

## Meeting: CSN 18<sup>th</sup> User Group Meeting

**Place and date:** Lisbon, 12 March 2019

**Agenda item:** CSN service results and performance

**Document number:** CSN 18.2.1

**Submitted by** EMSA

Summary	This paper provides summary information on CleanSeaNet service results and performance in 2018.
Action to be taken	As per paragraph 3.
Related documents	n.a.

## 1 Background

The scope of this paper is to present the results of CleanSeaNet in 2018 and to report the near real time performance of the service.

The service is available to 28 coastal States:

- 23 coastal European Union (EU) Member States (Belgium, Bulgaria, Croatia, Cyprus, Denmark, Estonia, Finland, France (including French Overseas Departments in the French Antilles under French Sovereignty), Germany, Greece, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Poland, Portugal, Romania, Slovenia, Spain, Sweden, United Kingdom);
- Two European Free Trade Association (EFTA) coastal States, Norway and Iceland;
- Three candidate countries, Albania, Montenegro and Turkey. The service has also been made available to other projects or territories under specific conditions.<sup>1</sup>

In this paper, unless explicitly stated otherwise, figures refer only to the service offered to these 28 EU and EFTA coastal States and paid through the funding foreseen under Regulation (EU) No 911/2014 of the European Parliament and of the Council of 23 July 2014 on multi-annual funding for the actions of the

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<sup>1</sup> The service is also being provided, through COPERNICUS program, to Kingdom of Denmark Overseas Territories in Greenland as well to Portugal for supporting Sao Tome and Principe authorities. Through the SAFEMED IV and BCSEA European Neighbourhood Policy Programmes, CleanSeaNet was also made available across the Mediterranean, the Black Sea, the Red Sea, and the Caspian Sea to official project beneficiary countries.

European Maritime Safety Agency in the field of response to marine pollution caused by ships and oil and gas installations.

## 2 CleanSeaNet service results

In 2018, the CleanSeaNet service was provided using SAR imagery from RADARSAT-2, SENTINEL-1 and TERRASAR-X missions. Additionally, optical images were provided in support to oil spill emergencies.

Satellite	Number of Ordered images	Number of Delivered images	Delivery Ratio 2018	Delivery Ratio 2017
SENTINEL-1A/B	4102	3848	94%	91%
RADARSAT-2	571	515	90%	95%
TERRASAR-X	308	275	89%	90%
VHR resolution optical (Deimos, Spot, Pleiades)	9	7	78%	75%
Total	4990	4645	93%	92%

Table 1 - CleanSeaNet images ordered and delivered per mission, 2018.

The delivery ratio improved by 1% across all the Satellite platforms when comparing 2018 and 2017, although there was a decrease in the delivery ratio of the RADARSAT-2 mission, due to a few satellite anomalies and outages stemming from the fact that this mission is already approaching its end of life.

Several changes to the planning approach were agreed with users in 2017, and during 2018 there was an overall increase of 22% on the number of delivered SAR images (3813 in 2017 versus 4638 in 2018). EMSA relies mostly on the Sentinel-1A/B to acquire EO data needed for the service, due to high availability of images, quality and cost.

### 2.1 CleanSeaNet service near real time (NRT) performance

CleanSeaNet service near real time (NRT) performance refers to service results being available on the CleanSeaNet web portal and/or that alerts have been sent to relevant authorities in the coastal States shortly after acquisition. For satellite images covering up to 160 000 Km<sup>2</sup>, the NRT service is available within 30 minutes. For larger images, more time is necessary.

The service NRT performance is best characterised by the delivery time of the alert report which contains all necessary operational information for the coastal States to take any initial action. The alert report includes a clip image of the spill extracted from the satellite image which allows authorities to assess the situation before the full resolution image is available on the CleanSeaNet portal.

Therefore, the indicator used to measure the service NRT performance is the time when the alert is sent. As alert sending times are not directly available in the system, an accurate approximation can be obtained by adding three minutes to the time when the oil spill notification package as delivered by service providers is available in the system. The three minutes is an estimate of the time it takes to generate alert reports and to send them. This is the time that is used in the figure below.

For optical imagery, this concept is not applicable as no alert report is currently associated with the delivery. The optical images were ordered in the context of emergency support with NRT 45 minutes. Out of the 8 optical images delivered:

- 5 ordered were delivered around 30 minutes after acquisition
- 3 ordered were delivered late – 51, 58 and 132 minutes after acquisition

The graph below shows the CleanSeaNet NRT performance of the service by SAR mission.

