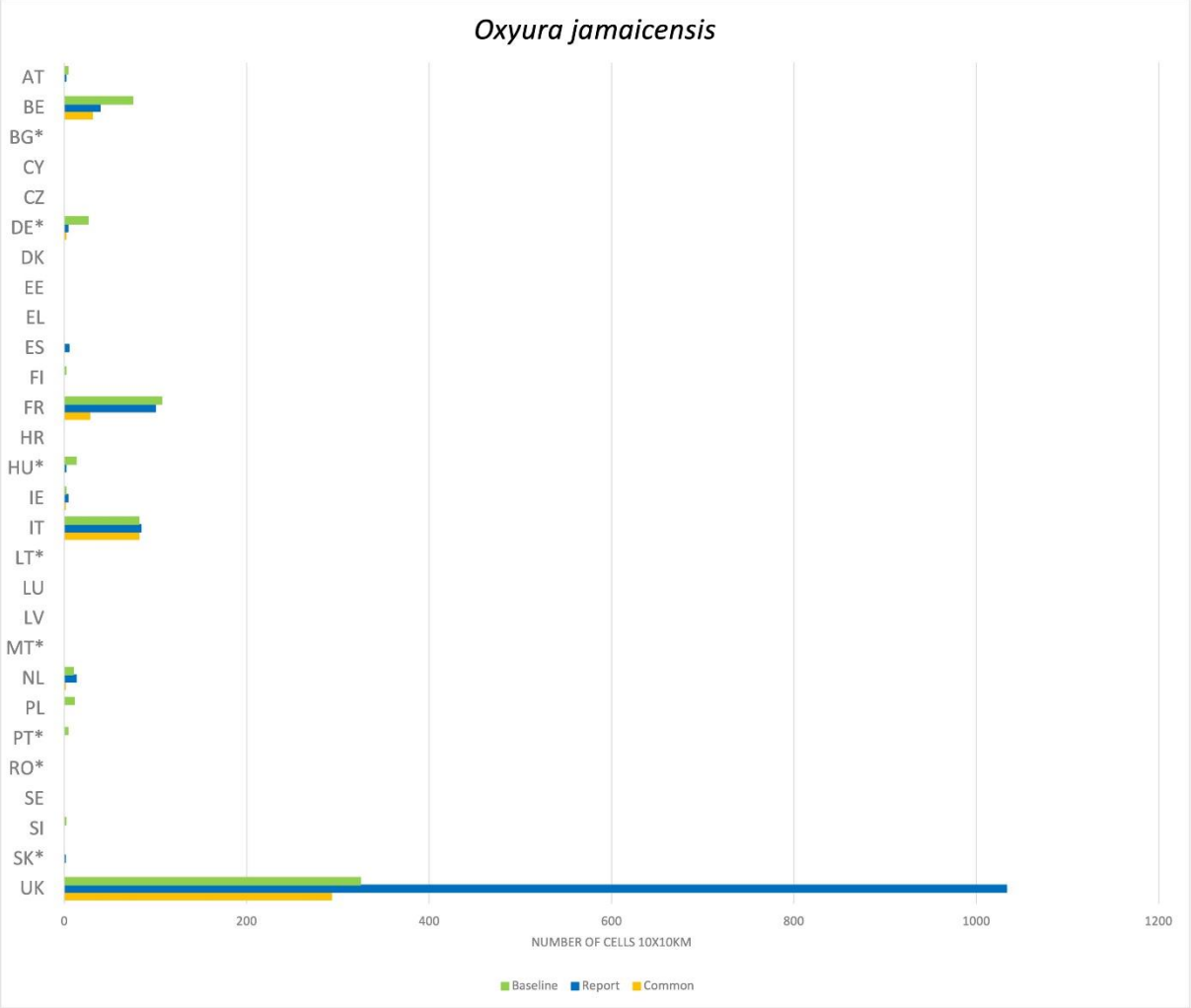


Figure 97. Distribution of *Pacifastacus leniusculus* in the EU (grid-level 10x10 km): JRC baselines, including MS validated and non-validated baselines.

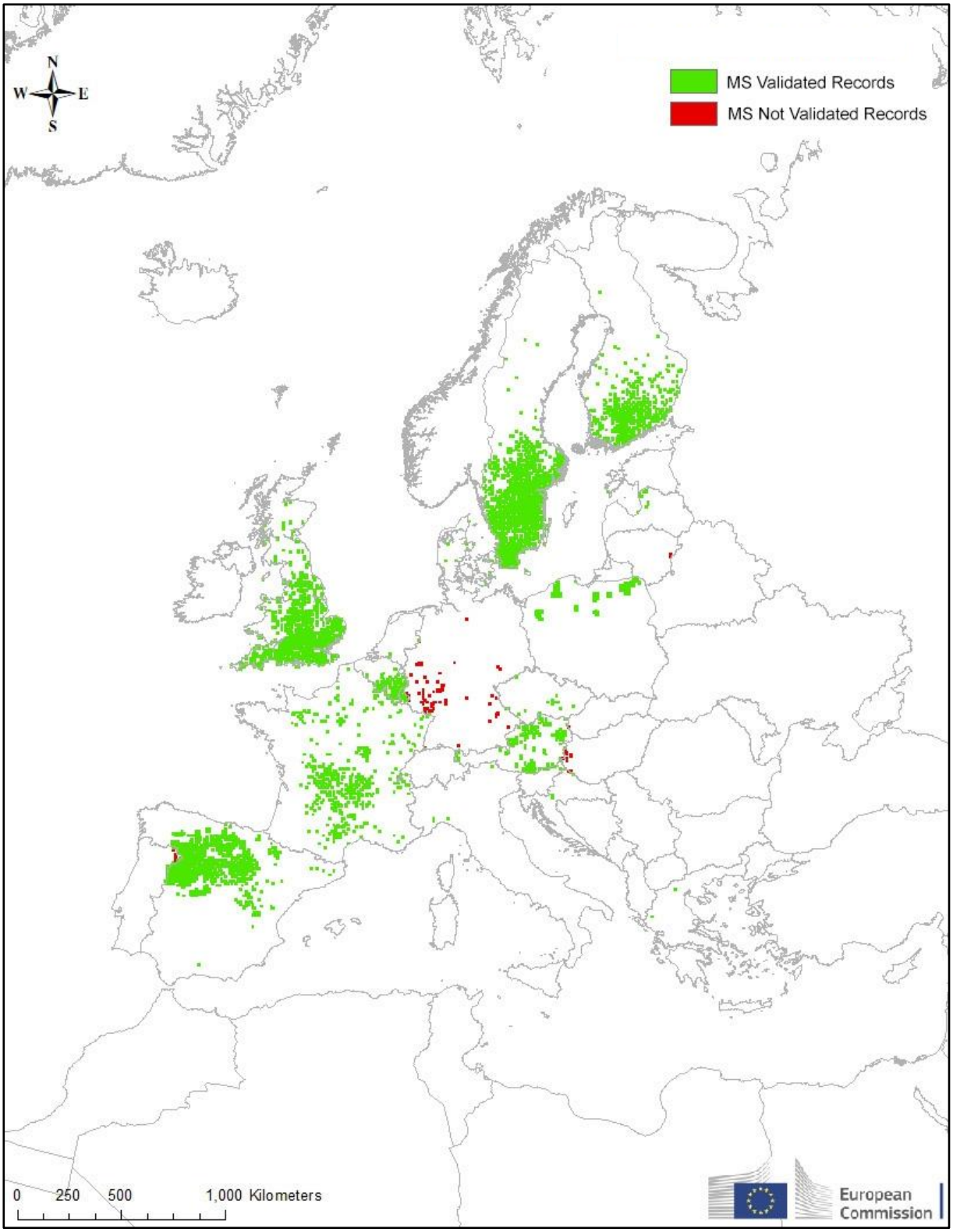


Figure 98. Distribution of *Pacifastacus leniusculus* in the EU (grid-level 10x10 km): MS reports.

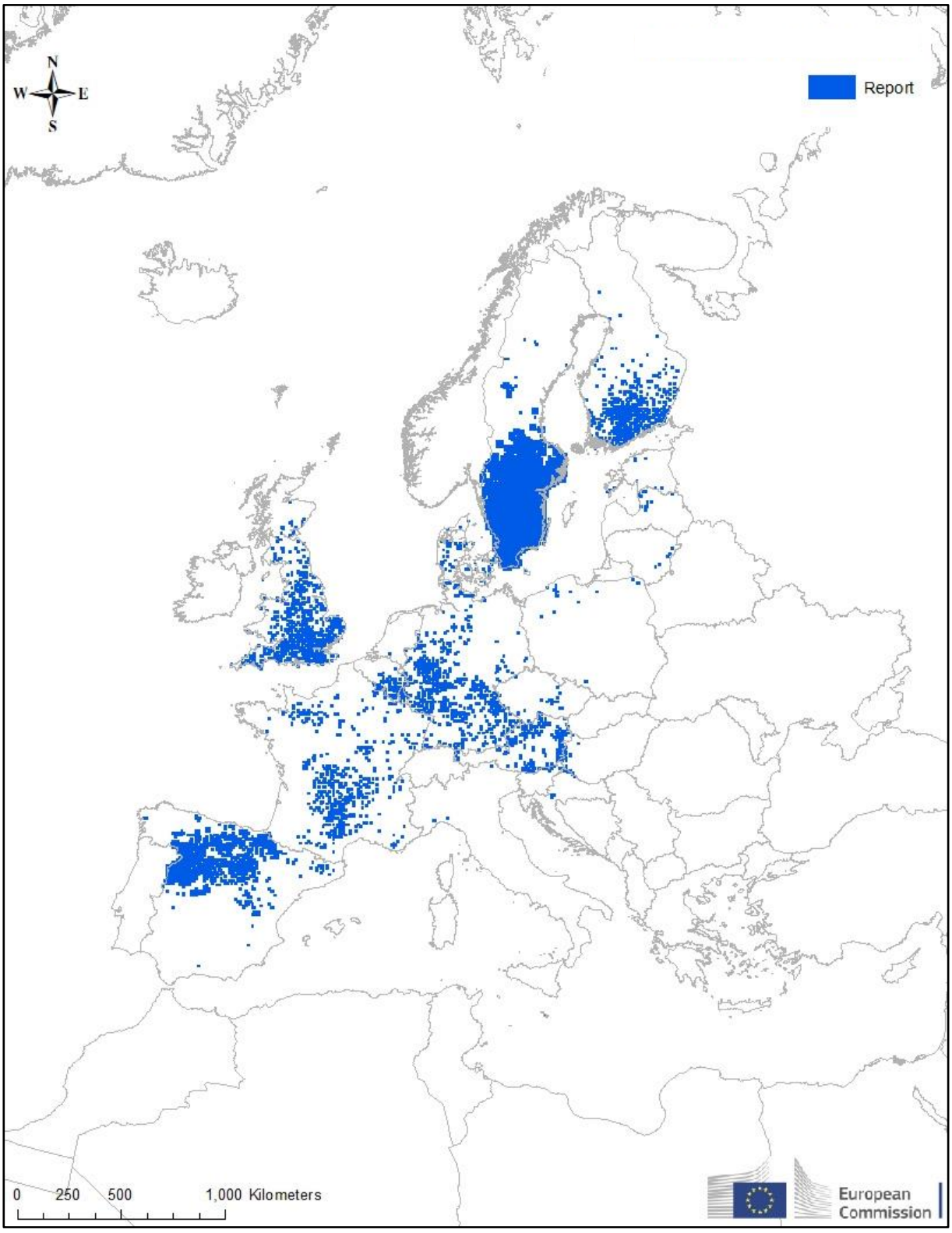


Figure 99. Spread of *Pacifastacus leniusculus* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

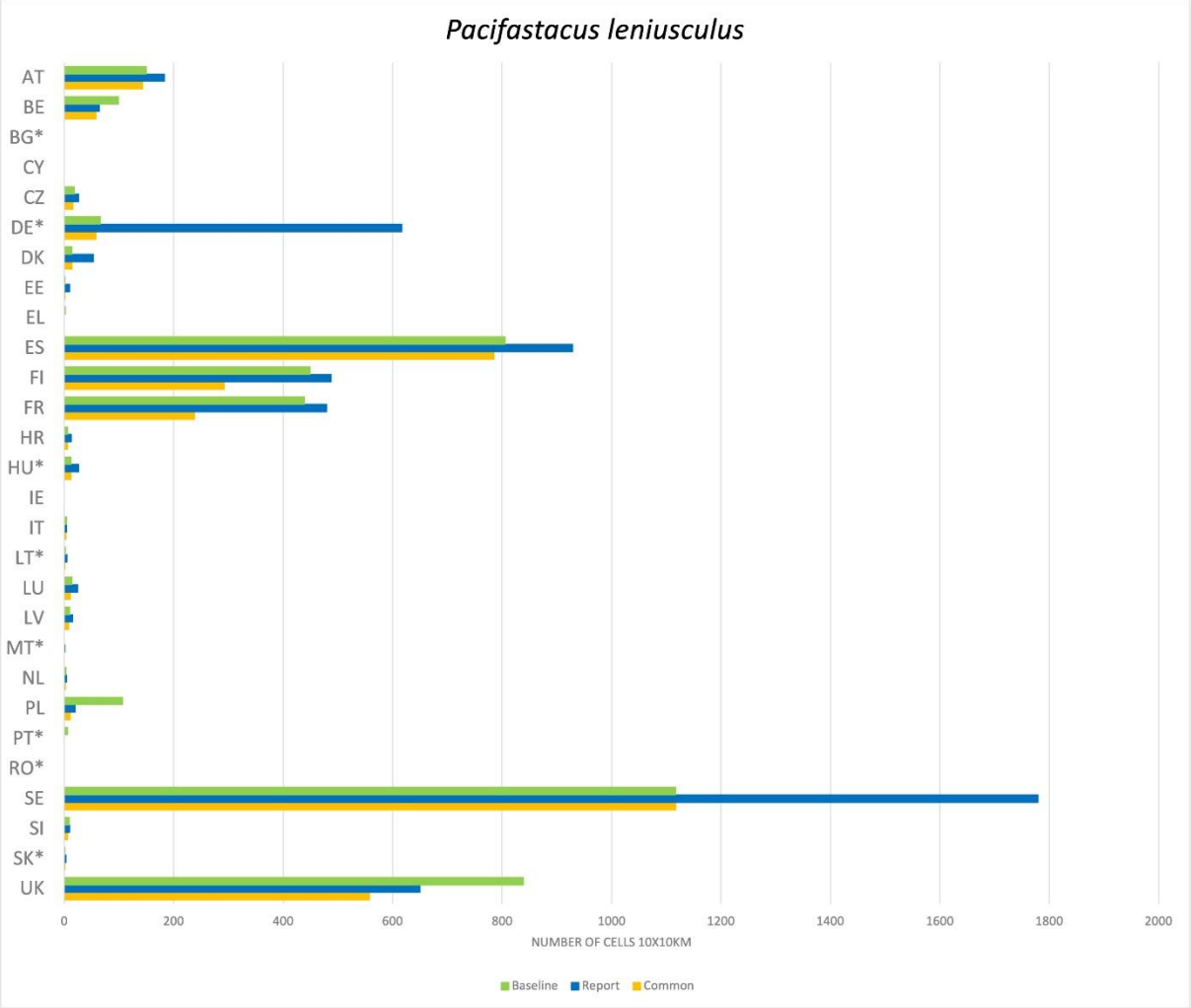


Figure 100. Distribution of *Parthenium hysterophorus* in the EU (grid-level 10x10 km): JRC baselines, including only MS validated baseline data; not mentioned in MS reports.

Figure 101. Distribution of *Pennisetum setaceum* in the EU (grid-level 10x10 km): JRC baselines, including MS validated and non-validated baselines.

Figure 102. Distribution of *Pennisetum setaceum* in the EU (grid-level 10x10 km): MS reports.

Figure 103. Spread of *Pennisetum setaceum* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

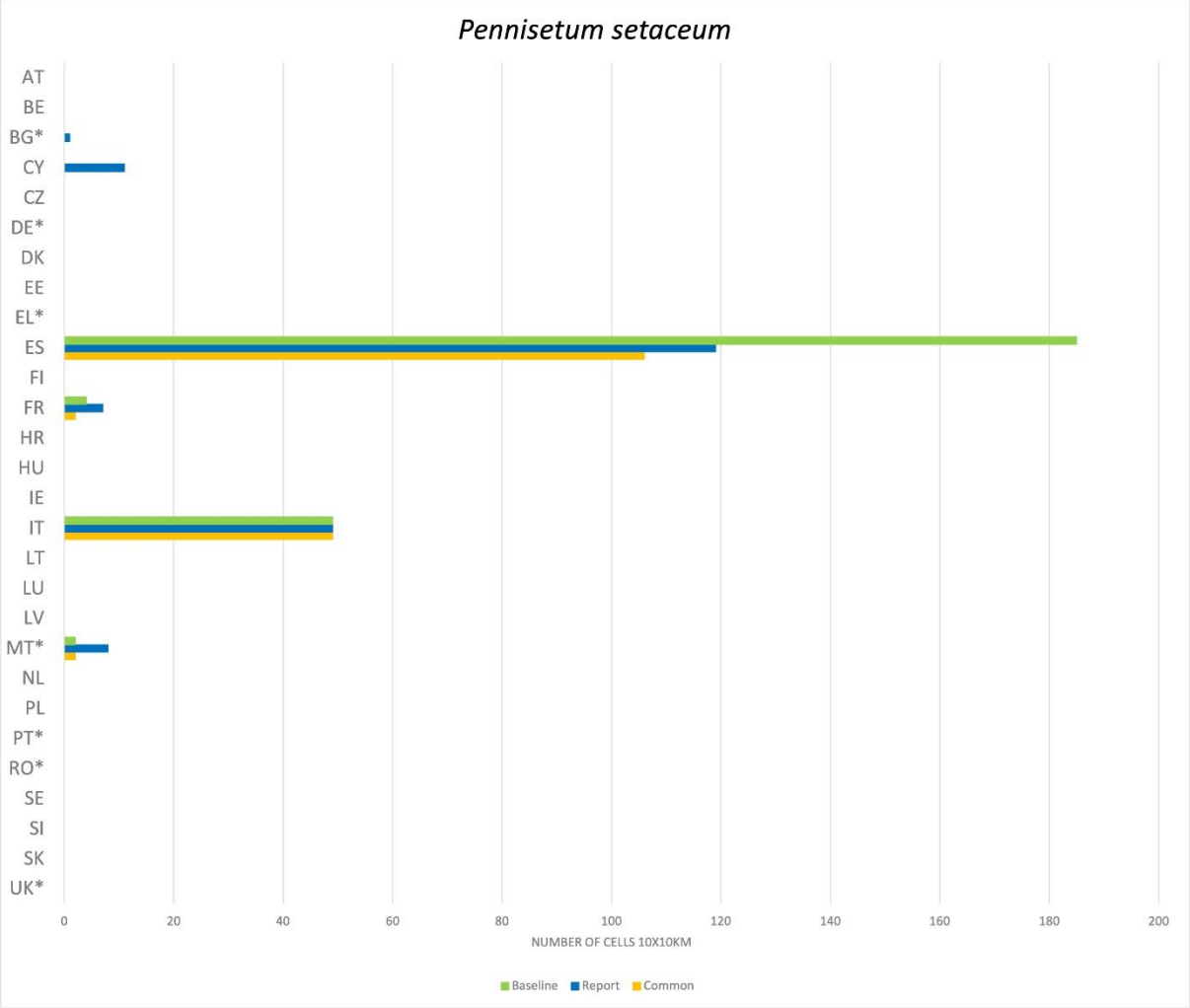


Figure 104. Distribution of *Perccottus glenii* in the EU (grid-level 10x10 km): JRC baselines including MS validated and non-validated records.

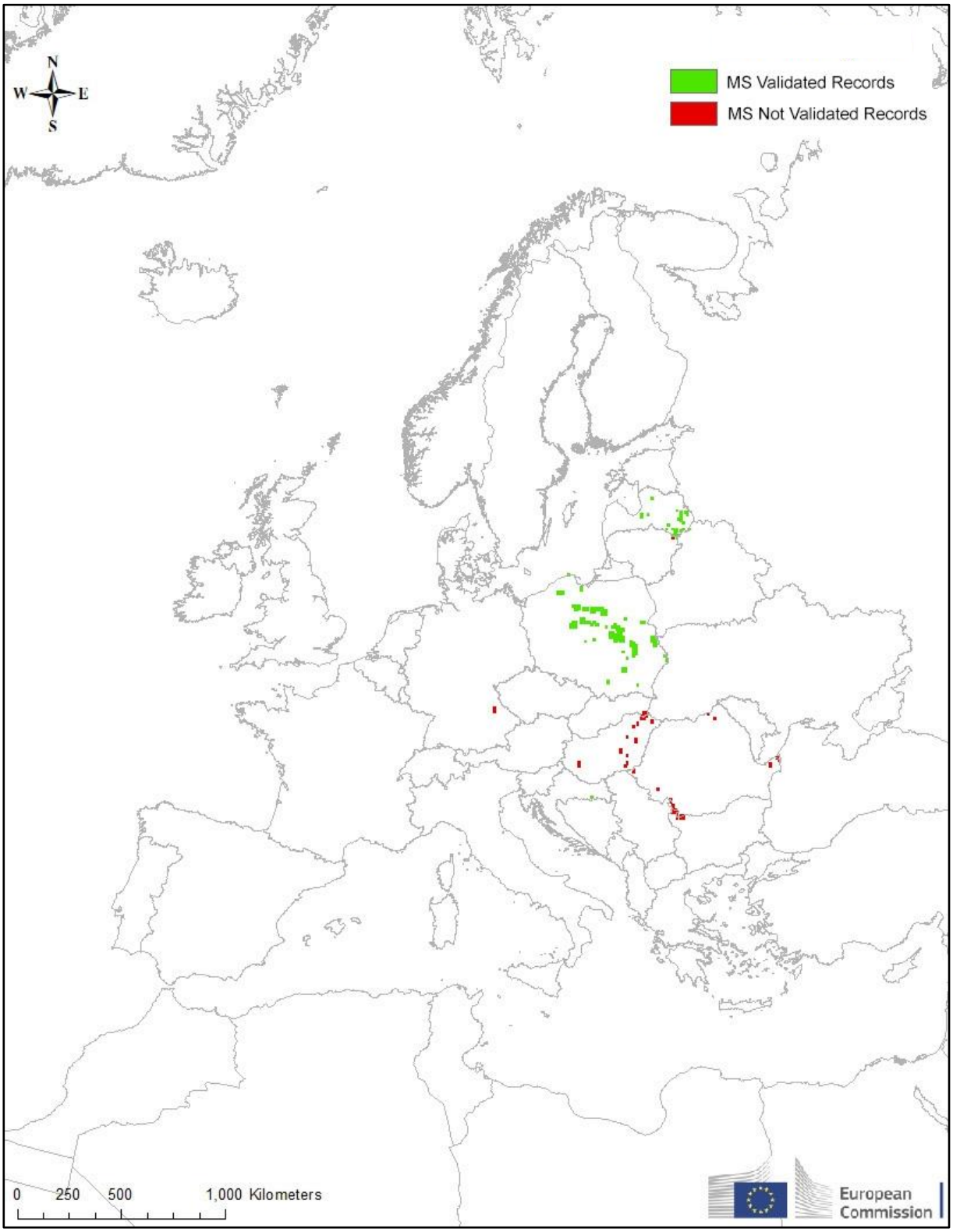


Figure 105. Distribution of *Perccottus glenii* in the EU (grid-level 10x10 km): MS reports.

Figure 106. Spread of *Perccottus glenii* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

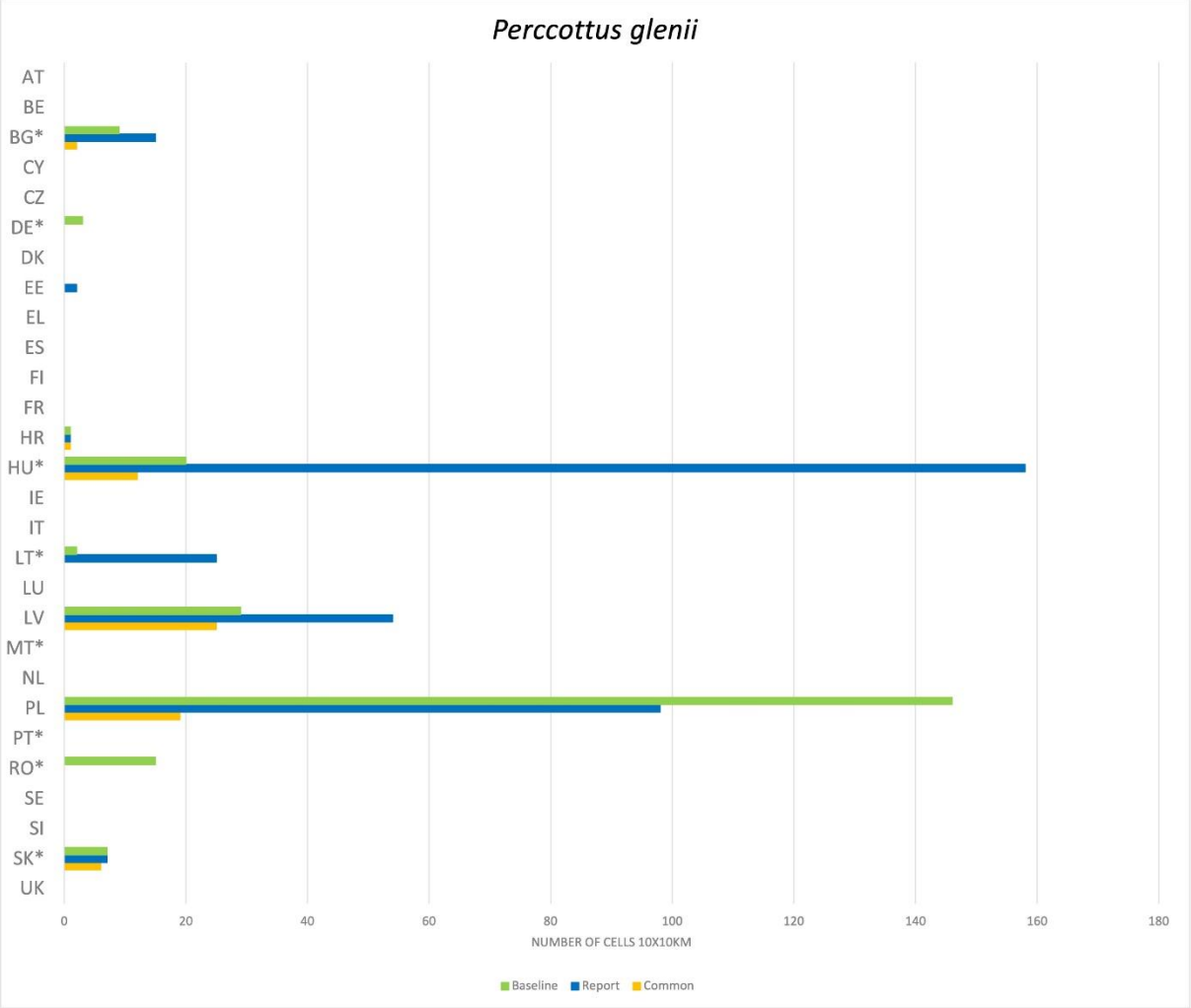


Figure 107. Distribution of *Procambarus clarkii* in the EU (grid-level 10x10 km): JRC baselines, including MS validated and non-validated records.

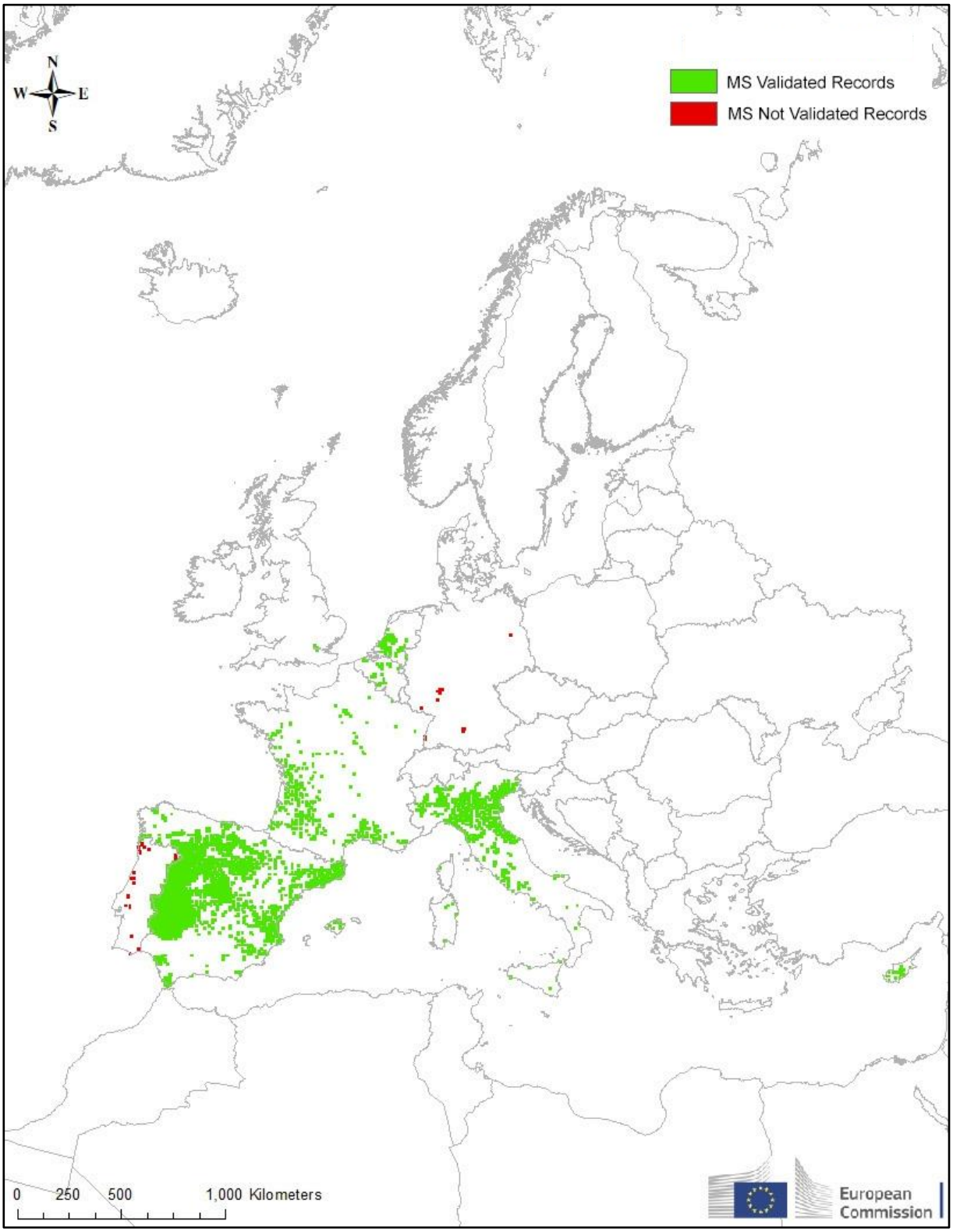


Figure 108. Distribution of *Procambarus clarkii* in the EU (grid-level 10x10 km): MS reports.

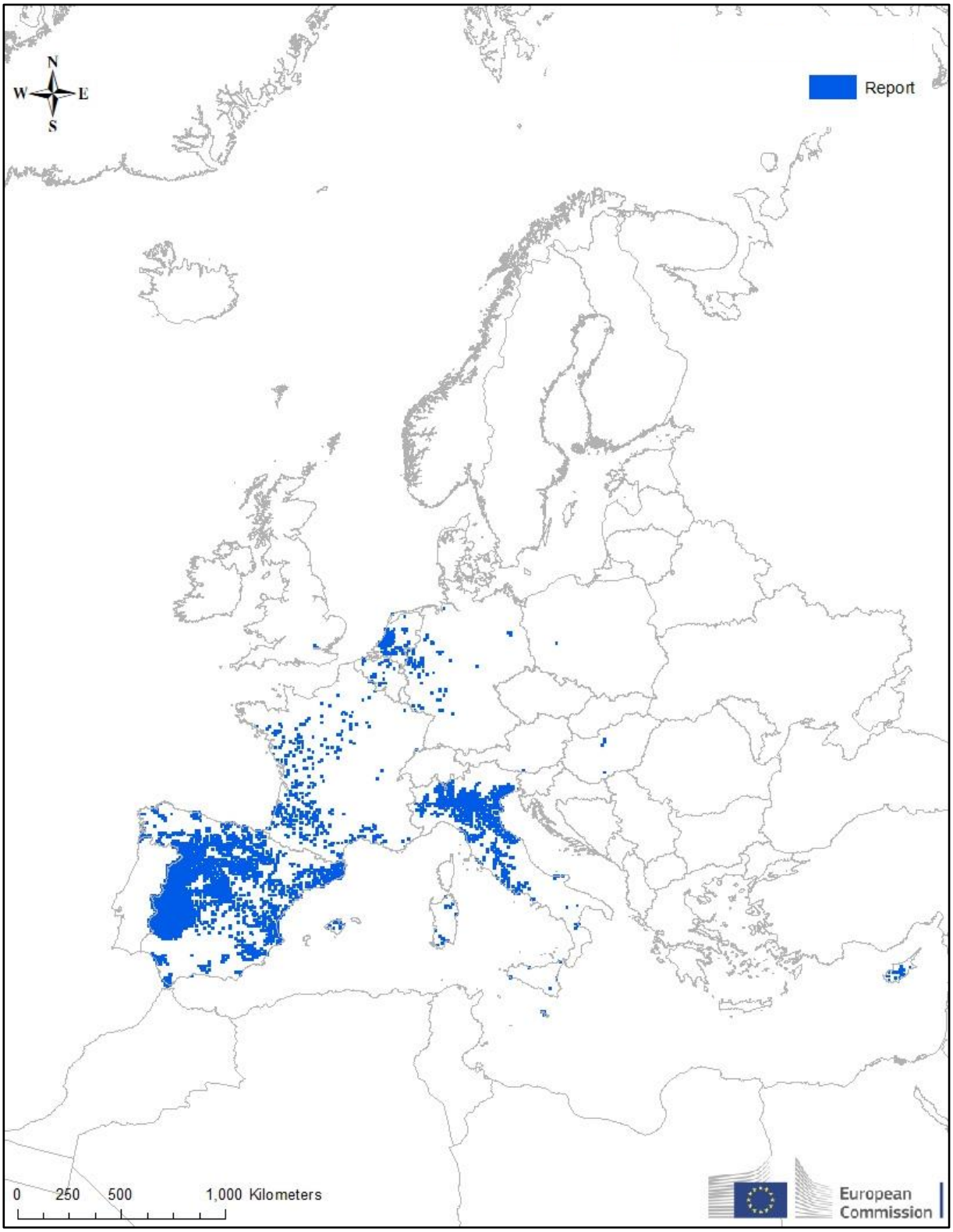


Figure 109. Spread of *Procambarus clarkii* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

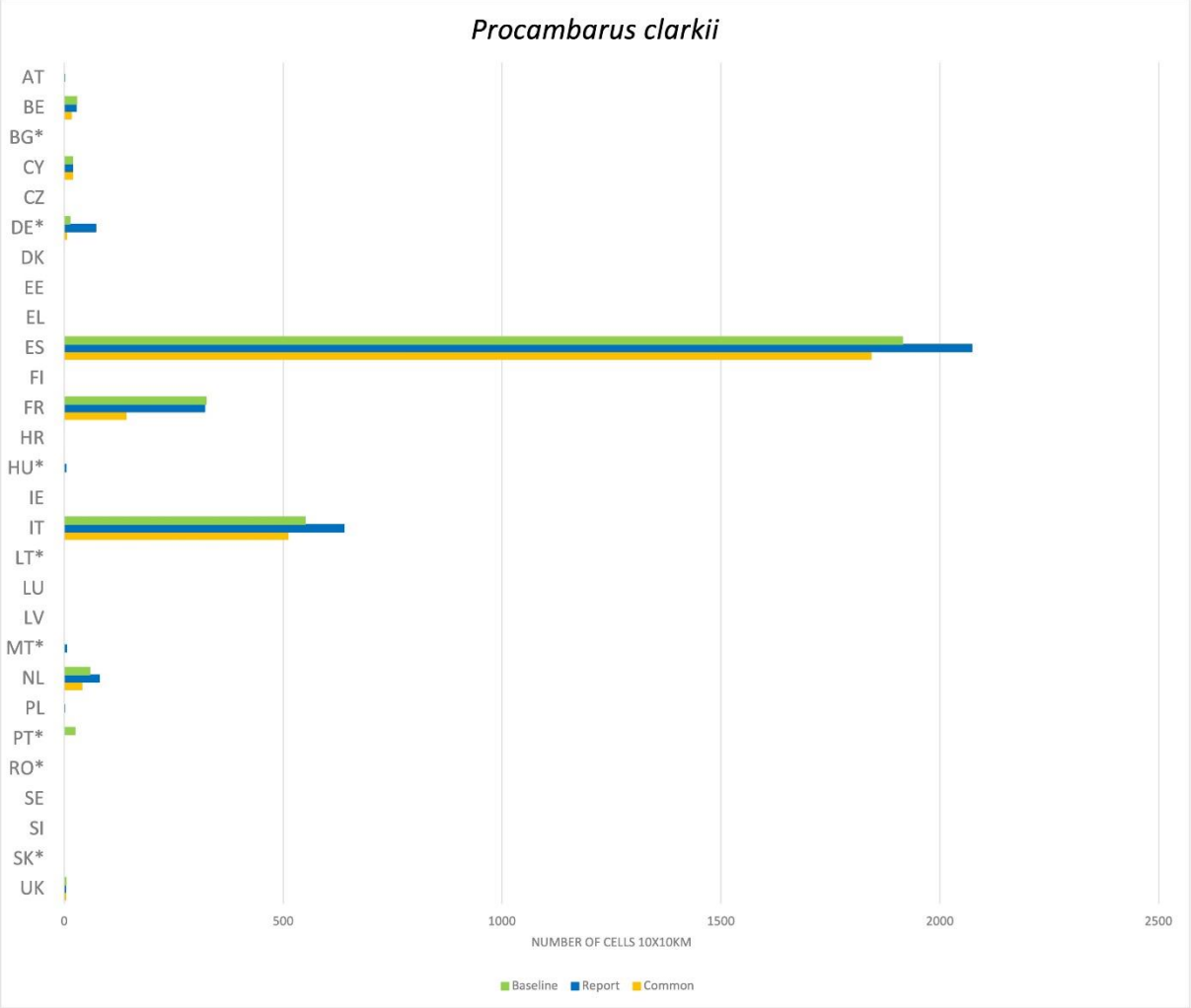


Figure 110. Distribution of *Procambarus fallax f. virginalis* in the EU (grid-level 10x10 km): JRC baselines including MS validated and non-validated records.