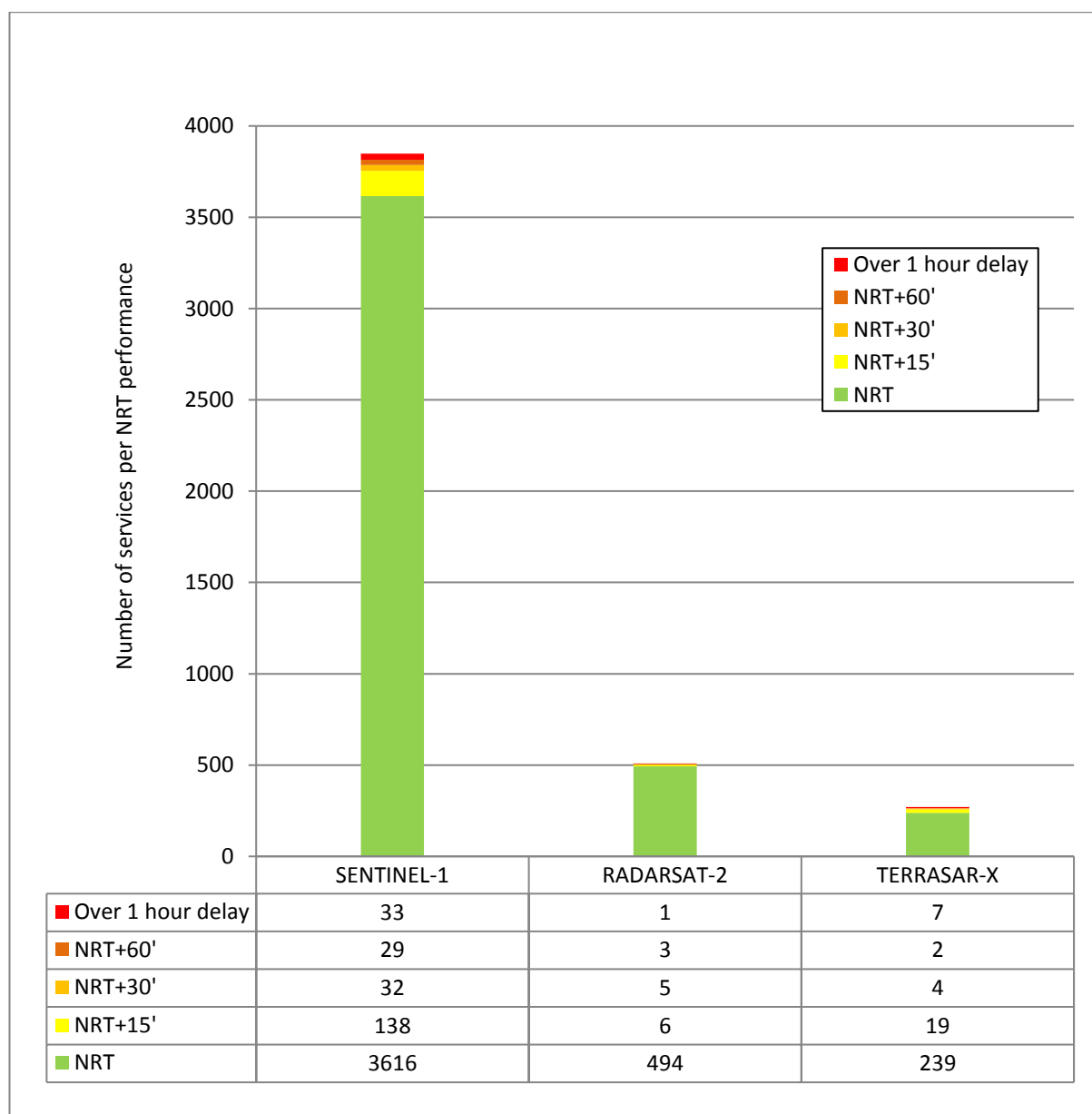


Figure 1 - CleanSeaNet NRT Performance by mission, 2018.

Mission	Total of Alert Reports in NRT	Total of Alert Reports	NRT Ratio 2018	NRT Ratio 2017
SENTINEL 1A/B	3616	3848	94%	92%
RADARSAT 2	494	509	97%	96%
TERRASAR-X	239	271	88%	54%

Table 2 - Alert reports sent in NRT per mission, 2018.

NRT performance improved across the board, with significant improvements on the TERRASAR-X mission, due to upgrades to the processing chain.

## 2.2 CleanSeaNet service detections

In 2018, in the 4,645 images delivered by the CleanSeaNet service, 6,127 possible oil spills were detected (an increase of 28% of detected oil spills comparing with 2017 – 4790 detected oil spills).

Figure 2 below shows the total number of possible spills detected and the average number of possible spills detected per million km<sup>2</sup>.

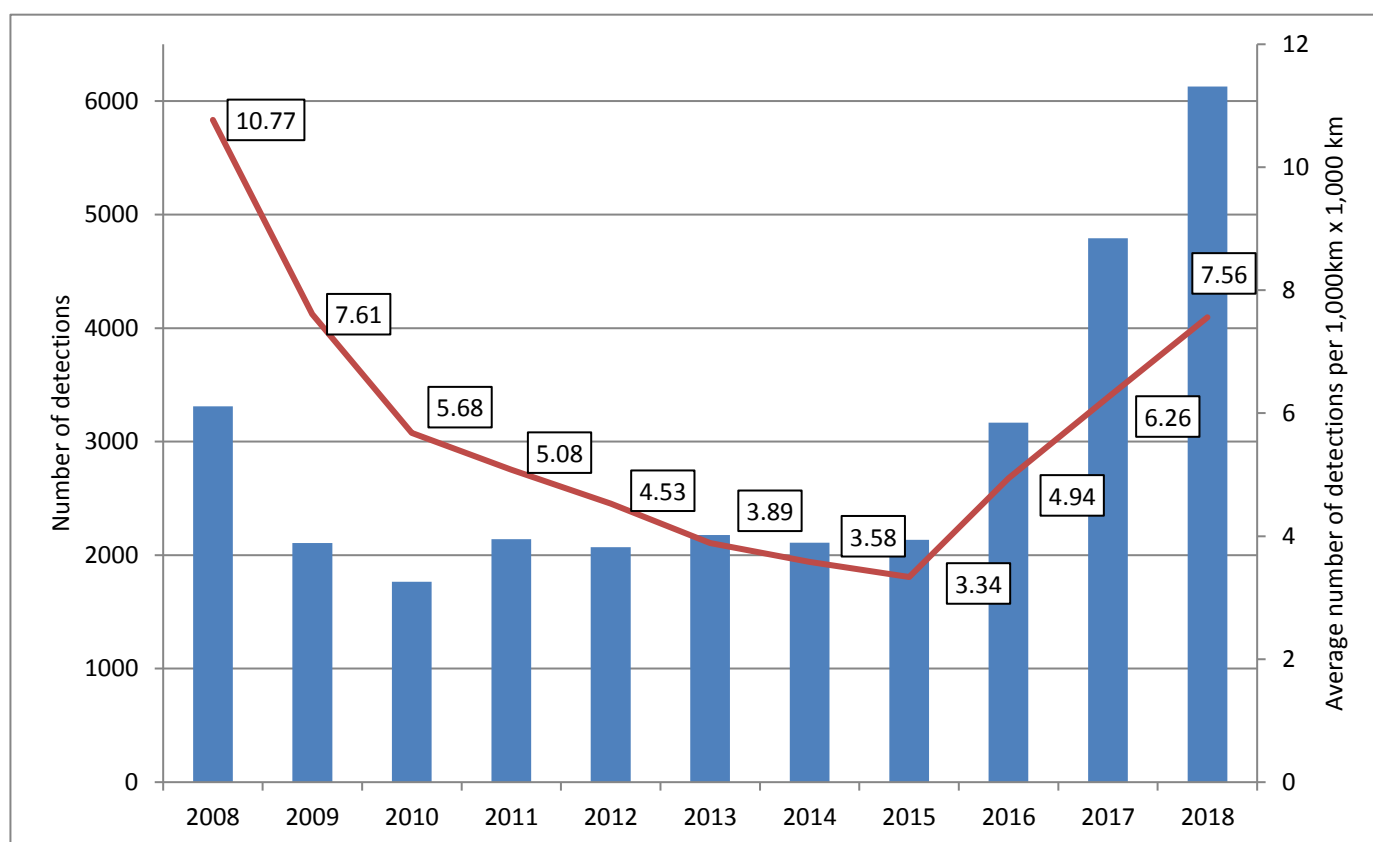


Figure 2 - CleanSeaNet possible pollution detected: 2008 – 2018.

The overall trend over most of the past decade has been a year-on-year reduction in the number of possible spills detected per million km<sup>2</sup> monitored, with a marked decrease per year in the period 2008-2010 and a more gradual decrease in the period 2010-2015. Between 2015-2018 this trend reversed, with an increase in the number of possible spills detected.

The reason for the apparent reversion in the trend is linked with the improved detection capabilities of Sentinel-1A/B, which is now the main constellation being used for the CleanSeaNet service. The spatial resolution of Sentinel-1 enables the detection of much smaller spills than before; these smaller spills are more numerous and would not have been detected previously. This is reflected in the average size of spills detected 4.6% smaller in 2018 when comparing with 2017 (in the past it was 40% smaller in 2017 when comparing with 2015).

The histogram in the figure below presents the distribution of possible oil spill detections classified according to their area (km<sup>2</sup>). Overlapped is the relative percentage for each area class of oil spill (number of detections in area class / total number of oil spills detected in the year).

In this figure the improvement in detection capabilities is clear, with the ability to detect smaller spills being responsible for the reversion in trend (note that the number of images delivered in 2018 was higher than in 2017, with an impact also on the number of detections).

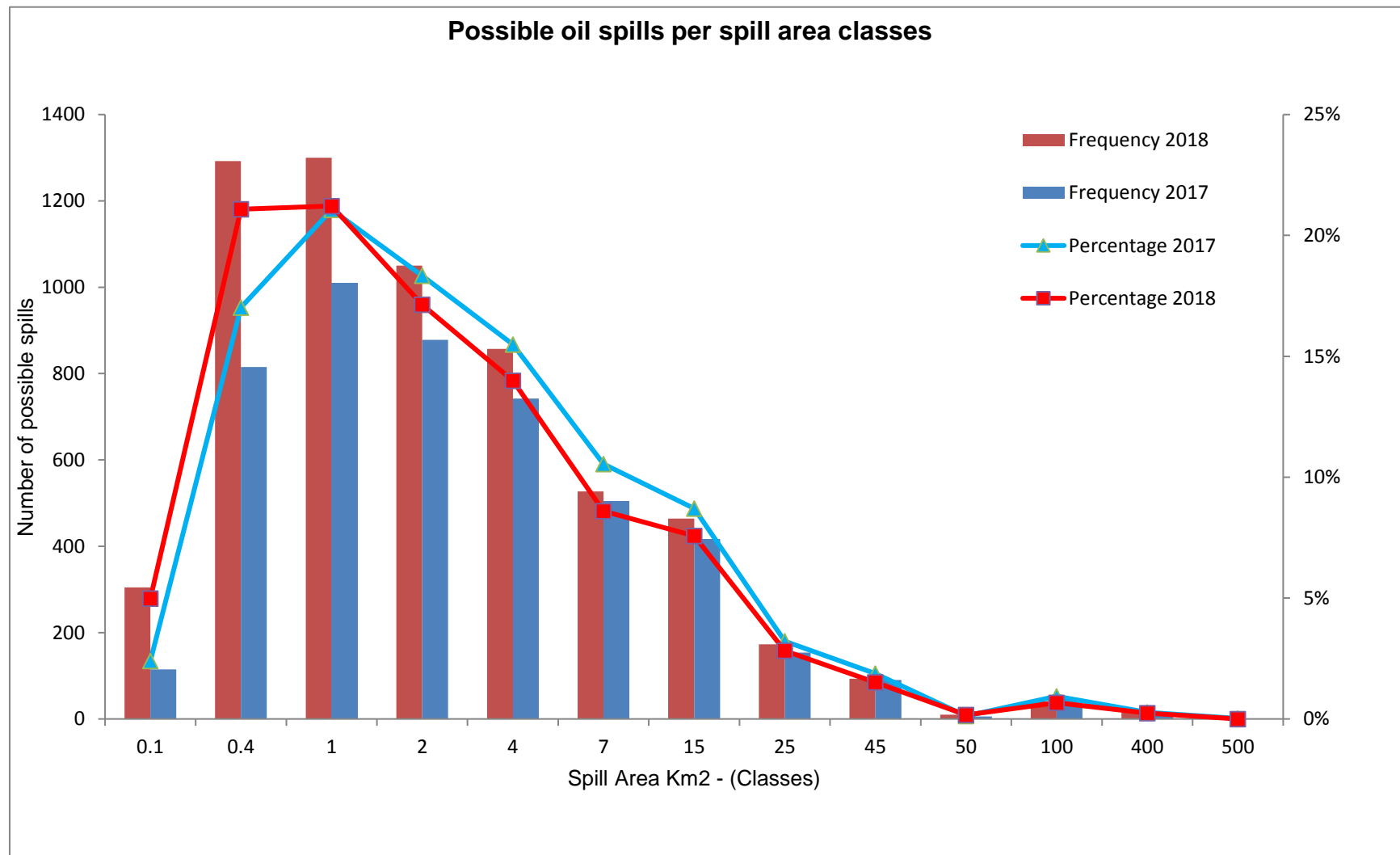


Figure 3 – Histogram of CleanSeaNet Oil spill detections according to area-classes: 2018 vs 2017.

It is to be noted that in 2018, there were three detected oil spills below 0.01km<sup>2</sup>. The percentage of detected oil spills is higher in 2018 for spills lower than 1 km<sup>2</sup>, while for oil spills higher than 1 km<sup>2</sup> the detection percentage was slightly higher in 2017.