Figure 111. Distribution of *Procambarus fallax f. virginalis* in the EU (grid-level 10x10 km): MS reports.

Figure 112. Spread of *Procambarus fallax f. virginalis* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

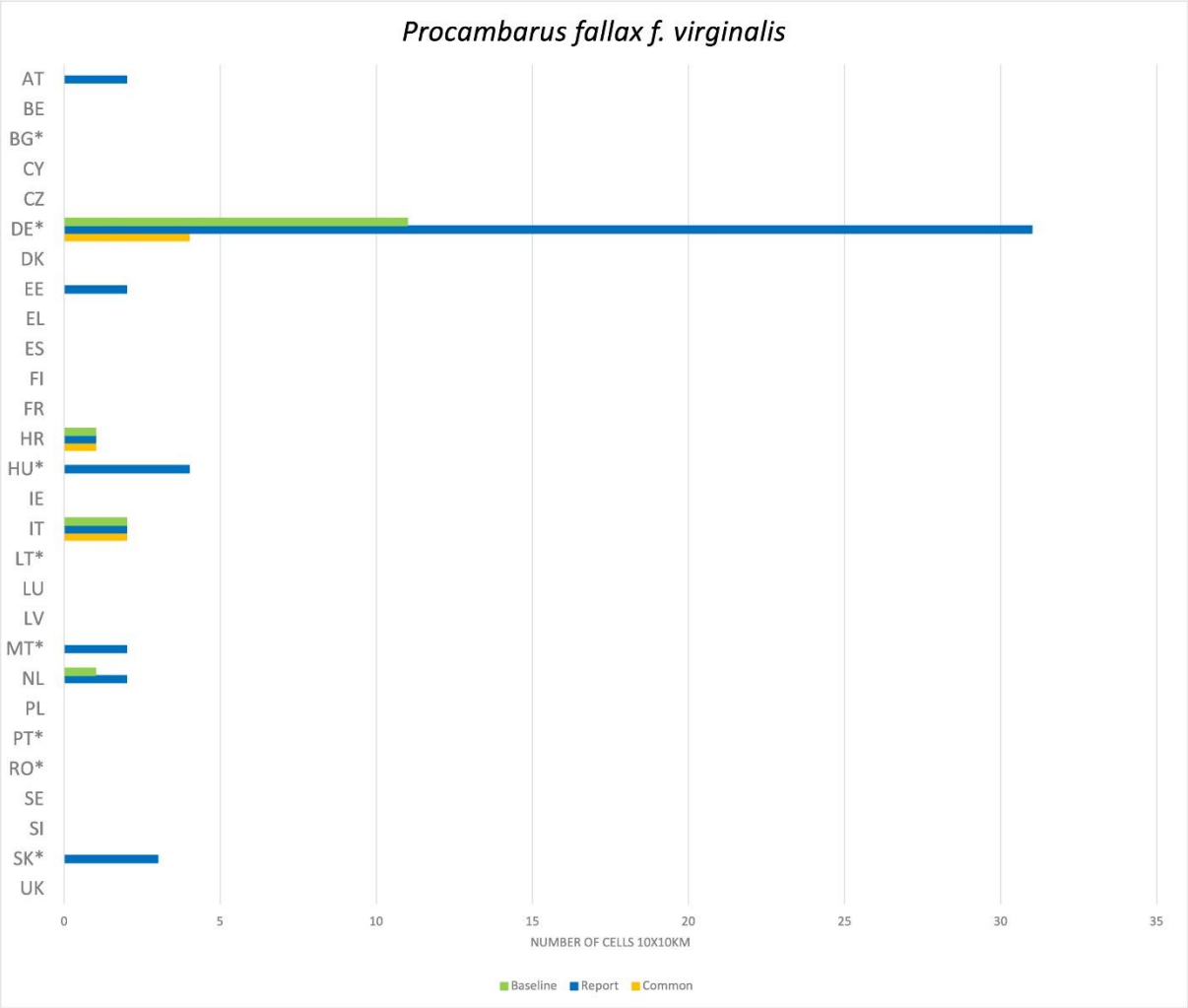


Figure 113. Distribution of *Procyon lotor* in the EU (grid-level 10x10 km): JRC baselines including MS validated and non-validated records.

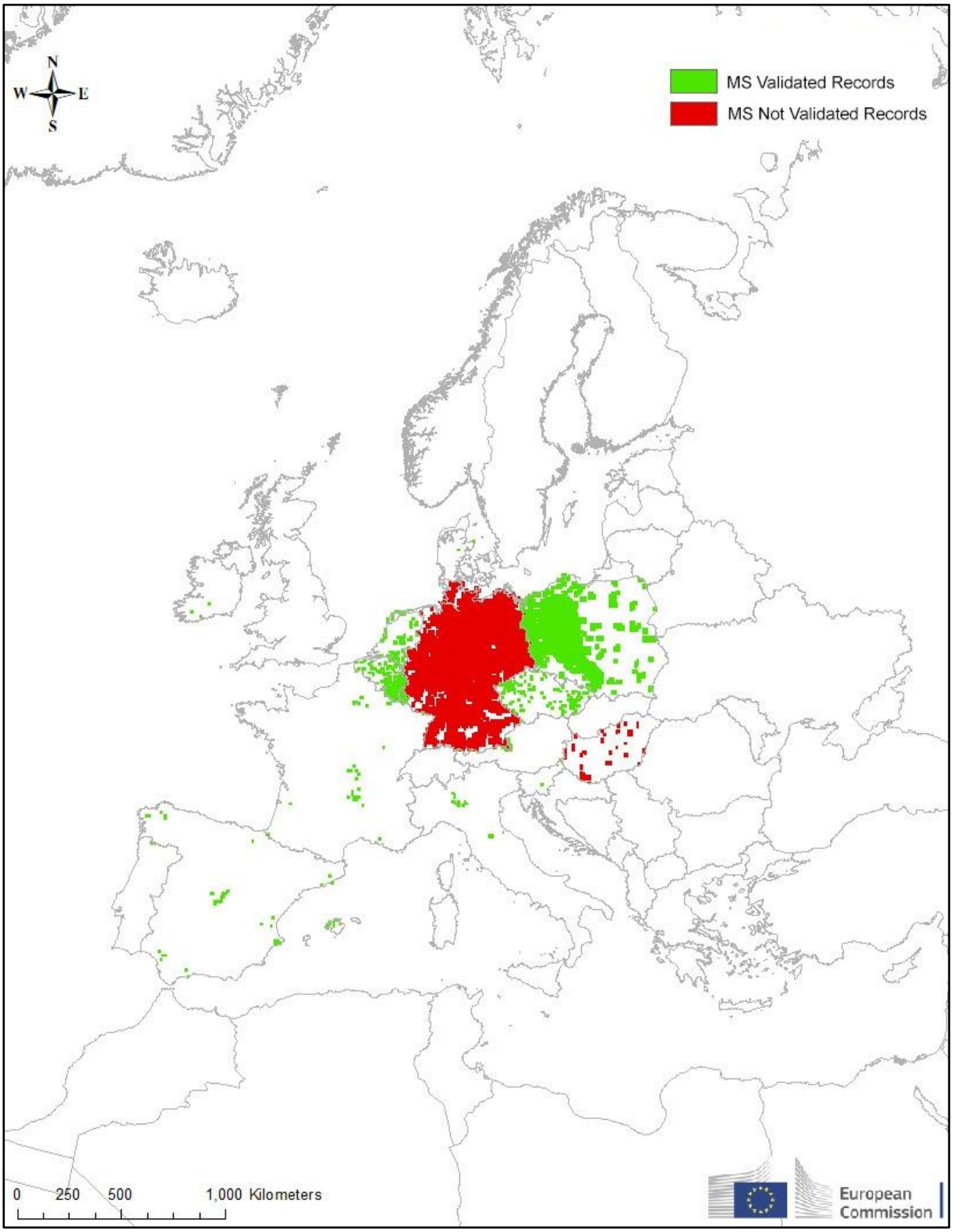


Figure 114. Distribution of *Procyon lotor* in the EU (grid-level 10x10 km): MS reports.

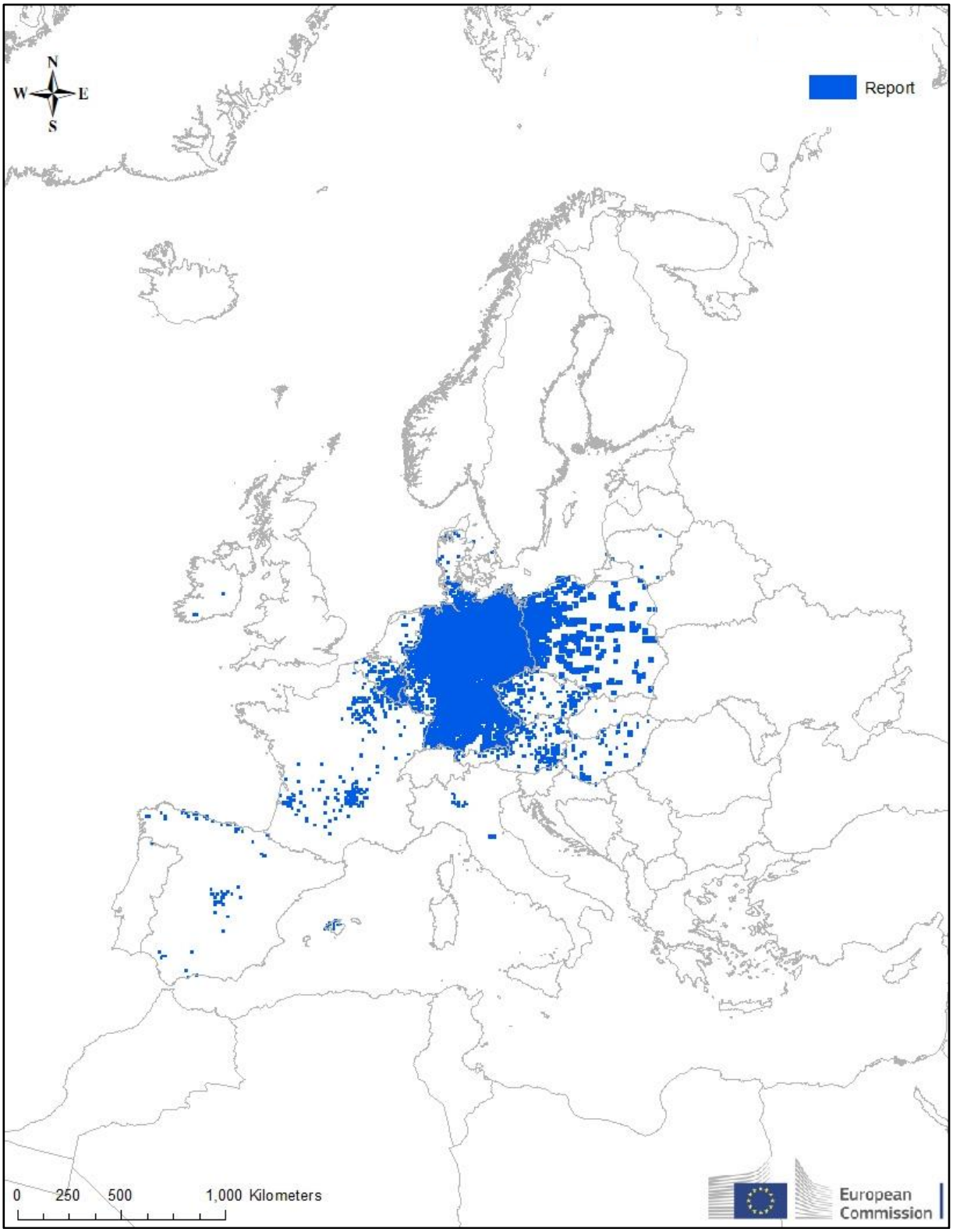


Figure 115. Spread of *Procyon lotor* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

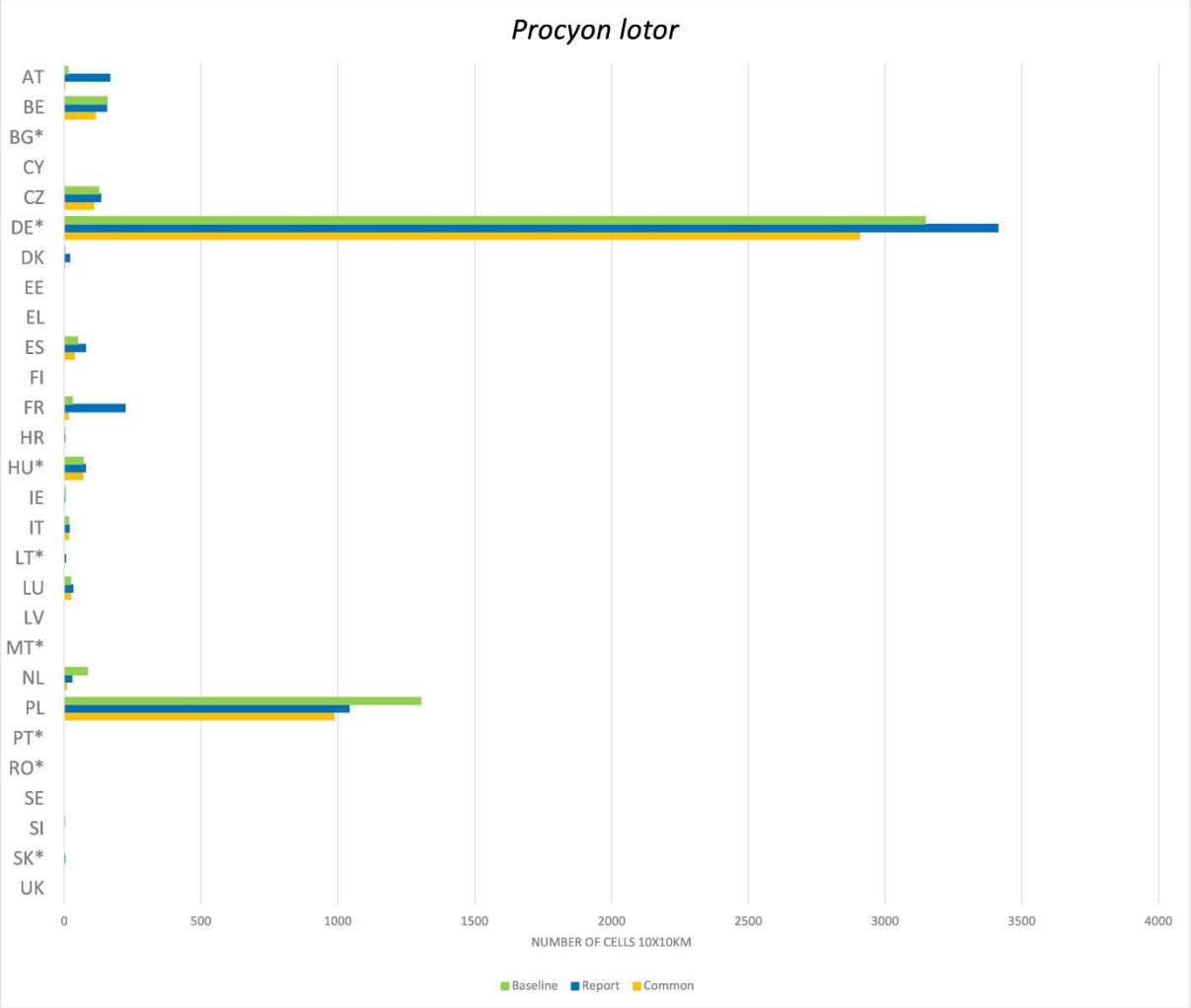


Figure 116. Distribution of *Pseudorasbora parva* in the EU (grid-level 10x10 km): JRC baselines including MS validated and non-validated records.

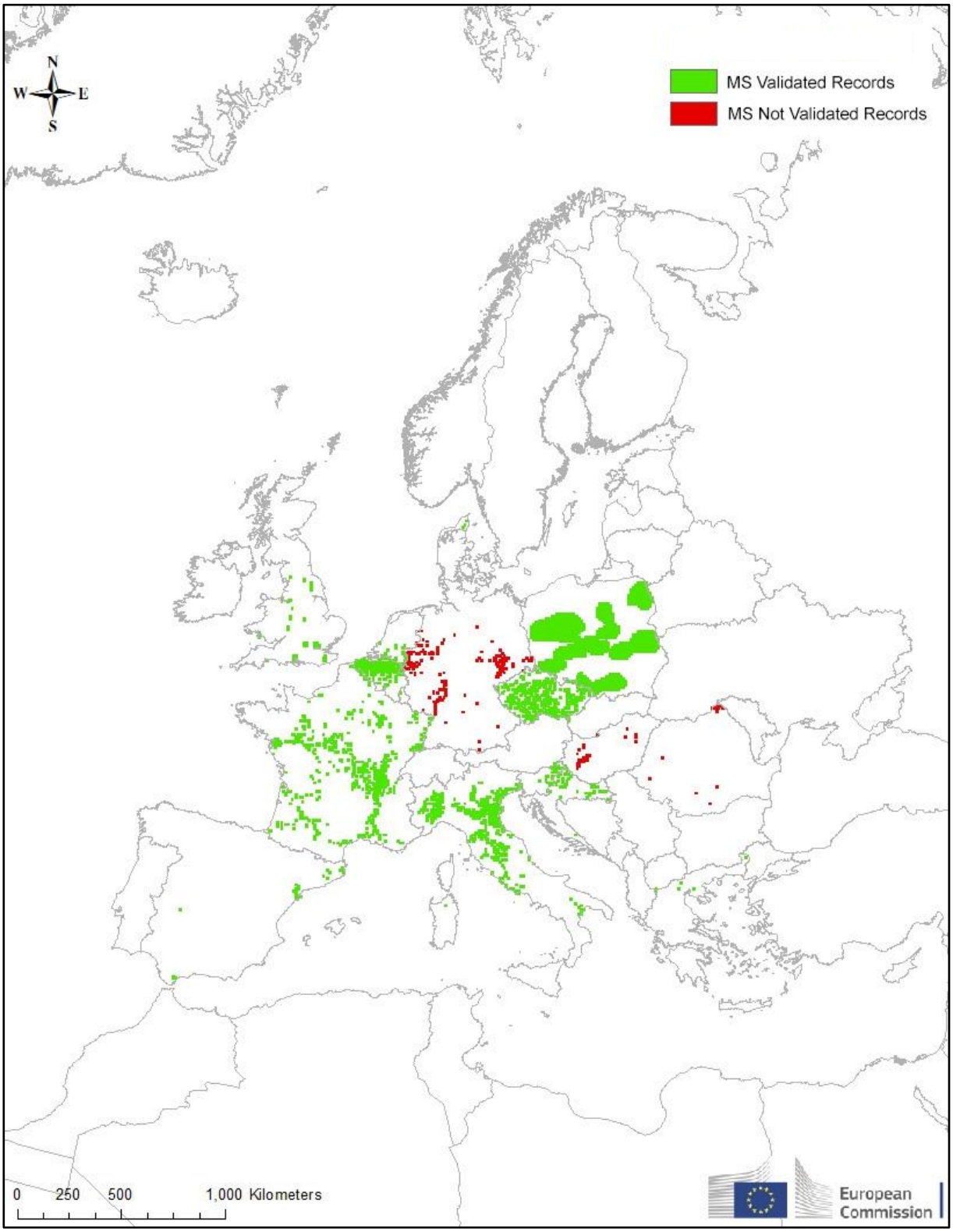


Figure 117. Distribution of *Pseudorasbora parva* in the EU (grid-level 10x10 km): MS reports.