From the phasing-in of Sentinel-1 in CSN service as from second half of 2015, the percentage of Sentinel-1 images has increased steadily achieving 76% of the total satellite data of CSN in 2017 and 83% in 2018. The percentage of spills detected with regards to Sentinel-1 also increased: 87% in 2017 and 88% in 2018.

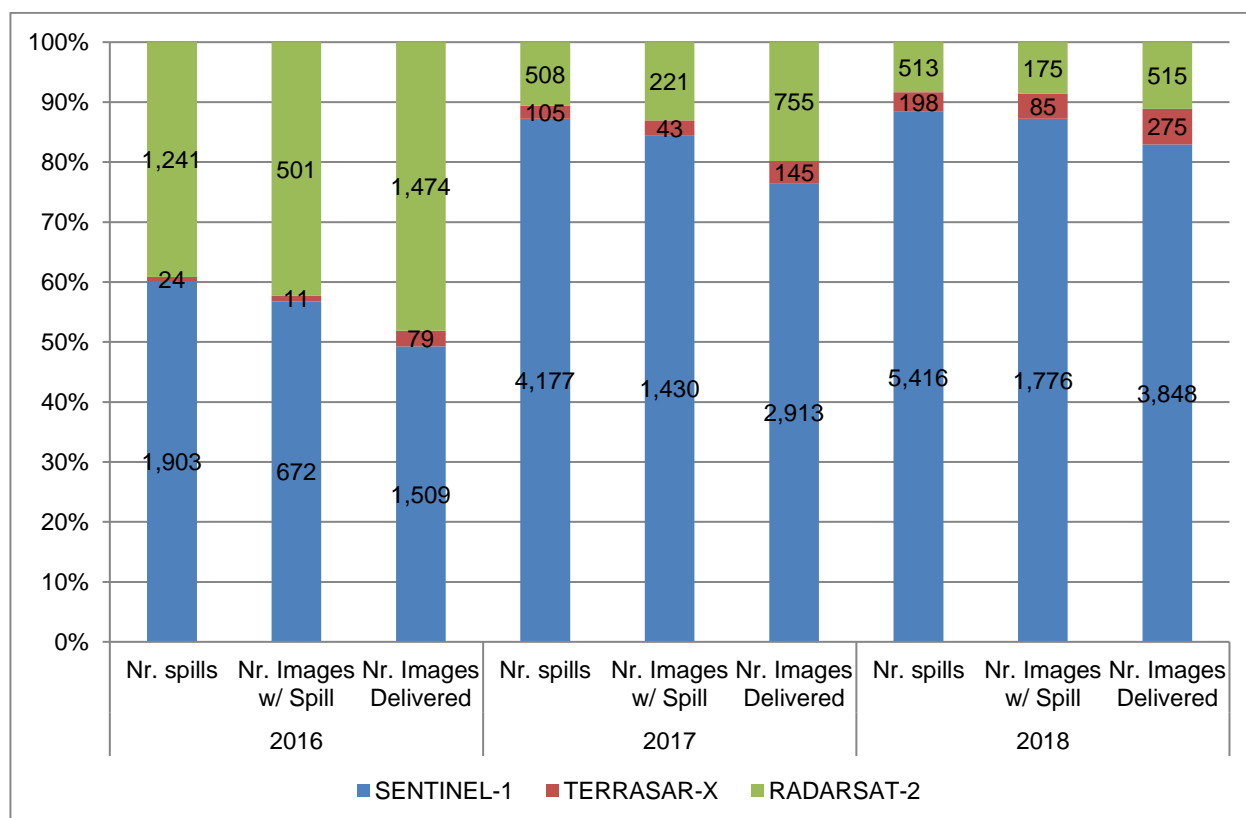


Figure 4 - CleanSeaNet oil spill detection: 2015 – 2018.

### 3 Relevant CleanSeaNet detections

Given the limitations of radar detection for the identification of spills, it is important to note that CleanSeaNet does not detect “oil spills” but “possible oil spills”. Other substances which produce a similar effect on the sea surface, and consequently in the image, include fish or vegetable oil, ice, and algae.

CleanSeaNet detections are separated into two classes:

- **Class A** – (2018 results: 3104) the detected spill has a higher detection confidence level.
- **Class B** – (2018 results: 3023) the detected spill has a lower detection confidence level.

Figure 5 shows the distribution of detections of probable and possible oil spills within the alert areas of EU coastal States (except French Outermost Regions), Iceland, Norway, Turkey and Montenegro. Alerts under the BCSEA and SafeMed projects, but outside the alerting area of the EU coastal States, have not been included.

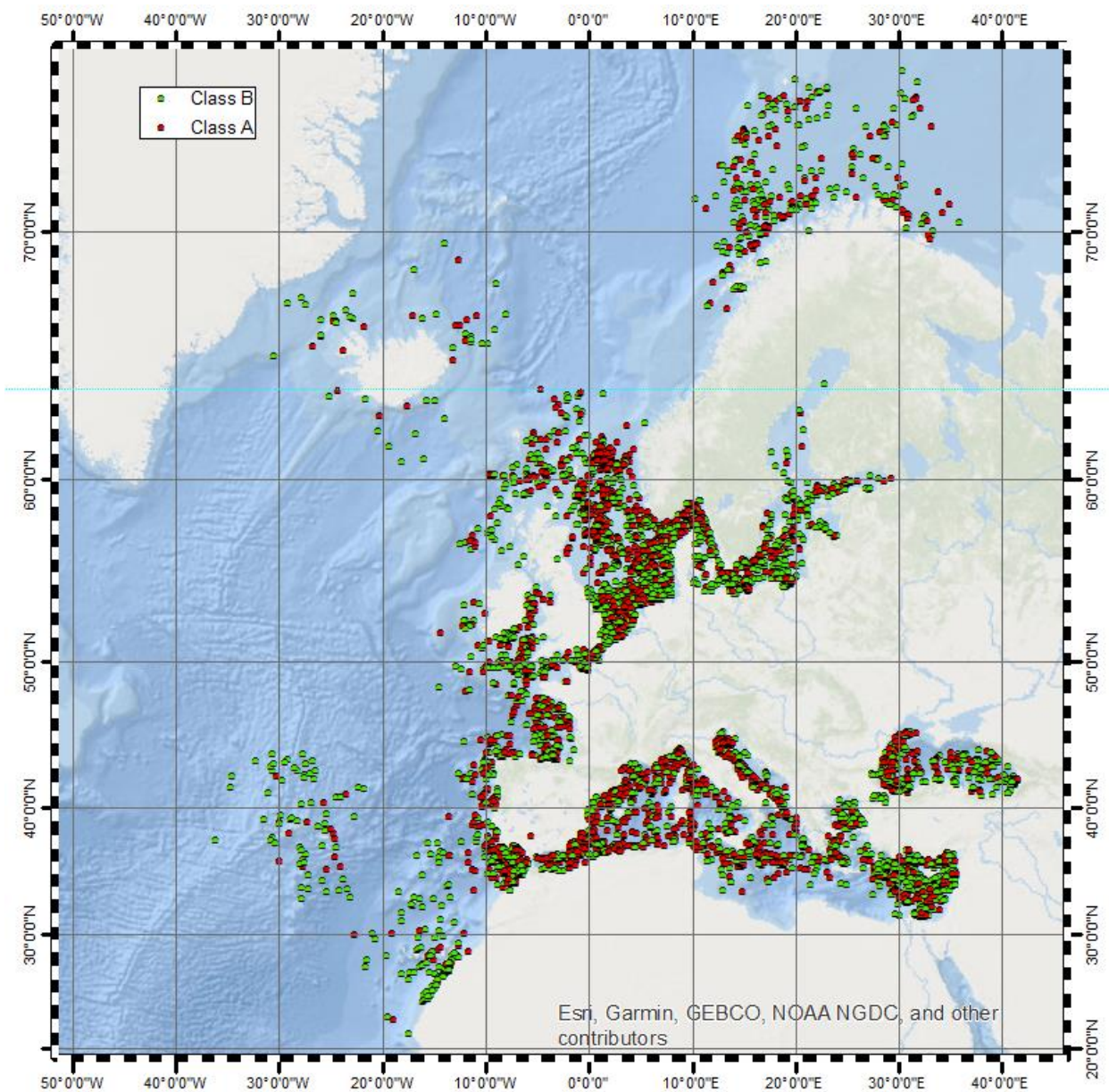


Figure 5 - Map of (probable and possible) spills detected in EU coastal States (except French Outermost Regions), Iceland, Norway, Turkey and Montenegro.

Figure 6 shows the distribution of detections of probable and possible oil spills in the French Outermost Regions.



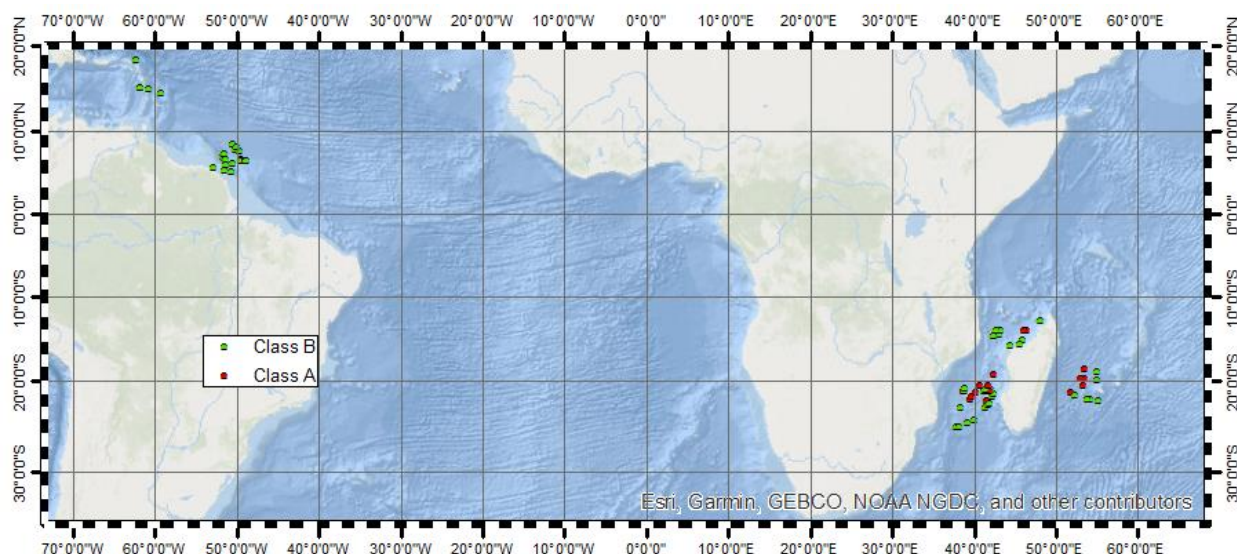


Figure 6 - Map of (probable and possible) spills detected in French Outermost Regions.

## 4 Verification Results

In 2018, 6,127 possible spills (category A and B) were reported by CleanSeaNet service to EU coastal States, Iceland, Norway, Turkey and Montenegro. 1,968 (32%) were checked on site. Out of those checked, 66 (3%) were confirmed as “mineral oil”, 173 (9%) as “other substance”, 37 (2%) as “unknown feature”, 86 (4%) were “natural phenomena” and nothing was observed for the remaining 1606 (82%).

As indicated in table 3, there is a decrease of 2% in 2018 when comparing with 2017, related with the overall verification results reported. The number of “Nothing observed” feedbacks increased, possibly due to the increase in the number of small spills detected, which could easily have dissipated or evaporated when the verification took place.

Verification Results	2018	2017	Feedback Ratio 2018	Feedback Ratio 2017
Mineral oil	66	356	3%	22%
Other substance	173	144	9%	9%
Unknown feature	37	45	2%	3%
Natural phenomena	86	56	4%	3%
Nothing observed	1606	1009	82%	63%
Total	1968	1610	32%	34%

Table 3 – Feedback report type provided concerning CSN SAR images, 2018 vs 2017.