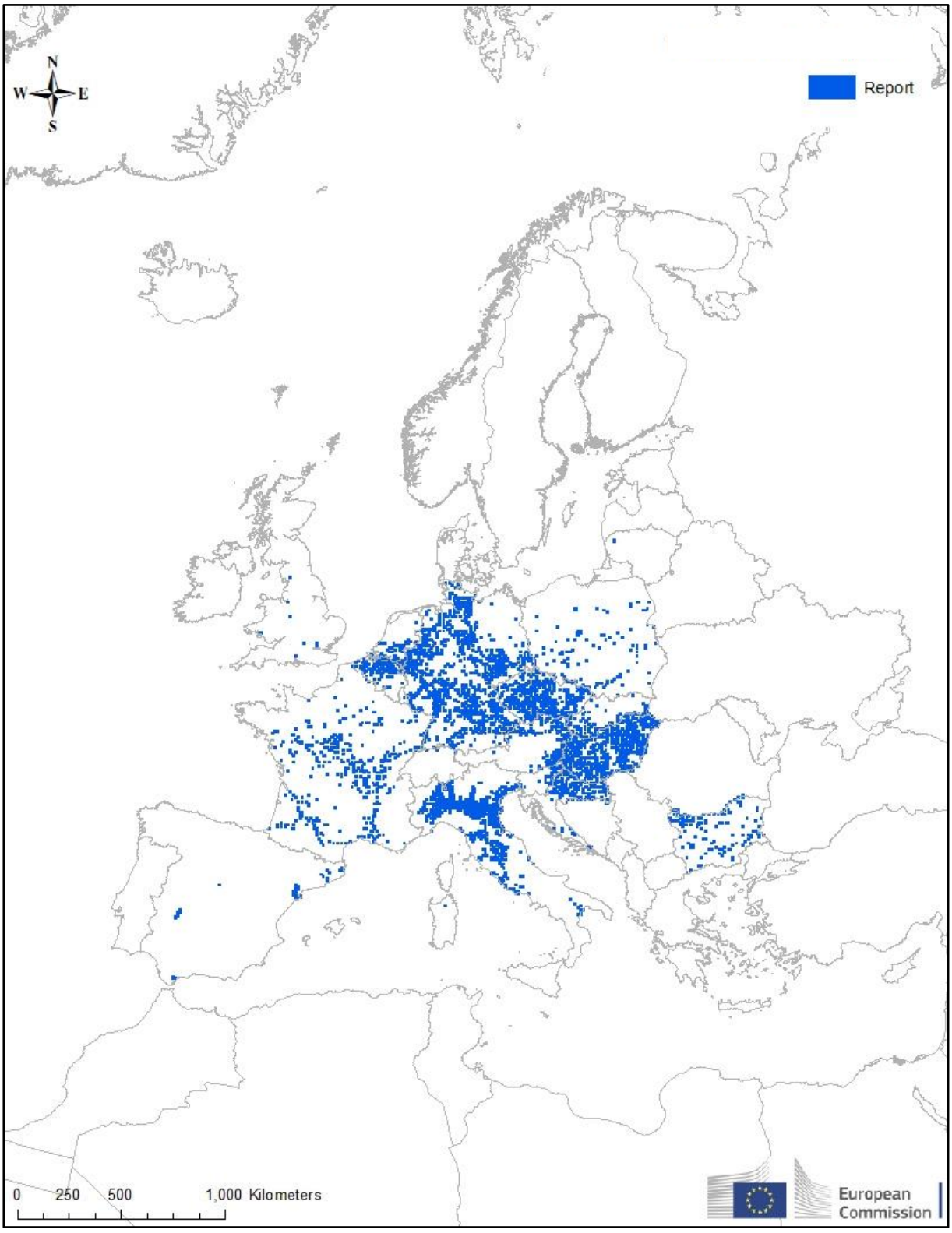


Figure 118. Spread of *Pseudorasbora parva* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

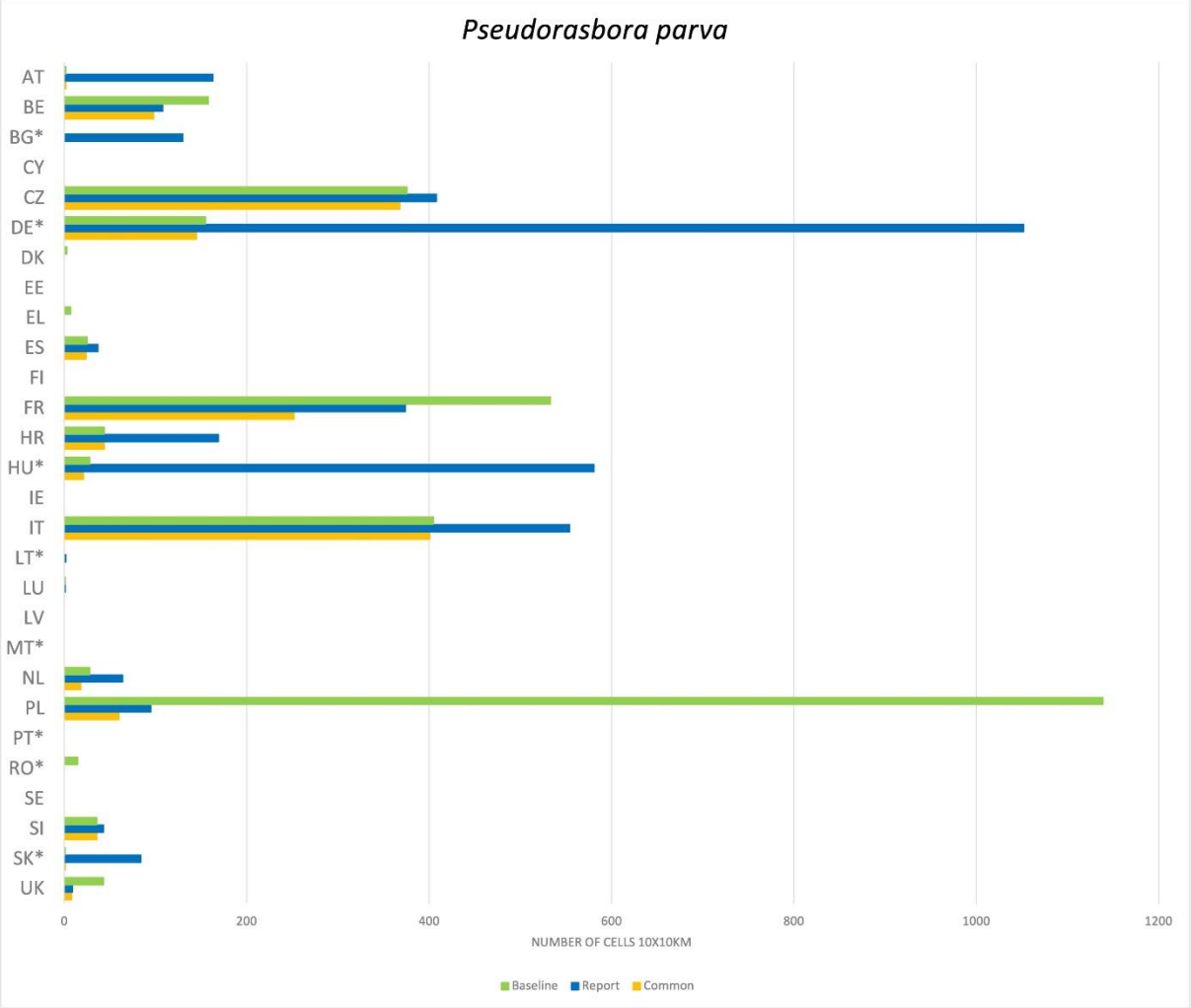


Figure 119. Distribution of *Pueraria montana var. lobata* in the EU (grid-level 10x10 km): JRC baselines including MS validated and non-validated records.

Figure 120. Distribution of *Pueraria montana var. lobata* in the EU (grid-level 10x10 km): MS reports.

Figure 121. Spread of *Pueraria montana var. lobata* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

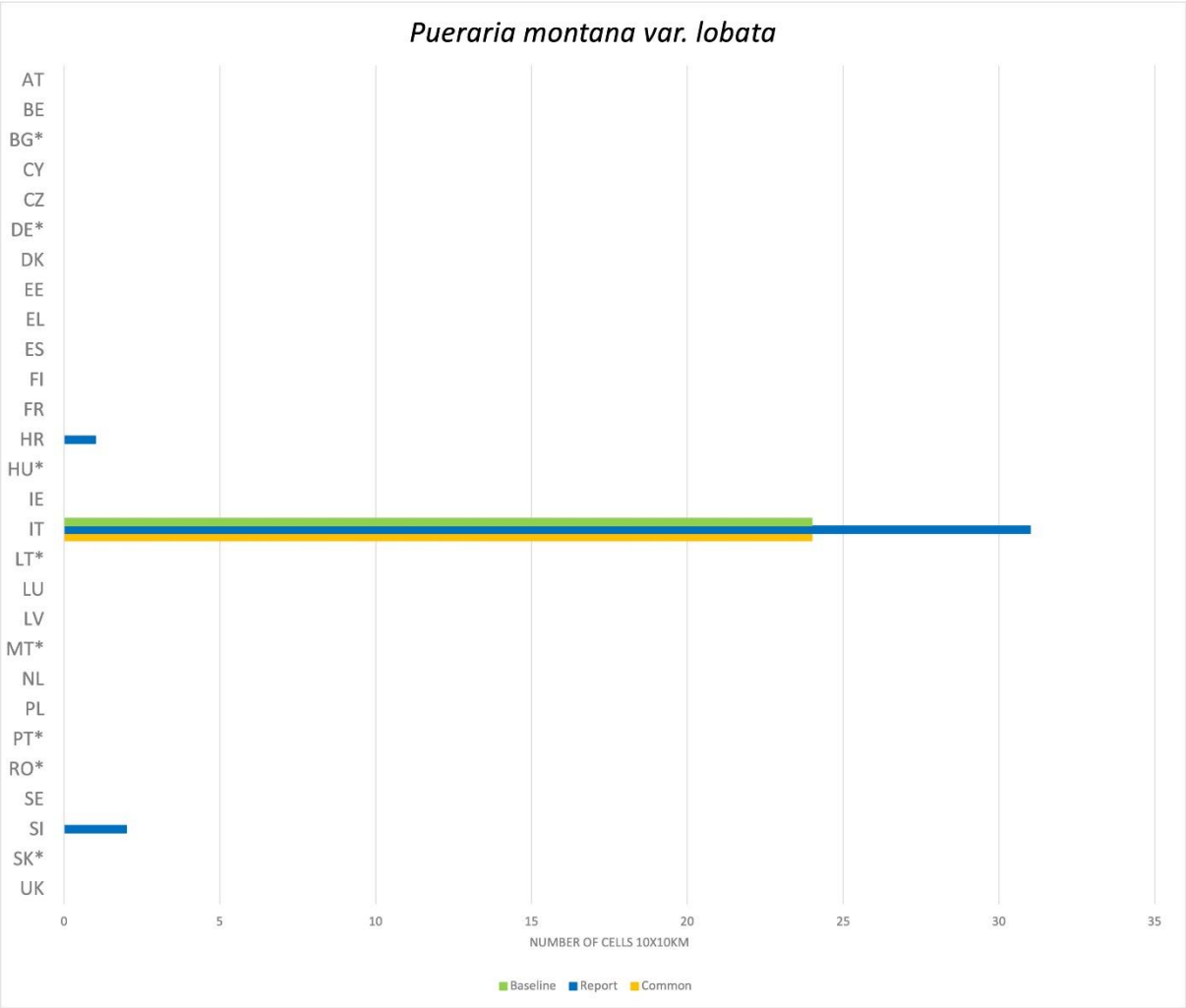


Figure 122. Distribution of *Sciurus carolinensis* in the EU (grid-level 10x10 km): JRC baselines including MS validated and non-validated records.

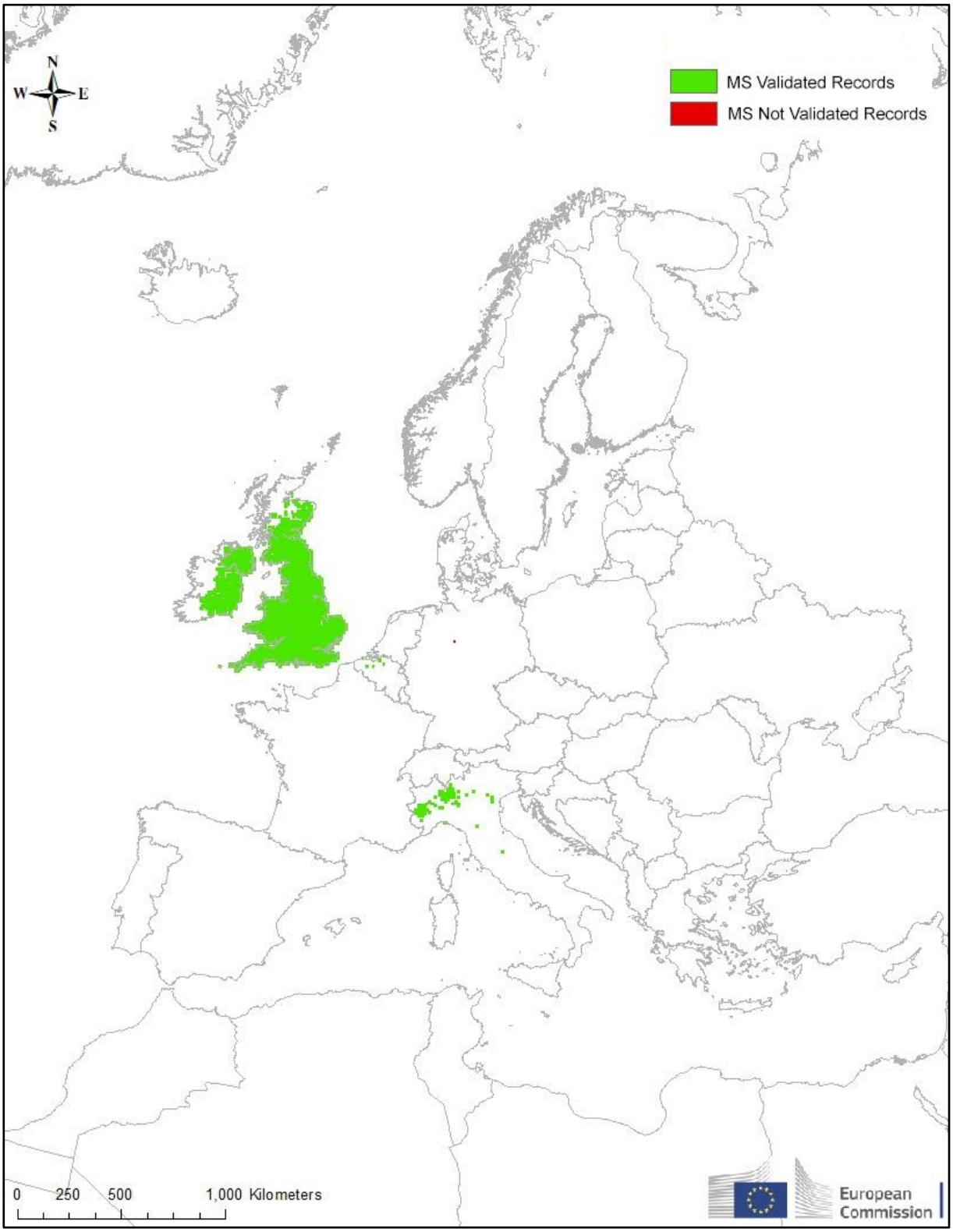


Figure 123. Distribution of *Sciurus carolinensis* in the EU (grid-level 10x10 km): MS reports.

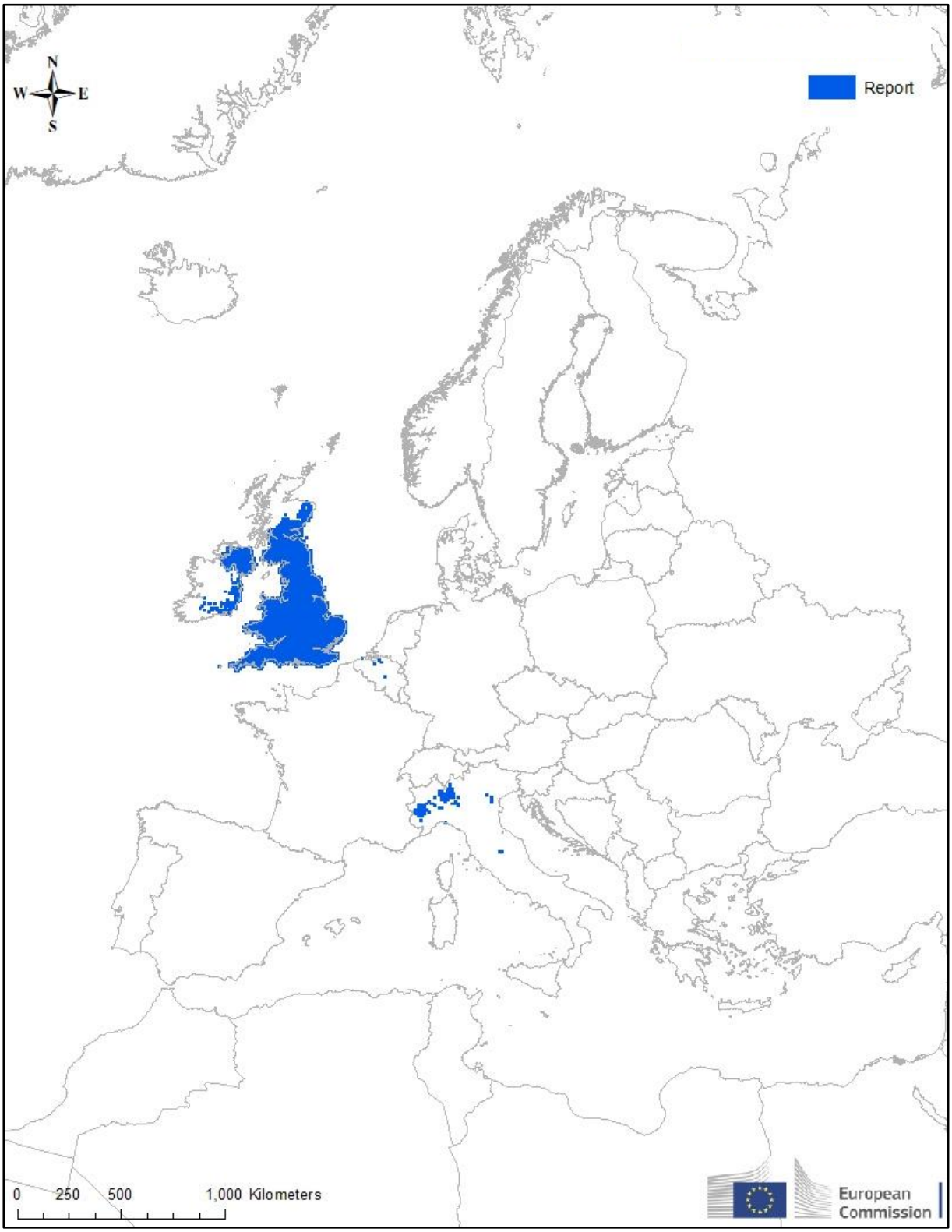


Figure 124. Spread of *Sciurus carolinensis* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

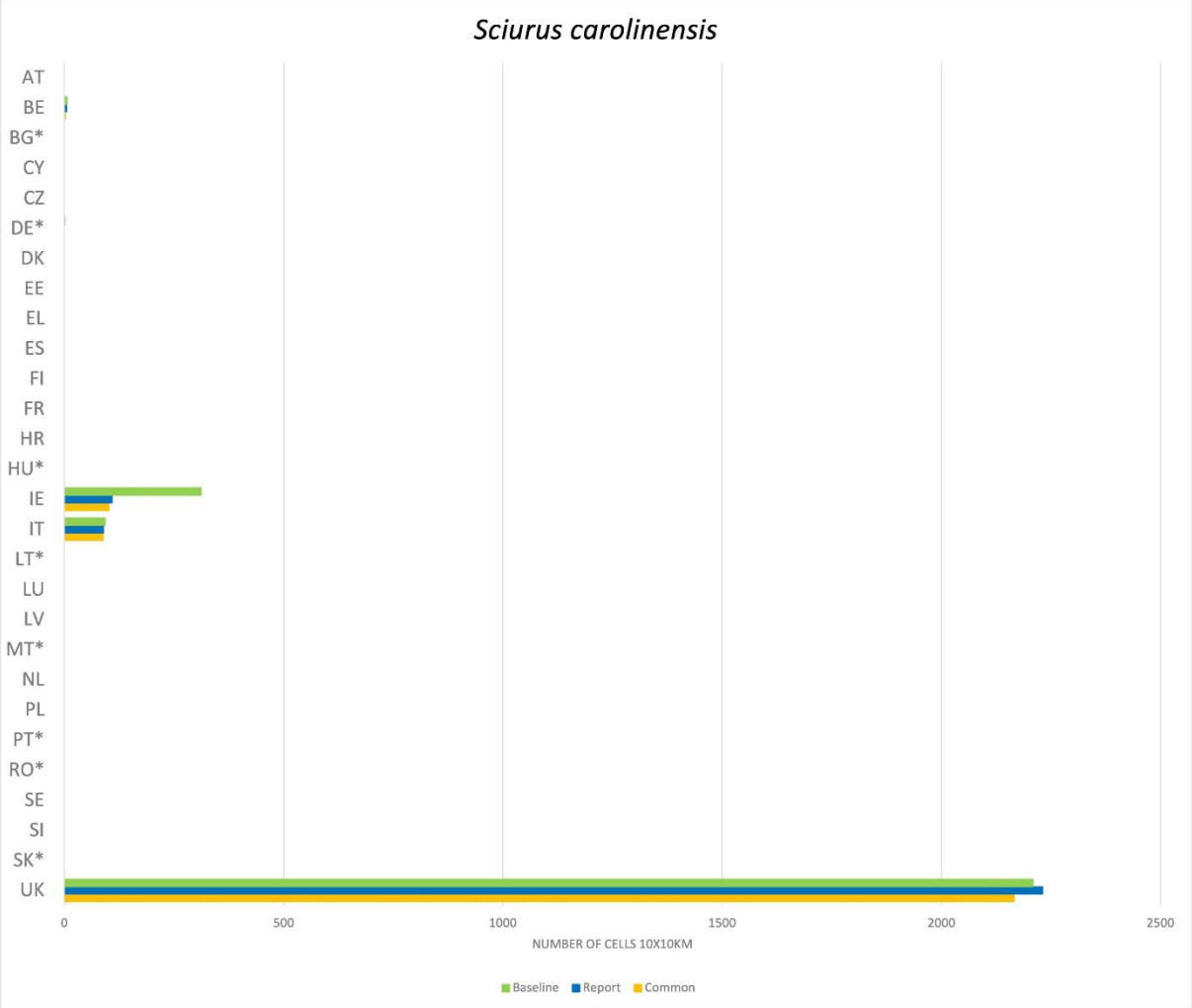


Figure 125. Distribution of *Tamias sibiricus* in the EU (grid-level 10x10 km): JRC baselines including MS validated and non-validated records.

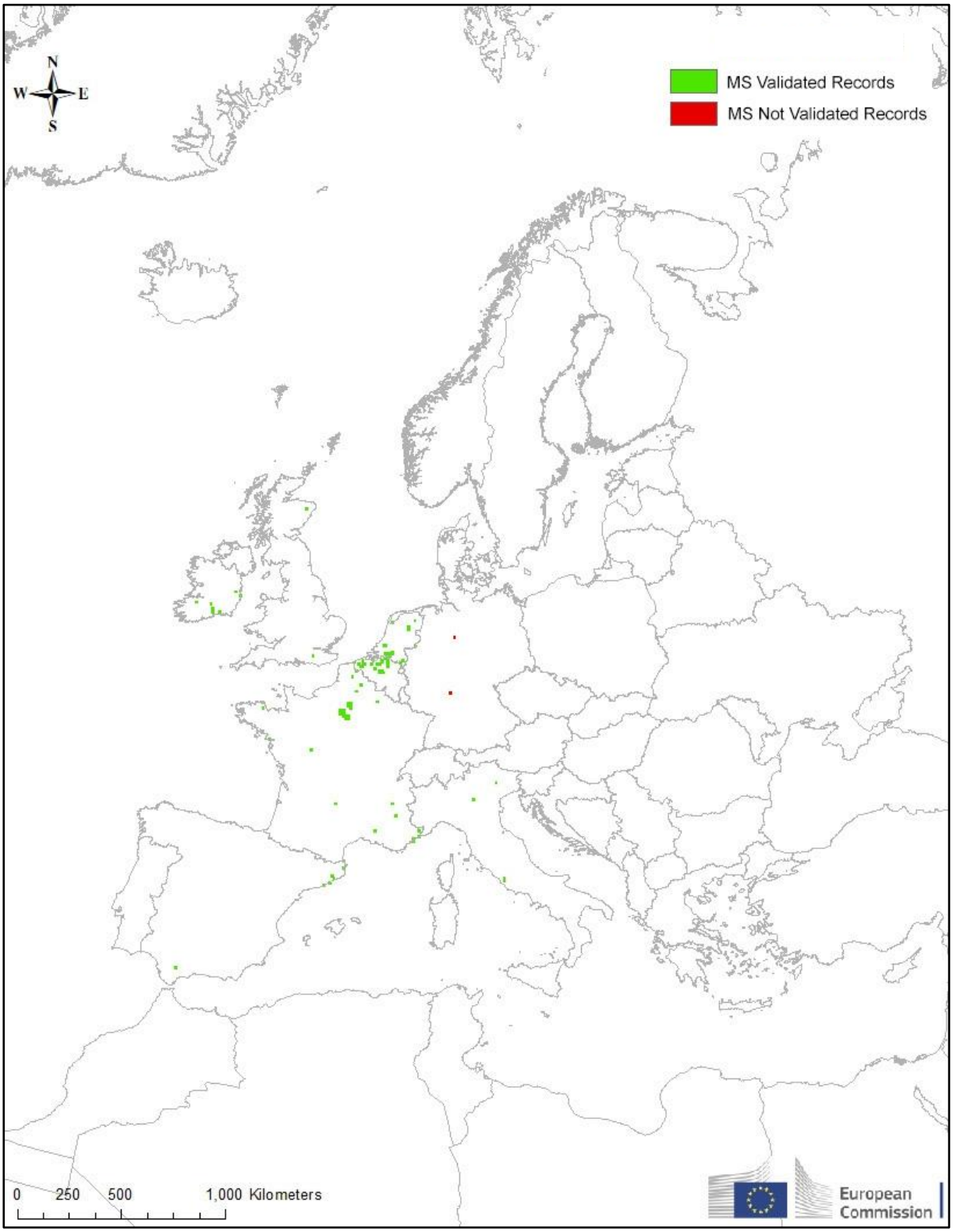


Figure 126. Distribution of *Tamias sibiricus* in the EU (grid-level 10x10 km): MS reports.

Figure 127. Spread of *Tamias sibiricus* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

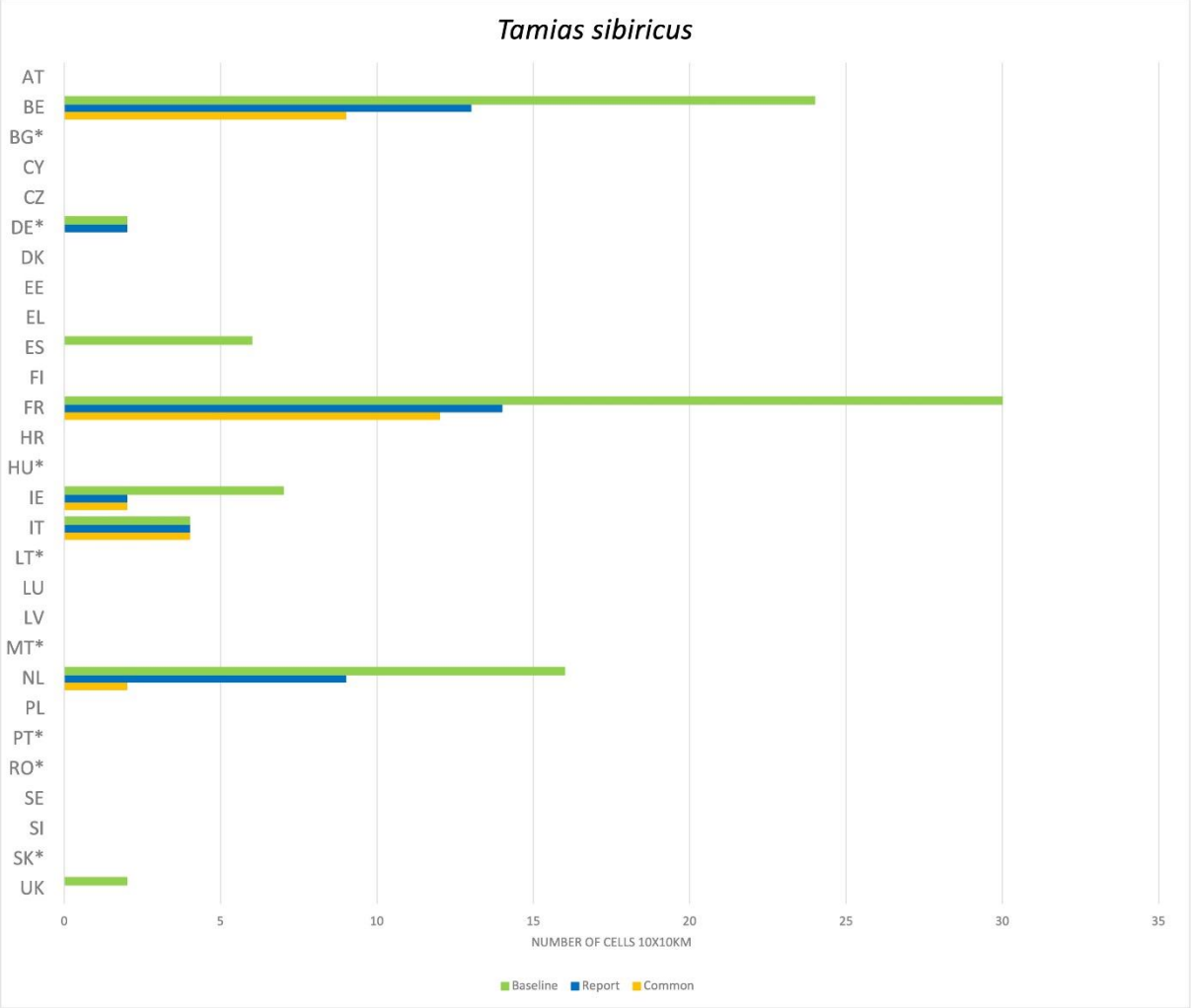


Figure 128. Distribution of *Threskiornis aethiopicus* in the EU (grid-level 10x10 km): JRC baselines including MS validated and non-validated records.

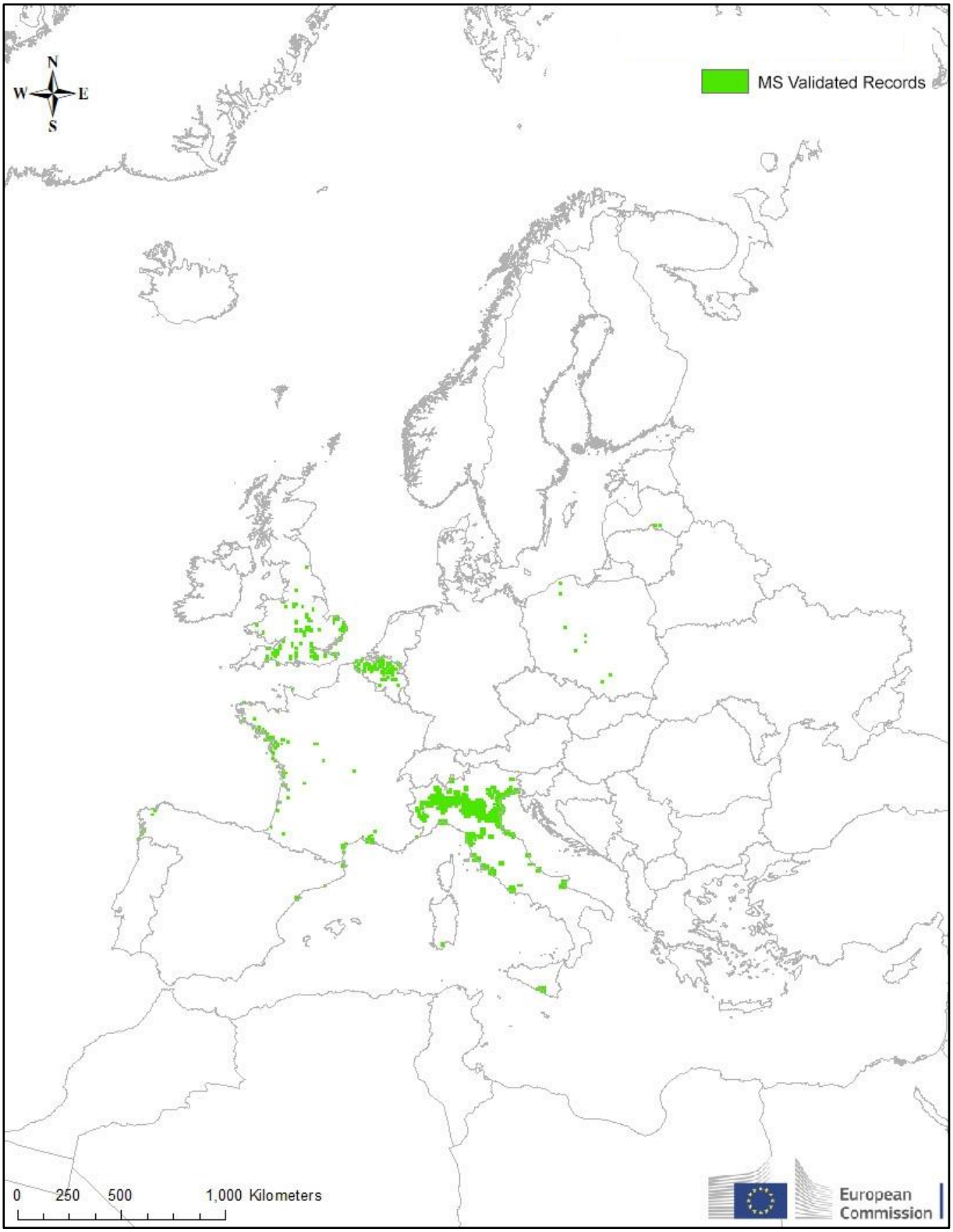


Figure 129. Distribution of *Threskiornis aethiopicus* in the EU (grid-level 10x10 km): MS reports.

Figure 130. Spread of *Threskiornis aethiopicus* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

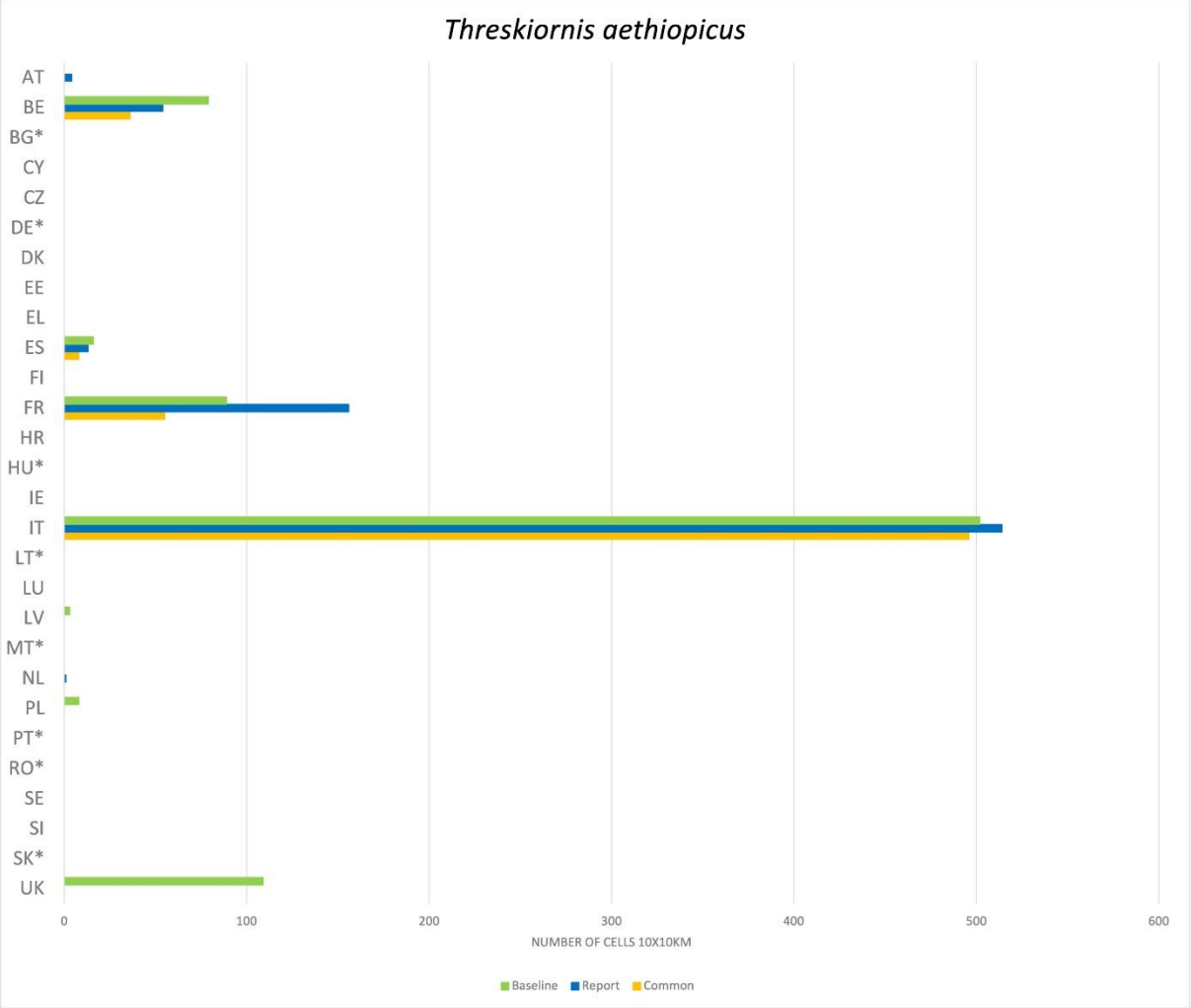


Figure 131. Distribution of *Trachemys scripta* in the EU (grid-level 10x10 km): JRC baselines including MS validated and non-validated records.