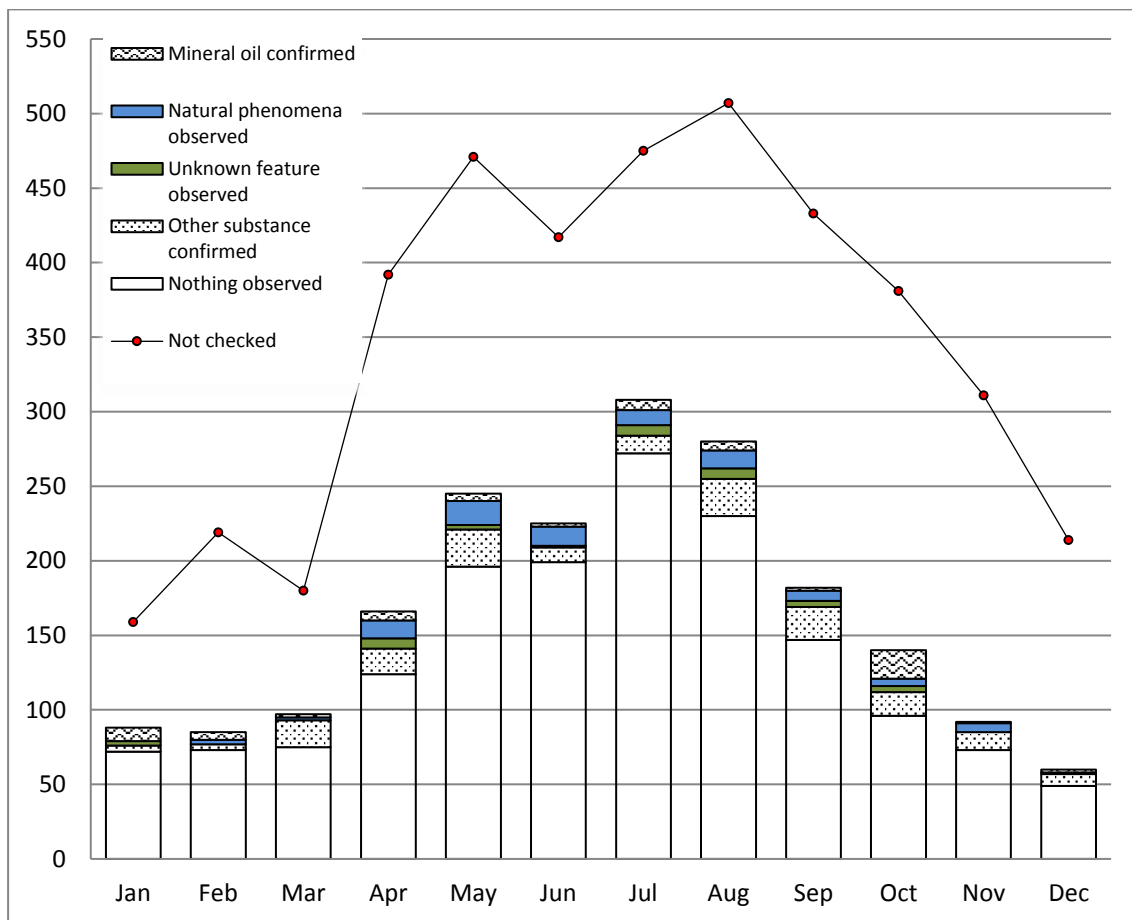


Figure 7 - Monthly distribution of checked detections and verification results on site (2018).

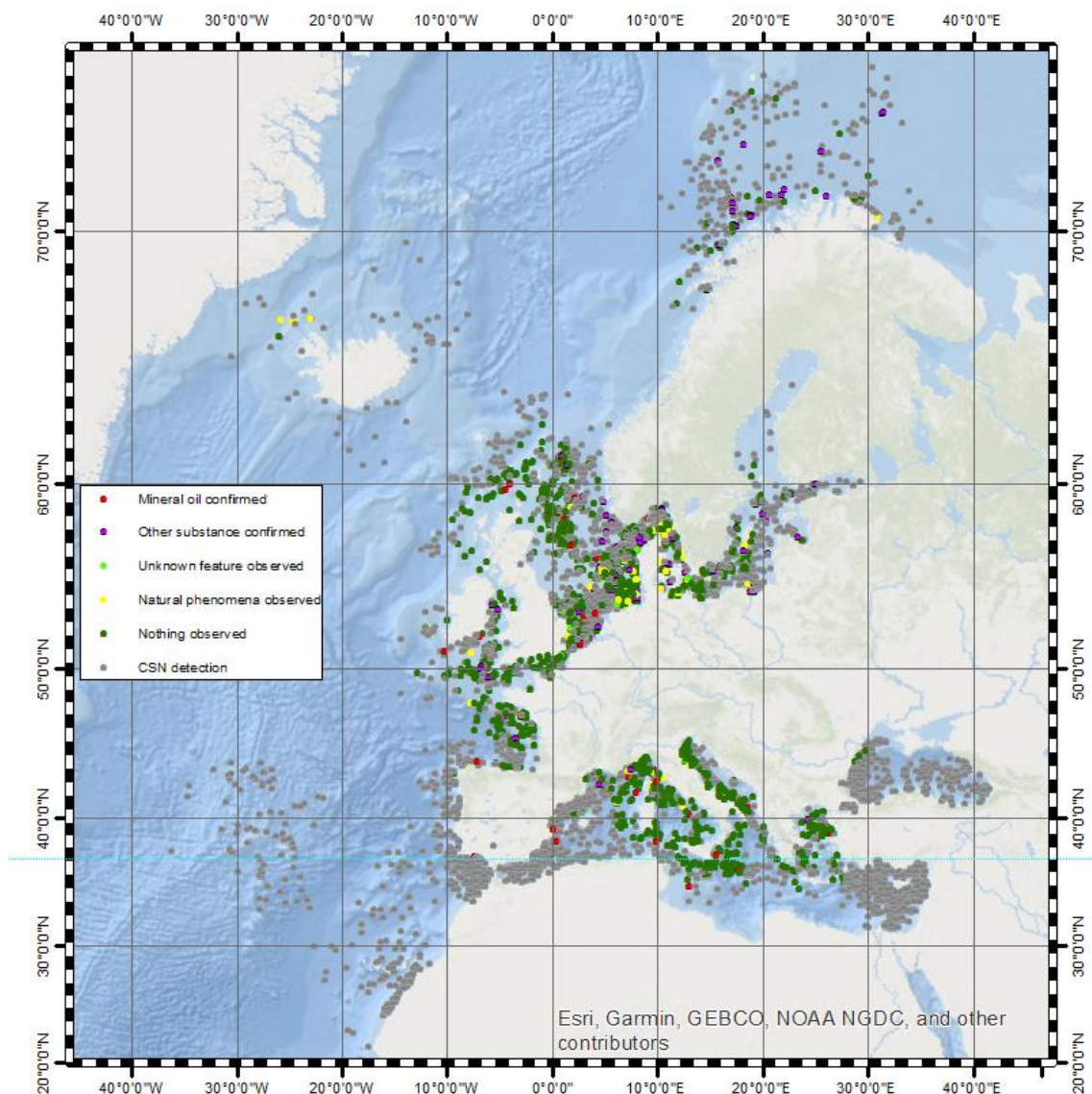


Figure 8 - Results of verifications in EU coastal States (except French Outermost Regions), Iceland, Norway, Turkey and Montenegro.

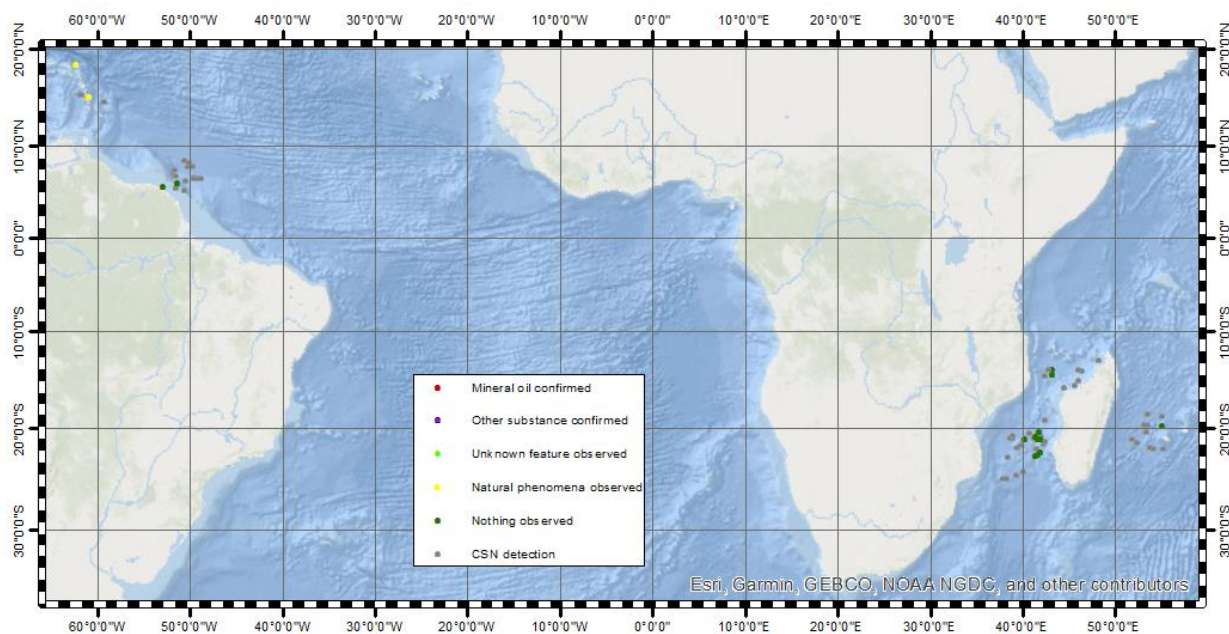


Figure 9 - Results of verifications in French Outermost Regions.

Figure 10 shows the assets (method) used for observation of the detected oil spills. As from October 2018 the “in situ-platform” was included as a possible source of the spill, as requested by users in the last CSN UG meeting. Nevertheless the “other” option still has a significant proportion on the choice being reported.

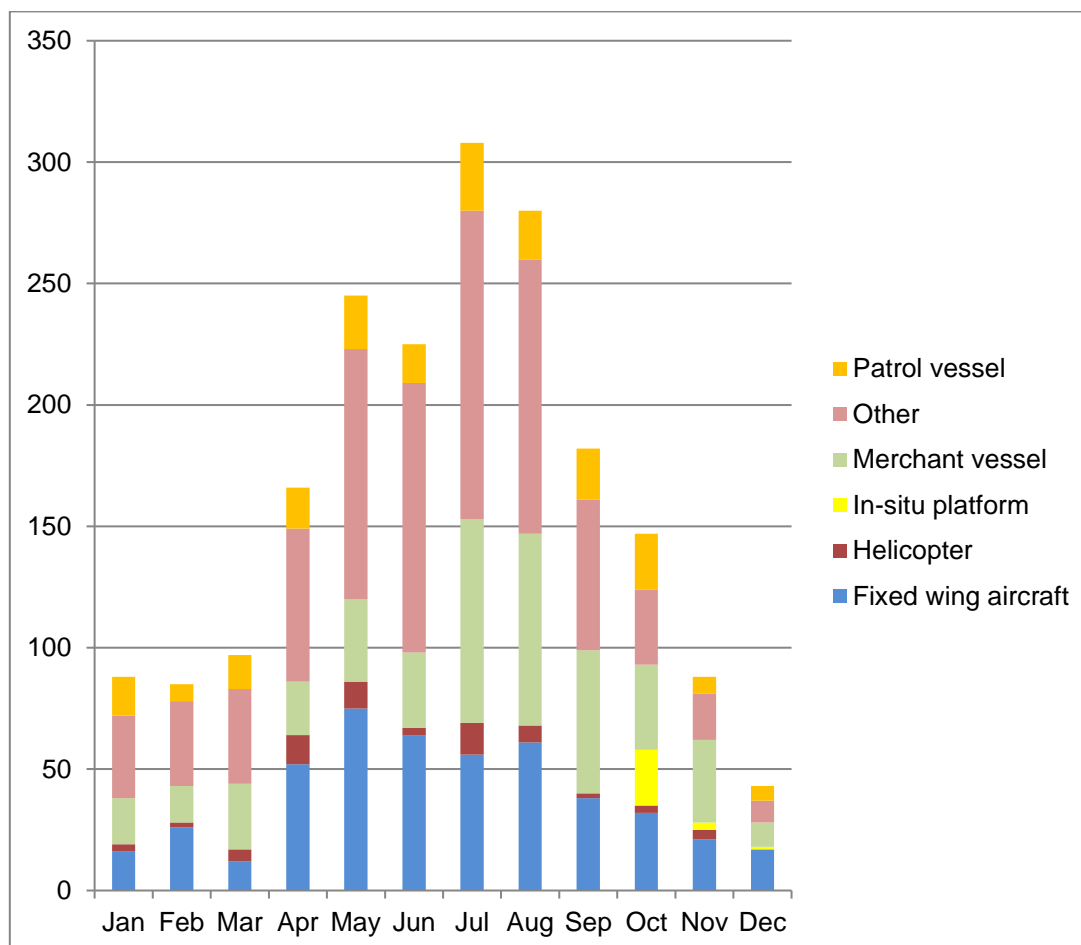


Figure 10 –Assets used for verification of detected oil spills.