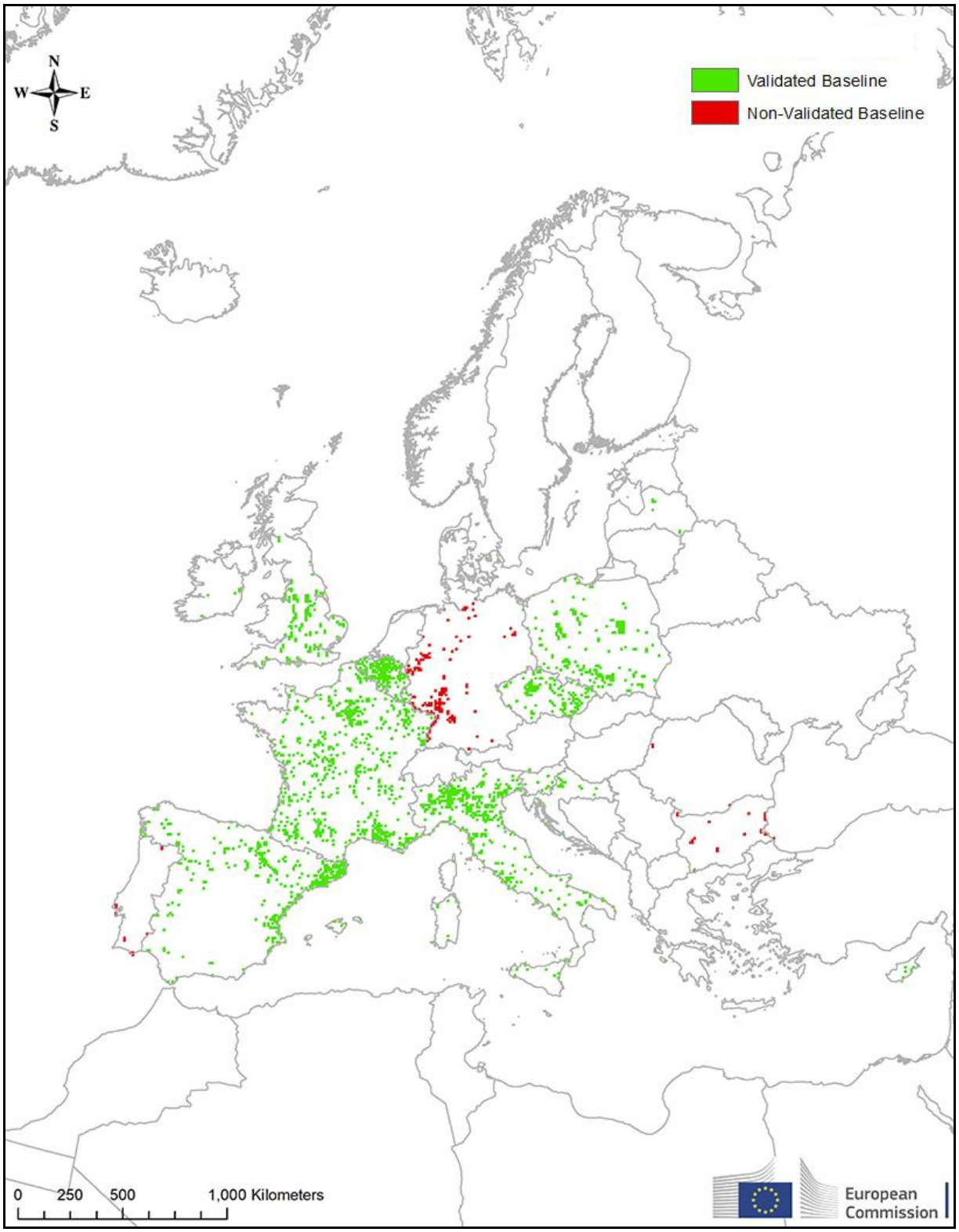


Figure 132. Distribution of *Trachemys scripta* in the EU (grid-level 10x10 km): MS reports.

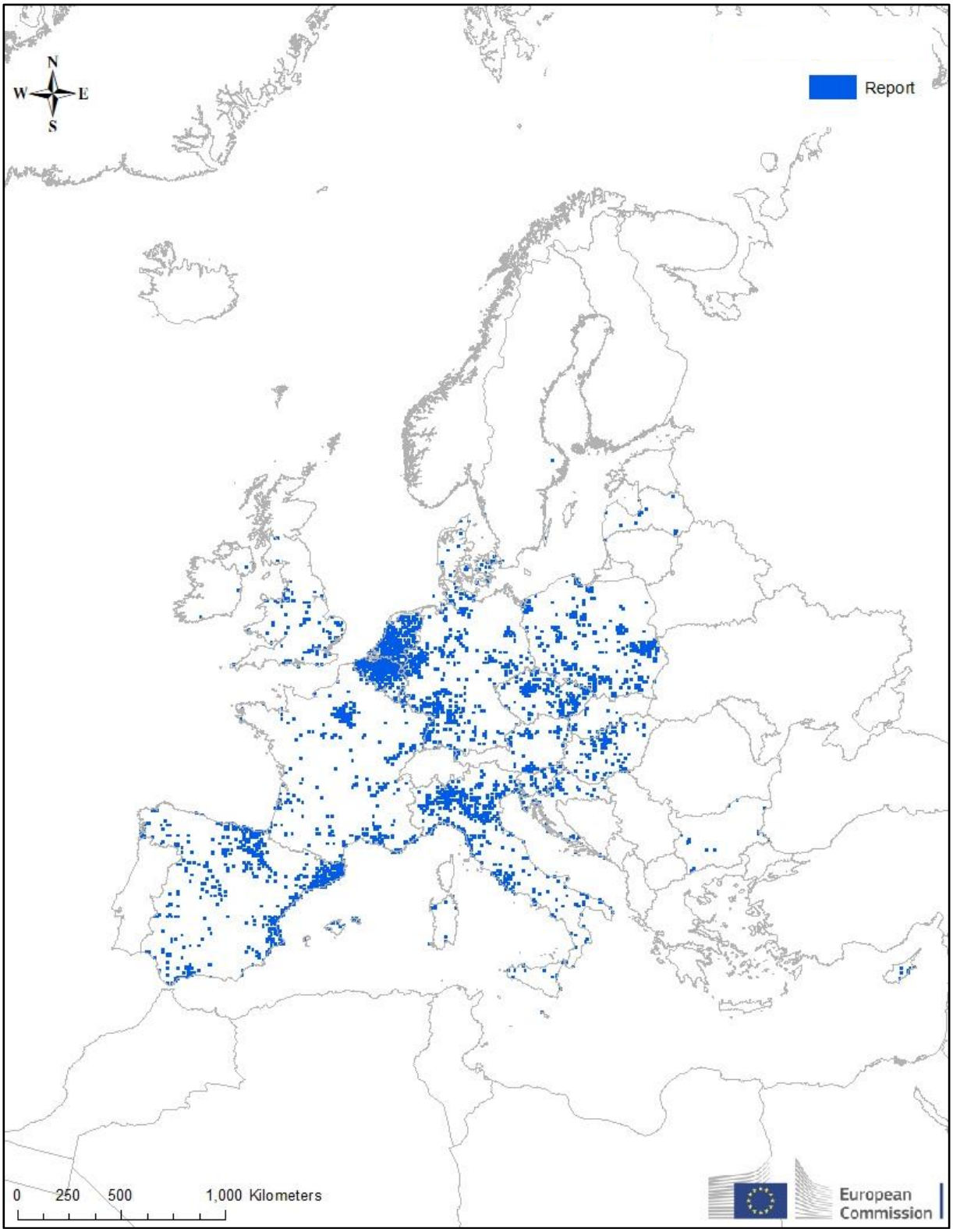


Figure 133. Spread of *Trachemys scripta* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.

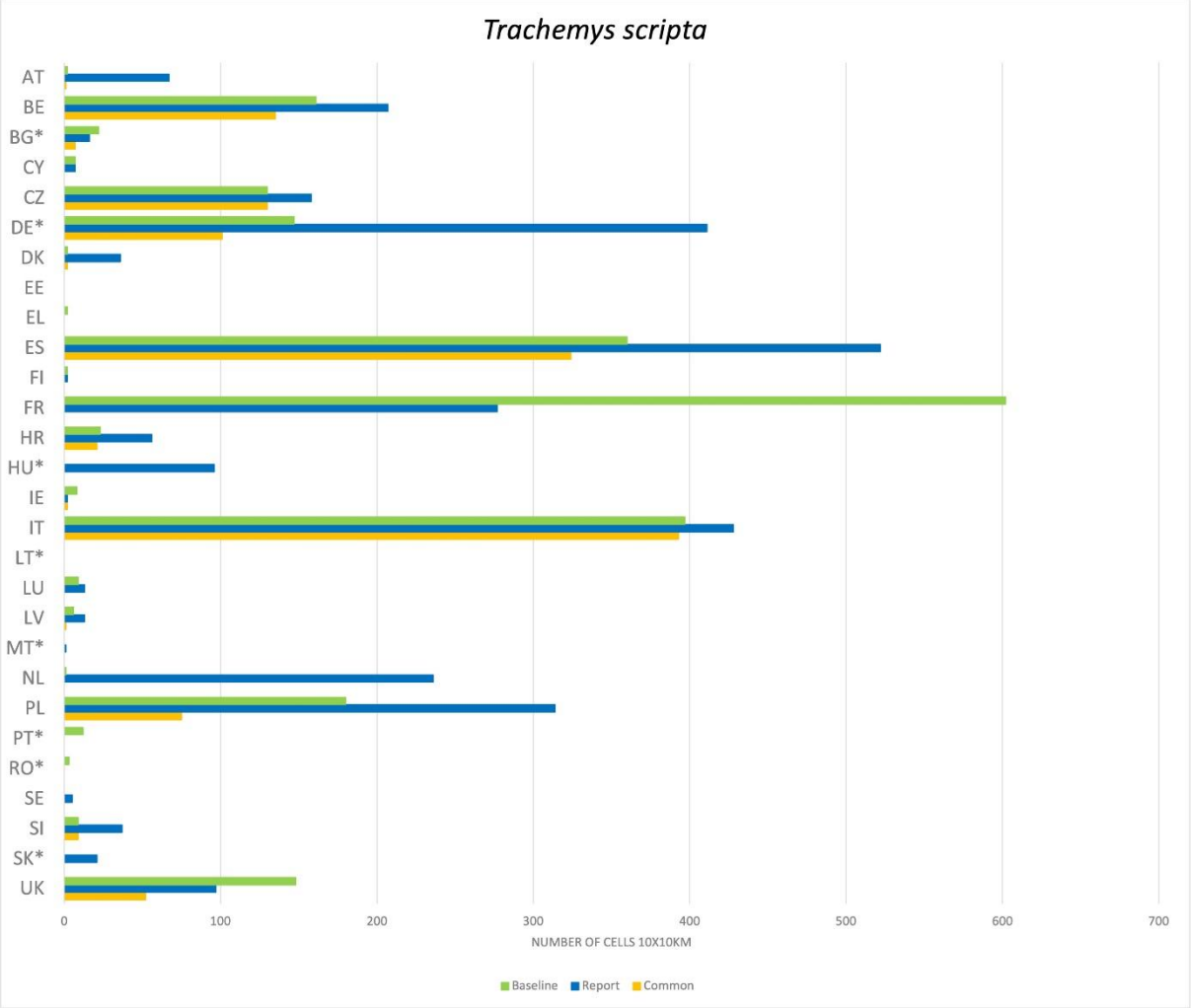


Figure 134. Distribution of *Vespa velutina nigrithorax* in the EU (grid-level 10x10 km): JRC baselines including MS validated and non-validated records.

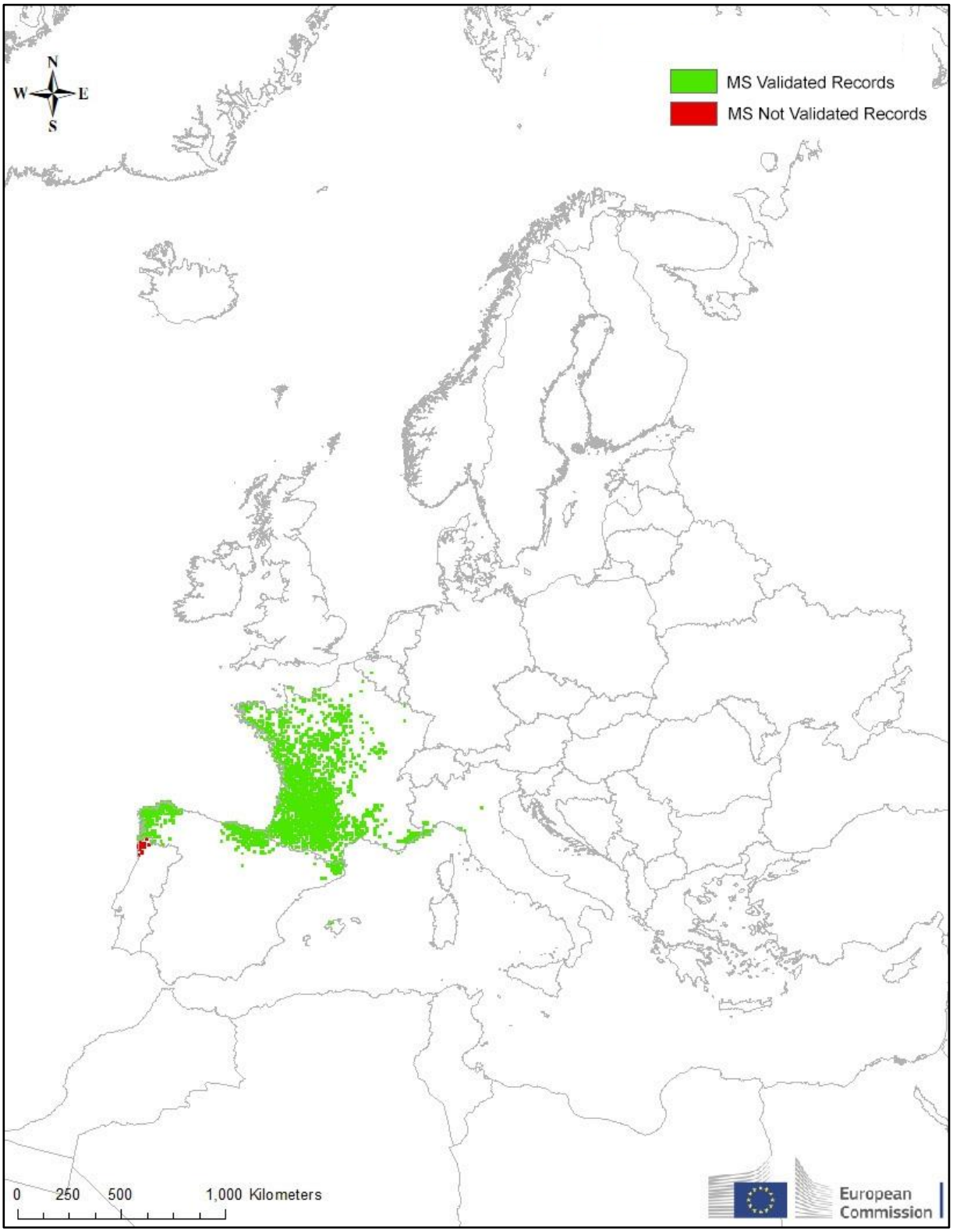


Figure 135. Distribution of *Vespa velutina nigrithorax* in the EU (grid-level 10x10 km): MS reports.

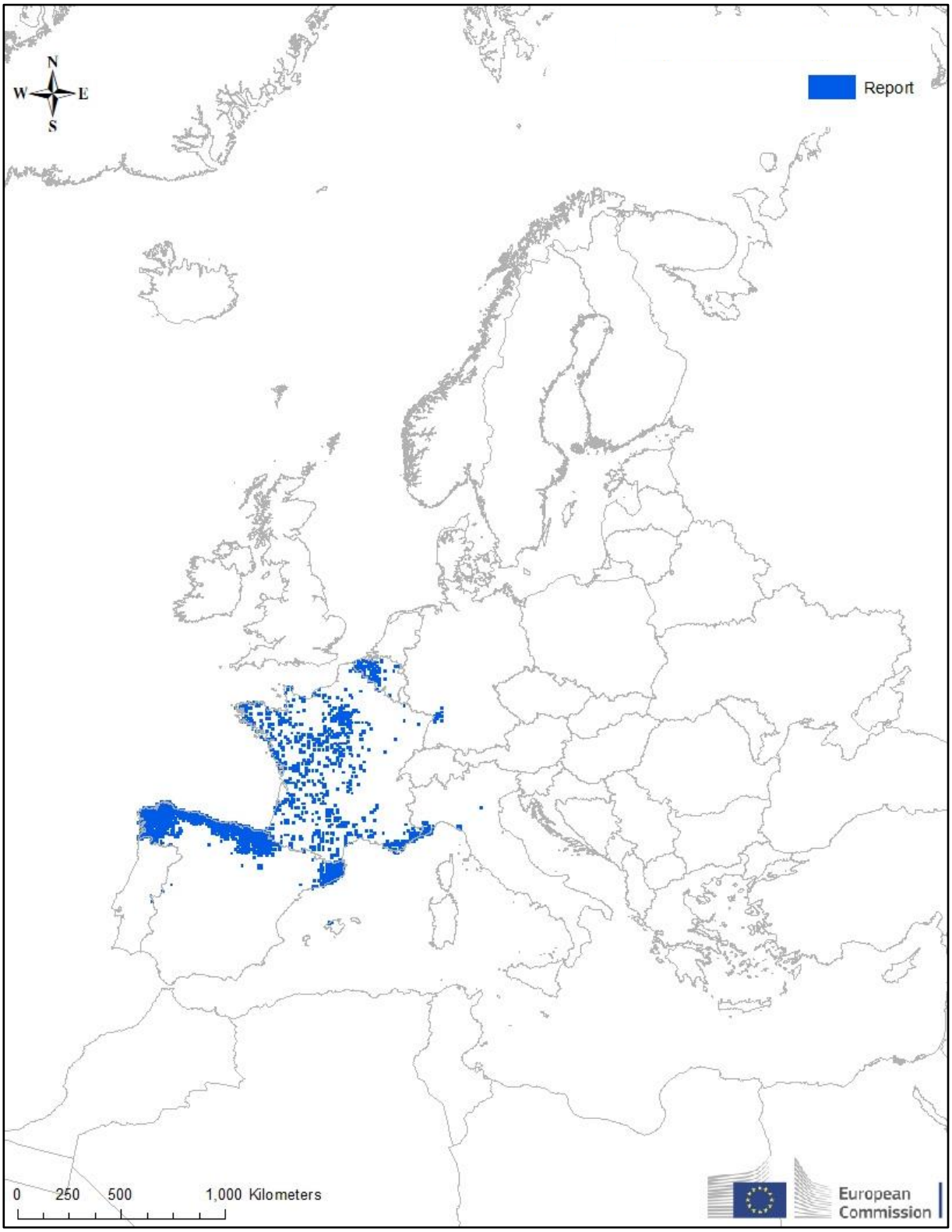
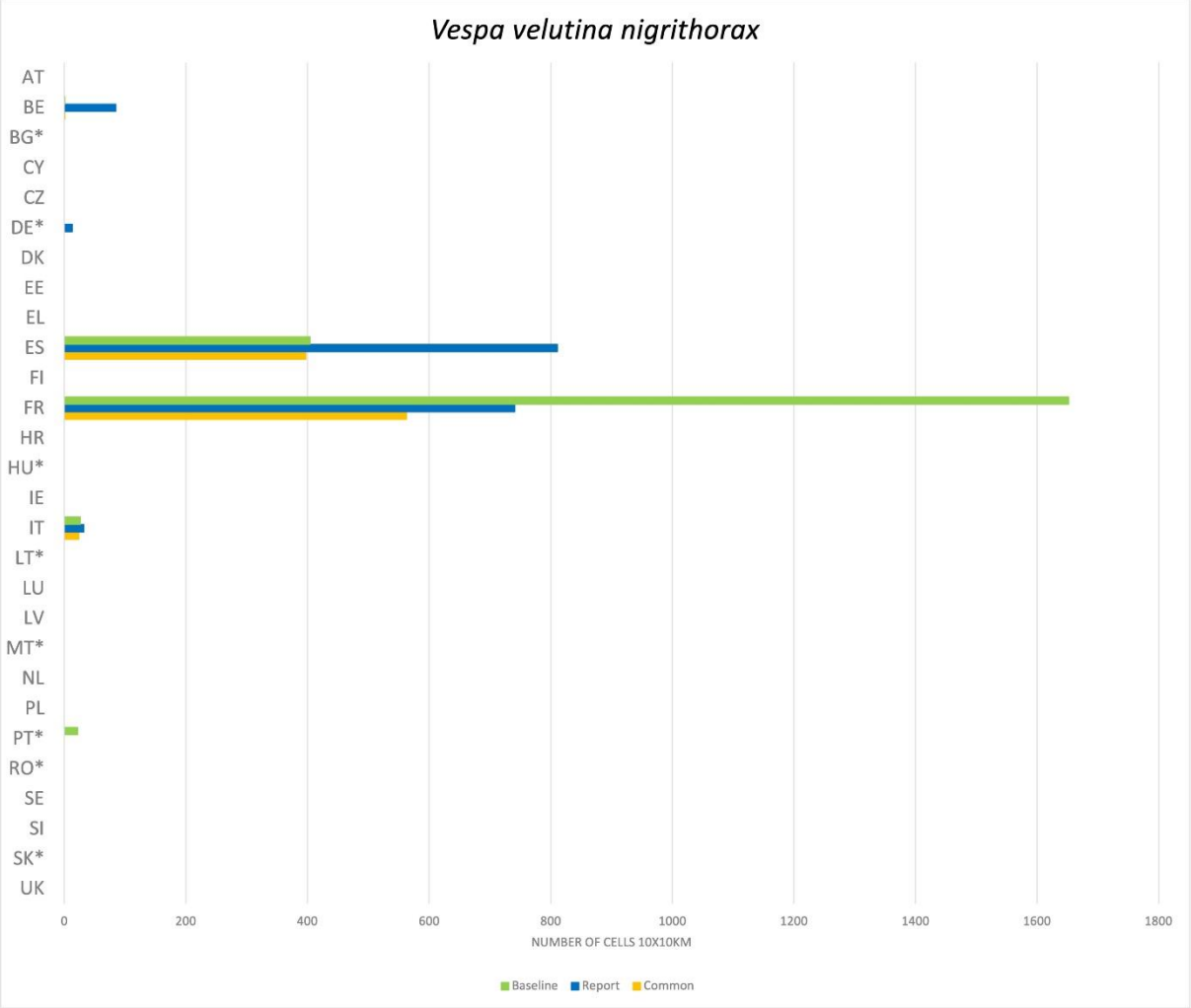


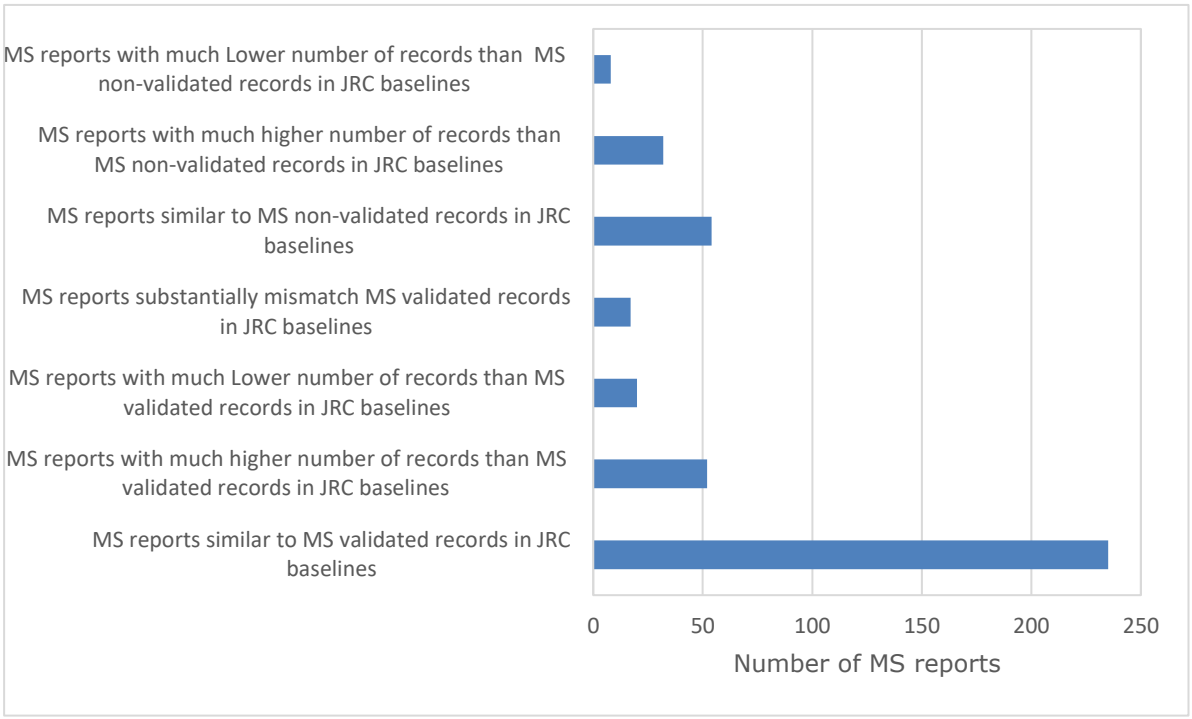
Figure 136. Spread of *Vespa velutina nigrithorax* in the EU (grid-level 10x10 km): JRC baselines, MS reports, and common cells. * indicates countries that did not validate the baseline data.



3.4 Comparison of spatial distributions of IAS of Union concern

For most cases, the species spatial distributions in the JRC baselines matched substantially the species distributions provided in the MS reports, especially in case of MS validated records in the JRC baselines (synthesis in Figure 137). However, in several cases MS reports added spatial information when compared to the relevant data validated by MS in the JRC baselines (e.g., for 11 species reported from NL) or the non-validated records in the JRC baselines (e.g., for 11 species reported from DE). On the other hand, fewer were the cases where MS reports included less spatial information in comparison with the MS validated data in the JRC baselines (e.g., for 8 species reported from FR) or the non-validated records in the JRC baselines (e.g., for 3 species reported by DE). Finally, in a limited number of cases the MS reports differed from the MS validated data in the JRC baselines (in both extent and locations within the country), most of them corresponding to species reported by FR. Details can be found in Annex 2.

Figure 137. Comparison of spatial distribution of IAS of Union concern between the MS reports and JRC baselines (detailed information in Annex 2).



4 Discussion

Most of the IAS of Union concern addressed in this assessment are present in the EU territory (43 IAS out of 48, based on MS reports), and several are widely distributed (32 IAS presented in more than 5 MS, based on MS reports) with higher concentrations of species in Western countries. Only five species were not present within the reporting period: *Corvus splendens*, *Microstegium vimineum, Parthenium hysterophorus, Persicaria perfoliata and Sciurus niger*. However, when considering the JRC baselines (MS validated records), *Corvus splendens* was also present, in the EU territories of EL, ES (casual), LV and PL, while *Parthenium hysterophorus* was present in BE (tagged as casual) and could have been eradicated prior to the reporting date.

For most MS reports, the spatial information showed considerable matching with the JRC baselines. This also applies to species distribution records not validated by MS in the JRC baselines, showing that the JRC baselines are fit-for-purpose e.g., represent a reference for MS in the establishment of surveillance systems for the targeted species, fostering cooperation and coordination across borders or within shared biogeographical regions, and providing a factual basis for the review of the application of the IAS Regulation (Tsiamis et al. 2017, 2019a, b).

However, there were several cases of mismatch (Figure 137). Since the JRC baselines covered a period mostly overlapping the MS reporting period (2015-2018), the observed differences could not be attributed to distributional trends of the species populations expanding or shrinking within EU countries.

Differences between the MS validated data in the JRC baselines and MS reports could be the result of improvements in data collection and/or improved availability of data (e.g., coming from recently established national surveillance systems) between the time the JRC baselines were prepared (2016, 2018) and the time of the MS reporting (2019). In addition, several MS reports may have included exclusively records of species found between 2015 and 2018, while the JRC baselines included also records found just before that period (although no historical records were included). Moreover, several populations with restricted distributions, included in the baselines, might have been eradicated in the last two years of the reporting period (applicable to IAS listed under Commission Implementing Regulation EU 2016/1141/EC). Species reported from FR (i.e., *Nasua nasua*) and NL (i.e., *Callosciurus erythraeus*, *Corvus splendens*, *Sciurus carolinensis*) commonly corresponded to this case.

Differences between the MS non-validated records in the JRC baselines and MS reports could be attributed to differences in data sources. The non-validated records in JRC baselines were based on EASIN data partners published information, including EASIN-Lit (Trombetti et al. 2013), while MS reports may have included also unpublished spatial records coming from national repositories, and other data from recently established national surveillance systems. Species reported from DE (e.g., *Elodea nuttallii*, *Eriocheir sinensis*, *Pseudorasbora parva*) commonly corresponded to this hypothesis.

Several IAS of Union concern included in the JRC baselines were missing in the MS reports. These species were not notified nor reported as eradicated. In total, 25 species included in MS validated records in the JRC baselines by 16 MS were missing in the corresponding MS reports (Table 3). Further investigations are necessary to clarify whether these species have been recently eradicated in the relevant countries or not detected within the reporting period 2015-2018 (and thus not reported) or were misreported in the MS validated records in the JRC baselines.

On the other hand, 10 species were recorded in the MS reports (by 7 MS) but missing in the validated JRC baselines (Table 4). These species were not notified through NOTSYS, although they seem to correspond to new detections in a country.

Inconsistencies in the use of NOTSYS were also found for other 5 species reported as not eradicated or under eradication, implying that the species are still present in the countries territory, but they were absent from the MS reports. Finally, one species was detected and then eradicated based on NOTSYS but recorded in the MS report.

The observed inconsistencies show the necessity of coherence in reporting updates on species distributions and their notification through NOTSYS, but may be also explained by a different interpretation of what constitutes a detection requiring official notification under art.16 (i.e., "the appearance on their territory or part of their territory of any species included on the Union list whose presence was previously unknown in their territory or in part of their territory"). An emblematic case of the latter is *Vespa velutina nigrithorax*, whose expanding distribution in the Italian territory during the reporting period has been well documented by the LIFE project STOPVESPA (https://www.vespavelutina.eu/it-it/risultati-raggiunti), but no notifications were included in NOTSYS. Harmonisation of approaches may be also needed for specific taxonomic groups, e.g., birds.

It is worth noticing the discrepancies between NOTSYS and public data coming from citizen science initiatives and the social media posted by reliable sources (LIFE projects, Research projects, National authorities). The support of citizens to the IAS Regulation is of outmost importance (Cardoso et al. 2017) and spotted discrepancies can jeopardise their support to the implementation of the IAS Regulation.

Another reason explaining discrepancies could be related to taxonomic identification difficulty. Species misidentifications have been described for IAS of Union concern, e.g. *Asclepias syriaca* (Gudžinsk et al 2019), and Heracleum species (Vladimirov 2019).

5 Conclusions & Recommendations

There were four main types of mismatch between the JRC baselines (MS validated records) and MS reports:

1) Several IAS of Union concern were included in the JRC baselines but not in the MS reports (25 species, by 16 MS).

2) 10 species were recorded in the MS reports (by 7 MS) but were not previously included in the validated JRC baselines and were not notified through NOTSYS.

3) 5 species reported as not eradicated or under eradication in NOTSYS, implying that the species are still present in the countries territory, were absent from the MS reports.

4) 1 species was detected and then eradicated based on NOTSYS, but it was recorded in the MS report.

Observed inconsistencies show the necessity of coherence in reporting updates on species distributions and notification of new observations through NOTSYS but may also reflect delays in data validation and synchronisation among relevant data repositories, as well as different interpretations of what constitutes a detection requiring official notification with reference to Article 16 of the IAS Regulation, and how to deal with casual species.

Based on these findings we draw the following main recommendations:

1) Reporting of data needs to be improved for consistency and coherence among MS, in terms of the time frame of the records and early detections notified through NOTSYS.

2) IAS of Union concern already present in a MS territory according to the JRC baselines might have been eradicated and thus not included in the MS reports. It would be useful if the MS would report also on these cases, with the aim of ensuring a complete official update of the concerned species distributions.

3) The use of NOTSYS by MS should be improved and expanded as much as possible, to ensure that notifications provide timely the necessary information on new detections of IAS of Union concern, measures applied for the effective implementation of the IAS Regulation and their effectiveness, helping the surveillance and management efforts of other MS.

4) Many other existing data collection programs can supplement species records reported from the MS official surveillance systems. EASIN aggregates data from a network of data partners, referring to several data collection initiatives, and can play a role in informing MS of new records, which after quality check could be notified through NOTSYS. This would increase coherence between data sources and the chance of prompt notification of new detections.

5) The discrepancies observed between the JRC baselines and the MS reporting are mostly attributable to data availability. Enhanced data sharing should be promoted to allow a common EU information background and better effectiveness of the IAS Regulation.

6) Solving the identified issues will allow JRC to prepare in the future tailored data packages that will ease the work by MS in fulfilling their reporting obligations under Art. 24 of the IAS regulation.

5.1 Possible future developments

Based on this assessment, with the aim of improving the effectiveness of the IAS Regulation, we propose the following activities:

1) Promotion of data harmonization and data sharing between MS Competent Authorities and EASIN.

2) Streamlining of some technical implementation aspects, e.g., guidelines on common approaches for monitoring and for notifying early detections.

3) Training on EASIN and NOTSYS to MS representatives, following the release of new web services.

4) Joint workshops on cross border cooperation issues.

5) Identification and sharing of best practices by the EC, MS competent authorities, and relevant projects (e.g. LIFE); sharing can be facilitated through EASIN.

6) Promotion of Citizen Science and integration of generated data in EASIN e.g., via the JRC "IAS in Europe" App and other applications.

7) Liaison with EU projects, such as LIFE and Interreg, dealing with eradication or management of IAS, by the JRC EASIN.

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List of abbreviations and definitions

Aichi Target 9 is one of 20 biodiversity targets of a universally acknowledged framework for action on biodiversity, adopted in the context of the CBD. Target 9 focuses on two types of actions, the control or eradication of invasive alien species and the management of their introduction pathways.

CBD Convention on Biological Diversity

DG ENV European Commission Directorate General for Environment

EASIN European Alien System Information Network (http://easin.jrc.ec.europa.eu/)

EC European Commission

EEA European Environmental Agency (http://www.eea.europa.eu/)

EU European Union

IAS Invasive Alien Species as defined in Art. 3 of EU Regulation 1143/2014.

IAS of Union concern Species identified according to Art. 4 of the EU Regulation 1143/2014, requiring EU concerted action

IAS Regulation Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species.

Interreg European Territorial Co-operation

JRC Joint Research Centre Directorate of the European Commission

LIFE EU's funding instrument for the environment and climate action

MS Member States

NOTSYS Official notification system for detection of IAS of Union concern (https://easin-notsys.jrc.ec.europa.eu/).

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Annex 1

Comparison of IAS of Union concern distribution between the JRC baselines and MS reports. Grey cells indicate presence of species based on EASIN data, i.e. not validated by MS (grey cells). Ba= JRC baselines, Re MS reports.