Knowing there was a decrease on the overall percentage of verification results provided, we can notice from the Table 5 there was a decrease on the “other” asset type being reported.

CSN Verification by Asset type	Ratio 2018	Ratio 2017
Fixed wing aircraft	24%	21%
Helicopter	3%	3%
In-situ platform	1%	-
Merchant vessel	23%	25%
Other	38%	43%
Patrol vessel	10%	9%

Table 4 – Verification Assets ratios, 2018 vs 2017.

Figure 11 shows that there were verification results where the report type was not included by the user (2% in total) even though there were verifications with assets taking place by the Member State. To avoid this issue, in the future the SEG (SafeSeaNet Ecosystem GUI) will have this field mandatory once there is information of assets used for verification.

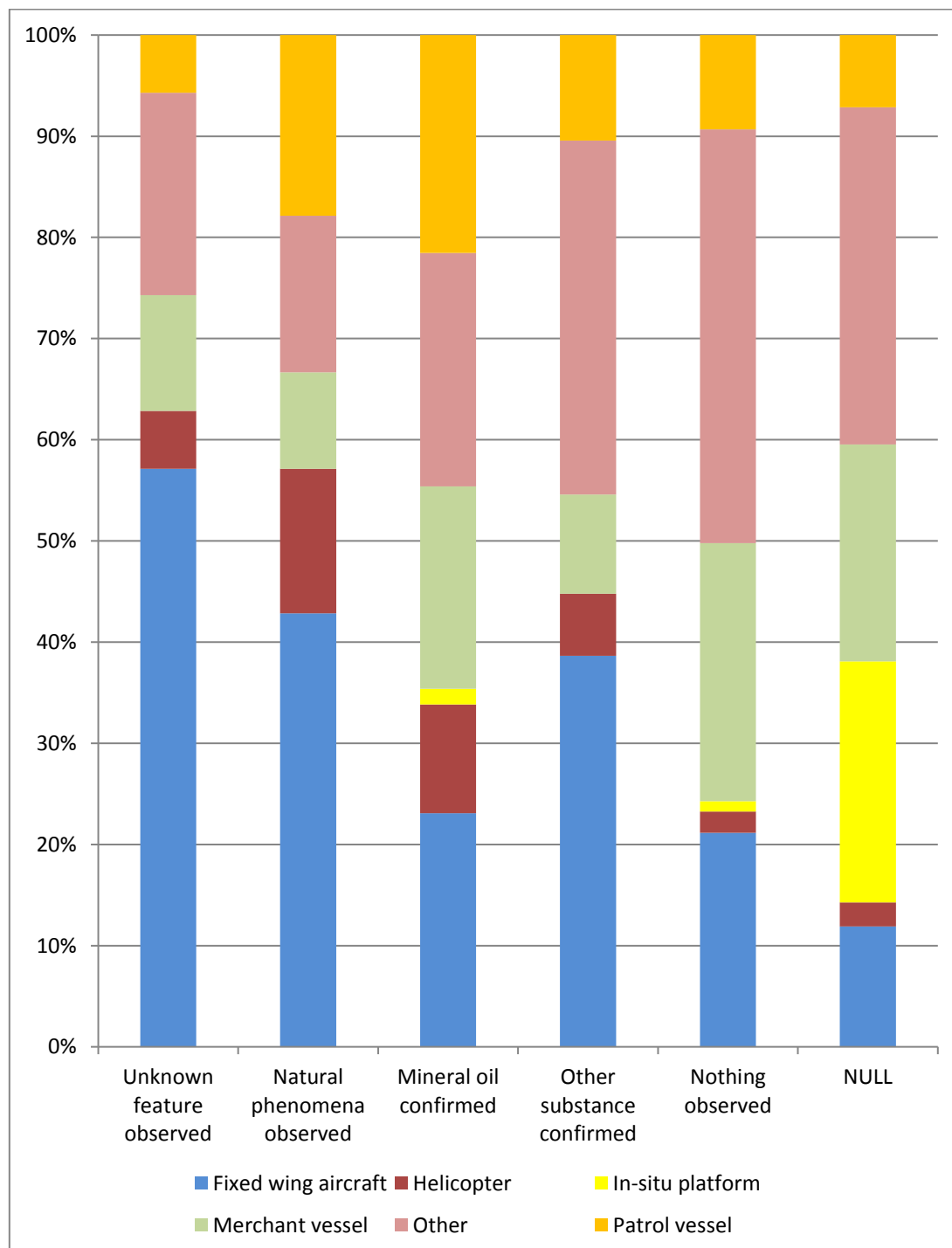


Figure 11 – Verification results of detected oil spills per Assets used for verification, 2018.

Table 5 reports only the last quarter of 2018, when it was included in the feedback report (in SEG) the list of possible reasons for no verification. It shows a high percentage of not verified oil spills with no feedback provided. For instance, in December 2018 only for 23% of the detected oil spills not verified there was a cause indicated in the feedback. This type of feedback is relevant as it enables an assessment on the service usage, potentially enabling improvements.

Month	Considered as a lookalike	No assets available	Not operationally relevant	Weather conditions	Total	Spills not verified with no feedback	Detected oil spills (Total)	% Spills not verified with no feedback
Oct	1	61	39	5	106	381	521	73%
Nov	2	56	29	7	94	311	403	77%
Dec		38	12		50	214	274	78%

Table 5 – Reasons for “No Verification” of detected oil spills, 2018.

## 5 Actions required

The CSN User Group is invited to take note of the information provided.