		Alopochen aegyptiaca	*Alternanthera philoxeroides*	*Asclepias syriaca*	*Baccharis halimifolia*	*Cabomba caroliniana*	*Callosciurus erythraeus*	*Corvus splendens*	*Eichhornia crassipes*	*Elodea nuttallii*	*Eriocheir sinensis*	*Gunnera tinctoria*	*Heracleum mantegazzianum*	*Heracleum persicum*	*Heracleum sosnowskyi*	*Herpestes javanicus*	*Hydrocotyle ranunculoides*	*Impatiens glandulifera*	*Lagarosiphon major*	*Lithobates catesbeianus*	*Ludwigia grandiflora*	*Ludwigia peploides*	*Lysichiton americanus*	*Microstegium vimineum*	*Muntiacus reevesi*	*Myocastor coypus*	*Myriophyllum aquaticum*	*Myriophyllum heterophyllum*	*Nasua nasua*	*Ondatra zibethicus*	*Orconectes limosus*	*Orconectes virilis*	*Oxyura jamaicensis*	*Pacifastacus leniusculus*	*Parthenium hysterophorus*	*Pennisetum setaceum*	*Perccottus glenii*	*Persicaria perfoliata*	*Procambarus clarkii*	*Procambarus fallax f. virginalis*	*Procyon lotor*	*Pseudorasbora parva*	*Pueraria montana var. lobata*	*Sciurus carolinensis*	*Sciurus niger*	*Tamias sibiricus*	*Threskiornis aethiopicus*	*Trachemys scripta*	*Vespa velutina nigrithorax*	
AT	Ba	x		x		x				x	x		x				x	x	x						x	x	x		x	x		x	x	x				x	x	x				x		20
	Re	x		x		x				x	x		x				x	x	x				x			x	x	x		x	x		x	x				x	x	x				x		22
BE	Ba	x		x	x	x	x		x	x	x		x				x	x	x	x	x	x	x		x	x	x	x		x	x		x	x	x				x		x	x	x	x	x	x		35
	Re	x		x	x	x	x		x	x	x		x				x	x	x	x	x	x	x		x	x	x	x		x	x		x	x					x		x		x	x	x	x		32
BG [2]	Ba			x						x								x								x				x	x					x										x		9
	Re			x						x	x		x					x								x				x	x				x	x										x		12
CY	Ba																																		x			x								x		3
	Re																																		x			x								x		3
CZ [1]	Ba	x		x					x	x	x		x					x								x			x	x		x	x					x		x	x				x		17
	Re	x		x						x	x		x					x								x			x	x		x	x							x	x				x		14
DE [2]	Ba	x		x		x			x	x	x	x	x		x		x	x	x	x	x		x			x	x	x	x	x	x		x	x			x		x	x	x		x	x	x	x		33
	Re	x		x		x				x	x		x				x	x	x	x	x	x	x		x	x	x	x		x	x		x	x					x	x	x			x		x		27
DK	Ba	x		x		x				x	x		x	x	x			x					x		x	x			x			x	x							x	x				x		19
	Re	x				x				x	x		x	x	x			x					x			x			x				x							x	x				x		14
EE	Ba	x								x	x		x	x	x			x					x						x				x			x					x					x		12
	Re									x	x		x	x	x			x											x	x			x			x				x						x		12
EL [1]	Ba	x						x												x			x			x				x															x	x		10
	Re																						x			x				x																x		6

(Continues)

		Alopochen aegyptiaca	*Alternanthera philoxeroides*	*Asclepias syriaca*	*Baccharis halimifolia*	*Cabomba caroliniana*	*Callosciurus erythraeus*	*Corvus splendens*	*Eichhornia crassipes*	*Elodea nuttallii*	*Eriocheir sinensis*	*Gunnera tinctoria*	*Heracleum mantegazzianum*	*Heracleum persicum*	*Heracleum sosnowskyi*	*Herpestes javanicus*	*Hydrocotyle ranunculoides*	*Impatiens glandulifera*	*Lagarosiphon major*	*Lithobates catesbeianus*	*Ludwigia grandiflora*	*Ludwigia peploides*	*Lysichiton americanus*	*Microstegium vimineum*	*Muntiacus reevesi*	*Myocastor coypus*	*Myriophyllum aquaticum*	*Myriophyllum heterophyllum*	*Nasua nasua*	*Ondatra zibethicus*	*Orconectes limosus*	*Orconectes virilis*	*Oxyura jamaicensis*	*Pacifastacus leniusculus*	*Parthenium hysterophorus*	*Pennisetum setaceum*	*Perccottus glenii*	*Persicaria perfoliata*	*Procambarus clarkii*	*Procambarus fallax f. virginalis*	*Procyon lotor*	*Pseudorasbora parva*	*Pueraria montana var. lobata*	*Sciurus carolinensis*	*Sciurus niger*	*Tamias sibiricus*	*Threskiornis aethiopicus*	*Trachemys scripta*	*Vespa velutina nigrithorax*	
ES	Ba	x	x	x	x			x	x		x		x				x	x	x		x	x				x	x	x	x	x	x			x				x		x			x	x	x	x	28
	Re	x	x	x	x				x		x		x				x	x		x	x	x				x	x	x	x	x			x	x				x		x			x	x	x	x	28
FI	Ba										x		x	x	x			x					x							x			x	x							x					x		10
	Re			x							x		x	x				x					x							x				x						x					x		10
FR	Ba	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x	x	x	x	x			x	x	x	x	x	x			x		x			x		x			x	x	x	x	35
	Re	x	x	x	x	x	x		x	x	x	x	x				x	x	x	x	x	x	x		x	x	x	x	x	x				x		x			x		x			x	x	x	x	34
HR	Ba	x		x						x			x			x		x								x			x	x			x			x			x						x		16
	Re	x		x						x			x			x		x				x				x			x	x			x			x			x	x	x	x			x		18
HU [1]	Ba	x		x		x			x	x	x		x		x		x	x	x		x					x	x	x	x	x		x	x		x				x	x							22
	Re	x		x		x			x	x	x		x		x		x	x	x		x	x				x	x	x	x	x		x	x		x		x	x	x	x					x		26
IE	Ba									x	x	x	x					x	x		x		x		x	x	x		x			x							x			x		x			17
	Re									x		x	x					x	x				x		x	x	x		x			x										x		x			14
IT	Ba	x	x	x	x		x		x	x	x		x				x	x	x	x	x	x				x	x		x	x		x	x		x			x	x	x	x	x	x	x	x	x	32
	Re	x	x	x	x		x		x	x			x				x	x	x	x	x	x				x	x		x	x		x	x		x			x	x	x	x	x	x	x	x	x	31
LT [1]	Ba			x							x				x			x											x	x			x			x									x		10
	Re			x							x				x			x											x	x			x			x											9
LU	Ba	x								x	x		x					x									x		x	x			x							x	x					x		12
	Re	x								x			x					x									x		x	x			x							x						x		10
LV	Ba							x			x		x		x			x											x	x			x			x								x	x			11
	Re										x				x			x											x	x			x			x									x			8

(Continues)

		Alopochen aegyptiaca	*Alternanthera philoxeroides*	*Asclepias syriaca*	*Baccharis halimifolia*	*Cabomba caroliniana*	*Callosciurus erythraeus*	*Corvus splendens*	*Eichhornia crassipes*	*Elodea nuttallii*	*Eriocheir sinensis*	*Gunnera tinctoria*	*Heracleum mantegazzianum*	*Heracleum persicum*	*Heracleum sosnowskyi*	*Herpestes javanicus*	*Hydrocotyle ranunculoides*	*Impatiens glandulifera*	*Lagarosiphon major*	*Lithobates catesbeianus*	*Ludwigia grandiflora*	*Ludwigia peploides*	*Lysichiton americanus*	*Microstegium vimineum*	*Muntiacus reevesi*	*Myocastor coypus*	*Myriophyllum aquaticum*	*Myriophyllum heterophyllum*	*Nasua nasua*	*Ondatra zibethicus*	*Orconectes limosus*	*Orconectes virilis*	*Oxyura jamaicensis*	*Pacifastacus leniusculus*	*Parthenium hysterophorus*	*Pennisetum setaceum*	*Perccottus glenii*	*Persicaria perfoliata*	*Procambarus clarkii*	*Procambarus fallax f. virginalis*	*Procyon lotor*	*Pseudorasbora parva*	*Pueraria montana var. lobata*	*Sciurus carolinensis*	*Sciurus niger*	*Tamias sibiricus*	*Threskiornis aethiopicus*	*Trachemys scripta*	*Vespa velutina nigrithorax*	
MT [2]	Ba																																	x															1
	Re								x																									x			x	x							x			6
NL	Ba	x		x		x	x	x	x	x	x		x				x	x	x		x	x	x		x	x	x	x		x	x	x	x				x	x	x		x		x	x	x		32
	Re	x		x		x			x	x	x		x				x	x	x		x	x	x		x	x	x	x		x	x	x	x				x	x	x				x	x	x		29
PL	Ba	x		x		x		x		x	x		x		x			x							x				x	x		x	x							x	x					x	x		19
	Re	x		x		x				x	x		x		x			x							x				x	x		x	x			x					x	x					x			17
PT [2, 3]	Ba	x							x		x	x							x								x					x	x		x			x								x	x	x	13
	Re																																																	0
RO [2]	Ba	x		x					x	x	x				x			x								x	x			x	x					x					x	x					x			15
	Re	x		x	x	x			x	x	x		x		x			x				x				x										x					x	x								13
SE	Ba			x		x				x	x		x	x				x				x							x				x													x			11
	Re	x		x		x				x	x		x	x				x				x							x				x													x			12
SI	Ba	x		x						x			x					x		x						x			x			x	x							x	x					x			14
	Re	x		x						x			x					x								x			x				x								x		x				x			12
SK [1]	Ba	x		x						x	x		x		x			x								x			x	x			x			x				x	x								15
	Re	x		x						x			x					x								x			x	x		x	x			x				x	x	x					x			15
UK [1]	Ba	x		x	x	x			x	x	x	x	x	x			x	x	x	x	x		x		x		x	x	x	x	x	x	x				x		x	x		x		x	x	x		31
	Re	x			x	x			x	x	x	x	x				x	x	x		x		x			x	x		x	x	x	x				x			x					x			24
TOTAL	Ba	20	3	19	5	10	4	6	11	20	22	5	21	4	10	1	8	24	11	7	9	6	10	0	5	18	13	9	4	25	19	2	15	23	1	6	10	0	10	6	19	20	1	6	1	8	14	24	6	
	Re	18	3	18	6	11	3	0	9	20	18	3	22	4	7	1	8	24	9	5	8	9	11	0	6	16	12	9	1	23	19	2	13	23	0	7	9	0	11	9	16	17	3	4	0	7	6	25	4	

([1]) Provided <u>partial</u> feedback to the JRC baselines
([2]) <u>No</u> feedback to the JRC baselines
([3]) <u>No</u> report

Annex 2

Analysis of commonalities between the JRC baselines and MS reports, considering presence/ absence, spatial matching/ coherence, and consistency with the notifications through NOTSYS.

			Alopochen aegyptiaca	*Alternanthera philoxeroides*	*Asclepias syriaca*	*Baccharis halimifolia*	*Cabomba caroliniana*	*Callosciurus erythraeus*	*Corvus splendens*	*Eichhornia crassipes*	*Elodea nuttallii*	*Eriocheir sinensis*	*Gunnera tinctoria*
Baseline validated by MS, and no discrepancies with MS reports	x	x	BE, ES, HR, HU, IT, LU, PL, SI	IT, ES, FR	BE, ES, HR, IT, LT, SK, SI	FR, ES, IT, BE, UK	AT(1), BE, FR, NL, PL, SE, UK	FR, IT	FR(1)	ES, IT, UK	BE, CZ, DK, EE, HR, HU, IE, IT, LU, NL, SE	AT(1), BE, CZ, DK, EE, ES, LV, UK	FR, IE
Baseline validated by MS, but larger number of occurrences in MS reports	x	x	AT, DK, NL(1)		NL					NL	PL(1), SK	NL	
Baseline validated by MS, but substantial larger number of records in baseline	x	x			CZ, FR, PL					FR	FR	FR, PL	
Baseline validated by MS, but records include substantial mismatch	x	x	FR					BE		BE			
Baseline not validated by MS, and no large discrepancies with MS reports	x	x	SK				DE(4), HU			HU(1)	SI(1), UK	HU, LT, RO	UK
Baseline not validated by MS, and substantial higher number of occurrences in MS reports	x	x	CZ, DE, UK		AT, BG(1), HU						AT, BG(1), DE	DE	
Baseline not validated by MS, and substantial higher number of records in baseline	x	x			DE								
Baseline not validated by MS, and and in MS reports	x		EL		UK					DE(4)		LU, SK	DE
Species in the baseline, but not in the MS reports	x		EE(1)		DEK			N	EL, ES, LV, NL, PL	CZ(1)		IE, IT	
Species not in the baseline, but in the MS reports		x	SE							MT		BG	

(Continues)

			Heracleum mantegazzianum	*Heracleum persicum*	*Heracleum sosnowskyi*	*Herpestes javanicus*	*Hydrocotyle ranunculoides*	*Impatiens glandulifera*	*Lagarosiphon major*	*Lithobates catesbeianus*	*Ludwigia grandiflora*	*Ludwigia peploides*	*Lysichiton americanus*
Baseline validated by MS, and no discrepancies with MS reports	x	x	BE, CZ, DK, ES, FI, FR, IE, LU, IT, PL, SE , SK, SI	DK, FI, SE	EE, DK, PL	HR	BE, ES, IT, NL, UK	BE, CZ, DK, EE, ES, FI, HR, HU, IT, LU, NL, PL, SE, SK, SI	AT(1), BE, IE, IT, NL, UK	BE, IT, FR	BE, ES, IE, NL, UK	EL(2)	BE, DK, FI, FR, IE, NL, SE, UK
Baseline validated by MS, but larger number of occurrences in MS reports	x	x	EE, NL	EE(1)	LV			IE, LT(1), LV(1)			IT	BE, ES, IT, NL	
Baseline validated by MS, but substantial larger number of records in baseline	x	x						FR					
Baseline validated by MS, but records include substantial mismatch	x	x					FR		FR		FR	FR	
Baseline not validated by MS, and no large discrepancies with MS reports	x	x	UK		HU,LT		DE,HU	DE, UK	DE, HU(1)	DE	DE, HU(1)		DE
Baseline not validated by MS, and substantial higher number of occurrences in MS reports	x	x	AT					AT, BG(1)					
Baseline not validated by MS, and substantial higher number of records in baseline	x	x	DE										
Baseline not validated by MS, and and in MS reports	x				DE, SK								
Species in the baseline, but not in the MS reports	x		LV	UK	FI				ES(1)	EL(1), SI, UK			EE(1)
Species not in the baseline, but in the MS reports		x	BG	DE						ES(5)		DE(6), HR, HU(7)	AT(5)

(Continues)

			Microstegium vimineum	*Muntiacus reevesi*	*Myocastor coypus*	*Myriophyllum aquaticum*	*Myriophyllum heterophyllum*	*Nasua nasua*	*Ondatra zibethicus*	*Orconectes limosus*	*Orconectes virilis*	*Oxyura jamaicensis*	*Pacifastacus leniusculus*
Baseline validated by MS, and no discrepancies with MS reports	x	x		NL, UK	CZ, EL([3]), IE, IT, PL	AT(1), BE, ES, IE, IT, NL, UK	BE, ES, HR	ES	BE, DK, IE, HR, IT, LU, PL, SE, SK	CZ, ES, HR, IT, NL, SI, UK	NL, UK	AT, BE, CZ([3]), IT	AT, BE, CZ, EL, ES, FI, FR, HR, IT, NL, SE, SI, UK
Baseline validated by MS, but larger number of occurrences in MS reports	x	x		BE	FR, HR, NL, SK([1]), SL		NL		ES, LT([1]), LV([1]), NL			IE, UK	DK, EE, LV
Baseline validated by MS, but substantial larger number of records in baseline	x	x		IE			FR		EE	AT, PL		PL	PL
Baseline validated by MS, but records include substantial mismatch	x	x			BE, ES	FR			FI, FR	BE, FR, LV		FR, NL	
Baseline not validated by MS, and no large discrepancies with MS reports	x	x				DE, HU([1])	AT, DE, HU, UK		EL([2])	BG([1]), LT, LU, SK([1])			HU, LT, LU, SK
Baseline not validated by MS, and substantial higher number of occurrences in MS reports	x	x			BG([1]), DE, HU([1]), SK,([1])				AT, BG, CZ, DE, HU([1]), SI([1])	DE			DE
Baseline not validated by MS, and substantial higher number of records in baseline	x	x								HU		DE([4]), HU	
Baseline not validated by MS, and and in MS reports	x							DE([1])					
Species in the baseline, but not in the MS reports	x			DK([1])	DK([1])			BE, FR([1])	UK			DK([1]), FI, SI	
Species not in the baseline, but in the MS reports		x		DE([4]), FR([4])						EE([5])		ES([5]), SK([7])	MT([5])

(Continues)

			Parthenium hysterophorus	*Pennisetum setaceum*	*Perccottus glenii*	*Persicaria perfoliata*	*Procambarus clarkii*	*Procambarus fallax f. virginalis*	*Procyon lotor*	*Pseudorasbora parva*	*Pueraria montana var. lobata*	*Sciurus carolinensis*	*Sciurus niger*
Baseline validated by MS, and no discrepancies with MS reports	x	x		ES, FR, IT	EE(1), HR		AT, BE, ES, CY, FR, IT, NL, UK	IT, NL, AT, HR	BE, ES, PL, CZ, H, IE, IT	CZ, ES, FR, IT, BE, SI, HR, EL, DK	IT	UK, IT, IE, BE	
Baseline validated by MS, but larger number of occurrences in MS reports	x	x			HU, LV				AT, DK, FR	AT(1), BG(1), NL			
Baseline validated by MS, but substantial larger number of records in baseline	x	x			PL				NL				
Baseline validated by MS, but records include substantial mismatch	x	x											
Baseline not validated by MS, and no large discrepancies with MS reports	x	x		MT	BG(1), LT			DE, HU, MT, SK(1)	DE, HU, LT(1), LU, SK(1)	LU			
Baseline not validated by MS, and substantial higher number of occurrences in MS reports	x	x			SK		DE			DE, HU, SK			
Baseline not validated by MS, and substantial higher number of records in baseline	x	x								PL			
Baseline not validated by MS, and and in MS reports	x				DE					LT(1)		DE	
Species in the baseline, but not in the MS reports	x		BE				SI(1.4)	CZ(1.4)	SU, UK(1)			NL	
Species not in the baseline, but in the MS reports		x		BG			HU(7), PL(5)	EE(5)	LV(5), FI(6.5)	LV(5)	HR(5), SI(8)		

(Continues)

			Tamias sibiricus	*Threskiornis aethiopicus*	*Trachemys scripta*	*Vespa velutina nigrithorax*
Baseline validated by MS, and no discrepancies with MS reports	x	x	BE, ES(2), FR, IE, IT, NL	AT(1), BE, CZ(1), DK(1), EL(2), ES, FR, IT, NL(1)	BE, CZ, DK(1), FI, IE, IT, PL, SE	IT
Baseline validated by MS, but larger number of occurrences in MS reports	x	x			AT, HR, NL, SV, LV, UK	BE, ES
Baseline validated by MS, but substantial larger number of records in baseline	x	x			ES, FR	FR
Baseline validated by MS, but records include substantial mismatch	x	x				
Baseline not validated by MS, and no large discrepancies with MS reports	x	x	DE		BG, LU	
Baseline not validated by MS, and substantial higher number of occurrences in MS reports	x	x			DE	DE
Baseline not validated by MS, and substantial higher number of records in baseline	x	x			BG, CY(2)	
Baseline not validated by MS, and and in MS reports	x			DE		
Species in the baseline, but not in the MS reports	x		UK	LV, PL, UK	EL	
Species not in the baseline, but in the MS reports		x			HU, MT, SK	

[1] No grid level data in the baseline
[2] No grid level data in the MS report
[3] No grid level data in the baseline and in the MS report
[4] Notified through NOTSYS
[5] Expected, but not reported in NOTSYS
[6] Only country level
[7] Baseline data not validated by the MS
[8] Reported in NOTSYS, eradicated but reported

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